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LAND MANAGEMENT PLAN – TAHMOOR SOUTH DOMAIN – LONGWALLS SOUTH 1A – SOUTH 6A

Tahmoor Coal Pty Ltd

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Document Control

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1 Introduction

1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates the Tahmoor Mine, an existing underground coal mine located approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW). Tahmoor Mine surface facilities are situated between the towns of Tahmoor and Bargo within the Wollondilly Local Government Area (LGA). The mine has previously extracted longwalls to the north and west of the surface facilities and has been operating continuously since 1979 when coal was first mined using bord and pillar mining methods, followed by longwall mining methods since 1987.

The location of Tahmoor Mine in the regional context is shown in **Figure** 1**.**

Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Extracted coal is processed on site at the coal handling and preparation plant (CHPP) and coal clearance facilities prior to transportation via rail to Port Kembla and Newcastle for Australian domestic and export customers.

An Environmental Impact Statement (EIS) was exhibited in early 2019 to gain approval for the Tahmoor South Coal Project, which involves use of the existing surface infrastructure and the expansion of underground longwall mining to the south of the existing workings (referred to as the Tahmoor South Domain). Tahmoor Coal subsequently revised the proposed mine design and submitted amended development applications on two occasions (in February and August 2020). In April 2021, Tahmoor Coal received Development Application Approval (SSD 8445) for the extraction of up to 4 Mtpa of ROM coal, with a total of up to around 33 Mt of ROM coal proposed to be extracted over a 10-year period.

The Tahmoor South Domain is located south of the Bargo River and east of Remembrance Driveway and the township of Bargo. Longwall mining would be used to extract coal from the Bulli coal seam within the bounds of Consolidated Coal Lease (CCL) 716 and CCL 747. Twelve longwalls are proposed in this domain which are divided into a series of six northern (A series) and six southern (B series) longwalls. The A series, Longwalls South 1A to South 6A (LW S1A-S6A), are the focus of the current Extraction Plan application.

The location of LW S1A-S6A and associated Study Area are illustrated in **Figure 2.**

1.2 Purpose

This Land Management Plan (LMP) has been prepared to support an Extraction Plan for the secondary extraction of coal from LW S1A-S6A.

The purpose of this management plan is to provide a framework for Tahmoor Coal personnel to ensure that compliance is achieved with relevant internal and external regulatory requirements related to landscape features monitoring and management within the Extraction Plan Study Area. The plan ensures that impacts on the environment and community are minimised and managed within a structured framework.

This plan is to ensure compliance with Development Consent (SDD 8445) (the Consent) Condition C8.

1.3 Scope

The Study Area applicable to this management plan consists of a combination of the predicted 20 millimetre (mm) Total Subsidence Contour and the 35° Angle of Draw Line as shown in **Figure 2**. Relevant environmental features within a 600 metre (m) buffer from extraction that could be susceptible to far-field or valley related movements have also been included for consideration.

This management plan:

- Addresses specific requirements set by Development Consent SSD 8445, EIS Commitments, Leases, Licences, and regulatory requirements (refer to **Section 2**);
- Addresses comments received during stakeholder consultation (refer to **Section 2.4**);
- Provides an overview of the existing environment for landscape features (refer to **Section 3**);
- Provides details on the predicted subsidence impacts and environmental consequences to landscape features from the extraction of LW S1A-S6A (refer to **Section 4**);
- Outlines the monitoring program for potential subsidence-related impacts to landscape features (refer to **Section 5**);
- Outlines the management strategies for potential subsidence-related impacts to landscape features (including cliffs, natural steep slopes, farm dams and agricultural land) (refer to **Section 6**);
- Outlines the strategies for implementation, reporting, and review of this document (refer to **Section 7**);
- Provides document information (refer to Section 8); and
- Provides Trigger Action Response Plans (TARPs) to be implemented to manage and protect landscape features (including cliffs, natural steep slopes, farm dams and agricultural land) within the Study Area (refer to **Appendix A**).

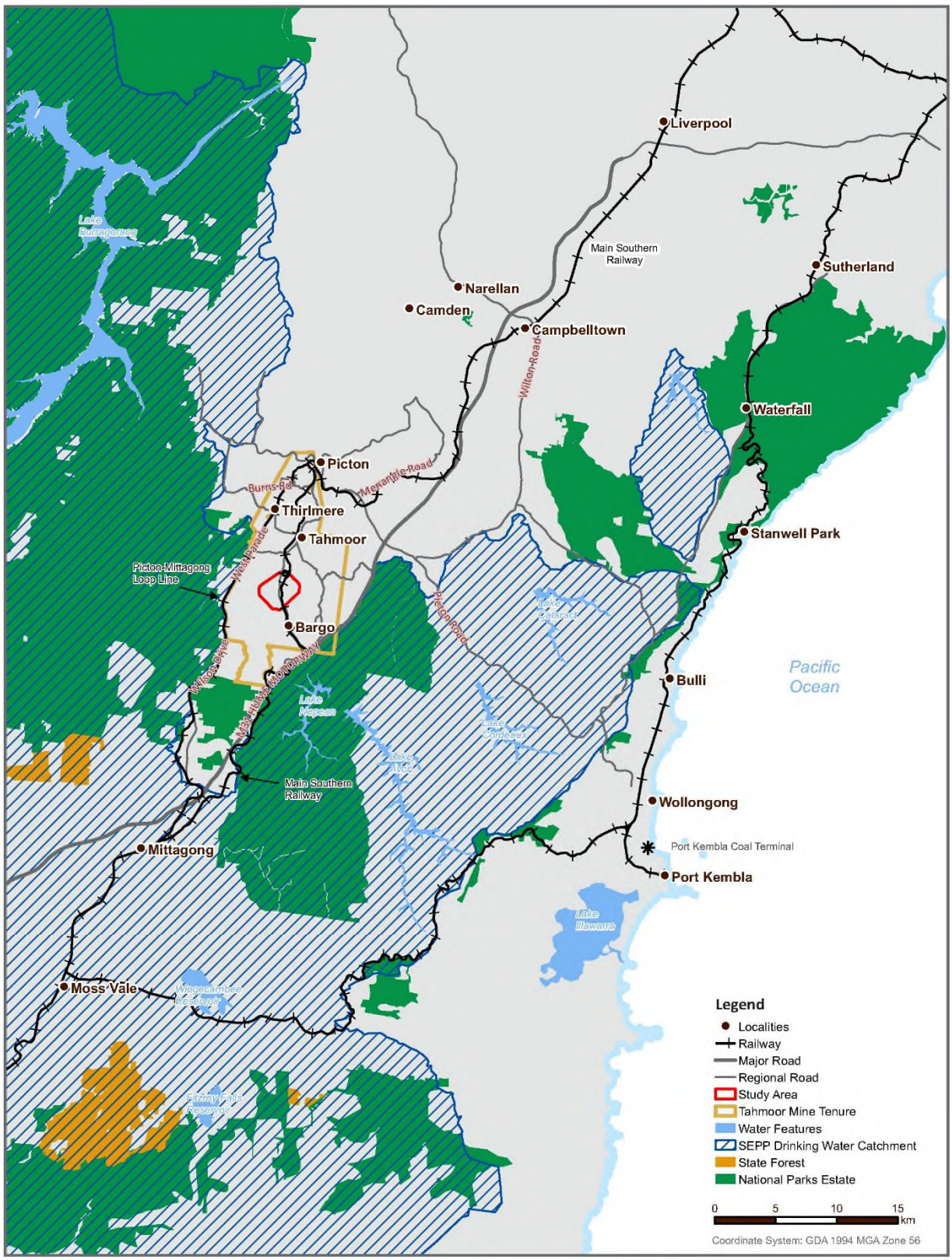
This management plan has been prepared based on the contents of the following technical reports:

- Geotechnical Assessment (Douglas Partners, 2022) (**Appendix B**);
- Land and Agricultural Resource Assessment (SLR, 2022) (**Appendix C**); and
- Subsidence Predictions and Impact Assessments Report (MSEC, 2022).

Potential risks to constructed steep slopes along road embankments and cuttings are managed separately in accordance with the Wollondilly Shire Council Management Plan.

Potential risks to constructed steep slopes along railway embankments and cuttings are managed separately in accordance with the Main Southern Railway Management Plan.

Potential risks to constructed steep slopes and dams on the Tahmoor Mine Site are managed in accordance separately with the Tahmoor Mine Site Management Plan.



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REGIONAL CONTEXT

Tahmoor South Domain Longwalls S1A to S6A Extraction Plan

FIGURE 1

Date: 24/03/2022

Data Sources:
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Figure 1 Regional Context

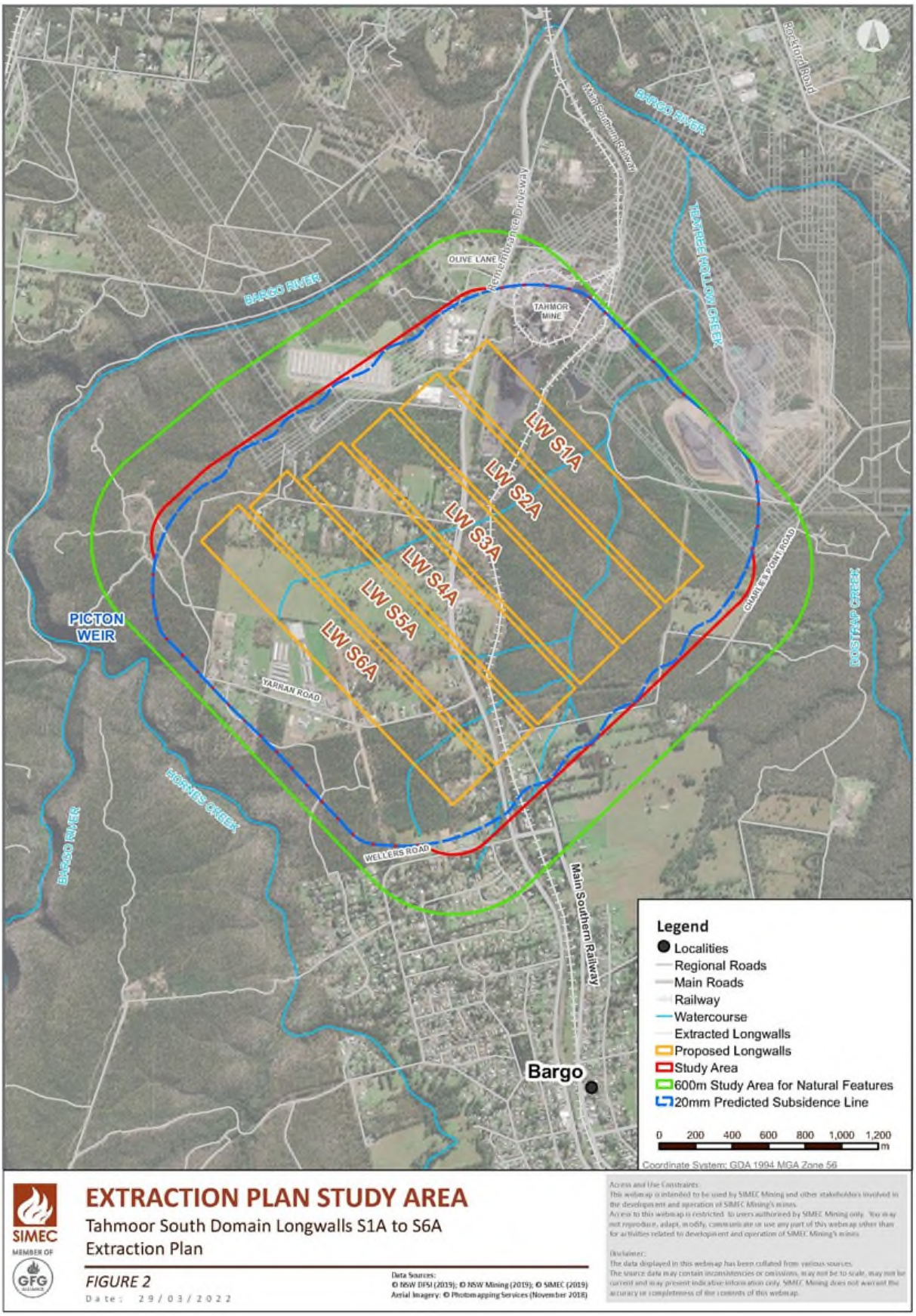

Figure 2 Extraction Plan Study Area

2 Regulatory Requirements

2.1 Project Approval

2.1.1 Development Consent Conditions

2.1.1.1 Extraction Plan Requirements

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

LW S1A-S6A will be extracted in the Tahmoor South mining area under Development Consent SSD 8445, as discussed further in Section 3.2.1 of the Extraction Plan Main Document. SSD 8445 provides the conditional planning approval framework for mining activities in the Tahmoor South Domain to be addressed within an Extraction Plan and supporting management plans. Conditions relevant to this management plan from SSD 8445 are detailed in **Table 1.**

Table 1 Key Conditions from SSD 8445 regarding Landscape Features

<table>
<tr><th>Condition Reference</th><th>Condition Requirement</th><th>Where Addressed</th></tr>
<tr><td>C1</td><td>SUBSIDENCE
Performance Measures – Natural and Heritage Features etc.
The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7.</td><td rowspan="2">Section 5, Section 6, Appendix A</td></tr>
<tr><td>Excerpt from Table 7</td><td>Table 7: Subsidence impact performance measures – natural and heritage features etc
<table>
<tr><th>Feature</th><th>Performance Measures</th></tr>
<tr><td colspan="2">Land</td></tr>
<tr><td>Any cliff located directly above longwalls</td><td>- Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of the cliff within any longwall mining domain)</td></tr>
<tr><td>Any cliff within Subsidence Area beyond the extent of longwalls</td><td>- Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within Subsidence Area)</td></tr>
<tr><td>All land within the Subsidence Area</td><td>- No greater subsidence impacts or environmental consequences than predicted in the EIS</td></tr>
<tr><td>All land outside the Subsidence Area</td><td>- Negligible subsidence impacts or environmental consequences</td></tr>
</table>
Notes for Table 7 (C1):
Notes:
• These performance measures apply to all mining taking place after the date of this consent.
• The Applicant is required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent (see condition CB).</td></tr>
</table>

<table>
<tr><th>Condition Reference</th><th>Condition Requirement</th><th>Where Addressed</th></tr>
<tr><td>C2</td><td>Performance Measures – Natural and Heritage Features etc.
Measurement and monitoring of compliance with performance measures and performance indicators in this consent is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans and monitoring programs. In the event of a dispute over the appropriateness of proposed methods, the Planning Secretary will be the final arbiter.</td><td>Section 5, Subsidence Management Plans for built features</td></tr>
<tr><td>C5</td><td>Performance Measures – Built Features
The Applicant must ensure that the development meets the performance measures in Table 8.
Table 8: Subsidence impact performance measures – built features
<table>
<tr><th>Feature</th><th>Performance Measures</th></tr>
<tr><td colspan="2">Other Built Features</td></tr>
<tr><td>- Other privately-owned built features and improvements, including petrol stations, sheds, garages, farm dams, tanks, swimming pools, tennis courts, roads, tracks and fences</td><td>- Always safe
- Serviceability should be maintained wherever practicable
- Loss of serviceability must be fully compensated
- Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant</td></tr>
<tr><td colspan="2">Public Safety</td></tr>
<tr><td>- Public safety</td><td>- Negligible additional risk</td></tr>
</table>
Notes for Table 8 (C5)
Notes:
• These performance measures apply to all mining taking place after the date of this consent.
• The Applicant is required to define more detailed performance measures in the Built Features Management Plans or Public Safety Management Plan (see condition CB).
• Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining.
• Requirements under this condition may be met by measures undertaken in undertaken in accordance with the Coal Mine Subsidence Compensation Act 2017.</td><td>Section 5, Section 6</td></tr>
<tr><td>C6</td><td>Performance Measures – Built Features
Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 8 is to be settled by the Planning Secretary, following consultation with the Resources Regulator. Any decision by the Planning Secretary shall be final.</td><td>Noted.</td></tr>
<tr><td>C8</td><td>Extraction Plan
The Applicant must prepare an Extraction Plan for all second workings on the site of the development to the satisfaction of the Planning Secretary. Each Extraction Plan must:</td><td>Noted.
This management plan is part of the LW S1A-S6A Extraction Plan Application.</td></tr>
<tr><td>C8(e)</td><td>provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent;</td><td>Section 4</td></tr>
<tr><td>C8(f)</td><td>describe in detail the performance indicators to be implemented to ensure compliance with the performance measures in Table 7 and Table 8, and manage or remediate any impacts and/or environmental consequences to meet the rehabilitation objectives in condition B56;</td><td>Section 5.1, Section 5.2, Section 6</td></tr>
</table>

Condition Reference	Condition Requirement	Where Addressed
C8(g)(v)	Land Management Plan which:	This management plan
	• has been prepared in consultation with any affected public authorities;	**Section 2.4**
	• provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on land in general, with a specific focus on steep slopes; and	**Section 5, Section 6, Appendix A**
	• is informed by a detailed slope stability assessment prepared by a suitably qualified and experienced person/s;	**Appendix D**
C8(g)(viii)	Trigger Action Response Plans addressing all features in Table 7 and Table 8, which contain:	**Section 6.3, Appendix A**
	• appropriate triggers to warn of increased risk of exceedance of any performance measure;	
	• specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded;	
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures; and	
	• adaptive management where monitoring indicates that there has been an exceedance of any performance measures in Table 7 and/or Table 8, or where any such exceedance appears likely; and	**Section 6.5**
C8(g)(ix)	Contingency Plan that expressly provides for:	**Section 6.4, Appendix A**
	• adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 7 and/or Table 8, or where any such exceedance appears likely;	**Section 6.5**
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures;	**Section 6.2, Section 6.5**
C8(i)	include a program to collect sufficient baseline data for future Extraction Plans.	**Section 5.3**
E4	**Adaptive Management** The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and performance measures in this consent. Any exceedance of these criteria or performance measures constitutes a breach of this consent and may be subject to offset or other provisions as specified in this consent and/or penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action (c) within 14 days of the exceedance occurring (or other timeframe agreed by the Planning Secretary), submit a report to the Planning Secretary describing these remediation options and any preferred remediation measures or other course of action; and (d) implement reasonable remediation measures as directed by the Planning Secretary.	**Section 6.5**

2.1.1.2 Management Plan Requirements

Condition E5 of the Consent outlines the general requirements for all management plans. **Table 2** outlines the requirements under this condition and identifies where these requirements have been addressed.

Table 2 Management Plan Requirements

Condition Reference	Condition Requirement	Where Addressed
E5	Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:	Noted.
(a)	a summary of relevant background or baseline data;	**Section 3**
(b)	details of:	NA
(b)(i)	the relevant statutory requirements (including any relevant approval, licence or lease conditions);	**Sections 2.1, 2.2 and 2.3**
(b)(ii)	any relevant limits or performance measures and criteria; and	**Section 5.1**
(b)(iii)	the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	**Section 5.1, Section 6.3, Appendix A**
(c)	any relevant commitments or recommendations identified in the document/s listed in condition A2(c);	**Section 2.1.2**
(d)	a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	**Section 6.2**
(e)	a program to monitor and report on the:	NA
(e)(i)	impacts and environmental performance of the development; and	**Section 5**
(e)(ii)	effectiveness of the management measures set out pursuant to condition E5(d);	**Section 6.2**
(f)	a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	**Section 6.4, Appendix A**
(g)	a program to investigate and implement ways to improve the environmental performance of the development over time;	**Section 6.4, Section 6.5.1**
(h)	a protocol for managing and reporting any:	NA
(h)(i)	incident, non-compliance or exceedance of any impact assessment criterion or performance criterion;	**Section 7**
(h)(ii)	complaint; or	**Section 7**
(h)(iii)	failure to comply with other statutory requirements;	**Section 7**
(i)	public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and	**Section 7**
(j)	a protocol for periodic review of the plan.	**Section 7**

2.1.2 EIS Commitments

Condition A2(g) of the Consent states that the development may only be carried out generally in accordance with the EIS. The relevant EIS documents include:

- Tahmoor South Project Environmental Impact Statement, Volumes 1 and 7, dated January 2019;
- Tahmoor South Project Amendment Report, including Appendices A to R and response to submissions, dated February 2020;
- Tahmoor South Project Second Amendment Report, Appendices A to O and response to submissions, dated August 2020; and

- Additional information responses dated 14 September 2020 (including Appendices A to L), 23 October 2020 and 4 November 2020.

EIS commitments relevant to this management plan are outlined in **Table 3**. These EIS commitments do not include commitments that are covered by the SSD 8445 Conditions of Consent.

Table 3 EIS Commitments

EIS Reference	Commitment	Where Addressed
LUR-3	**Land use and resources** Potential impact: Impacts of the surface aspects of the Project on land use Management and mitigation measures: Develop a Land Management Plan to manage land use and agricultural land within the Project Area	This document

2.1.3 Extraction Plan Guideline

This management plan has been prepared in accordance with the DPE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015), as detailed in Table 4.

Table 4 Extraction Plan Guideline Requirements for Key Component Plans

Extraction Plan Guideline Content Requirements for Key Component Plans	Where Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan.	**Section 3**
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan.	**Section 2.1.1, Section 5.1**
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation).	**Section 2, Section 5.1, Section 6**
Proposing performance indicators to establish compliance with these performance measures and statutory requirements.	**Section 5.1, Appendix A**
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance.	**Section 3**
Describe all currently predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan.	**Section 4**
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the Applicant's commitments.	**Section 6, Appendix A**
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites).	**Section 3**
Fully describing the proposed monitoring of subsidence impacts and environmental consequences.	**Section 5.2**
Describe the proposed monitoring of the success of remediation measures following implementation.	**Section 6.2, Section 6.4, Appendix A**
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences.	**Section 6.5**
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions or which exceed performance measures.	**Section 6.4, Appendix A**
Listing responsibilities for implementation of the plan.	**Section 7**
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	**Appendix A**

2.2 Relevant Legislation and Policies

For legislation that regulates health and safety during mining subsidence and obligations to remediate (which includes environmental consequences to cliffs, natural steep slopes, farm dams, or agricultural land), refer to the Extraction Plan Main Document, Public Safety Management Plan, and specific Subsidence Management Plans for built features.

2.3 Other Leases and Licences

All development consents, leases, licences, and other relevant approvals are stored in the Cority Compliance Management database, which is administered by both site and Liberty GFG Corporate. A summary of the relevant mining leases is provided in **Table 5.** A summary of other approvals and licences is provided in **Table 6**.

Table 5 Mining Lease

Lease	Title	Granted	Expires
CCL 716	Original Tahmoor Leases	15/06/1990	13/03/2021 (renewal documentation submitted and being assessed)
CCL 747	Bargo Mining Lease	23/05/1990	06/11/2025
ML 1376	Tahmoor North Lease	28/08/1995	28/08/2016 (renewal documentation submitted and being assessed)
ML 1308	Small Western Lease to west of CCL 716	2/3/1993	2/3/2035
ML 1539	Tahmoor North Extensions Lease	16/06/2003	16/06/2024
ML 1642	Pit-top and REA surface Mining Lease	27/08/2010	27/08/2031

Table 6 Environmental Approvals and Licences

Approval Title / Description	Date Granted	Expiry Date
Environmental Protection Licence 1389	01/05/2012	No Expiry
WAL36442 and WAL25777	6/12/2013	No Expiry
WAL43572	7/5/2021	No Expiry
WAL43656	1/8/2022	No Expiry

2.4 Stakeholder Consultation

2.4.1 Consultation to Date

The following stakeholders were consulted during the preparation of this management plan:

- NSW Department of Primary Industries – Agriculture (DPI Agriculture);
- Wollondilly Shire Council;
- Australian Rail Track Corporation (ARTC);
- NSW Department of Planning and Environment – Crown Lands Division (Crown Lands).

The feedback provided by stakeholders is summarised within **Table 7** below. No response from ARTC regarding the Extraction Plan has been received at this time. This consultation table does not include consultation completed during the Extraction Plan review stage post submission to DPE.

A summary of all consultation undertaken for this extraction plan is provided in Section 2.1.2 of the Extraction Plan Main Document, and a copy of the incoming correspondence is also provided in Appendix C of the Extraction Plan Main Document.

Tahmoor Coal will consult with built feature owners during the development of separate Subsidence Management Plans for their built features prior to the influence of subsidence on each relevant feature.

Table 7 Consultation to Date

Consulted Stakeholder	Consultation Conducted	Outcomes of Consultation
DPI Agriculture	A letter introducing the Extraction Plan for LW S1A-S6A was sent on 22 December 2021. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls. A response was received on 4 February 2022.	Noted.
	A full assessment of the agricultural land uses in the area that may be potentially impacted so any agricultural developments and associated enterprises in the area are considered in terms of identified risks and economic disruption particularly with subsidence.	An Agricultural Impact Statement was prepared for the first Amendment Report for SSD 8445 approval. For this Extraction Plan, a Land and Agricultural Resource Assessment (SLR, 2022) has been prepared to complement the information from the Agricultural Impact Statement, and provide any updates on agricultural development impacts from the proposed longwalls.
	Consult with the owners / managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about: the proposal, the likely impacts and suitable mitigation measures or compensation.	Consultation with owners of agricultural businesses in the Study Area has commenced. Tahmoor Coal will continue to consult with the owners during the preparation of a subsidence management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans. Further information on management plans to be prepared for built features is provided in **Section 2.1.2** and **Table 5**. In addition, all landowners in the Study Area have been informed by an information packaged delivered by mail of the proposed development and the subsidence impact claims process in the event that their property is damaged by mining.
	Consider possible cumulative effects to agricultural enterprises and landholders from subsidence/ other impacting events.	Given the described impacts are of a minor nature and readily managed through application of appropriate mitigation measures and management strategies, any resulting cumulative impacts on agricultural resources and enterprises are also expected to be minor and readily mitigated.

Consulted Stakeholder	Consultation Conducted	Outcomes of Consultation
	An assessment of the monitoring regime that will identify any changes as a result of the effects of the longwall mining, especially subsidence. This may include impacts of farm infrastructure i.e. buildings, fences, slope changes, water supply infrastructure.	Tahmoor Coal will consult with the agricultural business owners during the preparation of subsidence management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans. Further information on management plans to be prepared for built features is provided in **Section 2.1.2** and **Table 5**.
	In relation to the poultry enterprises that exist in the area, that these owner / managers as well as the processors / owners of the birds be consulted to ensure that production plans can be adjusted if required. This should have at least for 12 month period of mining activity.	Tahmoor Coal will consult with the agricultural business owners during the preparation of subsidence management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans. Further information on management plans to be prepared for built features is provided in **Section 2.1.2** and **Table 5**.
	For protected cropping enterprises (glasshouses) located in the impacted area, the slope of the glasshouses is critical for efficient irrigation so subsidence may be a potential issue. This may also be an issue for other open horticultural enterprises e.g. olives if they are irrigated with a dripper system.	Tahmoor Coal will consult with the agricultural business owners during the preparation of management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties (including hothouses and greenhouses) in accordance with these management plans. Further information on management plans to be prepared for built features is provided in **Section 2.1.2** and **Table 5**.
	Dust can also be an issue for greenhouse / glasshouse light transmission so this needs to be addressed if dust levels are an issue above ground.	The extraction of LW S1A-S6A involves the extraction of six underground longwall panels and as such there will be no impact to air quality resulting from this extraction activity. All other activities associated with the Tahmoor South Project that have the potential to create dust will be undertaken in accordance with the approved Air and Greenhouse Gas Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.
	With water quality any increase in the total dissolved salts (TDS) or an increase in sodium level will be a limitation to any horticultural system relying on hydroponics or fertigation.	There is no predicted increase in total dissolved salts or sodium in groundwater bores associated with LW S1A-S6A. This is discussed further in the Land and Agricultural Resource Assessment (SLR, 2022).
Wollondilly Shire Council	A letter introducing the Extraction Plan for LW S1A-S6A was sent on 22 December 2021. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	Noted.

Consulted Stakeholder	Consultation Conducted	Outcomes of Consultation
	A response from Council's Waste and Environmental Services Team was received on 14 February 2022.	
	A detailed geological model that identifies the likely interaction of subsidence induced fractures with the modelled groundwater environment as part of complying with the IESC publication.	The Tahmoor South Geological Model has been updated, as discussed in the Groundwater Technical Report in Appendix E of the Water Management Plan.
Crown Lands	A letter introducing the Extraction Plan for LW S1A-S6A was sent on 22 December 2021. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls. A response was received on 2 February 2022.	Noted.
	Surface disposal areas for material from the underground longwall sites will likely be documented in the plan. It is desirable that arrangements for disposal of spoil do not adversely impact on public land (including Crown land) in the environs.	This Extraction Plan discusses the management of potential impact from the extraction of LW S1A-S6A only. Details on the REA and any proposed changes as a result of proposed longwall extraction in the Tahmoor South Domain are documented in the EIS and two Amendment Reports, which were reviewed as part of the approval of SSD 8445. As per condition A39 of SSD 8445, Tahmoor Coal will consult with Crown Land and enter into a compensation agreement prior to undertaking any development on Crown Land or Crown Roads.

3 Existing Environment

3.1 Climate

Climate data for the Study Area has been obtained from the nearest Bureau of Meteorology (BOM) weather station located at Picton, approximately one (1) km to the north-west of the Study Area (Picton Council Depot, BOM Station 068052, Monthly Climate Statistics).

Picton BOM Station has recorded an average annual rainfall of 801 mm, of which approximately 475 mm (60%) falls between November and April, with an average of 70.8 rain days in any given year, as outlined within **Table 8**. Mean monthly maximum temperatures range between 29.3°C and 16.8 C, with January being the warmest month. Mean monthly minimum temperatures range between 15.4 C and 1.7°C, with July being the coldest month.

Table 8 Picton Climate Data (BoM, 2022)

Climate Data	Average (Mean)	Annual Range
Minimum temperature	8.8°C	1.7°C – 15.4°C
Maximum temperature	23.5°C	16.8°C – 29.3°C
Annual rainfall	800.9 mm	70.8
Wettest month - February	91.0 mm	6.8
Driest month – September	43.5 mm	5.1

The BOM classifies the region as a temperate climate zone. The region can be susceptible to occasional heavy showers and thunderstorms due to easterly troughs during warmer months. Summer winds are generally from the south or south-east, with a tendency for afternoon north-easterly winds. During winter, winds are predominantly from the south or south-west.

3.2 Topography

Topography in the region is varied, ranging from gently undulating plateaus, ridges and low hills in the upland areas, to a rugged landscape of deeply dissected valleys and gorges within the Hawkesbury Sandstone (SLR, 2022).

The Study Area is generally undulating with a fall from the south-west to the north-east. The major topographical feature within the Study Area is Teatree Hollow. The major topographical feature nearby the Study Area is the Bargo River valley, which is located to the north (SLR, 2022).

Elevation near the Study Area varies from a low point of approximately 265 metres AHD, in the base of Teatree Hollow, downstream from of the proposed LW S1A, to a high point of approximately 345 metres AHD, at the south-western end of the Study Area to the south-west of the proposed LW S6A (SLR, 2022).

3.3 Geology

The Study Area is located within the southern area of the Permo-Triassic Sydney Basin. The main coal bearing sequence is the Illawarra Coal Measures, which contains four workable seams. The upper most seam, located in the north-western part of the Illawarra Coalfield, is the Bulli Coal Seam. Overlying the Bulli Coal Seam is the Hawkesbury Tectonic Stage which is comprised of three stratigraphic units, namely the Narrabeen Group, Hawkesbury Sandstone Group and the Wianamatta Group. The Narrabeen Group overlies the Illawarra Coal Measures and is comprised of interbedded sandstones and claystone units up to 310 m thick (SLR, 2022).

Overlying the Narrabeen Group is the Hawkesbury Sandstone which is comprised of a series of bedded sandstones up to 185 m thick. The Wianamatta Group overlies the Hawkesbury Sandstone, and is comprised of shales and siltstones and is relatively thin in comparison. Another major geological feature is the Bald Hill Claystone which lies at the base of the Hawkesbury Sandstone. The Bald Hill Claystone varies in width to over 25 metres, which tends to act as an aquitard (SLR, 2022).

3.4 Cliffs

The Development Consent (SSD 8445) defines cliffs as a continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (>63.4^{o}).

Douglas Partners (2022a) and the Subsidence Prediction and Impact Assessment Report (MSEC, 2022) adopted similar definitions in support of the Extraction Plan.

The locations and heights of cliffs within the Study Area were determined based on the results of an airborne laser scan. Two cliffs are located on the outer edge of the 600 metres buffer for environmental features (BC1 and BC2). One cliff is located within a tributary to the Bargo River and is more than 500 metres from the proposed LW S4A. A small portion of another cliff is located along Hornes Creek and is located approximately 600 metres from the proposed LW S6A (MSEC, 2022).

The locations of cliffs within the Study Area are illustrated in **Figure 3**.

3.5 Steep slopes

The Development Consent (SSD 8445) defines steep slopes as an area of land having a gradient between 1 in 3 (33% or 18.3^{o}) and 2 in 1 (200% or 63.4^{o}).

Douglas Partners (2022a) adopted a similar definition. The Subsidence Prediction and Impact Assessment Report (MSEC, 2022) defined a steep slope "*as an area of land having a gradient greater than 1 in 3 (33% or 18.3^{o})*". The MSEC definition is broader than the definition in the Development Consent as it encompasses slopes greater than 2 in 1 that do not meet the criteria for cliffs.

The steep slopes within the Study Area were identified from an airborne laser scan. Steep slopes are generally located about incised creek gullies and include rocky outcrops, which are located on undeveloped land. Steep slopes comprising four road embankments and one cut batters along Remembrance Drive were also identified by the LiDAR survey. No other properties have been identified as containing structures close to steep slopes (Douglas Partners, 2022a).

The locations of steep slopes within the Study Area are illustrated in **Figure 3**.

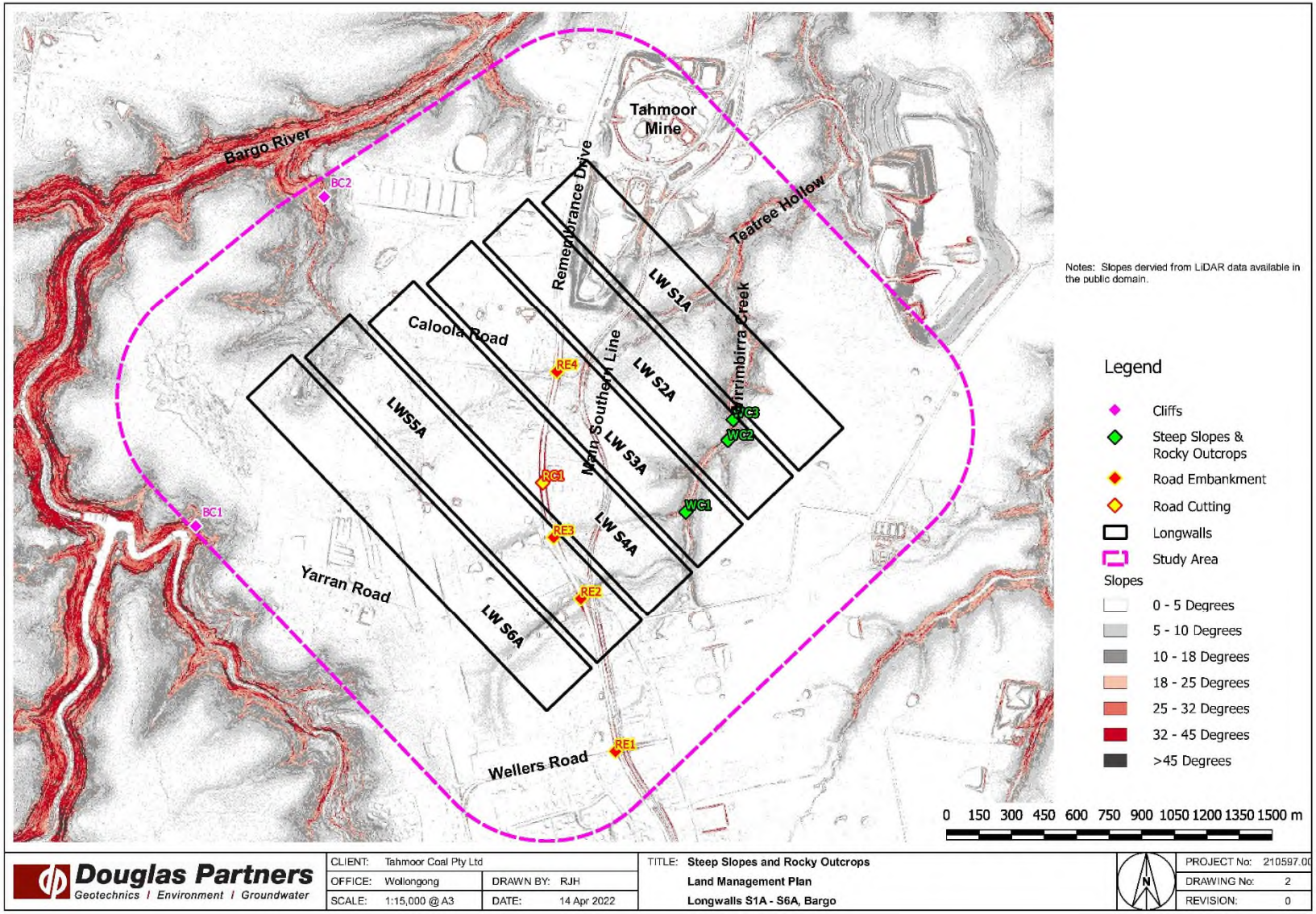

Figure 3 **Cliffs and Steep Slopes in the Study Area (Douglas Partners, 2022a)**

3.6 Soils

The soils within the Study Area consist of four Soil Landscape Units and are summarised in **Table 9**.

Agricultural land best suited to grazing land covers 12% of the Study Area, and about 84% of the soils within the Study Area are moderately limited for grazing and highly limited for cultivation (SLR, 2022).

Table 9 Soil Landscape Units (SLR, 2022)

Soil Landscape	Study Area		Agricultural Limitation Rating	
Unit	**Hectares**	**%**	**Unit**	**Hectares**
Gymea	14	2	High – Severe	High – Severe
Disturbed Terrain	12	2		
Lucas Heights	572	84	Moderate	High
Blacktown	85	12	Low	Moderate

Three Australia Soil Classification soil types are present in the Study Area:

- Kurosols – moderately low inherent fertility comprising 80% of the Study Area;
- Tenosols – moderately low inherent fertility comprising 12% of the Study Area; and
- Dermosols - moderately high inherent fertility comprising 4% of the Study Area.

The likelihood of acid sulfate soils occurring within the Study Area is very low due to its position away from the coast and potential acid sulfate landform type. Furthermore, none of the Soil Landscape Units mapped within the Study Area have acid sulfate soil potential (SLR, 2022).

3.7 Land Use

Only a minor portion of the Study Area is comprised of cleared pastoral land (approximately 27%) that may be suitable for agricultural enterprises (refer **Figure 4**). The remainder of the land is comprised of thick native vegetation along riparian zones and steep slopes, mine disturbance areas, and small holdings used as rural residential land (SLR, 2022).

Grazing is a major agricultural land use in the Study Area. Overall farm size is considered small and many would be classified as hobby farms with a very low potential to produce significant agricultural income. No intensive cropping activities were observed at the time of the inspection and assessment (SLR, 2022).

Poultry farms are a significant industry in the area, with three located within and adjacent to the Study Area. In addition, a number of rural structures that may be used for agricultural purposes also are located in the Study Area, including greenhouses, hothouses, irrigation systems, tanks, dams and groundwater bores.

3.8 Biophysical Strategic Agricultural Land

No Biophysical Strategic Agricultural Land exists within the Study Area. The nearest Biophysical Strategic Agricultural Land is located between Douglas Park and Camden, approximately 20 km to the north-east of the Study Area (SLR, 2022).

3.9 Farm Dams

A total of 45 farm dams have been identified within the Study Area, the locations of which are shown in **Figure 5**. The farm dams have been identified as typically shallow (less than three metres deep), of earthen construction and established by localised cut and fill operations within natural watercourses (MSEC, 2022).

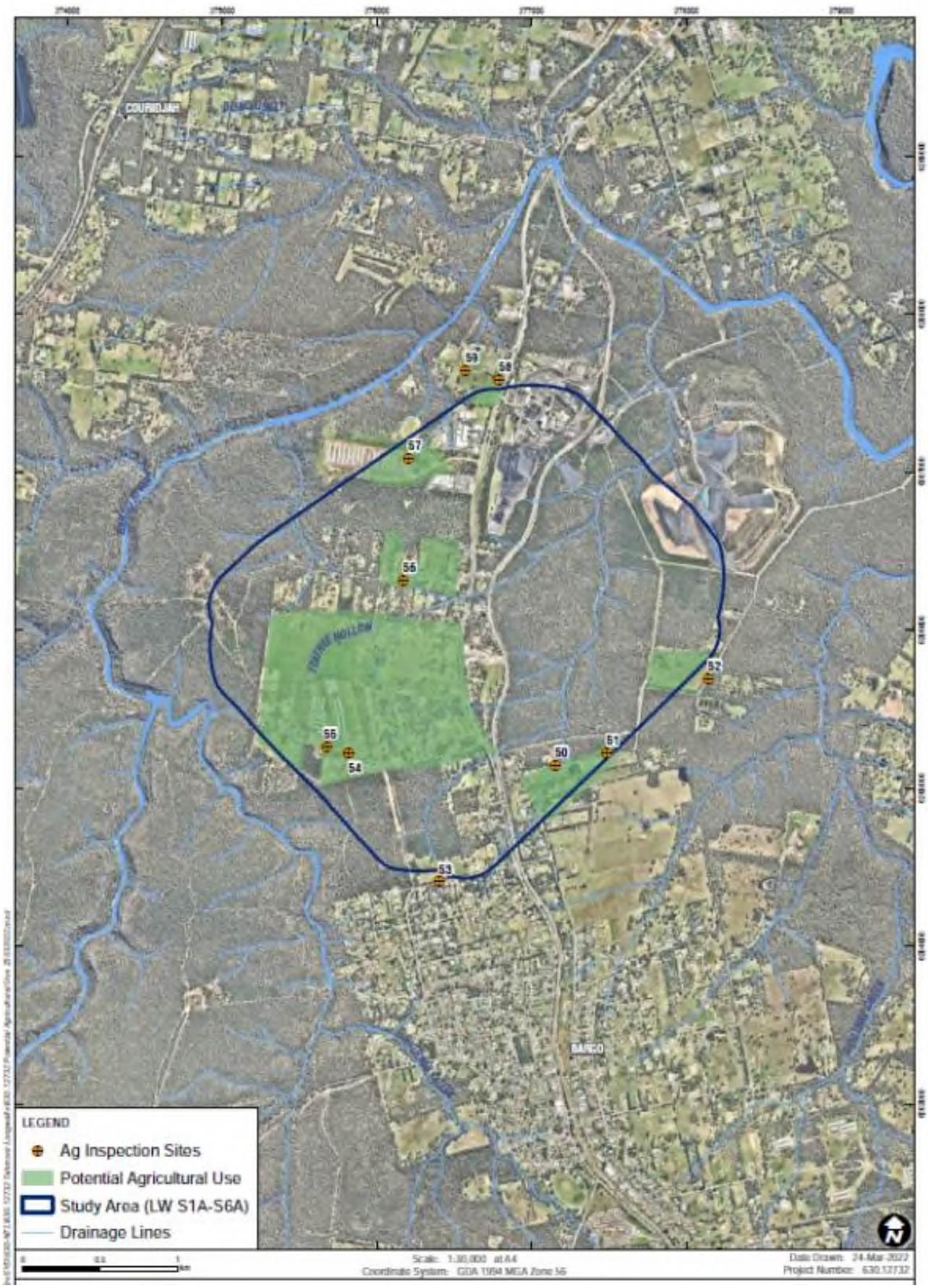

Figure 4 Agricultural Land in the Study Area (SLR, 2022)

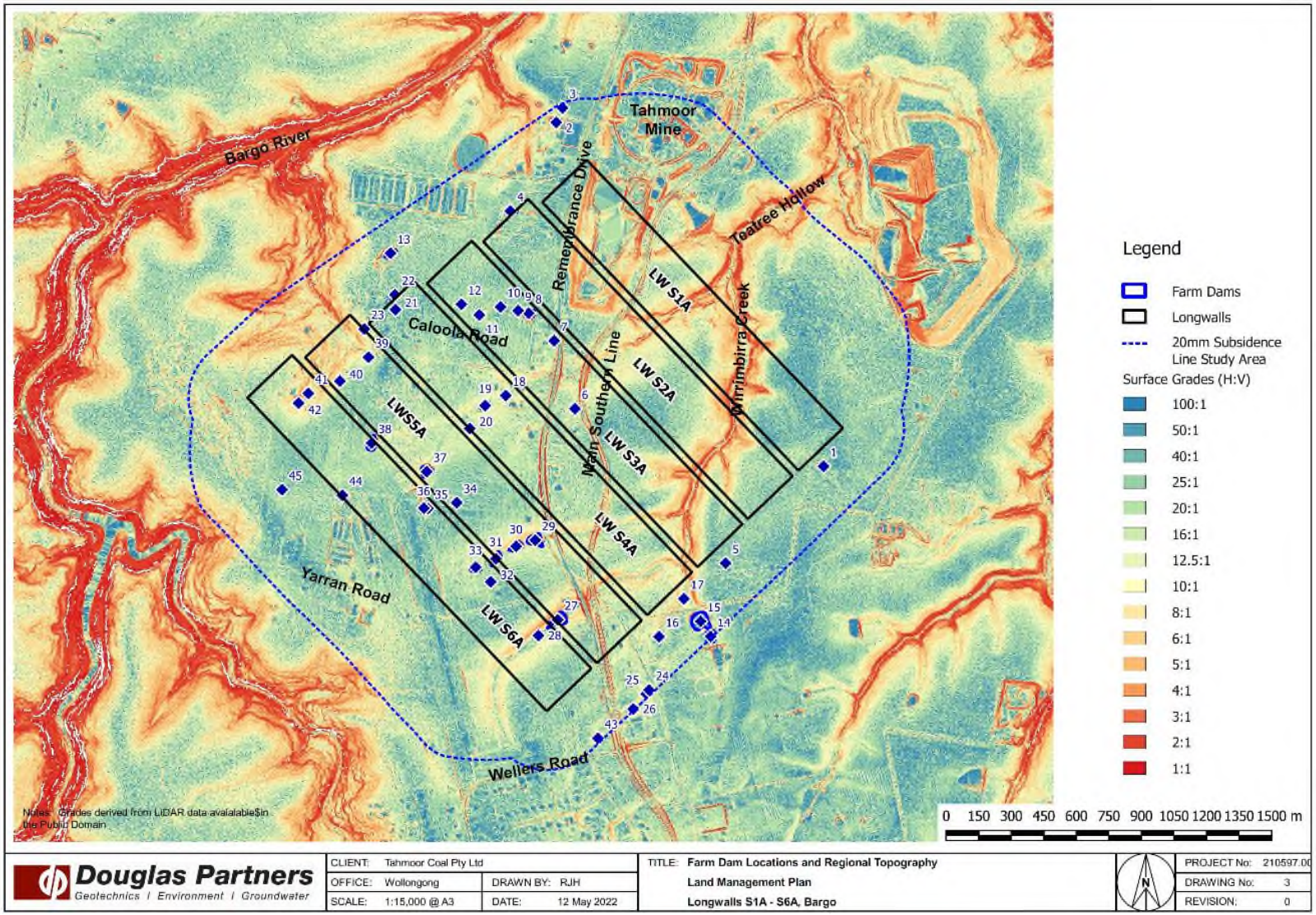

Figure 5 Study Area Farm Dams (Douglas Partners, 2022a)

4 Predicted Subsidence Impacts and Environmental Consequences

4.1 Cliffs

There has been extensive experience of mining directly beneath and adjacent to cliffs in the Southern Coalfield. These include cliffs along the Bargo River adjacent to Tahmoor Mine Longwalls 24A to 26, Appin Longwalls 301 and 302 adjacent to the Cataract River and Tower Longwalls 18 to 20 and Appin Longwalls 701 to 704 adjacent to the Nepean River (MSEC, 2022).

The cliffs are located outside the predicted limit of subsidence due to the extraction of LW S1A-S6A, and will not be directly mined beneath. Therefore, the cliffs are not expected to experience any substantial conventional tilts, curvatures and strains (MSEC, 2022).

Based on this previous experience of mining at Tahmoor, Appin and Tower Collieries, it is unlikely that cliffs beyond the extent of the longwall panels will experience large instabilities. It is possible that isolated rock falls could occur during the mining period due to natural weathering processes. Any impacts are expected to represent less than 0.5 % of the total face area of the cliffs. If the actual mine subsidence exceeded those predicted values by a factor of 2 times, the likelihood of impacts for the cliffs that are located well outside the proposed longwalls would still be expected to be very low (MSEC, 2022).

The two cliffs, BC1 and BC2, that are located beyond the extent of the longwalls panels, with BC1 potentially impacted by LW S6A and BC2 potentially impacted by LW S3A, S4A, S5A and S6A. The pre-mining baseline condition will be established prior to LW S3A for Cliff BC2 and prior to LW S6A for Cliff BC1, subject to land access. Tahmoor Coal also commits to completing a calculation of the face areas of the BC1 and BC2 cliffs by March 2023.

4.2 Steep Slopes

There has been extensive experience of mining beneath steep slopes in the Southern Coalfield. These include steep slopes along the Cataract, Nepean, Bargo and Georges Rivers and streams such as Myrtle Creek and Redbank Creek above Tahmoor Mine Longwalls 22 to 32, slopes on Redback Range above Tahmoor Mine Longwalls 26 and 27 and slopes along ridges and valleys above Tahmoor LWs W1-W3. No large-scale slope failures have been observed along these slopes, even where longwalls have been mined directly beneath them. Surface cracking and minor rock falls along clifflines or rock outcrops have been observed, for example, during the mining of Appin Longwalls 301 and 302 adjacent to the Cataract River, however, no large-scale slope failures have been observed (MSEC, 2022).

Potential impacts on steep slopes would generally result from the movement of soils, causing tension cracks to appear at the tops of the slopes and compression ridges to form at the bottoms of the slopes. These movements are consistent with observations of upsidence and closure of creek valleys where compression is developed at the bottoms of the valleys and tension is developed at the tops of the valleys. If tension cracks were left untreated it is possible that soil erosion could occur (MSEC, 2022).

While in most cases impacts to slopes are likely to consist of surface cracking, there remains a low probability of large-scale slope slippage. The probability is assessed to be very low for slopes that will not be directly mined beneath by the longwalls. Experience indicates that the probability of mining induced large-scale slippages is extremely low due to the substantial depths of cover within the Study Area. While the risk is extremely low, some risk remains and attention must therefore be paid to any structures or roads that may be located in the vicinity of steep slopes (MSEC, 2022).

A detailed slope stability assessment has been completed for the proposed longwalls in accordance with the requirement of Condition C8 (Douglas Partners, 2022b; refer **Appendix D**). As the slopes assessed are constructed steep slopes associated with Remembrance Drive, this information will be used to inform the Wollondilly Shire Council Management Plan.

4.3 General landscape

As discussed in the Subsidence Predictions and Impact Assessment Report (MSEC, 2022), longwall mining can result in surface cracking, heaving, buckling, humping and steeping at the surface. Surface cracking in soils as the result of conventional subsidence movements (e.g. away from valleys and steep slopes) is not commonly observed where the depths of cover are around those as measured in the Study Area. Extents of surface cracking observed as the result of conventional subsidence movements has generally been relatively isolated and of a minor nature (MSEC, 2022).

Localised ground buckling and shearing can occur wherever faults, dykes and abrupt changes in geology occur near the ground surface. In the Study Area, it is possible that ground deformations could develop where the Nepean Fault daylights on the surface (MSEC, 2022).

4.4 Agricultural Land

The majority of agricultural land use is for grazing and no intensive cropping activities are conducted. Based on the natural landscape contours and the predicted subsidence contours, there is unlikely to be any remnant ponding in the landscape. Therefore, there is no land which will be temporarily removed from agriculture as a result of LW S1A-S6A (SLR, 2022).

The majority of rural structures within the Study Area are of lightweight construction and are anticipated to tolerate mining-induced tilt. It has been found from past longwall mining experience that tilts of the magnitudes predicted in the Study Area generally do not result in adverse impacts on rural structures. Some minor serviceability impacts could occur at the higher levels of predicted tilt, including door swing and issues with roof and pavement drainage. These serviceability impacts can generally be remediated using normal building maintenance techniques (MSEC, 2022).

Farm fences are generally flexible in construction and can usually tolerate mine subsidence movements. Impacts to fences may include tension loss and changes to post alignment. The most vulnerable section of farm fences are gates particularly long gates or those with latches as they are less tolerant to differential horizontal movements and tilts between the gate posts and the ground (MSEC, 2022).

Potential risks to rural structures used for agricultural and farming purposes located in the Study Area are discussed in the Built Features Management Plan (e.g. poultry sheds, greenhouses, greenhouses, hothouses, irrigation systems, and tanks) and the Water Management Plan (i.e. watercourses and groundwater bores).

4.5 Farm Dams

Subsidence induced tilt may result in a reduction in the storage capacity of farm dams by decreasing the available freeboard on one side of the dam. As detailed in MSEC (2022), the maximum predicted final tilt for farm dams overlying the Study Area is 7.5 mm/m (i.e. 0.75%) in comparison with a maximum predicted tilt of 10 mm/m based on the EIS longwall layout. Less than 300 mm reduction in freeboard is predicted for 41 dams located in the Study Area, with two dams predicted to incur a reduction in freeboard between 300 mm and 400 mm and one dam predicted to incur a reduction in freeboard greater than 500 mm. Additionally, the predicted curvatures and strains may be sufficient to result in cracking in the base or walls of some farm dams within the Study Area (MSEC, 2022).

The potential impacts on the structural integrity of the dam embankments are addressed further in the Geotechnical Assessment (Douglas Partners, 2022a). Farm dams constructed with compacted clayey material can generally withstand low levels of strain that would result in conventional cracking. However, localised cracking and deformations may occur which may require remediation. It is noted that a number of the farm dams appear to be constructed from sandy soil and crushed sandstone, which would be more susceptible to cracking (e.g. due to mine subsidence) and erosion from overland stormwater flows during heavy rainfall events.

Douglas Partners (2022a) identified eight farm dams (FD8, FD19, FD23, FD27, FD29, FD30, FD31, FD38 and FD42) which may potentially experience cracking due to mining induced subsidence and associated loss of water storage capacity due to differential settlements across the footprint of the dam. A geotechnical investigation including dam break analyses will be carried out for these dams to assess the likelihood and extent of the assessed risk and to provide recommendations on remedial and precautionary works, if required. This investigation will be completed prior to impact from mining.

As detailed in Douglas Partners (2022a), a monitoring program pertaining to the structural integrity and water holding capacity of the farm dams would be implemented prior to mining of LW S1A-S6A, during operations and post mining. Should impacts be reported, a remediation program would be implemented in accordance with TARP LMP3. Further detail on potential remediation and make good measures is provided in **Section 6.2.3**.

5 Subsidence Monitoring Program

5.1 Performance Measures and Indicators

Performance measures for landscape features are provided in Table 7 of Condition C1 and Table 8 of Condition C5 of SSD 8445 and are summarised in **Table 10.**

Table 10 Subsidence Performance Measures and Performance Indicators for Landscape Features

Feature	Subsidence Performance Measures	Subsidence Performance Indicators
Any cliff located directly above longwalls	Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of the cliff within any longwall mining domain)	This performance measure is not relevant to this Extraction Plan, as there are no cliffs located directly above LW S1A-S6A.
Any cliff within Subsidence Area beyond the extent of longwalls	Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within Subsidence Area)	This performance measure will be considered to be triggered if more than 0.5% of the total face area of the cliffs within the 600 m Environmental Features Study Area is impacted by mining (i.e. by occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing). This performance measure and performance indicator have been incorporated into TARP LMP1 (cliffs).
All land within the Subsidence Area	No greater subsidence impacts or environmental consequences than predicted in the EIS	This performance measure will be considered to be triggered if mining results in mine subsidence-induced slope instability, which would be a greater subsidence impact or consequence than predicted in the EIS. This performance measure and performance indicator have been incorporated into TARP LMP2 (natural steep slopes).
All land outside the Subsidence Area	Negligible subsidence impacts or environmental consequences	This performance measure is not relevant to this Extraction Plan, as there are no steep slopes identified within the 600 m Environmental Features Study Area, other than the three steep slopes located within the Subsidence Area and already assessment in accordance with the 'All land within the Subsidence Area' performance measure.
Other privately-owned built features and improvements, including farm dams.	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant.	This performance measure will be considered to be triggered if mining results in damage to a farm dam such that the dam is not safe and serviceable and/or any damages cannot be fully repairable and/or compensated. This performance measure and performance indicator have been incorporated into TARP LMP3 (farm dams).

Feature	Subsidence Performance Measures	Subsidence Performance Indicators
Public safety	Negligible additional risk.	This performance measure will be considered to be triggered if subsidence monitoring identifies a mining induced hazard to the public that cannot be controlled or managed.

For the purpose of this management plan, 'negligible' is defined as being 'so small and insignificant as to not be worth considering'. A negligible impact is viewed with regards to a long term context, causing little or no impact. If a short term impact causes a greater than negligible impact, the impact can still be considered negligible if the impacts are of a limited duration and are considered negligible when considered over the long term.

Based on the predicted subsidence impacts (MSEC, 2022), it is considered that the performance measures for landscape features within the Study Area will be achieved during and after mining of LW S1A-S6A.

To assist in measurement of compliance with the performance measure for 'any cliff within Subsidence Area beyond the extent of longwalls', Tahmoor Coal will calculate the total face area of cliffs BC1 and BC2. This will be completed within the next six months (by March 2023), subject to land access.

5.2 Monitoring Program

A subsidence monitoring program for landscape features will be implemented to monitor the impacts and consequences of subsidence effects on during the extraction of LW S1A-S6A. The details of this monitoring program are provided in **Table 11**, and the locations of monitoring sites are illustrated in **Figure 3**.

The aim of the monitoring program is to identify where there is a risk of impact to landscape features as a result of extraction activities. The monitoring program provides for the opportunity to record the condition of the site during the following three phases:

- Prior to Mining – baseline survey of the condition of the site before the commencement of mining;
- During Mining – monitoring of the condition of the site during active subsidence to establish whether there has been any change to the site or if changes have occurred from the effects of subsidence; and
- Post Mining – monitoring of the condition of the site after mining to identify whether there has been any change to the site in the period since mining, and to determine if the ground surface conditions have stabilised.

If an impact is identified to have occurred or is likely to occur, the relevant TARP (refer to **Appendix A**) will then be referred to for the identification of appropriate mitigation strategies.

5.2.1 Agricultural Monitoring Locations

Agricultural monitoring will be completed from fixed photo points, as identified in **Figure 4** as agricultural inspection points. The location and number of these fixed photo points may change due to land access.

5.2.2 Rural Structure Monitoring and Management

Tahmoor Coal notifies all residents and/or businesses within the 20 millimetre subsidence area and 35 degree angle of draw prior to commencement of all first and second workings. Comprehensive monitoring of all potentially impacted properties within these areas is undertaken from the commencement of extraction, and continues regularly until extraction is completed. Further monitoring is completed during the post-extraction phase in accordance with the relevant management plan for the residence / business (refer to the Built Features Management Plan for further details).

In relation to the poultry enterprises that exist in the area, that the owner/manager as well as the processor/owner of the birds will be consulted during the preparation of the relevant management plan for each agricultural business to ensure that production plans can be adjusted if required. Monitoring will also be detailed in the relevant management plan, as agreed during consultation with the poultry enterprises.

5.2.3 Exclusions for this Monitoring Program

This management plan includes a monitoring program and TARP for natural steep slopes within the Study Area. It is noted that the monitoring of constructed slopes (i.e. slopes associated with roads, Main Southern Railway, and the Tahmoor Mine Site) will be monitored and managed in accordance with the specific subsidence management plans for these built features (e.g. Wollondilly Shire Council Management Plan, Main Southern Railway Management Plan, and the Tahmoor Mine Site Management Plan).

This management plan includes a monitoring program and TARP for farm dams within the Study Area. It is noted that the monitoring of dams located on the Tahmoor Mine Site will be discussed and managed in accordance with the Tahmoor Mine Site Management Plan.

5.3 Baseline Monitoring to Support Future Extraction Plans

To assist in the preparation of future Extraction Plans, landscape feature monitoring as outlined in **Table 11** would provide sufficient baseline data. Monitoring data collected during the mining of LW S1A-S6A would be used in the review of observed subsidence impacts to inform future Extraction Plans for the Tahmoor South Domain.

Table 11 Monitoring Program for Landscape Features

Feature	Monitoring Component / Location	Pre-mining Monitoring	During Mining Monitoring	Post-mining Monitoring
Cliffs	Cliffs (BC1 and BC2) within the 600 m Environmental Features Study Area.	Visual inspection baseline before mining by a geotechnical engineer, subject to land access (Cliff BC1 prior to LW S6A, Cliff BC2 prior to LW S3A). Surveyor to measure face area of cliffs within the Study Area.	None required.	Visual inspection at the completion of mining by a geotechnical engineer, subject to land access (Cliff BC1 after LW S6A, Cliff BC2 after LW S3A, S4A, S5A and S6A).
Natural Steep Slopes	Natural steep slopes (WC1, WC2 and WC3).	Visual inspection baseline one month before active subsidence period by a geotechnical engineer, subject to land access	Monthly visual inspection during active subsidence period by a geotechnical engineer, subject to land access.	Quarterly visual inspection for 12 months following active subsidence period by a geotechnical engineer, or as required in accordance with a Rehabilitation Management Plan, subject to land access.
Farm Dams	Identified farm dams within the Study Area.	Dam embankment integrity and water level observation by a geotechnical consultant one month before active subsidence period using fixed location photo points.	Dam embankment integrity and water level observation every week during active subsidence by Tahmoor Coal, and every month during the active subsidence period by a geotechnical consultant, using fixed location photo points.	Dam embankment integrity and water level observation using fixed location photo points on a quarterly basis for 12 months following completion of active subsidence by a geotechnical consultant, or as required in accordance with a Rehabilitation Management Plan.
Agricultural Land	Identified agricultural land within the Study Area.	Visual inspection prior to the commencement of mining from fixed photo points.	Weekly inspections along local roads and farm dams.	Visual inspection at the completion of each longwall for land within the predicted limit of subsidence for each longwall.

6 Subsidence Management Strategies

6.1 Mine Design Considerations

The Tahmoor South Domain mine plan has undergone a series of amendments since the issue of the first EIS for the Tahmoor South Project in 2014. These mine plan revisions are summarised below:

- EIS Submission (2014): Original EIS submission, which was placed on hold and subsequently withdrawn in late 2015;
- EIS Submission (January 2019): Updated EIS submission based on revised Secretary's Environmental Assessment Requirements (SEARs) issued in June 2018;
- Project Amendment Report (February 2020): The mine design was modified to reduce potential environmental impacts of the Project through the reduction in the extent of longwall mining. This was achieved by the following modifications:
- Removal of LW 109, which was located directly beneath Dog Trap Creek. This would result in elimination of direct impacts to Aboriginal heritage items;
- Configuration of the longwall layout to comprise two series of shorter longwall panels;
- Reduction in the proposed longwall width, from approximately 305 m to approximately 285 m; and
- Reduction in the height of extraction within the longwall panels from up to 2.85 m to up to 2.6 m.
- Second Amendment Report (August 2020): The mine design was again modified to further reduce potential environmental impacts. This included the removal of two longwalls in the southern part of the mine near the township of Bargo (LW 107B and LW108B), which would result in a reduction in magnitude of subsidence impacts.

The numerous modifications of the Tahmoor South Domain mine plan have resulted in a reduction of the magnitude and extent of subsidence impacts, as well as avoidance of significant impact to sensitive surface features of the environment, including Aboriginal heritage items.

The current mine plan proposes to complete underground mining with access to the Tahmoor South Domain provided from the existing pit top facilities. This mine design consideration minimises surface impacts from mining through the avoidance of establishing new surface facilities.

6.2 Mitigation Measures and Corrective Management Actions

6.2.1 Public Safety Management

Tahmoor Coal manages risks by following a risk management process, which involves the four steps:

- Identify hazards – find out what could cause harm;
- Assess risks if necessary – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening;
- Control risks – eliminate the risk or, if this is not possible, minimise the risk through risk control measures; and
- Review – review control measures to ensure they are working as planned.

The framework utilised for the risk assessment is the risk management process outlined within AS/NZS ISO 31000.

Tahmoor Coal has completed a risk assessment as part of the broader Extraction Plan process that included the risk assessment of built and natural features likely to be affected by subsidence from the extraction of LW S1A-S6A. The outcomes of the risk assessment are outlined further in the Public Safety Management Plan.

Landscape features that could be at risk from the development of mine subsidence in the Study Area include:

- Cliffs;
- Natural Steep slopes;
- Farm dams;
- Agricultural land.

Waterways, dams and groundwater are considered further in the LW S1A-S6A Water Management Plan.

Potential hazards to cliffs from mine subsidence can include:

- Potential for surface cracking;
- Potential for rock fall or toppling; and
- Potential for collapse.

Potential hazards to natural steep slopes from mine subsidence can include:

- Potential for surface cracking; and
- Potential for movement of overhang rock boulders/landslide.

Potential hazards from the impact of mine subsidence on agricultural land can include:

- Potential impact to land use from flooding;
- Potential for remnant ponding reducing available land;
- Potential impact on water resources - surface water and ground water;
- Potential change in grade of drainage lines; and
- Potential increase in erosion / tunnel erosion on earthworks.

6.2.2 Management of Cliffs and Natural Steep Slopes

Tahmoor Coal has extensive experience in managing potential impacts and environmental consequences on cliffs and steep slopes. In response to observed subsidence impacts causing surface deformations or surface cracking, Tahmoor Coal could implement the following management measures / corrective management actions:

- Install warning signs and/or danger tape in the immediate area if the cracking is consider a public safety risk;
- Plan and undertake site rehabilitation as soon as practical to remove any ongoing public safety risks. Site rehabilitation measures could include:
  - Backfilling or grout filling of surface cracking;
  - Re-profiling of compression humps;
  - Infilling of pot-holes or subsidence-related undulations developed;
  - Re-direction of drainage; and
  - Installation of supports or securing of unstable structures or natural features, such as rock masses or cliffs.

6.2.3 Management of Farm Dams

Should mining related impacts to farm dams be reported, a remediation program would be implemented in accordance with TARP LMP3 (farm dams). Any substantial cracking in the base or walls of the dam could be repaired by reinstating with cohesive materials.

If mining related impacts resulted in a reduction in water storage capacity/water supply, Tahmoor Coal could provide an alternative water source until the completion of repairs in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

All reports from any source of any new cracks or leakage from a dam, including a routine inspection or from the landowner or other member of the public or Subsidence Advisory NSW, are investigated as part of Tahmoor Coal's obligation to investigate all possible mining-related impacts and environmental consequences. Section 7.2 of Extraction Plan Main Document outlines the procedure for management of an incident in accordance with the following Tahmoor Coal management plans:

- Emergency and Incident Manual (TAH-HSEC-00232);
- Pollution Incident Response Management Plan (TAH-HSEC-00155); and
- Notification of Environmental Pollution Incidents (TAH-HSEC-00224).

In addition, Section 7.5 of the Extraction Plan Main Document outlines the procedure for management of any complaints and disputes in accordance with the Community Complaints and Enquiry Procedure (TAH-HSEC-00120).

6.2.4 Management of Agricultural Land

Tahmoor Coal could implement the following management and corrective management actions for agricultural land features if impacted during the extraction of LW S1A-S6A:

- Whilst there are no earthworks proposed during the extraction of LW S1A-S6A, in the unlikely event they would be required, gypsum will be applied for any remediation earthworks where sodic subsoils (exchangeable sodium is greater than 5%) are exposed. The application of gypsum will minimise the potential for tunnel erosion to occur on disturbed subsoil;
- Where watercourses have been impacted resulting in fractures and voids, remediation will be completed in accordance with the Water Management Plan;
- Tahmoor Coal has committed to "make good" provisions for any groundwater users shown to be adversely affected by mine operations and associated impacts (discussed in further detail in the Water Management Plan); and
- If impacts to tanks occur, the structure will be repaired in accordance with the *Coal Mine Subsidence Compensation Act 2017* (refer to the Built Features Management Plan);
- In the unlikely event of damage to fence tensioning or farm gate levels, Tahmoor Coal will remediate any damage in consultation with relevant landowner stakeholders;
- As discussed in **Section 6.2.3**, any substantial cracking in the dam bases or walls within the Study Area could be repaired by reinstating with cohesive materials. If any farm dams were to lose water as a result of mining, the mine would provide an alterative water source until the completion of repairs in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.2.5 Verification Methods

Ongoing monitoring as specified in **Section 5.2** will provide early warning of potential impacts to landscape features. In addition, landscape features will be inspected at the completion of each longwall, which will enable the current condition of each landscape feature to be verified against its pre-mining condition.

6.3 Trigger Action Response Plan

A series of TARPs have been developed to address various components of landscape features using the performance indicators for implementation during LW S1A-S6A mining, in accordance with Condition C8(g)(viii) of the Consent (refer to **Appendix A**).

The primary actions of the TARP are to:

- Define appropriate trigger levels for cliffs, natural steep slopes, farm dams, and agricultural land;
- Develop specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded; and
- Present a plan in the event a performance measures are exceeded or are likely to be exceeded and describe the management / corrective actions to be implemented (i.e. notifications to relevant agencies, repair of cracks and instabilities).

The 'Normal Condition' section of each TARP indicates that the environment is performing within normal levels or natural variability. Deviation from baseline or expected condition triggers an increased level of risk to the environment (Level 1 or higher based on escalating corresponding risk).

TARPs for constructed steep slopes associated with roads, railways and the Tahmoor Mine site have been developed separately in the relevant Subsidence Management Plans for built features. These TARPs will be added to the Master TARP, located in Appendix B of the Extraction Plan Main Document, once completed.

6.3.1 Implementation of Monitoring Program and TARP Requirements

Tahmoor Coal's standard approach for all monitoring, reporting, investigation and remediation is to commence all tasks as soon as practicable. The following sections provide more information on this standard approach to be adopted during the LW S1A-S6A pre-mining, mining and post-mining phases:

- All monitoring commitments will be tracked on a weekly basis so that tasks are completed as required, taking into consideration land access and environmental factors. Post-mining monitoring will typically be completed within one month of the completion of the relevant longwall and prior to the influence from the active subsidence zone on the feature from the next longwall.
- Following the receipt of monitoring data and laboratory results, specialist consultants will review the data against the relevant TARPs as soon as practicable. If any TARP trigger has occurred, specialist consultants will notify Tahmoor Coal as soon as practicable. Monitoring results and TARP triggers will also be discussed during the monthly Environmental Response Group meetings, and any relevant information from other disciplines will be shared within the group. It is noted that discussions amongst specialists from different disciplines will not be restricted to ERG meetings, and relevant specialists will be included at any time to discuss results and assist with the completion of required actions and responses, as required.
- In the event of a TARP trigger occurrence, Tahmoor Coal will initiate all requirements (actions and responses) in accordance with the relevant TARP (i.e. investigation, report, negotiation, CMA determination, or similar) as soon as practicable and endeavour to commence actions and responses within one month of the exceedance being recorded. This timeframe is noted to be subject to issues outside of Tahmoor Coal's control such as land access constraints, inclement weather, extended timeframes where further monitoring is required, and inability to communicate with a third party / landholder.
- Tahmoor Coal will complete the required actions and responses relating to the TARP trigger as soon as practicable and will endeavour to finalise these requirements, subject to issues outside of Tahmoor Coal's control, as follows:

- Level 1 and Level 2 TARP trigger actions and responses within three months of the exceedance being recorded;
- Level 3 and Level 4 TARP trigger actions and responses within six months of the exceedance being recorded; and
- Exceeds Performance Measures actions and responses in accordance with the timeframes provided in the relevant TARPs.

6.4 Contingency Plan

In accordance with Conditions C8(g)(ix) and E5(f) of the Consent, in the event that performance measures (in the form of pre-defined triggers) are considered to have been exceeded or are likely to be exceeded, a response will be undertaken in accordance with these TARPs (refer to **Appendix A**). This response is a contingency plan that describes the management / corrective management actions which can be implemented where required to remedy the exceedance.

If a Corrective Action Management Plan is required in accordance with the TARP, this plan will be prepared in accordance with Section 3.6.3 of the Extraction Plan Main Document.

The success of remediation measures / correction management actions that have been implemented for any TARP exceedance would be reviewed as part of any Corrective Action Management Plan, the Six Monthly Subsidence Impact Reports and the Annual Review.

6.5 Adaptive Management Strategies

6.5.1 Adaptive Management for Landscape Features

There are no adaptive management strategies currently proposed for the management of landscape features in the Study Area.

6.5.2 Continuous Improvement

Tahmoor Coal have adopted the “Plan-Do-Check-Act” model as shown in **Figure 6**. This model will be applied to all aspects of Tahmoor Coal’s environmental management and is utilised to embed the continuous improvement process in all system documents.

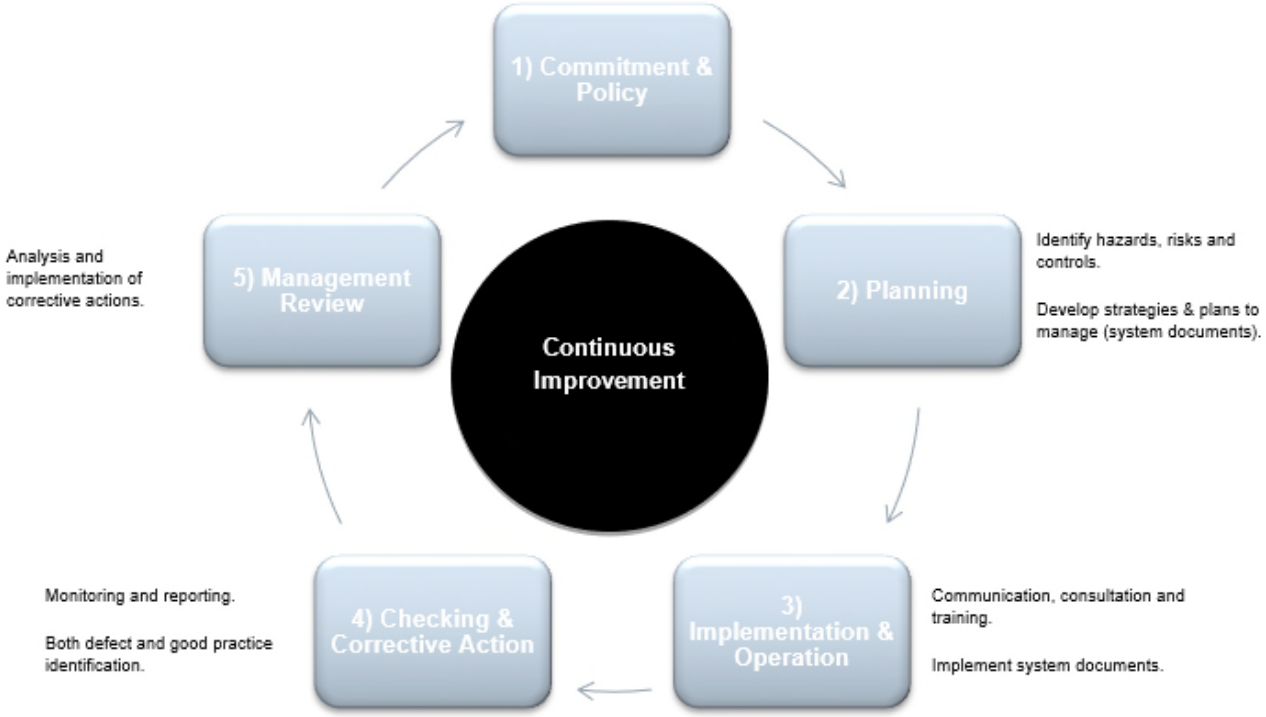

Figure 6 Continuous Improvement Model

7 Implementation and Reporting

7.1 General Requirements

This section of the management plan describes the key elements of implementation and reporting specific to the management of landscape features.

A description of requirements and procedures that are applicable to the extraction of LW S1A-S6A in general are provided in the Extraction Plan Main Document. This detail includes:

- Environmental Management System Framework;
- General reporting requirements, including details regarding the Six Monthly Subsidence Impact Report, Annual Review, and Annual Return;
- Incident management and reporting requirements;
- Non-compliance management and reporting requirements;
- Exceedances management and reporting requirements;
- Compliant and dispute management protocol;
- Audit and review requirements for general environmental performance, including internal audits and reviews, and independent environmental audits;
- General roles and responsibilities;
- Employee and contractor training requirements;
- Response groups to facilitate the review of monitoring data;
- Internal and External Stakeholder Communication Procedures;
- Access to information requirements, including Tahmoor Coal website and the Tahmoor Colliery Community Consultative Committee;
- Document control protocol; and
- Risk assessment for built and natural features and corresponding outcomes.

7.2 Reporting Requirements

7.2.1 Performance Measure Exceedance

In accordance with Condition E4 of the Consent, where any exceedance of the criteria or performance measures outlined within this document has occurred, Tahmoor Coal will:

- Take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- Consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures / corrective management actions or other course of action;
- Within 14 days of the exceedance occurring (or other timeframe agreed by the Planning Secretary), submit a report to the Planning Secretary describing these remediation options and any preferred remediation measures / corrective management actions or other course of action; and
- Implement reasonable remediation measures / corrective management actions as directed by the Planning Secretary.

7.2.2 Specific Reporting for Landscape Features

There are no reporting requirements specific to the management of landscape features identified for the extraction of LW S1A-S6A.

7.3 Review and Auditing

7.3.1 Plan Audit

Audits of the Land Management Plan are to be conducted in consultation with the Plan owner and nominated individuals and shall focus on the content and implementation.

Audits on the content shall consist of a determination of understanding of the Land Management Plan by the individual's allocated responsibility under this plan.

Audits on the implementation shall consist of reviews of the safe working procedures and risk assessments developed to ensure safe operation of this Land Management Plan, they may also involve discussions with personnel involved in the management plan to determine understanding and compliance.

Should an audit of this Land Management Plan determine that a deficiency is evident in the content or implementation, a corrective action must be developed and implemented. Actions will be assigned to a nominated individual and tracked in Cority.

Tahmoor Coal is responsible to verify that the nominated corrective action has been implemented by way of a follow up audit.

Any changes to the Land Management Plan are to be managed and communicated to all personnel in line with the Change Management Process.

7.3.2 Plan Review

This Land Management Plan will be reviewed:

Event based: in accordance with Condition E7 (a) of the Consent, a review will be required within 3 months of any incident, event or finding that identifies an inadequacy in the Land Management Plan risk assessment or associated documents to continue to effectively manage the identified hazard; a change to the workplace itself or any aspect of the work environment, a change to a system of work, a process or a procedure; or

Time based: in the absence of regular event-based reviews and in accordance with Condition E7 (b-e) of the Consent, this plan will be reviewed within three months of:

b) the submission of an Annual Review under Condition E13;

c) the submission of an Independent Environmental Audit under Condition E15;

d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise); or

e) notification of a change in development phase under Condition A19;

If deemed appropriate, relevant stakeholders may be included in the review process. All reviews are to be documented. The process for review of this document will be in according to Tahmoor Coal's *Document and Record Control* (TAH-HSEC-00124).

Following changes (or as otherwise required above), a copy of the amended management plan will be forwarded to the Secretary of the DPE for approval.

7.4 Roles and Responsibilities

There are no roles and responsibilities specific to the implementation of landscape features identified for the extraction of LW S1A-S6A.

8 Document Information

8.1 Referenced Documents

Reference information, listed in **Table 12** below, is information that is directly related to the development of this document or referenced from within this document.

Table 12 Reference Information

Title
Bureau of Meteorology (2022), BoM Website accessed March 2022, www.bom.gov.au
Department of Planning and Environment (DPE) (2015), Draft Guidelines for the Preparation of Extraction Plans V5.
Douglas Partners (2022a), Report on Geotechnical Assessment, Longwalls S1A to S6A, Bargo, prepared for Tahmoor Coal, December 2022, document 210597.00.R.002.
Douglas Partners (2022b), Report on Geotechnical Investigation, Detailed Slope Stability Assessment, Longwalls S1A to S6A, Bargo, September 2022, document 210597.02.R.001
SLR (2022), Tahmoor Extraction Plan LW S1A-S6A Land and Agricultural Resource Assessment, prepared for Tahmoor Coal, April 2022, document 630.12732.002.
Mine Subsidence Engineering Consultants (2022), Tahmoor South Project – Extraction Plan for Longwalls S1A to S6A: Subsidence ground movement predictions and subsidence impact assessments for natural features and surface infrastructure. Prepared for Tahmoor Coal, May 2022, document MSEC1192.
SIMEC (2019) Tahmoor South Project Environmental Impact Statement, Volumes 1 and 7, dated January 2019.
SIMEC (2020a) Tahmoor South Project Amendment Report, including Appendices A to R and response to submissions, dated February 2020.
SIMEC (2020b) Tahmoor South Project Second Amendment Report, Appendices A to O and response to submissions, dated August 2020.
SIMEC (2020c) Additional information responses dated 14 September 2020 (including Appendices A to L), 23 October 2020 and 4 November 2020.

8.2 Related Documents

Related documents, listed in **Table 13** below, are internal documents directly related to or referenced from this document.

Table 13 Related Documents

Number	Title
TAH-HSEC-00120	Community Complaints and Enquiry Procedure
TAH-HSEC-00124	Document and Record Control
TAH-HSEC-00155	Pollution Incident Response Management Plan
TAH-HSEC-00224	Notification of Environmental Pollution Incidents
TAH-HSEC-00323	Emergency and Incident Manual
TAH-HSEC-00365	LW S1A-S6A Extraction Plan Main Document
TAH-HSEC-00361	LW S1A-S6A Water Management Plan
TAH-HSEC-00362	LW S1A-S6A Land Management Plan
TAH-HSEC-00364	LW S1A-S6A Heritage Management Plan

Number	Title
TAH-HSEC-00366	LW S1A-S6A Built Features Management Plan
TAH-HSEC-00365	LW S1A-S6A Public Safety Management Plan
TAH-HSEC-00367	LW S1A-S6A Subsidence Monitoring Plan

8.3 Glossary of Terms

Section 8.3 of the Extraction Plan Main Document provides a compiles Glossary of Terms.

8.4 Abbreviations

Abbreviations used in this document are provided below in **Table 14.**

Table 14 Abbreviations

Abbreviation	Definition
AHD	Australian Height Datum
BOM	Bureau of Meteorology
DPE	NSW Department of Planning and Environment
DPIE	NSW Department of Planning, Industry and Environment (formerly DPIE)
DPI Agriculture	NSW Department of Primary Industries – Agriculture
EIS	Environmental Impact Statement
km	Kilometre/s
LMP	Land Management Plan
LW	Longwall
LW S1A-S6A	Longwall South 1A – South 6A
m	Metre/s
mm	Millimetre/s
ML	Mining Lease
NSW	New South Wales
Resources Regulator	Department of Regional NSW – Resources Regulator
Study Area	Study Area applicable to this management plan consists of a combination of the predicted 20 millimetre (mm) Total Subsidence Contour and the 35o Angle of Draw Line as shown in **Figure 2.**
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan

8.5 Change Information

Full details of the document history are recorded below in **Table 15**.

Table 15 Document History

Version	Date Reviewed	Reviewed By	Change Summary
1.0	May 2021	Zina Ainsworth, Charlie Wheatley, Malcolm Waterfall, Peter Vale	New Document.
2.0	September 2022	Charlie Wheatley, Zina Ainsworth	Updated document following consultation with DPE, government agencies and the Independent Advisory Panel for Underground Mining.
3.0	January 2023	April Hudson, Zina Ainsworth	Review in accordance with Condition E7(e) following the commencement of first and second workings (18 October 2022) of the Consent SSD 8445.

APPENDIX A – Trigger Action Response Plans

LAND MANAGEMENT PLAN TARP – LMP1 CLIFFS

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**
Performance Measure Feature Any cliff within Subsidence Area[1] beyond the extent of longwalls[2]. **Performance Measure** Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within Subsidence Area). **Performance Indicator** This performance measure will be considered to be triggered if more than 0.5% of the total face area of the cliffs within the 600 m Environmental Features Study Area is impacted by mining (e.g. by occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing). **TARP Objective** This TARP defines measures to manage potential impacts on cliff lines and the actions required to be implemented in response to exceedance of defined trigger levels. **Assessment Criteria** Extent of surface cracking, rockfalls, displacement or dislodgement of boulders or slabs observed.	**Locations** Cliffs (BC1 and BC2) within the 600 m Environmental Features Study Area as illustrated in Figure 3 of the Land Management Plan. **Monitoring Frequency** **Pre-mining** Visual inspection baseline before mining by a geotechnical engineer, subject to land access (Cliff BC1 prior to LW S6A, Cliff BC2 prior to LW S3A). **During Mining** None required (as the identified cliffs are located near the finishing ends of the longwalls). **Post-mining** Visual inspection at the completion of mining by a geotechnical engineer, subject to land access (Cliff BC1 after LW S6A, Cliff BC2 after LW S3A, S4A, S5A and S6A).	**Normal Range of Condition**		
		• Surface cracking < 10 mm wide above the cliff line, on the cliff face, or in the underside of overhangs. AND/OR • No rockfalls, displacement or dislodgement of boulders or slabs observed.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Surface cracking > 10 mm wide above the cliff line, on the cliff face, or in the underside of overhangs. AND/OR • No rockfalls, displacement or dislodgement of boulders or slabs observed.	• *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related. • Discuss findings and obtain other relevant information from key specialises (e.g. subsidence monitoring results). If it is concluded that the cliff has been damaged by subsidence impacts: • Consider and decide on reasonable and feasible options to support the cliff line, where relevant (e.g. repairing cracks, installation of support (e.g. rockbolts)). • Erect hazard/warning signs and restrict access to areas where necessary. • Consider increasing monitoring and review of data frequency at sites where Level 1 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of potential cliff instability and monitoring results relevant to the cliff locations.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. repairing cracks, installation of support). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Rockfalls, collapse of overhang, displacement or dislodgement of boulders or slabs observed.	• *Actions as stated in Level 1.* • Determine the percentage area of impacted area relative to the total face area. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, or the effect is unrelated to mining such as environmental effects, tree root jacking). If it is concluded that cliff line has been damaged by subsidence impacts: • Increase frequency of monitoring by geotechnical consultant during active subsidence period at sites where Level 2 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of potential cliff instability and monitoring results relevant to the cliff locations. • Notify and consult with affected landowner(s). • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options. • Review Land Management Plan and modify if necessary. • Undertake an investigation to determine if an exceedance of the performance measure is likely.	• *Responses as stated in Level 1.* If it is concluded that cliffs have been damaged by subsidence impacts: • Offer site visit with DPE and key stakeholders. • Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders if relevant. • Notify DAWE of any predictions of an exceedance of a performance measure (if relevant) within two business days. • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access. • Advise DPE and key stakeholders of any required amendments to Land Management Plan.
		Exceeds Performance Measure		
		• More than 0.5% of the total face area of the cliffs within the 600 m Environmental Features Study Area is impacted due to mining (e.g. by occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing).	• *Actions as stated in Level 2.* • Investigate reasons for the performance measure exceedance. • Review predictions of subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation. • Consider modifying mine plan for future longwalls located near cliffs.	• *Responses as stated in Level 2.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE) describing remediation options and any preferred remediation measures or other course of action. • Implement reasonable remediation measures as directed by DPE, subject to land access. • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days.

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	Action	Response
				• Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project).

Notes:
[1] Subsidence Area is defined as the 'Subsidence Study Area' as illustrated in Figure 1 of Appendix 2 of SSD 8445.
[2] It is noted that there are no cliff lines located directly above Longwalls S1A-S6A. Therefore, the performance measure for 'Any cliff located directly above longwalls' is not relevant.

LAND MANAGEMENT PLAN TARP – LMP2 NATURAL STEEP SLOPE (EXCLUDING CONSTRUCTED STEEP SLOPES ASSOCIATED WITH ROADS, RAILWAY AND THE TAHMOOR MINE SITE)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**
Performance Measure Feature All land within the Subsidence Area[1,2]. **Performance Measure** No greater subsidence impact or environmental consequences than predicted in the EIS[3]. **Performance Indicator** This performance measure will be considered to be triggered if mining results in mine subsidence-induced slope instability, which would be a greater subsidence impact or consequence than predicted in the EIS. **TARP Objective** This TARP defines measures to manage potential impacts on natural steep slopes[4,5] and the actions required to be implemented in response to exceedance of defined trigger levels. **Assessment Criteria** Extent of surface cracking and stepping, ground bulging, buckling and shearing for steep slopes[4].	**Locations** Natural steep slopes (WC1, WC2 and WC3) Locations of natural steep slopes shown in Figure 3 of the Land Management Plan. **Monitoring Frequency** **Pre-mining** Visual inspection baseline one month before active subsidence period by a geotechnical engineer, subject to land access. **During Mining** Monthly visual inspection during active subsidence period by a geotechnical engineer, subject to land access. **Post-mining** Quarterly visual inspection for 12 months following active subsidence period by a geotechnical engineer, or as required in accordance with a Rehabilitation Management Plan, subject to land access.	**Normal Range of Condition**		
		• Discontinuous surface cracking < 10 mm wide on steep slope (e.g. other than natural desiccation cracking). AND/OR • No localised ground bulging, buckling or shearing.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Persistent[6] surface cracking 10 - 20 mm, or stepping (including shearing) across a crack 10 – 20 mm high on steep slope. AND/OR • Localised ground bulging or buckling (between 100 – 200 mm) is observed on steep slope.	• *Actions as required for Normal Condition.* • Geotechnical consultant inspection to assess cause and determine need for further action/investigation. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results). If it is concluded that the slope has been damaged by subsidence impacts: • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. backfilling or grout filling of surface cracking, re-profiling of compression humps). • Erect warning signs and restrict access to areas where necessary. • Consider increasing monitoring and review of data frequency at sites where Level 1 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of potential slope instability and monitoring results relevant to the steep slope locations. • Consider additional specific monitoring at the impact site and implement if feasible and effective.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. backfilling or grout filling of surface cracking, re-profiling of compression humps, re-direct drainage) • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Persistent[5] surface cracking > 20 mm wide or stepping > 20 mm high on slope. AND/OR • Localised ground bulging or buckling > 200 mm is observed on steep slope. AND/OR • Slope instability < 300 m³ is observed or assessed as likely by a geotechnical engineer based on the extent of surface cracking or deformation.	• *Actions as stated in Level 1.* • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced cracking, or the effect is unrelated to mining such as wet weather or other environmental effects). If it is concluded that the slope has been damaged by subsidence impacts: • Increase frequency of monitoring by geotechnical consultant during active subsidence period at sites where Level 2 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of potential slope instability and monitoring results relevant to the steep slope locations. • Assess potential for slope instability (and if an exceedance of the performance measure is possible). • Consider actions to avoid or reduce the likelihood and/or consequence of slope instability and implement if feasible and effective. • Notify and consult with affected landowner(s). • Review CMAs with regards to the findings from further investigations and consider additional remediation options. • Review Land Management Plan and modify if necessary.	• *Responses as stated in Level 1.* If it is concluded that the slope has been damaged by subsidence impacts: • Offer site visit with DPE and key stakeholders. • Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders if relevant. • Notify DAWE of any predictions of an exceedance of a performance measure (if relevant) within two business days. • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access. • Advise DPE and key stakeholders of any required amendments to Land Management Plan.
		Exceeds Performance Measure		
		• Subsidence-induced impacts or environmental consequences that result in slope instability > 300 m³.	• *Actions as stated in Level 2.* • Investigate reasons for the performance measure exceedance. • Review predictions of mine subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation.	• *Responses as stated in Level 2.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed with DPE) describing temporary protection measures and long-term remediation options and any preferred remediation measures or other course of action. • Implement reasonable remediation measures as directed by DPE, subject to land access. • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project).

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	Action	Response
Notes: [1] Subsidence Area is defined as the 'Subsidence Study Area' as illustrated in Figure 1 of Appendix 2 of SSD 8445. [2] Steep slopes are defined as greater than 18.4°. There are three steep slopes identified within the 600 m Environmental Features Study Area that are also located within the Subsidence Area[1]. As no other steep slopes have been identified within the 600 m Environmental Features Study Area, the performance measure for 'all land outside the subsidence area' is not relevant. [3] EIS predictions are summarised in the Subsidence Predictions and Impact Assessment Report by MSEC (2022), and the relevant predictions for steep slopes is provided in Section 4.2 of the Land Management Plan. [4] All road embankments and road cutting identified in Figure 3 of the Land Management Plan will be managed in accordance with the Wollondilly Shire Council Management Plan. All railway embankments within the Study Area will be managed in accordance with the Main Southern Railway Management Plan. All steep slopes on the Tahmoor Mine Site will be managed in accordance with the Tahmoor Mine Site Management Plan. [5] TARPs for the management of constructed steep slopes will be provided as part of the Wollondilly Shire Council Management Plan (road embankments and cuttings), Main Southern Railway Management Plan (rail embankments) and the Tahmoor Mine Site Management Plan (mine site slopes). These yet to be prepared TARPs will be included in Appendix B Master TARP following preparation and approval by the infrastructure owner. [6] For the purpose of this TARP, persistent cracking is a tension crack/s that combine to form a potential backscarp or failure plane for slope instability. The length is proportional to the size of the failure surface.				

LAND MANAGEMENT PLAN TARP – LMP3 FARM DAMS

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**
Performance Measure Feature Other privately-owned built features and improvements, including… farm dams. **Performance Measure** • Always safe. • Serviceability should be maintained wherever practicable. • Loss of serviceability must be fully compensated. • Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant. **Performance Indicator** This performance measure will be considered to be triggered if mining results in damage to a farm dam such that the dam is not safe and serviceable and/or any damages cannot be fully repairable and/or compensated. **TARP Objective** This TARP defines measures to manage potential impacts on farm dams and the actions required to be implemented in response to exceedance of defined trigger levels. **Assessment Criteria** Dam embankment integrity, water level and seepage observations.	**Locations** Identified farm dams within the Study Area. Locations shown in Figure 8 of the Land Management Plan. **Monitoring Frequency** **Pre-mining** Dam embankment integrity and water level observation by a geotechnical consultant one month before active subsidence period using fixed location photo points. **During Mining** Dam embankment integrity and water level observation every week during the active subsidence period by Tahmoor Coal, and every month during the active subsidence period by a geotechnical consultant, using fixed location photo points. **Post-mining** Dam embankment integrity and water level observation using fixed location photo points on a quarterly basis for 12 months following completion of active subsidence by a geotechnical consultant, or as required in accordance with a Rehabilitation Management Plan.	**Normal Range of Condition**		
		• No cracks develop within dam embankment (e.g. other than natural desiccation cracking).	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Development of isolated cracks (> 10 mm wide) within the dam wall (e.g. other than natural desiccation cracking). AND/OR • Development of isolated seepage without suspended solids (e.g. clear water) from the face or toe of the farm dam embankment.	• *Actions as required for Normal Condition.* • Geotechnical consultant inspection to assess cause and determine need for further action/investigation. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results). If it is concluded that dam has been damaged by subsidence impacts: • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. backfilling surface cracking, reinstatement). • Notify and consult with affected landowner. • Erect warning signs and restrict access to areas where necessary and permitted by the landowner.	• Report trigger exceedance to DPE, SA NSW and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE, SA NSW and landowner with proposed corrective management actions (CMAs) for consultation (e.g. backfilling surface cracking, reinstatement). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Development of persistent longitudinal or arcuate cracking within dam wall > 20 mm. AND • Development of seepage with suspended solids (e.g. turbid water) from the face or toe of the farm dam embankment.	• *Actions as stated in Level 1.* • Consider increasing monitoring and review of data frequency at sites where Level 2 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequence of potential dam break, and monitoring results relevant to the dam locations. • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options. • Review Land Management Plan and modify if necessary. • Geotechnical Consultant to advise on the need for a reduction in the dam water level (e.g. half dam volume) to reduce the risk of a dam break failure.	• *Responses as stated in Level 1.* • Advise DPE, SA NSW and key stakeholders of any required amendments to Land Management Plan. • Provide findings of CMA review to DPE, SA NSW and landowner for consultation. • Implement additional CMAs, subject to land access.
		Level 3		
		• Development of persistent longitudinal or arcuate cracking within dam wall > 20 mm. AND • Subsidence monitoring identifies subsidence-induced impacts or environmental consequences that result in any slope instability to the farm dam embankment.	• *Actions as stated in Level 2.* • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, or the effect is unrelated to mining such as environmental effects). If it is concluded that the dam has been damaged by subsidence impacts: • Increase frequency of monitoring by geotechnical consultant during active subsidence period at sites where Level 3 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequence of potential dam break, and monitoring results relevant to the dam locations. • Reduction of dam water level in accordance with advice from Geotechnical Consultant. • Review predictions of mine subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation. • Assess potential for the safety and serviceability of the dam to be lost (and if an exceedance of the performance measure is possible).	• *Responses as stated in Level 2.* If it is concluded that the dam has been damaged by subsidence impacts: • Offer site visit with DPE and key stakeholders. • Repair or replace farm dam in consultation with DPE and SA NSW and landowner. • Provide alternate water supply for landowner, if required. • Notify DAWE of any predictions of an exceedance of a performance measure (if relevant) within two business days.

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**
		Exceeds Performance Measure		
		• Mining results in damage to a farm dam such that the dam is not safe and serviceable and/or any damages cannot be fully repairable and/or compensated.	• *Actions as stated in Level 3.* • Investigate reasons for the performance measure exceedance. • Review predictions of mine subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation.	• *Responses as stated in Level 3.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed with DPE) describing temporary protection measures and long-term remediation options and any preferred remediation measures or other course of action. • Implement reasonable remediation measures as directed by DPE, subject to land access. • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project).

LAND MANAGEMENT PLAN TARP – LMP4 AGRICULTURAL LAND

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="6"><u>Performance Measure Feature</u>
No performance measures relevant.

<u>TARP Objective</u>
This TARP defines measures to manage potential impacts on agricultural land and the actions required to be implemented in response to exceedance of defined trigger levels.

<u>Assessment Criteria</u>
Changes to agricultural land such as to impact the use of the land for agricultural productivity[1].</td><td rowspan="6"><u>Locations</u>
Identify agricultural land uses within the Study Area (refer to Figure 8 in the Land Management Plan).

<u>Monitoring Frequency</u>
Pre-mining
Visual inspection prior to the commencement of mining from fixed photo points.

During Mining
Weekly inspections along local roads and farm dams.

Post-mining
Visual inspection at the completion of each longwall for land within the predicted limit of subsidence for each longwall.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• Negligible impact to agricultural productivity or use of land, negligible effects from mining-induced changes in slope (tilt) on ponding / flooding (reversal of natural slope), or increase in soil / tunnel erosion (increase in slope).</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Minor impact to agricultural land from subsidence resulting in increased flooding or ponding within predicted impacts.
AND/OR
• Minor impact to drainage systems due to increased ponding / flooding or increased soil / tunnel erosion that can be remediated.
AND/OR
• Surface cracking affecting safety of livestock.</td><td>• Actions as required for Normal Condition.
• Undertake an investigation to assess cause and determine if mining related.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water monitoring results).
• Consider and decide on reasonable and feasible options for remediation as relevant (e.g. adjustment of farm gate levels, fence tensioning, backfilling of surface cracking).
• Consider increasing monitoring and review of data frequency at sites where Level 1 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of further impacts on agricultural land use and monitoring results relevant to the agricultural land.</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
• Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. adjustment of farm gate, fence tensioning, backfilling of surface cracking).
• Implement CMAs, subject to land access.
• Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Significant impact and change to agricultural land functionality or agricultural productivity greater than predicted (e.g. excessive subsidence and mining-induced changes in slope (tilt), resulting in substantial ponding / flooding (reversal in natural slope), excessive soil / tunnel erosion (increase in slope), or excessive surface cracking affecting safety of livestock that require livestock to be relocated from a property in order to rehabilitate the land.</td><td>• Actions as stated in Level 1.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, or the effect is unrelated to mining such as environmental effects).
If it is concluded that agricultural land has been damaged by subsidence impacts:
• Increase frequency of monitoring during active subsidence period at sites where Level 2 has been reached, subject to land access. Considerations will take into account position of LW face relative to impact site, rate of longwall retreat, current weather conditions, development of conventional subsidence above longwall, consequences of further impacts on agricultural land use and monitoring results relevant to the agricultural land.
• Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.
• Review Land Management Plan and modify if necessary.</td><td>• Responses as stated in Level 1.
If it is concluded that the agricultural land has been damaged by subsidence impacts:
• Offer site visit with DPE and key stakeholders.
• Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders if relevant.
• Provide findings of CMA review to DPE and key stakeholders for consultation.
• Implement additional CMAs, subject to land access.
• Advise DPE and key stakeholders of any required amendments to Land Management Plan.</td></tr>
<tr><td colspan="5">Notes:
[1] It is noted that the management of rural structures used for agricultural and farming purposes located in the Study Area are discussed in the Built Features Management Plan (e.g. poultry sheds, greenhouses, greenhouses, hothouses, irrigation systems, and tanks), the Water Management Plan (e.g. watercourses and groundwater bores), and the separate TARP for farm dams as part of this Land Management Plan.</td></tr>
</table>

APPENDIX B – Geotechnical Assessment (Douglas Partners, 2022a)

APPENDIX C – Land and Agricultural Resource Assessment (SLR, 2022)

TAHMOOR EXTRACTION PLAN LW S1A-S6A

Land and Agricultural Resource Assessment

Prepared for:

Tahmoor Coal
2975 Remembrance Drive
Bargo NSW 2573 Australia

SLR Ref: 630.12732.002
Version No: -v0.1
April 2022

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Tahmoor Coal (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12732.002	April 2022	Murray Fraser	Rod Masters	Rod Masters

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APPENDICES

1 Introduction

Tahmoor Coal Pty Ltd, (Tahmoor Coal), owns and operates Tahmoor Mine, an existing underground coal mine that is located approximately 80 km south-west of Sydney in the Southern Coalfield of New South Wales (NSW). Tahmoor Mine surface facilities are situated between the towns of Tahmoor and Bargo within the Wollondilly Local Government Area (LGA). The mine has previously extracted longwalls to the north and west of the surface facilities and has been operating continuously since 1979 when coal was first mined using bord and pillar mining methods, followed by longwall mining methods since 1987.

Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Extracted coal is processed on site at the coal handling and preparation plant (CHPP) and coal clearance facilities prior to transportation via rail to Port Kembla and Newcastle for Australian domestic and export customers.

An Environmental Impact Statement (EIS) was exhibited in early 2019 to gain approval for the Tahmoor South Coal Project, which involves use of the existing surface infrastructure and the expansion of underground longwall mining to the south of the existing workings (referred to as the Tahmoor South Domain). Tahmoor Coal subsequently revised the proposed mine design and submitted amended development applications on two occasions (in February and August 2020). In April 2021, Tahmoor Coal received Development Application Approval (SSD 8445) for the extraction of up to 4 Mtpa of ROM coal, with a total of up to around 33 Mt of ROM coal proposed to be extracted over a 10-year period.

The Tahmoor South Domain is located south of the Bargo River and east of Remembrance Driveway and the township of Bargo. Longwall mining would be used to extract coal from the Bulli coal seam within the bounds of Consolidated Coal Lease (CCL) 716 and CCL 747. Twelve longwalls are proposed in this domain which are divided into a series of six northern (A series) and six southern (B series) longwalls. The A series, Longwalls South 1A to South 6A (LW S1A-S6A), are the focus of the current Extraction Plan application.

The locations of LW S1A-S6A, along with the Study Area and regional locality, are shown in **Figure 1**. The Study Area for this assessment comprises the total combined area of the predicted limit of vertical subsidence, taken as the 20 millimetre subsidence contour (resulting from the extraction of LW S1A-S6A), and the 35 degree angle of draw.

The proposed mine layout for LW S1A-S6A lies within the approved Extent of Longwalls. Minor changes have been made to the mine layout since development consent was received (EIS Layout), as foreshadowed by Tahmoor Coal when it applied for development consent. These changes are all within the predicted extent of the longwall boundaries and are detailed in the Extraction Plan Main Document and the Land Management Plan.

1.1 Assessment Objective

The objective of this Land and Agricultural Resource Assessment is to outline the monitoring and management measures to be implemented to manage these potential subsidence related impacts on agricultural resources, specifically from the extraction of LW S1A-S6A.

This assessment will form part of an Extraction Plan being prepared by Tahmoor Coal for LW S1A-S6A for submission to the NSW Department of Planning and Environment (DPE), formerly the Department of Planning, Industry and Environment (DPIE).

1.1.1 Consultation with Department of Primary Industries

Tahmoor Coal received correspondence from DPI on the 3rd February 2022 which noted:

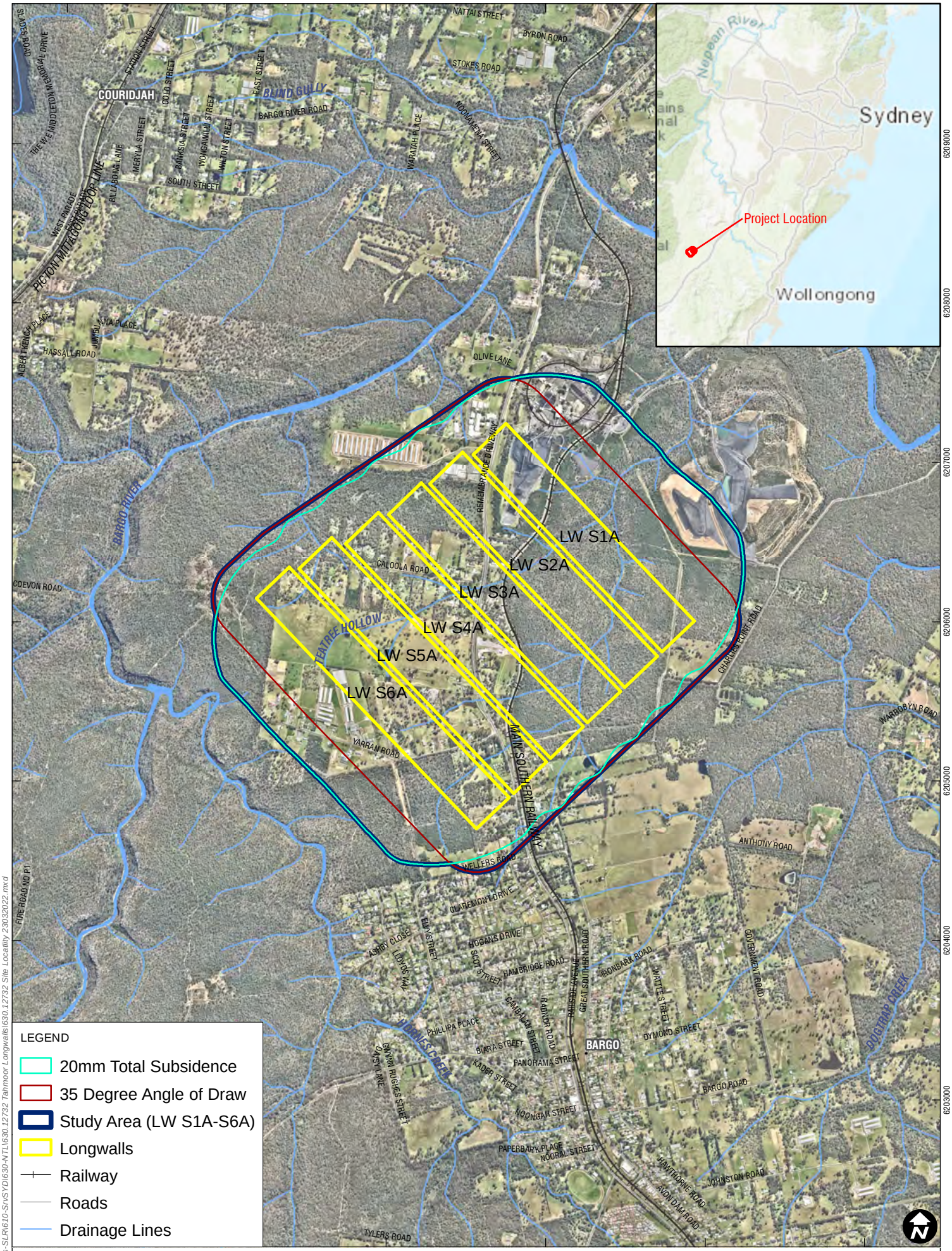
"DPI understands that the company is seeking advice with respect to matters it should consider in the development of the extraction plan. While the DPI does not have any regulatory involvement in this project, we have undertaken a brief review of the agricultural industries in the area and recommend that the company consider the following comments related to agricultural landuses when developing the plan", shown below in **Table 1**:

Table 1 DPI General Comment Register

DPI General Comments	Tahmoor Coal Response	Specific Section Where Addressed
A full assessment of the agricultural landuses in the area that may be potentially impacted so any agricultural developments and associated enterprises in the area are considered in terms of identified risks and economic disruption particularly with subsidence.	An Agricultural Impact Statement was prepared for the first Amendment Report for SSD 8445 approval. For this Extraction Plan, this document has been prepared to complement the information from the Agricultural Impact Statement, and provide any updates on agricultural impacts from the proposed longwalls.	2.8 & 4
Consult with the owners/ managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about; the proposal, the likely impacts and suitable mitigation measures or compensation	Consultation with owners of agricultural businesses in the Study Area has commenced. Tahmoor Coal will continue to consult with the owners during the preparation of the management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans. Further information on management plans to be prepared for infrastructure and structures is provided in the Extraction Plan Main Document. In addition, all landowners in the Study Area have been informed by an information packaged delivered by mail of the proposed development and the subsidence impact claims process in the event that their property is damaged by mining.	6
Consider possible cumulative effects to agricultural enterprises and landholders from subsidence/ other impacting events.	Given the described impacts are of a minor nature and readily managed through application of appropriate mitigation measures and management strategies, any resulting cumulative impacts on agricultural resources and enterprises are also expected to be minor and readily mitigated.	4.4.18

DPI General Comments	Tahmoor Coal Response	Specific Section Where Addressed
An assessment of the monitoring regime that will identify any changes as a result of the effects of the long wall mining, especially subsidence, this may include impacts of farm infrastructure i.e. buildings, fences, slope changes, water supply infrastructure. (This may overlap with the other documents noted in your letter).	Tahmoor Coal will consult with the agricultural business owners during the preparation of management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans.	6
DPI Poultry Comment		
In relation to the poultry enterprises that exist in the area, that these owner/ managers as well as the processors/owners of the birds be consulted to ensure that production plans can be adjusted if required. This should have at least for 12 month periods of mining activity.	Tahmoor Coal will consult with the agricultural business owners during the preparation of management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties in accordance with these management plans.	6
DPI Horticulture Comments		
For protected cropping enterprises (glasshouses) located in the impacted area, the slope of the glasshouses is critical for efficient irrigation so subsidence may be a potential issue. This may also be an issue for other open horticultural enterprises e.g. olives if they are irrigated with a dripper system.	Tahmoor Coal will consult with the agricultural business owners during the preparation of management plans for each individual agricultural business, and will monitor and manage potential impacts to the properties (including hothouses and greenhouses) in accordance with these management plans.	4.4.16
Dust can also be an issue for greenhouse/glasshouse light transmission so this needs to be addressed if dust levels are an issue above ground.	The extraction of LW S1A-S6A involves the extraction of six underground longwall panels and as such there will be no impact to air quality resulting from this extraction activity. All other activities associated with the Tahmoor South Project that have the potential to create dust will be undertaken in accordance with the approved Air and Greenhouse Gas Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.	4.4.4
With water quality any increase in the total dissolved salts (TDS) or an increase in sodium level will be a limitation to any horticultural system relying on hydroponics or fertigation.	There is no predicted increase in total dissolved salts or sodium in groundwater bores associated with LW S1A-S6A.	4.2.4

Addressing these comments from DPI on consultation, potential impacts and mitigation measures also forms part of this Land and Agricultural Resource Assessment.



Scale: 1:30,000 at A4
Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 20-Apr-2022
Project Number: 630.12732

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Site Locality

FIGURE 1

2 Agricultural and Water Resources

2.1 Climate

Representative climate data for the Study Area has been obtained from the nearest Bureau of Meteorology (BOM) weather station located at Picton, approximately one kilometre to the north-west of the Study Area (Picton Council Depot, BOM Station 068052, Monthly Climate Statistics).

Picton BOM Station has recorded an average annual rainfall of 801 millimetres, of which approximately 475 millimetres (60%) falls between November and April, with an average of 70.8 rain days in any given year (**Table 2**). Mean monthly maximum temperatures range between 29.3°C and 16.8°C, with January being the warmest month. Mean monthly minimum temperatures range between 15.4°C and 1.7°C, with July being the coldest month.

Table 2 Picton Climate Data

Temperature	Average (Mean)	Annual Range
Minimum temperature	8.8°C	1.7°C – 15.4°C
Maximum temperature	23.5°C	16.8°C – 29.3°C
Rainfall	**Average (Mean)**	**Average Rain Days**
Annual Rainfall	800.9 mm	70.8
Wettest month	February 91.0 mm	6.8
Driest month	September 43.5 mm	5.1

Source: *Bureau of Meteorology (2020)*

The BOM classifies this as a temperate climate zone. The area can be susceptible to occasional heavy showers and thunderstorms due to easterly troughs during warmer months. Summer winds are generally from the south or south-east, with a tendency for afternoon north-easterly winds. During winter, winds are predominantly from the south or south-west.

2.2 Topography

Topography in the region (Wollondilly LGA) is varied, ranging from gently undulating plateaus, ridges and low hills in the upland areas, to a rugged landscape of deeply dissected valleys and gorges within the Hawkesbury Sandstone.

Topography within the Subsidence Study is generally undulating with a fall from the south-west to the north-east (**Figure 2**). The major topographical feature within the Study Area is Teatree Hollow. The major topographical feature nearby the Study Area is the Bargo River valley, which is located to the north.

Elevation near the Study Area varies from a low point of approximately 265 metres AHD, in the base of Teatree Hollow, downstream from of the proposed LW S1A, to a high point of approximately 345 metres AHD, at the south-western end of the Study Area to the south-west of the proposed LW S6A.

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Topography and Hydrology

FIGURE 2

2.3 Hydrology

2.3.1 Surface Water

The Study Area is located in the catchment of the Hawkesbury-Nepean River, within the sub-catchment of the Nepean River (**Table 2**). The Nepean River rises in the Great Dividing Range to the west of the Study Area. Flows in the upper reaches of the Nepean River are highly regulated by the Upper Nepean Water Supply Scheme, operated by the Water NSW, incorporating four major water supply dams on the Cataract, Cordeaux, Avon and Nepean Rivers. There are no catchment areas or declared special areas within the Study Area. The nearest catchment area is the Metropolitan Special Area, which is located approximately 4.5 kilometres southeast of the proposed longwalls.

There are two dominant drainage channels associated with the Study Area, Teatree Hollow and Wirrimbirra Creek, which is a tributary to Teatree Hollow (**Table 3**). The streams have flow controlling features along their alignments that include rockbars, riffles, knick points and debris accumulations (MSEC, 2022).

In addition to these drainage channels there are a number of intermitted watercourses and numerous small farm dams. All drainage channels within the Study Area are considered low flow or intermittent channels suggesting that the number of users dependent on flows from these watercourses is limited.

Table 3 Streams within the Study Area

Location	Stream Order	Description
Teatree Hollow	3rd Order	Located directly above the proposed LW S1A-S6A, with a total length of 2.1 kilometres directly mined beneath.
Wirrimbirra Creek	3rd Order	Located directly above the proposed LW S1A-S4A, with a total length of 1.3 kilometres directly mined beneath

2.3.2 Licenced Surface Water Users

The Study Area is located within the Maldon Weir Management Zone of the Upper Nepean and Upstream Warragamba Water Source which is regulated in accordance with the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011. The NSW Water Register indicates there is one WAL is associated with a property located within the Study Area and one WAL is associated with a property located adjacent to the Bargo River downstream of the Study Area (Tahmoor Coal, 2022).

2.3.3 Groundwater

The Study Area is located within the Sydney Basin porous rock groundwater system (Nepean Groundwater Source, Management Zone 2) which is classed as highly productive. The recognised aquifers/water bearing zones within the area are the:

- Alluvium/sediment aquifers;
- Hawkesbury Sandstone aquifers;
- Narrabeen Group sandstone aquifers; and
- Illawarra Coal Measures water bearing seams.

Alluvium/Sediment Aquifers

Alluvial sediments within the plateau gullies and river bed are too shallow to be used as aquifers for groundwater supply (Geoterra, 2013).

Hawkesbury Sandstone

The Hawkesbury Sandstone aquifers are the principal groundwater source used within the region due to their significantly higher yields and quality in comparison to other water bearing strata. Due to the lack of fracturing and fault lines within the Hawkesbury Sandstone, the associated aquifers are generally primary permeability aquifers. As a result, yields and quality are highest in recharge areas south of the Nepean River. Groundwater monitored in the Hawkesbury Sandstone piezometers within the Study Area is considered low to brackish salinity (less than 6,895 µS/cm) with acid to circum-neutral pH (3.52 to 7.72). Recorded bore yields in the Hawkesbury Sandstone in the Study Area ranged from 0.22 litres per second to 4.5 litres per second (Geoterra, 2013).

Narrabeen Group and Associated Aquitards

The Narrabeen Group is the other major aquifer within the region, however, the quality and yield is significantly lower than the Hawkesbury Sandstone. The major aquifers are separated by aquitards associated with the Bald Hill Claystone, Stanwell Park Claystone and the Wombarra Claystone. These aquitards are exhibit low permeability and limit vertical groundwater flow between the aquifers (Geoterra, 2013).

Illawarra Coal Measures

The Illawarra Coal Measures exhibit low permeability due to their depth and fine-grained associated rock. Water quality within the water bearing coal seams is considered brackish to moderately saline (Geoterra, 2013).

2.3.4 Licenced Groundwater Users

The Study Area is covered by the Greater Metropolitan Groundwater Sources Water Sharing Plan. Five Department of Industry (Water) registered bores are located within the Study Area, with a further three bores located within the vicinity of the Study Area (**Table 4**). The majority of bores are registered for stock and/or domestic use. Groundwater for these bores is sourced from the Hawkesbury Sandstone Aquifer (SLR, 2022).

Table 4 Registered Groundwater Users

Identifier	Depth (m)	Purpose	Current Use	In Study Area
GW105883	Unknown	Domestic	Water feature & garden irrigation	Outside
GW104323	109	Stock & Domestic	On timer for crop irrigation	Yes
GW032443	130.1	Irrigation	Not currently used	Yes
GW109257	120	Stock & Domestic	Not used, previously used to fill dam	Yes
GW014262	48.8	Stock	Unknown	Yes
GW104659	132	Irrigation	Replenish adjacent dam by timer	Yes
GW111810	142	Stock & Domestic	Used for irrigation via holding tanks	Outside
GW105847	Unknown	Stock & Domestic	Unknown	Outside

2.4 Geology

The Study Area is located within the southern area of the Permo-Triassic Sydney Basin. The main coal bearing sequence is the Illawarra Coal Measures, which contains four workable seams. The upper most seam, located in the north-western part of the Illawarra Coalfield, is the Bulli Seam. Overlying the Bulli Seam is the Hawkesbury Tectonic Stage which is comprised of three stratigraphic units, namely the Narrabeen Group, Hawkesbury Sandstone Group and the Wianamatta Group. The Narrabeen Group overlies the Illawarra Coal Measures and is comprised of interbedded sandstones and claystone units up to 310 metres thick. Overlying the Narrabeen Group is the Hawkesbury Sandstone which is comprised of a series of bedded sandstones up to 185 metres thick. The Wianamatta Group overlies the Hawkesbury Sandstone, and is comprised of shales and siltstones and is relatively thin in comparison.

Another major geological feature is the Bald Hill Claystone which lies at the base of the Hawkesbury Sandstone. The Bald Hill Claystone varies in width to over 25 metres, which tends to act as an aquitard.

2.5 Soil Landscape Units

Soil Landscapes Units (SLU) within the Study Area have been mapped by the former NSW Department of Land and Water Conservation, incorporating the NSW Soil Conservation Service (now part of NSW Department of Primary Industries (DPI)), on the *Wollongong – Port Hacking 1:100,000 Sheet* (Hazelton & Tille, 1990) as shown in **Figure 3**. four soil landscapes occur in the Study Area and are summarised in **Table 5.**

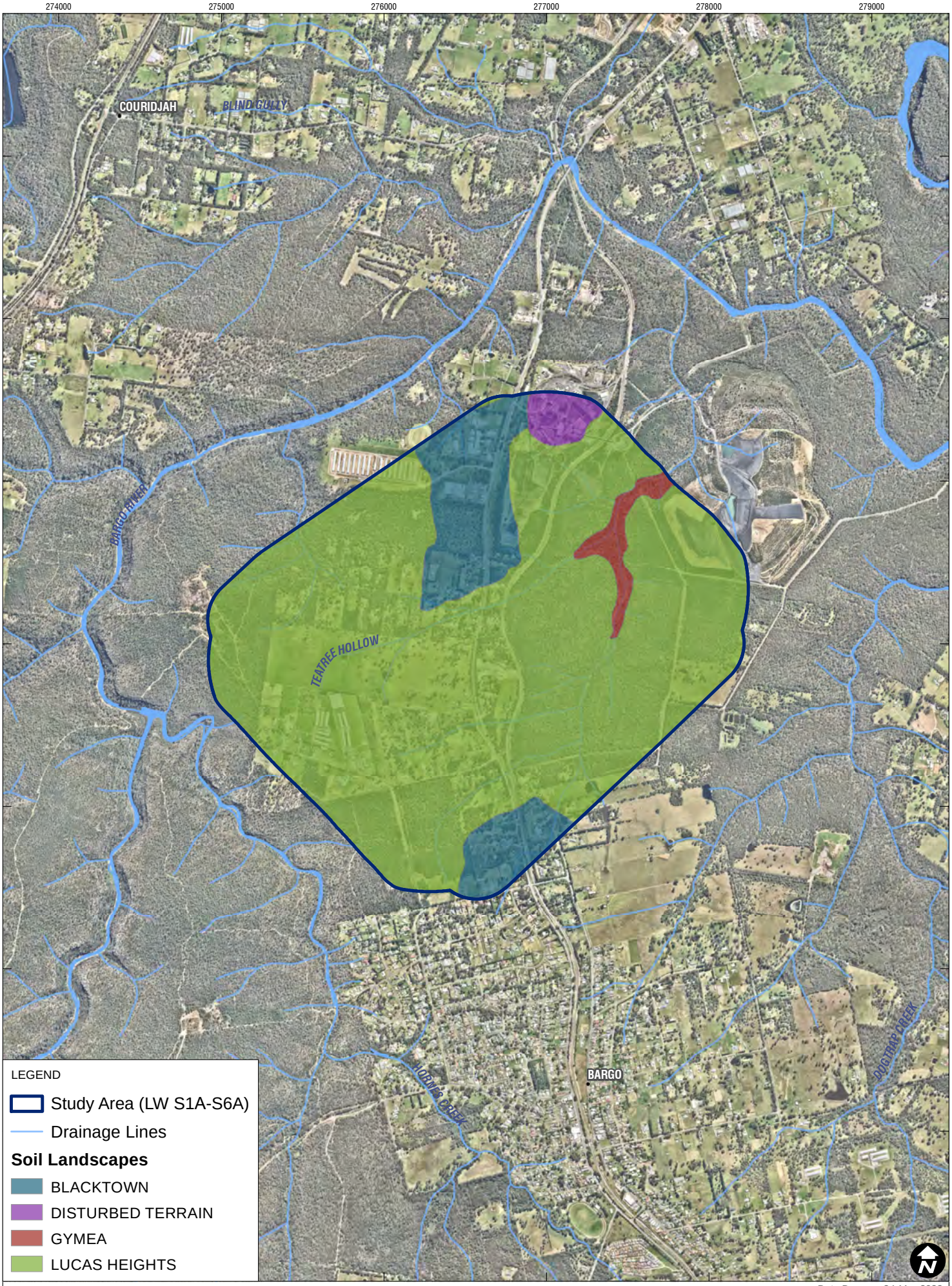
Below is a summary of the key agricultural features of each SLU:

- The majority of the Study Area (88%) is highly constrained for cultivation.
- The Gymea and Disturbed Terrain SLU are highly to severely constrained for any agricultural enterprises, which covers 4% of the Study Area.
- Agricultural land best suited to grazing enterprises is the Blacktown, SLU which covers 12% of the Study Area.
- Lucas Heights SLU has moderate limitations for grazing and high limitations for cultivation and covers the majority (84%) of the Study Area.

Table 5 Soil Landscape Units

Soil Landscape	Study Area		Agricultural Limitation Rating	
Unit	Hectares	%	Grazing	Cultivation
Gymea	14	2	High – Severe	High – Severe
Disturbed Terrain	12	2		
Sub Total	**26**	**4**		
Lucas Heights	572	84	Moderate	High
Blacktown	85	12	Low	Moderate
Total	**682**	**100**		

Source: *Soil Landscapes of the Wollongong – Port Hacking 1:100,000 Sheet* (Hazelton & Tille, 1990)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BLIND GULLY
BARGO RIVER
TEATREE HOLLOW
BARGO
HORNERS CREEK
DOGTRAP CREEK
LEGEND
Study Area (LW S1A-S6A)
Drainage Lines
Soil Landscapes
BLACKTOWN
DISTURBED TERRAIN
GYMEA
LUCAS HEIGHTS
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Date Drawn: 24-Mar-2022
Project Number: 630.12732
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SLR
Soil Landscape Units
FIGURE 3

2.6 Dominant Soil Types and Inherent Fertility

The two dominant Australia Soil Classification (ASC) soil types were digitally mapped by the Office of Environment & Heritage (now NSW Heritage) and are shown on **Figure 4**. Three soil types are present in the Study Area, dominated by Kurosols with some smaller areas of Dermosols and Rudosols & Tenosols (**Table 6**). These soil types are summarised in the major points listed below:

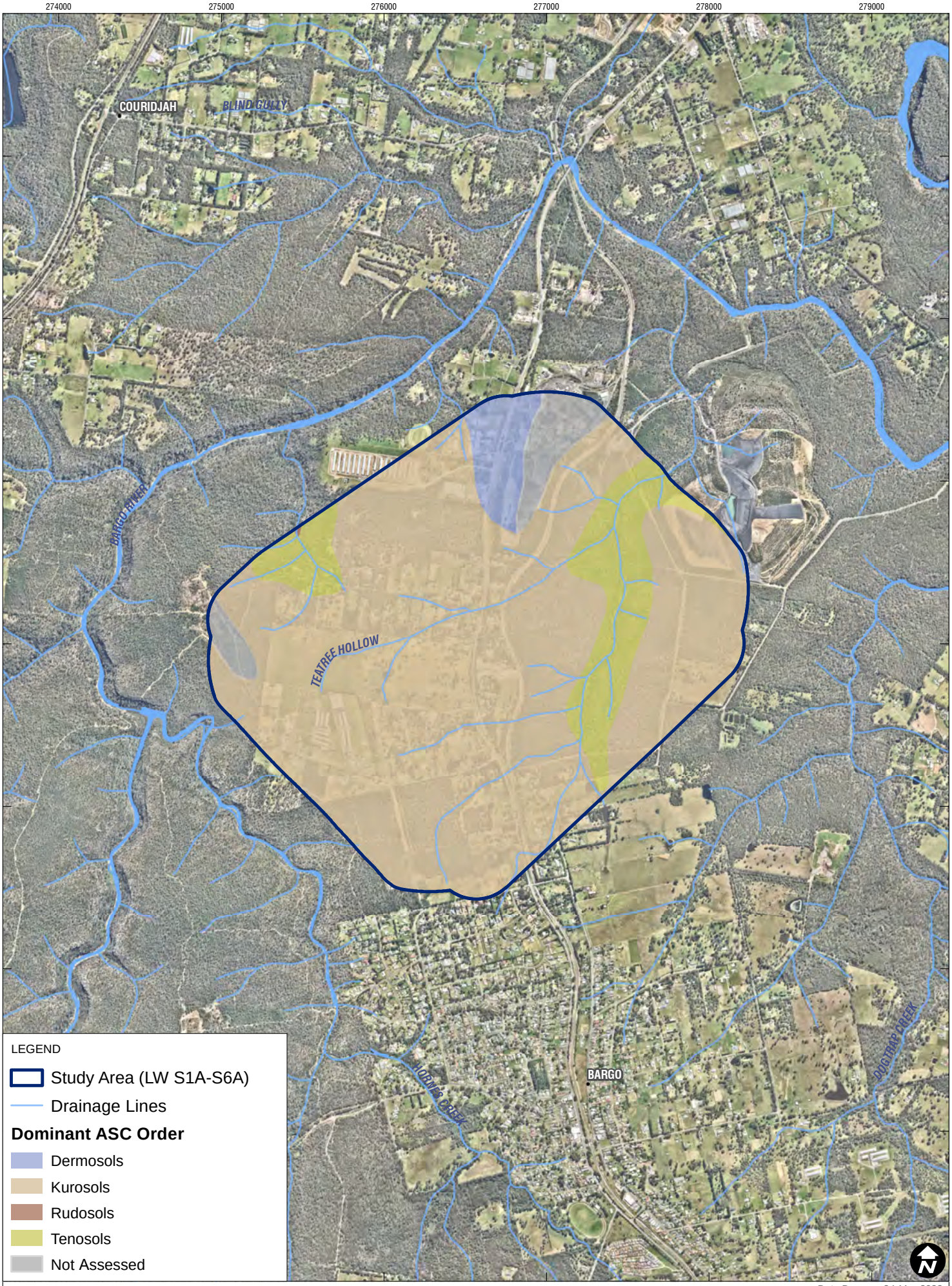
- Kurosols are the main soil type within the Study Area. Kurosols are soils with a strong texture contrast between the A horizons and strongly acidic B horizons and often have unusual subsoil chemical attributes such as high magnesium, sodium and aluminium. Kurosols generally have moderately low inherent fertility and comprise 80% of the Study Area.
- Tenosols are a minor soil type within the Study Area comprising 12% of the total area. Tenosols are soils with weak pedologic organisation apart from the A horizons. Tenosols comprise three major soil horizons and the profile is characterised by a sandy to sandy loam texture throughout, generally with moderately low inherent fertility.
- Rudosols comprise <1% of the Study Area and are soils with negligible pedologic organisation, often characterised by a very sandy texture. They are generally young soils which have not had time form structurally with low inherent fertility.
- Dermosols are the remaining soil type within the Study Area comprising 4% of the total area. Dermosols are soils with structured B horizons which lack strong texture contrast between the A and B horizons. Dermosols generally have moderately high inherent fertility and high agricultural potential with good structure and water-holding capacity.
- Areas of mine disturbance are not allocated an ASC soil type and comprise 4% of the Study Area.

Table 6 Dominant Soil Types and Inherent Fertility

Australian Soil Classification	Inherent Fertility	Hectares	%
Kurosol	Moderately Low	547	80
Tenosol	Moderately Low	82	12
Dermosol	Moderately High	25	4
Rudosol	Low	<1	<1
Not Assessed (Mine Disturbance)	N/A	28	4
	Total	**682**	**100**

2.7 Acid Sulfate Soils

The likelihood of acid sulfate soils occurring within the Study Area is very low due to its position away from the coast and potential acid sulfate landform type. Furthermore, none of the Soil Landscape Units mapped within the Study Area have acid sulfate soil potential.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COURIDJAH
BLIND GULLY
BARGO RIVER
TEATREE HOLLOW
HORNETS CREEK
BARGO
DOGTRAP CREEK
LEGEND
Study Area (LW S1A-S6A)
Drainage Lines
Dominant ASC Order
Dermosols
Kurosols
Rudosols
Tenosols
Not Assessed
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Date Drawn: 24-Mar-2022
Project Number: 630.12732
ASC Soil Type
FIGURE 4
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2.8 Vegetation and Land Use

Review of recent aerial images shows only a minor portion of the Study Area comprises of cleared pastoral land (approximately 27%) that may be suitable for agricultural enterprises, as shown in **Figure 5**. The remainder comprises thick native vegetation along riparian zones and steep slopes, along with mine disturbance areas and small holdings used as rural residential land.

Site inspections in June 2013 and December 2017 by SLR's Principal Agronomist showed several differing agricultural land uses within and adjacent to the Study Area, with poultry production being the main agricultural enterprise. The various land uses at each site were recorded and are shown on **Figure 5** and described in **Table 7**. Plates for each inspection site are shown in **Appendix A**.

Changes in observed land use between the 2013 and 2017 site inspections are highlighted in red. The changes in land use over the four years indicate a shift away from agriculture and an increase toward rural residential areas. No intensive cropping activities were observed at the time of the inspection and assessment.

Table 7 Observed Land Uses

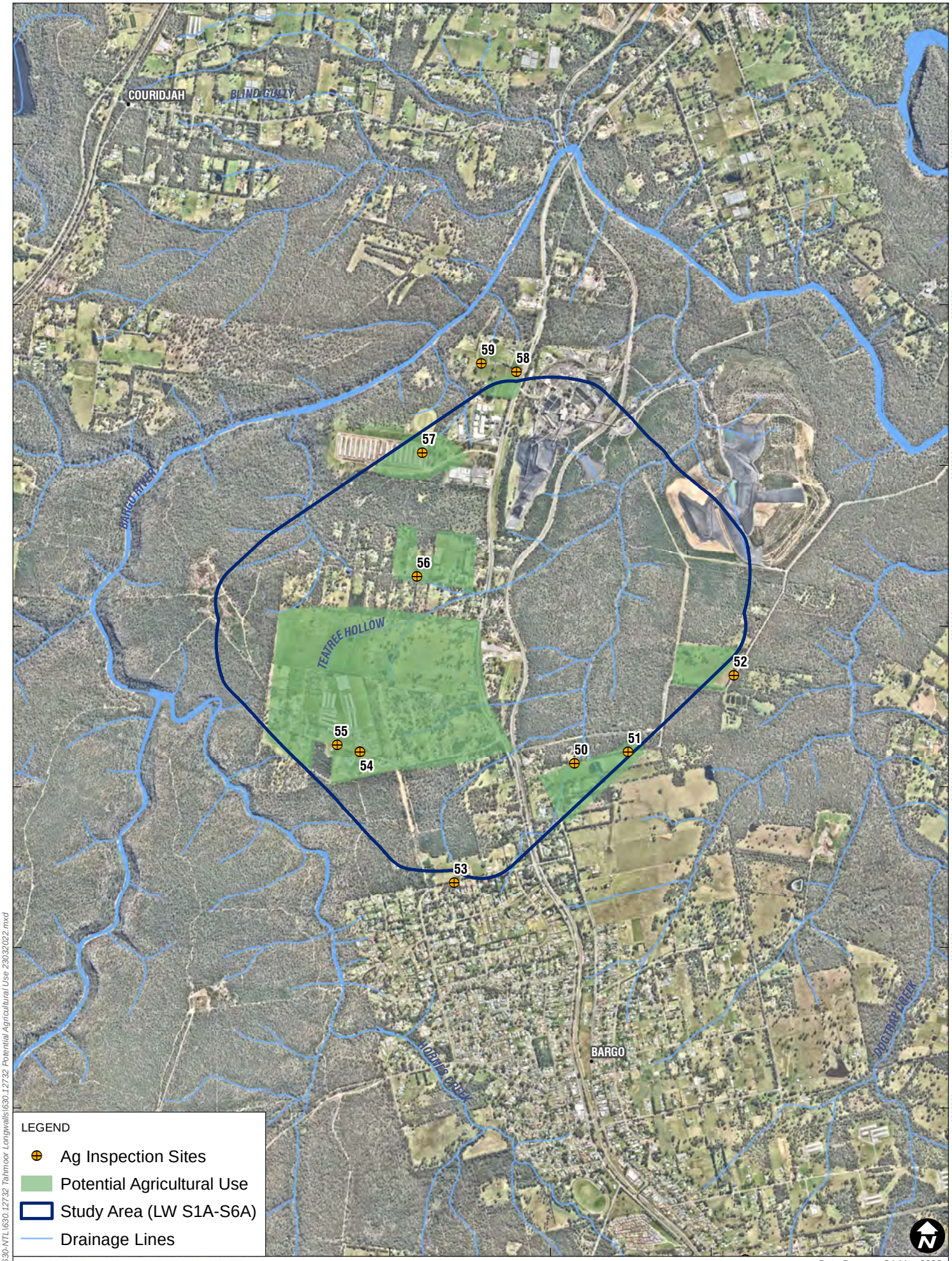
Inspection Site	Land Use
49	Pleasure horses
50	Cattle grazing
51	Cattle feedlot 2013, disused cattle feedlot 2017
52	Pleasure horses
53	Rural residential
54	Hydroponic lettuce and poultry sheds
55	Poultry sheds
56	Cut flower greenhouse 2013, disused cut flower greenhouses 2017
57	Poultry sheds
58	Olives & sheep grazing
59	Irrigated olives & alpaca stud

Grazing is the major agricultural land use within the Study Area (by area) appears to be commonly used as a grass and vegetation management tool rather than an income generating agricultural enterprise. Overall farm size is considered small and many would be classified as hobby farms with a very low potential to produce significant agricultural income. Approximately 182 hectares of potential grazing land is currently available for agricultural use. As previously described in correspondence received from DPI, poultry farms are a significant industry in the area, with three located within and adjacent to the Study Area (**Figure 5**). **Plate 1** and **Plate 2** show two of the intensive agricultural land uses within the area.

Native vegetation, present predominantly in riparian zones within the Study Area, was mapped during the Native Vegetation of Southeast NSW mapping project (Tozer et al., 2006). It includes the Cumberland Shale Sandstone Transition Forest which is listed as an Endangered Ecological community (EEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act), and a small area of Cumberland River Flat Forest which is listed as an EEC on the BC Act.

Plate 1 Poultry sheds at Site 55

Plate 2 Hydroponic Lettuce at Site 54



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SLR

Potential Agricultural Use

FIGURE 5

2.9 Land and Soil Capability Classification

2.9.1 Land and Soil Capability Methodology

The Land and Soil Capability (LSC) classification applied to the Study Area was in accordance with the OEH guideline *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2013). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 8** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards.
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

Table 8 Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

2.9.2 Determining LSC Classes

The LSC for the Study Area has been digitally mapped by the OEH and is summarised in **Table 9** and shown in **Figure 6**. The limitations associated with each LSC Class are discussed below.

Table 9 Land and Soil Capability Areas

LSC Class	Agricultural Capability Rating	Hectares	%
4	Moderate	572	84
6	Low	82	12
7	Very Low	<1	<1
Mine Disturbed	Nil	28	4
	Total	**682**	**100**

LSC Class 4 Land

Class 4 land is associated with Dermosols and Kurosols. This classification indicates a moderate land capability, with moderate to serve limitations for some land uses that need to be consciously managed to prevent soil and land degradation. This land is capable of pasture improvement and can be tilled for an occasional crop. LSC Class 4 land comprises the majority (84%) of the Study Area.

LSC Class 6 Land

Class 6 land is associated with Kurosols. The classification indicates low land capability, with very high limitations for high impact land management uses such as cropping. The land is generally more suitable to low impact land uses such as grazing with limitations. LSC Class 6 land comprises 12% of the Study Area.

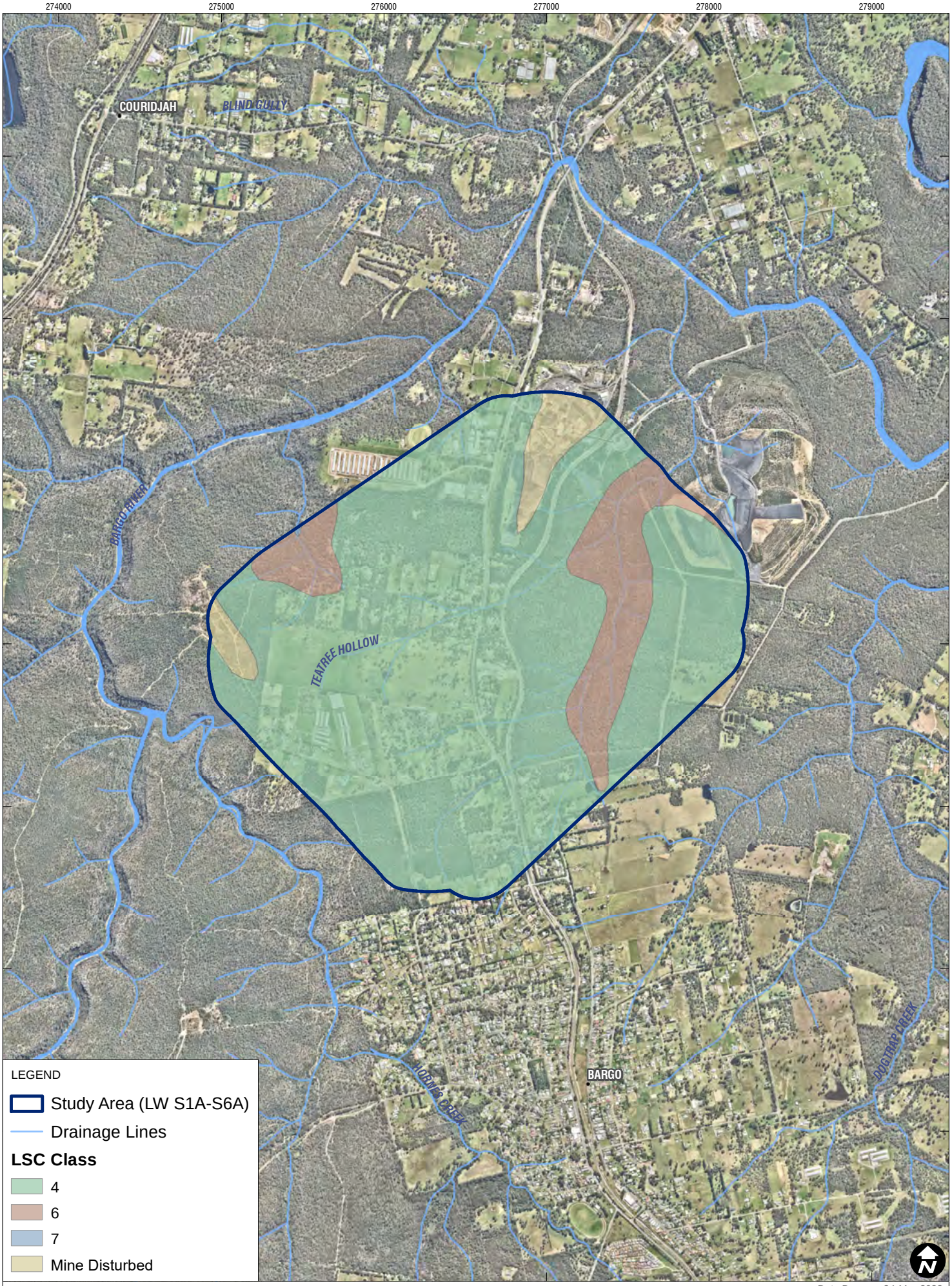
LSC Class 7 Land

Class 7 land indicates very low capability land, with severe limitations for most land uses. It is generally unsuitable for any type of cropping or grazing due to its limitations. It covers a minor portion of the Study Area (<1%).

Within the Study Area, 16% of the land area is considered to have low to very low agricultural capability according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2013), whilst the remainder has moderate to moderately low agricultural capability.

2.10 Biophysical Strategic Agricultural Land

The nearest mapped Biophysical Strategic Agricultural Land (BSAL) according to the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 – Strategic Agricultural Land Map – Sheet STA_41* (DPI, 2013) is between Douglas Park and Camden, approximately 20 kilometres to the north-east of the Study Area.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BLIND GULLY
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Study Area (LW S1A-S6A)
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Project Number: 630.12732
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Land and Soil Capability
FIGURE 6

3 Local and Regional Agricultural Enterprises

3.1 Regional Agricultural History

Agriculture within the Wollondilly LGA is based on a foundation of market gardens, orchards, dairy and poultry. Early European settlement saw the establishment of small villages including Picton, Menangle, Thirlmere, Tahmoor, Bargo, and Appin.

Picton is one of the earliest European settlements in the area. Agriculture dates back to when a number of cattle went missing in the early days of the colony and were later found in 1795 by a convict near the Nepean River. This area became known as Cowpastures and then Stonequarry until gaining its current name, Picton, in 1841.

In the 1860's the railway system came to Picton and created a building explosion. The area was proclaimed a municipality in 1895, and in 1939 Wollondilly Shire Council and Picton Municipality amalgamated to create today's LGA (Wollondilly Shire Council, 2020).

Poultry farming was established in in the Wollondilly region during the 1930's. Many Estonian families fled political upheaval in their homeland between 1924 and 1939. Australia offered cheap land and a new life, with many of these people settling at Thirlmere and established poultry farms.

In the late 1940's many Estonians who were caught in European Displaced Persons camps after World War II also chose to come to Australia, and were sponsored and supported by the Thirlmere community. They built on their national connections and helped each other to start poultry farming. By the 1960's there were over 60 families from Estonia involved in poultry farming in Thirlmere. Most farms comprised of 2,000 to 4,000 hens.

Estonians pioneered the Cooperative movement in 1912. The Thirlmere Estonians started "KUNGLA", the Thirlmere farmers' Cooperative in 1939 and was continued by the new settlers after the war. This considerably increased the viability and efficiency of the poultry industry until Thirlmere became the largest producer of eggs in Australia by the 1960's (Migration Heritage Centre, 2020).

Today, Wollondilly LGA is predominantly rural area with several national parks, whilst there are urban areas in 15 towns and villages. Two-thirds of the population live in the urban centres, and one-third in the rural areas. There are five large towns, the largest of which is Tahmoor, whilst Picton is the administrative centre. The LGA encompasses a land area of nearly 260,000 hectares, of which approximately 90% is national park, bushland, water catchment or rural land, including gorges, ranges and plains. Most of the rural land is used for agricultural purposes, including market gardens, orchards, dairy farms, poultry farms and grazing (profile.id, 2020).

3.2 Agricultural Enterprises and Associated Industries

3.2.1 Regional Land Use

Agriculture is a minor land use for the regional area (Wollondilly LGA), accounting for 11% of land use. (Australian Bureau of Statistics (ABS), 2011 [2011 is the latest regional agricultural data available from ABS]). The agricultural land use is outlined in **Table 10**. It details the area of land used for agriculture in the region and the specific uses of the land. The major points are summarised below:

- Agricultural land is almost exclusively used for grazing, utilising 98% of all agricultural land. The primary enterprise is meat cattle farming, which accounts for 60% of livestock numbers, followed by milk cattle (25%) and sheep farming (15%).
- Cropping enterprises comprise a minor portion of agricultural activities. The primary crops grown are vegetables for human consumption along with fruit and nuts. No cereals for grain are grown in the region.
- Minor irrigation cropping is carried out, comprising only 7% of the agricultural land in the region. Agriculture accounts for 5,513 megalitres of volume to irrigate approximately 2,000 ha of agricultural area, while 981 megalitres is utilised for other agricultural uses, such as poultry production and hydroponic vegetables.
- Poultry comprise a large portion of livestock numbers within the Wollondilly LGA, with 2.3 million birds were recorded at the last census of these 2.1 million were being raised for poultry meat production. The region also produced 2.4 million dozen eggs.

Table 10 Wollondilly LGA Agricultural Land Use

Agricultural Land Area	Units	Total
Total land area within LGA	Hectare	255,593
Area of National Parks, nature reserves & other protected lands	Hectare	160,555
Area of agricultural land	Hectare	28,058
Proportion of agricultural land	**%**	**11**
Agricultural Enterprise		
Land under cropping activities	Hectare	598
Land under grazing activities	Hectare	27,460
Proportion of agricultural land used for grazing	**%**	**98**
Grazing Enterprises	**Total**	**%**
Sheep and lambs	2,315	15
Meat cattle	9,553	60
Dairy cattle (excluding house cows)	3,943	25
Pigs	55	<1
Total	**15,866**	**100**
Cropping Enterprises		
Cereals for grain	Hectare	Nil
Vegetables for human consumption	Hectare	461

Agricultural Land Area	Units	Total
All fruit and nuts	Hectare	142
Total land cropped	**Hectare**	**603**
Irrigation		
Area irrigated	Hectare	2,000
Irrigation volume applied	Megalitre	5,513
Other agricultural uses	Megalitre	981
Total water use	**Megalitre**	**6,494**
Proportion of agricultural land irrigated	**%**	**7**

Source: *ABS* (2011) - 2011 is the latest regional agricultural data available from ABS

3.2.2 Regional Employment

A summary of the total regional employment and the proportion of agriculture related employment is shown in **Table 11.** The regional employment in the agriculture related sectors is shown in **Table 12.** The major points are summarised below:

- Agriculture is not a major employer within the region; the total of 1,911 persons employed in the direct and indirect agricultural sectors is only 10% of the total employed population.
- Agriculture-related wholesaling and retailing is responsible for 48% of agricultural employment, followed by processing and manufacturing (26%), and agricultural production (26%).
- The major agricultural production employers are beef cattle farming, poultry farming and vegetable growing, which account for 13% employment in agriculture. Horse farming, dairying and floriculture and nursery production comprise another 6% of employment in agriculture. All other sectors are minor agricultural employers in the region.
- The main agriculture-related processing and manufacturing is poultry processing, comprising 12% of agricultural related employment.
- Supermarkets and grocery stores account for the vast majority of agricultural related wholesaling and retailing employment, comprising 27% of the agricultural related employment.

Detailed agricultural employment figures are not available for the Study Area; however the main agricultural activities generating income within and adjacent to the Study Area observed during the site inspection were small scale horse and cattle grazing along with a number of poultry farms and orchards.

Table 11 Wollondilly LGA Employment Related to Agriculture

Employment Sector	No. of persons	%
Total Regional Employment	**19,417**	**100**
Direct Regional Agricultural Employment	497	3
Indirect Regional Agricultural Employment	1,414	7
Total Regional Employment Related to Agriculture	**1,911**	**10**

Source: *ABS* (2011) - 2011 is the latest regional agricultural data available from ABS

Table 12 Wollondilly LGA Agricultural Related Employment by Sector

Agricultural Production	Number of People	%
Beef Cattle Farming (Specialised)	103	5
Poultry Farming	84	4
Horse Farming	41	2
Dairy Cattle Farming	47	2
Other Livestock Farming and Beekeeping	24	1
Vegetable Growing (Outdoors)	80	4
Floriculture and Nursery Production	44	2
Turf Growing	12	1
Other Crop Growing (Grains, fruit and tree nuts, mushrooms etc.)	33	2
Agriculture (Not further defined)	29	2
Subtotal	**497**	**26**
Agriculture Related Processing and Manufacturing	**Number of People**	**%**
Poultry Processing	229	12
Cereal, Pasta and Baking Mix Manufacturing	56	3
Factory Based Manufacturing Bread, Biscuit, Cake, Pastry	50	3
Meat Processing and Manufacturing (Inc. Cured Meat and Smallgoods)	26	1
Log Sawmilling, Timber Re-sawing and Dressing	25	1
Cheese, Ice-cream, Milk and Other Dairy Product Manufacturing	25	1
Fruit and Vegetable Processing	20	1
Bakery Product Manufacturing (Non-factory based)	17	1
Potato, Corn and Other Crisp Manufacturing	11	1
Food Product Manufacturing (Not further defined)	46	2
Subtotal	**505**	**26**
Agricultural Related Wholesaling and Retailing	**Number of People**	**%**
Supermarket and Grocery Stores	509	27
Fresh Meat, Fish, Poultry, Smallgoods Retailing and Wholesaling	76	4
Fruit and Vegetable Retailing and Wholesaling	63	3
Grocery, Liquor and Tobacco Product Retailing and Wholesaling	113	5
Food Retailing (Not further defined)	25	1
Timber Wholesaling	20	1
Flower Retailing	14	1
Other Agricultural Product Wholesaling	89	4
Sub total	**909**	**48**
Total Agricultural Related Employment	**1,911**	**100**

Source: *ABS* (2011) - 2011 is the latest regional agricultural data available from ABS

3.3 Regional Agricultural Production Value

Agricultural production values for the Wollondilly LGA totals $61.3 M, detailed in **Table 13.** The main agricultural production by value is from poultry production, both for meat and eggs (livestock slaughtering and livestock products), and vegetables for human consumption (crops) accounting for almost 90% of the value of agricultural commodities produced (ABS, 2011 [2011 is the latest regional agricultural data available from ABS]).

Table 13 Regional Agricultural Production

Agricultural Production Gross Value	Value (M)	%
Crops	$21.7	35
Livestock slaughtering	$33.0	54
Livestock products	$6.6	11
Total gross agricultural production	**$61.3**	**100**

Source: *ABS* (2011) - 2011 is the latest regional agricultural data available from ABS

3.4 Potential Agricultural Production Value of the Study Area

Potential agricultural productivity was determined using NSW DPI agricultural gross margin productivity data for agricultural enterprises suitable for each of the LSC classes (see **Section 2.9**) that are present within the Study Area. This analysis has been undertaken on the potential capability of the land rather than current land use. If potential agricultural production values were to be pursued, significant investment in land management and agricultural infrastructure would be required. However, this information can be used to approximate potential farm incomes.

The *Beef Cattle Gross Margin Budget Inland Store Weaners* (DPI, 2019) has been applied to this assessment to determine potential agricultural income for the Study Area. The *NSW Department of Primary Industries Beef Stocking Rates & Farm Size* (DPI, 2006) was used to determine stocking rates in Dry Sheep Equivalents (DSE) for the three LSC's mapped within the Study Area. Full agricultural gross margin information is contained in **Appendix B**.

Table 14 summarises the potential gross margins for each applicable agricultural enterprise per LSC Class. The major points are listed below:

- Class 4 land has the potential to generate approximately $227 per hectare from beef cattle grazing enterprises (yearling beef production).
- Class 6 land has the potential to generate approximately $116 per hectare from beef cattle grazing.
- Class 7 land has the potential to generate approximately $58 per hectare from beef cattle grazing.
- Mine Disturbed land has no agricultural rating and no potential to generate income in its current guise.

Table 14 Gross Margin per LSC Class

LSC	Stocking Rate	Cow & Calf Equivalent	Revenue	Variable Costs	Gross Margin
Class	DSE	Per Hectare	Per Hectare	Per Hectare	Per Hectare
4	8	0.47	$282	$55	$227
6	4	0.24	$144	$28	$116
7	2	0.12	$72	$14	$58

Based on the nominated gross margins, and assuming the required agricultural capital costs and fixed costs are outlaid (not included in the calculations in **Table 14**), the Study Area has the capacity to generate an estimated gross margin of $139,412 per annum (**Table 15**). It is important to note that these figures are derived from the optimum potential uses and are likely to be higher than the actual incomes being achieved from the area under actual production.

Table 15 Annual Gross Margins per LSC Class

LSC	Gross Margin	Study Area	
Class	Per Hectare	Hectares	Gross Margin
4	$227	572	$129,939
6	$116	28	$9,473
7	$58	<1	Nil
	Total	**682**	**$139,412**

It is expected that income generated from agricultural enterprises within the Study Area would be less than that presented in **Table 13**, due to the small area (182 hectares) available for actual agricultural production (**Figure 5**). The majority of this cleared area is LSC Class 4 and using the gross margin information presented in **Table 14**, beef cattle grazing 182 hectares of LSC Class 4 land has a potential gross margin of $41,347 per annum.

3.5 Regional Agricultural Support Infrastructure

Agricultural support infrastructure within the Wollondilly LGA includes the Hume Highway as the major arterial road, and rail infrastructure providing transport from agricultural areas in the west, south and north of the state.

The main purpose-built agricultural support infrastructure within the Study Area is a number of large farm dams which are used for cattle and horse grazing areas.

There are two abattoirs located nearby in Tahmoor. Poultry processing is carried out at the Inghams processing facility whilst the Wollondilly Co-op abattoir processes pigs. The closest livestock selling centre is located at Moss Vale, approximately 50 kilometres south-west of the Study Area.

There are a number of small retail agricultural suppliers that service the numerous small hobby farms in the region. Other purpose built agricultural infrastructure is generally for intensive agricultural enterprises and includes greenhouses and hothouses for cut flower and vegetable production, poultry laying and growing sheds, farm dams and groundwater extraction bores.

4 Assessment of Potential Impacts

The primary potential impact to agricultural resources is from subsidence. MSEC (2022) predicts maximum vertical subsidence to be 1,350 millimetres over LW S5A-6SA. Maximum predicted tilt is 9.5 millimetres per metres over LW S6A which is very small when compared to the natural surface grade of slopes within the Study Area.

4.1 Land Resources

4.1.1 Land Temporarily Removed from Agriculture

Based on the natural landscape contours and the predicted subsidence contours, there is unlikely to be any remnant ponding in the agricultural landscape (Tahmoor Coal, 2022). Therefore, there is no land which will be temporarily removed from agriculture as a result of LW S1A-S6A.

4.1.2 Land Permanently Removed From Agriculture

There is no land which will be permanently removed from agriculture as a result of LW S1A-S6A.

4.1.3 Acid Sulfate Soils

As outlined in **Section 2.7** there are no Soil Landscape Units associated with the Study Area with acid sulfate potential. LW S1A-S6A will not impact upon acid sulfate soils.

4.1.4 Impact on Biophysical Strategic Agricultural Land

There is no Biophysical Strategic Agricultural Land within or adjacent to the Study Area. LW S1A-S6A will not impact any Biophysical Strategic Agricultural Land.

4.2 Water Resources

4.2.1 Surface Water

Based on the previous experience of mining beneath streams at Tahmoor Mine, it is likely that fracturing and surface flow diversions will occur in the sandstone bedrock along the streams over LW S1A-S6A, particularly for streams that are located directly above the proposed longwalls. In some of these locations, the fracturing could impact the holding capacity of the standing pools, particularly those located directly above the proposed longwalls. It is unlikely, however, that there would be any net loss of water from the catchment (MSEC, 2022).

Given that drainage channels within the Study Area are considered low flow or intermittent channels, the impact on agricultural users dependent on flows from these watercourses is negligible.

4.2.2 Groundwater

The NSW Aquifer Interference (AI) Policy 2012 established a 2 metre threshold as the maximum allowable drawdown for ‘water supply works’ in order to satisfy the considerations for ‘minimal harm’.

As shown in **Table 16,** all assessed bores will have a predicted drawdown of greater than 2 metres, however all have a greater available drawdown than the predicted drawdown, allowing continued access to groundwater for irrigation and stock & domestic purposes (SLR, 2022).

Table 16 Predicted Impacts to Private Bores

Identifier	Purpose	Condition	Potential Drawdown (m)	Available Drawdown (m)
GW105883	Domestic	Operational	N/A	N/A
GW104323	Stock & Domestic	Operational	14.8	40.4
GW032443	Irrigation	Not currently used	80.1	129.4
GW109257	Stock & Domestic	Not currently used	75.1	82.9
GW014262	Stock	Unknown	5.9	N/A
GW104659	Irrigation	Operational	10.2	88.2
GW111810	Stock & Domestic	Operational	14.8	82.0
GW105847	Stock & Domestic	Unknown	N/A	N/A

N/A = not available

4.2.3 Water Reallocation

Tahmoor Mine currently holds three groundwater extraction licences for a total of 1,642 megalitres, utilised for mine dewatering. However, this water would not be considered as being taken from potential agricultural use as Licence Condition 16 of all three groundwater extraction licences states '*this is a special purpose (mine de-watering) licence; as such, the licence is including the volumetric groundwater allocation not transferrable, and the licence will be lapsed at the conclusion of mining operations*'.

Therefore, whilst Tahmoor Coal currently holds groundwater extraction licences for 1,642 megalitres, this water would not be considered as being taken from potential agricultural production as the licences are restricted to mine de-watering only. There will be no impact on agricultural users through water reallocation.

4.2.4 Water Resource Impacts on Agricultural Productivity

Given the impacts described previously, longwall subsidence will result in limited impacts on water resources relied upon by agricultural enterprises and should not result in impacts on agricultural productivity. There is no predicted increase in total dissolved salts or sodium in groundwater bores associated with LW S1A-S6A (SLR, 2022).

4.3 Impact on Agricultural Resources from Biodiversity Offsets

A regional Biodiversity Offset Strategy (BOS) has been proposed by Tahmoor Coal to offset the loss of vegetation from clearing associated with the construction of the new surface facilities required to support the Tahmoor South Project. The Biodiversity Assessment Report (Niche, 2020) identifies five proposed biodiversity offset sites comprising 381 hectares, for the BOS:

- Rockford Road
- Pit Top
- 185 Charlies Point Road
- Bargo Colliery Land

- 220 Charlies Point Road

None of the identified sites are on potentially agriculturally productive land, and all are heavily timbered with native bushland. Therefore, the BOS will have negligible impact on agricultural resources, enterprises or BSAL.

The extraction of LW S1A-S6A is not expected to result in the establishment of any further biodiversity offsets; therefore there will be no impact to agricultural resources resulting from biodiversity offsets.

4.4 Other Impacts

4.4.1 Visual Amenity and Landscape Values

Site inspection during 2013 and 2017 by SLR's Principal Agronomist did not identify any agricultural enterprises which were reliant upon visual amenity or landscape values as component of their operations. On this basis, the extraction of LW S1A-S6A is considered to have negligible impact on visual amenity and landscape value relied upon by local and regional agricultural enterprises.

4.4.2 Tourism

The assessment has not identified any tourism infrastructure within the local area upon which agricultural enterprises are reliant. Therefore, LW S1A-S6A is not anticipated to impact on agriculture-related tourism.

4.4.3 Weed Management and Biosecurity

There is no risk from weed infestation during the extraction of LW S1A-S6A through vehicle movements on and off site. Weeds are currently managed within the frameworks of the Tahmoor Coal Environmental Management System.

Biosecurity is defined in the *NSW Biosecurity Strategy 2013 – 2021* (NSW DPI, 2013) as 'protecting the economy, environment and community from the negative impacts of pests, diseases and weeds'. It includes measures to prevent new pests, diseases and weeds from entering our country and becoming established. On a regional level, appropriate weed management will reduce biosecurity risks.

The vast majority of equipment used at Tahmoor Mine is site-dedicated and poses no biosecurity risk. Any import of equipment or machinery from interstate or overseas will follow the standard procurement safeguards and quarantine procedures as per NSW and Australian requirements.

Given the processes above, it is considered the extraction of LW S1A-S6A has negligible risk to the biosecurity of agricultural resources and enterprises within the region.

4.4.4 Air Quality

The extraction of LW S1A-S6A involves the extraction of six underground longwall panels and as such there will be no impact to air quality resulting from LW S1A-S6A.

All other activities associated with the Tahmoor South Project that have the potential to create dust will be undertaken in accordance with the approved Air and Greenhouse Gas Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.

4.4.5 Noise

The extraction of LW S1A-S6A involves the extraction of six underground longwall panels and as such there will be no impacts to agricultural production from noise generated during the extraction of LW S1A-S6A.

All other activities associated with the Tahmoor South Project that have the potential to generate noise will be undertaken in accordance with the approved Noise Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.

4.4.6 Blasting

The extraction of LW S1A-S6A does not involve any blasting on the surface and as such there will be no impact to agricultural resources from blasting.

All other activities associated with the Tahmoor South Project that have the potential to generate noise will be undertaken in accordance with the approved Noise Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.

4.4.7 Traffic

The extraction of LW S1A-S6A involves the extraction of six underground longwall panels with no increased surface traffic movements, and as such the impact to agricultural resources as a result of increased traffic movements is considered negligible.

All other activities associated with the Tahmoor South Project that have the potential to increase surface traffic movements will be undertaken in accordance with the approved Traffic Management Plan for any onsite construction as well as the ongoing operation of Tahmoor Mine.

4.4.8 Rural Structures

The majority of rural structures within the Study Area are of lightweight construction and are expected to tolerate mining induced tilt. It has been found from past longwall mining experience that tilts of the magnitudes predicted for LW S1A-S6A generally have limited adverse impacts on rural structures. Some minor serviceability impacts could occur at the higher levels of tilt, including door swing and issues with roof and pavement drainage. These serviceability impacts can generally be remediated using normal building maintenance techniques (MSEC, 2022).

Impacts on the rural structures that occur as the result of the extraction of the proposed longwalls are expected to be remediated using well established building techniques and it is unlikely that there would be long term impacts on rural structures resulting from the extraction LW S1A-S6A. It is considered that rural structures can be maintained at all times during the extraction of the proposed longwalls, even if actual subsidence movements were greater than the predictions or substantial non-conventional movements occurred (MSEC, 2022).

4.4.9 Tanks

There are water, gas and fuel storage tanks on some of the properties within the Study Area. There are 74 tanks which have been identified within MSEC's Subsidence Study Area, just less than half of which are not directly above LW S1A-S6A (MSEC, 2022).

Storage tanks are typically constructed above ground level, and therefore are unlikely to experience the full ground movements resulting from the proposed mining. It is possible, that any buried water pipelines associated with the tanks within the Study Area could be impacted by the ground strains, if they are anchored by the tanks, or by other structures in the ground. Any impacts are expected to be of minor nature and easily repaired (MSEC, 2022).

4.4.10 Farm Fencing

Farm fences are generally flexible in construction and can usually tolerate mine subsidence movements. Impacts to fences may include tension loss and changes to post alignment. The most vulnerable section of farm fences are gates, particularly long gates, or those with latches as they are less tolerant to differential horizontal movements and tilts between the gate posts and the ground. Any impacts on the wire fences or gates are likely to be of a minor nature and relatively easy to remediate by re-tensioning the fencing wire, straightening the fence posts, and if necessary, replacing some sections of fencing (MSEC, 2022).

4.4.11 Farm Dams

There are 45 farm dams which have been identified within the MSEC Subsidence Study Area. The length of farm dams within the MSEC Subsidence Study Area vary between 8 metres and 99 metres and the plan areas vary between 26 m^2 and 5,047 m^2. The dams are typically of earthen construction and have been established by localised cut and fill operations within the natural watercourses. The farm dams are generally shallow, with the dam wall heights generally being less than 3 metres (MSEC, 2022).

The maximum predicted final tilt for the farm dams is 0.75 %, which represents a change in grade of 1 in 133. Mining induced tilts can affect the water levels around the perimeters of farm dams, with the freeboard increasing on one side, and decreasing on the other. The predicted changes in freeboard at the farm dams within the Study Area is less than 300 millimetres at 41 dams, and it is unlikely that the majority of the farm dams within the would experience adverse impacts on the storage capacities due to these small changes in freeboard (MSEC, 2022).

The predicted changes in freeboard are greater than 500 millimetres at one 1 dam within the Study Area (i.e. < 1 % of the total). It is possible, that this dam could experience a reduced storage level, however, this could be remediated by increasing the height of the affected dam wall.

The maximum predicted conventional curvatures and strains for farm dams could be sufficient to result in cracking in the bases and walls of some farm dams within the Study Area.

4.4.12 Surface Water Extraction

At locations of minimum natural gradient, the predicted subsidence may result in a very slight reduction in surface grade (i.e. less than 1%). This level of change is not expected to result in impacts to overland flow and therefore impacts to registered surface water extraction will be negligible (Tahmoor Coal, 2022).

4.4.13 Groundwater Wells and Bores

Temporary lowering of the regional piezometric surface over the subsidence area due to extraction of LW S1A-S6A may occur, with impacts more notable directly over extracted panels. Groundwater levels may reduce up to 80 metres at GW032443 and GW109257, which are located directly over LW S1A and S4A, however neither of these bores are in use. The remaining four assessed private bores are anticipated have a drawdown of between six and 15 metres, with all bores having an available drawdown greater than the predicted drawdown (**Table 16**), meaning there will still be water available for extraction (SLR, 2022).

It is anticipated that groundwater levels will recover over a few months to two to three years. However, it must be noted the rate of groundwater level recovery is significantly affected by climatic conditions at the time. There is no predicted permanent post mining reduction in the Hawkesbury Sandstone Aquifer groundwater levels (SLR, 2022).

4.4.14 Impact on State Forest

There are no State forests or conservation areas present within the Study Area. The extraction of LW S1A-S6A is not expected to impact the State Forest.

4.4.15 Poultry Sheds

There are 21 poultry sheds within the Study Area. The poultry sheds are lightweight structures up to 113 metres in length. The Inghams Bargo Chicken Breeder Complex Production Complex is located on Remembrance Drive, beyond the finishing ends of LW S2A-S3A. The Inghams Turkey Farm and Bargo Valley Produce poultry sheds are located on Yarran Road, to the west of LW S6A. Part of one shed at Bargo Valley Produce is located directly above LW S6A.

The poultry sheds are predicted to experience relatively mild conventional subsidence, tilt, curvatures and strains. Tilt can potentially affect the serviceability of poultry sheds by altering the watering and drainage systems in the sheds. The predicted changes in grade are small and unlikely, therefore, to result in any adverse impacts on the serviceability of the tanks. Mining-induced curvature and ground strain can result in the opening of gaps or cracks in the wall linings of the poultry sheds. The potential for impacts are, however, considered low as only one shed at Bargo Valley Produce is above the proposed LW S6A.

It is expected that the predicted mine subsidence movements on the poultry sheds and ancillary building structures can be managed by the implementation of suitable management strategies, including visual monitoring during active subsidence (MSEC, 2022).

4.4.16 Horticulture & Permaculture

Irrigation Systems

Irrigation systems are used on commercial and private properties for production of olives, lettuce and other horticultural applications. Elevated troughs are located on Bargo Valley Produce on Yarran Road, to the west of LW S6A. Irrigation systems are usually constructed from polyethylene pipes which can tolerate ground movements much larger than the predicted mine subsidence movements within the Study Area. Elevated strains can occur in the pipelines where they are anchored to the ground, or where they are subjected to non-systematic ground movements. Impacts are expected to be minor, including leaking joints, which could be readily remediated (MSEC, 2022).

Glass Houses

No glass houses have been identified within the Study Area, though there are a number of greenhouses and hothouses. As these structures are relatively lightweight in construction, they are usually able to tolerate differential subsidence movements. Impacts can occur, e.g., if the roof materials are designed to be slid open or closed to ventilate the greenhouse or hothouse, differential horizontal movements can cause the frames to crack and prevent sliding of the materials. It is expected that the predicted mine subsidence movements on the greenhouses and hothouses can be managed by the implementation of suitable management strategies, including visual monitoring during active subsidence (MSEC, 2022).

Hydroponic Systems

There are no known hydroponic systems within the Study Area. However, there are a number of greenhouses and hothouses. These buildings may have hydroponic systems. While the water pipes are usually flexible and able to tolerate differential subsidence movements, the drainage of the systems may require monitoring and adjustment, if necessary. It is expected that the predicted mine subsidence movements on the hydroponic systems can be managed by the implementation of suitable management strategies, including visual monitoring during active subsidence (MSEC, 2022).

4.4.17 Agricultural Regional Community Impacts

No other impacts which may affect the regional agricultural community, resources or enterprises have been identified in this assessment.

4.4.18 Cumulative Impacts

Given the previously described impacts are of a minor nature and readily managed through application of appropriate mitigation measures and management strategies, any cumulative impacts on agricultural resources and enterprises are also expected to be minor and readily mitigated.

5 Mitigation Measures and Management Strategies

This section describes the proposed mitigation measures and management strategies recommended to minimise potential agricultural impacts. Whilst the majority of impacts on agricultural enterprises and resources have been assessed as negligible, as a matter of best practice, Tahmoor Coal has adopted a number of mitigation measures to further minimise these impacts. A summary of key measures specifically in relation to potential agricultural impact is provided below.

5.1 Soil Resources

Whilst there are no earthworks proposed during the extraction of LW S1A-S6A, in the unlikely event they would be required, gypsum will be applied for any remediation earthworks where sodic subsoils (exchangeable sodium is greater than 5%) are exposed. The application of gypsum will minimise the potential for tunnel erosion to occur on disturbed subsoil. The recommended application rates are shown in **Table 17**.

Table 17 Gypsum Application Rates

Exchangeable Sodium (ESP)	Gypsum Rate per Hectare	Gypsum Rate per Square Metre
5 to 10%	2 to 5 tonnes	0.2 to 0.5 kilograms
Greater than 10%	5 tonnes	0.5 kilograms

It is noted that there are no soil stripping or stockpiling activities anticipated within the Study Area associated with the extraction of LW S1A-S6A.

5.2 Surface Water Resources

Where impacted watercourses have sediment accumulations upstream, it is expected that some of the fractures would be naturally filled over time with sediment during subsequent flow events, as has previously been observed. Where little sediment is present, the impacts are likely to remain for longer periods of time and remediation may be required after the completion of mining, which could include sealing these fractures and voids with grout (MSEC, 2022).

Tahmoor Coal has previously developed Water Management Plans to manage the potential impacts on streams during the mining of longwalls. The management plans include ground monitoring, water quality and pool level monitoring and visual inspections. The plans also commit to remediation of aquatic ecosystems if impacts occur. A Water Management Plan has been prepared as part of the Extraction Plan for LW S1A-S6A.

5.3 Groundwater Resources

All currently operating private bores are predicted to be impacted by a maximum incremental drawdown of greater than two metres, however all impacted bores have a greater available drawdown than the predicted drawdown. Tahmoor Coal have committed to “make good” provisions for any groundwater users shown to be adversely affected by mine operations and associated impacts. These commitments are detailed in the Water Management Plan, which has been prepared as part of the Extraction Plan for LW S1A-S6A.

Although, groundwater quality is not predicted to adversely change, it will continue to be monitored and compared to groundwater quality triggers in the Trigger Action Response Plans which are prescribed to act as early warning measures for any changes in groundwater quality

5.4 Tanks

Only minor impacts to tanks are expected, if impacts occur the structure will be repaired in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

5.5 Farm Fencing

In the unlikely event of damage to fence tensioning or farm gates, Tahmoor Coal will remediate the damage in consultation with relevant stakeholders.

5.6 Farm Dams

It is expected that all farm dams in the Study Area can be maintained during the extraction of the proposed longwalls, even if impacts were greater than the predictions or substantial non-conventional movements occurred. Any substantial cracking in the dam bases or walls within the Study Area could be repaired by reinstating with cohesive materials. If any farm dams were to lose water as a result of mining, Tahmoor Coal would provide an alternative water source until the completion of repairs in accordance with the *Coal Mine Subsidence Compensation Act 2017* (MSEC, 2022).

6 Monitoring & Consultation

Tahmoor Coal notifies all residents and/or businesses within the 20 millimetre subsidence area and 35 degree angle of draw prior to commencement of all first and second workings. Comprehensive monitoring of all potentially impacted properties within these areas is undertaken from the commencement of extraction, and continues regularly until extraction is completed. Further monitoring is completed during the post-extraction phase in accordance with the relevant management plan for the residence / business (refer to the Extraction Plan for further details).

Agricultural reports completed during the extraction of Longwalls West 1, West 2 and West 3 in the Western Domain show that no impacts to agricultural resources or enterprises have been observed during the extraction of these longwalls. These inspections are based on baseline reporting undertaken by SLR prior to the commencement of extraction. An example of this reporting, the *Tahmoor Coal LW W1-W2 Agricultural Inspection Report*, is given in **Appendix C**.

In relation to the poultry enterprises that exist in the area, that the owner/manager as well as the processor/owner of the birds will be consulted during the preparation of the relevant management plan for each agricultural business to ensure that production plans can be adjusted if required. Monitoring will also be detailed in the relevant management plan, as agreed during consultation with the poultry enterprises.

Tahmoor Coal keeps a complaints register for any public matters resulting from aspects of mine operation. The complaints register is tracked using the compliance program Cority, which allows Tahmoor Coal to enter the details of complaints, as well as details of investigation procedures and outcomes as required. Tahmoor Coal also employs a Consultation Manager to track and undertake consultation with landowners.

7 Findings

This Land and Agricultural Resource Assessment has been prepared to be included in Tahmoor Coal's Extraction Plan LW S1A-S6A. The purpose of this Land and Agricultural Resource Assessment is to assess and report on the potential impacts on agricultural resources within and adjacent to the Study Area and recommend mitigation measures to alleviate any identified impacts. The key findings are listed below:

- The majority agricultural land use by area within the Study Area is for small scale cattle and horse grazing areas, which are not major contributors to agricultural income generation. This small scale grazing is mostly carried out as a land and vegetation management tool. Land available for agricultural land use comprises 27% of the Study Area.
- There are three poultry enterprises within the Study Area, and impacts are expected to be minor and readily remediated using well accepted techniques.
- Post-mining agricultural economic potential in the Study Area is expected to be very similar to pre-mining potential.
- The longwall mining will have minor impacts on surface and groundwater resources relied upon by agriculture, comprising two WALs and six private bores. Any surface or groundwater impacts will be "made good" by Tahmoor Coal.
- Any impacts resulting from longwall mining are expected to be minor and temporary, and can be managed through application of appropriate mitigation measures and management strategies.
- As a result of any impacts being minor, any cumulative impacts on agricultural resources and enterprises are also expected to be minor, and can be managed through application of appropriate mitigation measures and management strategies.
- Continuation of longwall mining by Tahmoor Coal will provide considerable positive economic benefits to the local and broader communities. These benefits are far greater than any potential income lost by existing or potential agricultural enterprises.

In summary, the extraction of LW S1A-S6A will provide considerable economic benefits to the region whilst having negligible impact on agricultural resources, enterprises or related industries.

8 References

Australian Bureau of Statistics website accessed March 2022 www.abs.gov.au

Bureau of Meteorology website accessed March 2022 www.bom.gov.au

Geoterra (2013), *Tahmoor South Project Shallow Groundwater Baseline Monitoring*

MSEC (2022), *Tahmoor South Project – Extraction Plan for Longwalls S1A to S6A*

Migration Heritage Centre (2020), website accessed March 2022 www.migrationheritage.nsw.gov.au

NSW Department of Planning and Infrastructure (2013), *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 Strategic Agricultural Land Map – Sheet STA_41_20130910*

NSW Department of Primary Industries (2019), *Beef Cattle Gross Margin Budget Inland Store Weaners*

NSW Department of Primary Industries (2013), *NSW Biosecurity Strategy 2013 – 2021*

NSW Department of Primary Industries (2006), *Beef Stocking Rates& Farm Size – Hunter Region 2006*

NSW Office of Environment & Heritage (2013) *Land and Soil Capability Assessment Scheme 2nd Approximation*

NSW Office of Water (2012), *Aquifer Interference Policy*

Profile.id (2020), website accessed March 2022 www.profile.id.com.au

SLR (2022), *Tahmoor Coal Pty Ltd LW S1A-S6A Baseline Private Bore Assessment*

SLR (2022), *Tahmoor Coal LW S1A-S6A Extraction Management Plan: Groundwater Technical Report*

Tahmoor Coal (2020) *Tahmoor Coal Pty Ltd Subsidence Monitoring Program Tahmoor North Western Domain Longwalls West 1 and West 2*

Tahmoor Coal (2022), *Tahmoor South Domain Longwalls South 1A – South 6A Water Management Plan*

Wollondilly Shire Council (2020), website accessed March 2022 www.wollondillyshire.com.au

Appendix A

Site Inspection Plates

Site 50 – Cattle grazing

Site 51 – Cattle feedlot 2013, disused cattle feedlot 2017

Site 52 – Pleasure horses

Site 53 – Rural residential

Site 54 – Hydroponic lettuce and poultry sheds

Site 55 – Poultry sheds

Site 56 – Cut flower greenhouse 2013, disused cut flower greenhouses 2017

Site 57 – Poultry sheds

Site 58 – Olives & sheep grazing

Site 59 – Irrigated olives & alpaca stud

Appendix B

Agricultural Productivity Gross Margin Data

Department of Primary Industries

BEEF CATTLE GROSS MARGIN BUDGET

Farm enterprise Budget Series: April 2019

Enterprise: **Inland store weaners**

Enterprise Unit: **100 cows**

Pasture: **Native pasture**

INCOME:			**Standard Budget**	**Your Budget**
42	steer weaners @	$725 /hd	$30,467	
21	heifer weaners @	$463 /hd	$9,727	
1	CFA Bull @	$1,554 /hd	$1,554	
6	CFA cows @	$963 /hd	$5,779	
0	Dry cows @	$963 /hd	$0	
13	Other culls @	$963 /hd	$12,522	
83				
	A. Total Income:		**$60,049**	

VARIABLE COSTS:						
Replacements	1	Bull @	$3,500	/hd	$3,500	
Livestock and vet costs: see section titled beef health costs for details.					$1,244	
Hay & Grain or silage. Low level supplementary feeding for 3 months					$2,250	
Drought feeding costs.					$0	
Pasture maintenence (372 Ha of native pasture)					$0	
Livestock selling cost (see assumptions on next page)					$4,776	
		B. Total Variable Costs:			**$11,770**	

GROSS MARGIN (A-B)	**$48,279**
GROSS MARGIN/COW	**$482.79**
GROSS MARGIN/DSE*	**$32.45**
GROSS MARGIN/HA	**$129.78**

Change in gross margin ($/cow) for change in price &/or the weight of sale stock

(Note: Table assumes that the price and weight of other stock changes in the same proportion as steers. As an example if steer sale price falls to 269c/kg and steer weight to 240 kg, gross margin would fall to $419 per cow. This assumes that price and weight of all other sale stock falls by the same percentage.

Liveweight (kg's) of Stock sold		**Steer sale price cents/kg live**				
		259	**269**	**279**	**289**	**299**
Steer wt.						
-40 kgs	**220**	358	375	393	411	429
-20 kgs	**240**	399	419	438	457	477
0	**260**	441	462	483	504	525
+20 kgs	**280**	483	505	528	550	572
+40 kgs	**300**	524	548	572	596	620

GM $ per Cow

An increase of 5% in weaning percentage increases gross margin per cow by $27.08

Assumptions **Inland store weaners**

Enterprise unit is 100 cows weighing on average 480 kg
Weaning rate: 84% - conception rate 90%

Sales

Steers sold at 9 months	260 kg	@279c/kg	live weight
Heifers sold at 9 months	230 kg	@201c/kg	live weight
21 heifers retained for replacement.			
Cull cows cast for age at 10 years	240 kg	@401c/kg	dressed weight
100% of preg tested empty cows culled	"	"	"
4% cows culled for other reasons	"	"	"
Bulls run at 3% & sold after 4 years use	420 kg	@370c/kg	dressed weight

Selling costs include: Commission 4%; yard dues $8.00/hd; MLA levy $5/hd; average freight cost to saleyards $12/hd; NLIS tags $3.60

Cows: age at first calf : 24 months

Mortality rate of adult stock: 2%

The average feed requirement of a cow + followers is rated at 2.21 LSU or 15.25 dse's. This is an average figure and will vary during the year.
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Age structure

Age	Number
2	21
3	18
4	15
5	13
6	11
7	9
8	7
9	6
Total Joined	**100**
10	6

6 sold cfa

Marketing Information:

Mainly sold to grass back-grounders for growing out.
Steers likely to end up in feedlots after further weight gain on grass.
Following sale, heifers either grown out to become breeders or fattened for the local trade market.

Production Information:

Mixed sex weaners sold from March to June from lighter country or at heavier stocking rates than for vealers. Common on unimproved areas with some supplementary feed in normal years.
This enterprise is the most drought susceptible.

Appendix C

Example Tahmoor Coal LW W1-W2 Agricultural Inspection Report

Table 1 Property Owner

Tahmoor Coal LW W1 – W2 Agricultural Inspections			20/07/2020
Mining Sequence	**During Mining Inspection**	**Property & Site**	**XXXXX**
Easting & Northing	XXXXX		
Current Land Use	Sheep grazing grass pasture		
Dominant Landform	Lower slope to creek flat		
Soil Surface Condition	Uneven surface +/- 150 millimetres in places		
Rainfall Since Last Inspection	15.24 mm		
Baseline Property Condition			
Erosion Presence	Nil	Minor	Widespread
Boundary Fence Condition	Good	Stock proof	Not stock proof
Boundary Fence Posts	Straight	Minor lean	Major lean
Boundary Fence Wire	Full Tension	Minor sag	Major sag
Internal Fence Condition	Good	Stock proof	Not stock proof
Internal Fence Posts	Straight	Minor lean	Major lean
Internal Fence Wire	Full Tension	Minor sag	Major sag
Paddock Gate Condition	Good	Stock proof	Not stock proof
Out-Building Condition	Useable	Unusable	N/A
Paddock Dams	Holding Water	No Water	N/A
Surface Slumping	Nil	Yes	*If yes, depth and width*
Surface Cracking	Nil	Yes	*If yes, depth and width*
Vegetation Dieback	Nil	Yes	Eucalypt
Additional Comments	<u>February Comments (02/03/2020):</u> No observed changes since January report Significant rainfall has however resulted in grass and shrub growth <u>March Comments (27/03/2020):</u> No observed changes since February report Increased vegetation growth <u>April Comments (24/04/20):</u> No observed changes since March report <u>May Comments (21/05/20):</u> Increased vegetation growth along riverbank due to recent rain. Dieback of paddock vegetation has begun as the change of season approaches. <u>June Comments (30/06/20):</u> Seasonal changes corresponding with mid-winter timing		


Property Owner east towards sheds (left: June 20; right: current)

Property Owner south towards Stonequarry Creek (left: June 20; right: current)


Property Owner ground surface (left: June 20, right: current)

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APPENDIX D – Detailed Slope Stability Assessment (Douglas Partners, 2022b)