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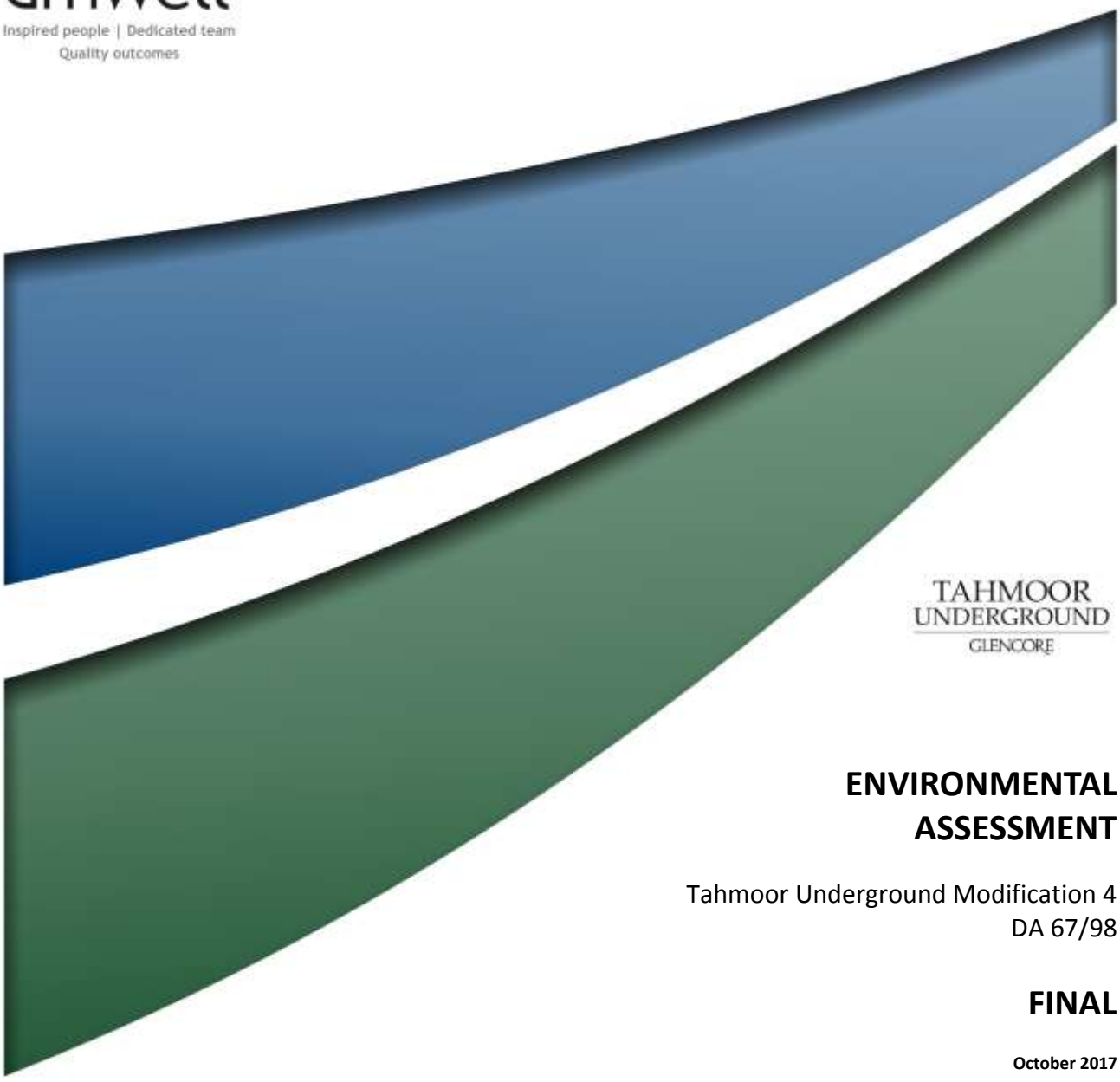

TAHMOOR
UNDERGROUND
GLENCORE

ENVIRONMENTAL ASSESSMENT

Tahmoor Underground Modification 4
DA 67/98

FINAL

October 2017

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Tahmoor Underground Modification 4
DA 67/98

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Tahmoor Coal Pty Ltd

Project Director:	Bret Jenkins
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Report No.	4081/R01/Final
Date:	October 2017

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Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
FINAL	G Allan	25/10/2017	B Jenkins	25/10/2017

Executive Summary

Tahmoor Coal Pty Ltd is seeking to modify the Tahmoor North consent (DA 67/98) to permit low levels of subsidence within an area where subsidence is not currently permitted to occur under Condition 6(i) of DA 67/98. The modification is sought under Section 75W of the *Environmental Planning and Assessment Act 1979*.

The need for the proposed modification has arisen as a result of improved accuracy in subsidence predictions which has been informed by the ongoing review of subsidence monitoring data within Tahmoor Underground and the broader Southern Coalfield District, and additional geological information that has become available. This improvement in subsidence predictions has identified that low levels of subsidence may extend further to the north-east of LW32 than predicted in previous approvals.

The proposed modification is required in order to implement the current Subsidence Management Plan (SMP) mine plan, and will provide for the ongoing employment of the existing workforce of approximately 343 employees, and provide ongoing economic contributions to the local and state economy. Without the proposed modification, LW32 will not be able to be extracted in an efficient and viable manner.

No changes are proposed to approved mining operations, associated surface facilities or production rates as part of the modification.

The Modification Area is located within an urban environment and land uses comprise of residential dwellings and Picton High School. There are no significant environmental features within the Modification Area, including no water courses, alluvial land, steep slopes or substantial remnant vegetation.

A preliminary environmental risk assessment has been conducted to identify the potential environmental impacts of the proposed modification, with subsidence being identified as the key issue for assessment. A detailed assessment of the potential subsidence impacts on all natural and built features within the Modification Area has been completed.

The detailed impact assessment concludes that subsidence associated with the proposed modification is likely to result in nil to negligible impacts on the land surface, natural and built features and on existing land uses within the Modification Area. Importantly, with the implementation of appropriate management measures, all structures, including dwellings and school buildings, will remain safe and serviceable at all times and the ongoing use of school buildings for educational purposes will not be affected.

This assessment of nil to negligible impact is primarily due to the very low levels of subsidence predicted within the Modification Area, the substantial depth of cover above the coal seam, the overlying site characteristics and the continued implementation of existing subsidence monitoring, management and mitigation measures which have been successfully implemented across the Tahmoor North mining area since 2004.

As the proposed modification is predicted to result in nil to negligible impacts and will not result in any material change to the previously assessed environmental impacts of Tahmoor Underground, no change to the existing management and monitoring measures established under Tahmoor Coal's SMP framework are proposed.

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1.0 Introduction

Tahmoor Coal Pty Ltd (Tahmoor Coal), a subsidiary of Glencore Coal Assets Australia , operates Tahmoor Underground, an underground coal mine located near the townships of Tahmoor and Picton approximately 80 kilometres (km) south west of Sydney in the Southern Highlands region of NSW (refer to **Figure 1.1**).

Mining commenced within Tahmoor Underground (formerly Tahmoor Colliery) in 1979 initially via bord and pillar mining and more recently via longwall (LW) mining methods. Tahmoor Underground comprises two broad mining areas, the southern Tahmoor area and the Tahmoor North area. Tahmoor Underground is capable of producing up to 3 million tonnes per annum (Mtpa) of coal from the Bulli Seam. The bulk of this production is coking coal; however, there is a small component of thermal coal produced as a by-product of coal preparation. The mine currently employs 343 employees and full time contractors and predominantly exports coal via rail through the Port Kembla Coal Terminal.

Tahmoor Underground operates in accordance with a number of historical development consents dating back to 1975. Mining within the majority of the Tahmoor North area was approved by the Land and Environment Court in 1994 under DA 57/93, with mining in the remainder of the Tahmoor North area approved by the Minister for Urban Affairs and Planning in 1999 under DA 67/98 (refer to **Figure 1.2**). Mining of the Tahmoor North reserves commenced in LW22 in 2004 and has progressed to LW31, which commenced extraction in June 2017. The current Tahmoor Underground Subsidence Management Plan approval permits the extraction of LW31 to LW37 as shown on **Figure 1.2**.

With the progression of mining within Tahmoor North and improvements in subsidence monitoring methodologies, greater accuracy has been achieved in the prediction of subsidence impacts. This refinement in subsidence predictions has identified a small extension to the extent of subsidence impacts to the north-east of LW32 compared to that predicted in previous approvals. As a result, low levels of subsidence are now predicted within an area where subsidence was not previously predicted, and is therefore not currently permitted to occur under DA 67/98.

1.1 Overview of Modification 4

Tahmoor Coal proposes to modify the Tahmoor North consent (DA 67/98) to permit low levels of subsidence within an area where subsidence is not currently permitted to occur under Condition 6(i) of DA 67/98. The proposed extension to the area approved for subsidence is shown on **Figure 1.3**.

No other changes to the approved mining operations, surface facilities or production rates are proposed as part of this modification.

1.2 Modification Area

The Modification Area comprises approximately 11 hectares (ha) of land within the predicted 20 millimetres (mm) subsidence contour where subsidence is not currently permitted under DA 67/98. The Modification Area consists of two areas of land and is shown on **Figure 1.3**. The environmental impacts of Modification 4 have been assessed within the Modification Area.

The 20mm subsidence contour is considered the limit of vertical subsidence. While some far field horizontal movements may occur beyond the limit of the 20mm subsidence contour, any natural or built surface features that could be sensitive to such movements have also been considered in this assessment.

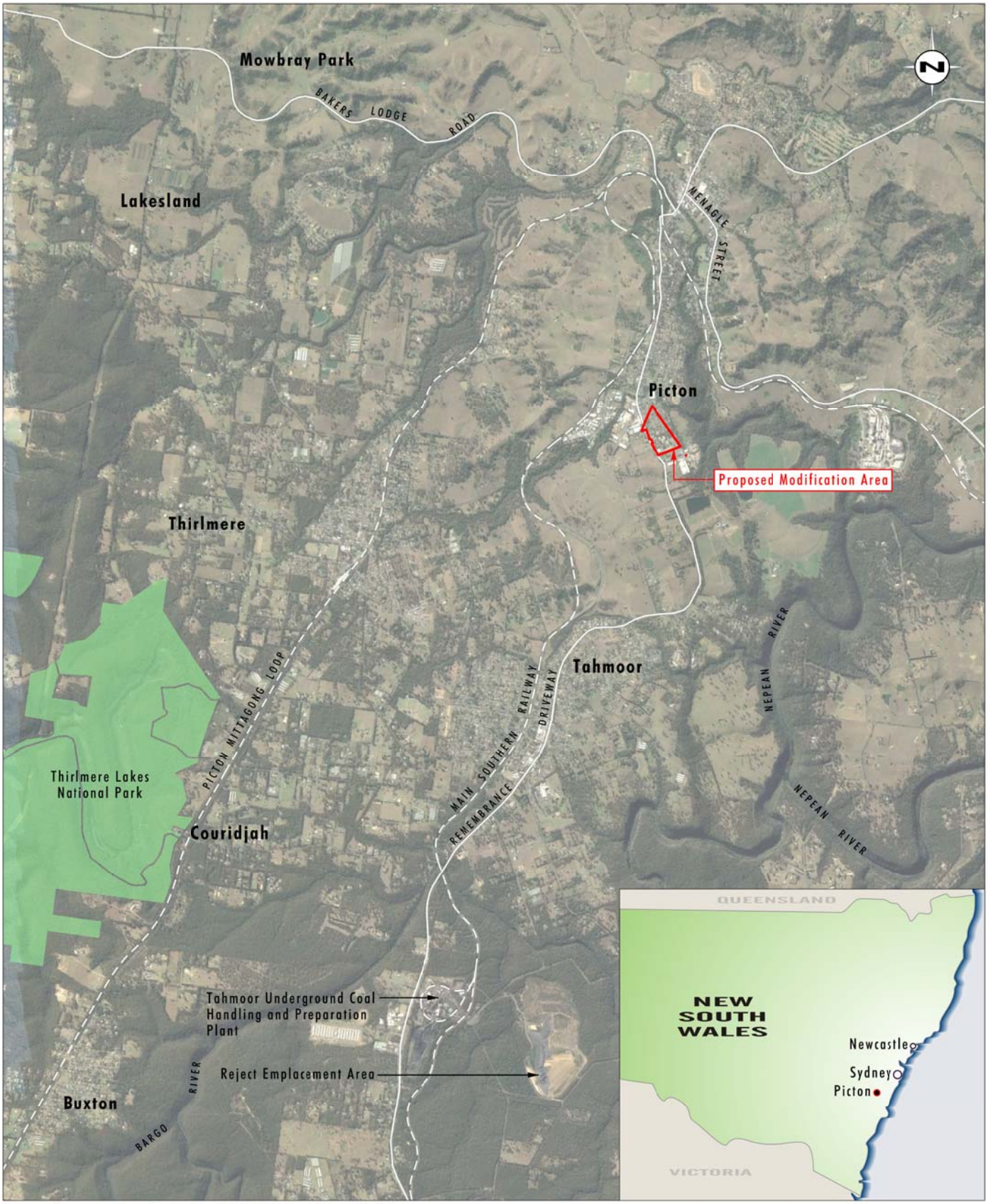


Image Source: Google Earth (CNES/Airbus May 2016)
Data Source: Tahmoor Underground (2017)

Legend

Proposed Modification Area

FIGURE 1.1

Locality Plan

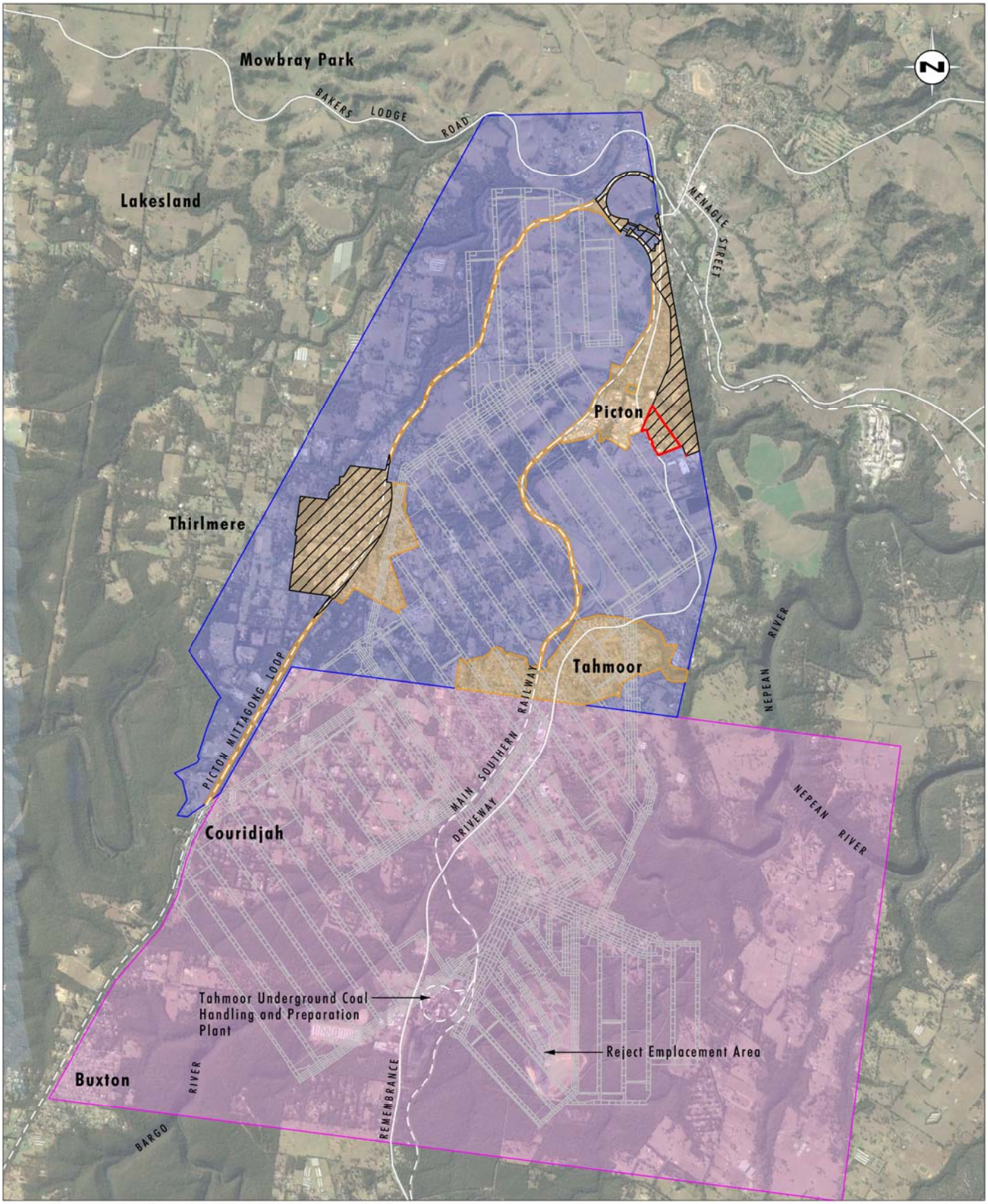


Image Source: Google Earth (CNES/Airbus May 2016)
Data Source: Tahmoor Underground (2017), NSW Department of Industry (2017)

0 1.0 2.0 3.0km
1:60 000

Legend

- Proposed Modification Area
- DA 1975 Consent Area (CCL 716)
- DA 57/93 Consent Area (ML 1376)
- DA 67/98 Consent Area (ML 1539)
- Area where subsidence is not permitted to occur

FIGURE 1.2

Tahmoor Underground Operations

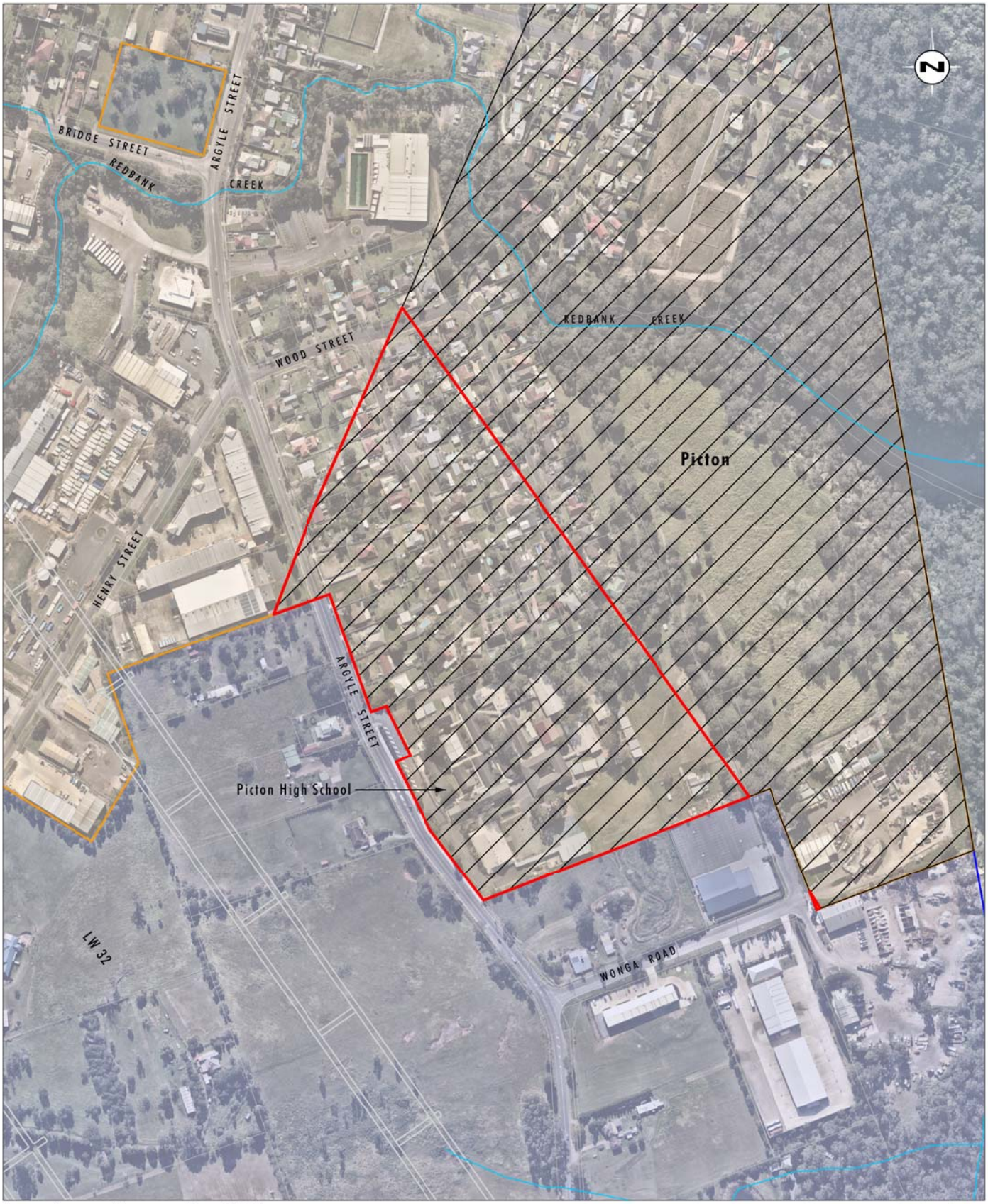


Image Source: Nearmap (May 2017)
Data Source: Tahmoor Underground (2017)

0 100 200 250m
1:5000

Legend

- Proposed Modification Area
- DA 57/93 Consent Area (ML 1376)
- DA 67/98 Consent Area (ML 1539)
- Area where subsidence is not permitted to occur
- LW 31-37 SMP Mine Plan

FIGURE 1.3

Proposed Modification Area

1.3 Environmental Context and Land Use

The Modification Area is located on the southern outskirts of the township of Picton in the Southern Highlands region of NSW (refer to **Figure 1.1**). The Modification Area is located approximately 2.3km from the Picton town centre and encompasses an area of residential development, Picton High School and a small area of industrial land. Land within the Modification Area is primarily zoned R2 Low Density Residential, with Argyle Street zoned SP2 Infrastructure and two small areas IN2 Light Industrial land to the west of Argyle Street and east of Wonga Road. The Modification Area is located within the Bargo Mine Subsidence District.

Tahmoor Underground is located in the Southern Coalfield portion of the Permio -Triassic Sydney Basin with the Illawarra Coal Measures of the Late Permian Age. The Illawarra Coal Measures are overlain by sandstones and claystones of the Narrabeen Group, then the massive quartz strata of the Hawkesbury Sandstone and finally the dark grey claystones of the Wianamatta Group at the surface (MSEC 2014). The Bulli Seam is the uppermost seam in the Illawarra Coal Measures and is currently mined by Tahmoor Coal.

The topography of the Modification Area is characterised by gentle undulating flats, with elevations ranging from approximately 200 to 220 metres (m) Australian Height Datum (AHD) (refer to **Figure 1.4**). No areas of steep slopes occur within the Modification Area, however steep, incised gullies occur to the north and east of the Modification Area associated with Redbank Creek and Stonequarry Creek.

The Modification Area is situated in the Redbank Creek catchment. Redbank Creek is located approximately 100 to 200m to the north of the Modification Area and flows roughly from west to east, joining Stonequarry Creek approximately 400m east of the Modification Area (refer to **Figure 1.4**). Stonequarry Creek flows into the Nepean River approximately 2.5km downstream. The Redbank Creek catchment covers an area of approximately 8km² and incorporates the townships of Thirlmere and Picton.

No natural surface water drainage lines occur within the Modification Area, with runoff typically captured within the street drainage system.

The soils of the Modification Area are mapped as the Blacktown (bt) soil landscape (refer to **Figure 1.5**). The Blacktown soil landscape is characterised by gently undulating rises of the Wianamatta Group shale with a local relief to 30m, with broad rounded crests and ridges with gently inclined sloped. The Blacktown soil landscape has moderate erodibility, with the topsoil often hardsetting and having fine sand and silt content. General fertility is low to very low with the soil materials having low to moderate available water capacity (Hazleton and Tille, 1990).

As shown **Figure 1.4**, the Modification Area has been developed for urban land uses and does not contain any significant areas of remnant vegetation. Areas of remnant vegetation surrounding the Modification Area are limited to the incised gullies and riparian areas associated with Redbank Creek and Stonequarry Creek (refer to **Figure 1.4**) to the north and east of the Modification Area.

Landownership within the Modification Area consists of privately owned residential properties, Council and State owned land and local Council roads.

The primary land use in the northern portion of the Modification Area is low density residential, with the southern portion comprising Picton High School (PHS) and a very small area of Council owned light industrial land. Forty-eight dwellings are located on private landholdings within the Modification Area. Land uses surrounding the Modification Area consist of light industrial to the west and south east, public recreation to the north and east and cleared rural land to the south west.

Image Source: Nearmap (Jul 2017)
Data Source: Tahmoor Underground (2017), Department of Finance, Services & Innovation (2017)
Note: 5m Contours Interval

0 100 250 500m
1:10 000

Legend

- Proposed Modification Area
- LW 31-37 SMP Mine Plan

FIGURE 1.4

Topography and Land Use Context

Data Source: Tahmoor Underground (2017), Department of Finance, Services & Innovation (2017)

0 100 200 250m
1:5000

Legend

- Proposed Modification Area

Soil Landscapes:

- Blacktown Soil Landscape
- Hawkesbury Soil Landscape
- Picton Soil Landscape

FIGURE 1.5

Soil Landscape

1.4 Environmental Assessment Team

This Environmental Assessment (EA) was prepared by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Tahmoor Coal, with specialist input provided by the following organisations/specialists. The specialist assessments prepared for this EA and their authors are presented in **Table 1.1**.

Table 1.1 Specialist Reports included within the EA

Report	Author
Subsidence Predictions and Impact Assessments	Mine Subsidence Engineering Consultants (MSEC)
Groundwater	GeoTerra Pty Ltd
Flood Impact Assessment	WRM water + environment

A full listing of the project team members and their respective roles are provided in **Appendix 1**.

1.5 The Proponent

The proponent for the Modification 4 is Tahmoor Coal. Tahmoor Coal is a wholly owned subsidiary of Glencore Coal Assets Australia (Glencore).

1.6 Environmental Assessment Structure

This EA has been prepared in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Regulation. The EA comprises a main text component and supporting studies, which are included as appendices. An overview of the layout of the main text is presented in **Table 1.2** below.

Table 1.2 Environmental Assessment Structure

EA Section	Environmental Assessment Details
Executive Summary	Provides a brief overview of the proposed modification, the major outcomes of the environmental assessment and key project commitments to mitigate potential impacts.
Section 1.0	Provides the background and context for the proposed modification, key modification details, the proponent and environmental assessment team.
Section 2.0	Describes the existing Tahmoor Underground operations and approvals including environmental management and monitoring at Tahmoor Underground.
Section 3.0	Describes the proposed modification.
Section 4.0	Provides a description of the current planning context for the proposed modification.
Section 5.0	Describes the stakeholder consultation process undertaken as part of the environmental assessment process.
Section 6.0	Provides a comprehensive analysis and assessment of the potential environmental and community impacts of the proposed modification, including the project specific and cumulative impacts.
Section 7.0	Provides a summary of proposed management and mitigation measures for the proposed modification
Section 8.0	Provides a conclusion and justification for the proposed modification, including how the proposed modification meets the principles of ecologically sustainable development.
Section 9.0 and **10.0**	References and abbreviations

2.0 Existing Operations

2.1 Mining History

Tahmoor Underground (formerly Tahmoor Colliery) is located in the Southern Coalfields of New South Wales (NSW) in the Wollondilly Shire Council Local Government Area. Development of the site commenced in 1975, with coal extraction via bord and pillar methods occurring from 1979. A Coal Handling and Preparation Plant (CHPP) and Reject Emplacement Area were established in 1980 and longwall mining was introduced in 1986.

The mine comprises two key mining areas, Tahmoor and Tahmoor North, with active mining currently occurring in the Tahmoor North area. Coal is extracted from the Bulli coal seam at depths of between 385 and 500m. Extracted coal is processed on site prior to transportation via rail to the Port Kembla Coal Terminal.

Tahmoor Underground operates within three mining titles, namely Consolidated Coal Lease 716 covering the original Tahmoor mining area, Mining Lease (ML) 1376 and ML 1539 covering the Tahmoor North mining area. The location of mining titles is shown on **Figure 1.2**.

2.2 Development Approval History

Development consent for the initial Tahmoor mining area was originally granted by Wollondilly Shire Council in 1975 (shown in pink shading on **Figure 1.2**). Development consent for the Tahmoor North area was sought from the Council in 1993. This consent was subsequently granted by the Land and Environment Court in 1994 (shown in blue shading on **Figure 1.2**). However it became apparent during this process that mining was prohibited in some areas within the application area and consequently consent could not be granted by the Court within these areas. This resulted in some areas being excluded from the 1994 consent (DA 57/93), including areas under urban land and rail lines.

The then Minister for Mineral Resources granted ML 1376 over the areas approved for mining under DA 57/93, however due to the exclusion of areas from DA 57/93 and ML 1376, it was impractical to develop Tahmoor North at that time.

In order to allow the development of Tahmoor North, a further development application was lodged with the Minister for Planning in 1998 which sought approval to mine the majority of those areas of Tahmoor North that were excluded from DA 57/93. Some areas outside the predicted extent of subsidence were not included in this application. A Commission of Inquiry was held and in February 1999, the Minister for Planning issued development consent for those areas (shown in orange shading on **Figure 1.2**) under DA 67/98. ML 1539 was granted for those areas not covered by the previously granted ML 1376.

The combination of DA 57/93, DA 67/98, ML 1379 and ML 1539 has enabled the economic development of Tahmoor North.

Despite this, DA 57/93 and DA 67/98 left a small number of areas where subsidence was not permitted to occur (shown in black cross-hatching on **Figure 1.2**). Approval for subsidence within these areas was not sought as part of DA 67/98 as they were located outside the then predicted extent of subsidence. The ability to obtain a modification to enable subsidence within those areas where subsidence was not approved in DA 67/98 is provided for under Schedule 2, Condition 6 of DA 67/98, which recognises the potential for future approvals or modifications of the consent under Part 4 of the EP&A Act to allow for subsidence to occur within those areas.

Subsequent changes to the Tahmoor North mine plan saw Tahmoor Underground seek a modification to DA 67/98 in 2006 (Modification 1) and 2012 (Modification 2) to subside a number of these areas. Approval was granted, leaving only two areas remaining within the Tahmoor North domain where subsidence is not permitted. These areas are primarily beneath residential or rail facilities in Picton and Thirlmere and shown on **Figure 1.2**. This restriction is defined by Condition 6(i) of DA 67/98, which states:

6. *The applicant shall not:*

   (i) cause subsidence within the two areas shown in black crosshatching in Figure 2; or

   (ii) cause moderate, severe or very severe structural damage to houses, sheds or polls within the DA area in excess of the percentages of such structures shown in the relevant column of Figure 3

   without obtaining either an approval under Part 4 of the Act or a modification of consent under Part 4 of the Act.

A summary of the development approval history at Tahmoor Underground is outlined in **Table 2.1**.

Table 2.1 History of Mining Approvals at Tahmoor Underground

Year	Approval	Title/Description	Expiry
1975	DA 1975	Tahmoor Underground Mine (CCL716)	No expiry
1979	DA 1979	Coal Preparation Plant Stockpiles and Refuse Emplacement Area	No expiry
1985	DA 1979 (Mod 1)	Modification for road haulage of trial coal shipments	No expiry
1985	DA 190/85	Surface works for Gas Extraction	No expiry
1986	DA 1979 (Mod 2)	Modification for upgrades for longwall mining	No expiry
1988	DA 1979 (Mod 3)	Modification for road haulage in Wollondilly Shire and when rail unavailable	No expiry
1994	DA 57/93	Tahmoor North Project	No expiry
1994	DA 1979 (Mod 4)	Modification for road haulage to Corrimal and Coal Cliff Coke Works	No expiry
1999	DA 67/98	Tahmoor North Extension Project	16/06/2024
2006	DA 67/98 (Mod 1)	Modification for additional areas to subsided	16/06/2024
2007	DA 57/93 (Mod 1)	Modification for heritage approval condition	No expiry
2012	DA 67/98 (Mod 2)	Modification for Redbank tunnel subsidence management	16/06/2024
2014	DA 67/98 (Mod 3)	Modification for Redbank tunnel subsidence management – Subdivision of Land	16/06/2024

The Tahmoor North mine plan has changed over time from that presented in the 1993 and 1998 EIS's. These changes have occurred in response to more geological information becoming available regarding the coal deposit, leading to more efficient recovery of the coal resource. Mine plan changes have also been implemented to limit or prevent subsidence impacts on surface features such as Queen Victoria Hospital and Thirlmere Heritage Conservation Area, and due to advances in longwall extraction technology. Such changes to the final Tahmoor North longwall layout have always been envisaged, with the 1993 and 1998 EIS's both identifying potential variations in the mine plan in response to improved understanding of the geological setting.

DA 57/93 and DA 67/98 approve the extraction of coal throughout the entire Tahmoor North area. These consents also provide approval to cause subsidence throughout the majority of the Tahmoor North area, with the exception of the two areas identified in Condition 6(i) of DA 67/98 and shown on **Figure 1.2**. Under the 1994 and 1999 consents, final mine plan approval is managed via the Subsidence Management Plan process and potential changes in the extent or severity of impact on structures associated with the final mine plan is addressed by Condition 6 of DA 67/98, which:

- Restricts subsidence within the two areas shown on **Figure 1.2**, without a separate approval or modification of existing approval under Part 4 of the EP&A Act, and

- Limits the severity of damage to structures within the DA area in excess of the percentages assessed under the consent and presented in Figure 3 of the consent, without a separate approval or modification of existing approval under Part 4 of the EP&A Act.

Consequently, the proposed modification (Modification 4) is sought to allow subsidence to occur within part of an area where subsidence is not currently permitted to occur under Condition 6(i) of DA 67/98. As noted above, such modifications are provided for and have previously been approved under Schedule 2, Condition 6 of DA 67/98, which recognises the potential for future approvals or modifications of the consent under Part 4 of the EP&A Act to allow subsidence to occur within the two areas where subsidence is currently not permitted. Further detail of the proposed modification is provided in **Section 3.0**.

2.3 Environmental Management of Existing Operations

The environmental management of existing operations at Tahmoor Underground is undertaken within the framework of the Tahmoor Underground Environmental Management System and supporting environmental management plans and the Environment Protection Licence for the mine (EPL 1389). This section provides an overview of the existing environmental management framework at Tahmoor Underground and its environmental performance.

2.3.1 Environmental Management and Monitoring

The Tahmoor Underground Environmental Management System and its supporting environmental management plans provide a methodical approach to fulfilling Tahmoor Coal's environmental obligations and ensuring the effective ongoing environmental management on site.

An independent audit of Tahmoor Underground was undertaken in 2014 and the audit concluded that *'a good standard of environmental management is generally being applied in Tahmoor Coal's Operations'* (Hansen Bailey 2015). A recent independent audit of the Tahmoor Underground Environmental Management System was conducted in October 2017, in accordance with requirements of DA 67/98 and included subsidence management and monitoring systems currently being applied by Tahmoor Underground. Results of this audit will be published when available.

The Environmental Management System Strategy and Framework is the central document of the Environmental Management System and has been prepared in accordance with Schedule 2, Condition 43 of DA 67/98. The Environmental Management System Strategy and Framework provides the strategic context for the environmental management of Tahmoor Underground and the framework for the implementation of a series of plans and strategies, which include the following:

- Cultural Heritage Management Plan

- Biodiversity and Land Management Plan

- Air Quality and Greenhouse gas Management Plan

- Waste Management plan
- Noise Management Plan
- Mine Closure Plan
- Environmental Monitoring Program
- Product Stewardship Management Plan
- Social Involvement Plan
- Pollution Incident Response Management Plan
- Soil and Water Management Plan
- Groundwater Management Plan.

Tahmoor Underground also operates in accordance with a Subsidence Management Plan as detailed in **Section 2.3.2**.

Tahmoor Coal's performance against relevant environmental standards and the requirements of its Environmental Management System and consents is reviewed annually as part of the Annual Review process and subject to independent audit every three years.

2.3.2 Subsidence Management and Monitoring

A Subsidence Management Plan covering LW31-37 (SMP (LW31-37)) was developed by Tahmoor Underground and submitted in December 2014. The secondary extraction of coal in LW31 was subsequently approved under SMP (LW31-37) by Division of Resources and Energy (DRE). SMP (LW31- 37) and the associated Management Plans also satisfy the subsidence prediction, monitoring and management requirements of DA 67/98 Schedule 2 Conditions 11 and 12.

The monitoring, management and mitigation of subsidence is implemented in accordance with the SMP (LW31- 37). The current Tahmoor Underground subsidence management framework requires the preparation, implementation and review of the following key plans (as relevant) for each longwall within the SMP mine plan:

- Environmental Management Plan
- Subsidence Monitoring Programme
- Built Structures Management Plan
- Heritage Management Plan
- Infrastructure Management Plans (including electricity, gas, potable water, sewer, Telstra and Wollondilly Shire Council plans)
- Property Specific Management Plans for each property impacted by subsidence.

A range of subsidence monitoring is implemented by Tahmoor Coal in consultation with relevant land and infrastructure owners. Monitoring measures are detailed in SMP (LW 31 – 37) management and monitoring plans and include:

- Subsidence monitoring lines
- Ground surveys of surface infrastructure and key environmental features such as creeks
- Pre-mining geotechnical and structural inspections
- Visual monitoring of natural and built surface features within the active subsidence zone
- Environmental monitoring.

The results of subsidence monitoring are regularly reviewed against predictions, with the results used to calibrate the subsidence prediction methodology and inform impact predictions. The results are reported annually as part of the Annual Review and a comprehensive review is presented in end of panel reports at the completion of each longwall. This is in addition to the extensive community consultation undertaken by Tahmoor Coal with the community broadly, and with residents and building owners affected by subsidence from Tahmoor Underground. Details of the extensive community consultation program undertaken by Tahmoor Coal are presented in **Section 5.2**.

Approval cannot be provided under the current SMP (LW 31-37) to extract coal by longwall methods from those parts of LW 32 that are predicted to cause subsidence in the Modification Area, until a modification of DA 67/98 is obtained, as outlined in DA 67/98 Schedule 2 Condition 6, to allow such subsidence to occur in the Modification Area.

3.0 Project Description

Tahmoor Coal proposes to modify DA 67/98 to permit low levels of subsidence within an area where subsidence is not currently permitted to occur under Condition 6 of DA 67/98 without seeking a modification to the consent. The area where subsidence is proposed to occur is referred to as the Modification Area and is shown on **Figure 1.4**.

No change to any other aspect of the approved mining operation is proposed as part of the modification, including no change to approved mining areas or methods, surface facilities, approved rates of mining, coal processing and handling or product transport rates.

Tahmoor Coal holds mining authority ML 1539 over the Modification Area. The Modification Area is wholly located within ML 1539 and no change to existing mining authorities is required to accommodate the proposed modification.

3.1 Project Justification and Alternatives

The need for the proposed modification has arisen as a result of improved accuracy in subsidence predictions which has been informed by the ongoing review of subsidence monitoring data within Tahmoor Underground and the broader Southern Coalfield District, and additional geological information that has become available. This improvement in subsidence predictions has identified that low levels of subsidence may extend further to the north-east of LW32 than predicted in previous approvals.

The proposed modification is required in order to implement the mine plan shown in the current SMP (LW31 – 37) which shows coal extraction in LW32, within the area approved for mining in DA 67/98.

The modification will provide for the ongoing employment of the existing workforce of approximately 343 employees, and provide ongoing economic contributions to the local and state economy. The proposed modification will enable Tahmoor Underground to mine LW32 in an efficient and viable manner.

Tahmoor Coal has considered the alternative of not proceeding with the extraction of LW32, or significantly altering the length of LW32 in order to avoid subsidence within the proposed Modification Area, however these options would result in the loss of in excess of 300,000 tonnes of run of mine (ROM) coal that has been approved for mining under DA 67/98 and will sterilise this resource from mining in the future.

Such a restriction of operations is not considered warranted given the very low levels of subsidence that would be experienced within the proposed Modification Area and the minimal impact predicted to surface features and the environment as a result of the proposed modification.

Modifications such as the proposed modification are provided for under Schedule 2, Condition 6 of DA 67/98, which recognises the potential for future modifications of DA 67/98 to allow for subsidence to occur within the two areas where subsidence is currently not permitted.

4.0 Planning Context

This section provides details of the relevant State and Commonwealth legislation and planning provisions and a discussion of their application to the proposed modification.

4.1 NSW Legislation

4.1.1 Environmental Planning and Assessment Act 1979

Tahmoor Coal seeks to modify DA 67/98 under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

DA 67/98 was granted by the Minister for Urban Affairs and Planning on 25 February 1999 pursuant to Section 101(8) if the EP&A Act prior to the commencement of the (now repealed) Part 3A provisions.

Under Clause 8J(8)(a) of the EP&A Regulation, Section 75W of the EP&A Act continues to apply to any modification of a development consent which was granted by the Minister under Section 101 if the EP&A Act.

Clause 8J(8) of the EP&A Regulation provides that:

> *(8) For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:*
>
> *(a) a development consent granted by the Minister under section 100A or 101 of the Act…*

Further, clause 12 of Schedule 6A of the EP&A Act provides that:

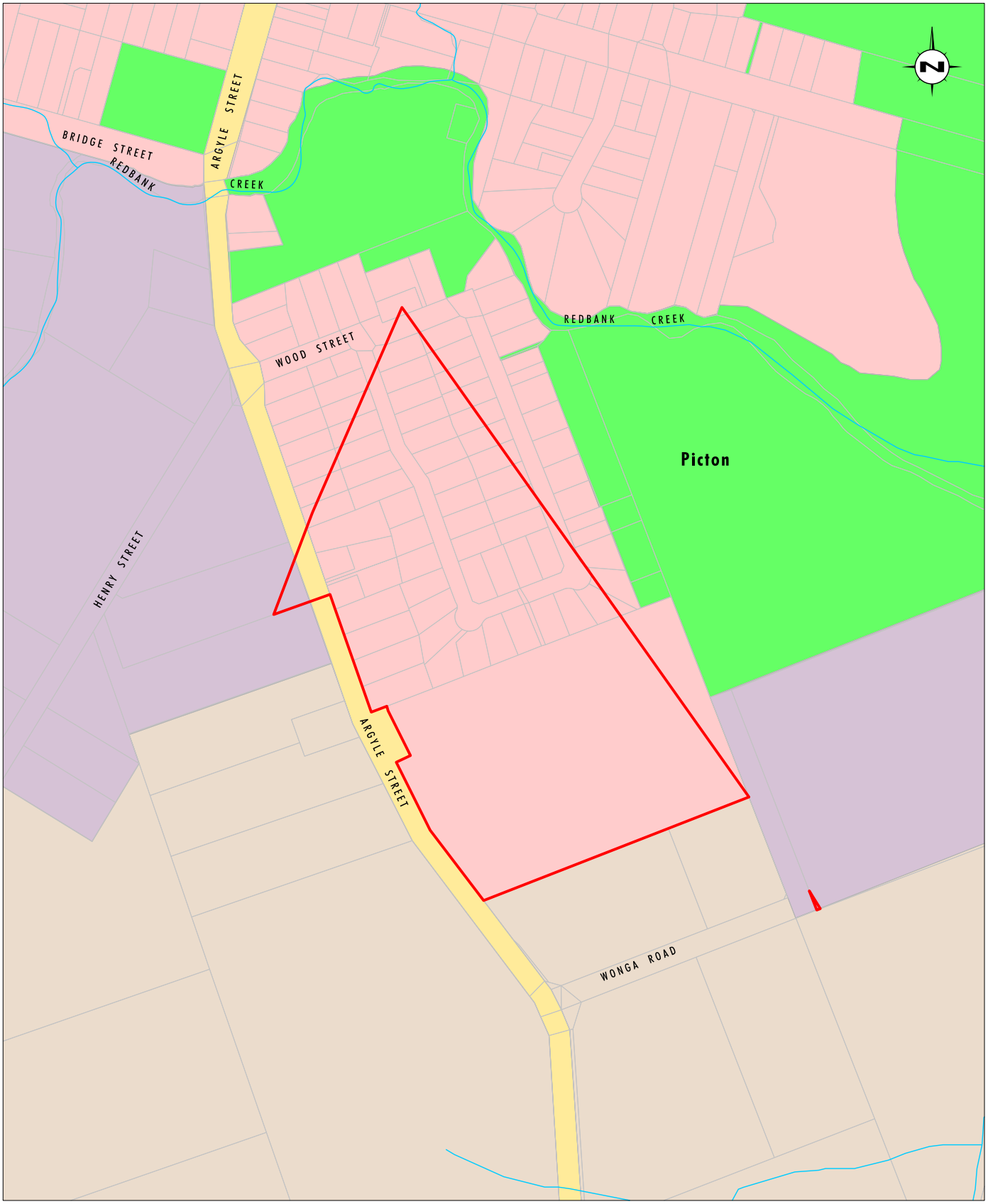
> ***12 Continuing application of Part 3A to modifications of certain development consents***
>
> *Section 75W of Part 3A continues to apply to modifications of the development consents referred to in clause 8J (8) of the Environmental Planning and Assessment Regulation 2000, and so applies whether an application for modification is made before or after the commencement of this clause.*

Accordingly DA 67/98 is a transitional Part 3A project, and Section 75W of the EP&A Act is the appropriate approval pathway for the modification.

Permissibility

Environmental planning instruments, other than State Environmental Planning Policies (SEPPs), do not apply to projects assessed under Section 75W of the EP&A Act, except as regards to permissibility.

The Modification Area is located in the Wollondilly local government area (LGA). Under the Wollondilly Local Environmental Plan (LEP) 2011, the Modification Area is primarily zoned R2 Low Density Residential, with a small area of Argyle Street zoned SP2 Infrastructure and land to the west of Argyle Street zoned IN2 Light Industrial (refer to **Figure 4.1**). Underground mining is prohibited on land zoned R2 and SP2, and permissible with consent on land zoned IN2. However, the provisions of SEPP (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP), override the permissibility provisions of the Wollondilly LEP. The Mining SEPP provides that underground mining may be carried out on any land with development consent. Consequently, the proposed modification is permissible with development consent under the Mining SEPP.



Data Source: Tahmoor Underground (2017), Department of Finance, Services & Innovation (2017)

0 100 200 250m
1:5000

Legend

- Proposed Modification Area
- SP2 - Infrastructure

Zoning:

- IN2 - Light Industrial
- R2 - Low Density Residential
- RE1 - Public Recreation
- RU2 - Rural Landscape

FIGURE 4.1

Land Zoning Map

File Name (A4): R01/4081_007.dgn
20171024 16.46

4.1.2 Other State Legislation

A summary of the other State environmental and planning legislation potentially relevant to the proposed modification is provided in **Table 4.1**.

Table 4.1 Summary of State Legislation and relevance to the modification area

Act	Comment	Further Approval Required for Proposed Modification
Mining Act 1992	Under this Act a ML is required before any mining or specified mining purpose can be carried out on the land. Tahmoor Underground currently holds mining lease ML 1539 over the Modification Area. ML 1539 provides Tahmoor Coal with the mining rights to the target seam. All mining operations must be subject to a Mining Operations Plan (MOP) and approved Extraction Plan or SMP.	No, Tahmoor holds an existing mining lease, approved MOP and SMP for the proposed modification.
Work Health and Safety (Mines) Act 2013 and Regulation	The *Work Health and Safety (Mines) Act 2013* commenced on 1 February 2015, replacing the *Coal Mine Health and Safety Act 2002*. The new laws align specific mine safety laws with general work health and safety laws. Under the Act, mine operators are required to notify the regulator of certain high risk activities, including secondary extraction by longwall methods. The approval of the regulator is however not required for these activities.	No, however Tahmoor Coal will be required to notify the regulator of all proposed high risk activities, including secondary extraction.
Protection of the Environment Operations Act 1997 (PoEO Act)	The PoEO Act is administered by the EPA and requires licences for environmental protection including waste, air, water and noise pollution control. Tahmoor Coal currently holds EPL 1389. No changes to surface operations, noise emissions, dust emissions or surface water management are proposed as a result of the proposed Modification.	No
National Parks & Wildlife Act 1974 (NP&W Act)	An Aboriginal Heritage Impact Permit (AHIP) is required under Section 90 of the NP&W Act to harm an Aboriginal object. The proposed modification will not impact any Aboriginal objects and an AHIP will not be required (refer to **Section 6.1**).	No
Heritage Act 1977 (Heritage Act)	Approval is required under Section 60 of the Heritage Act to disturb an item listed on the State Heritage Register or the subject of an Interim Heritage Order. An excavation permit is required under Section 140 to disturb or excavate other heritage items. No heritage items are listed within the Modification Area, therefore an approval or permit will not be required under the Heritage Act.	No
Roads Act 1993	The *Roads Act 1993* is administered by Roads and Maritime Services, local council or the Department of Industry - Lands depending on the classification of the road; the Roads and Maritime Services has jurisdiction over major roads, the local council over minor roads, and the Department of Industry - Lands over Crown roads and Crown road reserves.	Yes, if subsidence remediation works are required within any road reserve (unless works are undertaken by Council)

Act	Comment	Further Approval Required for Proposed Modification
	The *Roads Act 1993* requires that applications for the closure of Crown roads be made to the Minister. Consent under Section 138 of the *Roads Act 1993* is required in order to undertake works within a road reserve. Subsidence remediation works may be necessary along sections of Argyle Street, Wood Street and Coachwood Crescent. Approval for any such works will be required from Wollondilly Shire Council under s138 of the *Roads Act 1993*, unless works are undertaken by Council. If any works are required, approvals would be obtained prior to such works being undertaken.	
Crown Lands Act 1989	The *Crown Lands Act 1989* provides for the administration and management of Crown land in the eastern and central divisions of the State. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Lands (Continued Tenures) Act 1989*. It is noted that the *Crown Lands Act 1989* will be replaced by the *Crown Land Management Act 2016* on its commencement (anticipated for 2018). The modification area does not include Crown Lands.	No
Water Management Act 2000 (WM Act)	The WM Act regulates the taking, interception, storage and use of surface water and groundwater within areas subject to water sharing plans. The *Water Sharing Plan for the Greater Metropolitan Unregulated Water Sources 2011* (Greater Metropolitan Unregulated WSP) applies to the surface water sources within the Modification Area. The *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* (Greater Metropolitan Groundwater WSP) applies to the groundwater sources within the Modification Area. Any water extracted from water sources regulated by a WSP will require licensing under the WM Act. Based on the findings of the subsidence assessment (refer to **Section 6.2**), surface water impact assessment (refer to **Section 6.3**) and groundwater impact assessment (refer to **Section 6.4**), no material change to the approved impacts on surface water or water within alluvial or non-alluvial groundwater sources regulated by the WM Act is predicted as a result of the proposed modification. The following approvals are not required under the WM Act for the proposed modification: water use approval; water management work approval; or activity approval. Approval under the WM Act is not anticipated to be required.	No
Water Act 1912	This Act applies to the licensing and regulation of water that is not covered by a water sharing plan under the WM Act. There are no areas of the Tahmoor Underground or Modification area that are not covered by a WSP.	No

Act	Comment	Further Approval Required for Proposed Modification
Environmentally Hazardous Chemicals Act 1985	The EPA is granted power under *the Environmentally Hazardous Chemicals Act 1985* to assess and control chemicals and declare substances to be chemical wastes. A licence is required for any storage, transport or use of prescribed chemicals. The modification will not result in any changes to the storage, transport or use of prescribed chemicals.	No
Mine Subsidence Compensation Act 1961	The Modification Area is located within the Bargo Mine Subsidence District. Under this Act, the approval of Subsidence Advisory NSW (formerly the Mine Subsidence Board) is required for the erection or alteration of improvements within a mine subsidence district. The erection or alteration of improvements is not proposed as part of the modification. Therefore approval under Section 15 of the *Mine Subsidence Compensation Act 1961* does not apply. It is noted that changes are currently proposed to the mine subsidence compensation process whereby Subsidence Advisory NSW would no longer be responsible for processing claims for subsidence damage from active mines, rather, mining operators would directly compensate property owners for any subsidence damage that they cause. These proposed changes to the *Mine Subsidence Compensation Act 1961* are yet to be enacted.	No

4.1.3 Environmental Planning Instruments

The relevant SEPPS required to be considered in relation to the modification are outlined in **Table 4.2**.

Table 4.2 Relevant SEPPs for consideration in relation to the modification

NSW Legislation – Environmental Planning Instruments		
Planning Provision	**Comment**	**Relevance**
State Environmental Planning Policy (State & Regional Development) 2011	The modification is of a class of development listed in the SEPP and would have been categorised as State significant development if s75W did not apply to the proposed modification.	The proposed modification is categorised as State Significant Development but for the application of section 75W of the EP&A Act via schedule 6A of the EP&A Act.
State Environmental Planning Policy (Mining, Petroleum Production & Extractive Industries) 2007	Regulates the permissibility of mining and related development and specifies matters that must be considered in assessing mining developments requiring consent under Part 3A (repealed) and Part 4 of the EP&A Act.	The Mining SEPP provides that the proposed modification is permissible with consent.

NSW Legislation – Environmental Planning Instruments		
State Environmental Planning Policy 33 (Hazardous & Offensive Development) 1992	SEPP No. 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A preliminary hazard analysis is completed for potentially hazardous development to assist the consent authority to determine acceptability.	The existing Tahmoor Underground operations are not considered as hazardous or offensive. The proposed modification will not result in any changes to the existing operations which would alter this classification. No further consideration of SEPP No. 33 is required.
State Environmental Planning Policy 44 (Koala Habitat Protection)	SEPP No. 44 restricts a Council from granting development consent for proposals on land identified as core koala habitat without preparation of a plan of management.	No core koala habitat has been identified within the Modification area (refer to **Section 6.1**). The provisions of SEPP 44 do not apply and a koala plan of management is not required for the modification.
State Environmental Planning Policy 55 (Remediation of Land)	SEPP No. 55 restricts a consent authority from granting consent for the carrying out of development on land unless the consent authority has considered any potential contamination issues.	No potential contamination issues have been identified within the Modification Area.
State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011	The SEPP for the Sydney Drinking Water Catchment restricts a consent authority from granting consent for the carrying out of development under Part 4 of the EP&A Act within an area identified as being within the Sydney drinking water catchment, unless the proponent demonstrates via an assessment, that a neutral or beneficial effect on water quality can be achieved.	The Modification Area is located outside the Sydney drinking water catchment and therefore the provisions of the SEPP do not apply.

4.2 Commonwealth Legislation

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment and Energy is required for any action that may have a significant impact on matters of national environmental significance.

If an 'activity' is likely to have a significant impact on a matter of national environmental significance then it may be a 'controlled action' and should be referred to the Commonwealth Minister for consideration.

Matters of national environmental significance potentially relevant to the Modification are:

- Threatened Species and Ecological Communities
- Migratory Species
- Water Resources.

The water resources trigger relates to the protection of water resources from impacts of coal seam gas and large coal mining projects. According to Significant Impact Guidelines 1.3 prepared by the Department of Environment (2013), an action is likely to have a significant impact on a water resource if there is a real chance or possibility that it will directly or indirectly result in:

- a substantial change to the hydrology of a water resource
- a substantial change in water quality of a water resource

that is of sufficient scale or intensity as to reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes, or to create a material risk of such reduction in utility occurring.

An assessment of the potential impacts of the modification on surface water and groundwater resources has been undertaken and are discussed in **Sections 6.3** and **6.4**. These water resources impact assessments were undertaken with consideration of the key aspects of hydrological change listed by the Significant Impact Guidelines 1.3 (Department of Environment 2013).

An assessment of the potential ecological impacts was also undertaken and is discussed in **Section 6.1**.

On the basis of the assessments presented in **Section 6.1** to **6.4**, and given that no change is proposed to the currently approved mining area or methods, it is considered that the proposed modification will not have a significant impact on any of the matters of national environmental significance listed above.

Approval of the modification under the EPBC Act is therefore not required.

4.2.2 Native Title Act 1993

The (NSW*) Mining Act 1992* must be administered in accordance with the *Commonwealth Native Title Act 1993* (NT Act). The primary effect of the NT Act on mining authorities is to provide native title parties with a 'right to negotiate' prior to the Minister (administering the NSW Mining Act) considering the grant or renewal of the mining authority. A mining lease has already been granted over the Modification Area (ML 1539) and no new mining leases will be required for the proposed modification.

5.0 Stakeholder Engagement

Tahmoor Underground has an established relationship with the surrounding community and other stakeholders and has implemented a process for ongoing engagement regarding its mining operations. As part of the proposed modification, Tahmoor Underground is committed to working with the community to ensure it can continue to coexist with the local community.

5.1 Existing Community Engagement

Community consultation is integral to the operation of the Tahmoor Underground operations, with the mine having subsided in excess of 1,955 premises in the Tahmoor and Thirlmere areas since the commencement of LW22 in 2004. Tahmoor Underground has a well-established, comprehensive and ongoing community consultation programme in place that has been continually operating prior to the commencement of LW22.

5.1.1 Stakeholder Engagement for SMP LW31-37

Further ongoing stakeholder engagement was implemented for the application for SMP (LW31-37), which commenced in 2014. The community was notified of Tahmoor Coal's intention to lodge an SMP Application over the SMP (LW31-37) area, which includes the Modification Area.

Residents in the area covered by the application for SMP (LW31–37) received three letters. Two of these letters were notifying them that they were in the SMP area for LW31-37 and that there would be a Community Information Day on the 23 October 2014 and 11 December 2014. The third letter was to notify the residents that the SMP was on Public Display. Advertisements were also placed in the local papers regarding the SMP application for this area.

Agency consultation was undertaken to support the application for SMP (LW31-37). The SMP application was distributed to the following agencies for comment:

- Department of Primary Industry (Fisheries)
- Mine Subsidence Board
- Department of Planning and Environment
- NSW Office of Water
- Environment Protection authority
- Division of Resources and Energy (Department of Trade and Investment)
- Wollondilly Shire Council

Feedback received form these agencies and authorities was incorporated into the SMP documentation.

5.1.2 Comprehensive ongoing consultation approach

Tahmoor Underground has a comprehensive program of ongoing community engagement that supports the high level of community acceptance of its activities. Tahmoor Underground's approach includes the following practices:

- adoption of a conservative approach to predicting subsidence and assessing impacts so as to reduce the likelihood of under-stating impacts
- preparation of detailed subsidence predictions and impact assessments for individual premises/structures
- a number of advertised Community Information Days held each year and attended by mine representatives and the then MSB (now Subsidence Advisory NSW)
- regular Tahmoor Colliery Community Consultative Committee meetings
- letter and door knocking to residents advising of imminent longwall mining in their area, including at SMP application preparation, lodgement and approval stage, and prior to imminent commencement of each longwall. Residents are provided with a Subsidence Information Pack, which includes information on longwall mining and mine subsidence, claims process, recommendation to undertake pre-mining inspections with the MSB/SA NSW (or Tahmoor Underground if preferred), a list of emergency contact numbers and point of contact at Tahmoor Underground.
- individual meetings with residents
- newspaper advertisements to advise the community about community consultation opportunities, including Community Information Days
- regular reporting on the progress of mining and any observed impacts. This is conducted mainly by community newsletter distributed via mail, email, website and notice boards for any member of the community who wishes to be regularly informed
- offer of free confidential counselling services
- prompt response to reported impacts
- ongoing monitoring if/when impacts occur.

5.2 Stakeholder Engagement for Modification 4

A stakeholder engagement program has been developed and implemented for the proposed modification which builds on the well-established, comprehensive and ongoing community consultation programme in place at the Tahmoor Underground operations.

The objectives of the engagement program were to:

- identify key stakeholders likely to be affected by the proposed modification, and other interested stakeholders to be consulted;
- proactively disseminate information on the proposed modification and provide opportunity for feedback from key stakeholders;

- identify key issues of interest or concern to stakeholders in order to inform the environmental assessment; and

- work together with stakeholders to mitigate and address any significant issues/impacts.

A comprehensive stakeholder identification process was undertaken prior to commencement of the program. **Table 5.1** summarises the stakeholder groups consulted as part of the engagement program for the proposed modification and the range of engagement mechanisms utilised. Stakeholder engagement activities were undertaken by Tahmoor representatives from July to September 2017.

Table 5.1 Project Stakeholder Consultation

Stakeholder Group	Engagement Mechanisms
Landholders/residents within the Modification Area	Community Information Session Newsletter Letter to residents 1800 contact line Webpage Advertisements
Landholders/residents surrounding Modification Area	Community Information Session Newsletter 1800 contact line Webpage Advertisements
Picton High School (PHS)	Meetings with School Principal, architect, staff, P&C and students representatives Community Information Session at school Newsletter 1800 contact line Webpage Advertisements
Other education facilities and community groups	Community Information Session Webpage Advertisements
State government agencies	Briefing meeting
Wollondilly Shire Council	Meeting with Council staff and Councillors
Tahmoor Underground workforce	Employee briefings
Tahmoor Underground Community Consultative Committee (CCC)	Presentation at CCC meetings/briefing on the Project Community Information Session Newsletter

As noted in **Table 5.1**, consultation with the community and other key stakeholders has been undertaken via newsletters, the Tahmoor Underground CCC meetings and a Community Information Session, in accordance with a specific Stakeholder and Engagement Plan (Umwelt, 2017).

Members of the Tahmoor Underground CCC were first briefed on the proposed modification during a scheduled meeting on 7 September 2017, including an introduction to the modification and planning process. In addition to community members, representatives from Wollondilly Shire Council, Rivers SOS, DPI Water and Subsidence Advisory NSW also attended.

A Community Information Session was held on 21 September 2017 with representatives from Tahmoor Underground and the Subsidence Advisory NSW to discuss the proposed modification and was attended by members of the community from Picton, Tahmoor and Lakesland. Notification was by way of advertisements in local newspapers, letters to individual property owners within the SMP Area and information presented in Tahmoor Underground newsletters.

An Information Session was also held at PHS on 13 September 2017 to discuss the potential subsidence impacts of the mining of LW32 on the school, implications for school staff and student safety and school operations in general.

The Tahmoor Underground newsletter was issued in September 2017 at the commencement of consultation and included a description of the proposed modification, details of the Community Information Session and information on how members of the community could obtain further information on the Project. The newsletter was distributed along with a letter by the Project team to approximately 60 residents in the Modification Area. The letter included further Project details with the opportunity to meet with the Project team in regards to the proposed modification upon request. No individual meetings were requested.

A newsletter was developed specifically for the PHS and distributed to the P&C, staff and parents and also the Tahmoor Underground CCC, Wollondilly Shire Council, Jai Rowell (State Member for Wollondilly) and the Subsidence Advisory NSW in October 2017. The newsletter introduced the Project and provided information on potential subsidence impacts on the School specifically. Copies of the newsletters prepared and distributed are provided in **Appendix 2**.

A timeline of consultation activities is displayed in **Figure 5.1**.

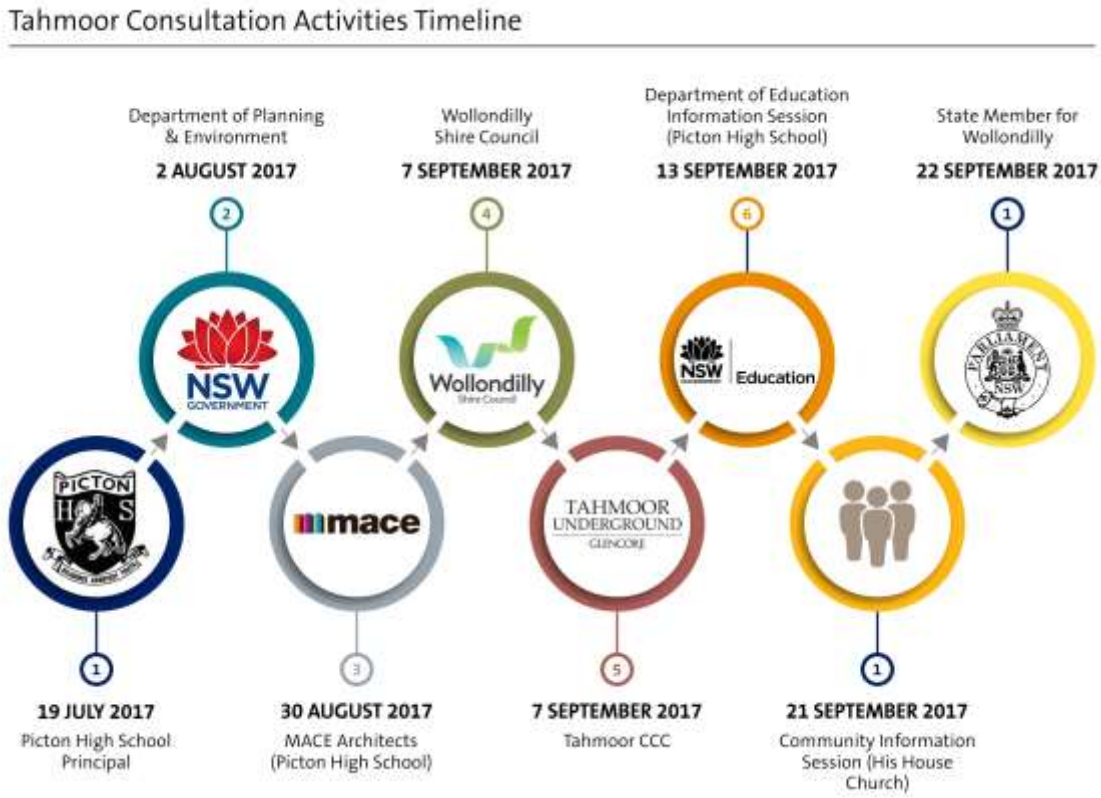


Figure 5.1 Modification 4 Consultation Activities

5.2.1 Ongoing Community Engagement

Community consultation will continue following approval of the modification with ongoing implementation of Tahmoor Underground's community consultation program (as outlined in **Section 5.2.1**), community and landholder notifications in relation to a panel specific SMP Application for LW32 and prior to extraction of LW32.

Prior to extraction of LW32, a Resident Information Pack will be distributed to all residents within the Modification Area. A letter will contain information about the mining approval, with the Resident Information Pack containing general information regarding subsidence and specific information required to be given by Condition 15 of DA67/98, which includes:

- pre-mining inspection rights including a copy of consent conditions 15 to 26 inclusive;
- revised subsidence predictions (from those presented in the relevant development application) using updated monitoring data (included in this SMP application);
- identification of potential damage to improvements;
- owner's obligation of disclosure under insurance policies and mortgage agreements;
- rights of claiming consequential loss under the Mining Act; and
- advice as to where complete copy of these conditions of consent are available for public inspection.

The Information Pack also provides contact details to arrange a face to face meeting with a Tahmoor Coal representative to discuss any issues and concerns stakeholders may have regarding mining.

The Resident Information Pack also contains information regarding lodging a claim with Subsidence Advisory NSW and contact details. The current Resident Information Pack will be updated to reflect reforms to the *Mine Subsidence Compensation Act 1961* when they take effect in 2018.

In addition, prior to subsidence of any structures within the Modification Area, property owners will be provided with detailed subsidence predictions and impact assessments for individual premises/structures.

5.3 Agency/Authority Consultation

Through the modification assessment process, there has been ongoing consultation with both State and local government representatives including briefings and meetings with relevant agencies to discuss the proposed modification, assessment outcomes, approach to management and mitigation of impacts, and to address issues specific to each respective agency.

The following NSW State and local government agencies have been consulted:

- DP&E - a Project briefing meeting was held between the Project team and DP&E on 2 August 2017 to discuss planning pathways, assessment approach and assessment requirements
- Wollondilly Shire Council - a Project briefing meeting and discussions regarding assessment findings/outcomes and management approach was held with the Wollondilly Shire Council on 7 September 2017. The briefing was then circulated by the Council to other Council members
- DoE - a Project briefing meeting was held between the Project team, DoE and Picton High School on 13 September 2017 to introduce the modification and mining planned for the area
- Jai Rowell MP - State Member for Wollondilly - a Project briefing meeting was held with Jai Rowell on 22 September 2017 to update the State member on the modification and mining planned for the area.

The briefings to Wollondilly Shire Council, agencies and representatives have outlined the key aspects of the Modification in terms of Project design and the approach to environmental assessments and stakeholder engagement.

5.4 Stakeholder Issues and Proposed Management

The key issue raised by the community relating to the proposed modification related to the management of subsidence. This matter was consistent with subsidence management issues raised by the community in relation to the currently approved operations at Tahmoor Underground; and were in regard to specific landholder properties. However, the majority of landholders had no concerns with the proposed modification, given the history of underground mining in the area.

State and local governments also raised potential subsidence as a key issue. Wollondilly Shire Council noted that Tahmoor Underground is required to address subsidence management at the former waste management facility in management plans. Concerns over impacts on other Council infrastructure were also noted.

Key discussions on the Project's schedule and the timing of PHS expansion and building plans were discussed with the School architect. The main issues raised related to the potential asbestos within the school, the level and timing of predicted subsidence and implications to the building works. Predicted subsidence for the Project is scheduled prior to the school's proposed construction activities. Tahmoor Underground will work with the School to provide updates or any proposed changes to either the building or mining schedule.

Management measures to address stakeholder issues in relation to subsidence are also further detailed in **Section 7**.

6.0 Environmental Assessment

6.1 Environmental Risk Analysis

A preliminary environmental risk analysis was undertaken for the proposed modification to identify the key issues that required detailed assessment as part of the EA process.

The proposed modification seeks to permit low levels of subsidence associated with the extraction of LW32 included in the current SMP mine plan within an area where subsidence is not currently permitted to occur under DA 67/98. The proposed modification does not include any changes to mining activities or methods, surface infrastructure or production. The key issues requiring assessment therefore relate to the potential impacts of subsidence within the Modification Area. Subsidence impacts outside the Modification Area are already approved under DA 67/98 and DA 57/93.

The identification of the key potential environmental issues that require assessment was based on consideration of:

- the scale and potential impact of the modification
- the planning and environmental context of the modification
- the findings of the previous environmental assessments and ongoing environmental monitoring of the existing Tahmoor Underground operations.

The preliminary environmental risk analysis was undertaken in general accordance with the principles outlined in Australian Standard AS/NZS ISO 31000:2009 and identified issues of high, medium or low risk to the environment or community. An evaluation of these risks was undertaken to determine the need for further detailed assessment. A copy of the preliminary environmental risk analysis is provided as **Appendix 3**, with a summary of the outcomes provided in **Table 6.1**.

A detailed assessment of each of the environmental and community aspects identified in the environmental risk analysis as requiring further assessment for the proposed modification is provided throughout the remainder of **Section 6.0**.

The preliminary environmental risk analysis has been revised following completion of the detailed assessments presented in the remainder of **Section 6.0**. The environmental risk analysis provided in **Appendix 3** and summarised in **Table 6.1** identifies both the preliminary risk rating and provides a revised risk rating that considers the EA assessment findings and control measures proposed for the proposed modification.

Table 6.1 Review of potential environmental impacts of the Modification Area

Aspect	Potential Impact and Preliminary Assessment	Preliminary Risk Ranking	Residual Risk Ranking
Subsidence	The proposed modification seeks a minor extension to the area of permitted subsidence impacts for Tahmoor Underground. Improvements in subsidence predictions has identified that low levels of subsidence (20-70mm) may extend further to the north-east of LW32 than predicted in previous approvals. The updated predictions are consistent with the current SMP approved mine plan. The Modification Area includes a number of built features that could potentially be impacted by subsidence, including 48 residences and PHS. A detailed subsidence assessment has been undertaken to confirm predicted subsidence impacts to built and natural features within the Modification Area and to inform subsidence management. The subsidence assessment is included as **Appendix 4** and a summary of the findings is presented in **Section 6.2**.	Medium	Medium
Community stakeholder concern	Potential exists for revised subsidence predictions to cause concern amongst residents and school staff/students/parents in the Modification Area. A comprehensive consultation program is required to address the potential concerns of community stakeholders. Details of the consultation program are provided in **Section 5.0**. Residents are to be provided with the results of the subsidence assessment process which indicates only very low risk of minor damage to residences.	Medium	Low
Surface Water Resources	No natural watercourses are present within the Modification Area and given the low levels of subsidence predicted, the modification is unlikely to result in any significant changes to flow regimes, flooding or ponding. However, as the proposed modification will result in minor changes to the landform within the Modification Area, any potential impacts on surface water resources have been considered as part of this EA. The potential hydrological impacts of the predicted changes in landform associated with the extraction of LW31-37 have been previously assessed by WRM (2014) as part of the LW31-37 SMP application. This assessment is included as **Appendix 5** and a summary of the findings is presented in **Section 6.3**.	Low	Low

Aspect	Potential Impact and Preliminary Assessment	Preliminary Risk Ranking	Residual Risk Ranking
Groundwater Resources	The proposed modification seeks a minor extension to the area of permitted subsidence impacts for Tahmoor Underground. No material changes are expected in relation to groundwater impacts of Tahmoor Underground as a result of the proposed modification. No groundwater users are likely to be impacted as there are no bores located within Modification Area. An assessment of the potential impacts of the proposed modification has been undertaken based on a review of the previous groundwater assessment undertaken for the LW31-37 SMP application (GeoTerra 2014) and existing groundwater monitoring. The assessment is included as **Appendix 6** and a summary of the findings is provided in **Section 6.4**.	Medium	Low
Ecology	The Modification Area is located within an urban environment and has been largely cleared of any remnant native vegetation. A small number of scattered native trees are present within residential yards and the PHS grounds. The modification will not result in any direct clearing of vegetation. Secondary impacts associated with subsidence such as changes to the landform or hydrological regime are also not expected due to the very low levels of subsidence predicted and the lack of native vegetation present within the modification area. An ecological survey and assessment has been undertaken by Niche Environment and Heritage in 2014 (Niche, 2014) as part of the LW31-37 SMP application. The report confirms that there are no threatened species or endangered ecological communities identified within the Modification Area. Based on this preliminary assessment, no further assessment of ecological impacts has been undertaken.	Low	Low
Aboriginal Archaeology and Cultural Heritage	A search of the OEH AHIMS database was undertaken on 17 August 2017. No Aboriginal Archaeological sites were identified within the Modification Area. The Modification Area is located within an urban environment and has been largely disturbed by development. The potential for any Aboriginal sites to be present is therefore considered low. The modification will not result in any direct disturbance of the ground surface. Secondary impacts associated with subsidence such as surface cracking, subsidence remediation works, changes in landform or hydrogeological regimes are unlikely given the very low levels of subsidence predicted. The potential for impacts on Aboriginal cultural heritage is therefore considered to be very low. Based on this preliminary assessment, no further assessment of ecological impacts has been undertaken.	Low	Low

Aspect	Potential Impact and Preliminary Assessment	Preliminary Risk Ranking	Residual Risk Ranking
Historic Heritage	A search of the State Heritage Inventory and Australian Heritage Database was undertaken on 6 September 2017. No historic heritage items were identified within the Modification Area. The Modification is not expected to impact on listed heritage items within or outside the Modification Area. Based on this preliminary assessment, no further assessment for Historic Heritage impacts has been undertaken.	Low	Low
Land Resources and Agriculture	The proposed modification may result in minor changes to the landform within the Modification Area as a result of subsidence. Subsidence impacts on land resources and agricultural use of the land were identified as having a low risk of significant impacts given the urban nature of the environment and predicted very low levels of subsidence. Previous experience within the Tahmoor Underground demonstrates that the predicted low levels of subsidence are compatible with the urban land uses within the Modification Area and that any damage to structures can be readily managed in accordance with existing management practices at Tahmoor Underground. No agricultural land is present within the Modification Area. Based on this preliminary assessment, no further assessment of impacts on land resources or agriculture has been undertaken. A detailed assessment of potential landform and land use impacts due to subsidence is provided in **Section 6.2**.	Low	Low
Greenhouse Gas	The proposed modification is limited to the extension of subsidence impacts to an area not approved for subsidence and does not include any extraction of coal resources or changes to the surface facilities, operations or production rates. The modification is therefore not predicted to result in the emission of additional greenhouse gases. Based on this preliminary assessment, no further assessment of greenhouse gas impacts has been undertaken.	Low	Low
Vibration	The modification is limited to the extension of subsidence impacts to an area not approved for subsidence and does not involve any change to existing approved surface facilities, operations or production rates. Subsidence impacts on the land surface from underground mining are not predicted to require significant surface remediation. The modification is therefore not predicted to result in any additional vibration impacts. Based on this preliminary assessment, no further assessment of vibration impacts has been undertaken.	Low	Low

Aspect	Potential Impact and Preliminary Assessment	Preliminary Risk Ranking	Residual Risk Ranking
Noise	The modification is limited to the extension of subsidence impacts to an area not approved for subsidence and does not involve any change to existing approved surface facilities, operations or production rates. Subsidence impacts on the land surface from underground mining are not predicted to require significant surface remediation. The modification is therefore not predicted to result in any additional noise impacts. Based on this preliminary assessment, no further assessment of noise impacts has been undertaken.	Low	Low
Air Quality	The modification is limited to the extension of subsidence impacts to an area not approved for subsidence and does not involve any change to existing approved surface facilities, operations or production rates, including coal handling and transportation, ventilation facilities. Subsidence impacts on the land surface from underground mining are not predicted to require significant surface remediation. The modification is therefore not predicted to result in any additional air quality impacts. Based on this preliminary assessment, no further assessment of air quality impacts has been undertaken.	Low	Low
Traffic	No change to existing approved traffic volumes, employee numbers, production levels, coal transport or access arrangements are proposed as a result of the modification. Based on this preliminary assessment, no further assessment of traffic impacts has been undertaken.	Low	Low
Visual Amenity	There is very little potential for visual impacts due to the nature of the modification. Potential visual impacts are limited to minor changes in terrain (approximately 20 to 70mm) associated with subsidence within the Modification Area. Based on this preliminary assessment, no further assessment of potential visual impacts has been undertaken.	Low	Low

Aspect	Potential Impact and Preliminary Assessment	Preliminary Risk Ranking	Residual Risk Ranking
Socio-Economic	The modification will not result in any change to employment levels at Tahmoor Underground. The modification will ensure ongoing employment which would otherwise not continue if LW32 cannot be viably mined. No changes to existing surface facilities or operations are proposed and based on previous experience of mining at similar depths of cover elsewhere within Tahmoor Underground, the proposed modification is also likely to have minimal impact on built and natural features on the surface associated with subsidence and will not cause any serious disruption to existing land uses. The modification is therefore unlikely to result in significant social impacts. By providing for ongoing employment and extraction of in excess of 300,000 tonnes of ROM coal, with minimal social or environmental impact, the proposed modification will ensure ongoing local and state economic contributions. Based on this preliminary assessment, no further assessment of socio-economic impacts has been undertaken.	Low	Low
Waste Management	The proposed modification will not generate any additional waste streams or increase existing waste volumes. Based on this preliminary assessment, no further assessment has been undertaken	Low	Low
Hazard/Risk	The proposed modification will not result in any changes to the existing operations which would alter the current hazard/risk classification. Based on this preliminary assessment, no further assessment has been undertaken.	Low	Low
Rehabilitation	Rehabilitation within the Tahmoor Underground is managed in accordance with the current approved MOP. The MOP provides a detailed description of emplacement areas, emplacement methods, final landform and final land use. The modification will not result in any change to existing approved rehabilitation methods, rehabilitation targets or objectives. No additional rejects or tailings will be generated by the modification. As no change to the existing approved rehabilitation measures is considered necessary to accommodate the proposed modification, no further assessment has been undertaken.	Low	Low

6.2 Subsidence

Mine Subsidence Engineering Consultants (MSEC) has undertaken an assessment of the potential incremental and cumulative subsidence impacts within the Modification Area, including predictions of subsidence related ground movements, impacts on natural and built features and management recommendations for preventative measures and monitoring. The assessment is provided in **Appendix 4** and a summary of findings presented below.

6.2.1 Prediction Methodology

MSEC has used the Incremental Profile Method to predict the incremental and total subsidence profiles resulting from the extraction of longwall panels within SMP (LW31-37) mining area. The Incremental Profile Method is based on a series of subsidence prediction curves derived from an extensive subsidence monitoring database from the Southern Coalfields.

Subsidence predictions were refined for Tahmoor Underground using local geological information and conditions and the model calibrated using monitoring results from completed longwalls within Tahmoor Underground. The calibration process found that the Incremental Profile Method has generally provided reasonable predictions of subsidence within Tahmoor Underground when compared to observed subsidence. The exception to this being areas of increased subsidence observed over the predicted levels above LW24A and the south-eastern ends of LW25-27. The higher levels of subsidence have decreased with the successive longwalls, with the observed subsidence above LW28-30 being similar to predicted. While increased subsidence is not anticipated above the SMP (LW31-37) area, MSEC has considered the potential impacts of increased subsidence on built and natural features within the SMP (LW31-37) area (including the Modification Area) by up to a factor of two times, as a precautionary measure.

6.2.2 Subsidence Predictions

The predicted total subsidence associated with the SMP (LW31-37) mine plan within the Modification Area is shown in **Figure 6.1**. The maximum predicted total subsidence parameters for the Modification Area is shown in **Table 6.2**. Also provided in **Table 6.2** is a comparison of the predicted total subsidence parameters within the Modification Area with that of the broader SMP (LW31-37) area.

Table 6.2 Maximum Predicted Total Subsidence Parameters within Modification Area and Approved LW 31-37 SMP Area

Location	Maximum Predicted Total vertical Subsidence (mm)	Maximum Predicted Total Tilt (mm)	Maximum Predicted Total Hogging Curvature (km^{-1})	Maximum Predicted Total Sagging Curvature (km^{-1})
Modification Area	70	<0.5	<0.01	<0.01
SMP (LW31-37) Area	1,225	6.0	0.09	0.13

As shown in **Table 6.2**, the maximum predicted total subsidence within the Modification Area is significantly less than that predicted to occur within the broader SMP (LW31-37) area.

The limit of vertical subsidence, being the furthest predicted extent of subsidence from the area of longwall extraction, is defined by the predicted 20mm subsidence contour as discussed in **Section 1.2**, and shown on **Figure 6.1**. The limit of vertical subsidence has been established by MSEC using the calibrated prediction methodology described in **Section 6.2.1**, including consideration by MSEC of potential impacts resulting from a two-fold increase in subsidence on built and natural features, as a precautionary measure. The limit of subsidence shown on **Figure 6.1** represents the maximum extent of subsidence that can be reasonably predicted to occur prior to mining, and has been adopted as the boundary of the Modification Area. However, potential remains for small variations to these subsidence predictions to occur. These minor variations can only be determined by final subsidence monitoring to be undertaken after mining, in accordance with the approved SMP (LW31-37) subsidence monitoring program.

Tahmoor Underground will consult with DP&E regarding any increase to the subsidence area that may arise following monitoring to be undertaken in accordance with the SMP (LW31-37). If required, Tahmoor Underground will apply for an administrative modification to revise the Modification Area to ensure alignment with any changes derived from subsidence monitoring.

6.2.3 Subsidence Impacts

Subsidence induced impacts to the ground surface are dependent on a number of factors, including mine geometry, depth of cover, overburden geology, the location of natural jointing in the bedrock and the presence of near surface geological structures. Potential impacts include surface cracking, slope and bank instability and changes to the hydrological regime including changes in ponding, channel alignment, channel gradients and redirection of surface or groundwater flow due to subsidence induced cracking.

Potential changes in the ground surface resulting from subsidence within the Modification Area have been assessed by MSEC. The subsidence assessment findings conclude that due to the depth of mining (greater than 480m), the small magnitude of predicted ground curvatures and strains and the absence of any steep slopes or valleys within the Modification Area, the potential for surface cracking is low. Based on low levels of subsidence predicted and previous experience within Tahmoor Underground, remediation of surface cracking in soils is unlikely to be required within the Modification Area.

The height of continuous fracturing above the extracted longwalls within the SMP (LW31-37) area is predicted to extend approximately 150m above the seam (GeoTerra 2014). Given the depth of cover within the Modification Area is 480 to 510m and the Modification Area is not located directly above any longwalls, hydraulic connection to the surface water or alluvial groundwater systems in not likely.

A summary of the predicted subsidence impacts on key natural and built features within the Modification Area is provided in **Table 6.3**.

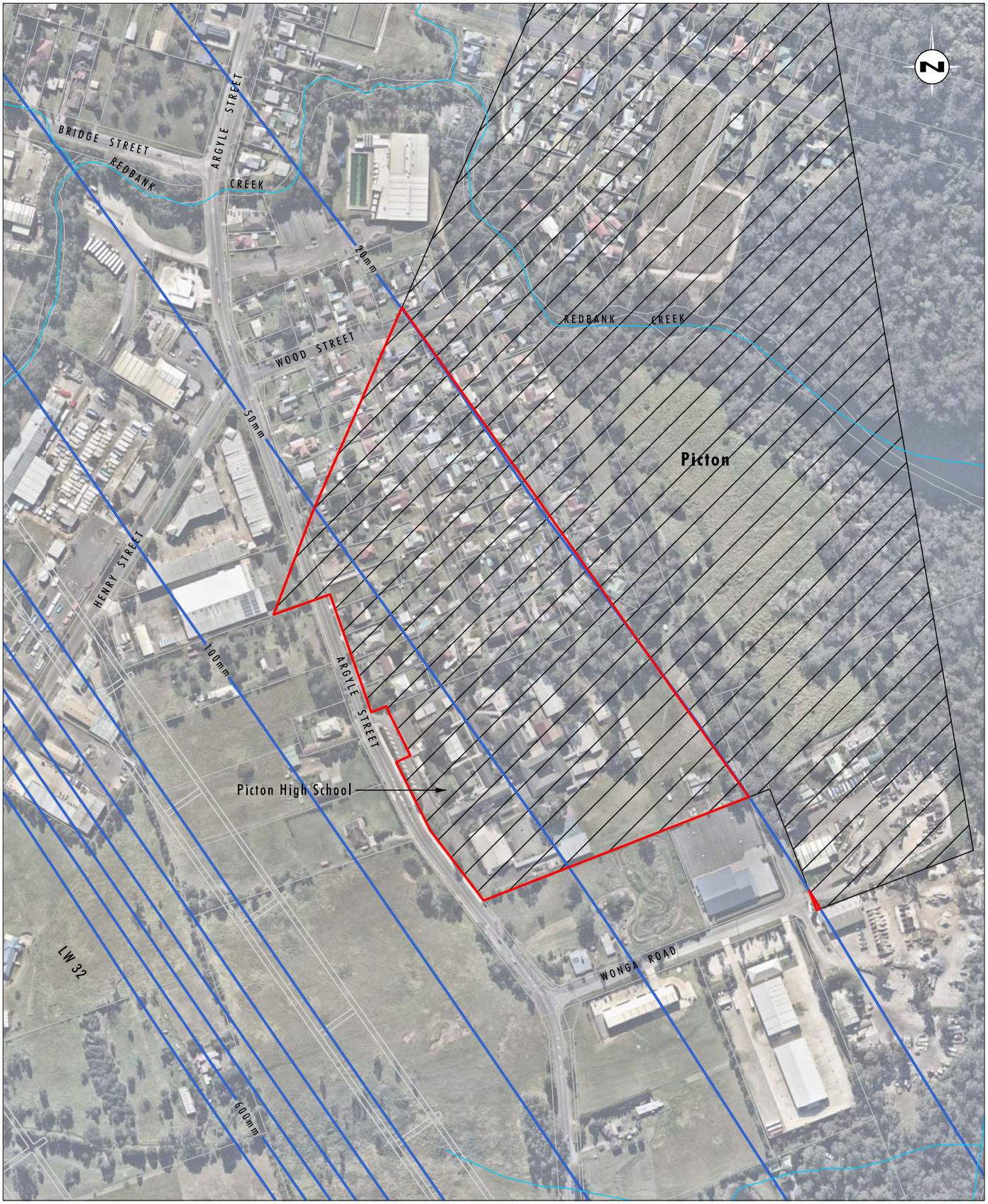


Image Source: Nearmap (May 2017)
Data Source: Tahmoor Underground (2017), MSEC (2017)

0 100 200 250m
1:5000

Legend

- Proposed Modification Area
- Area where subsidence is not permitted to occur
- Predicted Subsidence Contour
- LW 31-37 SMP Mine Plan

FIGURE 6.1

Predicted Total Subsidence LW31-37 SMP Mine Plan

Table 6.3 Summary of Predicted Subsidence Impacts on Natural and Built Features within the Modification Area

Feature	Predicted Subsidence Impact
Watercourses	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Groundwater Aquifers	Refer to **Section 6.4**.
Steep Slopes, Cliffs, Rocky Outcrops	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Houses	At total of 48 houses are located within the Modification Area and are predicted to experience very low levels of vertical subsidence (20-60 mm), with no measurable tilts, curvatures or strains predicted. All houses are expected to experience nil to negligible impacts and are expected to remain safe, serviceable and repairable throughout the mining period. If negligible impacts occur, these may require minor adjustments to door/window swings, cornice repair or movement of internal/external expansion joints. Similarly, the likelihood of impacts to sheds and swimming pools within the Modification Area is assessed as extremely low, given the low predicted subsidence movements, their relatively small footprints and distance from LW32. These predictions are supported by historical monitoring within Tahmoor Underground, with no houses having reported impacts at similar distances from extracted longwalls LW22-30. Tahmoor Coal has extensive experience of mining beneath urban areas, with Tahmoor North operations having subsided in excess of 1,955 premises in the Tahmoor and Thirlmere areas since the commencement of LW22 in 2004. During this time, Tahmoor Coal has developed and acted in accordance with a risk management plan to manage potential impacts to residential structures during the mining of LW22-30. This plan was reviewed as part of the LW31 SMP application process and will again be reviewed as part of the SMP approval for the extraction of LW32. This revised management plan will be applied to the management of subsidence within the Modification Area. The established risk management plan provides for: • Identification of buildings in poor pre-mining condition that are hazardous or may become hazardous due to mining • Implementation of management measures following findings of inspection • Visual kerbside monitoring of structures during active subsidence • Re-tensioning of fencing wire, straightening of fence posts and if necessary replacement of some sections of fencing • Repairs to structures as required. Consistent with Tahmoor Coal's existing SMP framework, Property Specific Management Plans will be prepared for all properties impacted by subsidence within the Modification Area in consultation with the land owner.

Feature	Predicted Subsidence Impact
Picton High School (PHS)	PHS is located within the Modification Area and will be subject to very low levels of vertical subsidence (20-70 mm), with no measurable tilts, curvatures or strains predicted. All buildings within PHS are predicted to remain safe and serviceable throughout mining and are unlikely to experience adverse impacts as a result of mining. Minor adjustments or repairs may be required to door/window swings, plasterwork, façade treatments or internal/external expansion joints. Any impacts would be expected to be minor and develop gradually, allowing them to be repaired at a suitable time to avoid disruption to school operation or safety. Initial structural investigations of buildings within the school have been undertaken and structures were broadly found to be in serviceable conditions with no significant structural dilapidation noticeable. Consistent with Tahmoor Coal's existing SMP framework, a Property Specific Management Plan will be prepared in consultation with PHS to manage potential impacts on the school from subsidence. The plan will include requirements for: • inspection by a structural engineer prior to active subsidence; and • if required, implementation of any preventive measures; visual and ground monitoring; and strategies to manage impacts during active subsidence. Consultation with PHS and Department of Education (DoE) officials has identified the proposal by DoE to upgrade PHS to increase student numbers from 1000 to 2000 students. This will involve demolition and replacement of all but 3 existing buildings. Tahmoor Coal and DoE have discussed the program of upgrades and the proposed time of mining and subsequent subsidence impacts on the PHS. A regular consultation process has been established between Tahmoor Underground and DoE /PHS to ensure any impacts of the proposed work is minimised. DoE has acknowledged that the PHS is in Mines Subsidence District and development plans will be required to meet building design requirements approved by Subsidence Advisory NSW.
Commercial, Industrial and Business Establishments	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Railways	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Local Roads	Three local roads are located within the Modification Area, Argyle Street, Wood Street and Coachwood Crescent. Based on the very low levels of subsidence predicted, it is unlikely that there would be any adverse impacts on the serviceability, safety or surface water drainage of these roads. Localised and minor impacts may occur within the Modification Area, including cracking or heaving of the road pavement, or impacts to kerb, guttering and drainage pits. Impacts are expected to be similar to those previously observed within areas of low subsidence and tilt within Tahmoor Underground, and would be readily repaired using normal road maintenance techniques Tahmoor Coal and Wollondilly Shire Council have previously developed and acted in accordance with an agreed risk management plan to manage potential impacts to local roads during mining. This plan was most recently reviewed as part of the LW31 SMP application process and will be again reviewed in consultation with Council as part of the SMP approval for the extraction of LW32.

Feature	Predicted Subsidence Impact
Road Drainage	No culverts are located within the Modification Area and no significant change in road drainage flows is predicted. The impacts of subsidence on drainage will be monitored by way of ground and visual monitoring of pavements, consistent with the procedures outlined in the existing LW31 Wollondilly Shire Council Management Plan.
Road Bridges	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Tunnels	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Potable Water Infrastructure	Potable water supply infrastructure is present within the Modification Area, generally following the road alignment. Given the very low levels of subsidence predicted, no significant impacts are likely however, a small number of minor leaks could occur. Tahmoor Coal and Sydney Water have developed and acted in accordance with an agreed risk management plan to manage potential impacts to potable water infrastructure during mining. This plan was reviewed as part of the LW31 SMP application process and will be applied to the management of subsidence within the Modification Area.
Sewage Infrastructure	Sewer reticulation infrastructure is present within the Modification Area servicing the residential premises and school. The sewer reticulation infrastructure has been designed at self-cleansing grades with consideration of the potential impacts of subsidence and approved by the Mine Subsidence Board (now Subsidence Advisory). While changes in sewer grades have previously occurred as a result of mine subsidence, no blockages or reversals of grade have been observed. This includes observations at locations above LW24A- 30 where specific ground surveys were undertaken to confirm that mining-induced tilts did not exceed pre-mining grades (MSEC 2017). Tahmoor Coal and Sydney Water have developed and acted in accordance with an agreed risk management plan to manage potential impacts to sewer infrastructure during mining. This plan was most recently reviewed as part of the LW31 SMP application process and will again be reviewed as part of the SMP approval for the extraction of LW32. This revised management plan will be applied to the management of subsidence within the Modification Area.
Gas Infrastructure	Gas supply infrastructure is located within the Modification Area, generally following the road alignment. Given the low levels of vertical subsidence, tilts, curvatures and strains predicted, adverse impacts to gas services is unlikely. Tahmoor Coal and Jemena have developed and acted in accordance with an agreed risk management plan to manage potential impacts to gas infrastructure during mining. This plan was most recently reviewed as part of the LW31 SMP application process and will again be reviewed as part of the SMP approval for the extraction of LW32. This revised management plan will be applied to the management of subsidence within the Modification Area.

Feature	Predicted Subsidence Impact
Electrical Infrastructure	Low voltage power lines and poles are located within the Modification Area, generally following the road alignment. Given the low levels of vertical subsidence, tilts, curvatures and strains predicted, adverse impacts to electrical services is unlikely. Tahmoor Coal and Energy Australia have developed and acted in accordance with an agreed risk management plan to manage potential impacts to electrical infrastructure during mining. This plan was most recently reviewed as part of the SMP (LW31-37) application process and will again be reviewed as part of the SMP approval for the extraction of coal from LW32. This revised management plan will be applied to the management of subsidence within the Modification Area.
Telecommunication Services	Optical figure and local telecommunication cables are present within the Modification Area. Given the low levels of vertical subsidence, tilts, curvatures and strains predicted, adverse impacts to telecommunications services is unlikely. Tahmoor Coal and Telstra have developed and acted in accordance with an agreed risk management plan to manage potential impacts to telecommunications infrastructure during mining. This plan was most recently reviewed as part of the SMP (LW31-37) application process and will again be reviewed as part of the SMP approval for the extraction of coal from LW32. This revised management plan will be applied to the management of subsidence within the Modification Area.
Groundwater Bores	Not present within the Modification Area and not predicted to be impacted by proposed modification.
Survey Control Marks	One survey control mark is located within the Modification Area and is likely to experience low levels of subsidence (approximately 50mm) and/or some small regional horizontal displacement. Consistent with existing management measures, the survey control mark will be re-established following the completion of subsidence related ground movements.
Wollondilly Council former non-hazardous waste disposal	During consultation with Council, the former facility was identified as being outside the predicted 20mm subsidence zone. Tahmoor Coal will monitor subsidence in proximity to the former facility and update management plans accordingly, if required.

6.2.4 Subsidence Impact Assessment

The subsidence assessment prepared by MSEC concludes that the levels of impact and damage to all identified natural and built features within the Modification Area are nil to negligible, and readily manageable through the implementation of the existing Subsidence Management Plan framework. All structures within the Modification Area will remain in a safe and serviceable condition throughout the mining period, with minor or no repair required.

All houses within the Modification Area are expected to experience no or negligible impacts, requiring either no repairs or minor serviceability repairs to door or window jams or swings, cornices and/or external or internal expansion joints.

All buildings within PHS are expected to experience similarly low levels of impact, requiring only minor serviceability and/or façade repairs. Predicted subsidence and any required minor repairs are not expected to impact on the safety of students and staff, or affect the use of the buildings at any time for educational or other purposes.

Given the depth of cover and low levels of subsidence predicted, subsidence is unlikely to impact significantly on any natural features within the Modification Area. Subsidence impacts on the ground surface are predicted to be minimal, with surface cracking unlikely to occur. Hydraulic connection to surface water or alluvial groundwater systems is unlikely, and no adverse impacts to watercourses, steep slopes, cliffs, rocky outcrops are predicted as these features do not occur within the Modification Area.

6.2.4.1 Subsidence Performance Criteria

Subsidence of houses, sheds or pools must meet performance criteria set out in DA 67/98. Schedule 2, Condition 6 (ii) specifies that Tahmoor Coal shall not cause moderate, severe or very severe structural damage to houses, sheds or pools within the DA area in excess of the percentages of such structures shown in Figure 3 of DA 67/98. Performance criteria from Figure 3 in DA 67/98, is reproduced in **Figure 6.2** below.

Damage Assessment Category	Houses		Sheds		Pools		Total	
	Number (1998)	Equiv't percent	Number (1998)	Equiv't percent	Number (1998)	Equiv't percent	Number (1998)	Equiv't percent
0 (Negligible)	756	83.17	389	95.34	63	96.92	1208	87.41
1 (Very Slight)	104	11.44	16	3.92	2	3.08	122	8.83
2 (Slight)	36	3.96	2	0.49	<1	<1.54	38	2.75
3 (Moderate)	13	1.43	<1	<0.25	0	0	13	0.94
4 (Severe)	<1	<0.11	0	0	0	0	<1	<0.07
5 (Very Severe)	0	0	0	0	0	0	0	0

Figure 3: Structural damage impacts associated with subsidence within the DA area as predicted in the EIS dated March 1998 (numbers only) and equivalent percentages (see condition 6(ii)).

Figure 6.2 DA 67/98 Subsidence Performance Criteria

Based on the impact assessment prepared by MSEC, all houses within the Modification Area are expected to experience no or negligible impacts. Therefore, the proposed modification will not result in an increase in the number of structures predicted to be subject to structural damage in the moderate, severe or very severe categories, and no change is proposed to the Equivalent Percentage performance criteria for these categories of damage.

6.2.5 Subsidence Management and Monitoring

Tahmoor Coal has extensive experience of mining beneath urban areas, with Tahmoor North operations having subsided in excess of 1,955 premises in the Tahmoor and Thirlmere areas since the commencement of LW22 in 2004. Tahmoor Coal has developed and acted in accordance with a risk management plan to manage potential impacts to structures during the mining of LW22-30. This management plan has been reviewed and updated based on experiences gained during mining and includes the following process:

1. Regular consultation with the community before, during and after mining as described in **Section 5.2**. This includes letters and door knocking to all residents of structures that will soon be affected by subsidence. The letters invite the residents to contact Tahmoor Underground should have any concerns with their structure, or alternatively contact Subsidence Advisory NSW for a pre-mining inspection.

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

   The site-specific investigations include the following:

   - Identification of structures and structure types from aerial photographs and kerbside inspections.

   - Additional front of house inspections by Tahmoor Coal and a structural engineer for all properties that are located directly above longwalls. The purpose of the inspections is to identify potentially unstable structures that may warrant a structural inspection, subject to approval by the landowner.

   - Pre-mining geotechnical inspections of structures located on or immediately adjacent to steep slopes

   - Pre-mining structural inspections of the following structures

     - Public amenities and commercial and business establishments that are located directly above longwalls.

     - Structures on or immediately adjacent to steep slopes that have been recommended for structural inspection by the geotechnical engineer.

     - Structures that have been identified as being potentially unstable or unsafe by landowners, or front of house inspections, or if an issue is raised by Subsidence Advisory NSW during the course of undertaking its pre-mining inspections.

     - Structures of heritage significance.

     - Houses and units located above hidden creeks.

     - Houses and units located outside any Mine Subsidence District that are predicted to experience more than 150mm of subsidence.

     - Houses estimated to have been constructed prior to the declaration of the Mine Subsidence District (1975) that are predicted to experience more than 150mm of subsidence.

3. Implementation of mitigation measures following inspections by geotechnical and/or structural engineer prior to subsidence occurring.

4. Surveys and inspections during mining within the active subsidence area:

    - Detailed visual inspections and vehicle based inspections along the streets
    - Ground surveys along streets
    - Visual inspections of public amenities and industrial, commercial and business establishments
    - Visual inspections of structures that have already reported impacts, where recommended by the Structures Management Group
    - Visual inspections of pool fences and gates
    - Specific ground surveys and visual inspections for selected properties, where recommended by a geotechnical or structural engineer due to their proximity to steep slopes or pre-existing condition.

This risk management process will be reviewed as part of the LW32 SMP process, based on experience gained during the mining of LW31, and will be applied to the management of subsidence within the Modification Area.

As the proposed modification will not result in any change to the previously assessed environmental impacts of Tahmoor Underground, no change to the existing management and monitoring measures are proposed.

6.3 Surface Water and Drainage

Assessments of the impact of the SMP (LW31-37) mine plan on streams, dams and the local flood and drainage regime was undertaken by GeoTerra (2014) and WRM Water and Environment (2014) as part of the SMP (LW31-37) application process. The LW31-37 flood impact assessment is provided in **Appendix 5**, and a summary of findings as they relate specifically to the Modification Area is presented below.

6.3.1 Surface Water Context

There are no natural water courses located within the Modification Area (refer to **Figure 1.4**).

The Modification Area is located within the catchment of Redbank Creek. Redbank Creek is a 4th order stream that drains in a generally easterly direction to the north of the Modification Area (refer to **Figure 1.4**). Redbank Creek joins Stonequarry Creek approximately 400m east of the Modification Area, before flowing into the Nepean River approximately 2.5km downstream (refer to **Figure 1.4**). The Redbank Creek catchment covers an area of approximately 8km² and incorporates the townships of Thirlmere and Picton. The creek bed and bank in the vicinity of the Modification Area is generally well vegetated and does not show significant erosion or bank instability, principally as it is developed on or above exposed Hawkesbury Sandstone basement. The creek has a relatively gradual gradient over its reach with a predominant sequence of rock bar, boulder and rock shelf constrained pools, however, upstream of its junction with Stonequarry Creek the channel becomes very steep and heavily incised with up to three waterfalls.

Water quality within Redbank Creek is variable and affected by runoff from the residential areas of Thirlmere and Picton (GeoTerra 2014).

The upstream reaches of Redbank Creek have been directly undermined by LW25-30. Tahmoor Coal has established eleven stream flow and six water quality monitoring locations in Redbank Creek to monitor potential impacts from mining on the creek system. Reversal of flow in the creek has not occurred due to subsidence as the creek gradient exceeds the subsidence tilt in the stream bed, however extended periods of pool desiccation and significantly reduced water level holding capacity of some pools compared to pre-mining has been observed. Monitoring has also observed cracking of the exposed sandstone stream bed and constraining rock bar, rock shelf and shallow waterfall in locations along Redbank Creek. Some changes in water quality have also been observed, including an increase in average salinity and an extension and increase in intensity of the downstream reaches containing iron hydroxide precipitates.

6.3.2 Flood Modelling Methodology

In order to assess the impacts of subsidence from the broader SMP (LW31-37) mine plan on existing flood levels within the Redbank Creek catchment, a flood impact assessment was undertaken as part of the SMP application process. The assessment methodology was based on the development of a runoff routing model to estimate design flood discharges and a two-dimensional hydraulic model to estimate design flood levels, extents, depths and velocities for the 1% AEP design event for the existing and post-subsidence conditions. The model extent included the Modification Area and the modelled post-subsidence landform includes the predicted subsidence within the Modification Area.

6.3.3 Impact Assessment

Redbank Creek is located outside the Modification Area and will therefore not be impacted by subsidence or subsidence related cracking associated with the proposed modification. The proposed modification is not expected to result in any change to the previously assessed impacts on Redbank Creek or water quality within Redbank Creek.

The flooding impact assessment undertaken for the broader SMP (LW31-37) mine plan (WRM 2014) confirms that the Modification Area is located outside the extent of the 1% AEP flood level for Redbank Creek and therefore the modification will not influence the local flooding and drainage regime.

6.3.4 Surface Water Management and Monitoring

Tahmoor currently implements a range of surface water management and monitoring measures across Tahmoor Underground. As the proposed modification will not result in any change to previously assessed surface water impacts of Tahmoor Underground, no change to the existing management and monitoring measures required under the existing SMP (LW31-37) and the Soil and Water Management Plan are proposed.

6.4 Groundwater

A groundwater assessment was undertaken by GeoTerra (2014) as part of the SMP (LW31-37) application process. The assessment considered the potential groundwater impacts of the SMP mine plan across the broader SMP area. GeoTerra has undertaken a review of the outcomes of this assessment as they relate specifically to the proposed Modification Area. This review is provided in **Appendix 6**, and a summary of findings presented below.

6.4.1 Groundwater Context

Groundwater flows east from the Modification Area to the Nepean River under a regional hydraulic gradient with dominantly horizontal confined flow along discrete discontinuities and fractures within bedding planes, and/or above fine grained, relatively impermeable strata within the overburden sequence. Recharge to the groundwater system occurs over a period of months to years after rainfall has soaked through the plateau's soil, Wianamatta Shale and Hawkesbury Sandstone units. In addition there is some baseflow discharge to the creeks along the preferential horizontal flow regime within the Wianamatta Shale Group and Hawkesbury Sandstone formations, as well as the interface between the main lithological units (GeoTerra 2014).

The Hawkesbury Sandstone generally provides low yielding aquifers with low hydraulic conductivities, whilst the Wianamatta Shale does not provide a groundwater supply. Groundwater supply in the Tahmoor/Thirlmere region is obtained from the Hawkesbury Sandstone with yields ranging up to 6.6L/sec from aquifers located approximately 21 to 161m below the surface. Hawkesbury Sandstone groundwater quality in the Tahmoor area ranges from 3,300µS/cm to 13,030µS/cm salinity with pH ranging from 3.53 to 6.49 and can have up to 36mg/L iron (GeoTerra 2014).

Alluvial sediments are not present within the Modification Area, however, outside the Modification Area within the plateau gullies and river bed are too shallow and intermittent to be used as aquifers for groundwater supply. Shallower, ephemeral and low yielding aquifers may be present as perched aquifers.

No registered groundwater bores are located within the Modification Area. There is one registered groundwater bore located within 500m of the Modification Area, a private stock/domestic bore (GW 105813) located approximately 480m to the south east of the Modification Area targeting the Hawkesbury Sandstone aquifer between 114m and 161m depth. Regional monitoring data within the Tahmoor North area indicates that the shallowest aquifer in private bores lies deeper than 21m below surface and the regional groundwater level is generally below the elevation of the stream beds and does not pervasively discharge into the creek.

6.4.2 Potential Groundwater Impacts

Monitoring of depressurisation within the Hawkesbury Sandstone in response to historical mining within Tahmoor North indicates that depressurisation is generally restricted to immediately above the extracted longwalls and reduces radially out to approximately 300m from the workings. The Modification Area is located approximately 200 to 45m north-east of LW32 and is therefore anticipated to experience minor depressurisation within the Hawkesbury Sandstone. The proposed modification will not however result in any observable or significant increase to the previously assessed impacts on the aquifers present within the Modification Area.

6.4.3 Groundwater Impact Assessment

The proposed modification will not result in any material change to the previously assessed groundwater impacts of Tahmoor Underground, including previously assessed impacts to groundwater levels, groundwater quality, groundwater users, groundwater dependent ecosystems or groundwater recharge.

6.4.4 NSW Aquifer Interference Policy

The potential groundwater impacts associated with the proposed modification have been assessed against the NSW Aquifer Interference Policy (AIP) which requires any mining activity to consider 'Minimal Impact Considerations' with respect to groundwater sources. The NSW AIP considers two categories of groundwater sources, being 'highly productive' and 'less productive'. The Hawkesbury Sandstone groundwater source within the Modification Area is considered a 'less productive' source as it does not meet the water quality requirements for 'highly productive' groundwater sources. An assessment against the relevant NSW AIP minimum impact criteria is provided in **Table 6.4**.

Table 6.4 Assessment Against NSW AIP Minimum Impact Criteria

Minimum Impact Criteria	Proposed Modification
Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any: • high priority groundwater dependent ecosystem; or • high priority culturally significant site; listed in the schedule of the relevant water sharing plan.	The closest high priority groundwater dependent ecosystem listed in Schedule 4 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* is Thirlmere Lakes, located approximately 6km west of the Modification Area. The proposed modification will not impact the water table at this distance. No high priority culturally significant sites are listed in the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*.
A cumulative pressure head decline of not more than a 2m decline, at any water supply work.	The closest registered bore is GW105813 located approximately 480m south east of the Modification Area targeting the Hawkesbury Sandstone aquifer between 114 and 161m depth. While historical underground longwall mining within Tahmoor North has resulted in temporary reductions in groundwater levels within bores in the shallow Hawkesbury Sandstone of up to 15m, the proposed modification will not result in any measurable change to existing potential impacts on groundwater bore levels or yields at GW105813.
Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.	The generally poor quality of groundwater within the Hawkesbury Sandstone (3,300µS/cm to 13,030µS/cm salinity) means that it has limited beneficial use potential. The proposed modification will not inhibit any potential future use of this aquifer. There are currently no known users of this groundwater source within the Modification Area and the proposed modification will not inhibit any potential future use of this aquifer system.

6.4.5 Groundwater Licencing

Tahmoor Coal's current water take from the Nepean Management Zone 2 of the Sydney Basin Nepean Groundwater Source is authorised under the *Water Management Act 2000* by access licence WAL36442, which has an entitlement of 1,642 shares. The proposed modification is not anticipated to result in any measurable increase in groundwater inflows into mine workings associated with Tahmoor Underground, therefore no increase in the existing licence allocation will be required for the proposed modification.

6.4.6 Groundwater Management and Monitoring

Tahmoor Coal currently implements a range of groundwater management and monitoring measures across the Tahmoor Underground, as outlined in the Groundwater Management Plan. As the proposed modification will not result in any material change to previously assessed groundwater impacts of Tahmoor Underground, no change to the existing management and monitoring measures are proposed.

6.5 Cumulative Impacts

An assessment of the environmental impacts of the proposed modification has been undertaken and is provided in **Sections 6.1** to **6.4** above. This assessment has identified that the proposed modification will not result in any material change to the previously assessed impacts of Tahmoor Underground.

The key impacts associated with the proposed modification are those related to subsidence.

The subsidence assessment undertaken for the proposed modification considers the cumulative impacts of subsidence from all previous underground mining and future approved mining associated with the approved SMP (LW31-37) mine plan. Predicted cumulative subsidence within the Modification Area is very low, and significantly less than that experienced elsewhere above extracted longwall panels within the broader SMP area. Cumulative subsidence within the Modification Area is not predicted to result in any significant impact on natural or built features within the Modification Area.

While the proposed modification will extend the area of land affected by subsidence and the number of structures subject to subsidence, the potential impacts associated with subsidence on natural and built features are very low and significantly less than experienced elsewhere above extracted longwall panels within the broader SMP (LW31–37) area. The cumulative impacts of the proposed modification are therefore also considered to be very low.

7.0 Summary of Management and Monitoring Measures

Tahmoor Coal currently implements a range of management and monitoring measures across Tahmoor Underground in accordance with its existing approved SMP framework. As part of the incremental SMP approval process for LW31-37, the following plans will be prepared and implemented for LW32, which includes the Modification Area:

- Environmental Management Plan
- Subsidence Monitoring Programme
- Built Structures Management Plan
- Heritage Management Plan
- Infrastructure Management Plans (including electricity, gas, potable water, sewer, Telstra and Wollondilly Shire Council plans)
- Property Specific Management Plans for each property impacted by subsidence.

The current SMP framework has been successfully implemented by Tahmoor Coal since the commencement of mining within the Tahmoor North area, which has included subsidence of in excess of 1,955 premises in the Tahmoor and Thirlmere areas. Tahmoor Coal will continue to implement the existing measures established by the current approved SMP framework.

As the proposed modification is predicted to result in nil to negligible impacts on the land surface, natural or built environment or on existing land uses within the Modification Area and will not result in any material change to the previously assessed environmental impacts of Tahmoor Underground, no change to the existing management and monitoring measures established under the SMP framework are proposed.

8.0 Conclusion

This section provides a conclusion which discusses the justification for the proposed modification and takes into account the environmental impacts associated with the proposal and the suitability of the site, which will assist the consent authority to determine whether or not the proposed modification is in the public interest.

8.1 Environmental Impacts

The potential environmental impacts of the proposed modification have been identified through a preliminary environmental risk assessment process involving:

- assessment of the site characteristics
- review of existing expert technical assessments, monitoring data and management plans
- consultation with government agencies and the community
- expert technical advice.

The key issues identified were the subject of detailed technical assessment to identify and assess the potential impacts of the proposed modification on the environment and community. The results of these assessments are detailed in **Section 6**.

The detailed impact assessments conclude that the proposed modification is likely to result in minimal environmental impacts. This is primarily due to the following factors:

- the characteristics of the site
- the depth of cover to mining areas (in excess of 450m)
- extensive experience to date in monitoring and management of subsidence in the Tahmoor and Tahmoor North mining areas
- predicted very low subsidence parameters.

8.2 Suitability of the Site

The Modification Area is located in an area of an existing mining lease and adjacent to areas that have been subject to extensive historical longwall mining. The Modification Area has been previously identified within the approved LW31-37 SMP mine plan as being likely to be subject to subsidence impacts associated with the extraction of LW 32, and Tahmoor Coal has consulted with stakeholders within the Modification Area regarding potential subsidence impacts as part of the SMP application process.

The Modification Area is located beneath private and State owned land, with the key land uses being residential dwellings, local roads and PHS. While there are a number of dwellings and school buildings located within the Modification Area, the very low levels of subsidence predicted are not expected to result in any significant adverse impacts to these structures, with all structures predicted to experience nil to negligible impacts and remain safe and serviceable throughout mining.

The topography of the Modification Area is characterised by gentle undulating flats with no areas of steep slopes. No water courses or areas of alluvial land are located within the Modification Area.

The proposed modification does not involve any additional surface development and due to the predicted nil to negligible impacts on the ground surface and structures associated with subsidence, the proposed modification will not limit the continued use of land or structures within the Modification Area for residential and educational purposes. Existing management and monitoring programs will be extended to the Modification Area in order to identify and manage potential impacts on these land uses.

8.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is one of a number of objectives of the EP&A Act and is defined by Section 6(2) of the *Protection of the Environment Administration Act 1991*. ESD requires the integration of economic and environmental considerations in decision making processes. ESD can be achieved through the implementation of the following principles and programs:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity and ecological integrity
- Improved valuation, pricing and incentive mechanisms.

These principles have been incorporated into the planning and assessment of the proposed modification and are discussed in **Sections below 8.3.1 to 8.3.4**.

8.3.1 The Precautionary Principle

Environmental assessment involves the prediction of potential environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A preliminary environmental risk analysis was undertaken for the proposed modification to identify key areas for further impact assessment. The results of the risk assessment are summarised in **Section 6.1.** A review of appropriate mitigation measures and strategies was also undertaken as a part of the detailed impact assessment process. The Precautionary Principle has therefore been applied to the assessment of the proposed modification through:

- identification of the potential impacts and the likelihood and consequences of these impacts
- identification of management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification
- continued implementation of existing monitoring and reporting mechanisms for the modification.

Mitigation and monitoring measures will be set out in the updated subsidence management plan and other associated management plans.

8.3.2 Inter-generational Equity

Intergenerational equity is based on the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The principles of intergenerational equity are addressed by the proposed modification through the implementation of existing management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification.

8.3.3 Conservation of Biological Diversity and Ecological Integrity

As discussed in **Section 6.1**, the Modification Area is located within an urban environment and has been largely cleared of any remnant native vegetation. A preliminary assessment of the potential ecological and biodiversity impacts of the proposed modification has been undertaken and concluded that the proposed modification will not result in any direct or indirect adverse impacts to the ecological values of the area. Tahmoor Coal will continue to implement the management measures currently in place within Tahmoor Underground, including those outlined in Tahmoor Underground's Biodiversity and Land Management Plan. Environmental monitoring will continue to be undertaken to determine whether the environmental control measures are operating effectively and enable timely detection of issues and implementation of appropriate management measures if and where required.

8.3.4 Valuation and Pricing of Resources

The efficient and non-wasteful management of resources to maximise the welfare of society, both now and for future generations is central to ESD. The modification maximises the efficient use and management of resources through maximising resource utilisation and providing for the efficient and viable recovery of coal that is readily accessible within existing mining leases and that has been identified for extraction by the approved LW 31-37 SMP mine plan.

8.4 Conclusion

Tahmoor Underground proposes to modify the Tahmoor North development consent (DA 67/98) to permit minor levels of subsidence within an area where subsidence is not currently permitted under Condition 6(i) of DA67/98. This EA has been prepared to support the modification application under section 75W of the EP&A Act.

The proposed modification is proposed in order to allow for the recovery of coal from LW32 in an efficient and viable manner, and is required in order to implement the current SMP mine plan. The proposed modification will not result in any changes to approved mining operations, surface facilities or production rates.

The impact assessments undertaken for the proposed modification conclude that subsidence associated with the proposed modification is likely to result in nil to negligible impacts on the land surface, natural or built environment or on existing land uses within the Modification Area. This is primarily due to the very low levels of subsidence predicted within the Modification Area, the substantial depth of cover above the coal seam, the overlying site characteristics and the continued implementation of existing subsidence monitoring, management and mitigation measures which have been successfully implemented across the Tahmoor North mining area since 2004.

This EA demonstrates that with the continued implementation of existing management and mitigation measures, the proposed modification can proceed within acceptable environmental standards.

9.0 References

Department of Environment, 2013. Significant Impact Guidelines 1.3: Coal Seam Gas and Large Coal Mining Developments - Impact on Water Resources

GeoTerra, 2014. Tahmoor Coal Pty Ltd – Tahmoor Colliery Longwall Panels 31 to 37 Streams, Dams and Groundwater Assessment Tahmoor, NSW

Hazleton, OP. A and Tille, P.J, 1990. Soil Landscapes of the Wollongong 1:100,000 Sheet, NSW Department of Land and Water Conservation, Sydney

Hansen Bailey, 2015. Tahmoor Coal Independent Environmental Audit Report

MSEC, 2014. Tahmoor Colliery – Longwalls 31 to 37 Subsidence Predictions and Impact Assessments for Natural and Built Features in Support of the SMP Application

MSEC, 2017. Tahmoor Colliery – Longwall 30 End of Panel Subsidence Monitoring Report for Tahmoor Longwall 30

Niche, 2014. Tahmoor North Longwalls 31 to 37 Terrestrial Ecology Assessment

Umwelt Pty Ltd, 2017. Stakeholder Engagement Plan, Tahmoor Underground Modification 4 DA 67/98

WRM Water + Environment, 2014. Tahmoor Coal Flood Impact Assessment: LW31-37

10.0 Abbreviations

µS/cm	Micro siemens per centimetre
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AIP	NSW Aquifer Interference Policy
CCL	Consolidated Coal Lease
CHPP	Coal Handling and Preparation Plant
DA	Development Application
EA	Environmental Assessment
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
Km	kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
L/s	Litres per second
LW	Longwall
m	metres
Mining SEPP	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
mm	millimetres
ML	Mining Lease
MOP	Mining Operations Plan
MSEC	Mine Subsidence Engineering Consultants
Mt	Million tonnes

Mtpa	Million tonnes per annum
NP&W Act	NSW *National Parks and Wildlife Act 1974*
NT Act	Commonwealth *Native Title Act 1993*
OEH	NSW Office of Environment and Heritage
PHS	Picton High School
PoEO Act	NSW *Protection of the Environment Operations Act 1997*
RMS	Roads and Maritime Services
ROM	Run of Mine
SEPP	State Environmental Planning Policy
SMP	Subsidence Management Plan
Umwelt	Umwelt (Australia) Pty Limited
WM Act	NSW *Water Management Act 2000*
WSP	Water Sharing Plan

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