TAHMOOR EXTRACTION PLAN LW W3-W4

Land and Agricultural Resource Assessment

Prepared for:

Tahmoor Coal
2975 Remembrance Drive
Bargo NSW 2573 Australia

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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.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12732.001	May 2021	Murray Fraser	Rod Masters	Rod Masters

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1 Introduction

Tahmoor Coal Mine (Tahmoor Mine) is an underground coal mine located approximately 80 kilometres south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (NSW) (refer to **Figure 1**). Tahmoor Mine produces up to three million tonnes of Run of Mine coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla and Newcastle for Australian domestic customers and export customers.

Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (**Tahmoor Coal**) since Tahmoor Mine commenced in 1979 using bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group.

Tahmoor Coal has previously mined 33 longwalls to the north and west of the Tahmoor Mine's current pit top location. The current mining area, the 'Western Domain', is located north-west of the Main Southern Rail between the townships of Thirlmere and Picton.

The mine plan for the Western Domain includes four longwalls - Longwalls West 1 to West 4. An Extraction Plan for the first two longwalls in the Western Domain, Longwalls West 1 and West 2 (**LW W1-W2**), was approved by the NSW Department of Planning, Industry and Environment (DPIE) on 8 November 2019. Longwall West 1 (**LW W1)** was the first longwall to be extracted in the Western Domain and was completed on 6 November 2020. The extraction of Longwall West 2 (**LW W2**) commenced on 7 December 2020. The further two longwalls to be mined are Longwall West 3 and LW W4 (collectively referred to as LW W3-W4).

Extraction of LW W4 is estimated to be completed by approximately August 2022, and visual monitoring of agricultural land will continue for 12 months following active subsidence (estimated August 2023).

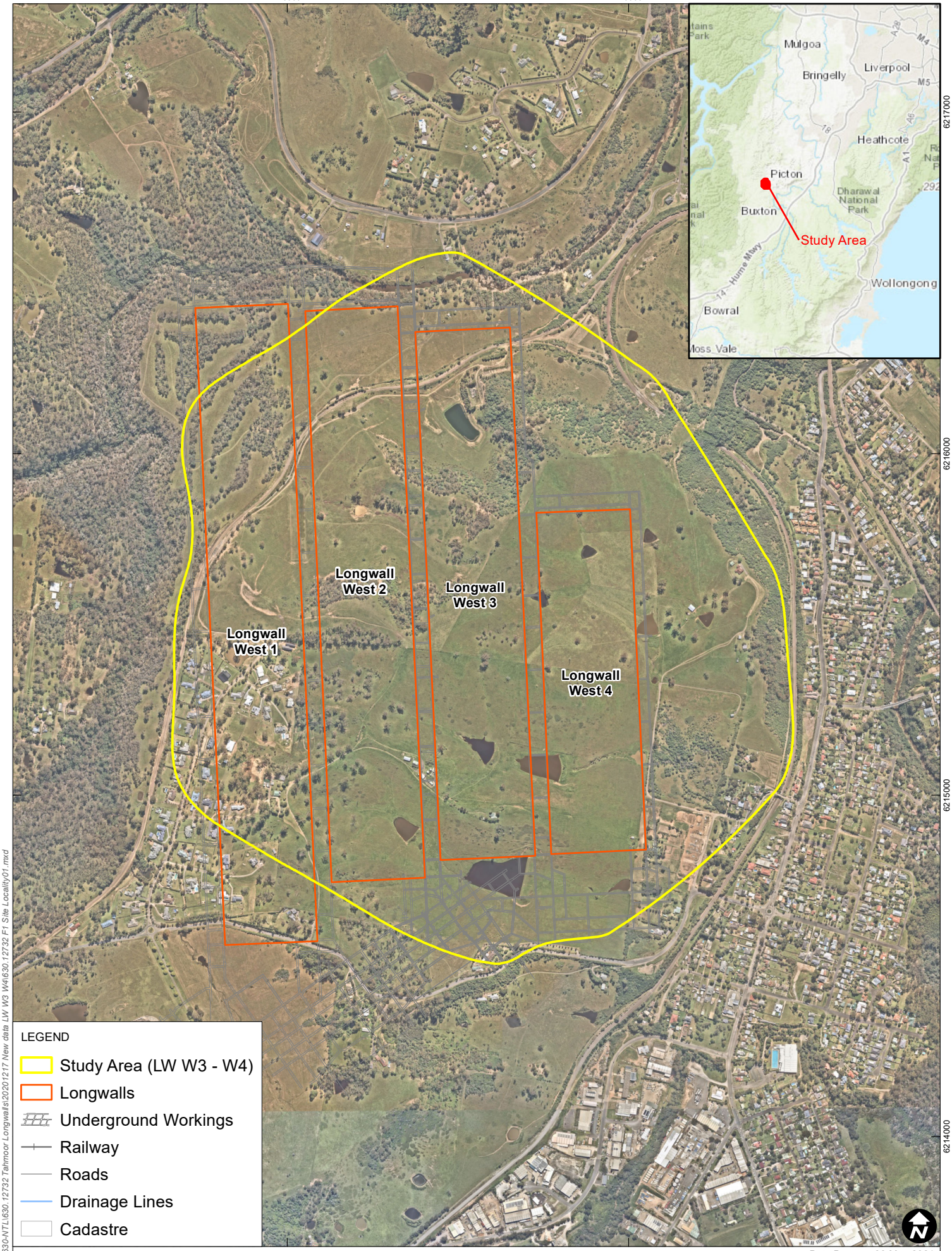
SLR has been commissioned by Tahmoor Coal to complete a Land and Agricultural Resource Assessment for the extraction of LW W3-W4. The purpose of this assessment is to form part of an Extraction Plan for LW W3-W4.

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 W3-W4. This assessment will form part of an Extraction Plan being prepared by Tahmoor Coal for LW W3-W4 for submission to DPIE.

The Extraction Plan Study Area (the Study Area), as shown on **Figure 1**, is defined as the surface area that is likely to be affected by the extraction of LW W3-W4 from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (mm) subsidence contour resulting from the extraction of LW W3-W4; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW W3-W4.



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Study Area
Tahmoor Extraction Plan
LW W3 W4

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 1**). 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 1 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 Study Area is generally undulating with rises in the south-east falling to lower slopes in the north. High points on rises have surface elevations up to 280 metres Australian Height Datum (**AHD**) and are generally cleared for small scale rural production, as shown in **Figure 2**, Surface levels on relatively flat land to the north of the Study Area are the location of vegetated creek lines running from the west to the north-east. Surface elevations of the low points are approximately 180 metres AHD. The slope analysis (**Figure 3**) further highlights the undulating rises and creek valleys, shown in red.

2.3 Hydrology

2.3.1 Surface Water

The Study Area is located in the Stonequarry Creek Catchment with the relevant natural waterway features comprising Matthews Creek, Cedar Creek, Stonequarry Creek and Redbank Creek, as shown on **Figure 2**. Redbank Creek flows from west to east adjacent to, though outside of, the southern boundary of the Study Area. A topographic ridgeline straddles the Study Area, with the south-east portion of the area discharging via tributaries to Redbank Creek. The south-west portion of the area discharges to Matthews Creek, while the north-northwest portion of the area discharges to Cedar Creek and Stonequarry Creek. A portion of Stonequarry Creek traverses the northern boundary of the Study Area, while Matthews Creek, Cedar Creek and Redbank Creek are located outside of the Study Area.

Matthews Creek and Cedar Creek rise in low hills to the west of the Study Area, with their junction approximately 850 metres west of LW W3. Stonequarry Creek also rises to the west and flows to the east, joining Cedar Creek approximately 370 metres north west of LW W3, before flowing east and south through the town of Picton. Redbank Creek rises to the west and flows into Stonequarry Creek towards the south-east of the Study Area. Redbank Creek is located approximately 600 metres south of the edge of LW W4 at its closest point. Downstream of the confluence with Redbank Creek, Stonequarry Creek continues to flow south-east, joining the Nepean River near Maldon.

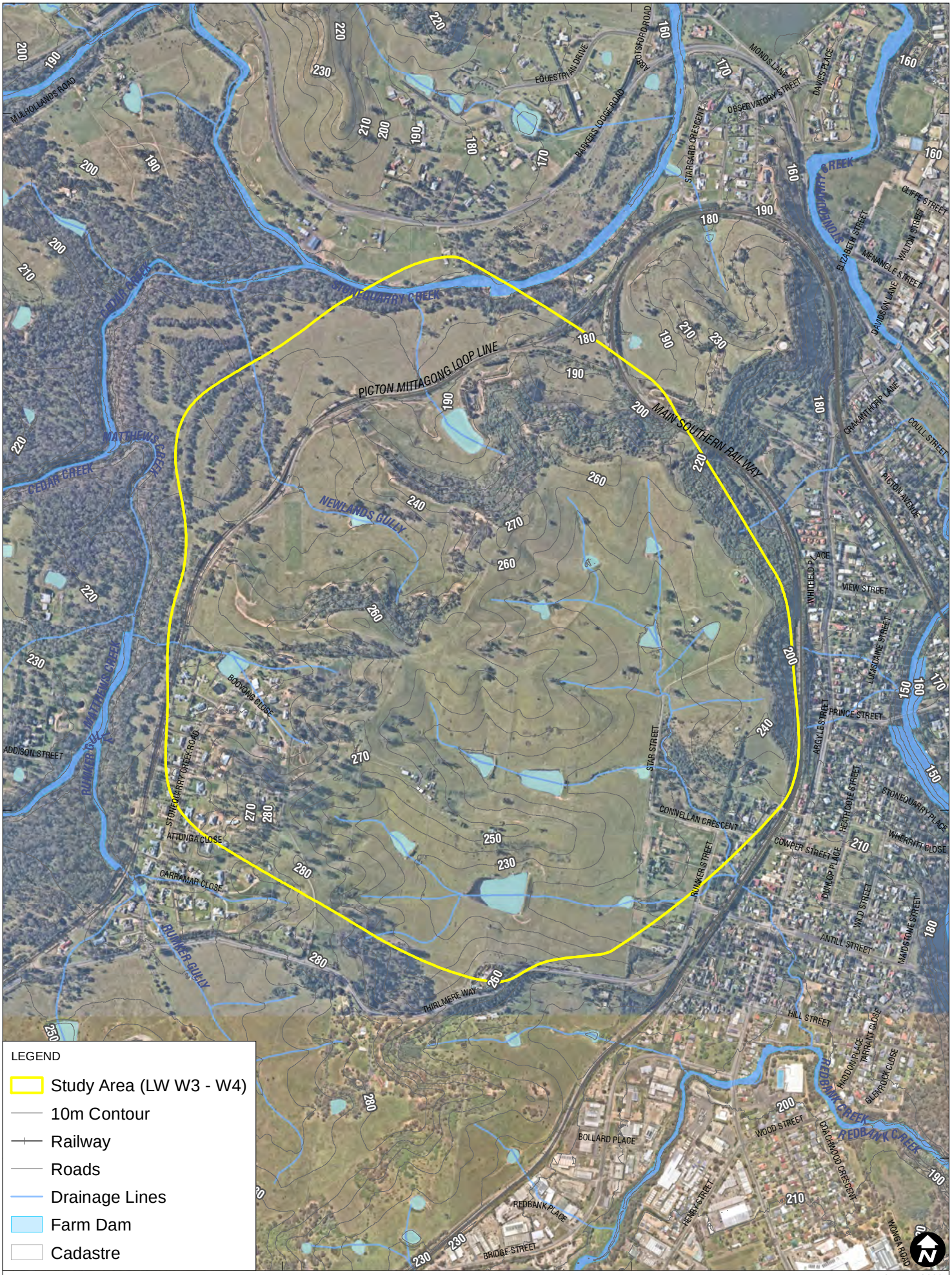
The Nepean River rises in the Great Dividing Range to the west of the Study Area, although its headwaters also lie in the coastal ranges to the east of the Study Area. Flows in the upper reaches of the Nepean River are highly regulated by the Upper Nepean Water Supply Scheme, operated by WaterNSW, which incorporates four major water supply dams on the Cataract, Cordeaux, Avon and Nepean Rivers. Flows in the Nepean River near and downstream of the Study Area are not part of a WaterNSW Drinking Water Catchment Area (HEC, 2021).

Table 2 Drainage Channels

Catchment	Sub Catchment	Associated Watercourses	Flow Direction
Stonequarry Creek Catchment	Nepean River	Matthews Creek	North
		Cedar Creek	North-East
		Stonequarry Creek	East
		Redbank Creek	South-East

2.3.2 Licenced Surface Water Users

A search of the WaterNSW Register for surface water licenses found six properties within the Study Area with a Water Supply Works and Water Use Approval (HEC, 2021).



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Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 21-Dec-2020
Project Number: 630.12732.001

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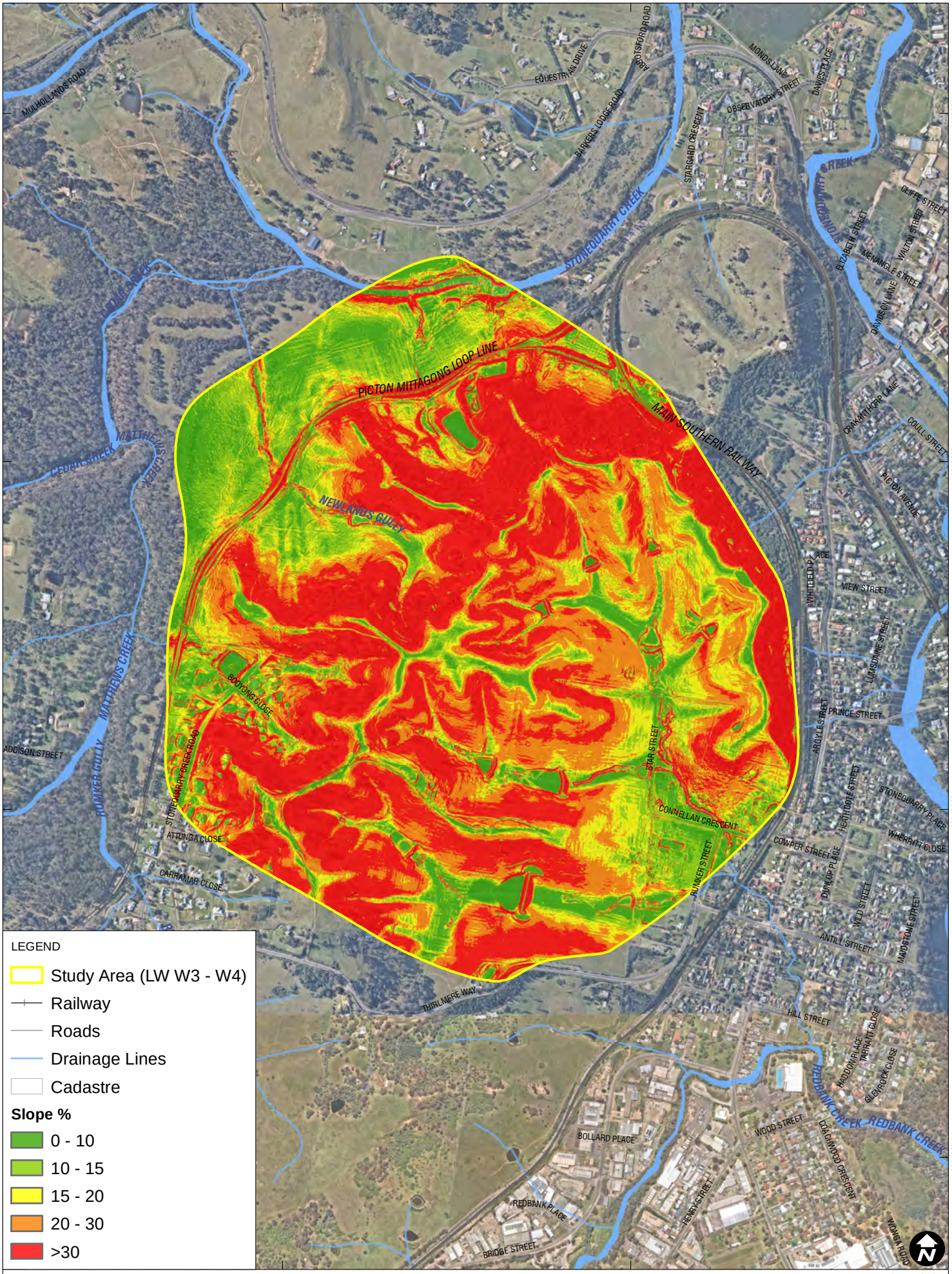
Topography and Hydrology
Tahmoor Extraction Plan
LW W3 W4

FIGURE 2



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Slope Analysis
Tahmoor Extraction Plan
LW W3 W4

FIGURE 3

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.

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. One bores registered by DPIE Water is located within the Study Area (GW104090), with a further eight bores located within the vicinity of the Study Area (**Table 3**). The majority of bores are registered for stock and/or domestic use. Groundwater for these bores is sourced from the Hawkesbury Sandstone Aquifer, with low yields ranging up to 2.67 litres per second (GeoTerra, 2021).

Table 3 Registered Groundwater Users

Identifier	Depth (m)	Yield (L/s)	Purpose	Currently Used	In Study Area
GW24750	11.9	N/A	Stock & Domestic	Bore Collapsed	No
GW35844	45.7	N/A	Irrigation	Not Inspected (property access not obtained)	No
GW64469	91	N/A	Domestic	Not Inspected (property access not obtained)	No
GW72402	72	N/A	Stock & Domestic	Pump Removed	No
GW104090	150.5	N/A	Recreation	Pump Disabled	Yes
GW105228	63	1.82	Stock & Domestic	Pump Installed, bore operational	No
GW105467	120	0.47	Stock & Domestic	Pump Installed, bore operational	No
GW105546	163	1.60	Irrigation	Pump Installed, bore operational	No
GW115860	60	2.28	Domestic	Pump Installed, bore operational	No

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 4**. Six soil landscapes occur in the Study Area and are summarised in **Table 4.**

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

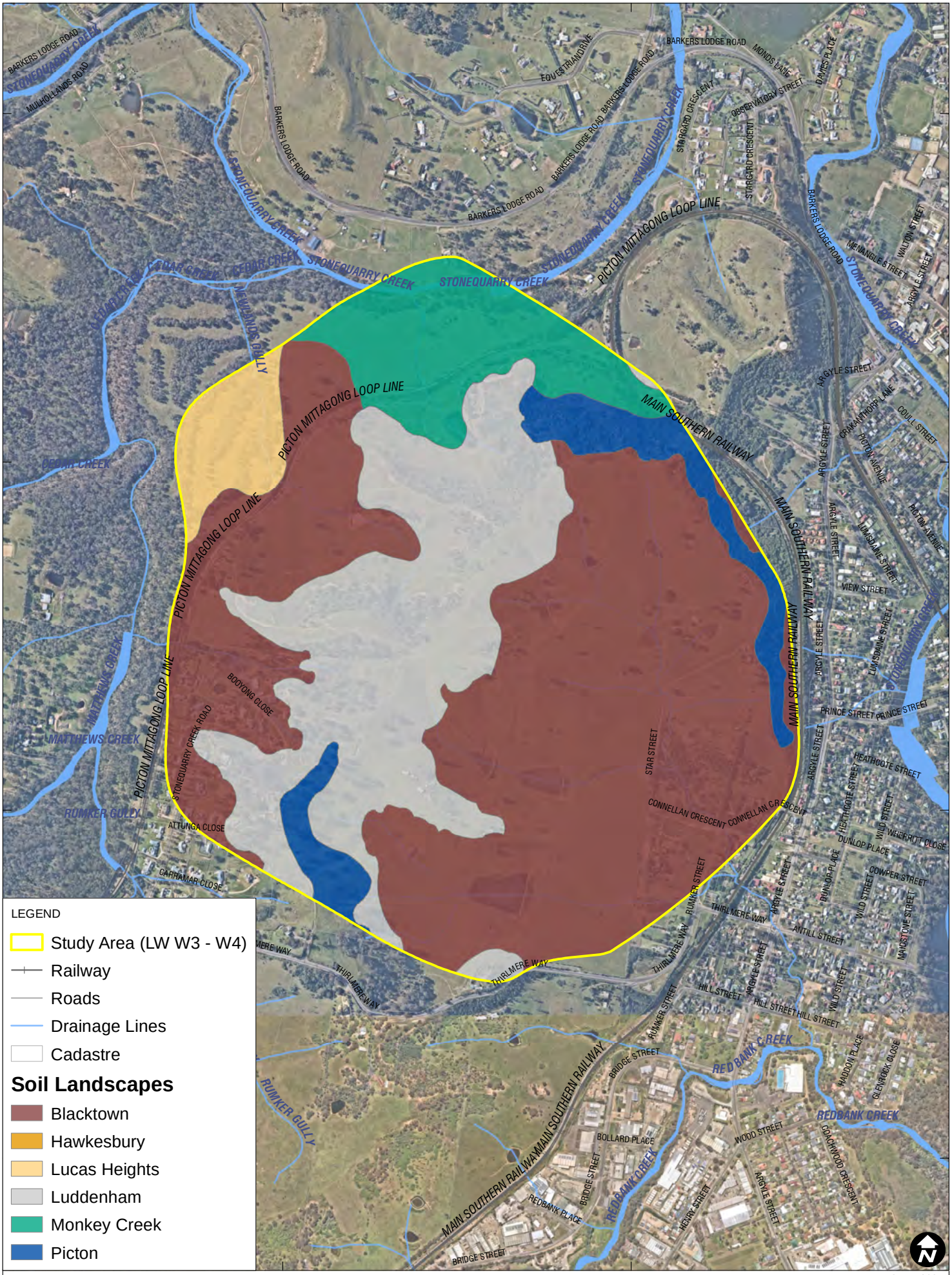
- The majority of the Study Area (90%) is moderately constrained for cultivation:
- The Hawkesbury and Picton SLU are highly to severely constrained for any agricultural enterprises, which covers 6% of the Study Area:
- Agricultural land best suited to grazing enterprises includes the Blacktown, Luddenham, and Monkey Creek SLU which covers 90% of the Study Area: and
- Lucas Heights SLU has moderate limitations for grazing and high limitation for cultivation and covers 4% of the Study Area.

Table 4 Soil Landscape Units

Soil Landscape	Study Area		Agricultural Limitation Rating	
Unit	Hectares	%	Grazing	Cultivation
Hawkesbury	<1	<1	High – Severe	High – Severe
Picton	16	6		
Sub Total	**16**	**6**		
Lucas Height	11	4	Moderate	High
Sub Total	**11**	**4**		
Blacktown	155	55	Low	Moderate
Luddenham	72	25		
Monkey Creek	28	10		
Sub Total	**255**	**90**		
Total	**282**	**100**		

Source: *Soil Landscapes of the Wollongong – Port Hacking 1:100,000 Sheet* (Hazelton & Tille, 1990)

Full descriptions of the six Soil Landscape Units within the Study Area are presented in **Appendix A**.



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Soil Landscape Units
Tahmoor Extraction Plan
LW W3 W4

FIGURE 4

2.6 Dominant Soil Types and Inherent Fertility

The two dominant Australia Soil Classification (ASC) soil types were digitally mapped by the DPIE and are shown on **Figure 5**. Two soil types are present in the Study Area, dominated by Dermosols and Kurosols (**Table 5**). These soil types are summarised in the major points listed below.

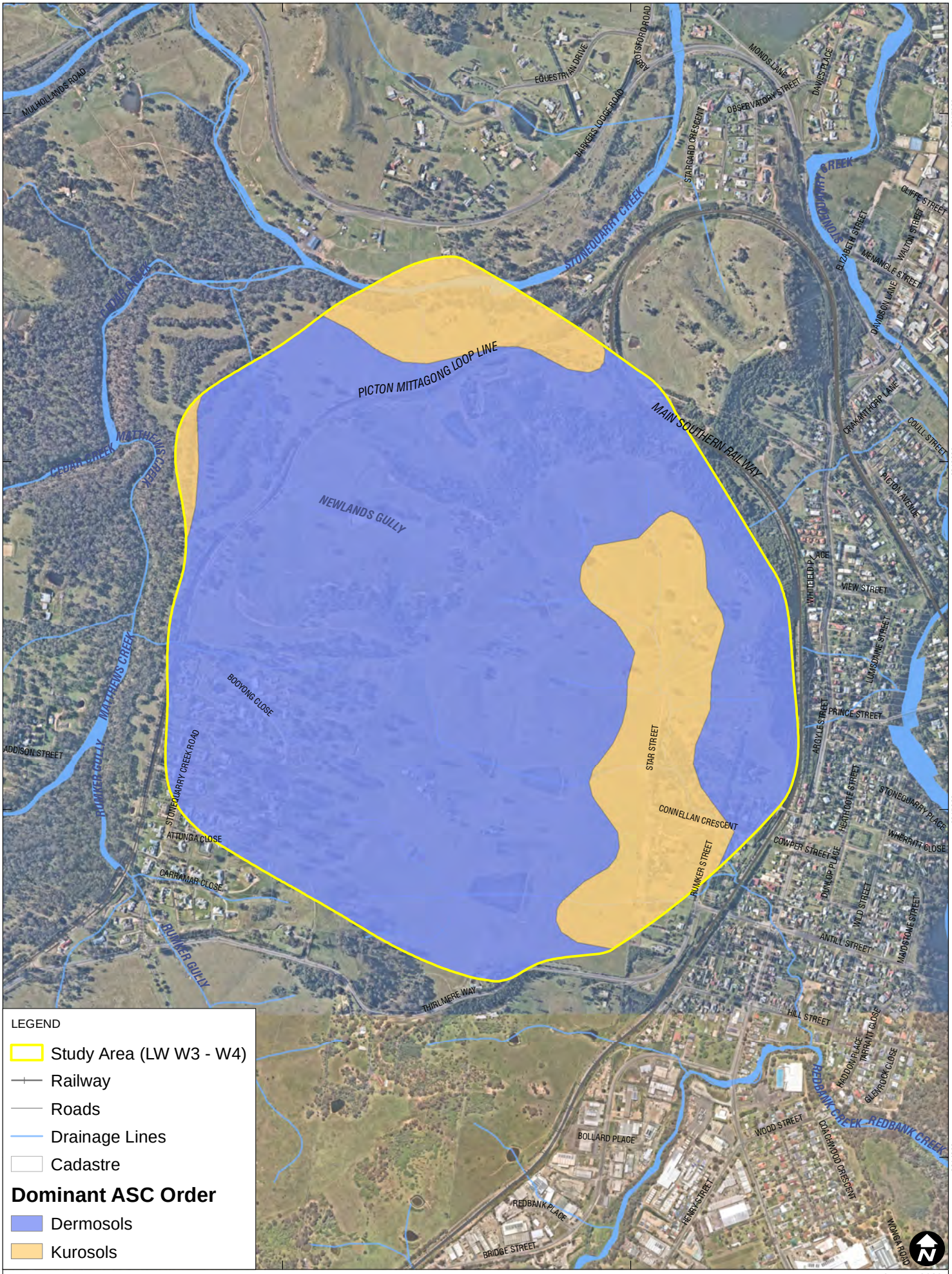
- Dermosols are the major soil type within the Study Area comprising 82% of the total area. Dermosols are soils with structured B horizons which lack strong texture contrast between the A and B horizons. Dermosols generally have moderately high inherent fertility.
- Kurosols are soils with a strong texture contrast between the A horizons and a strongly acidic B horizon. Kurosols generally have moderate inherent low fertility and comprise 18% of the Study Area.

Table 5 Dominant Soil Types and Inherent Fertility

Australian Soil Classification	Inherent Fertility	Hectares	%
Dermosol	Moderately High	230	82
Kurosol	Moderately Low	52	18
	Total	**282**	**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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ASC Soil Units
Tahmoor Extraction Plan
LW W3 W4

FIGURE 5

2.8 Vegetation and Land Use

Review of recent aerial images shows that the majority of the Study Area comprises of cleared pastoral land (approximately 64%) that may be suitable for agricultural enterprise, as shown in **Figure 6**. The remainder is comprised of thick native vegetation along riparian zones and steep slopes, along with small areas used as rural residential land. Site inspections in March 2019 and September 2020 by SLR's Associate Agronomist, in conjunction with a desktop assessment, has shown that small scale cattle and horse grazing of improved along with native grass species such as Kangaroo Grass (*Themeda australis*), Poa Tussock (*Poa labillardierei*), Red Grass (*Bothriochloa* spp.), Paspalum (*Paspalum dilatatum*) and Kikuyu (*Pennisetum clandestinum*) is the dominant agricultural enterprise. A small number of poultry farms, orchards and commercial vegetable gardens also exist within or adjacent to the Study Area. No intensive cropping activities were observed at the time of the inspection and assessment. The various land uses at each inspection site were recorded and are shown on **Figure 6** and described in **Table 6**. Plates for each inspection site are shown in **Appendix B**.

Table 6 Observed Land Uses

2019 Inspection Site	Land Use
4	Rural residential
5	Rural residential
6	Cattle grazing
7	Pleasure horses
8	Ungrazed pasture
10	Pleasure horses
11	Orchards
2020 Inspection Site	**Land Use**
1	Cattle grazing
2	Cattle grazing
3	Cattle grazing
4	Cattle grazing
5	Ungrazed pasture
6	Cattle & pleasure horse grazing
7	Cattle & pleasure horse grazing
8	Cattle & pleasure horse grazing
9	Ungrazed pasture
10	Residential & rural residential
11	Cattle & pleasure horse grazing
12	Cattle & pleasure horse grazing
13	Cattle & pleasure horse grazing
14	Cattle grazing

Grazing within the Study 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 206 hectares of potential grazing land is currently available for agricultural use. As described in correspondence received from the NSW DPI (30 April, 2019) poultry farms are a significant industry in the area, with two located to the west of the Study Area (**Figure 6**). DPI has also identified at least three protected cropping businesses to the south of the Study Area.

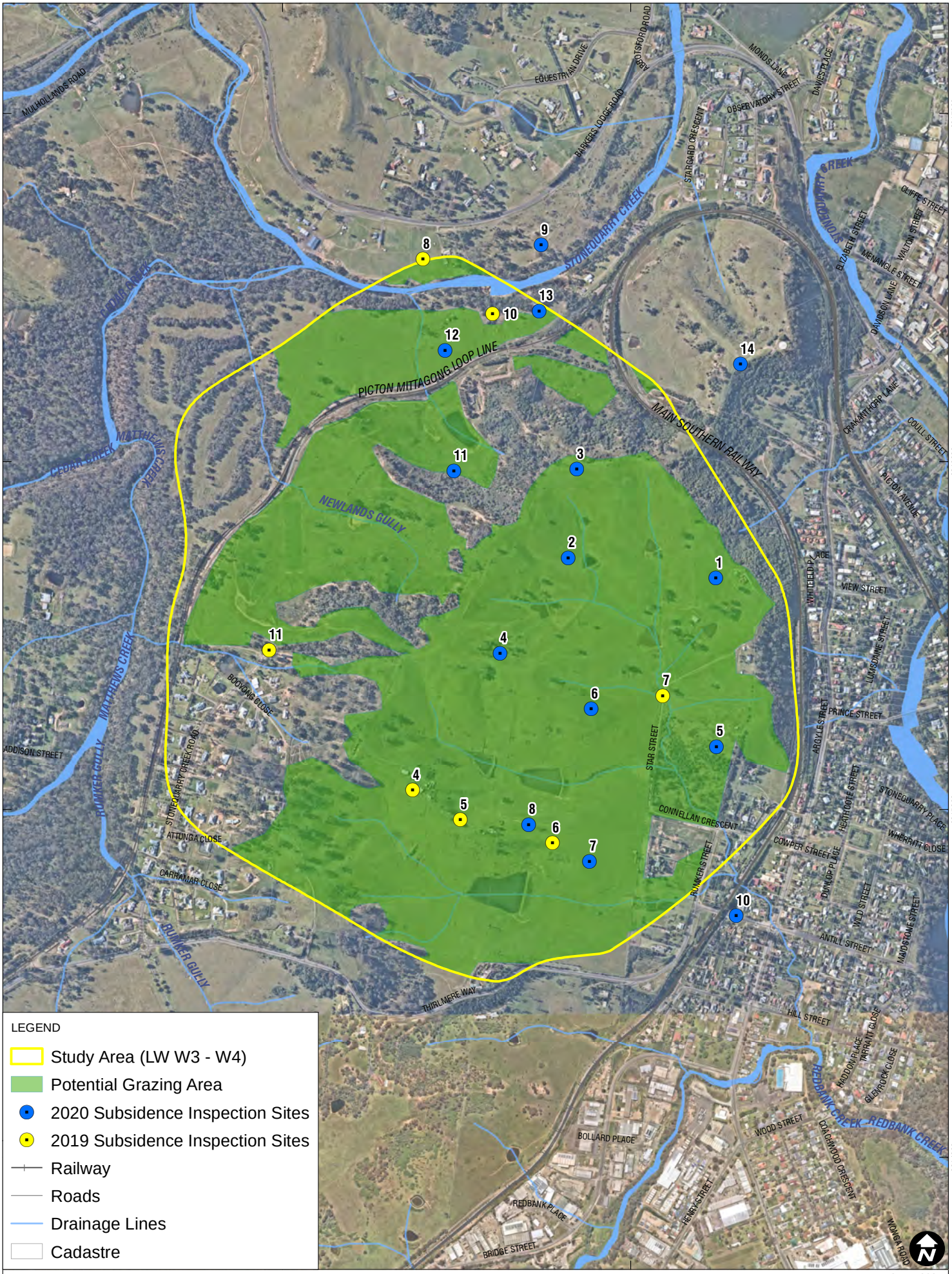
Site inspection revealed no poultry farms or protected cropping businesses in the Study Area.

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** to **Plate 3** shows some of the typical land uses within the area.

Plate 1 Cattle grazing grass pasture area on cleared hills within the Study Area

Plate 2 Grass pasture on rolling hills within the Study Area

Plate 3 Non-agricultural land adjacent to the Study Area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BOTSFORD ROAD
BARKERS LODGE ROAD
STARGARD CRESCENT
OBSERVATORY STREET
MONDS LANE
DAVIES PLACE
STONEQUARRY CREEK
OLIFFE STREET
ELIZABETH STREET
WALTON STREET
MENANGLE STREET
DAVIDSON LANE
CRAKANTHORP LANE
COULL STREET
PICTON AVENUE
PICTON MITTAGONG LOOP LINE
MAIN SOUTHERN RAILWAY
NEWLANDS GULLY
MATTHEWS CREEK
FOUR MILE CREEK
RUMKER GULLY
BOOKONG CLOSE
ADDISON STREET
STONEQUARRY CREEK ROAD
ATTUNGA CLOSE
CARRAMAR CLOSE
THIRLMERE WAY
STAR STREET
WHITFIELD PLACE
VIEW STREET
LUMSDAINE STREET
ARGYLE STREET
PRINCE STREET
HEATHCOTE STREET
STONEQUARRY PLACE
WHERRITT CLOSE
CONNELLAN CRESCENT
COWPER STREET
DUNLOP PLACE
WILD STREET
ANTILL STREET
MAIDSTONE STREET
HILL STREET
TARRANT CLOSE
GLENROCK CLOSE
REDBANK CREEK
WOOD STREET
COACHWOOD CRESCENT
BOLLARD PLACE
REDBANK PLACE
HENRY STREET
BRIDGE STREET
WONGA ROAD
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LEGEND
Study Area (LW W3 - W4)
Potential Grazing Area
2020 Subsidence Inspection Sites
2019 Subsidence Inspection Sites
Railway
Roads
Drainage Lines
Cadastre
0
0.5
1
km
Scale: 1:14,000 at A4
Coordinate System: GDA 1994 MGA Zone 56
Date Drawn: 18-Jan-2021
Project Number: 630.12732.001
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Potential Grazing Area
Tahmoor Extraction Plan
LW W3 W4
FIGURE 6

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 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 7** and their definition has been based on two considerations:

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

Table 7 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 DPIE and is summarised in **Table 8** and shown in **Figure 7**. The limitations associated with each LSC Class are discussed below.

Table 8 Land and Soil Capability Areas

LSC Class	Agricultural Capability Rating	Hectares	%
4	Moderate	40	14
5	Moderately Low	15	5
6	Low	35	13
7	Very Low	192	68
	Total	**282**	**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 14% of the Study Area.

LSC Class 5 Land

Class 5 land is associated with Kurosols and Sodosols. This classification indicates a moderate to low land capability, with severe limitations to high impact land management uses such as cropping. This land is generally more suitable for grazing with some limitations, or very occasional cultivation for pasture establishment. LSC Class 5 land comprises 5% 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 13% of the Study Area.

LSC Class 7 Land

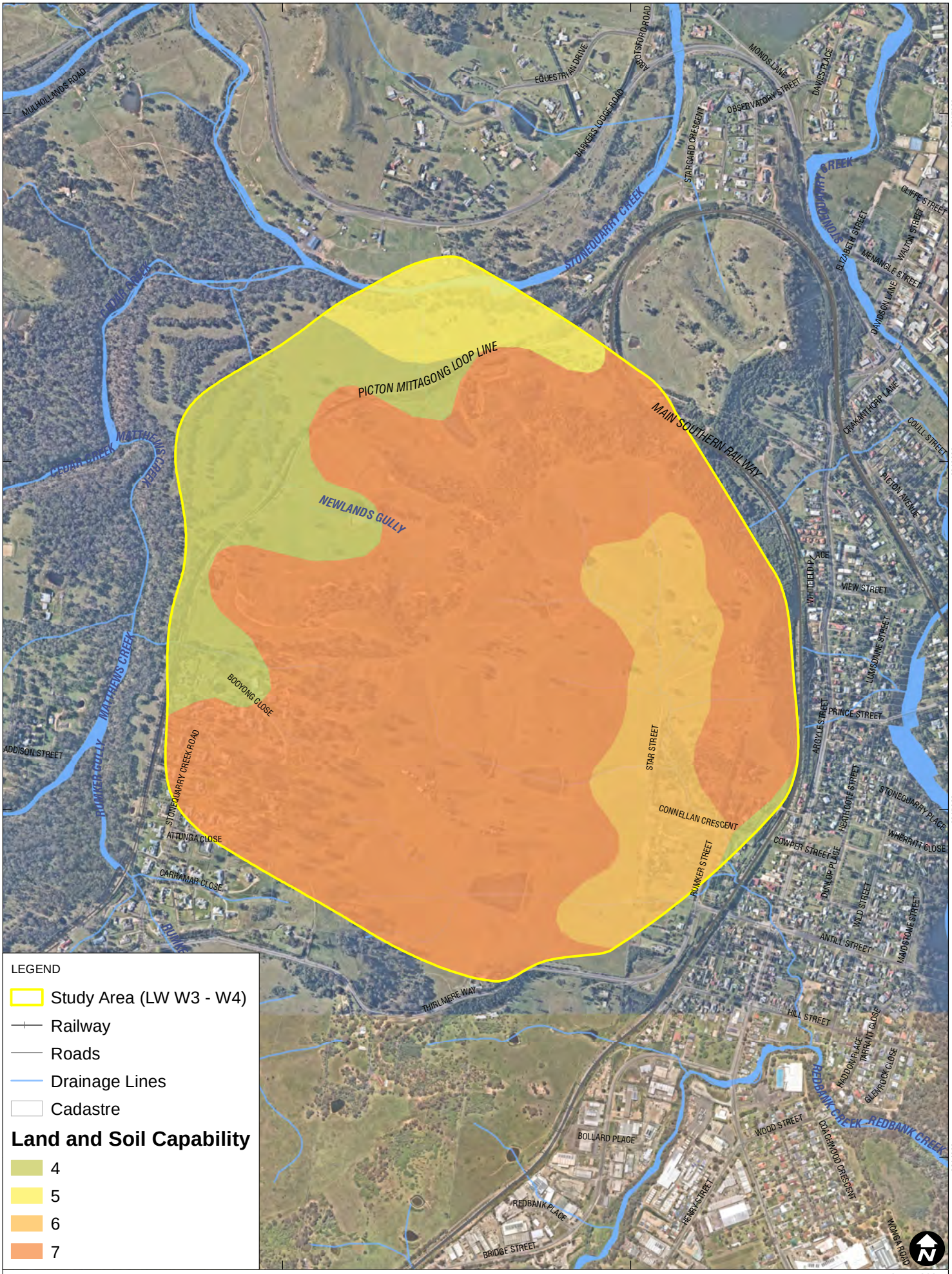
Class 7 land is represented by Dermosols, Rudosols and Tenosols. This classification indicates very low capability land, with severe limitations for most land uses. It is generally unsuitable for any type of cropping or grazing due to its limitations. It covers the major portion of the Study Area (68%).

Within the Study Area, 68% of the land area is considered to have 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.

There is no LSC Class 1, 2 or 3 land within or adjacent to the Study Area. These three LSC Classes are generally considered DPI Agriculture as 'Important Agriculture Land", given their agricultural capability is rated as high (LSC Class 3) to extremely high (LSC Class 1). As such, there will be no impact to "Important Agricultural Land".

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* (DP&I, 2013) is between Douglas Park and Camden, approximately 20 kilometres to the north-east of the Study Area.



Scale: 1:14,000 at A4
Coordinate System: GDA 1994 MGA Zone 56

Date Drawn: 18-Jan-2021
Project Number: 630.12732.001

H:\Projects-SLR\610-SrvSYD\630-NTL\630.12732 Tahmoor Longwals\20201217 New data LW W3 W4\630.12732-F7 Land and Soil Capability01.mxd

SLR

Land ans Soil Capability
Tahmoor Extraction Plan
LW W3 W4

FIGURE 7

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*). The agricultural land use is outlined in **Table 9**. 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; and
- 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 9 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 10.** The regional employment in the agriculture related sectors is shown in **Table 10.** 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; and
- 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 10 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*)

Table 11 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*)

3.3 Regional Agricultural Production Value

Agricultural production values for the Wollondilly LGA totals $61.3 M as detailed in **Table 12.** 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*).

Table 12 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*)

3.4 Potential Agricultural Production Value of the Study Area

Potential agricultural productivity was determined using 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* (NSW Department of Primary Industries, 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 C.**

Table 13 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 5 land has the potential to generate approximately $174 per hectare from beef cattle grazing;
- Class 6 land has the potential to generate approximately $116 per hectare from beef cattle grazing; and
- Class 7 land has the potential to generate approximately $58 per hectare from beef cattle grazing.

Table 13 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
5	6	0.36	$216	$42	$174
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 13**), the Study Area has the capacity to generate an estimated gross margin of $26,886 per annum (**Table 14**). 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 14 Annual Gross Margins per LSC Class

LSC	Gross Margin	Study Area	
Class	Per Hectare	Hectares	Gross Margin
4	$227	40	$9,080
5	$174	15	$2,610
6	$116	35	$4,060
7	$58	192	$11,136
	Total	**282**	**$26,886**

It is expected that income generated from agricultural enterprises within the Study Area would be minimal due to the small area (191 hectares) available for actual agricultural production (**Figure 6**). The majority of this cleared area is LSC Class 7 and using the gross margin information presented in **Table 14**, 191 hectares of LSC Class 7 land has a potential gross margin of $11,078 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 55 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 (2021) predicts maximum vertical subsidence over LW W3 to be 950 millimetres and for LW W4 to be 1,025 millimetres. Maximum predicted tilt for both longwalls is 5 millimetres per metre which is very small when compared to the natural surface grades of steep slopes within the Study Area. However, steep slopes are likely affected by curvature and strain that result in tension cracks appearing at the tops and sides of steep slopes with compression ridges forming at the bottom of the steep slopes (MSEC, 2021).

4.1 Land Resources

Within the Study Area, 68% of the land area is considered to have very low agricultural capability, whilst the remainder has moderate to moderately low agricultural capability. There is no LSC Class 1, 2 or 3 land within or adjacent to the Study Area. These three LSC Classes are generally considered by DPI Agriculture as 'Important Agriculture Land", given their agricultural capability is rated as high (LSC Class 3) to extremely high (LSC Class 1). As such, there will be no impact to "Important Agricultural Land" as a result of the extraction of LW W3-W4.

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 landscape (HEC, 2021). Therefore, there is no land which will be temporarily removed from agriculture as a result of LW W3-W4.

4.1.2 Land Permanently Removed From Agriculture

There is no land which will be permanently removed from agriculture as a result of the extraction of LW W3-W4.

4.1.3 Impact on Biophysical Strategic Agricultural Land

There is no Biophysical Strategic Agricultural Land within the Study Area. LW W3-W4 will not impact any Biophysical Strategic Agricultural Land.

4.1.4 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 W3-W4 will not impact upon Acid Sulfate Soils.

4.2 Water Resources

4.2.1 Surface Water

The Matthews Creek, Cedar Creek and Stonequarry Creek system is partly located within the Study Area. The proposed extraction of LW W3-W4 is predicted to result in minor additional increases in subsidence, valley closure and upsidence along Matthews and Cedar Creeks. This is in addition to movements that will have occurred previously due to the extraction of LW W1 (completed) and LW W2 (currently being extracted) (MSEC, 2021).

The majority of the movements for these creeks are predicted to occur during the mining of LW W1-W2. The predicted maximum additional movements due to the extraction of LW W3-W4 represent approximately 10 to 15% of the total maximum predicted movements due to LW W1-W4 (MSEC, 2021).

Should impacts develop within these creeks during the extraction of LW W1-W2, it is likely that further impacts will be experienced during the mining of LW W3. At the time of MSEC reporting, gas bubbles were observed in Pool MR45 in Matthews Creek between February and June 2020. If the gas bubbles were discharged due to mine subsidence movements, it is likely that further emissions will occur during the mining of LW W2 and further emissions could possibly occur during the mining of LW W3. No reduction in pool water levels have been observed during the mining of LW W1, taking into account variations due to rainfall and temperature (MSEC, 2021).

The proposed extraction of LW W3-W4 is predicted to result in minor additional increases in subsidence, valley closure and upsidence along Stonequarry Creek. The predicted movements are in addition to movements that will have occurred previously due to the extraction of LW W1 (completed) and LW W2 (currently being extracted) (MSEC, 2021).

Cedar Creek and Stonequarry Creek are predicted to experience 70 millimetre maximum vertical subsidence after mining LW W3-W4, while Matthews Creek is predicted to experience 100 millimetre maximum vertical subsidence. Matthews Creek and Cedar Creek are predicted to experience maximum total valley-related closure of 200 millimetre after mining LW W3-W4, while Stonequarry Creek is predicted to experience 80 millimetre maximum total valley-related closure. The majority of the predicted movements along Matthews Creek and Cedar Creek are expected to occur due to extraction of LW W1-W2 (MSEC, 2021).

Regarding flooding and inundation, WRM (2020) found that flows are generally contained within the channels of Matthews Creek, Cedar Creek and Stonequarry Creek within the Study Area. The crest of Barkers Lodge Road may be overtopped during a Probable Maximum Flood (PMF) event. The subsidence resulting from the mining of the proposed LW W1-W4 will results in a negligible change in flood levels, flow velocities and flood extent within the catchment area.

Gas emissions from the sandstone strata have been previously observed above and adjacent to mining areas in the Southern Coalfield, and some gas emissions have also been observed in water bores. Analyses of gas compositions indicate that the Bulli Seam is not the direct and major source of the gas and that the most likely source is the Hawkesbury Sandstone (MSEC, 2021).

Prior to the extraction of LW W1, all recorded examples of gas emissions have occurred in collieries located to the east and to the north-east of Tahmoor Mine. No gas emissions or consequential changes in water quality have been reported over Tahmoor Mine in the Bargo River, Redbank Creek or Myrtle Creek (MSEC, 2021).

4.2.2 Groundwater

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

The potential and available drawdowns for all private bores within the vicinity of LW W3-W4 are shown in **Table 15**. Based on observation of bores within the LW W3-W4 Study Area, the potential drawdown due to subsidence of private bores directly over the proposed workings may extend to 15 metres, however those not over the proposed workings may experience less than 5 metres, or have no impact, depending on the separation distance from the mine working to a particular bore. Based on a combination of site measurements and standing water levels, bore yields and recorded bore depths, all of the private bores have sufficient available drawdown and their pumps, where installed, are not anticipated to run dry (Geoterra, 2021).

Table 15 Predicted Impacts to Private Bores (SLR, 2021)

Identifier	Bore Use	Condition	Maximum Incremental Drawdown (m)	Maximum Cumulative Drawdown (m)	Available Drawdown (m)
GW24750	Stock & Domestic	Not Inspected	0	6.9	
GW35844	Irrigation	Not Inspected	0	0.2	21.4
GW64469	Domestic	Not Inspected	0	0.2	N/A
GW72402	Stock & Domestic	Pump Removed	0	3.1	59.8
GW104090	Recreation	Pump Disabled	7.5	30.8	111.5
GW105228	Stock & Domestic	Pump Installed	0	4.1	40.0
GW105467	Stock & Domestic	Pump Installed	0	5.6	88.0
GW105546	Irrigation	Pump Installed	0.9	12.8	131.11

One recreation bore (GW104090) will have a maximum incremental drawdown of greater than the Level 1 minimal impact considerations for the NSW AI Policy, of greater than two metres (highlighted in red). No bores with a registered agricultural use are predicted to have maximum incremental drawdown of greater than two metres (SLR, 2021).

4.2.3 Water Reallocation

Tahmoor Coal 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 are six properties within the Study Area with a Water Supply Works and Water Use Approval. For the surface water systems in which pumping would occur, MSEC (2021) has predicted that less than 10% of pools are likely to experience fracturing and associated reduction in standing water level (refer **Section 4.4.2**). As such, while minor impacts to water supply may occur, the potential impacts to water supply should be manageable through implementation of monitoring, mitigation and management measures (refer **Section 5**) and through contingency planning (HEC, 2021).

There will be minor impact on agricultural users through water reallocation.

4.2.4 Water Resource Impacts on Agricultural Productivity

Given the very limited impacts described previously, longwall subsidence will result in minor impacts on water resources relied upon by agricultural enterprises and will not result in any impact on agricultural productivity.

4.3 Impact on Agricultural Resources from Biodiversity Offsets

The extraction of LW W3-W4 is not expected to result in the establishment of any 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 by SLR's Associate 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 W3-W4 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 in the local area upon which agricultural enterprises are reliant. Therefore, LW W3 –W4 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 W3-W4 through vehicle movements on and off site. Weeds are currently managed within the frameworks of the Tahmoor 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 W3 –W4 has negligible risk to the biosecurity of agricultural resources and enterprises within the region.

4.4.4 Air Quality

The extraction of LW W3-W4 involves the extraction of two underground longwall panels and as such there will be no impact to air quality resulting from LW W3-W4.

4.4.5 Noise

The extraction of LW W3-W4 involves the extraction of two underground longwall panels and as such there will be no impacts to agricultural production from noise generated during the extraction of LW W3-W4.

4.4.6 Blasting

The extraction of LW W3-W4 does not involve any blasting on the surface and as such there will be no impact to agricultural resources from blasting.

4.4.7 Traffic

The extraction of LW W3-W4 involves the extraction of two 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.

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 W3-W4 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, 2021).

4.4.9 Tanks

There are water, gas and fuel storage tanks on some of the properties within the Study Area.

The tanks themselves 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, 2021).

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 are expected to be of minor nature and easily repaired (MSEC, 2021).

4.4.11 Farm Dams

A total of 20 medium to large sized dams are located within or adjacent to the Study Area for LW W3 and LW W4, of which, six dams are directly overlying LW W3 and LW W4. Note that FD-5 appears to be a detention basin within the Stonequarry Creek Estate. FD-9 to FD-11 were previously assessed for LW W1 – W2 (HEC, 2020), however, are outside the Study Area of LW W3 – W4 and have therefore not been included in this assessment.

Table 16 provides predictions of subsidence related impacts to these dams and the detention basin as summarised from MSEC (2021).

Table 16 Subsidence Predictions for Dams

Dam*	Predicted Total Subsidence after LW W3 (mm)	Predicted Total Subsidence after LW W4 (mm)	Predicted Total Tilt after LW W3 (mm/m)	Predicted Total Tilt after LW W4 (mm/m)	Predicted Change in Freeboard after LW W3 (mm)	Predicted Change in Freeboard after LW W4 (mm)
FD-1	150	200	1.5	2	<0 5	<0 5
FD-2	300	350	3	3.5	<0 5	<0 5
FD-3	425	775	4.5	3.5	150	300
FD-4	700	975	5	3.5	<0 5	<0 5
FD-5	675	700	4	4	150	150
FD-6	950	975	2.5	2.5	<0 5	<0 5
FD-7	725	775	5	5	50	50
FD-8	200	675	1.5	1.5	<0 5	<0 5
FD-12	700	750	4.5	5	150	150
FD-13	40	250	< 0.5	2.5	<0 5	<0 5
FD-14	50	375	< 0.5	4.5	<0 5	100

Dam*	Predicted Total Subsidence after LW W3 (mm)	Predicted Total Subsidence after LW W4 (mm)	Predicted Total Tilt after LW W3 (mm/m)	Predicted Total Tilt after LW W4 (mm/m)	Predicted Change in Freeboard after LW W3 (mm)	Predicted Change in Freeboard after LW W4 (mm)
FD-15	40	100	< 0.5	1	<0 5	<0 5
FD-16	80	500	< 0.5	3.5	<0 5	50
FD-17	< 20	80	< 0.5	< 0.5	<0 5	<0 5
FD-18	< 20	60	< 0.5	< 0.5	<0 5	<0 5
FD-19	< 20	< 20	< 0.5	< 0.5	<0 5	<0 5
FD-20	60	70	0.5	0.5	<0 5	<0 5

*FD-9 to FD-11 were previously assessed for LW W1 – W2, however, are outside the Study Area of LW W3 – W4 and have therefore not been included in this assessment.

4.4.12 Groundwater Wells and Bores

Temporary lowering of the regional piezometric surface over the subsidence area due to extraction of LW W3-W4 may occur, with impacts more notable directly over extracted panels. Groundwater levels may reduce up to 20 metres at GW104090, which is located directly over LW W2. All other private bores are not anticipated to experience adverse impacts to bore yield or serviceability (Geoterra, 2021).

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 (GeoTerra, 2021).

4.4.13 Impact on State Forest

There are no State forests or conservation areas present within the Study Area. The extraction of LW W3-W4 is not expected to impact the State Forest.

4.4.14 Cumulative Impacts

No further cumulative impacts have been identified within the various specialist impact assessments; therefore, it is anticipated there will be negligible cumulative impacts to agricultural resources as a result of the extraction of LW W3-W4.

4.5 Agricultural Regional Community Impacts

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

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 W3-W4, 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 W3-W4.

5.2 Groundwater Resources

All currently operating private bores are predicted to be impacted by a maximum incremental drawdown of greater than two metres. Tahmoor Coal have committed to “make good” provisions for any groundwater users shown to be adversely affected by mine operations and associated impacts.

5.3 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*.

5.4 Farm Fencing

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

5.5 Farm Dams

Tahmoor Coal have an extensive dam monitoring program recommended and carried out by geotechnical engineers from Douglas Partners. All farm dams in the study area are monitored by competent persons prior to, during and after mining to ensure safety and serviceability. 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 alternative water source until the completion of repairs in accordance with the *Coal Mine Subsidence Compensation Act 2017.*

5.6 Surface Water Extraction

The potential impact on streamflow would be mitigated by Tahmoor Coal purchasing sufficient water licences (WALs) for licensable surface water 'take' within the Stonequarry Creek Management Zone of the Upper Nepean and Upstream Warragamba Water Source. A median baseflow reduction of 51 ML/annum and a maximum baseflow reduction of 155 ML/annum are predicted for Stonequarry Creek at Picton due to mining of LW W3 – W4. A total of 680.3 share components (680.3 ML) is currently allocated as unregulated river access licences from the Stonequarry Creek Management Zone (WaterNSW, 2021). The median predicted reduction of 51 ML/annum equates to 7.5% of the total issued share component of the Stonequarry Creek Management Zone for unregulated river access while the maximum predicted reduction of 155 ML/annum equates to 22.8% of the total issued share component (HEC, 2021).

Although there may be some temporary loss of flow (diversion) from the surface water systems in the event of fracturing or dilation, connectivity between the groundwater and surface water systems is not predicted to occur (SLR, 2021). As such, the estimated baseflow reduction for Stonequarry Creek at Picton associated with mining influences is highly conservative as a portion of the diverted flow is likely to re-emerge further downstream in the event of fracturing and / or dilation.

6 Monitoring & Consultation

6.1 Agricultural Land Monitoring

Comprehensive monitoring of all potentially impacted properties within the LW W1-W2 Study Area is undertaken from the commencement of extraction, and continues monthly until extraction is completed. Further monitoring is undertaken quarterly for 12 months post-extraction, as detailed in the *Tahmoor Coal Pty Ltd Subsidence Monitoring Program Tahmoor North Western Domain Longwalls West 1 and West 2* (Tahmoor Coal, 2020).

The Tahmoor Coal LW W1–W2 Agricultural Inspection Reports show no impacts to agricultural resources or enterprises have been observed during the extraction of LW W1. These inspections are based on baseline reporting undertaken by SLR prior to the commencement of extraction. An example of the Tahmoor Coal LW W1–W2 Agricultural Inspection Report is given in **Appendix D**. The monitoring regime has enabled Tahmoor Coal to effectively monitor agricultural land during LW W1.

Similar monitoring of agricultural land will be completed for all potentially impacted properties within the LW W3-W4 Study Area, and will be document in the LW W3-W4 Extraction Plan (specifically the Land Management Plan and Subsidence Monitoring Program documents).

6.2 Community 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. This consultation was completed on 15 September 2020 and included an overview of the proposal, likely subsidence impacts, and information about the services offered by Tahmoor Coal (Pre-Mining Inspections and Hazard Identification), and the subsidence claims process under the *Coal Mine Subsidence Compensation Act 2017*.

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.

6.3 Government Agency Consultation

During the preparation of the LW W3-W4 Extraction Plan, Tahmoor Coal sent a letter of consultation to DPI Agriculture. A letter response was received, dated 7 October 2020, which provided a list of inclusions that are a guide for the development of this Land and Agricultural Resource Assessment. This list of inclusions is replicated in **Table 18** below, along with a response regarding how this inclusion has been covered by this report.

Table 18 DPI Agriculture Consultation Summary

DPI Agriculture List of Inclusions	Response
Describe the current *Important Agriculture Land* on the proposed development site and surrounding locality including the land capability, and soil landscapes. We note that the site verification is previous work indicates no presence of biophysical strategic agricultural land. This work provides a baseline evaluation of the current land resource for any impact assessment.	Section 2.9 Section 4.1 There is no *Important Agricultural Land* within or adjacent to the Study Area.
A description of the agricultural land uses in the area and associated enterprises and agricultural productivity of these again to provide a current status of agriculture in the area.	Section 3
Detail the expected life span of the proposed development.	Section 1 Extraction of LW W4 is estimated to be completed by approximately August 2022, and visual monitoring of agricultural land will continue for 12 months following active subsidence (estimated August 2023).
Consider possible cumulative effects to agricultural enterprises and landholders from subsidence / other impacting events.	Section 4.4.15 Cumulative effects are anticipated to be negligible.
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, water supply infrastructure. (This may overlap with the other informing plans).	Section 6.1 Impacts to agricultural resources is undertaken as part of the *Tahmoor Coal Pty Ltd Subsidence Monitoring Program Tahmoor North Western Domain Longwalls West 1 and West 2*.
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.	Section 6.2 In accordance with Condition 15(ii) of DA 67/98, Tahmoor Coal have notified relevant landowners / occupiers within the 20 millimetre subsidence area and 35^{o} angle of draw of the intention to extract LW W3-W4. This consultation was completed on 15 September 2020 and included an overview of the proposal, likely subsidence impacts, and information about the services offered by Tahmoor Coal (Pre-Mining Inspections and Hazard Identification), and the subsidence claims process under the *Coal Mine Subsidence Compensation Act 2017*.
Establish a complaints register that includes reporting and investigating procedures and timelines, and liaison with local government in relation to complaint issues involving agriculture.	Section 6.2 Tahmoor Coal has an established compliance register, Cority, into which complaints are registered and tracking of consequent investigative actions. In addition, Tahmoor Coal records all correspondence with landowners in Consultation Manager.

7 Findings

This Land and Agricultural Resource Assessment has been prepared to be included in Tahmoor Coal's Extraction Plan LW W3-W4. The purpose of this Land and Agricultural Resource Assessment is to assess and report on the potential impacts agricultural resources within and the Study Area and recommend mitigation measures to alleviate any identified impacts. The key findings are listed below:

- The majority of agricultural land use 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 64% of the Study Area;
- 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 one stock and domestic bore. Any 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; and
- 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 W3-W4 will provide considerable economic benefits to the region whilst having negligible impact on agricultural resources, enterprises or related industries.

8 References

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WRM (2020) *Tahmoor Coal Matthews Creek Flood Impact Study for LW W1-W4*

Appendix A

Soil Landscape Unit Descriptions

Blacktown Soil Landscape

The Blacktown Soil Landscape Unit consists of gently undulating rises, broad rounded crests and ridges, with slopes less than 5%, but occasionally up to 10% and local relief is up to 30 metres. It occurs on the Wianamatta Group geological unit, which is predominately comprised of shale. Vegetation is almost completely cleared eucalypt woodland, open-forest and tall open-forest. Soils are dominated by shallow to moderately deep Chromosols on crests, upper slopes and well drained areas; deep Dermosols occur on lower slopes and in drainage depressions.

Limitations of this unit include moderately reactive soil, low fertility and seasonal waterlogging. The Soil Landscape unit is suitable for cropping (requiring intensive management practices) and grazing. Much of the Blacktown Soil Landscape Unit has been urbanised or under rural residential development.

This soil landscape dominates the potential grazing areas and occurs over 170 hectares (53%) of the Study Area.

Luddenham Soil Landscape Unit

The Luddenham Soil Landscape Unit consists of undulating to rolling low hills, with slopes 5-20% and local relief is 50-80 metres. It occurs on the Wianamatta Group shales and often associated with Minchinbury Sandstone. Vegetation has been extensively cleared, consisting of open-forest. Soils are dominated by shallow Dermosols on crests; moderately deep Dermosols on upper and lower slopes and near drainage lines.

Limitations of this unit include erosion hazard, mass movement potential and moderate surface swelling potential. This soil landscape unit is suited to grazing enterprises.

This soil landscape occurs throughout 78 hectares (24%) of the Study Area.

Monkey Creek Soil Landscape Unit

The Monkey Creek Soil Landscape Unit consists of floodplains, valley flats and drainage depressions of the creeks draining the Cumberland Plain. Slopes are generally 1-2% but can locally range to up to 10%, local relief is less than 5 metres. Vegetation has been extensively cleared with isolated stands of river oaks. Dominant soils include Sodosols and Kurosols on floodplains and valley floors, with alluvial soils and Hydrosols and Rudosols on poorly drained depressions and close to recent flow lines.

Limitations of this soil landscape include flood hazards, permanently high watertable and seasonal waterlogging. This soil landscape is capable of both grazing and regular cultivation.

This soil landscape occurs throughout 44 hectares (14%) of the Study Area.

Picton Soil Landscape Unit

The Picton Soil Landscape Unit consists of steep to very steep sideslopes, with slopes greater than 20% and local relief of 90-300 metres. It occurs on Wianamatta group shales and derived colluvial materials. Vegetation consists of extensively cleared tall open-forest of blue gum and blackbutt. Dominant soils are shallow to deep Dermosols on upper slopes and Kurosols on lower slopes and benches.

Limitations of this soil landscape unit include steep slopes, mass movement hazards, seasonal waterlogging and water erosion hazards. This soil landscape is not suitable for any agricultural enterprise.

This soil landscape occurs throughout 19 hectares (6%) of the Study Area.

Lucas Heights

The Lucas Heights Soil Landscape Unit consists of gently undulating crests, ridges and plateau surfaces, with slopes less than 10% and local relief is 10-50 metres. It occurs on the Mittagong Formation geological unit consisting of shale, laminite and quartz sandstone. Vegetation is extensively to completely cleared dry sclerophyll low open-forest and low woodland. Soils are dominated by moderately deep hard setting Kurosols on ridges and plateaus with Kurosols on crests, Kandosols on shoulders of plateaus and ridges and Tenosols on valley flats.

Limitations of this unit include stoniness, low fertility and land surface movement potential. The soil landscape is predominantly suited to grazing enterprises.

This soil landscape occurs throughout 11 hectares (3%) of the Study Area.

Hawkesbury Soil Landscape Unit

The Hawkesbury Soil Landscape Unit covers rugged, rolling to very steep hills, with slopes greater than 25% and local relief of 100-200 metres. It occurs on the Hawkesbury Sandstone geological unit consisting of sandstone and some shale and laminate. Vegetation consists of mostly uncleared eucalypt woodland, open-forest (dry sclerophyll forest) and tall open forest (wet sclerophyll forest). Soils are dominated by shallow Tenosols and Rudosols associated with rock outcrops; Tenosols and Kandosols and locally deep sands occur on the inside of benches and along joints and factures. Kurosols are present on shale lenses with Tenosols on valley flats.

Limitations of this soil landscape unit include extreme soil erosion hazard, mass movement (rock fall) hazard, steep slopes, rock outcrop and shallow, stony, highly permeable soils of very low fertility. The Hawkesbury unit is not suitable for any agricultural enterprise.

This soil landscape occurs over less than 1 hectare (<1%) of the Study Area.

Appendix B

Site Inspection Plates

2019 Site Inspection Photos

Site 4 – Rural residential

Site 5 – Rural residential

Site 6 – Cattle grazing

Site 7 – Pleasure horses

Site 8 – Ungrazed pasture

Site 10 – Pleasure horses

Site 11 – Orchards

2020 Site Inspection Photos

Site 1 – Cattle grazing

Site 2 – Cattle grazing

Site 3 – Cattle grazing

Site 4 – Cattle grazing

Site 5 – Ungrazed pasture

Site 6 – Cattle & please horse grazing

Site 7 – Cattle & please horse grazing

Site 8 – Cattle & please horse grazing

Site 9 – Ungrazed pasture

Site 10 – Residential & rural residential

Site 11 – Cattle & please horse grazing

Site 12 – Cattle & please horse grazing

Site 13 – Cattle & please horse grazing

Site 14 – Looking west towards cattle grazing paddocks

Appendix C

Agricultural Productivity Gross Margin Data

NSW GOVERNMENT | 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

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 D

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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