Centennial Coal

Agricultural Impact Statement

Springvale Mine

Springvale Mine Extension Project

Springvale Coal Pty Ltd

FINAL DRAFT

October 2013

CCC15-012

SLR

GSS Environmental a Division of SLR Consulting Australia Pty Ltd (ABN 29 001 584 612) Effective 3 November 2012

GSS ENVIRONMENTAL

Environmental, Land and Project Management Consultants

Springvale Mine Extension Project

Agricultural Impact Statement

Prepared for Springvale Coal Pty Ltd

Date of Issue October 2013

SLR Ref CCC15-012

ISSUE AND AMENDMENT CONTROL HISTORY

Issue	Date	Description	Authors	QA/QC
1	28/06/13	Draft 1	MF	AC
2	31/10/13	Final Draft	MF	AC

Distribution List

Master: SLR

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AIS	Agricultural Impact Statement
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
DGRs	Director-General's Requirements
DP&I	NSW Department of Planning and Infrastructure
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
I&I	NSW Industry and Investment
ha	hectare
km	kilometre
LCC	Lithgow City Council
LDP	Licenced Discharge Point
LGA	Local Government Area
LSC	Land and Soil Classification
m	metre
M	million
ML	mega litre
mm	millimetre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
Mtpa	Million tonne per annum
N/A	not applicable
NOW	NSW Office of Water
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
$PM_{2.5}$	particular matter with an equivalent aerodynamic diameter of 2.5 microns or less
PM_{10}	particular matter with an equivalent aerodynamic diameter of 10 microns or less
Policy, the	*Strategic Regional Land use Policy*
Project, the	Springvale Mine Extension Project
RFS	Rural Fire Service
SAL	Strategic Agricultural Land

SDWTS	Springvale Delta Water Transfer Scheme
SRLUP	Strategic Regional Land Use Plan
t	tonne
TSP	total suspended particulate matter
µS/cm	micro Siemens per centimetre
°C	degrees Celsius

1 INTRODUCTION

SLR (formerly GSS Environmental) has been engaged by Springvale Coal Pty Ltd (Springvale Coal) to prepare an Agricultural Impact Statement (AIS) for the Springvale Mine Extension Project (the Project). This AIS is intended to form part of the Environmental Impact Statement (EIS) to be submitted to the New South Wales Department of Planning and Infrastructure (DP&I) as part of the application for development consent the Project under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 Project Overview

Springvale Mine is owned by Centennial Springvale Pty Limited (as to 50%) and Springvale SK Kores Pty Limited (as to 50%) as participants in the Springvale unincorporated joint venture. The Springvale Mine is operated by Springvale Coal Pty Limited (Springvale Coal), for and on behalf of the Springvale joint venture participants.

Springvale Mine (Springvale) is an existing underground coal mine regionally located 15 kilometres (km) northwest of Lithgow, as shown in **Figure 1.1**. Springvale's initial Development Consent (DA 11/92) was granted in July 1992, pursuant to Section 101 under Part 4 of the EP&A Act and is due to expire on the 28 September 2014. Springvale Coal is seeking to continue its mining operations beyond the expiry date.

Specific objectives of the Project are to:

- Continue to extract up to 4.5 million tonnes per annum (Mtpa) of ROM coal from the Lithgow Seam underlying the Project Application Area.
- Develop underground access headings and roadways from the current mining area to the east to allow access to the proposed mining areas.
- Undertake secondary extraction by retreat longwall mining technique for the Proposed Workings LW416 to LW432 and LW501 to LW503.
- Continue to use the existing ancillary surface facilities at the Springvale pit top.
- Continue to manage the handling of ROM coal through a crusher and screening plant at the Springvale pit top, and the subsequent loading of the coal onto the existing overland conveyor system for despatch to offsite locations.
- Continue to operate and maintain the existing ancillary surface infrastructure for ventilation, electricity, water, materials supply, and communications at the Springvale pit top and on Newnes Plateau.
- Install and operate two additional dewatering bore facilities (Bores 9 and 10) on Newnes Plateau and the associated power and pipeline infrastructure, and upgrade the existing and construct two new sections of access tracks to Bores 9 and 10 facilities.
- Construct a downcast ventilation borehole at the Bore 10 facility location.
- Establish a services borehole area.
- upgrade the existing Springvale Delta Water Transfer Scheme (SDWTS) comprising construction of new sections of the trenched pipelines to increase the water delivery capacity of SDWTS from the existing 30 mega litres per day (ML/day) to up to 50 ML/day.
- Manage mine inflows using a combination of direct water transfer to the Wallerawang Power Station, via the SDWTS, and discharge through Angus Place Colliery's licensed discharge point LDP001 and Springvale Colliery's LDP009.
- Continue to undertake existing and initiate new environmental monitoring programs.

- Continue to operate 24 hours per day seven days per week.
- Continue to provide employment to a full time workforce of up to 310 persons.
- Progressively rehabilitate disturbed areas at infrastructure sites no longer required for mining operations.
- Undertake life-of-mine rehabilitation at the Springvale pit top and the Newnes Plateau infrastructure disturbance areas to create final landforms commensurate with the surrounding areas and the relevant zonings of the respective areas.
- Transfer the operational management of coal processing and distribution infrastructure to the proposed Centennial Western Coal Services Project.

No changes are proposed to the existing pit top infrastructure. All existing infrastructure for the underground mining and coal handling operations for subsequent despatch off site will continue to be utilised in this Project. However, the run of mine coal handling logistics for the despatch of coal from the pit top to the final destinations will be managed under the proposed Centennial Western Coal Services Project's development consent.

The following surface infrastructure area will be established as part of the Project and all items will be located on Newnes Plateau.

Dewatering Provisions

Two dewatering bore sites, Bore 9 and Bore 10 (refer **Figure 1.2**) will be established for the continued management of mine inflows to satisfy safety and operational requirements. Four boreholes (each installed with submersible pumps) will be constructed at each bore site, and the associated power and switchroom facilities will also be established. Power to each bore site will be supplied from the existing substation 4 located on Newnes Plateau using trenched power cables running along the existing and/or upgraded access tracks (refer **Figure 1.2**).

Mine inflows will continue to be transferred into the existing SDWTS. Extensions of pipelines to Bores 9 and 10, trenched within the same infrastructure corridor as the underground power cable noted above, are proposed in the Project.

Duplication of the SDWTS (refer **Figure 1.2**) will be undertaken to accommodate the increased mine inflows predicted from the Proposed Workings within this Project and the Angus Place Mine Extension Project (Golder, 2013a). This duplication will involve trenching of a second set of pipelines along the existing pipeline network at sections marked in **Figure 1.2**, to increase the water transfer capacity of the SDWTS from the current 30 ML/day to 50 ML/day.

Further detail on the proposed extensions and duplication of the SDWTS is provided in the EIS (Golder, 2013b) and accompanying Decommissioning and Rehabilitation Strategy for the Angus Place Mine Extension Project.

Underground Ventilation Services

An additional air intake shaft will be constructed within the Bore 9 dewatering facility site to deliver fresh air to the underground mine.

Mine Services Borehole Compound

A mine services borehole compound will be established on Newnes Plateau (refer **Figure 1.2**) for the supply of materials (e.g. ballast and concrete) underground. The mine services borehole compound will consist of four boreholes, appropriate water management structures, provisions for the supply of concrete material underground on an as-needed basis, and a shed or suitable housing to contain a telephone.

1.2 Project Application Area

The area subject to this AIS is the entire Project Application Area totalling an area of approximately 5,812 hectares (ha) (**Figure 1.2**). Of relevance to this assessment are the following major proposed project components:

- Proposed Workings: includes land proposed to be subject to underground mining activities covering an area of 1,335 ha.
- Proposed Surface Infrastructure: includes multiple infrastructure components including the proposed SDWTS duplication pipeline, Bores 9 & 10 dewatering facilities with associated extensions to the existing SDWTS comprising power lines and power cables trenched within an infrastructure corridor, and a mine services borehole compound. The actual proposed surface infrastructure disturbance area is 11.8 ha (Golder, 2013b). However, the assessment area covers a larger area of 86 ha to incorporate a number of potential alignment options. This is a conservative approach to ensure due diligence following any required mine plan changes during the EIS process.

1.3 Purpose of this Report

This report has been prepared to address the *Strategic Regional Land Use Policy* (the Policy) (DP&I, 2012a). The Policy aims to assist the development of a long-term strategy for continued progress of the mining industry that also ensures local community sustainability and on-going viability of existing agricultural industries. The Policy applies to areas within NSW where there is high value agricultural land and increasing activity in the coal and coal seam gas industries. Seven regions within NSW have been identified as applying under this Policy and each of these regions will progressively have a Strategic Regional Land Use Plan (SRLUP) developed or alternatively a similar plan incorporated into the relevant proposed Regional Growth Plans. The SRLUP and/or Regional Growth Plan covering the Project Application Area has not been released at the time of this assessment.

Part of this policy requires all state-significant mining development proposals, whether or not they are located on land mapped as strategic agricultural land (SAL), to prepare an Agricultural Impact Statement (AIS) for consideration at the development application stage. The purpose of an AIS is to assess and report on the potential impacts of the Project on agricultural resources and/or industries within and surrounding the Project Application Area. The term 'agricultural resource' is used to describe the land on which agriculture is dependent and the associated water resources (quality and quantity) that are linked to that land.

DP&I have issued an exemption, supplementary to the Project's Director-General's Requirements, whereby an AIS is not required to be prepared as the Project Application Area is not situated on high value agricultural land. However, the proponent, Springvale Coal, have elected to undertake an AIS for due diligence. SLR has prepared this AIS to address the requirements of the Policy in accordance with the *Guideline for Agricultural Impact Statements* (DP&I, 2012b).

1.4 Structure of this Report

This AIS, in accordance with the *Strategic Agricultural Land Use Policy: Guideline for Agricultural Impact Statements* (DP&I, 2012b), addresses the information listed in **Table 1.1**.

Table 1.1 AIS Requirements

This AIS must include the following information	Addressed in this document in:
Information Relating to the Project Application Area and Region	
Detailed assessment of the agricultural resources and agricultural production of the project area	
This section should include detailed information (including maps) on:	
• the soils, slope, land characteristics, water characteristics (availability, quality);	Section 2
• relevant history of the agricultural enterprises from within the project area and also surrounding land acquired as part of the development's buffer and/or offset zone.	Section 3
For the project area this should include a description of:	
• any land identified as SAL in a Strategic Regional Land Use Plan on or within two kilometres of the project site (SAL will be further identified in an amendment to the Mining SEPP);	Section 2
• the location and area of land to be temporarily removed from agriculture during operation of the project, and the period of time	Section 2
• the location and area of land to be returned to agricultural use post-project, and its productive potential relative to pre-project;	Section 2
• the location and area of land that will not be returned to agriculture, including areas to be used for environmental plantings or biodiversity offsets;	Section 2
• the agricultural enterprises to be undertaken on any buffer and/or offset zone lands for the life of the project, and comparison with enterprises undertaken on the land prior to the project.	Section 2
Identification of the agricultural resources and current agricultural enterprises within the surrounding locality of the project area	
The AIS must contain maps/information for areas within the locality surrounding the project describing existing agricultural resources. This should include:	
• soil characteristics, including soil types and depth;	Section 2
• topography/slope;	Section 2
• key agricultural support infrastructure (e.g. roads, railways, processing facilities);	Section 3
• water resources and other water users' extraction locations;	Section 2
• location and type of agricultural industries;	Section 3
• climate conditions.	Section 2
Describe the location and production levels of each commodity produced by all agricultural enterprises within the locality surrounding the project area.	Section 3
Assessment of Impacts	
Identification and assessment of the impacts of the project on agricultural resources or industries	
The AIS should identify any adverse impacts on agricultural resources and production on the site and in the local area during the operation and post-operation phases of the project. The AIS should include a risk-based assessment (guided by the DGRs) of:	
• the effects of the project on agricultural resources;	Section 4
• consequential productivity effects of this on agricultural enterprises, including productivity impacts of any water moved away from agriculture and any water quality issues as they affect agriculture (this should extend to farm productivity, land values and flow on impacts to regional communities and environment);	
• uncertainty associated with the predicted impacts and mitigation measures and the consequences of and likelihood that these uncertainties will be realised;	

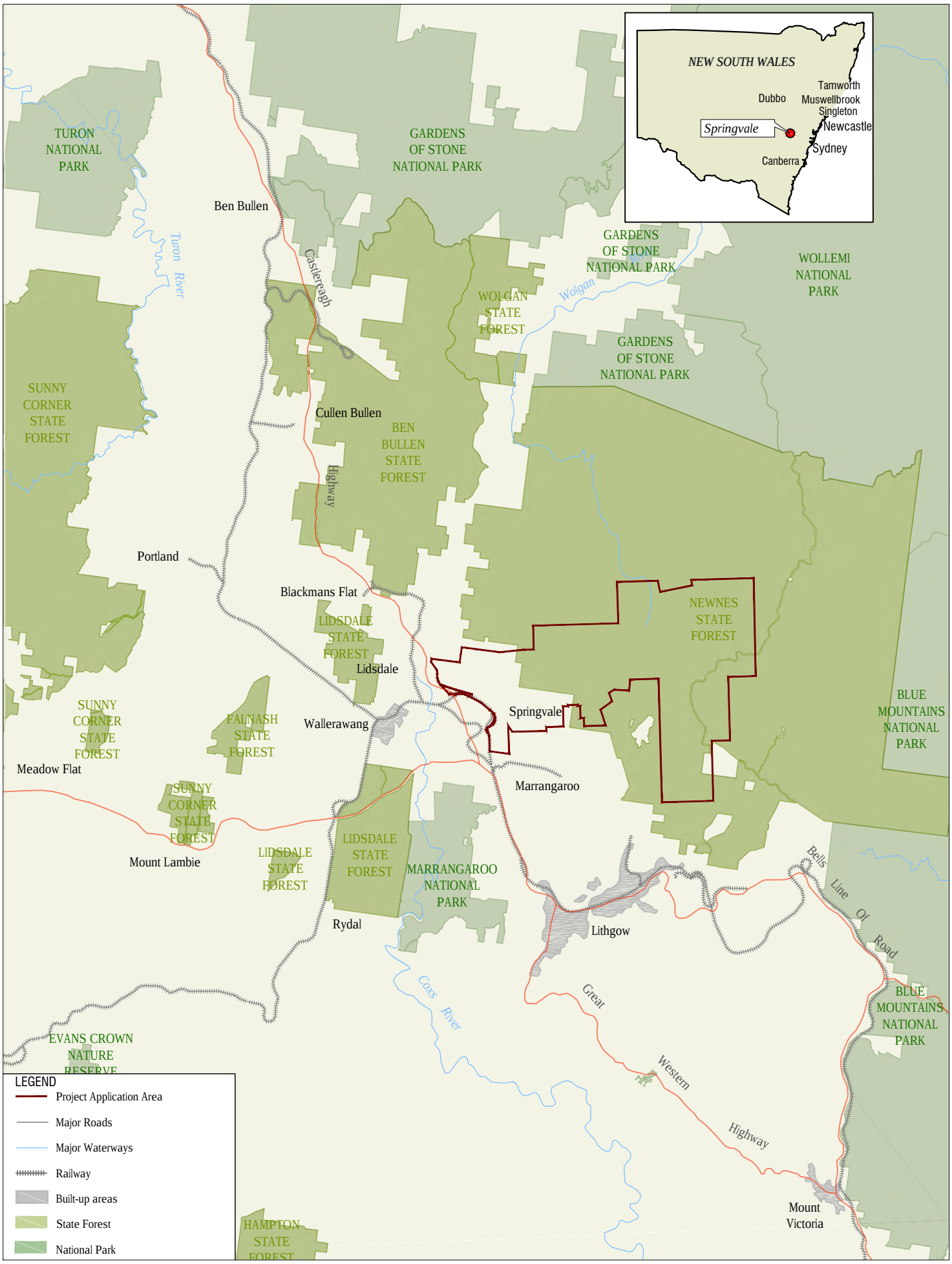
This AIS must include the following information	Addressed in this document in:
• further risks such as weed management, biosecurity, subsidence, dust, noise, vibration and traffic conditions. The AIS should also consider other aspects, e.g. proposed biodiversity offsets that may result in the loss or dislocation of agricultural resources/industries)	
If the project site is located on or within 2 kilometres of any land identified as SAL in a Strategic Regional Land Use Plan, the AIS must specifically address the potential impacts of the project on the relevant SAL. This should include a consideration of the relevant Gateway criteria which include matters such as:	
• surface area disturbance, subsidence and soils;	N/A >2km from mapped BSAL
• salinity, soil pH and groundwater;	
• access to agricultural resources and infrastructure; and	
• agricultural scenic and landscape values.	
Account for any physical movement of water away from agriculture	
Any water that is transferred or will no longer be available for agricultural use as a result of the proposal should be identified and fully accounted for.	Section 4
The potential impacts of the development on water resources should be assessed against the minimal impact considerations, consistent with the requirements of the Aquifer Interference Policy (NOW, 2012).	
All predicted impacts should be based on robust modelling.	
Assessment of socio-economic impacts	
The AIS should include an assessment of the impacts on agricultural support services, processing and value adding industries and regional employment.	Section 4
The socio-economic impact assessment must detail agricultural support services and value adding industries relevant to affected agricultural enterprises including potential impacts on local and regional employment.	
The socio-economic impact assessment must also address any potential impact on visual amenity, landscape values and tourism infrastructure relied upon by local and regional agricultural enterprises.	
Mitigation Measures	
Identification of options for minimising adverse impacts on agricultural resources, including agricultural lands, enterprises and infrastructure at the local and regional level	
The AIS should document feasible options to avoid, minimise or mitigate potential impacts on agricultural resources including:	
• project design review/alternatives;	Section 5
• proposed monitoring programs to assess predicted versus actual impacts as the project progresses;	
• trigger response plans and trigger points at which operations will cease or be modified or remedial actions will occur to address impacts including a process to respond to unforeseen impacts;	
• the proposed remedial action to be taken in response to a trigger event;	
• the basis for assumptions made about the extent to which remedial actions will address and respond to impacts;	
• demonstrated capacity for the rehabilitation of disturbed lands to achieve the final land use and restore natural resources;	
• Demonstrated planning for progressive rehabilitation that minimises the extent of disturbances.	
Consultation	
Document consultation with adjoining landusers and Government Departments	
An AIS should include details of an engagement strategy including:	
• consultation undertaken to date, including consultation undertaken at the Exploration Licence stage;	Section 6
• consultation with relevant government agencies;	
• consultation with impacted landholders and community groups;	
• the issues identified and measures to address these issues;	

This AIS must include the following information	Addressed in this document in:
• the outcomes of the consultation;	
• any commitments for further consultation.	

1.5 Methodology

The AIS was assessed using the methodology set out below:

- Desktop review of all publicly available information relating to the Project.
- Field visit and site inspection in June, 2013 by SLRs Senior Agronomist, Murray Fraser.
- Description of the biophysical environment for the Project Application Area and surrounding locality.
- Review of relevant specialist impact assessments that accompany the project's EIS.
- Assessment of potential impacts on agricultural resources and industry, including mitigation measures for any identified impacts.
- Provision of Springvale's demonstrated capacity for rehabilitation.



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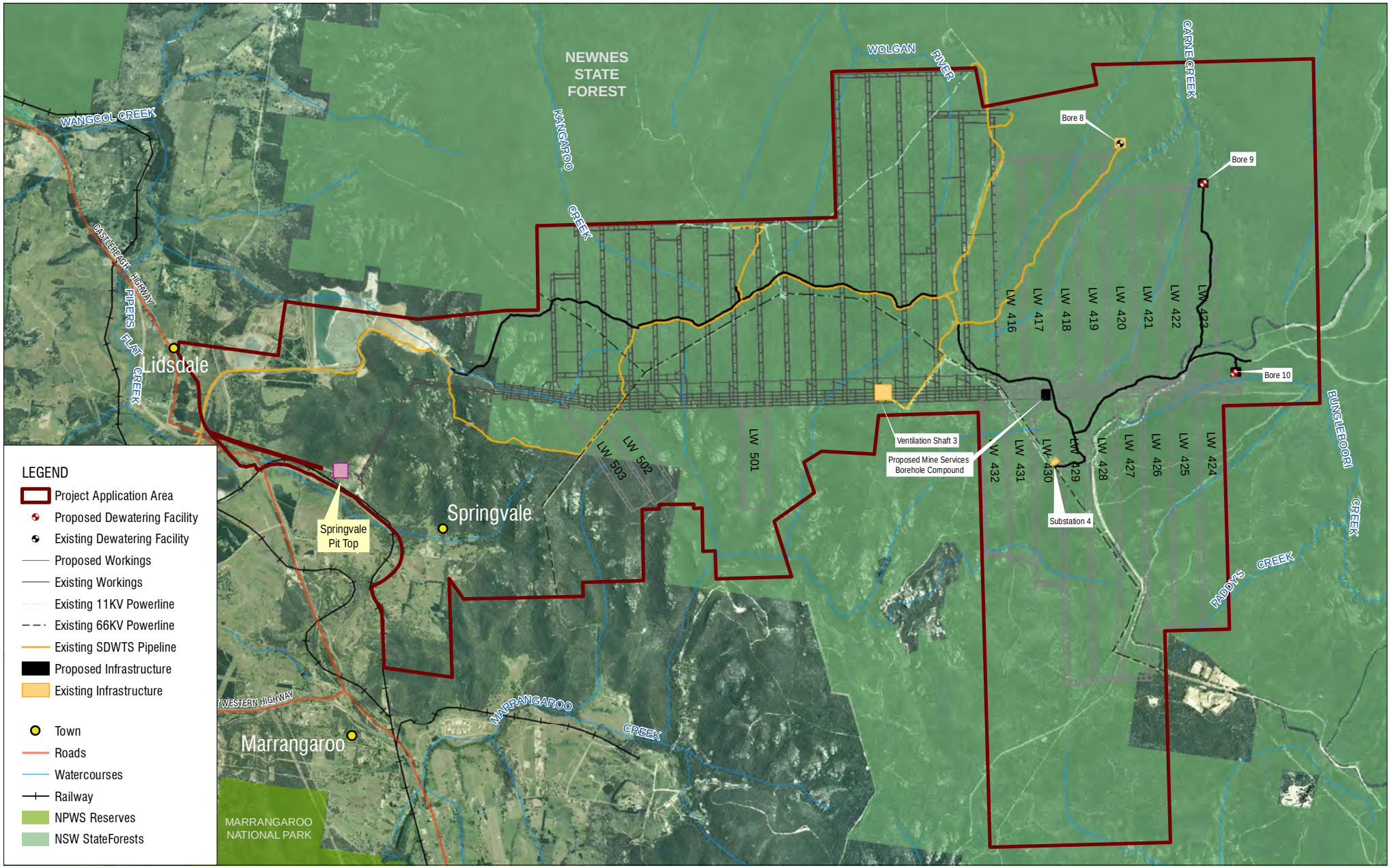
Regional Location

FIGURE 1.1



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Site Layout

FIGURE 1.2

2 AGRICULTURAL AND WATER RESOURCES

2.1 Climate

Representative climate data for the area has been obtained from the nearest Bureau of Meteorology (BoM) weather station located at the Lithgow Newnes Forest Centre, (Station 063062; BoM 2012). The Newnes Forest Centre ceased operation in 1999; however, it is considered to be a reliable and representative dataset for the Project Application Area.

Data from the Newnes Forest Centre shows that the Project Application Area experiences a summer dominant rainfall and temperature pattern with an average rainfall of 1,073 millimetres (mm) per year and an average maximum temperatures range of 9.4 degrees Celsius (^{o}C) in July to 23.5 ^{o}C in February. The BoM classifies the Lithgow area as having an oceanic climate with warm summers, cool to cold winters and generally steady precipitation year-round.

2.2 Topography

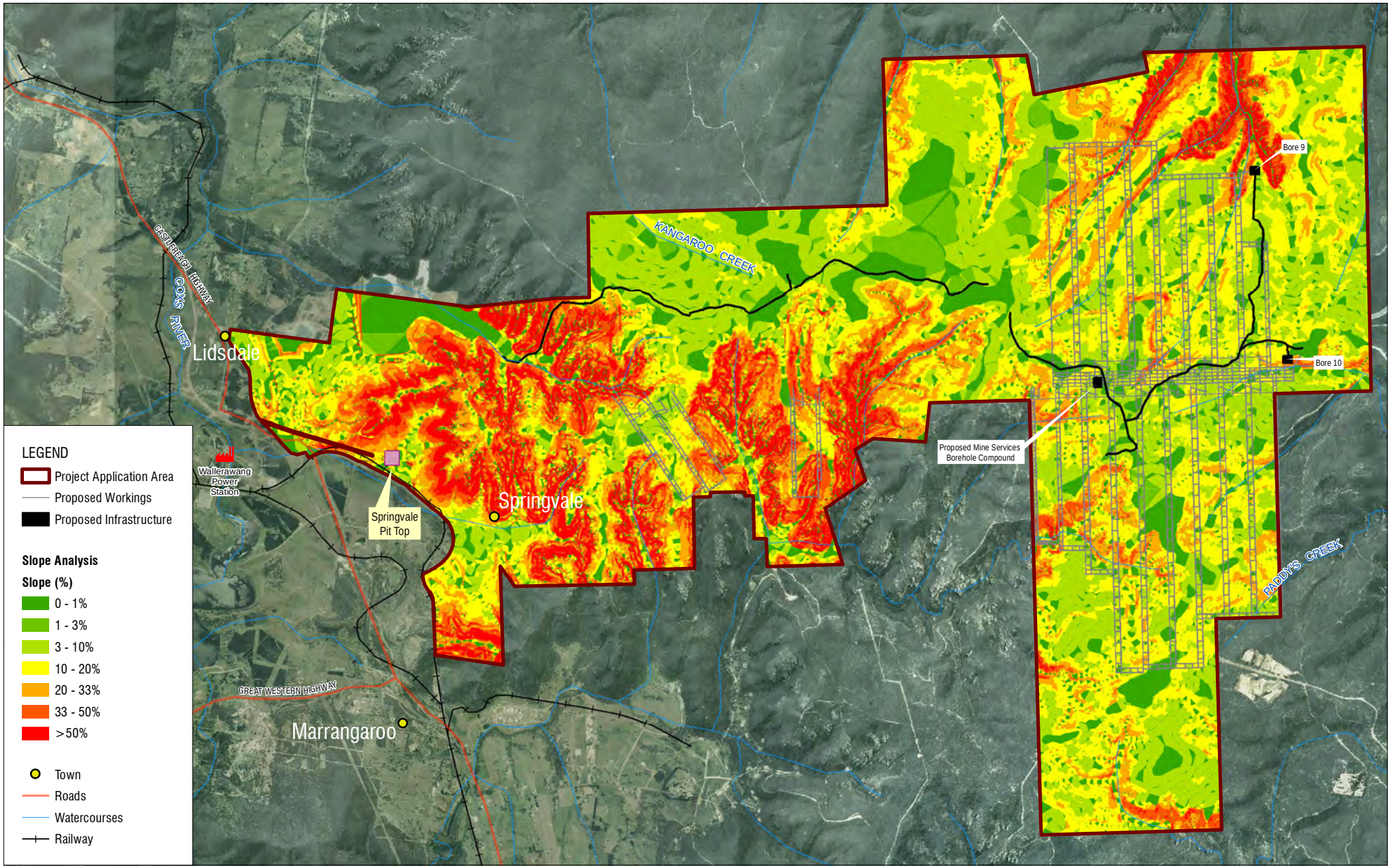
The topography of the region consists of rugged mountain ranges and plateaus characterised by sheer and benched cliffs and steep sided gorges (**Figure 2.1**). The majority of the Project Application Area lies within the Newnes Plateau, which is a relatively undulating plateau occurring between 1,000 metres (m) and 1,180 m above sea level (ASL). The plateau forms part of the divide between the Wolgan and Coxs River valleys. It consists of a number of connecting, wide, gently undulating ridges, dissected by relatively steep-sided valleys with the floors of the creeks and gullies occurring between 960 m and 980 m ASL. Sandstone cliffs 40 m in height can be found in the south western and north eastern corners, and along the southern boundary of the lease area. In general, however, the sandstone cliffs range between 10 m and 40 m in height throughout the area. Swamps occur within the headwater valleys along the tributaries of Carne Creek and Marrangaroo Creek and are controlled by the flat topography and impervious shale layers.

2.3 Hydrology

2.3.1 Surface Water

The Project Application Area lies wholly within the western boundary of the Hawkesbury-Nepean catchment and covers three adjacent sub-catchments, the Upper Coxs River, Wolgan River and Colo River. All catchments are under the jurisdiction of Hawkesbury-Nepean Catchment Management Authority and the Upper Coxs River sub-catchment is also listed within the boundary of Sydney Drinking Water Catchment.

Catchments and associated watercourses for the Project Application Area are shown in **Figure 2.2** and described in **Table 2.1**.



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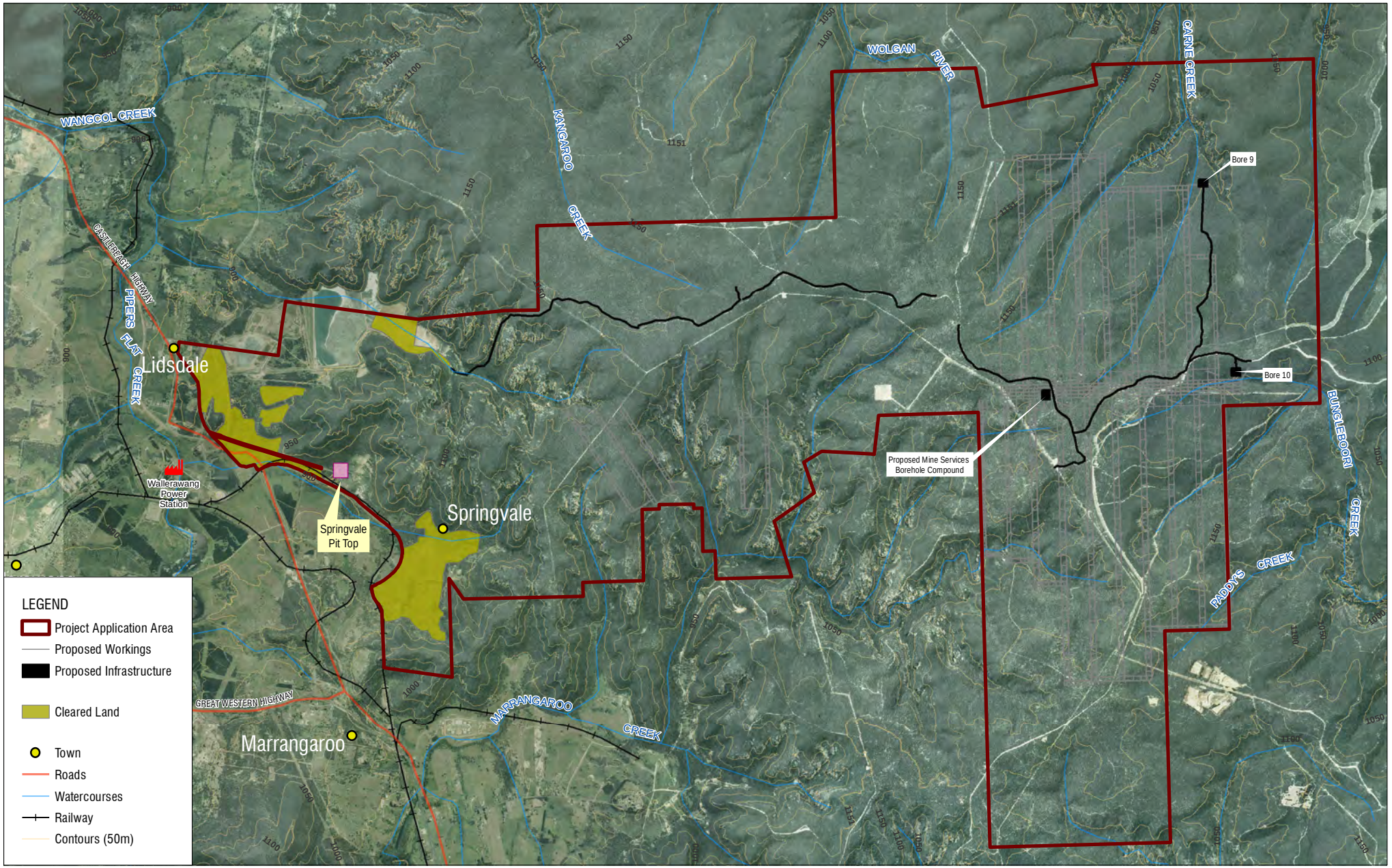
Slope Analysis

FIGURE 2.1



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SPRINGVALE AIS

Topography & Hydrology

FIGURE 2.2

Table 2.1 Catchments within the Project Application Area

Sub-catchment	Minor Catchment	Associated Watercourses	Minor Catchment Area (ha)	% of Project Application Area
Upper Coxs River	Coxs River	Wangool Creek, Springvale Creek, Kangaroo Creek, Lambs Creek, Sawyers Swamp Creek	13,026	30
	Marrangaroo Creek	Unnamed watercourses south of Project Application Area	5,495	30
	Pipers Flat Creek	Unnamed watercourses south of Project Application Area	5,948	Nil
Wolgan River	Wolgan River Western Branch	Wolgan River	8,526	9
	Wolgan River Eastern Branch	Carne Creek	8,597	30
Colo River	Nine Mile Creek/Bungleboori	Nine Mile Creek	4,840	1

Source: *Surface Water Impact Assessment* (RPS, 2013a)

2.3.1.1 Upper Coxs River Sub-catchment

The Project Application Area is situated to the east of the Coxs River, which is a major tributary and headwater that flows into Lake Burragorang. The Coxs River minor catchment contains an impoundment, the Lake Wallace reservoir, approximately five km south of the Wangool Creek confluence. Lake Wallace provides Energy Australia's Wallerawang Power Station's water requirements and also the town of Wallerawang with drinking water (RPS, 2013a).

Marrangaroo Creek is a minor catchment of the Upper Coxs River sub-catchment, towards the southern boundary of the Project Application Area. Marrangaroo Creek flows south westerly to converge with the Coxs River downstream of Lake Wallace Reservoir. Most of the watercourses in the southern portion of the Project Application Area drain into Marrangaroo Creek, which in itself is a perennial watercourse (RPS, 2013a).

Springvale Creek is a tributary of Coxs River that is connected to the watercourses originating from the valleys around the Springvale Pit Top and drains into Lake Wallace. Springvale Creek is of relevance to the Project as the main Pit Top Licensed Discharge Point (LDP001) discharges into this creek. Further, excess mine groundwater is discharged via LDP009 into the Coxs River (RPS, 2013a).

2.3.1.2 Wolgan River Catchment

The north eastern section of the Project Application Area is situated in the headwaters of the Wolgan River sub-catchment. Springvale's LDP004 and LD005 discharge into this sub-catchment (RPS, 2013a). The Wolgan River sub-catchment has two branches, the Western Branch and the Eastern Branch.

The Wolgan River is the main watercourse in the Western Branch which flows northerly off the Newnes Plateau into the Wolgan Valley to join the Capertee and Wollemi Rivers in the Wollemi National Park when it becomes the Colo River.

Carne Creek is the main tributary to the Eastern Branch and consists of several tributaries that flow east-northerly to join the main course of the river and occupies a significant portion of the eastern section of the Project Application Area.

2.3.2 Groundwater

The regional hydrogeology is considered complex due to the non-uniform sequence of interbedded rocks consisting of heterogeneous lithic properties and therefore varying hydro-permeability. The variability creates rock horizons capable of promoting or inhibiting the flow of groundwater in the region, however, the strata is considered to have low permeability and the flow of groundwater of primarily due to the fractures within the strata. The regional hydrogeology if also multifaceted by the presence of mine voids from previous and current mining operations, which can act as preferred flow paths for groundwater.

Six aquifers or relatively permeable water-bearing strata have been identified within the Project Application Area above the Lithgow Seam. These six aquifers are categorised into three basic groundwater systems. A brief summary of each groundwater system follows.

- **Perched groundwater system** – a discontinuous, near-surface systems which are independent of the underlying regional groundwater systems, and located within 15 m of the ground surface. The perched groundwater system is derived from excess rainfall which is largely prevented from infiltrating into the deeper systems by less permeable beds.
- **Shallow groundwater system** – this system is a regional groundwater system located in the Narrabeen Group, largely in the Banks Wall Sandstone. This system generally extends to a depth of up to 100 m. The shallow groundwater system in underlain by the Mount York Claystone which forms acts as an aquitard, restricting infiltration to the deep groundwater system.
- **Deep groundwater system** – a deeper groundwater system exists in the strata below the Mount York Claystone, and includes the Illawarra Coal Measures, which generally lie at a depth of more than 200 m. The Illawarra Coal Measures also includes the Lithgow Seam, which will require dewatering as part of the Project. The few water bearing zones that occur in this system are typically fractured rock aquifers.

2.3.3 User Extraction Points

A search of the NSW Office of Water (NOW) registered bores database identified 114 registered bores within 10 km of the centre-point of the Project Application Area. Two of these bores are within five km of the centre-point radius (**Figure 2.3**). The registered bores extract from the shallow and the deep groundwater systems with no bores extracting from the perched groundwater system.

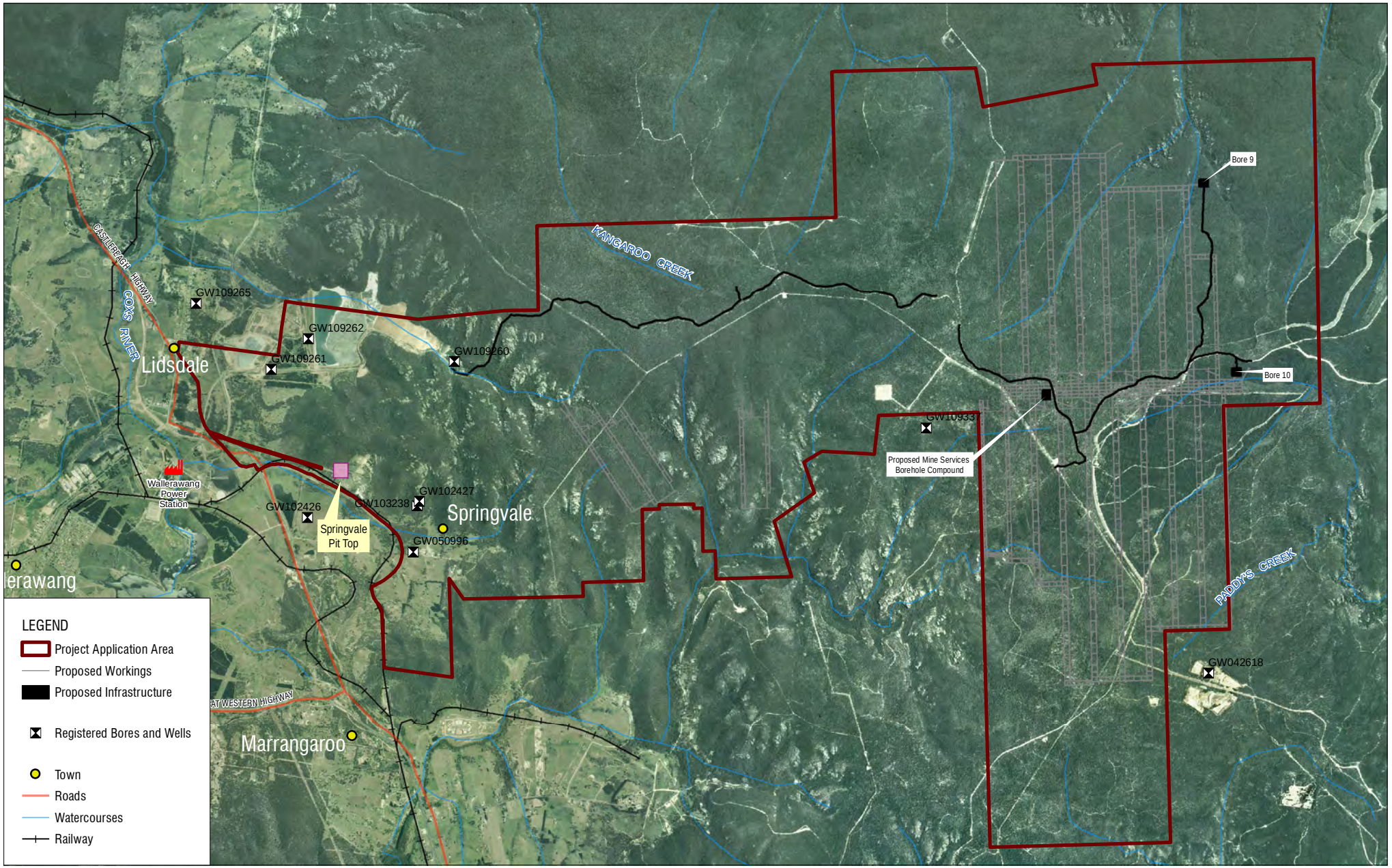
The bores are operated for a range of uses (**Table 2.2**) and there are 33 stock and domestic bores, with 26 of these bores extracting from the deep groundwater system.

There are seven registered groundwater extraction bores, two of these recorded as ‘stock’ use (GW050996 and GW102427), within the Project Application Area. Neither of the ‘stock’ bores are located within the five km centre point radius.

Table 2.2 Registered Groundwater Bores & Wells

Groundwater System	Stock & Domestic	Monitoring	Other Use	Total Bores
Shallow	7	37	4	48
Deep	26	18	22	66
Total	**33**	**55**	**26**	**114**

Source: *Groundwater Impact Assessment* (RPS, 2013b)



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Registered Bores and Wells

FIGURE 2.3

2.4 Geology

The Project Application Area is located in the southern portion of the Western Coalfields. The underlying strata comprise mostly sandstones of the Triassic Narrabeen Group, which are inter-bedded with shale and siltstone bands. The Narrabeen Group rocks are underlain by the Illawarra Coal Measures, which comprise inter-bedded sandstone, siltstone, shale and coal. The general dip of the bedding is to the northeast at about two degrees. The plateau area is cut by several deeply incised creek valleys, which drain to the north and west of the Project Application Area.

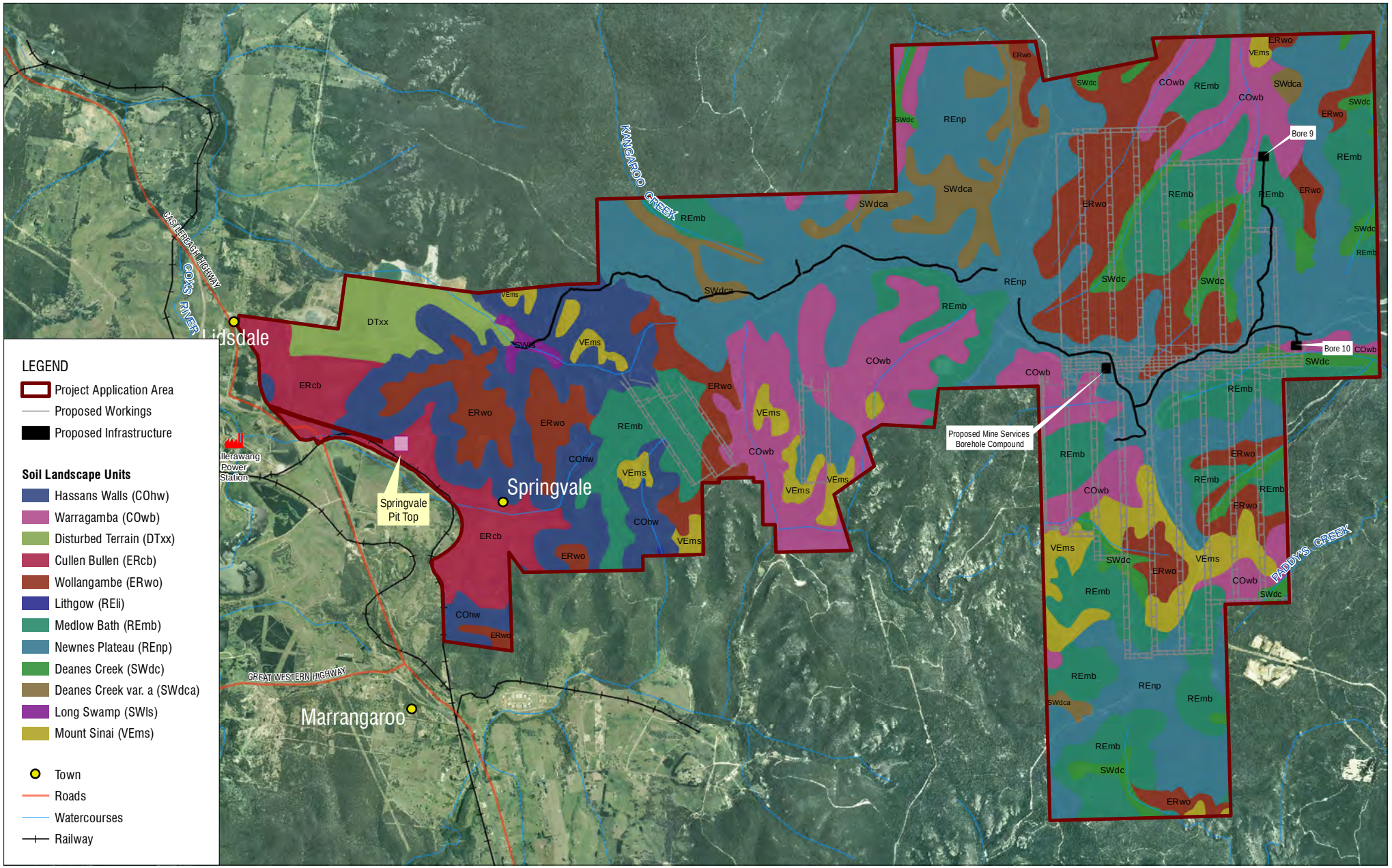
The Narrabeen Group rocks near the surface belong to the Grose Sub-group and include the Banks Wall Sandstone, the uppermost part of which is deeply weathered and generally very friable. The sandstone, which is up to 200 m thick in this region, is underlain by the Mt York Claystone, a fine grained stratum, with a thickness in this area ranging from four to 11 m, that limits vertical infiltration of groundwater from the overlying strata. The Illawarra Coal measures have a total thickness of about 120 m. The Lithgow Seam is the lowermost seam in the coal measures and is located about 25 m above the base of the coal measures (Aurecon, 2010).

2.5 Soil Landscape Units

The soil landscapes units within the Project Application 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 *Wallerawang 1:100,000 Sheet* (King, 1993) as shown in **Figure 2.4**.

As listed in **Table 2.3**, eleven soil landscapes occur within the Project Application Area. Major points regarding the dominant soil landscape units are provided below.

- 2,923 ha (50%) of the Project Application Area and 17 ha (15%) of the Proposed Surface Infrastructure assessment area is highly to severely constrained for cultivation (cropping) enterprises.
- Land that is highly to severely constrained for any agricultural activity includes the Mount Sinai, Deanes Creek, Warragamba and Hassans Walls soil landscape units, which together cover 2,108 ha (36%) of the Project Application Area and 15 ha (13%) of the Proposed Surface Infrastructure assessment area.
- Agricultural land best suited to grazing enterprises includes the Newnes Plateau, Medlow Bath, Cullen Bullen and Lithgow soil landscape units, which together cover 2,889 ha (50%) of the Project Application Area and 71 ha (83%) of the Proposed Surface Infrastructure assessment area. These soil landscape units have moderate limitations for cultivation enterprises.



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Soil Landscape Units

FIGURE 2.4

Table 2.3 Soil Landscape Units

Soil Landscape	Project Application Area		Proposed Surface Infrastructure Assessment Area		Agricultural Limitation Rating	
Unit	**ha**	**%**	**ha**	**%**	**Grazing**	**Cultivation**
Mount Sinai	266	5	Nil	Nil	Severe	Severe
Deanes Creek	424	7	3	3	Severe	Severe
Warragamba	750	13	5	6	Severe	Severe
Hassans Walls	532	9	5	6	High – Severe	Severe
Subtotal	**1,972**	**34**	**13**	**15**		
Long Swamp	17	<1	1	1	Moderate	Severe
Wollangambe	798	14	1	1	Moderate – High	High
Subtotal	**815**	**14**	**2**	**2**		
Newnes Plateau	1,609	28	60	70	Low	Moderate
Medlow Bath	1,008	17	11	13	Low	Moderate
Cullen Bullen	271	5	Nil	Nil	Low	Moderate
Lithgow	1	<1	Nil	Nil	Low	Moderate
Subtotal	**2,889**	**50**	**71**	**83**		
Disturbed Terrain	136	2	Nil	Nil	Severe	Severe
Total	**5,812**	**100**	**86**	**100**		

Source: *Soil and Land Capability Assessment* (SLR, 2013a)

These soil landscape units are further detailed in the Project's *Soil and Land Capability Assessment* (SLR, 2013a) prepared for the Project.

2.6 Dominant Soil Types and Inherent Fertility

The dominant soil types within the Project Application Area were ground-truthed at the scale of 1:100,000 by SLR as part of the *Soil and Land Capability Assessment* (SLR, 2013a) and are shown in **Figure 2.5** These soil types are summarised in **Table 2.4** and the major points listed below.

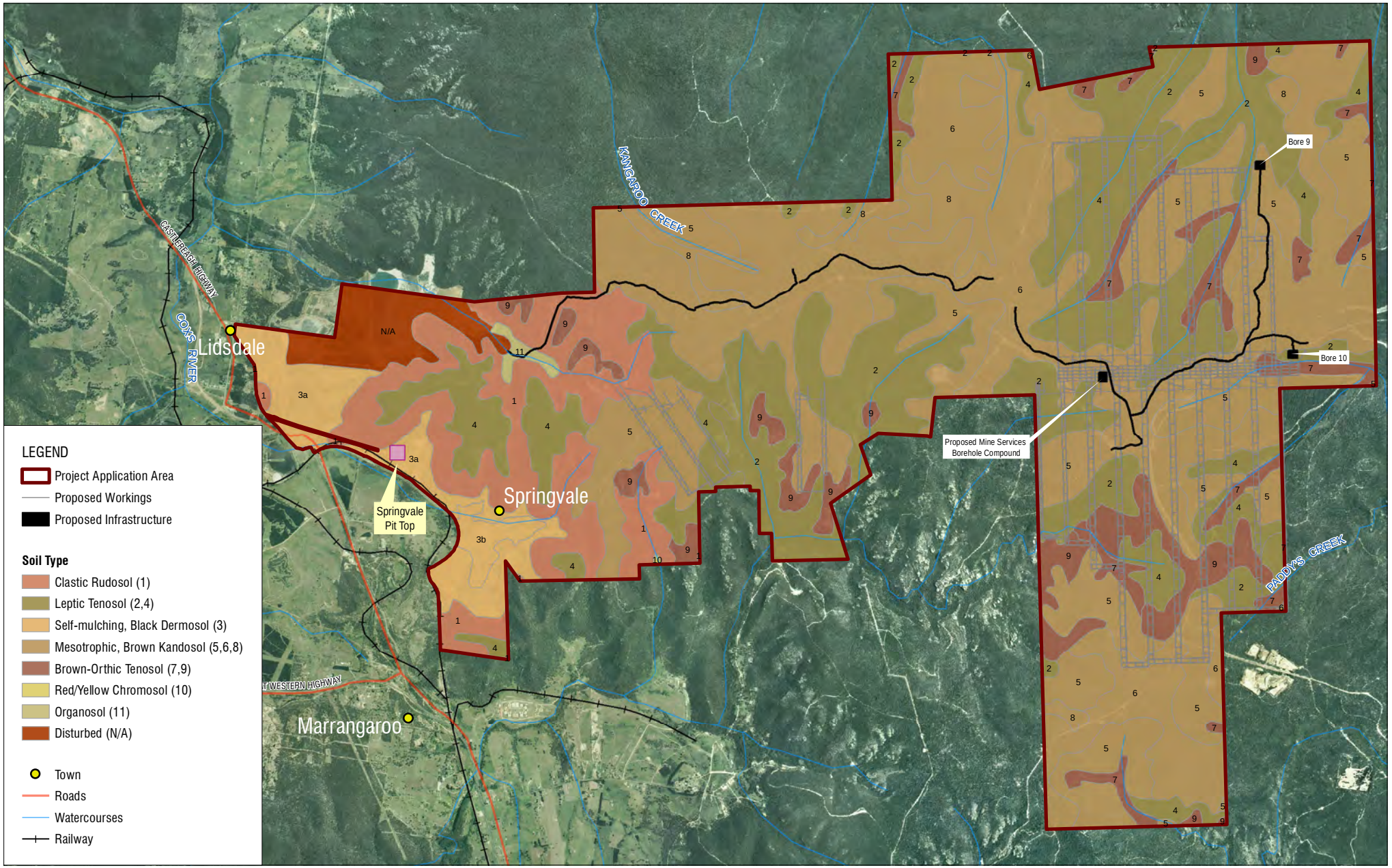
- The two major soil orders present in the Project Application Area are Tenosols and Kandosols. Tenosols are skeletal soils with minimal pedological development beyond the topsoil horizon and minimal profile development. Kandosols are uniformly textured soils, poorly structured in the subsoil.

- Kandosols cover 69% (4,037 ha) of the Project Application Area and 92% (79 ha) of the Proposed Surface Infrastructure assessment area and were generally strongly acidic with moderate inherent fertility.

- Tenosols cover 19% (1,064 ha) of the Project Application Area and 7% (6 ha) of the Proposed Surface Infrastructure assessment area and were generally strongly acidic with low inherent fertility.

- Rudosols cover 9% (532 ha) of the Project Application Area and 6% (5 ha) of Proposed Surface Infrastructure assessment area. Rudosols are poorly developed soils and within the Project Application Area are characterised as strongly acidic skeletal soils with a high coarse fragment and low inherent fertility.

- A minor portion of the Project Application Area (1%) consists of a Black Dermosol. Dermosols are soils that have a gradational profile and a structured subsoil. Black Dermosols have high inherent fertility. No Black Dermosols will be disturbed by the Project. The remaining soil types are an Organosol and a Kurosol which comprise <1% (18 ha) of the Project Application Area.



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Soil Types

FIGURE 2.5

Table 2.4 Dominant Soil Types and Inherent Fertility

Australian Soil Classification Soil Type	Associated Soil Landscape	Project Application Area		Proposed Surface Infrastructure Assessment Area		Inherent Fertility
Name	**Name**	**ha**	**%**	**ha**	**%**	
Clastic Rudosol	Hassans Walls	532	9	5	6	Low
Brown-Orthic Tenosol	Wollangambe	798	14	1	1	
Brown-Orthic Tenosol	Mount Sinai	266	5	Nil	Nil	
Organosol	Long Swamp	17	<1	1	1	
Subtotal		**1,613**	**28**	**7**	**8**	
Eutrophic Brown Kurosol	Lithgow	1	<1	Nil	Nil	Moderate
Dystrophic Brown Kandosol	Deanes Creek	424	7	3	3	
Mesotrophic Brown Kandosol	Medlow Bath	1,008	17	11	13	
Mesotrophic Brown Kandosol	Newnes Plateau	1,609	28	60	70	
Mesotrophic Brown Kandosol	Warragamba	750	13	5	6	
Mesotrophic Brown Kandosol	Cullen Bullen (a)	245	4	Nil	Nil	
Subtotal		**4,037**	**69**	**79**	**92**	
Eutrophic Black Dermosol	Cullen Bullen (b)	26	1	Nil	Nil	High
Subtotal		**26**	**1**	**Nil**	**Nil**	
Disturbed Terrain		136	2	Nil	Nil	N/A
Total		**5,812**	**100**	**86**	100	

Source: *Soil and Land Capability Assessment* (SLR, 2013a)

2.7 Acid Sulfate Soils

Acid sulfate soils are naturally occurring soils, sediments or organic substrates (e.g. peat) formed under waterlogged conditions that contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. When exposed to the air following the lowering of the water table (through, for example. dewatering, groundwater abstraction, drainage or excavation) the sulfides in these soils readily oxidise, releasing sulfuric acid and iron into the soil and groundwater. This acid can, in turn, release aluminium, nutrients and heavy metals (particularly arsenic) held within the soil matrix (Ahern et al., 2004).

Acid sulphate soils, which are the main cause of acid generation within the soil mantle, are commonly found less than 5 m above sea level, particularly in low-lying coastal areas. The Project Application Area is located approximately 150 km from the coast and has an elevation range of 960 – 1,080 m ASL. It is therefore unlikely that acid sulphate soils (to a depth of 1.5 m) are present in the Project Application Area

2.8 Vegetation and Land Use

The Newnes State Forest is located on the Newnes Plateau and covers 80% of the Project Application Area (**Figure 1.2**). It contains both native woodland and pine plantations. The Newnes Plateau is adjacent to the Wollemi National Park, part of the World Heritage listed Greater Blue Mountains area.

The vegetation associated with the Project Application Area is dominated by native woodland (**Plate 2.1**). The *Flora and Fauna Assessment* (RPS, 2013c) undertaken for the Project identified 19 native vegetation communities. Of these, three were listed as endangered ecology communities namely Newnes Plateau Shrub Swamp, Montane Peatlands and Swamps and Temperate Highland Peat Swamp on Sandstone.

A total of 11 threatened flora species were noted to have potential to occur within Project Application Area, and of these, three were recorded during the RPS survey. These species were *Persoonia hindii*, *Veronica blakelyi Syn. Derwentia blakelyi* and *Boronia deanei* spp. *Deanei*.

The majority of the Project Application Area is not used for agriculture. Of the total 5,812 ha within the Project Application Area, there is 175 ha (3%) along the western boundary which has been cleared and is currently utilised for agricultural activities (**Figure 2.2**). A site inspection in June 2013 by SLR's Senior Agronomist, in conjunction with a desktop assessment, found that the dominant agricultural activities being carried out on the cleared area are small scale grazing with beef cattle, sheep, horses and goats. These grazing areas consisted of semi-improved cocksfoot, tall fescue, native grass and clover pastures on the flatter areas and valley floor, with native grasses and some clover on the hillslopes (**Plate 2.2**). No intensive cropping activities were observed at the time of the assessment.

It was also observed that the described grazing areas are being encroached upon by rural residential development, with lot sizes becoming too small for reliance on income generated by agricultural enterprises.

Plate 2.1 Typical State Forest landscape on Newnes Plateau

Plate 2.2 Typical agricultural landscape on western edge of the Project Application Area

2.9 Land and Soil Classification

In NSW the Rural Land Capability System developed by the former NSW Soil Conservation Service, which has been widely used to evaluate agricultural potential of land (Emery, 1986), has now been largely replaced by the new Land and Soil Classification (LSC) assessment scheme developed for NSW: *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012). The LSC scheme builds on the Rural Land Capability system and retains the eight class system, however places additional emphasis on specific soil limitations and management.

The LSC classes are based on the biophysical features of the land associated with various hazards and the management of these hazards including the level of inputs, expertise and investment required to manage the land sustainably. Full details regarding the LSC assessment are provided in the *Soil and Land Capability Assessment* (SLR, 2013a).

The LSC Assessment for the Project Application Area and the relevant agricultural capability rating is summarised in **Table 2.5**. The distribution of the LSC classes throughout the Project Application Area is shown in **Figure 2.6**. In summary, the major assessment points are:

- Class 4 land is associated with the Medlow Bath and Cullen Bullen soil landscape units and is considered to be moderately capable land primarily suited to pasture cropping and grazing enterprises. The land has moderate to high limitations for high-impact activities (e.g. regular cultivation). Class 4 land covers 22% (1,279 ha) of the Project Application Area and 13% (11 ha) of the Proposed Surface Infrastructure assessment area.

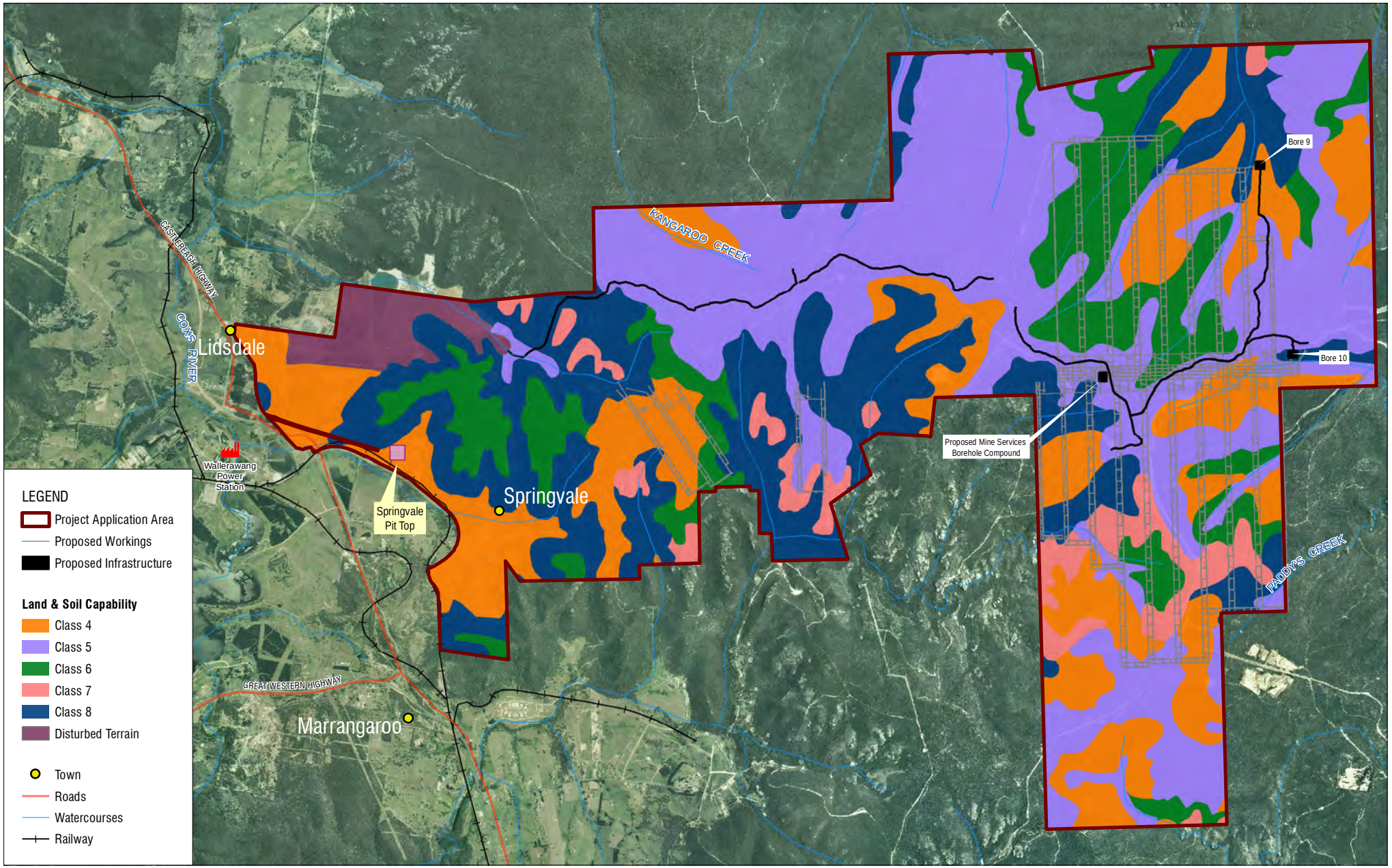
- Class 5 land is associated with the Newnes Plateau, Deanes Creek, Lithgow and Long Swamp soil landscape units and is considered moderately low capability land that is primarily suited to grazing enterprises. The land has high limitations for high-impact activities and comprises 35% (2,051 ha) of the Project Application Area and 74% (64 ha) of the Proposed Surface Infrastructure assessment area.
- Class 6 land is associated with the Wollangambe soil landscape unit and is considered to have low capability for agricultural enterprises and is suited to grazing enterprises only. Class 6 land covers 14% (798 ha) of the Project Application Area and 1% (1 ha) of the Proposed Surface Infrastructure assessment area.
- Class 7 land is associated with the Mount Sinai soil landscape unit and is considered to have a very low capability for agricultural enterprises and is suitable existing green timber coverage and native vegetation. This class covers a 5% of the Project Application Area (266 ha) and is not found in the Proposed Surface Infrastructure assessment area.
- Class 8 land is associated with the Hassans Walls and Warragamba soil landscape units and is considered to have an extremely low capability for agricultural enterprises and is not considered suitable for any land use apart from nature conservation. Class 8 land covers 22% (1,282 ha) of the Project Application Area and 12% (10 ha) of the Proposed Surface Infrastructure assessment area.

Within the Project Application Area, 76% of the land area is considered to have moderately low to extremely low agricultural capability according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012). When considering these definitions 87% of the Proposed Surface Infrastructure assessment area has moderately low to extremely low agricultural capability.

Table 2.5 Land and Soil Classification

LSC	Associated Soil Landscape	Project Application Area		Proposed Surface Infrastructure Assessment Area		Agricultural Capability Rating
Class	**Name**	**ha**	**%**	**ha**	**%**	
4	Medlow Bath	1,008	17	11	13	Moderate
	Cullen Bullen (a & b)	271	5	Nil	Nil	
Subtotal		**1,279**	**22**	**11**	**13**	
5	Newnes Plateau	1,609	28	60	70	Moderately low
	Deanes Creek	424	7	3	3	
	Lithgow	1	<1	Nil	Nil	
	Long Swamp	17	<1	1	1	
Subtotal		**2,051**	**35**	**64**	**74**	
6	Wollangambe	798	14	1	1	Low
Subtotal		**798**	**14**	**1**	**1**	
7	Mount Sinai	266	5	Nil	Nil	Very low
Subtotal		**266**	**5**	**Nil**	**Nil**	
8	Hassans Walls	532	9	5	6	Extremely low
	Warragamba	750	13	5	6	
Subtotal		**1,282**	**22**	**10**	**12**	
Disturbed Terrain		136	2	Nil	Nil	N/A
Total		**5,812**	**100**	**86**	**100**	

Source: *Soil and Land Capability Assessment* (SLR, 2013a)



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Land & Soil Capability Pre Mining

FIGURE 2.6

2.10 Biophysical Strategic Agricultural Land Assessment

The NSW Government recently released the Policy to assist the development of a long-term strategy for continued progress of the mining industry that also ensures local community sustainability and on-going viability of existing industries. Part of this policy is the development of SRLUPs and/or Regional Growth Plans, which includes the determination of biophysical strategic agricultural land (BSAL). BSAL is defined as areas with unique natural resource characteristics highly suited for agriculture.

The SRLUP/Regional Growth Plan for land within the Project Application Area has not been released at this point in time. Notwithstanding, and adopting a precautionary approach, SLR (2013a) assessed the Project Application Area against the BSAL criteria contained in the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c) and the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* ((OEH & DPI - Office of Agricultural Sustainability and Food Security (DPI-OASFS) 2013).

2.10.1 BSAL Assessment – Upper Hunter Strategic Regional Land Use Plan

The first BSAL assessment was undertaken using the criteria from the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c).

The minimum requirement for rainfall reliability for the region was met for the Project Application Area (mean rainfall 1,073 mm, refer **Section 2.1**); therefore, only the LSC and fertility class were further assessed by SLR (2013a). To do this, this assessment compares the LSC classes against each soil types inherent fertility attributes to determine if the BSAL criteria are met in the Project Application Area. The soil fertility and the outcomes of the BSAL assessment are shown in **Table 2.6**.

Table 2.6 Applied Biophysical Strategic Agricultural Land Criteria

Soil Landscape	Soil Name	LSC	Inherent Fertility	BSAL	BSAL Limitation
Unit	ASC	Class	Class	Yes/No	Description
Cullen Bullen (b)	Dermosol	4	High	No	LSC class
Cullen Bullen (a)	Kandosol	4	Moderate	No	LSC class
Medlow Bath	Kandosol	4	Moderate	No	LSC class
Lithgow	Kurosol	5	Moderate	No	LSC class
Newnes Plateau	Kandosol	5	Moderate	No	LSC class
Deanes Creek	Kandosol	5	Moderate	No	LSC class
Long Swamp	Organosol	5	Low	No	LSC class & fertility
Wollangambe	Tenosol	6	Low	No	LSC class & fertility
Mount Sinai	Tenosol	7	Low	No	LSC class & fertility
Hassans Walls	Rudosol	8	Low	No	LSC class & fertility
Warragamba	Kandosol	8	Moderate	No	LSC class
Disturbed Terrain	N/A				

Source: *Soil and Land Capability Assessment* (SLR, 2013a)

The inherent fertility class and LSC classifications for the soil types associated with Long Swamp, Wollangambe, Mount Sinai and Hassans Walls soil landscape units indicate that the soil resources do not qualify as BSAL under the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c).

The soil types associated with Cullen Bullen, Medlow Bath, Lithgow, Newnes Plateau, Deanes Creek and Warragamba soil landscape units do not meet the LSC class criteria and therefore also do not qualify as BSAL under the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c).

Whilst the Project Application Area met the minimum rainfall criteria of >350 mm per annum in nine out of ten years, no soil types qualified as BSAL under criteria for the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c).

2.10.2 BSAL Assessment – Interim Protocol for Site Verification

The second BSAL assessment undertaken by SLR (2013a) used the criteria from the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH & DPI-OASFS, 2013). This methodology uses a two phase verification assessment:

Phase 1 – Confirm reliable water supply.

Phase 2 – 12 step site verification criteria.

Phase 1 Assessment – Access to Reliable Water Supply

For lands to be classified as BSAL they must have access to reliable water supply, defined as:

- Greater than 350 mm rainfall per annum (in nine out of 10 years); or
- Within 150 m of a regulated river; or
- Within 150 m of a 5th order unregulated river; or
- Within 150 m of an unregulated river that flows 95% of the time; or
- Access to highly productive groundwater (as defined by NSW Office of Water).

Phase 2 Assessment - Verification Criteria

The 12 step site verification criteria are shown in **Table 2.7**. If a criterion fails to meet any of the BSAL conditions (except step 5 or step 6), the site is rejected as BSAL and the remaining conditions are not assessed.

Table 2.7 Twelve Step Site Verification Criteria According to Interim Protocol

Step Number	Criteria	BSAL Definition
1	Slope	Slope of less than or equal to 10%
2	Rock Outcrop	Rock outcrop of less than 30%
3	Surface Rockiness	Less than 20% of the area has unattached rock fragments greater than 60 mm diameter
4	Gilgai	Less than 50% of the area has gilgai depression that are deeper than 500 mm
5	Slope	Slope of less than 5%
6	Rock Outcrop	Nil rock outcrop
7	Soil Fertility	Moderate fertility (if < 5 % slope, nil rock outcrop
		Moderately high or high fertility (if < 5% slope, 5-30% rock outcrop)
		Moderately high or high fertility (if > 5% slope)
8	Physical Barrier	Effective rooting depth to a physical barrier is greater than or equal to 750 mm
9	Soil Drainage	Soil drainage is better than poor
10	pH	pH within range of 5.0 to 8.9 when measured in water or pH within range of 4.2 to 8.1 when measured in calcium chloride.
11	Soil Salinity	Electrical conductivity in a saturated extract less than or equal to 4 dS/m or if gypsum is present, chlorides less than 800 mg/kg
12	Chemical Barrier	Effective rooting depth to a chemical barrier is greater than or equal to 750 mm

Source: *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH & DPI-OASFS, 2013)

BSAL Assessment Results - Interim Protocol for Site Verification

The minimum requirement for Phase 1 was met with an average annual rainfall of approximately 1,073 mm for the Project Application Area (**Section 2.1**). A summary of the Phase 2 BSAL verification criteria assessment across the Project Application Area is provided in **Table 2.8** and the key findings are:

- Soil types associated with the Hassans Walls, Warragamba, Wollangambe, Medlow Bath, Newnes Plateau and Mount Sinai Soil Landscape Units did not meet the criteria for Step 1 with slopes greater than 10 %. All remaining Soil Types met the criteria for Steps 2 to 4.

- Soil types associated with the Deanes Creek and Long Swamps Soil Landscape Units are all classified as 'less than 5% slope' for Step 5, and 'Nil rock outcrop' for Step 6. These soil types did not meet the fertility criteria according to the Interim Protocol and did not meet the minimum criteria for Step 7.

- Soil types associated with the Cullen Bullen (a) and Lithgow soil landscape units are all classified as 'greater than 5% for Step 5, and 'Nil rock outcrop' for Step 6. These soil types did not meet the fertility criteria according to the *Interim Protocol* and did not meet the minimum criteria for Step 7.

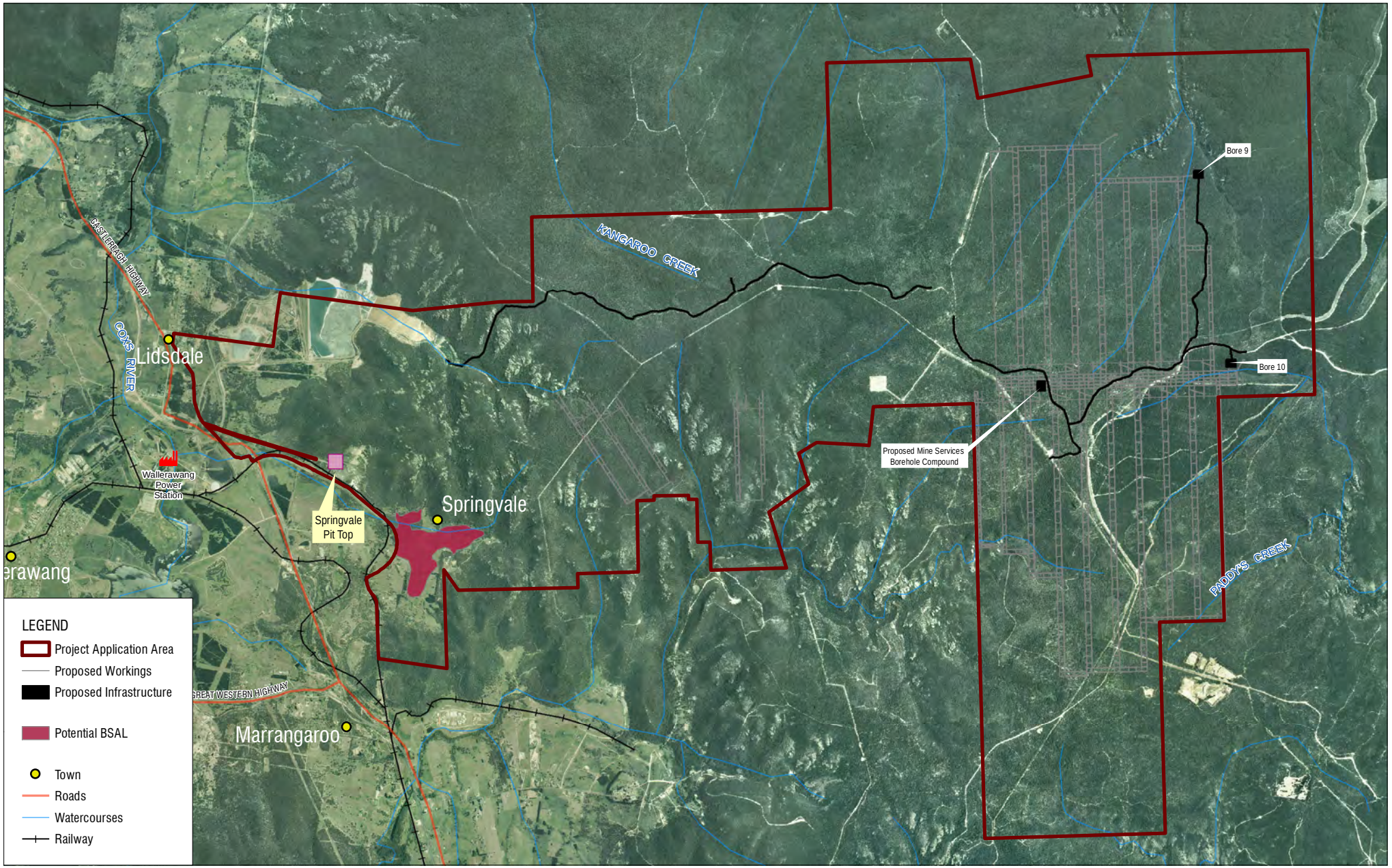
The soil type associated with the Cullen Bullen (b) soil landscape unit met all criteria, therefore is considered potential BSAL (**Table 2.8**).

Therefore there are 26 ha of potential BSAL within the Project Application Area (**Figure 2.7**). The Cullen Bullen (b) soil landscape unit is well removed from the Proposed Workings and the Proposed Surface Infrastructure assessment area and therefore the Project will not impact any potential BSAL.

Table 2.8 Applied BSAL Criteria: Interim Protocol for Site Verification

Soil Landscape	Site Verification Step												Potential BSAL
Unit	1	2	3	4	5	6	7	8	9	10	11	12	
Hassans Walls	✘	-	-	-	-	-	-	-	-	-	-	-	No
Warragamba	✘	-	-	-	-	-	-	-	-	-	-	-	No
Cullen Bullen (a)	✓	✓	✓	✓	✘	-	✘	-	-	-	-	-	No
Cullen Bullen (b)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Wollangambe	✘	-	-	-	-	-	-	-	-	-	-	-	No
Medlow Bath	✘	-	-	-	-	-	-	-	-	-	-	-	No
Newnes Plateau	✘	-	-	-	-	-	-	-	-	-	-	-	No
Deanes Creek	✓	✓	✓	✓	✓	✓	✘	-	-	-	-	-	No
Mount Sinai	✘	-	-	-	-	-	-	-	-	-	-	-	No
Lithgow	✓	✓	✓	✓	✘	-	✘	-	-	-	-	-	No
Long Swamp	✓	✓	✓	✓	✓	✓	✘	-	-	-	-	-	No

Source: *Soil and Land Capability Assessment* (SLR, 2013a)



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Potential BSAL

FIGURE 2.7

2.10.3 Biophysical Strategic Agricultural Land Summary

As discussed two BSAL assessments have been completed due to differing BSAL assessment criteria contained firstly in the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c) and secondly the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH & DPI-OASFS, 2013).

The BSAL assessment conducted according to the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c) determined there was no BSAL within the Project Application Area.

Alternately, the BSAL assessment conducted according to the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH & DPI-OASFS, 2013) determined there are 26 ha of potential BSAL within the Project Application Area. However as the Proposed Workings and the Proposed Surface Infrastructure assessment area are well removed from the area of potential BSAL; no BSAL will be impacted by the Project.

The discrepancy in BSAL assessments can be traced to different assessment criteria between the two systems for 'Waterlogging Hazard'. Imperfect soil drainage with typical waterlogging duration of two-three months, every two-three years is classified as LSC Class 4 and therefore not potential BSAL according to the *Upper Hunter Strategic Regional Land Use Plan* (DP&I, 2012c). However, any soil classified as 'better than poor soil drainage' at Step 9 is considered BSAL according to the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH & DPI-OASFS, 2013).

The nearest mapped BSAL according to the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 - Strategic Agricultural Land Map - Sheet STA_33* (DP&I, 2013) is approximately 15 km to the north-west of the Project Application Area.

3 LOCAL AND REGIONAL AGRICULTURAL ENTERPRISES

3.1 Agricultural History

Whilst the modern Lithgow economy was established based on coal mining, copper smelting, steel manufacturing and other industrial enterprises, the grazing of beef cattle and sheep, along with some cropping for grain production have been carried out in the region since the 1830s. There are records of flour milling from locally grown wheat as far back as 1837, and later in 1857 a wool mill was developed to produce tweed from locally sourced wool. The wool mill operation continued for 115 years, ceasing operation in 1972. Grazing and some cropping activities still occur within the Lithgow Region, although it is not the dominant source of employment or earnings when compared to surrounding districts (Lithgow Tourism, 2012).

3.2 Agricultural Enterprises and Associated Industries

3.2.1 Regional Land Use

The Project Application Area has experienced forestry activities in conjunction with the coal mining industry since early European settlement. However, given the terrain, soils and vegetation within the area, very little agricultural activity has occurred within the immediate vicinity of the Project Application Area.

The agricultural land uses for the Lithgow LGA (Local Government Area), (Australian Bureau of Statistics (ABS), 2011) are shown in **Table 3.1**. The major points are summarised below.

- Agriculture accounts for 31% of land use of the total area within the Lithgow LGA.
- Agricultural land is almost exclusively used for grazing of sheep and beef cattle, covering greater than 99% of all agricultural land. Of these two main grazing enterprises sheep numbers make up 54% of the grazing animal population.
- Cropping enterprises comprise a minor portion of agricultural activities, utilising <1% of the agricultural land area.
- Cereal cropping for grain occurs over only 23 ha in the Lithgow LGA, which represents <0.1% of the total LGA land area.
- Minimal irrigation cropping is carried out, comprising <1% of the agricultural land in the region. Agriculture is a minor water user in the Lithgow Region, with 136 ML used to irrigate approximately 91 ha of agricultural land and an additional 674 ML utilised for other agricultural uses, such as vegetable and fruit growing.

Forestry has not been assessed as an agricultural enterprise as it is not included as an agricultural enterprise in the *Guideline for Agricultural Impact Statements* (DP&I, 2012b).

Table 3.1 Lithgow LGA – Agricultural Land Use

Agricultural Land Area	**Units**	**Total**
Total land area within LGA	ha	251,372
Area of agricultural land	ha	77,604
Proportion of agricultural land	%	31
Agricultural Enterprise		
Land under cropping activities	ha	85
Land under grazing activities	ha	77,519
Proportion of agricultural land used for grazing	%	>99%
Grazing Enterprises	**Units**	**Total**
Sheep and lambs	no.	36,381
Beef cattle	no.	30,420
Dairy cattle	no.	8
Pigs	no.	78
Total	no.	66,887
Proportion of sheep of total stock	%	54
Proportion of beef cattle of total stock	%	46
Proportion of pigs and milk cattle of total stock	%	<1%
Cropping Enterprises		
Cereals for grain	ha	23
Vegetables for human consumption	ha	3
Orchard trees (including nuts)	ha	35
Non-cereal broad acre crops	ha	24
Total land cropped	ha	85
Proportion of cropping land used for cereals	%	27
Irrigation		
Area irrigated	ha	91
Irrigation volume applied	ML	136
Other agricultural uses	ML	674
Total water use	ML	810
Proportion of agricultural land irrigated	%	<1%

Source: ABS (2011)

3.2.2 Regional Employment

A summary of the total employment within the Lithgow Region (Lithgow LGA) and the proportion of agriculture related employment is shown in **Table 3.2**. Agriculture is not a major employer within the region, accounting for only 9% of the total employed population.

Table 3.2 Lithgow Regional Agricultural Employment

Employment Sector	No. of persons	%
Total Regional Employment	**7,717**	**100**
Direct Regional Agricultural Employment	**207**	**3**
Indirect Regional Agricultural Employment	**492**	**6**
Total Regional Employment Related to Agriculture	**699**	**9**

Source: *ABS* (2011)

Employment in the agriculture related sectors is broken down in **Table 3.3** and the following key points are made in relation to this 9% employed in agriculture are:

- Agriculture-related wholesaling, retailing manufacturing and processing is responsible for the majority (70%) of total agricultural-related employment, compared to employment associated with direct agricultural production (30%).
- The major agricultural production employers are beef cattle comprising 68% of direct agricultural production. All other sectors are minor employers in the region.
- The main indirect agricultural related employment for the processing and manufacturing sector is road freight transport at 71%.
- Supermarkets and grocery stores account for the vast majority (70%) of indirect agricultural related employment in wholesaling and retailing.

Detailed agricultural employment figures are not available for the Project Application Area. However, a detailed agricultural enterprise assessment has been carried out in **Section 3.4**.

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- Supermarkets and grocery stores account for the vast majority (70%) of indirect agricultural related employment in wholesaling and retailing.

Detailed agricultural employment figures are not available for the Project Application Area. However, a detailed agricultural enterprise assessment has been carried out in **Section 3.4**.

Table 3.3 Lithgow Regional Agricultural Related Employment by Sector

Agricultural Related Sector Agricultural Production (Direct)	No. Persons	%
Agriculture General	18	3
Beef Cattle Farming (Specialised)	91	13
Nursery Production (Outdoors)	6	1
Onshore Aquaculture	3	<1
Other Livestock Farming	7	1
Grain-Sheep or Grain-Beef Cattle Farming	7	1
Horse Farming	5	1
Sheep Farming (Specialised)	25	4
Sheep-Beef Cattle Farming	42	6
Vegetable Growing (Outdoors)	3	<1
Subtotal	**207**	**30**
Agriculture Related Processing and Manufacturing (Indirect)	**No. Persons**	**%**
Bakery Product Manufacturing (Non-factory based)	11	2
Bread Manufacturing (Factory based)	5	1
Cake and Pastry Manufacturing (Factory based)	4	1
Fertiliser Manufacturing	3	<1
Meat Processing	4	1
Poultry Processing	3	<1
Fruit and Vegetable Processing	19	3
Food Product Manufacturing	6	1
Other Agriculture and Fishing Support Services	8	1
Road Freight Transport	154	22
Subtotal	**217**	**31**
Agricultural Related Wholesaling and Retailing (Indirect)	**No. Persons**	**%**
Agricultural and Construction Machinery Wholesaling	3	<1
Dairy Produce Wholesaling	3	<1
Other Agricultural Product Wholesaling	9	1
Flower Retailing	7	1
Fresh Meat, Fish and Poultry Retailing	18	3
Fruit and Vegetable Retailing	6	1
Other Grocery Wholesaling	22	3
Supermarket and Grocery Stores	204	29
Agricultural and Construction Machinery Wholesaling	3	<1
Subtotal	**275**	**39**
Total Agricultural Related Employment	**699**	**100**

Source: *ABS* (2011)

3.3 Regional Agricultural Production Value

Agricultural production values for the Lithgow LGA (ABS, 2011) total $18 million (M) per annum. The main agricultural production by value is from livestock products and slaughtering, accounting for $17 M (95%). Cropping enterprises comprise only $1 M of regional agricultural production (5%) (**Table 3.4**).

Table 3.4 Regional Agricultural Production

Agricultural Production Gross Value	Total (M)
Crops	$1
Livestock slaughtering	$11
Livestock products	$6
Total gross agricultural production	**$18**

Source: *ABS* (2011)

3.4 Potential Agricultural Production Value of the Project Application Area

After field inspection by SLR's Senior Agronomist it is expected that income generated from agricultural enterprises within the Project Application Area would be minimal due to the small area available for actual agricultural production, with most landholders reliant on off-farm income. It is therefore concluded that there are minimal individuals directly employed within agriculture in the Project Application Area.

Notwithstanding, potential agricultural productivity was determined using the NSW Department of Trade and Investment agricultural productivity data for agricultural enterprises suitable for each of the LSC classes that are within the Project Application Area and could potentially be impacted upon by the Project (see **Section 2.9**). This analysis has been undertaken on the potential agricultural capability of the land rather than current land use. At present the majority of the Project Application Area is native woodland and not suitable for agricultural production in its current guise. If the below agricultural production values were to be realised, significant investment in land management and agricultural infrastructure would be required in order to yield the identified agricultural production values. However, this information can be used to approximate potential agricultural income.

The *Beef Cattle Gross Margin Budget Yearling Southern/Central NSW* ((NSW Industry and Investment (I&I), 2012), the *NSW Department of Primary Industries Beef Stocking Rates & Farm Size* (DPI, 2006) and the *Merino Ewes (20 micron) – Maternal Meat Rams Farm Enterprise Budget Series – December 2011* (DPI, 2011) have been applied to this assessment. Full agricultural productivity information is contained in **Appendix 1**. Gross margins for each applicable agricultural enterprise per LSC Class are shown in **Table 3.6** and **Table 3.5**. The major points are listed below:

- Class 4 land has the potential to generate approximately $167/ha from a beef cattle grazing enterprise or $307/ha from a Merino meat lamb enterprise.
- Class 5 land has the potential to generate approximately $125/ha from beef cattle grazing enterprise or $230/ha from a Merino meat lamb enterprise.
- Class 6 land has the potential to generate approximately $107/ha from beef cattle grazing enterprise or $171/ha from a Merino meat lamb enterprise.
- Class 7 land has the potential to generate approximately $54/ha from beef cattle grazing enterprise or $86/ha from a Merino meat lamb enterprise.
- Class 8 land is not suited to any agricultural enterprise and as such does not have a gross margin value.

Table 3.5 Beef Cattle Gross Margin per LSC Class

LSC	Livestock-Carrying Capacity	Cow and Calf	Revenue	Variable Costs	Gross Margin
Class	**Dry sheep equivalent**	**Per ha**	**Per ha**	**Per ha**	**Per ha**
4	8	0.48	$276	$109	$167
5	6	0.36	$207	$82	$125
6	4	0.24	$138	$31	$107
7	2	0.12	$69	$15	$54
8	Nil	N/A	N/A	N/A	Nil

Table 3.6 Merino Meat Lamb Gross Margin per LSC Class

LSC	Livestock-Carrying Capacity	Ewe & Lamb	Revenue	Variable Costs	Gross Margin
Class	**Dry sheep equivalent**	**Per ha**	**Per ha**	**Per ha**	**Per ha**
4	8	3.2	$592	$285	$307
5	6	2.4	$444	$214	$230
6	4	1.6	$296	$125	$171
7	2	0.8	$148	$62	$86
8	Nil	N/A	N/A	N/A	Nil

Beef cattle and sheep comprise the majority of livestock numbers in the Lithgow LGA, as such an 'average' gross margin per ha was determined by combining these grazing enterprises, shown in **Table 3.7**.

Based on the nominated average gross margins, and assuming the required agricultural capital costs and fixed costs are outlaid (not included in the calculations in **Table 3.5** and **Table 3.6**) the Project Application Area has the potential to generate an estimated gross margin of $797,743 per annum, included in this value is the potential gross margin for the Proposed Surface Infrastructure assessment area of $14,138 (see **Table 3.7**). It is important to note that these figures are derived from the optimum potential agricultural use and are likely to be much greater than actual agricultural enterprise income being achieved at the time of publication.

Table 3.7 Potential Annual Gross Margins

LSC	Average Gross Margin (GM)	Project Application Area		Proposed Surface Infrastructure Assessment Area	
Class	**Per ha**	**ha**	**Gross Margin**	**ha**	**Gross Margin**
4	$237	1,279	$303,123	11	$2,607
5	$178	2,051	$365,078	64	$11,392
6	$139	798	$110,922	1	$139
7	$70	266	$18,620	Nil	Nil
8	Nil	1,282	Nil	Nil	Nil
Disturbed Terrain	Nil	136	Nil	Nil	Nil
Total	**N/A**	**5,812**	**$797,743**	**86**	**$14,138**

3.5 Agricultural Support Infrastructure

There is limited agricultural support infrastructure in the Lithgow LGA. The main arterial road is the Great Western Highway whilst the main rail line is the Main Western Railway.

There are a small number of rural merchandise and agricultural businesses which cater to the various 'lifestyle' and 'hobby farms'. The nearest livestock selling centre is located at Carcoar Central Tablelands Livestock Exchange, approximately 52 km from the Project Application Area and outside of the Lithgow LGA. Grain production is a minor activity in the area and there are no grain delivery sites in the Lithgow LGA.

In the broad regional context, agriculture is a minor contributor to the local economy with total gross agricultural production of $18 M; this is in comparison the Bathurst LGA at $47 M (ABS, 2011). Approximately 33% of land within the Lithgow LGA is suitable for agricultural production (Bathurst LGA 63%). The total value of agricultural production to the Lithgow LGA is low.

The average value of agriculture (livestock and cropping activities) for agriculturally suitable land in the Lithgow LGA in 2011 was calculated at $135/ha from a total agriculture production value of $18 M (ABS, 2011). This low value per ha and the smaller holding size suggests that many agricultural enterprises are reliant on off-farm income (Lithgow City Council (LCC), 2007 and LCC, 2010).

Of the land suited to agriculture within the Lithgow LGA only 1.4% (2,945 ha) is capable of sustaining regular cultivation. Only 64% (134,563 ha), of the land zoned Rural General 1(a) (210,357 ha) in accordance with the Lithgow Local Environment Plan 1994, which is largely fragmented, is capable of sustaining regular agricultural production such as sheep or beef cattle grazing. There is a bias towards beef cattle and to a lesser extent sheep grazing for agricultural enterprises in the Lithgow LGA (LCC, 2007).

There small areas of traditional agricultural production, such as beef cattle, sheep, horse and goat grazing, within the Project Application Area, however they are far removed from any areas of potential disturbance.

4 ASSESSMENT OF POTENTIAL IMPACTS

The land within the Project Application Area with the potential to be disturbed by the Proposed Surface Infrastructure will be a maximum of 11.8 ha. The Proposed Surface Infrastructure area includes the proposed disturbance associated with the establishment of:

- Bores 9 and 10 dewatering facilities.
- The upgrade of existing and creation of new sections of access tracks.
- Establishment of the infrastructure corridors between the existing SDWTS and substation 4 to the proposed dewatering facilities.
- The upgrade or the duplication of the SDWTS to increase the transfer capacity.

Whilst none of this land is currently being used for agricultural activities an agricultural productivity assessment has been applied against its potential agricultural value.

4.1 Land Resources

4.1.1 Land Temporarily Removed From Agriculture

4.1.1.1 Surface Disturbance: Social and Economic Impact

To ensure due diligence and allow for the incorporation of possible alignment changes during the EIS process a Proposed Surface Infrastructure assessment area of 86 ha has been assessed for potential surface disturbance (**Figure 1.2**). The Proposed Surface Infrastructure assessment area includes all Asset Protection Zones as defined by the NSW Rural Fire Service (RFS) in *Standards for Asset Protection Zones* (RFS, 2006).

The Proposed Surface Infrastructure assessment area has been assessed under the scenario that it will temporarily remove 86 ha of land from potential agricultural production during the life of the Project (approximately 13 years), which represents 1.5% of the Project Application Area. The LSC classes within this 86 ha are listed in **Table 4.1**.

Table 4.1 Temporary Surface Disturbance

LSC	Proposed Surface Infrastructure Assessment Area		Gross Margin	
Class	**ha**	**% of Project Application Area**	**Per ha**	**Total**
4	11	0.2	$237	$2,607
5	64	1.1	$178	$11,392
6	1	<0.1	$139	$139
7	Nil	Nil	$70	Nil
8	10	0.2	Nil	Nil
Total	**86**	**1.5**	**-**	**$14,138**

Using potential agricultural productivity information described in **Section 3.4**, the estimated net annual economic impact on potential agricultural productivity resulting from the temporary loss of land is $14,138 per annum (**Table 4.1**). The flow-on effects to employment and local business are considered negligible as the area of land to be disturbed and associated potential agricultural productivity is very low.

4.1.1.2 Other Impacts Social and Economic Impact

The *Subsidence Predictions and Impact Assessment* (MSEC, 2013) identified potential impacts on manmade and natural features as a result of subsidence and these are:

- Wire fencing used in agriculture can be affected by tilting of fence posts and by changes of tension in the fence wires due to strain as mining occurs. These types of fences are generally flexible in construction and can usually tolerate tilts of up to 10 mm/m and strains of up to 5 mm/m without significant impacts. It is likely, therefore, that some of the wire fences within the Project Application Area would be impacted as the result of mining.
- Groundwater wells or bores. There were no registered groundwater bores identified above the Proposed Workings. There were, however, registered groundwater bores identified in the vicinity of the Proposed Workings, with the locations shown in **Figure 2.3**. The registered uses of these bores are for groundwater monitoring or mine dewatering. No detrimental impacts are anticipated on any other groundwater users in the area (RPS, 2013a).
- Ponding. The predicted post-disturbance slope gradients are expected to be very similar to the natural grades along drainage lines. Therefore it is not expected that any significant change in ponding or scouring along drainage lines will occur. Where the natural gradients are naturally low upstream of longwall chain pillars, some minor ponding may occur (MSEC, 2013)

Such impacts are readily managed through mitigation measures, as summarised in **Section 5**.

Total potential loss to agricultural enterprises due to the Project is $14,138 per annum. When compared to the gross annual value of agricultural production for the Lithgow Region ($18 M) and the net present value for the Project of $62.15 M per annum (Agis Group, 2013), $14,138 is considered a negligible impact on agricultural enterprises and related industries. The only area of actual agricultural production (175 ha) is well outside the Proposed Surface Infrastructure assessment area and Proposed Workings and will not be impacted by the Project.

4.1.2 Land Permanently Removed From Agriculture

Following cessation of mining the *Decommissioning and Rehabilitation Strategy* (SLR, 2013b) proposes to rehabilitate the disturbed land to create final landforms commensurate with the end land uses in accordance with the proposed land zoning in the draft *Lithgow City Local Environmental Plan* (2013). The final land use for the Proposed Surface Infrastructure area is woodland, which is consistent with the proposed RU3 Forestry for all infrastructure areas on Newnes Plateau.

There is no land within the Project Application Area that will be permanently removed from agriculture as a result of the Project.

4.2 Water Resources

4.2.1 Surface Water

Springvale is a net water producer with excess surface water released through LDP001 There is no proposed change to surface water management at the Springvale Pit Top, with water balance modelling indicating there is no proposed increase in discharge at LDP001 (RPS, 2013a).

The Project will lead to increased groundwater inflows to underground workings and excess groundwater will be released through LDP009 into the Coxs River. The water management strategy at Springvale will continue to transfer excess water to the SDWTS to the full 30 ML/day capacity of the pipeline, discharging into the Coxs River at LDP009. At a later stage of the Project capacity of the SDWTS may be increased to 50 ML/day (RPS, 2013a).

The median flow (50th percentile) of the Coxs River immediately upstream from Lake Wallace is 12.2 ML/day. Current water demand at Wallerawang Power Station is 30 ML/day, of which 18.5 ML/day is currently met by the SDWTS; the remainder is sourced from the Fish River Water Supply Scheme or the Coxs River. In addition, the Mt Piper Power Station sources 34.5 ML/day from the Coxs River. Consequently the impact of any increased discharge into the Coxs River will be negligible as there is excess water demand for the Coxs River water source (RPS, 2013a).

The discharges at LDP009 are not expected to significantly change the current salt (EC) concentration of the Coxs River in the long term. Salt levels in the Coxs River average 600 micro Siemens (µS/cm), ranging between 400 µS/cm to 1,200 µS/cm. Analysis of groundwater to be discharged at LDP009 is 1,100 µS/cm (RPS, 2013a). These daily releases will have a positive impact on water security for downstream agricultural enterprises as water within this salinity range is suitable for all livestock and moderately salt sensitive plants such as lucerne, perennial grasses and cereal crops (Industry & Investment, 2009).

RPS (2013a) recommends current water quality requirements of pH 6.5 – 8.0, total suspended solids 30 mg/L and oil and grease of 10 milligrams per litre (mg/L) be maintained, therefore there are no impacts expected on water quality in the Coxs River catchment.

Any cumulative drawdown impacts resulting from the Project are not predicted to reach the Coxs River, resulting in no baseflow loss or loss of surface flow within the Coxs River. There are predicted baseflow declines at Paddy's Creek, Marrangaroo Creek and Carne Creek. However, as these creeks are ephemeral and flow only after prolonged or significant rainfall events the differences in observed on recorded flows are unlikely to be noticeable (RPS, 2013b).

The predicted changes in grade due to the Proposed Workings along Wolgan River are small when compared to the existing natural grades and it is unlikely that there would be any significant changes in the levels of ponding, flooding or scouring of river banks, or any significant changes in the stream alignment. If any fracturing were to occur in the river, it would be expected to be isolated and minor in nature (MSEC, 2013).

The *Surface Water Assessment* (RPS, 2013a) states that predicted subsidence impacts indicate the catchment boundaries of the creek systems to be undermined will not change significantly. It was found the potential for any significant change to remnant ponding or storage of surface run-off will be minimal.

Minor impacts on the Newnes Plateau surface water drainage and features are expected to occur due to mine induced subsidence. It is anticipated that subsidence will locally increase land scouring and/or sedimentation, but the overall soil loss balance of the catchment will remain close to neutral (sedimentation balanced with scouring). The overall available runoff during rainy events will be slightly reduced due to the overall increased permeability of the catchment due to surface decompression and fracturing, but this will enhance shallow aquifer recharge, and then down-gradient base flow contributions to stream flows. There exists a risk of impacts on stream flows in rivers, creeks and swamps due to fracturing of the river bed but it is expected for the flows to reappear further downstream as it has been observed in previous mining operations (RPS, 2013a).

It can be concluded that the Project is unlikely to cause long term impacts on surface water quality or quantity within the Project Application Area or further downstream, which are relied on by agriculture.

4.2.2 Groundwater

Coal mines surrounding the Project Application Area were included in the groundwater impact model to adequately address Aquifer Interference Policy (NSW Office of Water, 2012) requirements and the Project's DGRs. The *Groundwater Impact Assessment* (RPS, 2013b) states that there are no detrimental impacts anticipated on any other groundwater users in the vicinity of the Project Application Area. This is supported by the *Groundwater Impact Model* (CSIRO, 2013), which predicts only minor impacts to the shallow groundwater system and baseflow. This was modelled on a conservative basis whereby the model was unable to replicate the self-healing nature of creek sand swamps, and as such over-predicts the magnitude of potential impacts.

No deterioration in groundwater quality has been observed during current operations at Springvale, with current inflow water quality between 700 – 1,000 µS/cm and no detrimental impacts to groundwater quality are predicted as a result of the Project within the Project Application Area or potential regional influence (RPS, 2013b).

The only known groundwater user in the vicinity of the Project Application Area is Springvale itself, with approximately 1.5 ML/day utilised for mine supply (RPS, 2013b). As there are no other groundwater users within the vicinity of the Project Application Area, there are no detrimental impacts anticipated upon agricultural enterprises reliant on groundwater resources associated with the Project.

Therefore there are no detrimental impacts anticipated upon agricultural enterprises reliant on groundwater resources associated with the Project.

4.2.3 Groundwater Reallocation

The *Western Coalfields Water Balance* (GHD, 2013) shows groundwater licences held by Springvale total 9,483 ML (**Table 4.2**). There is the possibility that groundwater extracted via Springvale`s current groundwater extraction licences could be used for agricultural irrigation, given the groundwater electrical conductivities fall in the range 700 – 1,000 µS/cm (RPS, 2013b), which is defined as good quality groundwater and suitable for all agricultural enterprises (NSW Industry & Investment, 2009).

Table 4.2 Groundwater Extraction Licences

Licence Number	Bore Name	Extraction Volume (ML/year)	Groundwater Source
10BL603519	Bore 6	5,958	Sydney Basin Richmond
10BL601863	Shaft 3	3,300	Sydney Basin Coxs River
10BL602017	Collector System	585	Sydney Basin Coxs River
Total		**9,483**	

Source: *Western Coalfields Water Balance* (GHD, 2013)

4.2.3.1 Agricultural Productivity Impact

Applying an agricultural productivity assessment and assuming that all 9,483 ML could have been be used elsewhere in the catchment for irrigated cropping, the gross margin for the production of spray-irrigated lucerne has been calculated. Spray-irrigated lucerne uses on average 8 ML/ha/annum; therefore, a maximum of 1,185 ha of lucerne could be irrigated using the 9,483 ML of licenced groundwater extraction.

Assuming five cuts of irrigated lucerne per season, at 2.5 tonnes per/ha/cut, the gross annual revenue and for this enterprise is $3,440/ha with a gross margin of $780/ha. Gross margins were determined using *Dryland Lucerne Hay Gross Margin Budget Northern Zone Summer 2010-11* (I&I, 2010) and *Surface Irrigated Lucerne – Established Stand Summer 2011-2012* (DPI, 2011) (**Appendix 1**).

Whilst there is not land suitable for irrigation within the Project Application Area (LSC Class 1, 2 or 3), there is land suited to irrigation within the region. With a potential 9,483 ML not being available for agriculture it is assumed that the 1,185 ha of irrigation land would otherwise be used for dryland lucerne production with productivity levels represented by LSC Class 3 (**Table 4.**). The estimated net annual economic impact on potential agricultural productivity as a result of using this land for dryland cropping rather than irrigated cropping is a difference in estimated potential gross income of $373,275 per annum.

Table 4.3 Groundwater Use Gross Margins

LSC	Farming Type	Lucerne	Potential Revenue	Variable Costs	Gross Margin	Total
Class		**Tonnes per ha**	**Per ha**	**Per ha**	**$ Per ha**	**1,185 ha**
3	Dryland	5	$1,440	$975	$465	$551,025
3	Irrigation	12.5	$3,440	$2,660	$780	$924,300

The above calculations consider groundwater removed by the Springvale through de-watering would otherwise be available for agricultural use. Therefore, whilst the Springvale currently holds groundwater extraction licences for 9,483 ML, this water would not be considered as being taken from potential agricultural as there are no agricultural users of groundwater within the vicinity of the Project Application Area.

In summary the total potential gross income which could be generated from a 1,185 ha irrigated lucerne enterprise utilising 9,483 ML of licenced groundwater is $924,300 per annum, a difference of $373,275 per annum when compared to gross income generated by a dryland lucerne enterprise.

4.2.3.2 Long-term Use of Reallocated Water

At the completion of mining operations and following rehabilitation, water licences held by Springvale, may be sold on the water transfer market, and as such water may become available for irrigated agriculture or some other beneficial use.

4.3 Impact on Biophysical Strategic Agricultural Land

The *Soil and Land Capability Assessment* (SLR, 2013a) identified 26 ha of potential BSAL within the Project Application Area; whilst there is no BSAL identified within the Proposed Surface Infrastructure assessment area. Therefore the Project is not expected to have any impact upon BSAL.

Furthermore the nearest mapped BSAL is approximately 15 km to the north-west of the Project Application Area and will not be impacted by the Project.

4.4 Impact on Agricultural Resources from Biodiversity Offsets

A regional biodiversity offset strategy has been proposed by Springvale to offset the loss of vegetation clearing associated with the construction of the new surface facilities required to support the Project.

The proposed regional offset strategy will take into consideration the impacts and offset requirements for other Centennial projects in the locality including the Angus Place Colliery Mine Extension Project, Nuebecks Project and the Airly Mine Extension Project. Until the biodiversity offset strategy is formalised, impacts upon agricultural resources cannot be determined as the area of agricultural land which may be used for biodiversity offsets is not known. However, Centennial will aim to minimise any impact of these biodiversity offsets on productive agricultural land.

4.5 Other Impacts

4.5.1 Visual Amenity and Landscape Values

The Project aims to maximise the use of existing surface infrastructure, and there is no new surface infrastructure proposed to be installed on currently utilised agricultural land (**Figure 2.2**). The *Visual Impact Assessment* (Golder, 2013c) undertaken found the Project to have a negligible to low visual impact. Among other reasons, this can be attributed to the Proposed Surface Infrastructure to be located within a landscape context of sloping and ridgeline formations with moderate to dense tree cover and a high visual absorption capacity, far removed from any agricultural enterprises. On this basis, the Project will have negligible impact on visual amenity and landscape value relied upon by local and regional agricultural enterprises.

4.5.2 Tourism

The impact assessment has not identified any tourism infrastructure in the local area upon which agricultural enterprises are reliant. Therefore the Project is not anticipated to have an impact on local agriculture-related tourism.

4.5.3 Weed Management and Biosecurity

There is moderate risk from weed infestation during the construction and operational phases of the Project through vehicle movements on and off site. Weeds are currently managed within the frameworks of the Springvale Environmental Management System (EMS), which includes issue-specific environmental management plans and monitoring programs. Continued inspection for weed germination will be conducted during the construction phase of the Project.

Biosecurity is defined in the *Draft NSW Biosecurity Strategy* (DPI, 2012b) as 'the protection of the economy, environment and community from 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. Any import of equipment or machinery from overseas will follow the standard procurement safeguards and quarantine procedures as per Australian requirements. Given the processes above, it is considered the Project is unlikely to represent an increased risk to the biosecurity of agricultural resources and enterprises within the region.

4.5.4 Dust

There is potential for the Project to generate dust primarily as a result of construction activities, mine operations (including crushing and transfer of coal), mine ventilation and site rehabilitation. The *Air Quality and Greenhouse Gas Assessment* (SLR, 2013c) undertaken for the Project advised the predicted results showed that construction, mine operations and subsequent rehabilitation activities are unlikely to cause any exceedences of the relevant ambient air quality criteria for TSP, PM_{10} and $PM_{2.5}$ concentrations or dust deposition at any identified surrounding sensitive receptors.

On this basis, it is concluded the Project will have negligible impact on agricultural resources and enterprises. Mitigation measures to minimise dust generation are discussed in **Section 5.**

4.5.5 Noise

Generally, agriculture is only impacted by noise when constantly high noise levels or sudden loud noise leads to a decrease in animal production through increased livestock stress. Results of the construction noise modelling assessment undertaken by SLR (2013d), *Noise Impact Assessment*, indicates that the relevant intrusive and amenity noise criteria will be significantly below the relevant noise criteria at the nearest receiver locations, and will result in negligible increases in cumulative mining and industrial noise levels.

Operational noise modelling has indicated that noise emissions associated with the existing Springvale Pit Top are not predicted to exceed the project specific noise levels. No noise level increases are predicted at the nearest residential receivers as a result of the Project. Similarly traffic noise generated during construction and operation of the Project is predicted to be within the NSW Road Noise Policy criteria at all receiver locations.

On this basis, noise is unlikely to impact agricultural production within the area.

4.5.6 Traffic

Noise and dust emissions generated by the Project, including those associated with traffic movements, are anticipated to have a negligible impact on agricultural resources and enterprises within the area (SLR, 2013c and SLR, 2013d). There will be an increase in road traffic as a result of the Project from the construction phase and additional vehicle movements in the operational phase. The transportation of coal extracted Project Application Area will be via overland conveyor systems and will therefore not result in increased road traffic.

The *Traffic Impact Assessment* (ARC Traffic Transport, 2013) found that the Project will not adversely impact on the local road network. On this basis, and considering there are no agricultural enterprises in the immediate surrounds of the Project Application Area, the impact to agricultural resources and enterprises as a result of increased traffic movements associated with the Project is considered negligible.

4.6 Other Agricultural Regional Community Impacts

Other impacts which may affect the regional community include bushfire risk, social impact, greenhouse gas production and economic impact, all of which are addressed fully in the EIS with specialist studies assessing these regional impacts and the recommended mitigation measures and management strategies to ensure impact to the regional community as a result of the Project is minimised. These specialist studies include:

- *Bushfire Hazard Assessment* (Golder, 2013a)
- *Economic Impact Assessment* (Agis Group, 2013)
- *Social Impact Assessment* (Marshall, 2013)
- *Air Quality and Greenhouse Gas Assessment* (SLR, 2013c)

5 MITIGATION MEASURES

5.1 Review of Project Design

As part of the pre-feasibility and feasibility phases undertaken for the Project, a detailed mine design exercise was undertaken by Springvale in parallel with the exploration drilling program, baseline environmental surveys and the development of the subsidence model. Various mine layouts were developed and assessed in response to information being received on geological, geotechnical, environmental, surface infrastructure and mining constraints.

Furthermore, a number of locations within the Project Application Area were considered by Springvale for the Proposed Surface Infrastructure. The proposed locations were identified and selected as the optimal option in consideration of, the existing surface environment, including vegetation communities, soil type and watercourses.

5.2 Proposed Mitigation Measures and Management Strategies

This section describes the proposed mitigation measures and management strategies recommended to be implemented to minimise potential agricultural impacts as a result of the Project. It is proposed that the recommendations made in the specialist assessments (as relevant) undertaken for the Project be adopted and incorporated into the Springvale's EMS (including issue-specific environmental management plans and monitoring programs).

Whilst the majority of impacts on agricultural enterprises and resources have been assessed as negligible, as a matter of best practice Springvale 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.

5.2.1 Land Resources

5.2.2 Minimisation of Impacts to Agricultural Lands

No land currently used for agricultural production will be impacted by the Project.

5.2.2.1 Soil Resources

The *Decommissioning and Rehabilitation Strategy* (SLR, 2013b) provides general soil management practices to minimise the impact of the Project on soil resources. These practices include the:

- Identification and quantification of potential soil resources for rehabilitation.
- Optimisation and recovery of useable topsoil and subsoil during stripping operations.
- Management of soil reserves in stockpiles so as not to degrade the resource.
- Establishment of effective soil amelioration procedures to maximise the availability of soil reserve for future rehabilitation works.

5.2.2.2 Wire Fencing

Any subsidence impacts on wire fencing could be remediated by re-tensioning the fence wire, straightening fence posts, and if necessary, replacing some sections of fencing.

The development of an Extraction Plan is recommended in the *Subsidence Predictions and Impact Assessment* (MSEC, 2013) and will include mitigation measures for possible subsidence damage to wire fencing and gates.

5.2.2.3 Dust

The *Air Quality and Greenhouse Gas Assessment* (SLR, 2013c) recommends procedures to minimise the impact of dust generated in association with construction and during the life of the Project, including unsealed roads to be kept sufficiently watered to minimise windblown and traffic generated dust and truck movements being controlled on site and restricted to designated roadways. All loaded trucks during construction should be covered to minimise dust.

5.2.3 Water Resources

The Project will have negligible anticipated impact on water resources (surface and groundwater) associated with agricultural resources and associated enterprises (RPS, 2013a; RPS, 2013b). A Water Management Plan will be developed and will include monitoring of surface and groundwater.

The Water Management Plan will include aspects that will control run-off generated from the surface infrastructure area. This will minimise off-site water quality impacts and the volume of surface water run-off that is contained on-site and therefore unavailable for agricultural uses.

The Project also includes the installation of a number of boreholes for a ventilation shaft, dewatering bore facilities and service boreholes that will be drilled between the underground workings and the ground surface. Previous service bores at Springvale have been installed using blind boring, mud rotary drilling methods to minimise any potential mixing of different quality water between aquifers. On completion of drilling the service bores are cased and grouted over their full length. The grouting of the service bores will prevent the possibility of shallow aquifers draining to deeper aquifer or the underground and will also prevent any cross contamination of aquifers of differing water quality (RPS, 2013b).

The *Surface Water Assessment* (RPS, 2013a) recommends a number of surface water management options which will minimise impact of the Project on water resources which include:

- Expansion the surface water monitoring network within the Newnes Plateau to detect any significant impacts on surface flows as a result of the Project.
- Installation at least one flow station on the Coxs River to monitor real time natural flows for comparison with the increased discharges at LPD001 and LDP009.
- Implementation of a surface water management strategy that aims to minimise discharge to Coxs River.
- Upgrading the water management system at the pit top to achieve complete clean and dirty water separation so that water being discharged off site via LDP001 will not compromise the water quality of the receiving waters.
- Continue to meet current water quality requirements at LDPs, with treatment occurring should water quality fall outside these ranges.

5.2.3.1 Farm Dams

There are no farms dams located within the Proposed Workings area, therefore there are no impacts predicted as a result of subsidence.

5.3 Rehabilitation of Disturbed Lands: Demonstrated Capacity

The successful restoration of land to target LSC classification is an important component of mining operations to negate any long-term impacts on agricultural resources. Springvale has previously demonstrated successful rehabilitation of disturbed lands at disturbance sites to achieve nominated final land use and restoration of natural resources. Rehabilitated areas of Springvale's previous surface disturbance have well established vegetative cover, effectively minimising the potential for erosion.

Examples of successful rehabilitation are taken directly from the *2012 Springvale Annual Environmental Management Report* (AMER) (Centennial, 2013) and are briefly described below:

- All exploration and groundwater monitoring drill sites disturbed during the 2012 drilling program have been rehabilitated.
- Rehabilitated sections of the Springvale surface area are well established and have provided vegetation cover to effectively minimise the potential for erosion.
- A review of the rehabilitation cost estimate for the operations was undertaken in 2012 as part of a review of the operation. The review resulted in some minor changes to the Springvale estimate as rates were adjusted for inflation. The disturbance footprint for the operation is similar to last year.

To date Springvale and has completed 7.88 ha of surface disturbance rehabilitation to native woodland, with detail given in **Table 5.1**, which also shows the total area of surface disturbance to be rehabilitated in the future (26.03 ha). Springvale has shown an ongoing commitment to the rehabilitation of mine disturbance areas.

Table 5.1 Springvale Rehabilitation Summary

Mine Lease Area		Area Impacted/Rehabilitated (ha)	
		Current to Date	2013 Estimate
Springvale Mine	All disturbed areas to be rehabilitated at closure	24.73	26.03
	Total area rehabilitated to native woodland	7.88	1.5

Source: *Springvale AEMR* (2013)

5.4 Demonstrated Planning for Progressive Rehabilitation

Planning for progressive rehabilitation is detailed in the *Decommissioning and Rehabilitation Strategy* (SLR, 2013b). Principal rehabilitation objectives for the Project include:

- Commencing progressive rehabilitation of disturbed areas as soon as practicable,
- Creating a stable post-mining landform that is consistent with surrounding areas and preserves downstream water quality.

In addition to the above key rehabilitation objectives, the Springvale Environment and Community Policy also take into account mine closure issues, with specific reference to:

- Making appropriate decisions which comply with or exceed approvals, licences and agreements.
- Working constructively with local authorities, stakeholders and communities.
- Contributing to the conservation of biodiversity.
- Planning, designing and closing operations in a manner that enhances sustainable development.
- Engaging and communicating openly with communities, with due regard and respect for local interests, cultures and customs.

Springvale has committed to a policy of post-mining land use being consistent with the *Decommissioning and Rehabilitation Strategy* (SLR, 2013b).

6 STAKEHOLDER CONSULTATION

Springvale has undertaken consultation with government agencies, local Aboriginal groups, the Springvale Community Consultative Committee (CCC), surrounding residents and the wider community and service providers during pre-feasibility, feasibility and planning stages of the Project.

At commencement of the Project, the *Springvale Mine Extension Project Stakeholder Engagement Plan October 2011 – December 2014* (Centennial, 2011) was developed to provide a consistent management framework for the identification and consultation with stakeholders that have an interest in the Project. The objectives of the plan are to:

- Establish a process for engagement with stakeholders, with clear outcomes for Springvale and the various stakeholders.
- Openly communicate with stakeholders about the Project.
- Provide a means of community access to the Springvale Project Team via a dedicated information phone line (the Springvale Community Information Hotline).

A number of different strategies for communicating with the community throughout the Project were identified and undertaken, including:

- the Springvale CCC which meets every six months;
- meetings with individual landowners and stakeholders;
- community newsletters;
- publications in the local newspaper, the *Lithgow Mercury*;
- the Centennial Coal website;
- community open days and information sessions; and
- community surveys.

Outcomes of the Springvale Stakeholder Engagement Strategies are outlined in the *Springvale Mine Extension Project Stakeholder Engagement Plan* (Centennial, 2011), and include the following:

- To maintain and continue to develop trust in Springvale's operations with neighbouring residents, community, government and other stakeholders through comprehensive and well-timed engagement and communication.
- Contribute to good working relationships with neighbouring residents, community and government by proactively anticipating and addressing concerns regarding the Project.
- Be responsive to community concerns by incorporating community feedback into periodic internal and external reviews of environmental compliance and community engagement.
- Contribute to the development of local social capital and capacity by sponsoring and donating to local community organisations.

Full details of consultation undertaken by Springvale are contained in the EIS prepared for the Project. No issues regarding impacts to agricultural resources or enterprises were raised by stakeholders during the extensive consultation process.

Springvale is committed to on-going community consultation and will continue to engage with the community for the purposes of providing information relating to the Project and on-going operations of Springvale.

7 KEY FINDINGS

This AIS has been prepared for the Springvale Mine Extension Project in accordance with the *Strategic Regional Land Use Policy* (DP&I, 2012a) and *Guideline for Agricultural Impact Statements* (DP&I, 2012b). The purpose of this AIS is to assess and report on the potential impacts of the project on agricultural resources and/or industries within and surrounding the Project Application Area.

The key findings of the AIS are listed below.

- There will be no land permanently removed from agriculture as a result of the Project.
- There is no land which has been, or is currently being used for agriculture, which will be impacted by the Project. Note, forestry was not assessed as an agricultural enterprise as it is not included as an agricultural enterprise in the *Guideline for Agricultural Impact Statements* (DP&I, 2012b).
- Only 3% (175 ha) of the Project Application Area is cleared land and currently used for agricultural production. The main aagricultural land use within the Project Application Area is beef cattle, sheep, horse and goat grazing in areas along the western edge.
- There are no agricultural enterprises located within or adjacent to the Proposed Workings or the Proposed Surface Infrastructure assessment area.
- The Project Application Area contains 26 ha of potential BSAL; however, there is no BSAL within the Proposed Workings area or the Proposed Surface Infrastructure assessment area. However there is no mapped BSAL within 2 km of the Project Application Area.
- Post-mining potential agricultural economic activity in the Project Application Area is expected to be similar to pre-mining activity as there is no change predicted between the pre- and post-mining LSC classifications.
- The Project will have a positive impact on surface water resources relied upon by agriculture through increased discharge of water ‘suitable for agriculture’ into the Coxs River catchment
- The Project will have negligible impact on groundwater resources relied upon by agriculture.
- The Project will provide considerable positive economic benefits to the local and broader communities with a net present value of $808 M. These benefits are much greater than the potential income lost by existing or potential agricultural enterprises, calculated as a precautionary assessment on impacted agricultural resources.
- No issues regarding impacts to agricultural resources, enterprises or stakeholders were raised during the consultation process.
- Stakeholder and community consultation will be ongoing throughout the life of the Project.

In summary, the Project will provide economic benefits to the region whilst having negligible impact on agricultural resources, enterprises or related industries.

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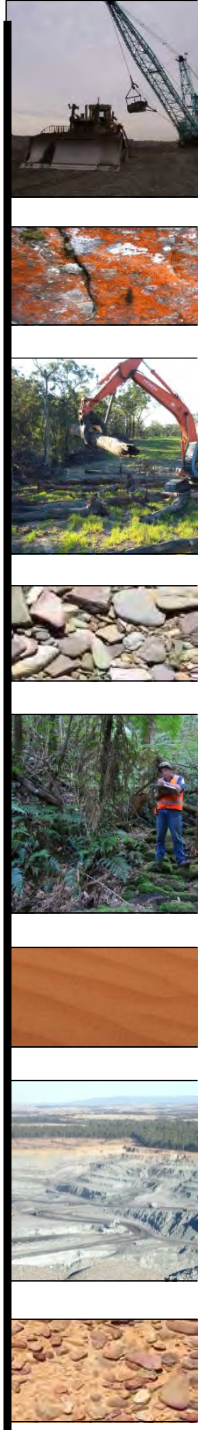
Agricultural Gross Margin Sensitivity Analysis



APPENDIX 1

BEEF CATTLE GROSS MARGIN BUDGET

Farm enterprise Budget Series: June 2012

Enterprise: **Yearling (Southern/Central NSW)**

Enterprise Unit: **100 cows**

Pasture: **Improved**

INCOME:				**Standard Budget**	**Your Budget**
42	steers 12-15 months @		$687 /hd	$28,844	
22	heifers 12-15 months @		$611 /hd	$13,431	
1	CFA Bull @		$1,253 /hd	$1,253	
7	CFA cows @		$701 /hd	$4,909	
11	Other culls @		$701 /hd	$7,714	
83					
	A. Total Income:			**$56,150**	

VARIABLE COSTS:					
Replacements	1	Bull @	$5,000 /hd	$5,000	
Livestock and vet costs: see section titled beef health costs for details.				$1,203	
Ear tags @	$2.00			$40	
Fodder crops				$0	
Hay & Grain				$0	
Droughts can increase feed costs. For example costs see main menu.				$0	
Pasture maintenence (211 ha improved pasture per 100 cows)				$10,550	
Livestock selling cost (see assumptions on next page)				$4,437	
B. Total Variable Costs:				**$21,230**	

	GM including pasture cost	GM excluding pasture cost	
GROSS MARGIN (A-B)	**$34,920**	**$45,470**	
GROSS MARGIN/COW	**$349.20**	**$454.70**	
GROSS MARGIN/DSE*	**$20.67**	**$26.92**	
GROSS MARGIN/HA	**$165.50**	**$215.50**	

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 325c/kg and steer weight to 195 kg, gross margin would fall to $281 per cow. This assumes that price and weight of all other sale stock falls by the same percentage.

Dresses wt kgs / **Stock sold**		**Steer sale price cents/kg dw** 315	325	335	345	355
Steer dw						
-40 kgs	**185**	217	230	243	256	269
-20 kgs	**195**	267	281	296	311	325
0	**205**	317	333	**349**	365	382
+20 kgs	**215**	366	384	402	420	438
+40 kgs	**225**	416	436	455	475	495

GM $ per Cow

An increase of 5% in weaning percentage increases gross margin per cow by $29.59

Assumptions **Yearling (Southern/Central NSW)**

Enterprise unit is 100 cows weighing on average 500 kg
Weaning rate: 86%, conception 92%

Sales

100% steers sold at 12-15 months	205 kg	@335c/kg	dressed weight
100% sale heifers sold at 12-15 months	185 kg	@330c/kg	dressed weight
20 heifers retained for replacement.			
Cull cows cast for age at 10 years	255 kg	@275c/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	432 kg	@290c/kg	dressed weight

Selling costs include: Commission 5%, MLA levy $5/hd, average freight cost to abattoirs 5.5c/kg dw, NLIS tags @ $2.90 for all sale cattle.

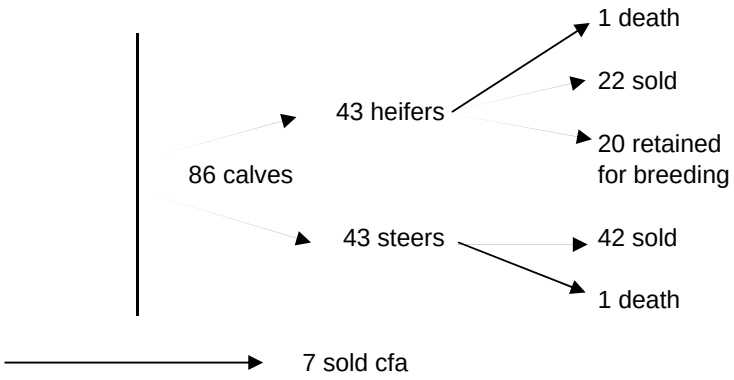
Cows: age at first calf : 24 months

Mortality rate of adult stock: 2%

The average feed requirement of a cow + followers is rated at 16.89 dse's*. This is an average figure and will vary during the year.

Age structure

Age	Number
2	20
3	17
4	15
5	13
6	11
7	9
8	8
9	7
Total Joined	**100**
10	7



Marketing Information:
Suited to the domestic supermarket trade and could access MSA grading with careful preparation. Note that for MSA grading producers need to be licensed. Good frame, well muscled, later maturing steers can be suited to the Japanese grain fed markets at heavier turn off weights than above. Steer portion may also be suited for live export to the Japanese feeder steer market (Angus and Murray Grey and Shorthorn breeds preferred) as a lighter weight option.

Production Information:
A common production system in the south west slopes; and the southern and central tablelands areas.

MERINO EWES (20 micron) - Terminal Rams

Farm Enterprise Budget Series - Dec 2011 (average wool and sheep price 1 June to 1 Dec)

Flock size: 1000 ewes
Ewe body weight: 55 kgs
DSE rating: 2.4 dse's / ewe

INCOME

						Standard Budget ($)	Your Budget ($)
Wool		**number**	**class**	**kg /hd**	**$/kg**		
Shear		960	ewes	5.39	$8.47	$43,836.23	
		20	rams	3.50	$3.94	$275.80	
Crutch		1177	mixed ages	0.40	$4.80	$2,260.97	
		882	xb lambs	0.25	$1.84	$406.41	
Sheep Sales		**number**	**class**	**$ /hd**			
		177	CFA ewes	$88.85	(22.6 kg cwt)	$15,725.92	
		4	CFA rams	$60.48		$241.92	
	8 months	441	mixed sex lambs	$110.46	(21.0 kg cwt)	$48,712.86	
	10 months	441	mixed sex lambs	$126.24	(24.0 kg cwt)	$55,671.84	
Fodder		**tonnes**	**type**	**value per tonne**			
Graz/fodder crop		0 t	0	$0 /t		$0.00	
				A. Total Income:		**$167,131.95**	

VARIABLE COSTS

Replacements		**number**	**class**	**cost ($)**	**reps**		
		4	rams	$900.00		$3,600.00	
		217	ewes	$135.00		$29,295.00	
Cartage		217	ewes	$2.00		$434.00	
Wool Harvesting & Selling Costs							
Shearing		960	ewes	$5.89	1	$5,650.53	
		20	rams	$8.50	1	$170.02	
Crutching		1177	ewes	$1.13	1	$1,331.70	
		20	rams	$1.95	1	$39.04	
		882	weaners	$1.13	1	$997.93	
Wool tax				2.00%		$935.59	
Commission, warehouse, testing charges				$39.27/ bale		$1,374.48	
Wool - cartage		35	bales	$18.00		$630.00	
- packs		35	packs	$13.81		$483.35	
Sheep Health		**number**	**class**				
Broadspectrum		980	adults	$0.65	2	$1,274.00	
		930	lambs	$0.33	3	$920.70	
Narrowspectrum		980	adults/hoggets	$0.38	1	$372.40	
		930	lambs	$0.21	1	$195.30	
Dipping		980	adults	$1.16	1	$1,136.80	
		980	adults	$1.85	1	$1,813.00	
Fly control (long acting)		882	weaners	$1.55	1	$1,367.10	
Vaccination- 6 in 1		980	adults	$0.27	1	$264.60	
		930	lambs	$0.27	1	$251.10	
Mark		930	lambs	$1.55	1	$1,441.50	
Scanning		1000	ewes	$0.80	1	$800.00	
Livestock Selling Costs							
Livestock cartage		1,063	sale sheep	$2.00		$2,126.00	
Commission on sheep sales				5.00%		$6,017.63	
Levies (Yard dues, MLA Transaction levy and RLPB rates)						$2,628.00	
Pasture maintenance		247 ha	@	$41 /ha		$10,161.58	

Fodder

		Supp. feed - ewes 2.1kg -		lambs 3.5kg grain/hd/wk @ $150 /t			
Ewes		960	ewes	$0.32 /week	10 weeks	$3,024.00	
Lambs			ewe lambs	$0.21 /week	12 weeks	$0.00	
		882	finisher lambs	$0.53 /week	10 weeks	$4,630.50	
Graz/fodder crop		0 ha	@	$100 /ha		$0.00	
				B. Total Variable Costs:		**$83,365.85**	

	excl. fodder	incl. fodder
GROSS MARGIN (A-B)	**$91,420.60**	**$83,766.10**
GROSS MARGIN /EWE	**$91.42**	**$83.77**
GROSS MARGIN /DSE	**$37.93**	**$34.76**
GROSS MARGIN /HA	**$379.34**	**$347.58**

ASSUMPTIONS

1. Flock Parameters

Flock mortality	4%	Ram %	2%
Productive life	5 years	Marking %	93%
Ewe body weight	55 kg	Weaning %	90%
DSE rating /ewe	2.4	Weaning age	3 months
Stocking rate/ha	10 dse's		

Pasture maintenance = 90kg single super @ $346t + $10.00 application

2. Flock Structure

Sheep numbers are modified to reflect mortality throughout the year.

Age	Number of ewes
1.5	217
2.5	208
3.5	200
4.5	192
5.5	184
6.5	0
Total	**1000**

217 **replacements bought**

930 **lambs**

900 **weaners**

882 **mixed sex lambs sold**

177 **CFA's sold**

3. Wool Prices

Merino Ewe	Micron	AWEX Type	Clean price	Yield	Greasy price	Specifications (all 35n/ktex)	Proportion of Clip
- Fleece GTM	20	MF5B.	$14.17	65%	$9.24	1%VMB, 90mm	75%
- Skirtings/bellies	19	MP5B.	$12.17	56%	$6.79	4.8%VMB, 80mr	20%
- Cardings	20	MZ2B.	$7.09	52%	$3.68	2.9%VMB.	5%
					$8.47		used in budget

4. Sensitivity Table - Adult wool price and wool cut per head

Effect of wool price and cut on gross margin per DSE (incl. fodder costs)

Wool Cut kg/hd	Adult Greasy Wool Price $/Kg greasy				
$34.76	$6.78	$7.62	$8.47	$9.32	$10.16
4.31 kg	$28.49	$29.91	$31.34	$32.77	$34.19
4.85 kg	$29.83	$31.43	$33.03	$34.64	$36.24
5.39 kg	$31.19	$32.98	**$34.76**	$36.54	$38.32
5.93 kg	$32.53	$34.49	$36.45	$38.41	$40.37
6.47 kg	$33.87	$36.01	$38.15	$40.28	$42.42

5. Sensitivity Table - Value of mixed sex lamb (1st cross terminal)

Export Lmb $/Hd	Value of Domestic lamb $/Hd				
$34.76	$88.37	$99.41	$110.46	$121.51	$132.55
$100.99	$26.53	$28.45	$30.37	$32.29	$34.21
$113.62	$28.72	$30.64	$32.56	$34.48	$36.40
$126.24	$30.92	$32.84	**$34.76**	$36.68	$38.60
$138.86	$33.11	$35.03	$36.95	$38.87	$40.79
$151.49	$35.31	$37.23	$39.15	$41.07	$42.99

6. Sensitivity Table - Weaning % and cost of replacement ewes

Replace ewes $/Hd	Weaning %				
$34.76	72%	81%	90%	99%	108%
$108.00	$30.08	$33.63	$37.19	$40.72	$44.27
$121.50	$28.86	$32.42	$35.97	$39.50	$43.06
$135.00	$27.65	$31.20	**$34.76**	$38.28	$41.84
$148.50	$26.43	$29.99	$33.54	$37.07	$40.62
$162.00	$25.21	$28.77	$32.33	$35.85	$39.41

7. Sensitivity Table - Weaning % and value of cast for age ewes

CFA ewes $/Hd	Weaning %				
$34.76	72%	81%	90%	99%	108%
$71.08	$26.41	$29.96	$33.52	$37.04	$40.60
$79.96	$27.03	$30.58	$34.14	$37.66	$41.22
$88.85	$27.65	$31.20	**$34.76**	$38.28	$41.84
$97.73	$28.27	$31.82	$35.38	$38.90	$42.46
$106.62	$28.89	$32.44	$36.00	$39.52	$43.08

Note: In all sensitivity tables, prices and quantities have been varied by +/- 10% and +/- 20%.

This budget should be used as a GUIDE ONLY and should be changed by the grower to take account of movements in commodity and input prices, changes in seasonal conditions and individual farm characteristics. Estimated prices are GST exclusive.

DRYLAND LUCERNE HAY

Northern Zone **Summer 2010-11**

1. GROSS MARGIN BUDGET:

			Sample Budget $/ha	Your Budget $/ha
INCOME: Assumes most bales are prime hay quality.				
2 cuts per season	@ 2.00 t/ha per cut			
Total Yield =	**4.00** tonnes per hectare			
@	40 bales per tonne (25 kg bales)			
60% AFIA Grade A1	96 bales/ha@	$8.50 / bale	$816	
20% AFIA Grade B2	32 bales/ha@	$6.50 / bale	$208	
20% AFIA Grade C3	32 bales/ha@	$4.00 / bale	$128	

See http://www.afia.org.au/quality/national_grades/ for more details on hay grades used.

A. TOTAL INCOME $/ha:	**$1,152**

VARIABLE COSTS:

see following pages(s) for details

Depreciation of establishment cost (over 4 years).....	$52.32
Fertiliser.....	$125.00
Herbicide.....	$17.96
Insecticide.....	$0.00
Mow, rake & bale (contract).....	$524.40
Twine @ $0.113/bale.....	$18.13
Cart and stack 100% of hay ($10.68/t).....	$42.72
B. TOTAL VARIABLE COSTS $/ha:	**$780.52**
C. GROSS MARGIN (A-B) $/ha:	**$371.48**

SENSITIVITY TABLE

EFFECT OF HAY YIELD AND PRICE ON GROSS MARGIN PER HECTARE

Yield Cuts	Total tonnes/ha	Grade A1 $6.50 Grade B2 $4.50 Grade C3 $2.00 $208 /tonne	Grade A1 $7.50 Grade B2 $5.50 Grade C3 $3.00 $248 /tonne	Grade A1 $8.50 Grade B2 $6.50 Grade C3 $4.00 $288 /tonne	Grade A1 $10.50 Grade B2 $8.50 Grade C3 $5.00 $360 /tonne	Grade A1 $12.50 Grade B2 $10.50 Grade C3 $6.00 $432 /tonne
1 cuts	2.0	-72	8	88	232	376
2 cuts	3.0	-53	67	187	403	619
2 cuts	3.5	-1	139	279	531	783
2 cuts	**4.0**	51	211	**371**	659	947
3 cuts	5.0	70	270	470	830	1,190
3 cuts	6.0	175	415	655	1,087	1,519
4 cuts	8.0	298	618	938	1,514	2,090

DRYLAND LUCERNE HAY

Northern Zone **Summer 2010-11**

CALENDAR OF OPERATIONS:		Machinery			Inputs			
			Cost	Total		Cost	Total	**Total Cost**
Operation	Month	hrs/ha	$/hour	$/ha	Rate/ha	$	$/ha	**$/ha**
Spray - 2,4-DB 500g/L	Jul	0.10	17.05	1.71	1.0 L	16.25/L	16.25	**17.96**
Apply Single Super	Aug	contract		20.00	250kg	0.42/kg	105.00	**125.00**
Mow, rake 3 times and bale	Oct	contract		262.20				**262.20**
Cart and stack hay in shed	Oct	$0.27	per bale @ 80 bales/ha per cut					**21.36**
Mow, rake 3 times and bale	Jan	contract		262.20				**262.20**
Cart and stack hay in shed	Jan	$0.27	per bale @ 80 bales/ha per cut					**21.36**

AGRONOMIC NOTES:

Herbicides: 2,4-DB applied to established stands to clean up weeds.

To reduce the likelihood of herbicide resistance, rotate herbicide groups and weed management techniques.

For more information, refer to the I&I NSW Management Guide "Weed Control in Pastures and Lucerne 2010"

Establishment: This budget assumes a stand life of four years, so depreciation of establishment cost is the cost of establishment divided by four.

This budget should be looked at in conjunction with the budget for establishment of a dryland lucerne stand.

Fertilisers: Nutrient requirements should be assessed with soil tests, strip trials and paddock history records.

Hay storage: The assumption is made that all of the hay is stored on farm prior to selling.

Hay Grades: The Australian Fodder Industry Association (AFIA) has developed a national grading system for legume and cereal hays. It is based on digestible dry matter, crude protein percentage and metabolisable energy.

Profitability: Profitability may vary widely depending on dry matter yield and hay prices. Please refer to the sensitivity table and factor in the seasonal and market risks in your planning activities.

AFIA (Incorporated in 1996) is the peak body for the hay and silage industries. Further information and a fodder vendor declaration form is available from AFIA Phone: 03 9890 6855 Website: www.afia.org.au

Use of a particular brand name does NOT imply recommendation of that brand by I&I NSW.

Always read chemical labels and follow directions, as it is your legal responsibility to do so.

LABOUR REQUIREMENT Labour for carting hay from the paddock to the shed is accounted for in this budget at $1.50 per bale.

MACHINERY ASSUMPTIONS:

Tractor: PTO power: 57kW (76 HP)

Machinery costs refer to variable costs of: fuel, oil, filters, tyres, batteries and repairs.

Mow, Rake, Bale costs: If you use your own machinery for mowing, raking and baling then substitute this cost in your own budget.

SURFACE IRRIGATED LUCERNE - Established stand

Farm Enterprise Budget Series - Northern Zone

Summer 2011-2012

1. GROSS MARGIN BUDGET:

			Sample Budget	Your Budget
INCOME:			$/ha	$/ha
7 cuts	per season	@ 1.90 t/ha per cut		
Total Yield =	**13.30** tonnes per hectare			
@	40 bales per tonne (25 kg bales)			
60% AFIA Grade A1	320 bales/ha at	$8.80 / bale	$2,816.00	
20% AFIA Grade B2	106 bales/ha at	$5.00 / bale	$530.00	
20% AFIA Grade C3	106 bales/ha at	$3.00 / bale	$318.00	
See http://www.afia.org.au/quality/national_grades/ for more details on hay grades used.				
A. TOTAL INCOME $/ha:			**$3,664.00**	

VARIABLE COSTS:

see following page(s) for details

Depreciation of establishment cost.....	$101.91	
Fertiliser.....	$241.85	
Herbicide.....	$60.15	
Insecticide.....	$6.33	
Irrigation.....	$443.90	
Mow, rake & bale (contract).....	$1,773.80	
Twine @ $0.113/bale.....	$60.29	
Cart and stack 100% of hay ($10.68/t).....	$142.04	
B. TOTAL VARIABLE COSTS $/ha:	**$2,830.28**	
C. GROSS MARGIN (A-B) $/ha:	**$833.72**	
D. GROSS MARGIN $/ML:	**$83.37**	

SENSITIVITY TABLES

2. EFFECT OF YIELD AND PRICE ON GROSS MARGIN PER HECTARE:

Yield		Grade A1 $6.80 Grade B2 $3.00 Grade C3 $1.00	Grade A1 $7.80 Grade B2 $4.00 Grade C3 $2.00	Grade A1 $8.80 Grade B2 $5.00 Grade C3 $3.00	Grade A1 $10.80 Grade B2 $7.00 Grade C3 $4.00	Grade A1 $12.80 Grade B2 $9.00 Grade C3 $5.00
Cuts	**tonnes/ha**	$195 /tonne	$235 /tonne	$275 /tonne	$347 /tonne	$419 /tonne
4 cuts	5.8	-$820	-$588	-$356	$62	$480
5 cuts	8.3	-$623	-$291	$41	$639	$1,237
6 cuts	10.8	-$427	$5	$437	$1,215	$1,993
7 cuts	**13.3**	-$230	$302	**$834**	$1,792	$2,750
8 cuts	15.8	-$34	$598	$1,230	$2,368	$3,506
9 cuts	18.3	$163	$895	$1,627	$2,945	$4,263
10 cuts	20.8	$359	$1,191	$2,023	$3,521	$5,019

3. EFFECT OF YIELD AND PRICE ON GROSS MARGIN PER MEGALITRE:

Yield		Grade A1 $6.80 Grade B2 $3.00 Grade C3 $1.00	Grade A1 $7.80 Grade B2 $4.00 Grade C3 $2.00	Grade A1 $8.80 Grade B2 $5.00 Grade C3 $3.00	Grade A1 $10.80 Grade B2 $7.00 Grade C3 $4.00	Grade A1 $12.80 Grade B2 $9.00 Grade C3 $5.00
Cuts	**tonnes/ha**	$195 /tonne	$235 /tonne	$275 /tonne	$347 /tonne	$419 /tonne
4 cuts	5.8	-$82	-$59	-$36	$6	$48
5 cuts	8.3	-$62	-$29	$4	$64	$124
6 cuts	10.8	-$43	$1	$44	$122	$199
7 cuts	13.3	-$23	$30	**$83**	$179	$275
8 cuts	15.8	-$3	$60	$123	$237	$351
9 cuts	18.3	$16	$89	$163	$294	$426
10 cuts	20.8	$36	$119	$202	$352	$502

SURFACE IRRIGATED LUCERNE - Established stand

Farm Enterprise Budget Series - Northern Zone **(diesel pump from river-regulated)**

Summer 2011-2012

CALENDAR OF OPERATIONS:		Machinery			Inputs			
Operation	Month	hrs/ha	Cost $/hr	Total $/ha	Rate/ha	Cost $	Total $/ha	**Total Cost $/ha**
Spray - paraquat + diquat	Jul	0.10	24.51	2.45	2.5 L	10.28	25.70	**28.15**
Spray - diuron	Jul	with above			2.50 L	7.70	19.25	**19.25**
Apply Single Super	Aug	0.42	21.55	9.05	125kg	0.35	43.75	**52.80**
Spray aphids -dimethoate	Aug	0.10	24.51	2.45	0.37 L	10.49	3.88	**6.33**
Fertiliser- #Muriate of Potash	Aug	0.42	21.55	9.05	250kg	0.72	180.00	**189.05**
Irrigate	Oct				1.25 ML	44.39	55.49	**55.49**
Irrigate	Nov				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	Nov	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Nov	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Irrigate	Nov				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	Dec	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Dec	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Irrigate	Dec				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	Dec	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Dec	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Herbicide (haloxyfop-R)	Dec	0.10	24.51	2.45	0.1 L	103.00	10.30	**12.75**
Irrigate	Feb				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	Feb	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Feb	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Irrigate	Mar				1.25 ML	44.39	55.49	**55.49**
Mow, rake & bale + accumulator	Mar	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Mar	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Irrigate	Apr				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	Apr	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	Apr	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**
Irrigate	May				1.25 ML	44.39	55.49	**55.49**
Mow, rake, bale & accumulator	May	contract		253.40				**253.40**
Cart & stack in shed (tractor + FEL)	May	contract	0.27	per bale @ 76 bales/ha per cut				**20.29**

AGRONOMIC NOTES:

Herbicides: paraquat + diquat and diuron applied to established stands to clean up weeds.
To reduce the likelihood of herbicide resistance, rotate herbicide groups and weed management techniques.

Fertilisers: # In areas of long term irrigated hay production, there is a possibility that higher rates of potash may be required to correct chronic potassium deficiency.

Hay storage: The assumption is made that all of the hay is stored on farm prior to selling.

Hay Grades: The Australian Fodder Industry Association (AFIA) has developed a national grading system for legume and cereal hays. It is based on digestible dry matter, crude protein content and metabolisable energy.

AFIA (Incorporated in 1996) is the peak body for the hay and silage industries. Further information and a fodder vendor declaration form is available from AFIA. Phone: 03 9890 6855 Website: www.afia.org.au

Use of a particular brand name does NOT imply recommendation of that brand by NSW DPI.
Always read chemical labels and follow directions, as it is your legal responsibility to do so.

LABOUR REQUIREMENTS: Labour to apply fertiliser or spray is not costed. If we assume a labour cost of $21/hr the total labour cost would be $29.93/hectare, reducing the gross margin to $804/ha.

This does not include labour required to irrigate since this is more likely to be an overhead cost.

MACHINERY ASSUMPTIONS:

Tractor: pto power: 57 KW (76 HP) FEL = front end loader

Machinery costs refer to variable costs of: fuel, oil, filters, tyres, batteries and repairs.

Mow, Rake, Bale costs: Assumes raking is done twice. Use your own costs if you use your own machinery.

Irrigation Costs: Estimated water usage charge of $31.75 per ML assumed, your charges may be different.
Estimated water pumping cost of $12.64 per ML assumed, your costs may be different.

Water use assumed: 10.0 ML/Ha
Costs calculated using a flood/furrow system with diesel powered pumping from surface supply.