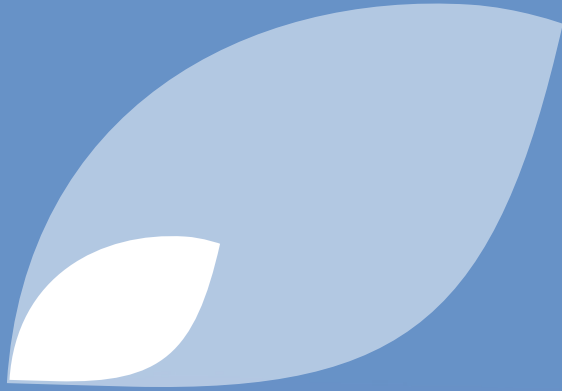


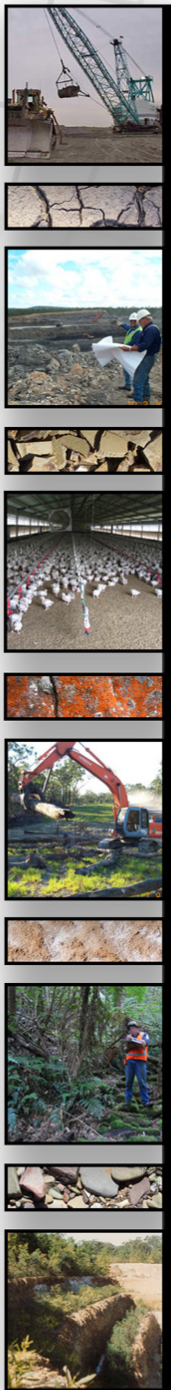


APPENDIX G

Agricultural impact statement







Agricultural Impact Statement

Cobbora Coal Project

September 2012

EMG00-005



GSS ENVIRONMENTAL
Environmental, Land and Project
Management Consultants

Prepared on behalf of EMGA Mitchell McLennan for Cobbora Holding Company



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APPENDICES

Appendix 1	Agricultural Lands and Water Economic Assessment – Cobbora Project
Appendix 2	Agricultural Gross Margin Sensitivity Analysis

LIST OF SHORT FORMS

AIS	agricultural impact statement
AIS Guideline	<i>Agricultural Impact Statement Guideline</i>
BOS	biodiversity offset strategy
CHC	Cobbora Holding Company Pty Limited
CHPP	coal handling and preparation plant
DSEWPaC	Australian Government Department of Sustainability, Environment, Water, Population and Communities
DGR	Director General's environmental assessment requirements
DSE	dry sheep equivalent
DP&I	NSW Department of Planning and Infrastructure
DTIRIS	NSW Department of Trade & Investment, Regional Infrastructure and Services
EA	environmental assessment
EPBC Act	Environment Protection and Biodiversity Conservation Act
EMM	EMGA Mitchell McLennan Pty Limited
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
GL	gigalitre
GM	gross margin
GSS	Global Soil Systems
GSSE	GSS Environmental
ha	hectares
km	kilometre
LGA	local government area
L/S	litres per second
m	metre
M	million
m/d	metres per day
mg/L	milligrams per litre
µS/cm	micro Siemens per centimetre
ML	megalitre
Mtpa	million tonnes per annum
n.a.	not applicable
NOW	NSW Office of Water
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
OOP	out-of-pit

PAA	Project Application Area
PEA	preliminary environmental assessment
Policy, the	NSW Strategic Regional Land Use Plan
Project, the	Cobbora Coal Project
ROM	run-of-mine
SRLUP	strategic regional land use plan
t	tonne
VPA	voluntary planning agreement
WAL	water access licence

1.0 INTRODUCTION

GSS Environmental (GSSE) was commissioned by EMGA Mitchell McLennan Pty Limited (EMM) on behalf of the proponent, Cobbora Holding Company Pty Limited (CHC), to prepare an Agricultural Impact Statement (AIS) to accompany a major Project Application under Part 3A of the *Environmental Planning and Assessment Act 1979* (New South Wales (NSW)) (the EP&A Act) for the proposed Cobbora Coal Project (the Project).

An AIS is required under the NSW Strategic Regional Land Use Policy to accompany all new mining and petroleum project applications. The AIS will form part of the Project's environmental assessment (EA) and it provides decision-makers with details of potential impacts on agricultural resources or industries.

In August 2012, the mine plan was revised for Year 16 and Year 20 operations to improve final rehabilitation outcomes. The primary changes were as follows:

Year 16:

- removal of the waste dump extension to the east of Mining Area C; and
- waste rock placement in the northern part of the mined-out area of Mining Area B.

Year 20:

- removal of the waste dump extension to the east of Mining Area C, as per Year 16;
- further waste rock placement in the northern part of the mined-out area of Mining Area B; and
- waste rock placement in the mined-out area of Mining Areas A and C.

The modification reduces the number of final voids from three to one, halves area of the remaining final void and increases the area of rehabilitated landform, specifically the quantity of land rehabilitated to woodland (see the Project's *Mine Rehabilitation Strategy*). The quantity of proposed post-mining cropping land and pasture land has not been affected and the findings of this AIS are unaffected.

1.1 Project Overview

The Project is an open-cut coalmine that will be developed near Dunedoo in the central west of New South Wales (NSW). The Project Application Area (The 'Project site') is approximately 274 square kilometres (km²) (see **Figure 1.1**). The primary purpose of the Project is to provide coal for five major NSW power stations.

The mine will extract around 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. From this, approximately 9.5 Mtpa of product coal will be sold to Macquarie Generation, Origin Energy and Delta Electricity under long-term contracts. In addition, approximately 2.5 Mtpa will be produced for sale on the spot domestic market or for export.

The Project's key elements are:

- an open-cut mine;
- a coal handling and preparation plant (CHPP);
- a train loading facility and rail spur;

- a mine infrastructure area; and
- the necessary supporting infrastructure, which includes access roads, water supply and storage, and electricity supply.

It is envisaged that construction activities will commence in mid-2013 with coal supplied to customers from the second half of 2015. The mine life will be 21 years.

1.2 Purpose of the Report

The NSW Strategic Regional Land Use Policy (hereafter referred to as the Policy) applies state-wide to areas where there is high value agricultural land and increasing activity in the coal and coal seam gas industries (DP&I, 2011; DP&I, 2012a). Seven regions in NSW have been identified as applying under this Policy and each of these regions will have a strategic regional land use plan (SRLUP) developed. The Project Site falls within the Central West region. At the time of publication, an SRLUP has not been released for this region.

In the absence of a finalised SRLUP an AIS is required to be completed for all new state-significant development applications for mining and coals seam gas projects that have the potential to affect agricultural resources or industries. While the Project is not classified as a state significant development, this document has been developed to satisfy some of the Project's Director General's Requirements (DGRs) (refer **Section 2.2**). These requirements are similar to those of an AIS and as such the proponent has selected to complete an AIS.

1.3 Scope of the Assessment

This AIS, in accordance with the *Agricultural Impact Statement Guideline* (DP&I, 2012b), provides the following information.

A description of agriculture in the region, including:

- details of the agricultural resources and agricultural production of the Project Site; and
- identification of the agricultural resources and current agricultural enterprises that surround the Project Site.

Assessment of impacts, including:

- identification and assessment of the impacts of the Project on agricultural resources or industries;
- accounting for any physical movement of water away from agriculture; and
- assessment of socioeconomic impacts.

Mitigation measures, including:

- identification of options for minimising adverse impacts on agricultural resources, including agricultural lands, enterprises and infrastructure at the local and regional levels.

Stakeholder consultation, which includes:

- undertaking consultation with adjoining land users and relevant government departments; and
- documenting the results of this consultation.

1.4 Structure of the Report

To satisfy the above requirements, this AIS provides the information as set out below:

Section 1: Introduction

This section:

- provides a summary of the Project description;
- provides an overview of the Strategic Regional Land Use Policy; and
- outlines the structure of the report.

Section 2: Planning and Legislation

This section details:

- the relevant initiatives of the Strategic Regional Land Use Policy; and
- the relevant DGRs for the Project.

Section 3: Key Project Information

This section:

- details the Project's disturbance footprint; and
- provides a socioeconomic overview of the Project.

Section 4: Regional Agricultural Industry Overview

This section describes:

- the type of local and regional agricultural enterprises; and
- agricultural productivity value and employment value.

Section 5: Existing Agricultural Resources

This section provides:

- an overview of the biophysical characteristics of the Project Site and surrounds, including climate, land and water resources; and
- the preliminary strategic agricultural land determination for the Project Site.

Section 6: Assessment of Potential Impacts

This section describes:

- temporary foregone agricultural production and employment from altered use of land and water resources;
- the Project's predicted economic impact on un-impacted Project Site land;

- permanent foregone agricultural production and employment from altered use of land and water resources;
- agricultural production and employment of the rehabilitated post-mining landform;
- the predicted impact of reallocation of water resources;
- potential agricultural impact of the biodiversity offset package; and
- further impacts associated with the Project.

Section 7: Mitigation Measures

This section:

- provides proposed management measures and monitoring plans to be implemented for the Project to minimise potential agricultural impacts.

Section 8: Stakeholder Consultation

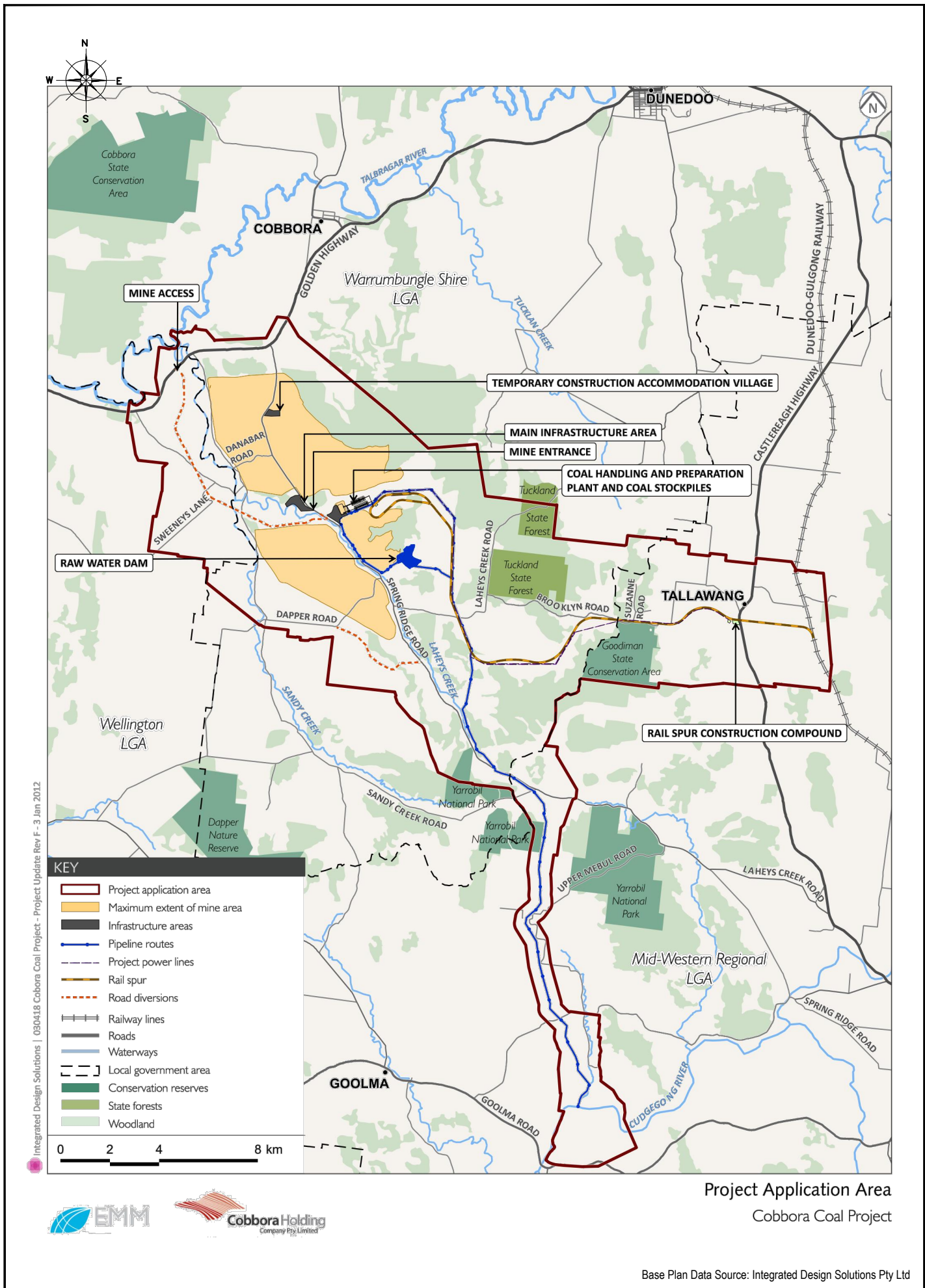
This section:

- provides information on the stakeholder process and results for the Project.

Section 9: Key Findings

This section:

- summarises the main findings of this AIS.



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Agricultural Impact Statement: Cobbora Coal Project
Mine Plan
FIGURE 1.1

2.0 PLANNING AND LEGISLATION

2.1 Strategic Regional Land Use Policy

The Policy seeks to balance economic growth in regional NSW with the sustainable management of natural resources and the protection of agricultural land. The government is preparing strategic regional land use plans for NSW, which will provide the framework for land use discussions. As part of this process, strategic agricultural lands will be identified.

The seven regions identified as applying under this policy are the Upper Hunter, New England North West, Central West, Southern Highlands, Murrumbidgee, Alpine and the West. The Project Site is within the Central West region.

The Policy is comprised of multiple initiatives that are being implemented over time. Initiatives of relevance to the Project are the SRLUPs and the 'gateway process'.

2.1.1 Strategic Regional Land Use Plans

Development of SRLUPs will provide frameworks for land use discussions for the seven key regions. SRLUPs will include regional maps of strategic agricultural land. The Central West region, which encompasses the Project Site, has not (at the time of publication of this AIS) been released. Draft SRLUPs for the Upper Hunter and New England North West regions have been released.

2.1.1.1 Strategic Agricultural Land Definition

The Policy proposes to classify strategic agricultural land within the identified regions based on the following two categories:

- biophysical strategic agricultural land; and
- critical industry clusters.

The Cobbora Coal Project is within the Central West SRLUP, which at the time of preparing this assessment had not been released. Therefore, this assessment uses the strategic agricultural land criteria from the Upper Hunter SRLUP (DP&I, 2012c).

2.1.2 Gateway Process

Development of the 'gateway process' will determine whether a project's development proposal should proceed to the application lodgement stage. The gateway process investigates a project's impacts on strategic agricultural land and the process applies to areas where an SRLUP is in force. For areas that do not yet have an SRLUP in force, such as this Project, an AIS is required to accompany the project's EA if the project has the potential to affect agricultural resources or industries.

2.1.3 Agricultural Impact Statement Guideline

This AIS has been prepared in accordance with the *Agricultural Impact Statement Guideline* (DP&I, 2012b). Additional requirements for the AIS are included in the DGRs.

2.2 Director General's Environmental Assessment Requirements

The original DGRs for the Project were issued on 4 March 2011 and, following modification of the Project, revised DGRs were issued on 23 December 2011. The AIS has been prepared in accordance with the relevant DGRs, which are summarised in **Table 2.1**.

Table 2.1: Director General's Environmental Assessment Requirements

Specific Issue	Where Addressed in Document	Relevant Associated Project Report
Key Issues: Land Resources		
- Agricultural land productivity, which includes: - o a detailed assessment and mapping of pre-mining and post-mining (including land capability and agricultural suitability) soil characteristics across all proposed areas of surface disturbance and an assessment of their value and limitations for rehabilitation	Section 5 and 6	Mine Rehabilitation Strategy; Surface Water Assessment; Ground Water Assessment
- A description of the agricultural resources (especially soil and water resources used or capable of being used for agriculture) and agricultural enterprises of the locality	Sections 4 and 5	
- Identification of any regionally or state-significant agricultural resources in the locality, with particular reference to higher productive alluvial soils and associated surface/groundwater systems that may be impacted directly or indirectly by the proposal	Section 5	
- A detailed assessment of the potential impacts of the Project on agricultural resources and/or enterprises of the locality including: - o impacts as a results of reallocation of licensed water extraction from irrigation to mining uses; and - o direct impacts on soil resources as a result of mining activities	Section 6	Mine Rehabilitation Strategy; Surface Water Assessment
- A detailed description of the measures that would be implemented to avoid, reduce or mitigate impacts of the Project on agricultural resources and/or enterprises of the locality	Section 7	Mine Rehabilitation Strategy;
- Justification for any significant long-term changes to agricultural resources, particularly if highly productive agricultural resources (e.g. alluvial lands and associated groundwater resources) are likely to be impacted	Section 7	Mine Rehabilitation Strategy; Economic Assessment

3.0 KEY PROJECT INFORMATION

3.1 Project Disturbance Area

The Project Site is 27,386 ha and the Project's disturbance footprint is approximately 4,700 ha. The Project's disturbance footprint has been divided into five domains for the purposes of rehabilitation planning (**Figure 3.1**). An overview of each domain is provided below.

Domain 1: Mining Operations Domain

Domain 1 is the Mining Operations area (3,950 ha). It includes the open-cut Mining Areas A, B and C, and the out-of-pit waste rock emplacements AC-OOP, B-OOPE and B-OOPW. These Mining Areas and waste rock emplacements occur in three discrete disturbance areas:

- Northern Mining Operations area, which includes the open-cut Mining Areas A and C and out-of-pit waste rock emplacement AC-OOP;
- Southern Mining Operations area, which includes open-cut Mining Area B and out-of-pit waste rock emplacement area B-OOPW; and
- Eastern Operations Mining area, which includes the out-of-pit waste rock emplacement area B-OOPE.

Domain 2: Mine Infrastructure Domain

Domain 2 is the Mine Infrastructure area (130 ha). It includes the administration and workshop buildings, CHPP, coal stockpile area and locomotive provisioning infrastructure.

Domain 3: Auxiliary Infrastructure Domain

Domain 3 is the Auxiliary Infrastructure area (450 ha). It includes the water pipelines, rail lines and electricity infrastructure.

Domain 4: Road Network Domain

Domain 4 is the road network (110 ha). It includes the road upgrades and haul roads outside the mining area.

Domain 5: Raw Water Dam Domain

Domain 5 is the raw water storage dam (60 ha).

The area of land estimated to be disturbed by the Project has been generated by grouping individual disturbance elements into a single disturbance area. This area includes some land that is located between individual disturbance elements that will in practice not be impacted upon by the Project. For example, the water pipeline will have a maximum footprint width of 10 m; however, the pipeline's footprint is contained within a disturbance area that is up to 100 m wide in places as it also contains the rail spur's footprint and other infrastructure components such as the pump station. The expected total area to be disturbed is approximately 4,300 ha. For the purpose of this assessment, the entire 4,700 ha is considered to be the disturbance footprint.

3.2 Project Economic Impact

The Project will provide considerable economic activity in the regional economy. The direct annual output of the Project, at 20 Mtpa of ROM coal production, is estimated at \$535 million (M) and is forecast to directly employ an average of 482 persons (**Table 3.1**). The annual regional flow-on effects of this production is estimated to be \$714 M and is forecast to employ, through direct and indirect employment, an average of 1,170 persons. The stimulus provided by the Project is expected to continue for at least 21 years.

Table 3.1: Regional Economic Impacts of the Project

Item	Unit	Output
Production type	Enterprise	Coal
Direct output	\$ M	535.4
Direct value added	\$ M	99.5
Direct income	\$ M	49.7
Direct employment	No. Person	482*
Direct and indirect output	\$ M	713.9
Direct and indirect value added	\$ M	183.6
Direct and indirect income	\$ M	102.4
Direct and indirect employment	No. Person	1,170

Source: Gillespie Economics , 2012a (**Appendix 1**)

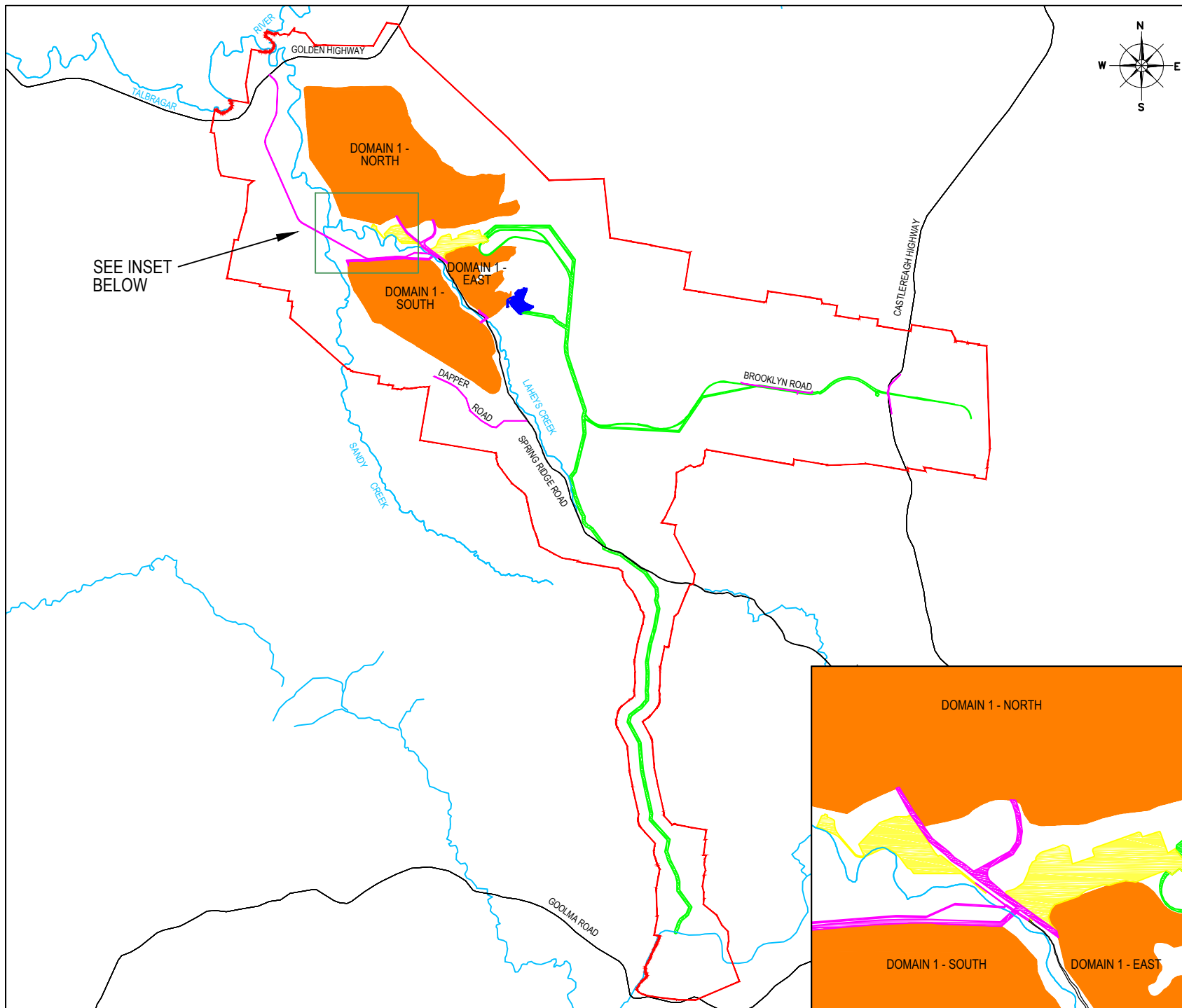
* the Project would provide up to 590 direct jobs, the balance is contractor workforce which is included in production induced flow-ons (see Gillespie Economics (2012b)).

3.3 Project Water Use

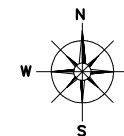
The Project will require water primarily for the CHPP and dust suppression. The initial water balance for the Project indicated a deficit in the water available for the proposed development and the need to source additional water from external sources. As there is an embargo on the issuing of new water licences, water for any new developments can only be sourced through the purchase of entitlements from existing licence holders.

To provide the necessary level of security for the Project, the purchase of high security water access licences (WALs) commenced in late 2009 in accordance with the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source* (WSP). CHC has secured 3,311 ML of high security WALs from willing sellers for extraction from the Cudgegong River, with some water licence transfers from Warren LGA and Narrabri LGA approved by NSW Office of Water (NOW). CHC also currently holds entitlements under the *Water Act 1912* that provide authorisation to extract water from two existing supply dams located on the Project Site.

The Project's groundwater modelling indicates that the peak mine inflow rate from groundwater sources will be 1,775 ML per annum in 2031. This will consist of up to 280 ML per annum from the Talbragar River, with the remaining 1,495 ML per annum coming from the Gunnedah-Oxley Basin groundwater source. Licences from each individual water source will be obtained by CHC.



SEE INSET
BELOW



LEGEND

- Project Application Area
- Waterways
- Roads
- Project Components
 - Domain 1 -
 - Operations Area North
 - Operations Area South
 - Operations Area East
 - Domain 2 - Mine Infrastructure
 - Domain 3 - Auxiliary Infrastructure
 - Domain 4 - Road Network
 - Domain 5 - Raw Water Dam

0 3.0km 6.0km
Scale 1: 190 000

FIGURE 3.1

Domain Plan

Project: Agricultural Impact Statement
Cobbora Coal Project

Client: EMGA Mitchell McLennan
Pty Limited

File: Fg3.1_EMG00-005_DomainPlan_120628

Projection:
MGA94 Zone 55

Version:	Date:	Author:	Checked:	Approved:
1	30/03/12	KC	AC	AC
2	24/05/12	ZJ	AC	AC
3	15/06/12	ZJ	AC	AC
4	18/06/12	ZJ/LF	AC	AC



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4.0 REGIONAL AGRICULTURAL INDUSTRY OVERVIEW

The Project Site is located in the Warrumbungle, Wellington and Mid-Western Regional LGAs but is likely to have impacts on a wider region that includes the Dubbo LGA. The socioeconomics of these LGAs is discussed in this section to provide a regional context for the Project.

4.1 Assessment Method

A regional economic impact assessment for the potential agricultural activities in the Project region was undertaken by Gillespie Economics (2012a) and is included in **Appendix 1**. Regional information was sourced primarily from the Australian Bureau of Statistics and indirect regional economic activity was generated based on an input–output model that was developed for the region (Gillespie Economics, 2012b).

4.2 Agricultural Enterprises

Agriculture is the dominant land use in the region (**Table 4.1**). The main agricultural activity is grazing, with the primary enterprise being sheep farming followed by cattle farming. Cropping enterprises comprise a minor portion of agricultural activities and the primary crops grown are dryland cereals. Minimal irrigation cropping is carried out and the area of land under irrigation is minor, comprising only 0.1% of the agricultural land in the Warrumbungle LGA (**Table 4.1**).

Table 4.1: Regional LGAs – Agricultural Land Use

	Units	Warrumbungle	Dubbo	Mid-Western	Wellington	Total
Agricultural Land Area						
Land area	ha	1,238,000	343,000	876,000	411,000	2,869,000
Area of agricultural land	ha	871,000	210,000	422,000	395,000	1,898,000
Proportion of agricultural land	%	70	61	48	96	66
Agricultural Enterprise						
Land under cropping activities	ha	72,606	27,442	11,800	43,224	155,068
Land under grazing activities	ha	798,394	182,558	410,200	351,776	1,742,932
Proportion of grazing land	%	92	87	97	89	92
Grazing Enterprises						
Sheep and lambs	no.	651,820	199,136	768,343	661,092	2,280,391
Meat cattle	no.	203,257	32,739	87,775	57,171	380,942
Milk cattle (excluding house cows)	no.	12	3,084	153	103	3,352
Pigs	no.	6,125	2,230	254	4,602	13,211
Total	no.	861,214	237,189	856,525	722,968	2,677,896
Sheep as proportion of total stock	%	76	84	90	91	85
Meat cattle as proportion of total stock	%	24	14	10	8	14
Cropping Enterprises						
Cereals for grain	ha	69,220	25,461	10,435	41,472	146,588
Vegetables for human consumption	ha	n.a.	108	8	73	188
Orchard trees (including nuts)	ha	29	53	389	35	505
All fruit (excluding grapes)	ha	29	53	384	35	500
Non-cereal broadacre crops	ha	3,328	1,767	584	1,609	7,287

	Units	Warrumbungle	Dubbo	Mid-Western	Wellington	Total
Total land cropped	ha	72,606	27,442	11,800	43,224	155,068
Proportion of land under cereal cropping	%	95	93	88	96	95
Irrigation						
Area irrigated	ha	1,000	2,000	7,000	2,000	12,000
Irrigation volume applied	ML	3,718	7,978	15,190	5,847	32,733
Other agricultural uses	ML	7,091	1,458	3,875	3,527	15,951
Total water use	ML	10,809	9,435	19,065	9,374	48,683
Proportion of agricultural land irrigated	%	0.1	1.0	1.7	0.5	0.6

Source: ABS 2006a In Gillespie Economics, 2012a (**Appendix 1**)

4.3 Agricultural Gross Value and Employment

The total gross value of agricultural production in this region in 2006 is estimated at \$271 M (**Table 4.2**). This gross value is mainly derived from the slaughter of livestock and livestock products (63%); however, cropping products are also contributors (37%) to the region's gross value.

Table 4.2: Regional Agricultural Gross Value by Agricultural Output

Output	Units	Warrumbungle LGA	Dubbo LGA	Mid-Western LGA	Wellington LGA	Total
Livestock slaughter	\$ M	54	22	19	25	119
Livestock products	\$ M	14	13	8	18	53
Crops	\$ M	36	25	16	22	99
Total	\$ M	103	60	43	65	271
Percent of livestock output	%	66	58	63	66	63

Source: ABS 2006a In Gillespie Economics, 2012a (**Appendix 1**)

The region employs 3,261 persons in the agricultural industry. The main employers are beef and sheep farming followed by grain and grape enterprises. A summary of the main enterprises and employment is provided in **Table 4.3** below. Agriculture supports a food manufacturing industry of 726 persons in which meat processing accounts for 50% of the workforce, followed by production of wine and other alcoholic beverage (**Table 4.3**).

Table 4.3: Regional Employment by Sector

Agricultural Sector	No. Person	%
Beef farming (specialised)	726	22
Sheep farming (specialised)	635	19
Grain sheep or grain-beef cattle farming	502	15
Sheep-beef cattle farming	481	15
Other grain growing	204	6
Grape growing	136	4
Subtotal	2,684	82
Other (e.g. bee keeping, pigs, deer, horses and poultry)	577	18
Total	3,261	100
Food Manufacturing Sectors	No. Person	%
Meat processing	472	50
Wine and other alcoholic beverage manufacturing	148	15

Agricultural Sector	No. Person	%
Bakery product manufacturing (non-factory based)	71	7
Bread manufacturing	63	7
Prepared animal and birdfeed manufacturing	52	5
Grain mill product manufacturing	43	4
Subtotal	849	88
Other	113	12
Total	962	100

Source: ABS 2006b In Gillespie Economics 2012a (**Appendix 1**)

4.4 Agricultural Infrastructure

The region contains various infrastructure that supports agricultural economic activity. This infrastructure includes:

- abattoir and meat processing facilities such as the Dubbo and Mudgee based abattoirs;
- a fellmongery, wool scouring and top-making plant associated with the abattoir at Dubbo;
- livestock saleyards located at Dubbo and Mudgee;
- multiple grain receival points in various locations across the region;
- transport links, such as the Gulgong Railway, Newell, Mitchell and Golden Highways;
- various associated agri-business such as rural merchandise, rural machinery dealerships and agricultural consultancies; and
- various agricultural courses offered by Western TAFE out of the Dubbo College such as holistic management, shearing and wool classing.

5.0 EXISTING AGRICULTURAL RESOURCES

The Project Site is comprised of land that will be directly impacted upon by the Project (termed disturbance footprint; 4,700 ha) and surrounding land that will not be directly impacted (termed un-impacted land; 22,686 ha).

5.1 Land Resources

5.1.1 Regional Climate

The Project Site is situated in the north-western region of NSW. This region typically experiences a cool temperate climate with moderately dry winters and wetter summers. The annual average rainfall is approximately 620 mm with the majority of this rainfall falling in the months of December to January (BOM, 2012). Temperatures range from an average daily maximum of approximately 32 °C in January to an average daily minimum of 2°C in July. The average annual evaporation ranges between 1,800–2,000 mm (average annual pan evaporation (BOM, 2008), which is more than twice the annual precipitation.

5.1.2 Geology and Topography

The majority of the Project Site is underpinned by the Nappery and Dunedoo formations, which are ancient fractured igneous and sedimentary rocks. Basic geologic structures include undifferentiated Permian sandstones and shale and alluvium. Parent rocks include conglomerate; sandstone; siltstone; shale; quartz sandstone; lithic sandstone; ferruginous sandstone and siltstone; carbonaceous shale and coal (Colquhoun et al., 1999).

The Project Site is characterised by undulating low hills in the north to undulating rolling hills in the south. The elevation ranges between 280 m around Sandy Creek to 600 m in the south of the Project Site.

5.1.3 Soil

The Project Site contains five main soil types: Red-Brown Duplex; Yellow Duplex; Grey Skeletal; Friable; and Alluvial. The co-dominant soil types are the Red-Brown Duplex and Yellow Duplex soils, which cover 88% of the Project Site and 92% of the disturbance footprint (**Table 5.1; Figure 5.1**). An overview of the two main soil types is provided below, while further details are given in the Project's mine rehabilitation strategy (GSSE, 2012).

Table 5.1: Soil Types Overview

Soil Type			Project Site		Disturbance Footprint	
#	Common Name	Australian Soil Classification Name	ha	%	ha	%
1	Red-Brown Duplex	Red-Brown Chromosol/Sodosol	11,253	41	2,209	47
2	Yellow Duplex	Yellow Chromosol/Sodosol	12,944	47	2,115	45
3	Grey Skeletal	Grey Tenosol/Rudosol	1,783	7	329	7
4	Friable	Red-Brown Dermosol	656	2	<5	<1
5	Alluvial	Rudosol/Tenosol	750	3	47	1
Total			27,386	100	4,700	100

The Red-Brown Duplex soil type generally consists of weakly structured brown loams and sandy loams overlying strongly structured brown medium-heavy clay subsoil. These soils range from moderately acidic in the upper layers to moderately alkaline at depth and are non-saline. The topsoil is generally non-sodic; however the subsoil can be sodic.

The Yellow Duplex soil type generally consists of weakly structured brown loams and sandy loams overlying strongly structured yellow to yellowish-brown medium-heavy clay subsoil. Red-grey subsoil mottling is present which indicates restricted internal drainage. These soils range from moderately acidic in the upper layers to moderately alkaline at depth and are non-saline. The topsoil is generally non-sodic; however the subsoil can be sodic.

5.1.4 Vegetation

The Project Site has been highly modified by agricultural practices. More than half the site has been cleared and is covered by pasture grasses. The remaining areas are in various stages of natural regeneration post-grazing (<10% of the site) or contain mature remnant woodland communities (EMM, 2012a). Remnant vegetation occurs in large patches across the Project Site and includes parts of Tuckland State Forest, Goodiman State Conservation Area and a small section of the Yarrobil National Park, with smaller discrete patches along the watercourses, roads and on hilltops.

Remnant vegetation typically consists of five broad vegetation communities: Box Gum Woodlands, Ironbark/Stringybark Woodlands, Red Gum Woodlands, Cypress Woodlands and regrowth communities. Of these, 74.4 ha are classified as threatened ecological communities, which is comprised of the endangered ecological communities (EEC): Box Gum Woodland (14.1 ha); Fuzzy Box Woodland (12.6 ha) and Grey Box Woodland (47.7 ha).

5.2 Water Resources

5.2.1 Surface Water

The Project Site is in the broader Macquarie–Bogan Catchment and locally within the Sandy Creek Catchment. The Macquarie–Bogan Catchment extends from the central tablelands of Oberon, Bathurst and Rylstone to the western plains of Nyngan and Coonamble and includes the Castlereagh, Bogan and Macquarie river valleys.

Regional rivers in the wider region include the Talbragar River, Cudgegong River, Castlereagh River and the Macquarie River. The Talbragar and Cudgegong rivers are proximal to the Project Site, situated on its northern edge and traversing the Project Site in the south respectively. The Talbragar River flows in a south-westerly direction, joining the Macquarie River north of Dubbo. It is an ephemeral waterway; that is, it ceases to flow during dry periods. The Cudgegong River rises in the Great Dividing Range above Rylstone and is a major tributary of the Macquarie River.

Within the Project Site, the main watercourses are the ephemeral Laheys Creek and Sandy Creek. Laheys Creek begins in the Project Site's central area and flows north to drain into Talbragar River. Sandy Creek begins in the south-western section of Yarrobil National Park and flows in a northerly direction external to the Project Site until its confluence with Laheys Creek in the Project Site's central north (**Figure 3.1**). There is no long-term water flow information available from within the Project Site. Therefore, data from a monitoring station on the Talbragar River at Elong Elong, which is located approximately 10 km downstream of the Project Site, have been used to provide information on local flows. This data shows that flows in Talbragar River are seasonal and are less than 0.01 ML/day approximately 30% of the time (Parsons Brinckerhoff, 2012a).

5.2.2 Groundwater

The main aquifers in the Project Site are the alluvium associated with the Talbragar River and its tributaries (Sandy and Laheys Creek) and the porous rock aquifer within the Triassic and Permian sediments (Parsons Brinckerhoff, 2012b).

The alluvium aquifer is of low permeability (0.6–3.8 m/d) and has an average salinity of around 3,650 $\mu\text{S}/\text{cm}$ (or 2,370 mg/L). There is no yield data available for this aquifer. The porous rock aquifer is of

low to moderate permeability 0.2–4.7 m/d. The highest pumping test yield, sustained over a 14 day period, was 4.4 L/s, but yields are variable, and were as low as 1.0 L/s. Salinity in the porous rock aquifer ranges from an average of 3,993 $\mu\text{S/cm}$ (or 2,600 mg/L) in the Triassic units down to an average of 1,618 $\mu\text{S/cm}$ (1,050 mg/L) in the Permian units. The disturbance footprint predominately occurs across the porous rock aquifer (Parsons Brinckerhoff, 2012a).

5.2.3 Water Sharing Plans

The Project Site is not yet covered by a water sharing plan. A water sharing plan is currently being developed for the Macquarie–Bogan Unregulated and Alluvial Sources, which will cover the Project Site. Parts of the Cudgegong and Macquarie rivers upstream from the Macquarie Marshes are regulated under the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source* (NSW Government, 2006).

5.3 Land Classification

5.3.1 Rural Land Capability

A Rural Land Capability assessment of the Project Site has been undertaken and a classification determined using the guideline *Rural Land Capability guideline Systems Used to Classify Rural Lands in New South Wales* (Cunningham et al., 1988).

The Project Site's Rural Land Capability classifications range from Class II through to Class VII (**Table 5.2**). It is capable of cropping (Class II and III) and grazing (Class IV–VI) as well containing some land that is best left undisturbed due to its erosion risk (Class VII) (**Table 5.2; Figure 5.3**). The dominant Rural Land Class in the Project Site is Class IV (36%), followed by similar proportions of Class II, Class V and Class VI land. The disturbance footprint mainly affects Class IV land (50%) as well as some Class III and VI land.

Table 5.2: Rural Land Capability Classes

Agricultural Enterprise Suitability	Rural Land Capability	Project Site		Disturbance Footprint	
	Class	ha	%	ha	%
Suitable for regular cultivation	II	568	2	Nil	Nil
	III	5,985	22	782	17
Suitable for grazing	IV	9,880	36	2,380	50
	V	4,797	18	435	9
	VI	4,664	17	790	17
Protect with green timber	VII	1,492	5	313	7
Unsuitable	VIII	Nil	Nil	Nil	Nil
Total	Total	27,386	100	4,700	100

Source: Mine Rehabilitation Strategy – Cobbora Coal Project (GSSE, 2012)

5.3.2 Strategic Agricultural Land

The Project Site contains strategic agricultural land, as defined under the draft Upper Hunter SRLUP. This is because the Project Site has greater than 20 ha of Class III land, contains land that is defined as being potential strategic agricultural land based on the *Draft Inherent General Fertility of NSW* map (OEH, 2011a), and is proximal (less than 150 m) to Talbragar River, which is a 5th Order River (**Table 5.3**).

Identification of critical cluster industries has yet to occur as the draft Central West SRLUP has not, at the time of publication, been finished. However, it is expected that there will be no or limited critical cluster industries within the Project Site, assuming that these clusters may include viticulture and major horse studs.

Table 5.3: Strategic Agricultural Land Criteria in Project Site

Value	Criteria	Project Site	Disturbance Footprint
Biophysical strategic agricultural land	Land that falls under soil fertility classes 'high' or 'moderately high' under the Draft Inherent General Fertility of NSW (OEH, 2011a); and	Yes	No
	Land capability classes II or III under the Land and Soil Capability Mapping of NSW (OEH); and	Yes	Yes
	- Reliable water of suitable quality, characterised by: - land having rainfall of greater than 350 mm per annum (9 out of 10 years); or	Yes	Yes
	- land within 150 m of the following surface or groundwater resource: - a regulated river; or	-	--
	- unregulated rivers where there are flows for at least 95% of the time (i.e. the 95th percentile flow of each month of the year is greater than zero); or	No	No
	- 5th order and higher rivers; or	Yes	No
	- groundwater aquifers (excluding miscellaneous alluvial aquifers, also known as small storage aquifers) which have a yield rate greater than 5 L/s and total dissolved solids of less than 1,500 mg/L.	No	No
	Minimum 20 hectares in areas (based on minimum area required for commercial food production).	Yes	Yes
Critical industry cluster	Industry clusters that meet the following criteria: - There is a concentration of enterprises that provides clear development and marketing advantages and is based on an agricultural product; - The productive industries are interrelated; - It consists of a unique combination of factors such as location, infrastructure, heritage and natural resources; - It is of state, national and/or international importance; - It contributes to the region's identity; and - It is potentially substantially impacted by coal seam gas or mining proposals.	Unknown as industry clusters for the region not yet identified by Infrastructure DP&I but unlikely.	

Source: Draft Upper Hunter Strategic Regional Land Use Plan (DP&I, 2012c)

5.4 Land Use

The Project Site is mainly being used for cattle and sheep grazing. On the Rural Land Capability Class III land, some crops are being produced for feedstock (e.g. wheat and oats), while on the Class II land in the south, rotation crops (canola, wheat, pulses and barley) have been produced. As stated previously, the site has been cleared of regrowth and replaced with native and improved pastures and, to a lesser extent, crops. Remnant vegetation occurs in patches occupying the remaining half of the site.

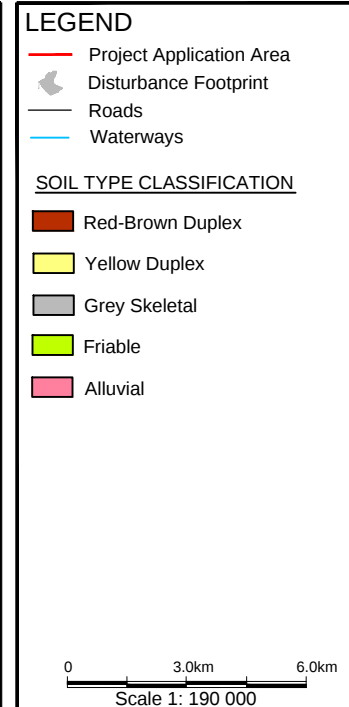
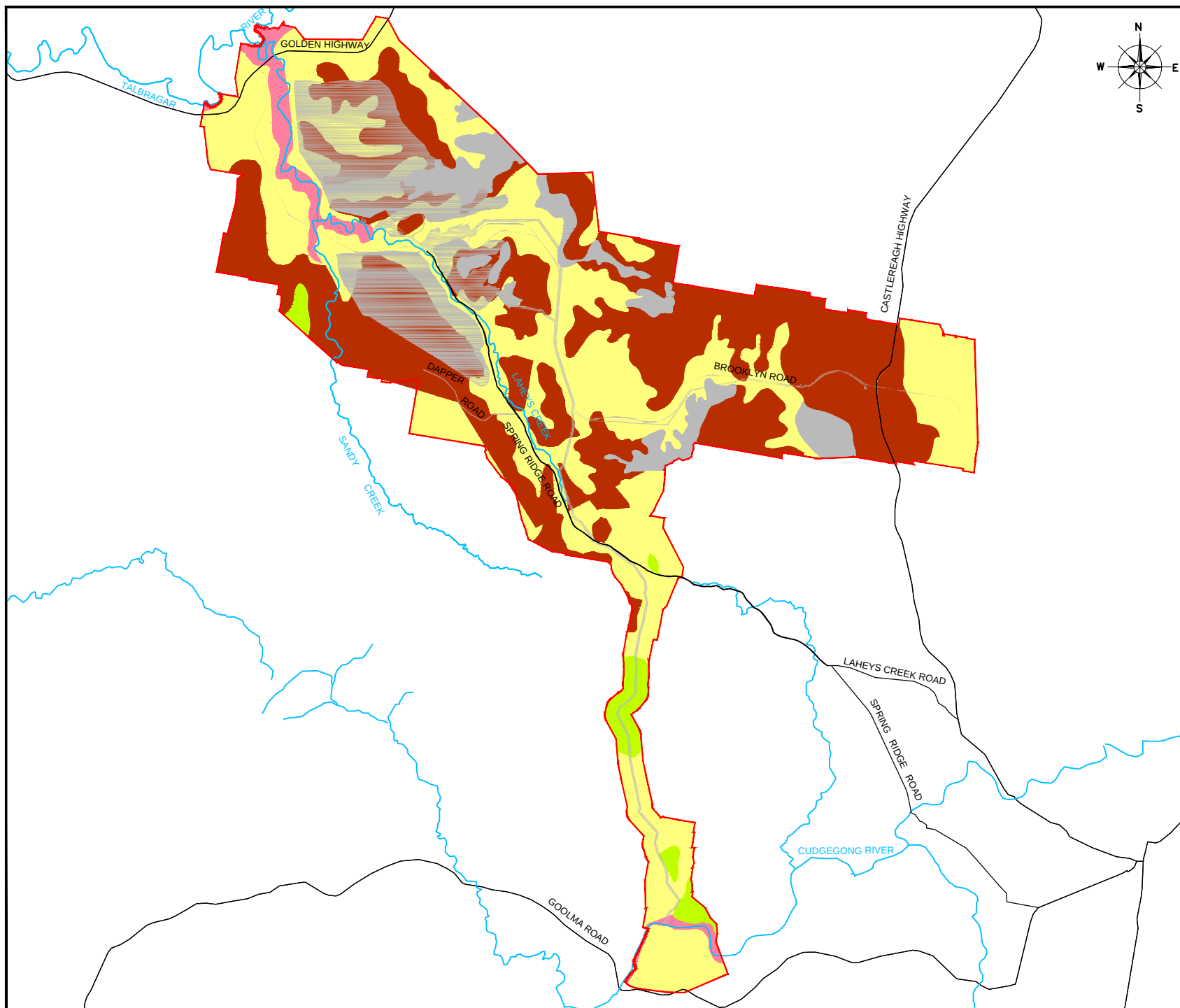


FIGURE 5.1

Soil Types

Project: Agricultural Impact Statement
Cobbora Coal Project

Client: EMGA Mitchell McLennan
Pty Limited

File: Fg5.1_EMG00-005_SoilTypes_120628

Projection:
MGA94 Zone 55

Version:	Date:	Author:	Checked:	Approved:
1	30/03/12	KC	AC	AC
2	25/05/12	ZJ	AC	AC
3	19/06/12	ZJ/LF	AC	AC



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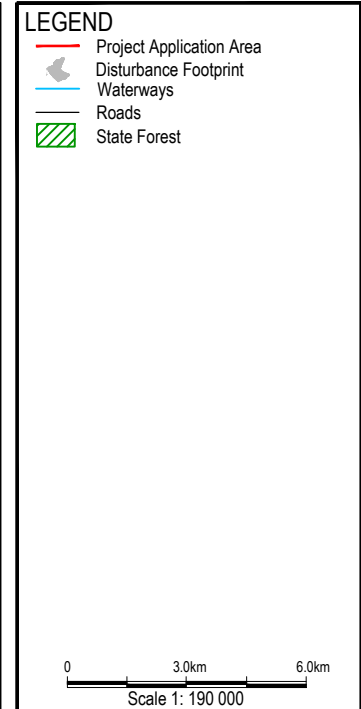
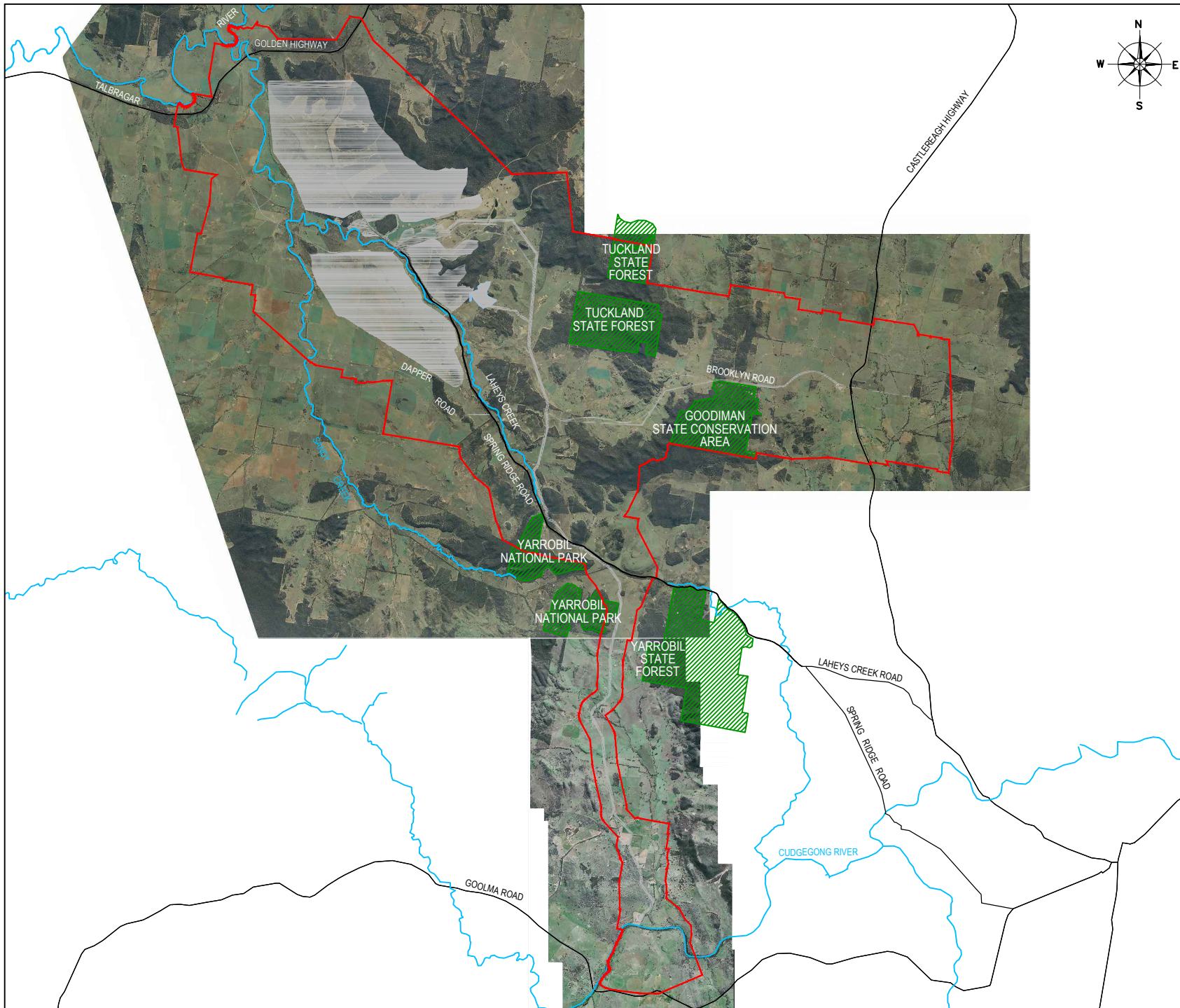


FIGURE 5.2

Biophysical Environment

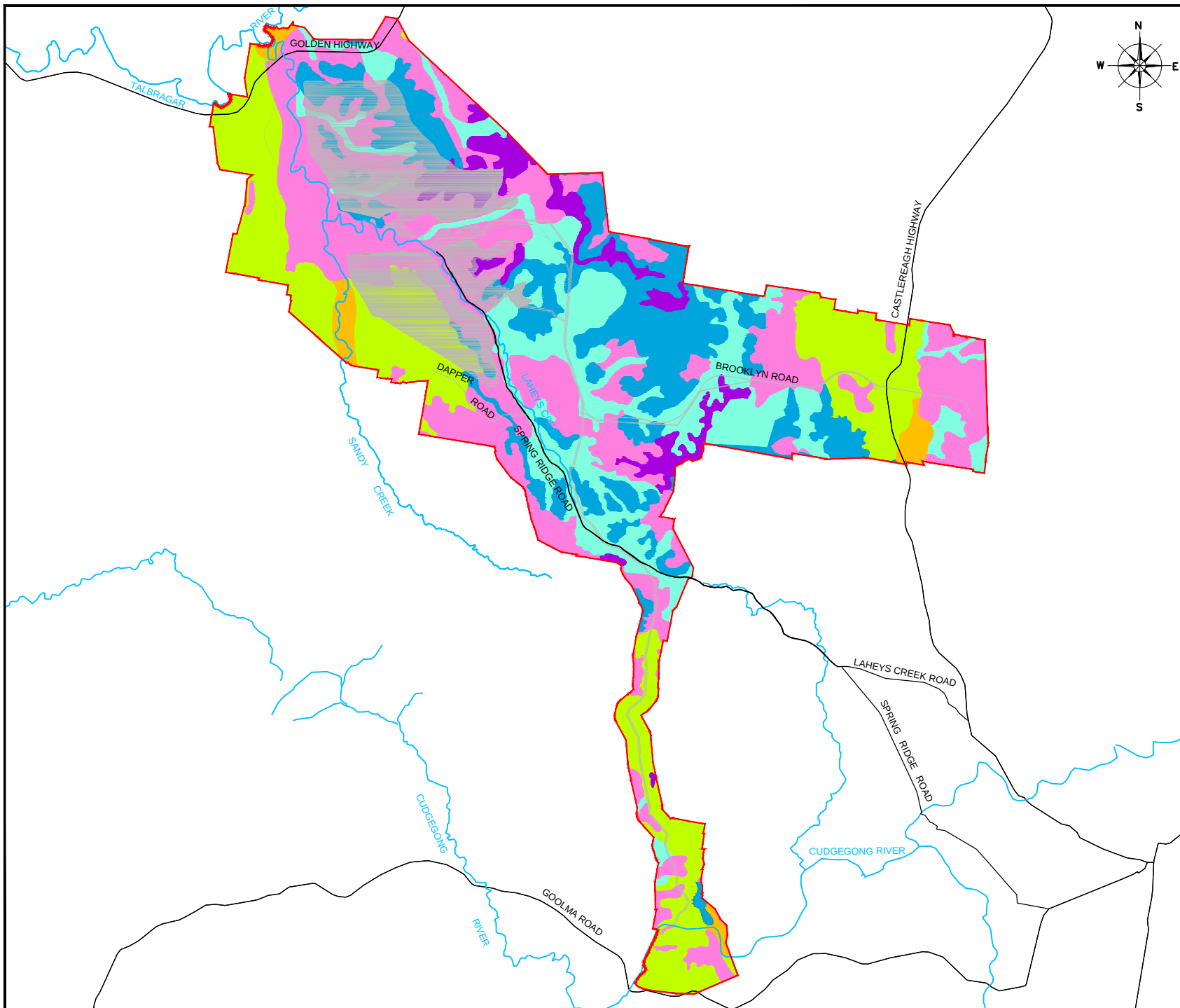
Project: Agricultural Impact Statement
Cobbara Coal Project

Client: EMGA Mitchell McLennan
Pty Limited

File:
Fg5.2_EMG00-005_BiophysicalEnvironment_120628

Projection:
MGA94 Zone 55

Version:	Date:	Author:	Checked:	Approved:
1	30/03/12	KC	AC	AC
2	25/05/12	ZJ	AC	AC
3	19/06/12	ZJ/LF	AC	AC



LEGEND

- Project Application Area
- Disturbance Footprint
- Roads
- Waterways

LAND CAPABILITY

- Class II
- Class III
- Class IV
- Class V
- Class VI
- Class VII

0 3.0km 6.0km
Scale 1: 190 000

FIGURE 5.3

Pre-mining Rural Land Capability

Project: Agricultural Impact Statement
Cobbora Coal Project

Client: EMGA Mitchell McLennan
Pty Limited

File:
Fg5.3_EMG00-005_RuralLandCap_120628

Projection:
MGA94 Zone 55

Version:	Date:	Author:	Checked:	Approved:
1	28/11/11	ZJ	AC	AC
2	29/11/11	ZJ/LH	AC	AC
3	01/02/12	KC	AC	AC
4	20/02/12	LF	AC	AC
5	30/03/12	KC	AC	AC
6	25/05/12	ZJ	AC	AC
7	19/06/12	ZJ/LF	AC	AC



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6.0 ASSESSMENT OF POTENTIAL IMPACTS

The impact of the Project on the Project Site's agricultural resources (including land and water resources) is described in this section. Agricultural resources are defined by the Policy as 'land upon which agriculture is dependent and the associated water resources that are linked to that land' (DP&I, 2012b). Other potential impacts addressed in this section include loss of economic activity from the Project's biodiversity offset strategy and Project impacts on visual amenity and the tourism industry.

6.1 Land Resources

6.1.1 Land Use of Un-impacted Project Site Land

Land within the Project Site that is external to the disturbance footprint will not be directly impacted upon by the Project. Over 65% of this land is owned by CHC (buffer land) and is generally being leased and the agricultural enterprises undertaken prior to purchase by CHC are ongoing. A Land Management Strategy is being prepared by CHC to manage the buffer land (refer **Section 7**). There is no predicted change to the agricultural productivity of the un-impacted land as a result of the Project.

6.1.2 Land Temporarily Removed from Agricultural Activities

An agricultural productivity assessment of the land that will be impacted by the Project has been undertaken. The Project proposes to disturb 4,700 ha of land, of which 17% is potential cropping land, 76% potential grazing land and the remainder is land best covered by green timber due to its erosion risk.

6.1.2.1 Agricultural Productivity Data

Potential agricultural productivity was determined using DTIRIS agricultural productivity data for agricultural enterprises suitable for each of the land classes that will be impacted. The most profitable enterprises have been selected to provide best case scenarios under the current economic conditions.

Rural Capability Land Class II and III land could support a rotational sequence of cereals and pulses to generate a gross margin of \$546/ha. Class IV and V land could support merino ewes (18 micron) and generate \$450/ha annum. Classes VI land could support merino wethers (18 micron) and generate \$330/ha annum and Class VII could support a similar enterprise at a lower stocking rate to generate an income of \$110/ha annum (**Table 6.1**). Full gross margin ranges and sensitivity analyses are provided in **Appendix 2**.

Table 6.1: Agricultural Productivity – Project Site

Land Capability Class	Enterprise Type*	Enterprise Assumptions	Gross Margin (\$/ha)
II & III	Cropping land: short fallow canola, cereal and pulse rotation – crop rotation over six-year period		
	Canola: short fallow	Yield of 2.2 t/ha – year 1	482
	Cereal: wheat – short fallow (no till).	Yield of 3.8 t/ha – year 2; yield after a canola crop	556
	Pulse: chickpeas	Yield of 2.2 t/ha – year 3	365
	Cereal: wheat – short fallow (no till)	Yield of 4 t/ha – year 4; yield after a pulse crop	835
	Canola: short fallow	Yield of 2.2 t/ha – year 5	482
	Cereal: wheat – short fallow (no till)	Yield of 3.8 t/ha – year 6; yield after a canola crop	556
Gross margin average per year			546
IV & V	Grazing land: best case scenario – sheep		
	Merino ewes (18 micron) (referred to as rams by DTIRIS; however, is	2.1 dry sheep equivalent (DSE)/ewe; and	450

Land Capability Class	Enterprise Type*	Enterprise Assumptions	Gross Margin (\$/ha)
	mainly stocking of ewes)	fodder supplemented	
VI	Grazing land: best case scenario – sheep		
	Merino wethers (18 micron)	1 DSE/ewe; and fodder supplemented	330
VII	Grazing land: best case scenario – sheep		
	Merino wethers (18 micron)	0.3 DSE/ewe; and fodder supplemented	110

Source: DTIRIS (www.dpi.nsw.gov.au/agriculture/farmbusiness/budgets)

* DTIRIS Region: Dryland East Cropping Region

6.1.2.2 Potential Agricultural Productivity

Based on the nominated gross margins, the Project Site has the capacity to generate an estimated gross margin of \$11.9 M per annum. Of this, 17% (\$2.0 M) is from the land within the proposed disturbance area (**Table 6.2**). It is important to note that these figures are derived from the optimum potential uses and are much higher than the actual incomes being achieved at the time of publication.

Table 6.2: Annual Gross Margins – Pre-mining

Rural Land Capability	Gross Margin (GM)	Project Site		Disturbance Area		
Class	\$/ha	ha	GM (\$ M)	ha	Gross Margin (\$ M)	Proportion of Total Project Site GM (%)
II	546	568	0.3	Nil	Nil	Nil
III		5,985	3.3	782	0.4	4
IV	450	9,880	4.4	2,380	1.1	9
V		4,797	2.2	435	0.2	2
VI	330	4,664	1.5	790	0.3	2
VII	110	1,492	0.2	313	<0.1	<1
VIII	Nil	Nil	Nil	Nil	Nil	Nil
Total		27,386	11.9	4,700	2.0	17

6.1.2.3 Annual Economic Impact for Agricultural Productivity

The regional economic impact assessment (**Appendix 1**) predicts direct and indirect economic activity (impact) from agricultural activities on land that is to be affected by the Project. The economic activity arises from purchases by agricultural business, and employers. It can be estimated in terms of a number of specific indicators: output; value added (gross output less non-labour input costs); income (wages); and employment. The assessment captures the effect on inter-sectoral linkages which are predicted to increase the total economic activity. The ratio multipliers used to model these linkages are based on an input–output model developed for the region (Gillespie, 2012b).

The estimated annual economic impact of the potential agricultural productivity for Project site is:

- \$5.0 M in annual direct and indirect output or regional business turnover;
- \$2.3 M in annual direct and indirect regional value-added;
- \$1.2 M in annual direct and indirect income; and
- 39 direct and indirect jobs.

Further details are listed in **Table 6.3**.

Table 6.3: Annual Economic Activity – Disturbance Area

Item	Unit	Agricultural Enterprise: Sheep & Grain
Land area	ha	4,700
Direct output	\$ M	3.4
Direct value added	\$ M	1.6
Direct income	\$ M	0.7
Direct employment	No. Person	31
Direct and indirect output	\$ M	5.0
Direct and indirect value added	\$ M	2.3
Direct and indirect income	\$ M	1.2
Direct and indirect employment	No. Person	39

Source: Gillespie Economics, 2012a (**Appendix 1**)

6.1.3 Long-term Impact on Land for Agricultural Activities

6.1.3.1 Predicted Impacts to Post-mining Rural Land Capability Classes

The rehabilitation of the disturbance area has been designed to be consistent with the land use in the local area and will consist predominately of land capable of grazing activities (approximately 64%) and land capable of being cultivated for crops (24%). However, some of the land will not be suitable for any agricultural activity (**Table 6.4**; **Figure 6.1**).

Table 6.4: Post-mining Rural Land Capability – Disturbance Area

Agricultural Enterprise Suitability	Rural Land Capability	Pre-mining		Post-mining		Change	
	Class	ha	%	ha	%	ha	%
Suitable for regular cultivation	II	Nil	Nil	Nil	Nil	Nil	Nil
	III	782	17	1,105	24	323	7
Suitable for grazing	IV	2,380	50	1,755	37	-625	-13
	V	435	9	145	3	-290	-6
	VI	790	17	1,145	24	355	7
Protect with green timber	VII	313	7	5	Nil	-308	-7
Unsuitable	VIII	Nil	Nil	545	12	545	12
Total		4,700	100	4,700	100		

Source: Mine Rehabilitation Strategy – Cobbora Coal Project (GSSE, 2012)

6.1.3.2 Predicted Impacts to Post-mining Agricultural Productivity

The main changes between the pre-mining and post-mining landform within the disturbance area are an increase in cropping land (Class III; 7%), a reduction in the better quality grazing land (Class IV; 13%), a reduction in land requiring erosion protection (Class VII; 7%) and the addition of land unsuitable for agricultural production (Class VIII; 12%).

Based on agricultural gross margins for each land capability class (**Table 6.1**), the post-mining Project Site will have the capacity to generate an estimated \$11.8 M per annum in gross margin from agriculture. Of this, \$1.8 M is directly contributed from the land covered by the rehabilitated area (**Table 6.5**). There is a small reduction in overall gross margin: a reduction of approximately 7% for the disturbance footprint and 1% for the overall Project Site. Therefore the rehabilitated landform will be capable of supporting a similar level of agricultural economic activity as the pre-mining land.

Table 6.5: Annual Gross Margins – Post-mining (Final Landform)

Rural Land Capability	Gross Margin (GM)	Project Site		Disturbance Area	
Class	\$/ha	ha	GM (\$ M)	ha	GM (\$ M)
II	546	568	0.3	Nil	Nil
III		6,318	3.5	1,105	0.6
IV	450	9,234	4.2	1,755	0.8
V		4,637	2.1	145	<0.1
VI	330	4,920	1.6	1,145	0.4
VII	110	1,182	0.1	5	<0.1
VIII	Nil	527	Nil	545	Nil
Total		27,386	11.8	4,700	1.8

Post-mining agricultural employment opportunities on the Project Site are expected to be similar to or the same as the pre-mining opportunities. This is because there will only be a small difference between the potential pre-mining and post-mining agricultural economic activities.

6.1.4 Land Permanently Removed from Agricultural Activities

6.1.4.1 Rural Land Capability Class VIII Land

The Project will result in the long-term disturbance of some agricultural land (Rural Land Capability Class VIII). This is associated with the final voids, raw water dam and the road network and totals 545 ha (**Table 6.5**). The agricultural economic impact of the removal of this land is accounted for in **Section 6.1.3**.

6.1.4.2 Woodland Establishment

The Project will remove approximately 1,835 ha of woodland from the disturbance area. A similar amount of woodland will be established on the rehabilitated landform. This will be undertaken on rehabilitated land in Domain 1 (Operations Area) as this is largely the area from which the vegetation will be removed. The woodland will be established on Rural Land Capability Class IV and VI land (**Table 6.6**). It is conservatively assumed that this wooded land will be permanently removed from agricultural production (i.e. the economic benefit of any low intensity grazing undertaken to improve biodiversity has not been accounted for).

The agricultural economic impact of this woodland establishment will be minimal as the pre-mining and post mining area of woodland will be similar.

Table 6.6: Post-mining Land Use – Domain 1

Land Use	Associated Rural Land Capability Class	Associated Landform	Area (ha)	Area (%)
Cropping	III	Flat to gently sloping land	1,000	25
Grazing	IV	Flat to gently sloping land	580	15
Woodland	IV and VI	Flat to steeply inclined land	1,945	49
Subtotal			3,525	89
Void	VIII	Voids	425	11
Total			3,950	100

Source: Mine Rehabilitation Strategy – Cobbora Coal Project (GSSE, 2012)

6.1.5 Impact on Agricultural Resources from Biodiversity Offsets

The Project will impact on vegetation communities and threatened species habitat. Some of these impacts cannot be minimised or avoided by the Project. The Environmental Assessment provides a biodiversity offset strategy (BOS) to compensate for unavoidable impacts on threatened flora species, threatened fauna habitat, threatened ecological communities (TECs) and other native vegetation. The Project's BOS is being prepared in accordance with the *Interim Offsetting Policy* (OEH, 2011b) and developed through consultation with NSW and Commonwealth government agencies.

The BOS will detail land that will be conserved to ensure that the Project results in a 'maintain or improve' or net gain outcome for biodiversity values in the region. The specific land parcels to be part of the offset package are not finalised but will consist mainly of land that already contains native vegetation. A smaller area of land that is currently used for agriculture will also be used as this land will be important to allow wildlife corridors to be improved. Rural Land Capability Class I, II or III land will not be used for offsets unless this leads to substantial ecological benefits.

For the purpose of this analysis it has been assumed that:

- there will 4,450 ha conserved in offset areas (there will be additional TECs conserved that are not in areas used for agriculture);
- up to 40% of offsets will be on agricultural land, although it is likely that this proportion will be much lower; and
- agricultural land used by the BOS will be on Class IV land, although it is likely that Class V and VI land will be used as well.

The estimated economic impact on potential agricultural productivity as a result of the BOS is as follows:

- \$1.8 M in annual direct and indirect output or regional business turnover;
- \$0.8 M in annual direct and indirect regional value-added;
- \$0.4 M in annual direct and indirect income; and
- 16 direct and indirect jobs.

This represents in the order of 0.4% of the 2006 annual regional output value of agriculture production, with these impacts occurring in perpetuity. Further details are listed in **Table 6.7**.

Table 6.7: Regional Economic Impacts of the BOS

Item	Unit	Biodiversity Offset Instead of Sheep Farming
Land area	ha	1,780
Rural Land Capability classification	Class	IV*
Direct output	\$ M	1.2
Direct value added	\$ M	0.6
Direct income	\$ M	0.2
Direct employment	No. person	13
Direct and indirect output	\$ M	1.8
Direct and indirect value added	\$ M	0.8
Direct and indirect income	\$ M	0.4
Direct and indirect employment	No. person	16

Item	Unit	Biodiversity Offset Instead of Sheep Farming
------	------	--

*Assumed that 40% of the offset land will be located on Rural Land Capability Class IV land.

Source: Gillespie Economics, 2012a (**Appendix 1**)

6.2 Water Resources

6.2.1 Surface Water and Ephemeral Creeks

The Project Site contains two ephemeral creeks, Sandy and Laheys Creeks. During the Project's life, clean water from undisturbed catchments will be diverted around the mine site and into Sandy and Laheys Creek (Parsons Brinckerhoff, 2012a). Downstream flow impacts of the Project on the Talbragar River have been assessed as being minor, with the annual average flow volume at the Elong Elong gauge being reduced by less than 1%, and low and high flow categories changing by about 6% and 1% respectively (Parsons Brinckerhoff, 2012a). The annual average flows in Sandy Creek will reduce by up to 5% in average and dry conditions, though flows are better maintained in low to very low flow regimes.

The changes to surface water flows are minor and therefore predicted to have minimal impacts on regional agricultural economic activities.

6.2.2 Water Reallocation

CHC has purchased water licences from willing sellers from within the area covered by the *Macquarie and Cudgong Rivers water sharing plan* (NSW Government, 2006) to supplement water supplies during the mine's operational phase. CHC has acquired 3,311 ML of high security WALs, with some transfers from Warren LGA and Narrabri LGA approved by NOW (refer **Section 3**).

The Project's groundwater modelling indicates that the peak mine inflow rate from groundwater sources will be 1,775 ML per annum in 2031. This will consist of up to 280 ML per annum from the Talbragar River, with the remaining 1,495 ML per annum coming from the Gunnedah-Oxley Basin groundwater source. Licences from each individual water source will be obtained by CHC.

6.2.2.1 Environmental Impact

The water sharing plan includes environmental rules to protect the water source and its ecosystems. NOW has determined that CHC's proposed surface water extraction will not have a significant impact as the rural environmental water rules for the water sharing plan will be met by the Project (Parsons Brinckerhoff, 2012a).

6.2.2.2 Agricultural Productivity Impact

Water from the current and forecasted purchased WALs could have been used for agricultural activities. Applying a conservative scenario and assuming that all of this water could have been used 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; therefore, a maximum of 636 ha could be farmed using the purchased water. The total annual revenue and gross margin for this enterprise is \$2,613/ha and \$1,405/ha (five cuts @ 2.5 t per cut), respectively.

With this water no longer being available for agriculture it is assumed that the land could otherwise be used for dryland cropping with productivity levels represented by Rural Land Capability Class II and III land (refer **Table 6.1**). The estimated net annual economic impact on potential agricultural productivity as a result of using this water for dryland cropping rather than irrigated cropping is as follows:

- \$1.5 M in annual direct and indirect output or regional business turnover;

- \$0.6 M in annual direct and indirect regional value-added;
- \$0.4 M in annual direct and indirect income; and
- 9 direct and indirect jobs.

This represents in the order of 0.4% of the 2006 annual regional output value of agriculture production, with 35% of these impacts (those associated with groundwater licences) occurring over an extended period and 65% occurring for the duration of the Project. Further details are listed in **Table 6.8**.

Table 6.8: Regional Economic Impacts of the Reallocated Water

Item	Unit	Dryland Cropping Instead of Spray-irrigated Lucerne
Annual water usage	GL	5.1
Land area	ha	636
Direct output	\$ M	1.0
Direct value added	\$ M	0.4
Direct income	\$ M	0.2
Direct employment	No. person	6
Direct and indirect output	\$ M	1.5
Direct and indirect value added	\$ M	0.6
Direct and indirect income	\$ M	0.4
Direct and indirect employment no.	No. person	9

Source: Gillespie Economics, 2012a (**Appendix 1**)

6.2.2.3 Long-term Use of Reallocated Water

At the completion of mining operations and following rehabilitation, the water licences will be sold on the open market. This means the water will be available for agricultural or some other beneficial use.

6.3 Other Impacts

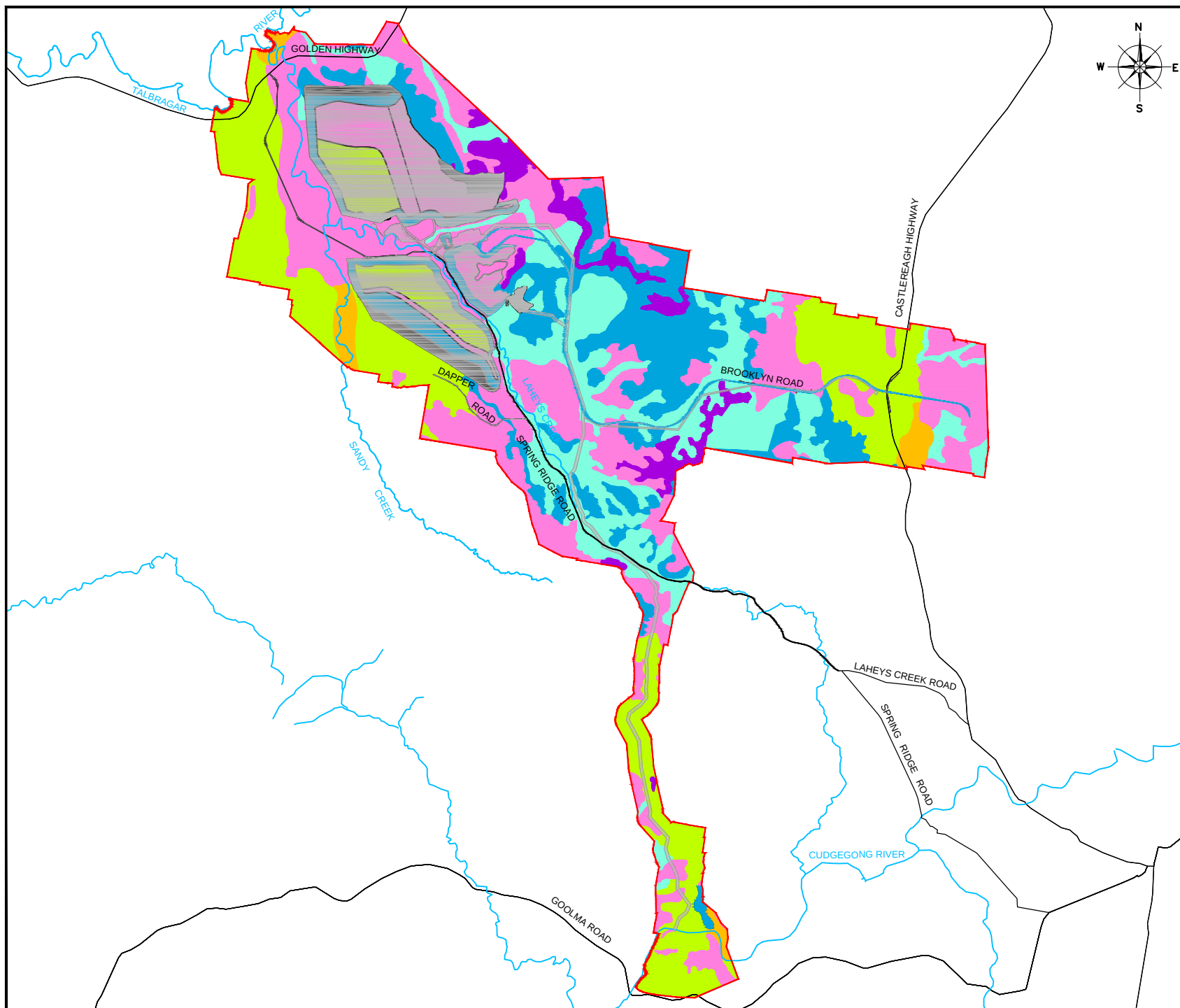
6.3.1 Visual Amenity and Landscape Values

The *Visual and Lighting Impact Assessment* (EMM, 2012b) identified potential visual impacts for recreational users and local residents. The development of a greenfield mine will change the landscape, particularly in the early stages prior to rehabilitation of exposed overburden faces and maturation of screen landscaping. Such changes will be noticeable to viewers and generally perceived as intruding into a rural landscape. The magnitude of such impacts will be localised as the Project Site is distant from townships and major transport routes, and most affected neighbouring properties have already been acquired by CHC.

Various mitigation measures have been developed to address impacts both generally and from specific viewpoints surrounding the Project. The exact form of each measure will be determined following individual assessments of each area and these design details will be incorporated into a Landscape Management Plan.

6.3.2 Tourism

The impact assessment has not identified any tourism infrastructure in the local area upon which agricultural enterprises are reliant. Therefore the Project will have no anticipated impact on local agriculture-related tourism (e.g. wineries).



LEGEND

- Project Application Area
- Disturbance Footprint
- Waterways
- Roads

LAND CAPABILITY

- Class II
- Class III
- Class IV
- Class V
- Class VI
- Class VII
- Class VIII

0 3.0km 6.0km
Scale 1: 190 000

FIGURE 6.1

Post-mining Rural Land Capability

Project: Agricultural Impact Statement
Cobbora Coal Project

Client: EMGA Mitchell McLennan
Pty Limited

File:
Fg6.1_EMG00-005_PostMineLandCap_120628

Projection:
MGA94 Zone 55

Version:	Date:	Author:	Checked:	Approved:
1	30/03/12	KC	AC	AC
2	25/05/12	ZJ	AC	AC
3	15/06/12	ZJ	AC	AC



GSS ENVIRONMENTAL
Environmental, Land and Project
Management Consultants

7.0 MITIGATION MEASURES

7.1 Project Design Review/Alternatives

Following submission of the original Major Project application under Part 3A of the EP&A Act to the NSW Department of Planning and Infrastructure (DP&I) on 5 January 2010 (application number MP_10_0001), subsequent changes to the proposed Project were made in order to minimise the predicted impact on agriculture. These changes included:

- a reduced mining footprint;
- an altered rail spur line;
- no creek diversions; and
- avoidance of Class II Rural Land Capability land.

7.2 Proposed Management Measures

This section describes the proposed management measures and monitoring plans to be implemented for the Project to minimise potential agricultural impacts. The proposed management and monitoring plans will include trigger points and plans for predicted and unforeseen impacts of the Project. It will include appropriate operational responses and remedial action, including the basis for each trigger response.

7.2.1 Land Resources

Agricultural land resource management for the Project would include the following key components:

- Minimisation of disturbance to agricultural lands where practicable.
- Continued use of adjoining CHC-owned land for agricultural use.
- Management of soil resources at the Project Site so they can be used in the rehabilitation program.
- Inclusion of agricultural lands in the Project's mine rehabilitation strategy.

7.2.1.1 *Minimisation of Disturbance to Agricultural Lands*

The area of agricultural land disturbed by the Project at any one time will be minimised so that agricultural uses can continue. Mine planning will minimise land clearance in advance of operations and will include prompt rehabilitation of disturbed areas. This will reduce potential impacts on agricultural land.

7.2.1.2 *Land Resources: Continued Use of Existing Agricultural Areas*

A Land Use Management Plan will be prepared to support the management of CHC-owned agricultural land within the Project Site. This strategy will minimise the impact of existing agricultural enterprises through management of grazing and cropping practices, as well as erosion, weed and pest controls.

The Land Use Management Plan will document the measures that will be taken to allow the following objectives to be met:

- the proactive management of CHC-owned land;
- the maintenance or improvement of the value of properties owned by CHC; and

- ensuring Land Use Management Plan complements the operational strategy.

7.2.1.3 *Soils Resources*

The Project's mine rehabilitation strategy 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 to not degrade the resource; and
- establishment of effective soil amelioration procedures to maximise the availability of soil reserve for future rehabilitation works.

7.2.1.4 *Re-establishment of Agricultural Lands*

The mine rehabilitation strategy has been designed to minimise the impact of the Project on agricultural land. The purpose of the mine rehabilitation strategy includes:

- a summary of the Project Site's existing biophysical environment;
- a rehabilitation strategy for the areas that are expected to be affected by surface disturbance;
- short-, and long-term objectives for the rehabilitation of the site;
- a revegetation program based on current industry good practice and progressive learning as the site program is implemented;
- objectives and preliminary success criteria for mine closure; and
- a monitoring program to progressively assess performance of the rehabilitated areas.

7.2.2 **Water Resources**

The Project will have no anticipated impact on water resources (surface and groundwater) associated with agricultural resources and associated enterprises (Parsons Brinckerhoff, 2012a); however, 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 surface development 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 Water Management Plan will also describe the water management protocols and response procedures for the Project Site's water resources.

7.3 **Rehabilitation of Disturbed Lands: Demonstrated Capacity**

The successful restoration of agricultural land to target Rural Land Capability classifications is a critical component of mining operations to negate any long-term impacts on agricultural resources.

The 'Alluvial Lands Project', carried out by Coal & Allied in 1994, was performed to validate recommended soil rehabilitation techniques to reinstate Class I and II land within a mining disturbance footprint, compared to nearby undisturbed control land. In order to measure the success of the Project, productivity yield

monitoring and soil chemical attribute analysis was conducted from 2003 to 07 (Nelson & Stewart, 2007), and soil structure and fertility monitoring was conducted from 2003 to 06 (GSS, 2003; GSSE, 2007).

The study reported that the rehabilitated land contained optimal nutrient levels for lucerne crops, and exhibited higher than average yield for the district. The observed rehabilitated soil showed no significant difference in physical and chemical structure compared to control land, with a minor reduction in organic carbon that would naturally increase following correct pasture management techniques.

This dedicated study demonstrated that successful rehabilitation of agricultural land is achievable when following recommended soil rehabilitation techniques.

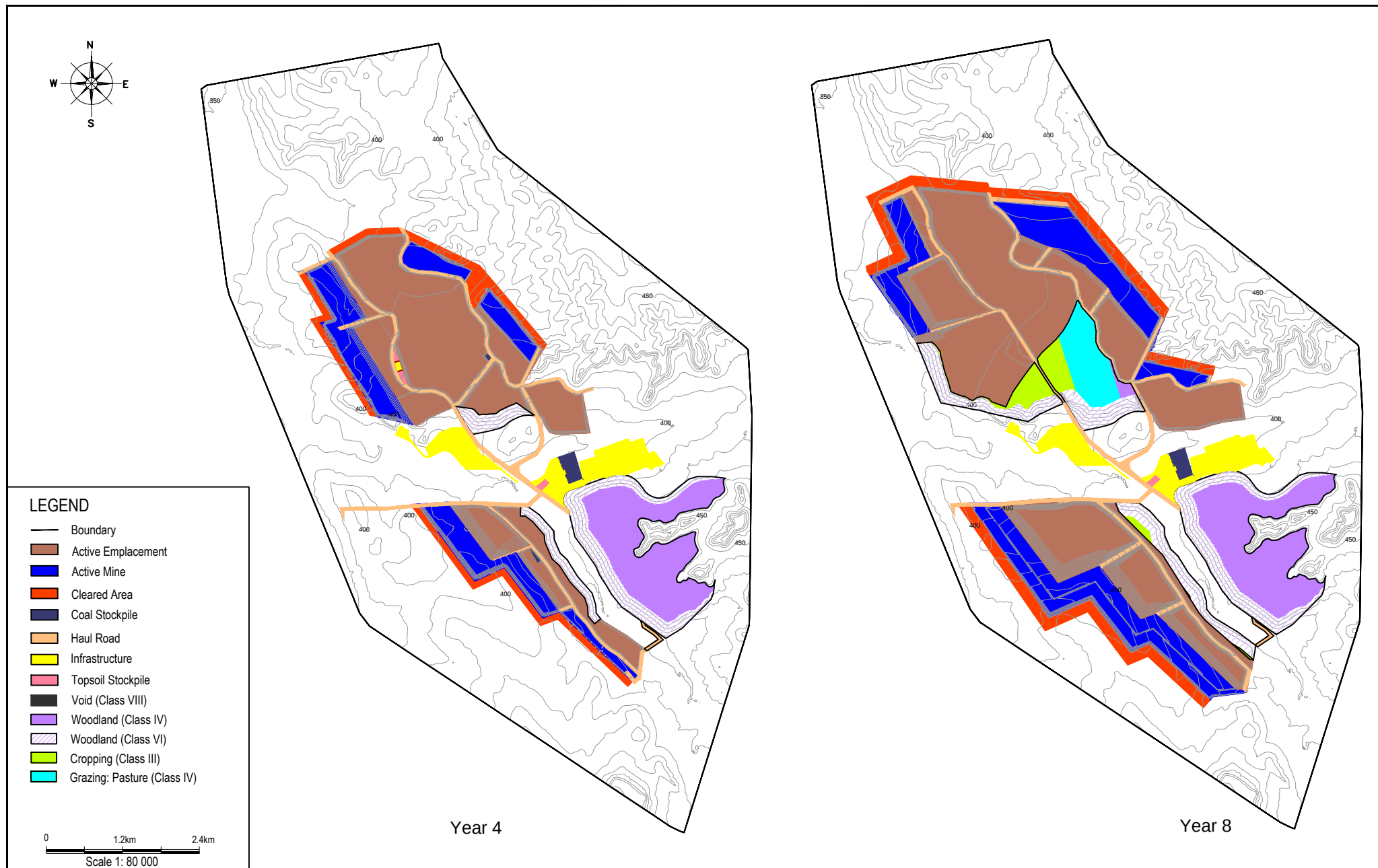
7.4 Demonstrated Planning for Progressive Rehabilitation

The mine rehabilitation strategy (GSSE, 2012) includes details of the planned progressive revegetation of the site and the monitoring program requirements necessary to assess the performance of rehabilitation.

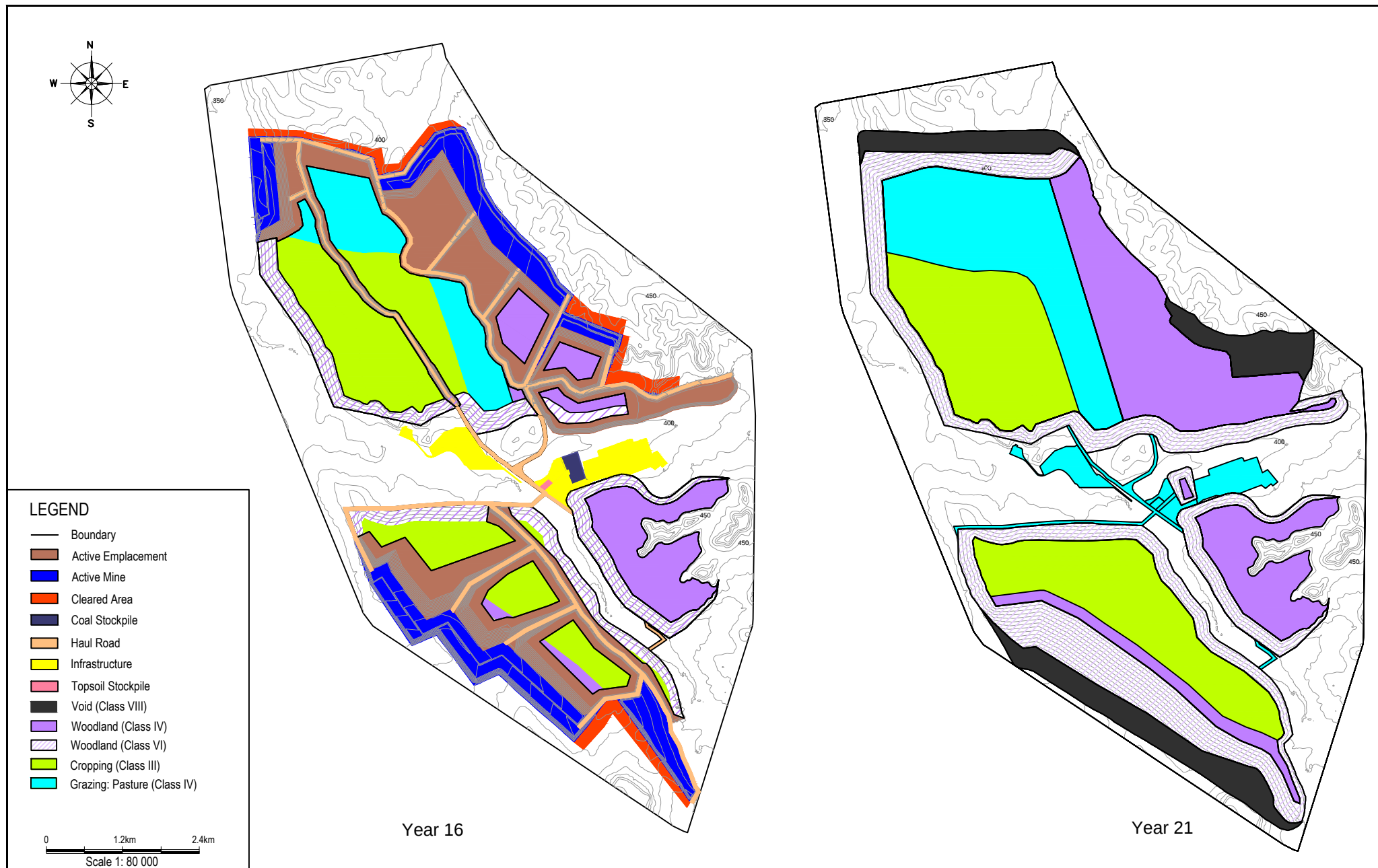
The Operations Area (Domain 1) will be progressively rehabilitated; excluding the final voids, Domain 1 contains 3,525 ha that requires rehabilitation works. The other domains will be rehabilitated at closure.

Figures 7.1a and **7.1b** illustrate the progressive rehabilitation of the main disturbance area for years 4, 8, 16 and closure (year 21). The following is a brief description of the annual rehabilitation sequencing:

Year 1	No rehabilitation.
Years 2–4	Rehabilitation of 410 ha of land, which includes all of the Eastern Operations Area and some land in the east of the Southern Operations Area.
Years 4–8	Rehabilitation of 255 ha of land, which includes land in the east of the Southern Operations Area, and south and south-west of the Northern Operations Area.
Years 8–16	Rehabilitation of 1,055 ha of land, which includes land in the north and east of the Southern Operations Area, and land in the south and south-west of the Northern Operations Area.
Years 16–21	Rehabilitation of 1,805 ha of land, which includes all remaining land in Domain 1.



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Agricultural Impact Statement: Cobbora Coal Project
Staged Rehabilitation Year 16 & 21

FIGURE 7.1b

8.0 STAKEHOLDER CONSULTATION

Stakeholder engagement has been undertaken to clarify potential issues, minimise the risk of conflict, provide information to affected farmland owners and the rural community, and generate additional information to assist with preparation of the AIS. A summary of consultation activities deemed relevant to the AIS is presented in this section. Further information is contained in the *Social Impact Assessment: Cobbora Coal Mine* (EMM, 2012c).

8.1 Overview of Consultation Process

Consultation for the Project has been undertaken in two major steps. Consultation was originally carried out as part of a preliminary environmental assessment (PEA), between September and December 2009. The PEA was submitted to DP&I (formerly the Department of Planning) on 23 December 2009.

CHC continued to undertake further consultation in early 2010 leading up to the Project receiving Major Project status under Part 3A of the EP&A Act and the issuing of the DGRs in March 2010. The original proposal was subsequently modified following issues raised by the Project's stakeholders, and all consultation listed with Project's stakeholders since August 2011 relates to the modified Project.

A full-time consultation specialist is based in the local area to facilitate effective and comprehensive consultation with stakeholders and to respond to requests for meetings with groups and individuals. Consultation with the Project's stakeholders includes meetings with government agencies, councils, relevant community groups (including Aboriginal groups) and affected landowners,

A full-time CHC Property Manager is also based in the local area to respond to landowner queries and manage ongoing property issues with CHC-owned land and properties being leased back by CHC.

8.2 Key Consultation Activities

The main stakeholder groups identified as relevant to the Project's AIS are:

- government agencies (local, state and federal);
- local specialist community groups; and
- local landholders.

8.2.1 Major Consultation Groups

8.2.1.1 Consultation with Relevant Government Agencies

A summary of the key government parties engaged is provided below:

- locals councils: Warrumbungle Shire Council, Wellington Council, Mid-Western Regional Council and Dubbo City Council;
- Federal and State Government Members of Parliament: Federal Member for Calare, Federal Member for Parkes, State Member for Orange, State Member for Barwon and State member for Dubbo; and
- government agencies: Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), Planning Coordination Group, DP&I, OE&H, NSW Roads and Maritime Service, Transport for NSW, NOW, former NSW Department of Industry and Investment, Central West Catchment Management Authority, NSW Department of Trade and Investment Regional

Infrastructure Services, State Water Corporation, NSW Department of Premier and Cabinet and Australian Government Department of Education and Employment and Workplace Relations.

8.2.1.2 Consultation with Special Interest Group – Infrastructure

Special interest groups that have been consulted with regards to impacts on local and regional infrastructure include: Australian Rail Track Corporation, Rail Corp, Country Rail Infrastructure Authority, Emergency Services (Central West District), , Essential Energy and Telstra.

8.2.1.3 Consultation with Special Interest Group – Business

Special interest groups that have been consulted with regards to impacts on local and regional business include: Greater Region of Business Forum, Regional Development Australia (Orana region), Central West/Orana Region Business Chamber, Cudgegong Business Group, Dubbo Chamber of Commerce and Industry, Dubbo City Development Corporation, Dunedoo and District Development Group, Gulgong Chamber of Commerce, Mudgee Business Association and Mudgee Regional Tourism.

8.2.1.4 Consultation with Special Interest Group – Agricultural Resources

Other relevant special interest groups consulted include Cudgegong Valley Water Users Group and National Farmers Federation.

8.2.1.5 Consultation with Relevant Landholders

Consultation has been underway with landowners affected and potentially affected by the Project since 2006 and continues to occur on a regular basis. CHC maintains a commitment to assist landowners with any Project-related concerns during the application process and the life of the mine.

8.2.2 Information Access

8.2.2.1 Community Information Package

A letter with a Project fact sheet and a list of Frequently Asked Questions (FAQs) was distributed to landowners surrounding the Project in January 2012. The letter and fact sheet informed the local community of the revised Project and provided updates on the progress of the EA and specialist studies to be undertaken. It included a number of contact methods for interested parties to obtain further information on the Project.

The fact sheet was also distributed to the wider community during the consultation activities.

A second community fact sheet will be produced and distributed during the public exhibition of the EA, outlining the opportunities for community members to comment.

8.2.2.2 Project Website

A dedicated Project website has been established, <http://www.cobbora.com.au/>, which provides a Project overview, Project updates and opportunities to participate in CHC's community support program. The website content will be reviewed and revised regularly to include current information, including upcoming consultation events and the outcomes of consultation.

8.2.2.3 Project Information Hotline

CHC has established a toll-free Project information hotline, 1800 239 894, that provides community members and stakeholders with an easy way to have their questions answered and to provide Project feedback.

8.2.3 Community Information Sessions

Four community information sessions (listed below) have been held. The purpose of these sessions was to provide an opportunity for all members of the local community to raise any specific queries or issues of concern relating to the Project.

- Gulgong: Gulgong Public School on 14 May 2012;
- Wellington: St Marys Catholic School on 15 May 2012;
- Dunedoo: Dunedoo Jubilee Hall on 16 May 2012; and
- Dubbo: Lazy River Estate on 17 May 2012.

The main issues raised during these meetings included impacts on ground and surface water, geographical spread of environmental impacts on local residents, impacts on local roads and employment opportunities.

8.3 Issues Identified from Consultation

The following section lists the major issues, as relevant to the AIS, identified by consultation:

- Mitigation of impacts on affected landowners;
- Future and foregone employment opportunities from altered land use (mining instead of agriculture);
- Future and foregone business opportunities for local businesses from altered land use; and
- Allocation of water.

8.4 Mitigation Measures

The section outlines mitigation and management measures designed to minimise negative impacts and enhance positive impacts associated with the Project.

8.4.1 Affected Landowners

The measure(s) listed below have been negotiated with any landowner directly affected by the construction and operation of the Project:

- purchase or provision of other compensation for owners of all land directly affected by the mine infrastructure. This measure has been in place since 2009 and is designed to increase certainty;
- purchase or provision of other compensation for owners of land where modelling had predicted that impacts will exceed thresholds for noise and dust; and
- where properties have been purchased, formal agreements have been made with landowners for them to remain and continue farming operations until an agreed date.

8.4.2 Employment Opportunities

CHC is actively working with local training providers and participating in local forums with agencies, councils, education providers and businesses to discuss and promote employment and training opportunities in the region. These include:

- working with TAFE NSW Western Institute to create a new education module dedicated to training individuals for a mining industry career. The course will give students entry level employment qualifications for surface extraction mining;
- playing a central role in both the Central West and Orana regions' Education Skills and Industry forums recently facilitated by Regional Development Australia in Orange and Dubbo. The focus in these forums will be on developing better pathways to employment for people within both regions;
- developing a pilot training program with local councils and industry groups so there will be a ready supply of apprentices in the region that will alleviate potential shortages in the future availability of suitably trained apprentices;
- developing a scholarship and graduate training program that will support local students in mine-relevant tertiary education, that will lead to employment upon completion; and
- partnering with Aboriginal Affairs NSW to drive the development of the Central West Aboriginal Mining Steering Committee, which will aim to develop, implement and monitor the Central West Aboriginal Mining Memorandum of Understanding (MOU), negotiated by mining companies, government agencies, service providers, Aboriginal traditional owners, Aboriginal land councils and the community. In partnership with TAFE NSW Western Institute, the committee will develop strategies to help Aboriginal participants complete the newly created mining module.

8.4.3 Local Business Opportunities

CHC will maximise local business opportunities by:

- giving preference (where cost effective) to local suppliers;
- developing a register of local businesses, which will be used to notify them of upcoming tenders; and
- assisting in the development of systems that will be required for businesses that will service the mine operations.

8.4.4 Water Reallocation

The reallocation of water has been assessed as having limited impact on the local and regional area. Refer **Section 6.2**.

8.5 Commitments to Further Consultation

8.5.1 Monitoring

CHC will continue its comprehensive stakeholder engagement program. CHC is committed to transparency in its dealings with stakeholders.

Ongoing consultation will include liaison with landowners neighbouring the Project area, community members potentially impacted by other aspects of the Project, relevant State and Commonwealth agencies, service and infrastructure providers, local government representatives, local Members of Parliament, business organisations, community groups, cultural and heritage groups and media organisations.

CHC will ensure timely and effective ongoing communication with stakeholders by:

- producing and distributing a Project newsletter outlining the opportunities for community members to review the Project's EA document, once it is lodged. Additionally, on-the-ground briefings and meetings will be conducted with stakeholders in relation to the EA document.
- forming the Cobbora Coal Project Community Consultative Committee, should Project approval be granted.
- ongoing participation in local stakeholder briefings, meetings and public speaking requests.
- ongoing employment of a full-time property manager, based in the local area, to respond to landowner queries and manage ongoing property issues with CHC-owned land and properties being leased back to former landowners.
- regularly updating and promoting information sources. CHC's website will be frequently refreshed with information on environmental monitoring and management, local community initiatives and other relevant information.
- regular visits to the region by senior Project personnel to meet with stakeholders and regular media interviews to relay important information to local communities.
- finalising Voluntary Planning Agreements with relevant local Councils and continued participation in local communities through CHC's Community Support Program.

Discussions have begun with regional service providers in relation to training local people for a range of roles when the mine is operational. Apprenticeships, graduate positions and other traineeships, including an indigenous employment program, will be available. CHC is committed to minimising the mine's impact on the skills base of local industries.

CHC will continue to work closely with local government and business organisations in the region to plan for and manage the expected increase in population, and other impacts, associated with the mine opening.

Subsequent to the Project being approved, CHC will produce an Annual Environmental Management Report reviewing its activities and performance in key areas. This document will be publicly available on the website and in hard copy upon request.

9.0 KEY FINDINGS

This AIS has been prepared in accordance with the NSW Strategic Regional Land Use Policy, which seeks to balance economic growth in rural NSW with the sustainable management and use of natural resources and agricultural land.

The key findings of this AIS are listed below.

- No Rural Land Capability Class II land will be impacted.
- The Disturbance Footprint contains 780 ha of strategic agricultural land (as defined using the draft Upper Hunter SRLUP).
- Post-mining, and following rehabilitation, the Project will reinstate 7% more Rural Land Capability Class III land (about 1,000 ha) than is present pre-mining (780 ha).
- Post-mining agricultural economic activity on the Project Site is expected to be similar to pre-mining activity as there are only nominal differences between the pre- and post-mining Rural Land Capability classifications.
- Post-mining water licences will be sold on the open market. This means the water will be available for agricultural or some other beneficial use. There will be some temporary loss of potential agricultural productivity from the Project's non-agricultural use of purchased water licences.
- The implementation of a Land Use Management Plan on the buffer land will ensure on-going opportunities to private farmers through the provision of long-term leases.
- The Project will provide considerable economic activity to the regional economy. This activity is much greater than the potential activity generated by the impacted agricultural resources.

In summary, the Project will provide economic benefits to the region and has been designed to minimise impacts on surrounding agricultural resources and dependent industries.

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Agricultural Lands and Water Economic Assessment

Gillespie Economics 2012



APPENDIX 1

Agricultural Lands and Water Economic Assessment

Prepared for

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1.0 INTRODUCTION

The Cobbora Coal Project (the Project) is an open cut coal mine proposed by the Cobbora Holding Company Pty Limited (CHC). The Project is located approximately 5 km south of Cobbora, 22 km south-west of Dunedoo, 64 km north-west of Mudgee and 60 km east of Dubbo in the central west of NSW.

The Project will include an open cut coal mine, a coal handling and preparation plant, mine infrastructure area, coal stockpiling and train loading facility. Associated infrastructure will include a rail spur line, water supply pipeline, pumping station, access roads, power lines and an electricity substation. Construction is planned to commence in mid-2013. Mine operations will start in the first half of 2015. A mine life of 21 years is proposed.

A Major Project application under Part 3A of the *Environmental Planning and Assessment Act, 1979* (NSW) (EP&A Act) was submitted to the NSW Department of Planning on 5 January 2010 (application number MP 10_0001). The Director General's environmental assessment requirements (DGRs) for the Project were issued on 4 March 2010. Revised DGRs were issued for the Project on 23 December 2011 in response to changes in the proposed Project and government assessment requirements.

The DGRs for the Project require a consideration of the impact of the Project on land and water resources. This assessment has been undertaken by GSS Environmental. However, the physical impacts on land and water resources also have an economic dimension. This report identifies the economic efficiency and regional economic impact implications of the Project using land and water resources that would otherwise be available for agriculture. It draws on physical impact assessments of GSS Environmental.

This report commences by addressing some of the underlying issues that have been raised in relation to the perceived conflict between coal mining and the use of agricultural land and water. The economic efficiency and regional economic impact assessment frameworks for consideration of the economic impacts of Projects that impact land and water resources, is then briefly identified. The economic efficiency and regional economic impacts of the Project's use of land and water resources is then examined.

2.0 UNDERLYING ISSUES WITH COAL MINING AND USE OF AGRICULTURAL LAND AND WATER

2.1 Agricultural Lands are Important to New South Wales

Agricultural lands are important to NSW. They cover approximately 81% of NSW (65 million (M) hectares) (ANRA 1997) and directly provide employment for 76,261 people or 2.7% of total employment in NSW (ABS 2006)¹. Payment to agriculture, forestry and fishing employees in 2009-10 was \$1,421M and value-added was \$5,077M. Gross operating surplus and gross mixed income from agriculture, forestry and fishing was \$2,441M (ABS, 2010).

However, other land uses including mining are also important to NSW. The area used for mining is a small fraction of the area of NSW, i.e. less than 0.1% of the total NSW land area (BRS 2009) and directly employs 19,026 people or 0.7% of total employment in NSW (ABS 2006). Payment to mining employees in 2009-10 was \$3,049M and value-added was \$14,535M. Gross operating surplus and gross mixed income from mining was \$9,519M (ABS, 2010).

Hence, using considerably less land area, mining is a more significant sector than agriculture in terms of payments to employees, value-added and gross operating surplus and mixed income.

Nevertheless, no policy implication should be drawn from the relative magnitudes of existing sectors. What is relevant in a policy context is whether moving from one land use to another results in an increase in community welfare i.e. improves economic efficiency. That is, do the benefits to the community from changing land uses, exceed the costs? This is discussed in Section 3.0.

2.2 Agricultural Lands Support Economic Growth in Regional Areas

Agricultural lands have historically supported the economies of regional areas. However, regional economies are facing a number of trends including:

- loss of significant industries such as abattoirs and timber mills;
- increased mechanisation of agriculture and aggregation of properties resulting in loss of employment opportunities;
- long run decline in agricultural commodity prices;
- the preference of Australians for coastal living, particularly for retirement; and
- the preference of many of today's fastest growing industries for locating in large cities (Collits 2001).

The result is that there has been declining population growth in 47 out of 96 rural statistical local areas (SLAs) that are located in non-coastal statistical subdivisions (excluding Hunter SD) (ABS 3218.0). There has also been a decline in the population of smaller towns even in regions that have been growing.

Trends in agriculture are leading to improved productivity but reduced stimulus in regional areas as demand for inputs to production, particularly labour, decline. The prosperity of rural areas reliant on agriculture has also been in decline.

It is the increased or new spending in regions that contributes to economic activity and growth. One potential source of new spending is mining projects that utilise the resource endowments of a region. Studies (e.g. ICMM *et al*, 2008, IIED 2002, Gillespie Economics 2003; Gillespie Economics 2007) have shown that mining projects provide significant new economic activity to regional and rural

¹ This is based on the ABS sector of agriculture, forestry and fishing.

economies through direct expenditures on inputs to production as well as the expenditure of employees. The expenditure impact of employees is enhanced by the high wages paid in the mining sector.

Mining projects can also broaden the economic base of regions, thereby insulating the economy from external shocks such as droughts and downturns in agricultural commodity prices (Collits 2001).

2.3 Prime Agricultural Land and Other Land Uses

In NSW, dryland and irrigated cropping land covers an area of 84,878 square km. Mining covers an area of 630 square km, 0.74% of the area of cropping lands.

Table 2.1 - NSW Land Uses

Land use	Area (sqkm)	Area (%)
Nature conservation	61,058	7.6%
Other protected areas	2,478	0.3%
Minimal use	59,178	7.4%
Grazing native vegetation	309,428	38.6%
Production forestry	25,242	3.2%
Plantation forestry	4,200	0.5%
Grazing modified pastures	222,164	27.7%
Dryland cropping	74,692	9.3%
Dryland horticulture	390	0.0%
Irrigated pastures	3,160	0.4%
Irrigated cropping	10,186	1.3%
Irrigated horticulture	1,073	0.1%
Land in transition	951	0.1%
Intensive animal and plant production	243	0.0%
Intensive uses (mainly urban)	10,218	1.3%
Rural residential	4,387	0.5%
Mining and waste	630	0.1%
Water	11,352	1.4%
Total	801,030	100.0%

Source: Bureau of Rural Sciences (2009)

The threat to cropping land from mining would therefore appear to be minimal at a macro level. Nevertheless, the desirability of proposals that impact this land should be addressed at a micro level through a consideration of costs and benefits, including the costs to society of impacting high value, agricultural land.

Another issue is food security. "Food security refers to the ability of individuals, households and communities to acquire appropriate and nutritious food on a regular and reliable basis, and using socially acceptable means. Food security is determined by the food supply in a community, and whether people have adequate resources and skills to acquire and use (access) that food" (NSW Centre for Public Health and Nutrition 2003).

With respect to food supply in NSW, the output of key food products such as wheat and barley from prime agricultural land has increased over time, as has the area of land allocated to these crops (ABS 2012).

Australia's agricultural industries have become more heavily export oriented over the last twenty years. Around two-thirds of agricultural production is now either directly or indirectly exported. The wool industry currently exports around 95 per cent of its production. The beef, sugar and wheat industries export around 65-75 per cent of their production, while the sheep meat, wine and dairy industries export around 50-60 per cent. With the exception of the wool industry — which has always been highly export oriented — these shares have all risen steadily in recent decades (Productivity Commissions 2005).

2.4 Water Supplies and Mining

In NSW, the agriculture sector consumes the largest volume of water with 2,127 GL, or 49% of NSW water consumption in 2009-2010. Mining is relatively small consumer of water, using 62 GL or 1% of NSW water consumption in 2009-2010 (Table 2.2).

Table 2.2 – NSW Water Consumption 2009-2010

Sector	GL	%
Agriculture	2,127	49%
Forestry and fishing	1	0%
Mining	62	1%
Manufacturing	142	3%
Electricity and gas	68	2%
Water supply(a)(b)	1,001	23%
Other industries(c)	357	8%
Household	565	13%
Total	4,323	100%

(a) Includes sewerage and drainage services

(b) Includes water losses

(c) Includes aquaculture and services to agriculture

Source: ABS (2011a)

Like land, water can also be considered a scarce resource that faces competing demands. Consequently, the government has established a framework to facilitate its allocation between competing uses.

The *NSW Water Management Act 2000* (WM Act) vests ownership of water in the Crown; water access and use is now only permissible with possession of a water access licence (except in the case of harvestable rights, native title rights and some stock and domestic rights). Water Sharing Plans that are prepared under the WM Act set the rules by which water is shared between all users, including the environment, in each water management area in NSW. These plans also set rules for water trading, that is, the buying and selling of water licences and also annual water allocations (Montoya 2010).

The aim of water trading is to facilitate the re-allocation of water from sectors with low added value to sectors with a higher added value (Savenije and van der Zaag 2001). Like the situation with land, the price of water performs the function of rationing the scarce supply of water among competing uses. Users that value water the most will be willing to pay the most for water entitlements.

Water productivity is one measure of water efficiency and can be expressed as the amount of output produced from one unit of water. Table 2.3 provides data on water consumption and industry gross value added for 2009–10, from which water intensity by industry can be calculated. Mining in Australia recorded (on average) \$196 million in gross value added per gigalitre (GL) of water consumed in 2009–10 with the equivalent figure for coal mining being \$298 million per GL. This compares to the agriculture sector which generated, on average, \$3 million in gross value added for every GL of water consumed in 2009–10 (Table 2.3).

Table 2.3 - Industry Gross Value Added For Water Using Industries—2009–10 (Australia)

		Industry gross value added (a)	Water consumption	Industry gross value added per GL of water consumed
		\$m	GL	\$m/GL
Agriculture, forestry and fishing	Agriculture	24 265	6 987	3
	Aquaculture, forestry, fishing	4 499	200	22
	Total Agriculture, forestry and fishing	28 764	7,187	4
Mining	Coal mining	22 576	76	298
	Oil and gas extraction	26 340	34	785
	Other mining(b)	38 880	336	116
	Exploration and mining support services	8 309	44	187
	Total mining	96 105	489	196
Manufacturing	Food, beverages and tobacco	23 953	301	80
	Wood and paper products	7 736	81	96
	Printing, publishing and record media	4 088	4	941
	Petroleum, coal, chemical and associated products	17 807	77	230
	Non-metallic, mineral products	5 783	33	176
	Metal products	21 310	139	153
	Machinery and equipment	19 881	9	2 134
	Other manufacturing (includes furniture)	3 047	1	2 998
	Total manufacturing	107 707	658	164
Electricity and gas		18 837	297	64
Water supply, sewerage and drainage		7 191	1 893	4
All other industries		944 442	1 084	871
Total		1 203 046	11 609	104

(a) At 2009–10 current prices

(b) Includes services to mining

Source: ABS (2011a)

3.0 ECONOMIC FRAMEWORKS FOR THE ASSESSMENT OF PROPOSALS THAT IMPACT AGRICULTURAL LAND AND WATER

3.1 Economic Efficiency

From an economic perspective, it is desirable to use scarce resources, such as capital, labour, land and water, to maximise economic welfare or community fulfilment. This is referred to as economic efficiency and refers to a situation where production costs are as low as possible (technical or productive efficiency), and consumers want the combination of goods and services that is being produced (allocative efficiency).

Economic efficiency can be achieved for market goods, where there are no externalities, through competitive markets. In this situation, the price mechanism (interaction of supply and demand) functions to allocate resources in a manner that maximises the net benefits to society as a whole.

Agricultural land and water (where property rights have been established) are market goods. The market will allocate these resources to their most productive use for society. The exception is where a change in land use or water use may result in market failure through the occurrence of externalities. In these circumstances, markets will not allocate resources to maximise economic welfare. Government intervention may therefore be required to determine how resources should be allocated.

In these situations, any Government intervention should be guided by a consideration of the costs and benefits of the intervention. The method that economists use to do this is benefit cost analysis (BCA). The essence of BCA is:

- the estimation of the extent to which a community is made better off by a resource reallocation;
- the estimation of the extent to which the community is made worse off by a resource reallocation; and
- a comparison of these two figures.

If the benefits of the intervention are greater than the costs of the intervention then it provides net benefits to the community and results in an improvement in economic efficiency.

In a simple BCA framework, the potential costs and benefits of a mining project that impacts agricultural land and water may be as follows:

Table 3.1 – Potential Costs and Benefits of a Mining Proposal that Impacts Agricultural Land

	COSTS	BENEFITS
Net Production Benefits	Production	
	Opportunity costs of land, water and capital equipment	Value of mineral resource
	Capital and operating costs (including impact mitigation and rehabilitation)	Residual value of land and capital
Net Externalities	Externalities	
	Residual environmental impacts after impact mitigation	Non use employment benefits of mining *

*these benefits have been estimated using choice modelling in Gillespie Economics 2008, Gillespie Economics 2009a and Gillespie Economics 2009b.

Where the proposal uses agricultural land and water there is an opportunity cost to society of using these resources for mining instead of agriculture. The magnitude of this opportunity cost is reflected in the market value of land and water.

The market value of the land reflects, among other things, the discounted future net income that can be earned from the property and income reflects how much the community values the outputs of

agricultural production. Where agriculture production becomes increasingly scarce, this will be reflected in the value of agricultural products and the value of agricultural land.

Similarly, the market value of agricultural water entitlements reflects, among other things, its value as an input to production (i.e. its marginal value product). Where water becomes increasingly scarce or the value of output that is produced from water becomes increasingly valuable, the value of water as an input to production increases.

The ultimate outcome of any BCA of a project is an empirical issue. But estimating the value of the opportunity cost of agricultural land and water is an integral component of the analysis.

3.2 Regional Economic Impact Assessment

Regional economic impact assessment (using input-output analysis) may provide additional information as an adjunct to economic efficiency analysis. Input-output analysis can be used to estimate the change in economic activity in a region from land and water resources being used for mining instead of agriculture. These changes in economic activity are defined in terms of a number of specific indicators of economic activity, such as:

- Gross regional output – the gross value of business turnover;
- Value-added – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output;
- Household income – the wages paid to employees including imputed wages for self employed and business owners; and
- Employment – the number of people employed (including full-time and part-time).

It is important not to confuse the results of regional economic impact assessment, which focuses on indicators of economic activity in a specific region, with the results of BCA which is concerned with the net benefits to Australia from a project.

4.0 COBBORA COAL PROJECT

4.1 Introduction

The Project comprises the development of site infrastructure and the mining of up to 20 million tonnes per annum (Mtpa) run-of-mine (ROM) coal over at least a 21-year period, using open-cut mining methods.

4.2 Population

The Project Area is located within the Mid-Western Regional, Wellington and Warrumbungle Local Government Areas (LGAs) but is likely to have impacts on a wider region that includes the Dubbo LGA. Between 2001 and 2006 all these LGAs, apart from Dubbo, experienced a decline in population resulting in the region as a whole experiencing a decline in population (NSW Department of Planning 2010). The NSW Department of Planning (2010) predicted some modest growth for the region to 2026 followed by a decline in population. The growth was mainly predicted for the Dubbo LGA, and to a lesser extent the Mid-Western Regional LGA, with Wellington and Warrumbungle LGA both predicted to experience a reduction in population.

Table 4.1 - Past and Projected LGA Populations, 1996-2036

LGA	1996	2001	2006	2011	2016	2021	2026	2031	2036
Dubbo	36,500	38,800	39,600	41,100	42,500	43,700	44,700	45,300	45,600
Mid-Western Regional	21,200	22,100	22,000	22,200	22,300	22,300	22,200	22,000	21,600
Wellington	8,900	8,800	8,500	8,600	8,300	8,000	7,700	7,400	7,100
Warrumbungle Shire	10,800	10,800	10,200	9,800	9,500	9,100	8,700	8,300	7,900
Total Region	77,400	80,500	80,300	81,700	82,600	83,100	83,300	83,000	82,200
Dubbo		1.26%	0.41%	0.76%	0.68%	0.56%	0.46%	0.27%	0.13%
Mid-Western Regional		0.85%	-0.09%	0.18%	0.09%	0.00%	-0.09%	-0.18%	-0.36%
Wellington		-0.22%	-0.68%	0.24%	-0.70%	-0.72%	-0.75%	-0.78%	-0.81%
Warrumbungle Shire		0.00%	-1.11%	-0.78%	-0.61%	-0.84%	-0.88%	-0.92%	-0.96%
Total Region		0.80%	-0.05%	0.35%	0.22%	0.12%	0.05%	-0.07%	-0.19%

Source: NSW Department of Planning (2010)

Between 2006 and 2010 the region has been experiencing greater than predicted average annual population growth of 1.06% (Table 4.2). The strongest average annual population growth has occurred in the Dubbo LGA (1.35% pa) and Wellington LGA (1.16% pa) with the lowest occurring in the Warrumbungle LGA (0.23% pa). The Mid-Western Region LGA has been experiencing an average annual population growth rate of 0.89%. This compares to the NSW average annual population growth of 1.56%

Table 4.2 – Population Growth 2006-2010

SLA/LGA	2006	2007	2008	2009	2010	Average Annual Growth Rate
Dubbo	39,618	40,005	40,483	41,211	41,763	1.35%
Mid-Western Regional	22,074	22,242	22,458	22,677	22,860	0.89%
Wellington	8,482	8,345	8,749	8,904	8,875	1.16%
Warrumbungle Shire	10,236	10,146	10,242	10,323	10,330	0.23%
Total	80,410	80,738	81,932	83,115	83,828	1.06%

Source: ABS (2011b, 2011c, 2011d, 2011e)

4.3 Agricultural and Mining Industries in the Dubbo, Mid-Western Regional, Wellington and Warrumbungle Region

4.3.1 Agriculture

The study region (i.e. the Dubbo, Mid-Western Regional, Wellington and Warrumbungle LGAs) has a combined land area of 2.9M ha, of which 66% is agricultural land (Table 4.3). Of this agricultural land, 0.6% is irrigated with annual irrigation volumes of approximately 32,733 million litres (ML) (Table 4.3). The total value of agricultural production in this region in 2006 is estimated at \$271M (Table 4.3).

Table 4.3 - Existing Agricultural Land Use and Value of Production in the Region – 2006

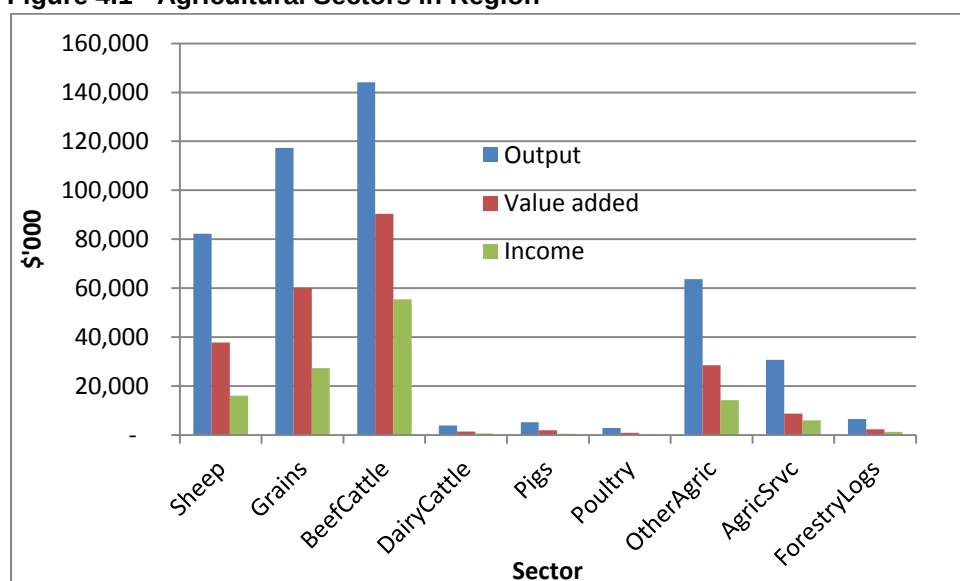
	Units	Dubbo LGA	Mid-western LGA	Wellington LGA	Warrumb. LGA	Total
Area						
Land area	ha '000	343	876	411	1,238	2,869
Area of agricultural land	ha '000	210	422	395	871	1,898
Irrigation						
Area irrigated	ha '000	2	7	2	1	12
Irrigation volume applied	ML	7,978	15,190	5,847	3,718	32,733
Other agricultural uses	ML	1,458	3,875	3,527	7,091	15,951
Total water use	ML	9,435	19,065	9,374	10,809	48,683
Area irrigated as proportion of agricultural land	%	1.0	1.7	0.5	0.1	0.6
Area of Cropping						-
Cereals for grain	ha	25,461	10,435	41,472	69,220	146,588
Vegetables for human consumption	ha	108	8	73	-	188
Orchard trees (including nuts)	ha	53	389	35	29	505
All fruit (excluding grapes)	ha	53	384	35	29	500
Non-cereal broadacre crops	ha	1,767	584	1,609	3,328	7,287
Number of Stock						-
Sheep and lambs	no.	199,136	768,343	661,092	651,820	2,280,391
Milk cattle (excluding house cows)	no.	3,084	153	103	12	3,352
Meat cattle	no.	32,739	87,775	57,171	203,257	380,942
Pigs	no.	2,230	254	4,602	6,125	13,211
Value						-
Gross value of crops	\$m	16	22	25	36	99
Gross value of livestock slaughterings	\$m	19	25	22	54	119
Gross value of livestock products	\$m	8	18	13	14	53
Total gross value of agricultural production	\$m	43	65	60	103	271

Source: ABS (2011b, 2011c, 2011d, 2011e)

Note: Totals may have minor discrepancies due to rounding.

The input-output table developed for the region (Gillespie Economics, 2012) provides an indication of the direct relative significance of the different agricultural sectors, affirming beef cattle, grains and sheep as the main agricultural sectors (Figure 4.1).

Figure 4.1 - Agricultural Sectors in Region



Source: Gillespie Economics (2012).

Total employment in the agricultural industry in the region is 3,261 (ABS, 2010d). Table 4.4 provides a more detailed employment by industry breakdown which indicates that the main agricultural employment is in beef cattle farming (specialised), sheep farming (specialised), grain-sheep or grain-beef cattle farming and sheep-beef cattle farming.

Table 4.4 - Employment by Agricultural Sectors in the Region

Industry	Employment
0100 Agriculture, nfd	110
0110 Nursery and Floriculture Production, nfd	4
0112 Nursery Production (Outdoors)	11
0113 Turf Growing	3
0121 Mushroom Growing	11
0123 Vegetable Growing (Outdoors)	8
0130 Fruit and Tree Nut Growing, nfd	21
0131 Grape Growing	136
0135 Stone Fruit Growing	5
0136 Citrus Fruit Growing	4
0137 Olive Growing	12
0140 Sheep, Beef Cattle and Grain Farming, nfd	6
0141 Sheep Farming (Specialised)	635
0142 Beef Cattle Farming (Specialised)	726
0143 Beef Cattle Feedlots (Specialised)	3
0144 Sheep-Beef Cattle Farming	481
0145 Grain-Sheep or Grain-Beef Cattle Farming	502
0149 Other Grain Growing	204
0159 Other Crop Growing, nec	38
0160 Dairy Cattle Farming	25

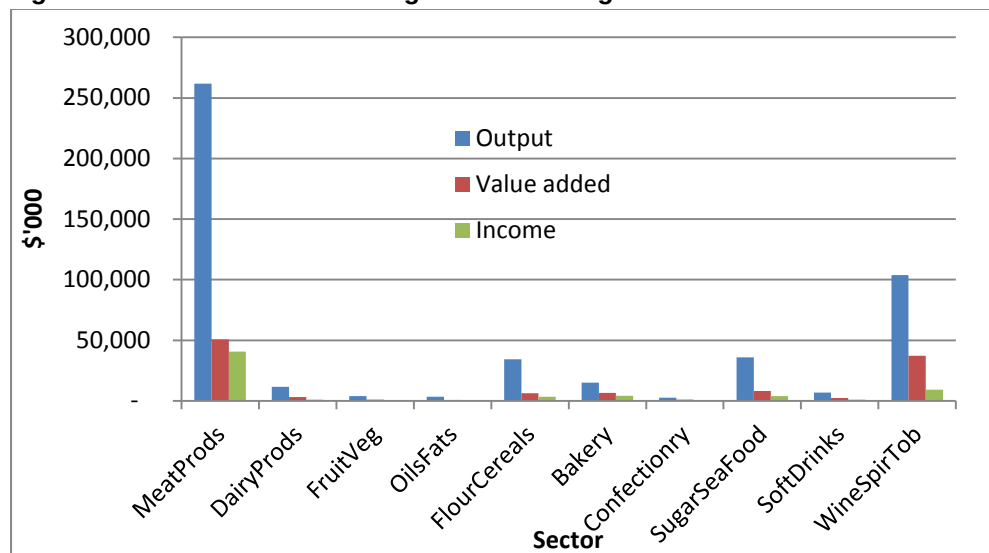
0170 Poultry Farming, nfd	5
0172 Poultry Farming (Eggs)	7
0180 Deer Farming	3
0191 Horse Farming	50
0192 Pig Farming	20
0193 Beekeeping	39
0199 Other Livestock Farming, nec	23
0301 Forestry	24
0302 Logging	3
0400 Fishing, Hunting and Trapping, nfd	3
0500 Agriculture, Forestry and Fishing Support Services, nfd	4
0510 Forestry Support Services	10
0520 Agriculture and Fishing Support Services, nfd	3
0522 Shearing Services	38
0529 Other Agriculture and Fishing Support Services	63
A000 Agriculture, Forestry and Fishing, nfd	21
Total	3,261

Notes: nec – not elsewhere classified; nfd – not further defined.
Source: ABS (2006b)

4.3.2 Downstream Agricultural Processing

The input-output table developed for the region (Gillespie Economics, 2012) also provides an indication of the direct relative significance of the different food manufacturing sectors. Meat products manufacturing is the most significant food manufacturing sector followed by the wine and spirit manufacturing sector (Figure 4.2).

Figure 4.2 - Food Manufacturing Sectors in Region



Total employment in the food manufacturing sectors in the region is 962 (ABS, 2006b). Table 4.5 provides a more detailed employment by industry breakdown which indicates that the main food manufacturing employment is in meat processing sector (mainly abattoir operation).

Table 4.5 - Employment by Food Manufacturing Sectors in the Region

Industry	Employment
1100 Food Product Manufacturing, nfd	3
1110 Meat and Meat Product Manufacturing, nfd	3
1111 Meat Processing	472
1112 Poultry Processing	17
1113 Cured Meat and Smallgoods Manufacturing	3
1131 Milk and Cream Processing	4
1133 Cheese and Other Dairy Product Manufacturing	11
1140 Fruit and Vegetable Processing	10
1150 Oil and Fat Manufacturing	4
1160 Grain Mill and Cereal Product Manufacturing, nfd	14
1161 Grain Mill Product Manufacturing	43
1171 Bread Manufacturing (Factory based)	63
1172 Cake and Pastry Manufacturing (Factory based)	14
1174 Bakery Product Manufacturing (Non-factory based)	71
1181 Sugar Manufacturing	3
1182 Confectionery Manufacturing	7
1192 Prepared Animal and Bird Feed Manufacturing	52
1199 Other Food Product Manufacturing, nec	6
1210 Beverage Manufacturing, nfd	4
1211 Soft Drink, Cordial and Syrup Manufacturing	10
1214 Wine and Other Alcoholic Beverage Manufacturing	148
Total	962

Source: ABS 2006b

4.3.3 Mining

The main mining activities in the region are related to the coal mines of Ulan, Wilpinjong and Moolarben. In 2007/08 saleable coal output from Ulan and Wilpinjong² was estimated at 11.11Mt pa, which is estimated to have a value of around \$705M (Table 4.6), greater than the value of agricultural production in the region in 2006 (Table 4.3).

Table 4.6 - Existing Coal Mining Production, Gross Value and Direct Employment in Region

Coal Mining	Units	Total
Coal Saleable Production (2007/2008)	Mt	11.11
Gross Value of Coal Production	\$M	705
Direct Mining Employment	No.	677

Source: NSW Department of Primary Industries (DPI) (2009).

Note: Mt = million tonnes.

Assuming AUD\$63.47/t which was the median price for NSW Steaming coal exports FOB in December 2007 (DPI, 2009)

² Moolarben had not commenced Stage 1 operation at this time.

4.4 Physical Impacts of the Project

4.4.1 Disturbance Footprint and Final Landform

The Cobbora Coal Project Site is 27,386 ha. The disturbance footprint is estimated at 4,700 ha of predominantly Rural Land Capability Class IV land. The disturbed land will be rehabilitated to predominantly land capability Class III and IV land (Table 4.7).

Table 4.7 – Land Capability Class for the Cobbora Project Disturbance Footprint and Final Landform

Land Capability Class	Project Site		Disturbance Footprint		Final Landform		Change	
	ha	%	ha	%	ha		ha	%
II	568	2%	Nil	Nil	Nil	Nil	Nil	Nil
III	5,985	22%	782	17%	1,105	24%	323	7%
IV	9,880	36%	2,380	50%	1,755	37%	-625	-13%
V	4,797	18%	435	9%	145	3%	-290	-6%
VI	4,664	17%	790	17%	1,145	24%	355	8%
VII	1,492	5%	313	7%	5	0%	-308	-7%
VIII	0	0%	0	0%	545	12%	545	12%
Total	27,386	100%	4,700	100%	4,700	100%		

Source: GSSE (2012)

4.4.2 Impacts of Biodiversity Offsets

The Environmental Assessment provides a biodiversity offset strategy to compensate for unavoidable impacts on threatened flora species, threatened fauna habitat, threatened ecological communities (TECs) and other native vegetation. The offset package is being developed in consultation with NSW and Commonwealth government agencies. It will detail land that will be conserved to ensure that the Project results in a 'maintain or improve' or net gain outcome for biodiversity values in the region.

The specific land parcels to be part of the offset package are not finalised but will consist of a majority of land that already contains native vegetation and a smaller area of land that is currently used for agriculture. Use of agricultural land for offsets is important to allow wildlife corridors to be improved.

Rural Land Capability Class I, II or III land will not be used for offsets unless this leads to substantial ecological benefits. For the purpose of this analysis it has been assumed that:

- there will 4,450 ha conserved in offset areas (there will be additional TECs conserved that are not in areas used for agriculture);
- up to 40% of offsets will be on agricultural land, although it is likely that this proportion will be much lower; and
- offsets will be on Class IV land, although it is likely that Class V and VI land will be used as well.

4.4.3 Impacts on Water Resources

As well as using agricultural lands, the Cobbora Coal Project would also utilise up to 3,311 ML per year of water from the Macquarie and Cudgegong Regulated River Water Source.

Groundwater modelling indicates that the peak mine inflow rate will be 1,775 ML per annum in year 2031. This will consist of up to 280 ML per annum from the Talbragar River, with the remaining 1,495 ML per annum coming from the Gunnedah-Oxley Basin groundwater source. Licences from each individual water source will be obtained by CHC.

4.5 Annual Output and Gross Margin Agricultural Impacts of the Project

4.5.1 Production Information

Economic assessment of the agricultural implications of the Project requires identification of the annual net value (gross margin) and annual output of agricultural production that would potentially be foregone as a result of the Project.

For the purpose of this analysis, the agricultural uses and productivity identified in Table 4.8 for different Rural Land Capability Classes, pre and post mining, are assumed.

Table 4.8 – Agricultural Productivity¹

Land Capability Class	Enterprise Type	Enterprise Assumptions	GM (\$/ha)	Total Income \$/ha	Variable Costs
II & III	Cropping land: Short Fallow Canola, Cereal & Pulse rotation – crop rotation over 6 year period				
	Canola: Short Fallow	Yield of 2.2 t/ha – year 1	\$482	\$1,100	\$618
	Cereal – Wheat: Short Fallow (No-till)	Yield of 3.8 t/ha – year 2; yield after a canola crop	\$556	\$969	\$413
	Pulse – Chickpeas:	Yield of 2.2 t/ha – year 3;	\$365	\$836	\$471
	Cereal – Wheat: Short Fallow (No-till)	Yield of 4 t/ha – year 4; yield after a pulse crop	\$835	\$1,220	\$385
	Canola: Short Fallow	Yield of 2.2 t/ha – year 5	\$482	\$1,100	\$618
	Cereal – Wheat: Short Fallow (No-till)	Yield of 3.8 t/ha – year 6; yield after a canola crop	\$556	\$969	\$413
Gross margin Average per year			\$546	\$1,032	\$486
IV & V	Grazing Land: Best case scenario: Sheep				
	Merino rams (18 micron)	2.1 dry sheep equivalent (DSE) /ewe; and Fodder supplemented	\$450	\$680	\$230
VI	Grazing Land: Best case scenario: Sheep				
	Merino wethers (18 micron)	1 dry sheep equivalent (DSE) /ewe; and Fodder supplemented	\$330	\$731	\$401
VII	Grazing Land: Best case scenario: Sheep				
	Merino wethers (18 micron)	0.3 dry sheep equivalent (DSE) /ewe; and Fodder supplemented	\$110	\$244	\$134

Source: GSSE (2012)

It is assumed that water entitlements would used by the Project would otherwise have been used for spray irrigated lucerne at a rate of 8 ML/ha (GSSE, 2012). With this water no longer being available for agriculture, it is assumed that the land could otherwise be used for dryland cropping with productivity of Class II and III land in Table 4.8.

4.5.2 Annual Value of Impacted Agricultural Production

Disturbance Footprint

Based on the above information, the potential annual value of agricultural output and gross margin displaced by the disturbance footprint of the Cobbora Coal Project is estimated at \$3.4M and \$2.0M, respectively³ (Table 4.9). This represents in the order of 1.2% of the 2006 annual regional value of agriculture production, with these impacts to occur for 21 years. The rehabilitated landform would be capable of supporting a similar level of agricultural activity (Table 4.9).

Table 4.9 – Value of Impacted Agricultural Production

Land Capability Class	Disturbance Footprint		Final Landform	
	Gross Margin \$/yr	Revenue \$/yr	Gross Margin \$/yr	Revenue \$/yr
II	-	-	-	-
III	426,972	807,024	603,330	1,140,360
IV	1,071,000	1,618,400	789,750	1,193,400
V	195,750	295,800	65,250	98,600
VI	260,700	577,490	377,850	836,995
VII	34,430	76,372	550	1,220
VIII	-	-	-	-
Total	1,988,852	3,375,086	1,836,730	3,270,575

Ecological Offsets

Assuming 40% of the 4,450 ha of offsets will be on Class IV land the potential annual value of agricultural output and gross margin displaced by the Project is estimated at \$1.2M and \$0.8M, respectively⁴. This represents in the order of 0.4% of the 2006 annual regional output value of agriculture production, with these impacts occurring in perpetuity.

Water Entitlements

Spray irrigated lucerne uses 8 ML/ha and therefore a maximum of 636 ha could be farmed using the 5.1 GL per annum of surface and groundwater allocation (GSSE 2012). The total revenue and gross margin for this spray irrigated lucerne is \$2,613/ha/yr and \$1,405/ha/yr (5 cuts @ 2.5 t per cut), respectively. With this water no longer being available for agriculture it is assumed that the land could otherwise be used for dryland cropping with productivity of Class II and III land in Table 4.8. Based on these assumptions the net agricultural impact is a reduction in annual revenue and annual gross margin of \$1.0M and \$0.6M, respectively. This represents in the order of 0.4% of the 2006 annual regional output value of agriculture production, with 35% of these impacts (those associated with groundwater licences) occurring over an extended period and 65% occurring for the duration of the Project.

³ This is an approximation based on general agricultural information rather than site specific information. It should also be noted that the prices assumed in the DPI gross margin budgets were correct at the time but world market prices are volatile making estimates of future pricing difficult.

⁴ See footnote 3.

4.6 Economic Efficiency of Using Land and Water Resources for the Project Instead of Agriculture

A BCA of the Project (Gillespie Economics, 2012) estimated the present value of net production benefits of the Project to Australia, at \$2.0B, including an allowance for the opportunity costs of the agricultural land and water entitlements.

In contrast, the present value of using land and water resources for agriculture is estimated at \$40.9 M.

The present value of net production benefits of the Project are therefore 49 times those of continued use of land and water resources for agricultural production. Excluding consideration of the potential residual externalities of the Project and agricultural land, the Project is considered to be a significantly more efficient use of scarce resources than continued agricultural production.

Table 4.10– Net Production Benefits of Different Land Uses (\$M)

	Surface and Groundwater	Agricultural Land Disturbance Footprint	Biodiversity Offsets	Total Agricultural Impact	Project
Annual net production benefits	\$0.6	\$2.0	\$0.8	\$3.3	\$341
Net Present Value (NPV) *	\$6.4	\$23.2	\$11.3	\$40.9	\$2,021

*Discounting is at 7% with agricultural impacts in perpetuity included.
For agricultural land the NPV includes offsetting agricultural production.

There are a number of potential environmental, cultural and social costs associated with the Project, valued at in the order of \$68M. Potential positive employment externalities of the Project are estimated at \$192M. Including all environmental, cultural and social impacts the Project is estimated to have net benefits to Australia of between \$1,946M and \$2,138M, which is significantly more efficient than continued agricultural production (Gillespie Economics 2012).

4.7 Regional Impacts of Using Land and Water Resources for the Project Instead of Agriculture

Table 4.11 identifies the direct and indirect regional impacts of the above levels of impacted annual agricultural production from the Project disturbance footprint, biodiversity offsets and purchase of 5.1 GL of water allocation. This was estimated from the sectors in the regional input-output table within which production is located i.e. canola and wheat growing is included in the *grains sector*, sheep enterprises in the *sheep sector* and lucerne production in the *other agriculture sector*. The net agricultural impacts are compared to the estimated annual direct and indirect regional economic impact of the Project.

Table 4.11 – Regional Economic Impacts of the Project and Displaced Agriculture

	Surface and Groundwater	Agriculture Land Disturbance Footprint	Biodiversity Offsets	Total Agricultural Impact*	Project
Annual water usage (GL)	5.1			5.1	5.1
Area (ha)	636	4,700	1,780	7,116	4,700
Production type	Dryland Cropping instead of Spray Irrigated Lucerne	Sheep and Grains	Sheep		Coal
Direct output (\$M)	1.0	3.4	1.2	5.6	535.4
Direct value added (\$M)	0.4	1.6	0.6	2.6	99.5
Direct income (\$M)	0.2	0.7	0.2	1.2	49.7
Direct employment (no.)	6	31	13	51	482
Direct and indirect output (\$M)	1.5	5.0	1.8	8.3	713.9
Direct and indirect value added (\$M)	0.6	2.3	0.8	3.7	183.6
Direct and indirect income (\$M)	0.4	1.2	0.4	2.0	102.4
Direct and indirect employment (no.)	9	39	16	63	1,170

*Some inconsistencies due to rounding.

The Project is estimated to provide considerable economic activity to the regional economy that is far in excess of the regional economic impacts of using the impacted agricultural land and water resources for agriculture.

The direct annual output of the Project (at 20 Mtpa of ROM coal production) is estimated at \$535M. This is greater than the annual value of all agriculture production in region in 2006 and 96 times the agricultural revenue from the land and water entitlements used by the Project. Direct employment provided by the Project is estimated at nine times that provided by continued agricultural use of the land and water.

This economic activity provided by the Project will continue for approximately 21 years, should the approval be granted. At the cessation of the Project the rehabilitated landform would be capable of supporting a similar level of agricultural activity, and hence regional economic activity, as it does now. Similarly, surface water resources could potentially be returned to agricultural production. The majority of the impacts on agriculture are therefore temporary. Only those agricultural impacts related to biodiversity offsets and groundwater will occur for an extended period.

5.0 CONCLUSION

- The population of the region comprising the Dubbo, Mid-Western Regional, Wellington and Warrumbungle LGAs declined between 2001 and 2006 but from 2006 to 2010 experienced average annual population growth rate of 1.06% compared to 1.56% for NSW.
- Agricultural land uses comprise 66% of the land area in the region while extractive industries are likely to comprise less than 1% of the land area;
- The output value of existing coal production is greater than all agricultural production in the region;
- The annual output value of the Cobbora Coal Project will be greater than the annual output value of all agriculture production in the region;
- Direct (and indirect) employment provided by the Project will be nine times (19 times) that provided by continued agricultural use of the land and water resources required for the Project;
- The present value of the net production benefits of the Project (including the opportunity costs of agricultural land and water resources) are 49 times those of continued agricultural production and use of water;
- Incorporating the value of externality impacts, the Project is estimated to have net benefits to Australia of between \$1,946M and \$2,138M, which is significantly more efficient than continued agricultural production;
- Most agricultural impacts from the Project would be temporary, with disturbed land returned to a similar level of productivity following post-mining rehabilitation and surface water entitlements potentially available for agriculture post-mining. Only those agricultural impacts related to biodiversity offsets and groundwater will occur for an extended period.

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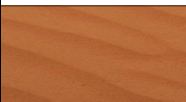
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Gross Productivity Margins



Canola: Short Fallow (No-till)

Central Zone - East

Winter 2011

1. GROSS MARGIN BUDGET:

INCOME:

2.20 tonnes/ha @ \$500.00 /tonne (on farm)

A. TOTAL INCOME \$/ha:
VARIABLE COSTS:

See opposite page for detail

Sowing.....

\$58.91

Fertiliser.....

\$246.80

Herbicide.....

\$73.09

Insecticide.....

\$56.19

Contract-harvesting.....

\$129.00

Levies.....

\$14.47

Crop Insurance.....

\$39.46

Cartage, grading & bagging.....

\$0.00

B. TOTAL VARIABLE COSTS \$/ha:

\$617.92

C. GROSS MARGIN (A-B) \$/ha:

\$482.08

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

YIELD tonnes/ha	ON FARM PRICE (\$/tonne)				
	\$420 /t	\$460 /t	\$500 /t	\$540 /t	\$580 /t
1.30	-\$41	\$9	\$58	\$108	\$157
1.60	\$79	\$140	\$201	\$262	\$323
1.90	\$198	\$271	\$343	\$416	\$488
2.20	\$314	\$398	\$482	\$566	\$650
2.50	\$428	\$523	\$619	\$714	\$810
2.80	\$542	\$649	\$755	\$862	\$969
3.10	\$655	\$774	\$892	\$1,010	\$1,129
3.40	\$769	\$899	\$1,029	\$1,158	\$1,288

 Gross
Margin
(\$/ha)

PRODUCT TRADE NAMES

The product trade names in this publication are supplied on the understanding that no preference between equivalent products is intended and that the inclusion of a product does not imply endorsement by NSW DPI over any other equivalent product from another manufacturer.

Canola: Short Fallow (No-till)

Central Zone - East

Winter 2011

CALENDAR OF OPERATIONS:

Operation	Month	Machinery			Inputs			Total Cost \$/ha
		hr/ha	Cost \$/hour	Total \$/ha	rate/ha	Cost \$	Total \$/ha	
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Dec/Jan	0.05	70.67	\$3.81	1.20 L	\$5.67/L	\$6.80	\$10.60
Wetter eg. alkoxyated alcohol 1000 g/L (BS 1000®)	Dec/Jan	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Weed control eg: triclopyr 600 g/L (Garlon®)	Dec/Jan	with above			0.08 L	\$21.00/L	\$1.68	\$1.68
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Feb/Mar	0.05	70.67	\$3.81	1.00 L	\$5.67/L	\$5.67	\$9.47
Wetter eg. alkoxyated alcohol 1000 g/L (BS 1000®)	Feb/Mar	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Weed control eg: 2,4-D amine (Surpass®) 300g/L	Feb/Mar	with above			1.00 L	\$3.76/L	\$3.76	\$3.76
Weed control eg: glyphosate 540 g/L (Roundup PowerMAX®)	Apr	0.05	70.67	\$3.81	0.65 L	\$7.21/L	\$4.68	\$8.49
Weed control eg: trifluralin 480 g/L (Triflur® X)	Apr	with above			1.70 L	\$6.70/L	\$11.39	\$15.20
Sowing - treated seed	Apr/May	0.17	91.67	\$15.41	3.00 kg	\$14.50/kg	\$43.50	\$58.91
Nitrogen and sulfur fertiliser eg: Extra Sul®	Apr	with above			84 kg	\$0.90/kg	\$75.60	\$75.60
Starter fertiliser eg: MAP	Apr/May	with above			100 kg	\$1.03/kg	\$103.00	\$103.00
Mite control eg: omethoate 290 g/L (Le mat® 290 SL)	May	0.05	99.38	\$5.35	0.10 L	\$48.00/L	\$4.80	\$10.15
Topdress urea	Jun/Jul	0.17	91.67	\$15.70	70.00 Kg	\$0.75/kg	\$52.50	\$68.20
Weed control eg: clopyralid 300 g/L (Lontrel®)	Jun	0.05	70.67	\$3.81	0.30 L	\$38.01/L	\$11.40	\$15.21
Weed control eg: haloxyfop-R 520 g/L (Verdict®)	Jun	with above			0.05 L	\$80.08/L	\$4.00	\$4.00
Uptake®	Jun	with above			0.25 L	\$7.50/L	\$1.88	\$1.88
Aphid control (1 year in 2) eg: pirimicarb 500 g/Kg (Pirimor WG®)	Sep/Oct	contract		\$18.15	0.5 kg	\$60.80/kg	\$30.40	\$24.28
Heliothis control (every year) eg: cypermethrin 100 g/L (Fastac Duo®)	Oct	contract		\$18.15	0.30 L	\$12.05/L	\$3.62	\$21.77
Contract windrow	Oct/Nov			\$75.00				\$75.00
Contract-harvest	Nov	contract		\$54.00				\$54.00
Crop Levies					\$1.50/tonne + 1.02% of on-farm value			\$14.47
Crop Insurance					3.59% of on-farm value			\$39.46

*** Input and crop prices are correct at the time of writing (March 2011). Market uncertainty makes estimation of future pricing impractical

NOTES:

Place in rotation:	- This budget applies to canola following cereal. - Excellent disease and weed break crop for wheat. - Short Fallow: Fallow or weed free period of 5-6 months between harvest of one crop and sowing of the next crop. For example, a paddock harvested in November would allow for a 5-6 month fallow until sowing in May.
Paddock selection:	- Avoid acidic soils with exchangeable aluminium and manganese. Avoid hard pans. - Apply lime on acid soils where pH_{ca} is below 5.0. - Subsoil moisture of at least 60 cm is recommended at sowing.
Sowing time:	- Sow from mid April to late May. - High stubble loads directly over seeding row may result in poor crop establishment. - Adjust seeding rates accordingly.
Fertiliser:	- Seed price used above is for purchased seed of open pollinated varieties. Farmer retained seed is not recommended. - Canola has high requirements for essential nutrients phosphorus, nitrogen and sulfur. - A starter fertiliser is recommended at sowing. Canola is very responsive to phosphorus. - Phosphorus is essential for good growth and development and effective utilisation of other nutrients. - Needs 30% more nitrogen than equivalent yielding wheat. All nitrogen should be applied before stem elongation. Soils low in sulfur, particularly red soils, should receive 25 kg/ha sulfur per hectare.
Weed control:	- Trifluralin as a pre-emergent for selected grass and broadleaf weeds. - Clopyralid for broadleaf weed control (capeweed, skeleton weed and saffron thistle). - Rotate herbicide groups & use other non-chemical methods to delay herbicide resistance.
Insect control:	- Earthmite control is essential to protect seedlings. - Monitor regularly from flowering onwards for chewing and sucking insects eg. aphids and heliothis. - Heliothis control is needed in most years.
Windrowing:	- Is recommended to promote even ripening and minimize shattering losses.
Machinery:	- A tractor with 153 kW (181 HP) pto power and 166 kW (225 HP) engine power is assumed. - Machinery costs refer only to variable costs: fuel, oil, filters, tyres, batteries & repairs. - Contract-harvesting does not include the cost of fuel.
Labour:	- The labour required for machinery operations is 0.55 hr/ha - Using a labour cost of \$22/hr, an additional \$12.03 can be deducted from the budget
Important notes:	- These gross margins are only a guide. They do not include overhead costs. - Use your own figures and price assumptions to estimate your own gross margin. - Use of a particular brand name does NOT imply recommendation of that brand by NSW DPI.

This budget is ONLY A GUIDE and should be used as a guide only. It does not take account of improvements in crop and input prices, changes in seasonal conditions and the farm characteristics.

Wheat: Short Fallow (No-till)

Central Zone - East

Winter 2011

1. GROSS MARGIN BUDGET:

PREVIOUS CROP:

After	INCOME:		
Pulse	4.00 tonnes/ha @	\$305.00	/tonne (on farm) (PH)
Canola	3.80 tonnes/ha @	\$255.00	/tonne (on farm) (AH)
Cereal	3.20 tonnes/ha @	\$255.00	/tonne (on farm) (AH)

A. TOTAL INCOME \$/ha:

VARIABLE COSTS:

See opposite page for detail

Sowing	\$61.31	\$61.31	\$61.31	
Fertiliser.....	\$220.21	\$220.21	\$182.71	
Herbicide.....	\$78.93	\$18.92	\$18.92	
Fungicide.....	\$18.92	\$18.92	\$18.92	
Contract-harvesting.....	\$56.40	\$63.60	\$66.00	
Levies.....	\$8.32	\$9.88	\$12.44	
Crop Insurance.....	\$16.73	\$19.86	\$25.01	
Cartage, grading & bagging.....	\$0.00	\$0.00	\$0.00	

B. TOTAL VARIABLE COSTS \$/ha:

C. GROSS MARGIN (A-B) \$/ha:

CEREAL Standard Budget \$/ha	CANOLA Standard Budget \$/ha	PULSE Standard Budget \$/ha	Your Budget \$/ha
		\$1,220.00	
	\$969.00		
\$816.00			
\$816.00	\$969.00	\$1,220.00	
\$61.31	\$61.31	\$61.31	
\$220.21	\$220.21	\$182.71	
\$78.93	\$18.92	\$18.92	
\$18.92	\$18.92	\$18.92	
\$56.40	\$63.60	\$66.00	
\$8.32	\$9.88	\$12.44	
\$16.73	\$19.86	\$25.01	
\$0.00	\$0.00	\$0.00	
\$460.82	\$412.71	\$385.31	
\$355.18	\$556.29	\$834.69	

PRODUCT TRADE NAMES

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

	YIELD tonnes/ha	ON FARM PRICE (\$/tonne)					
		\$215 /t	\$235 /t	\$255 /t	\$275 /t	\$295 /t	
After Cereal	2.20	\$31	\$74	\$116	\$159	\$202	Gross Margin (\$/ha)
	2.70	\$133	\$185	\$238	\$290	\$342	
	3.20	\$231	\$293	\$355	\$417	\$479	
	3.70	\$329	\$401	\$473	\$544	\$616	
	4.20	\$428	\$509	\$590	\$672	\$753	

	YIELD tonnes/ha	ON FARM PRICE (\$/tonne)					
		\$215 /t	\$235 /t	\$255 /t	\$275 /t	\$295 /t	
After Canola	2.30	\$112	\$157	\$201	\$246	\$290	Gross Margin (\$/ha)
	2.80	\$213	\$267	\$321	\$375	\$430	
	3.30	\$311	\$375	\$439	\$503	\$567	
	3.80	\$409	\$483	\$556	\$630	\$704	
	4.30	\$507	\$591	\$674	\$757	\$841	
	4.80	\$605	\$698	\$791	\$885	\$978	
	5.30	\$704	\$806	\$909	\$1,012	\$1,115	

	YIELD tonnes/ha	ON FARM PRICE (\$/tonne)					
		\$265 /t	\$285 /t	\$305 /t	\$325 /t	\$345 /t	
After Pulse	2.50	\$191	\$240	\$288	\$337	\$385	Gross Margin (\$/ha)
	3.00	\$289	\$347	\$406	\$464	\$522	
	3.50	\$388	\$455	\$523	\$591	\$659	
	4.00	\$486	\$563	\$635	\$718	\$796	
	4.50	\$584	\$671	\$758	\$846	\$933	
	5.00	\$682	\$779	\$876	\$973	\$1,070	
	5.50	\$780	\$887	\$994	\$1,100	\$1,207	

NOTES:

Place in rotation:

- The performance of short fallow wheat crops can vary depending on the previous crop.
- Pulse and canola crops can provide an effective disease break if grass weeds are adequately controlled before and during canola/pulse crop. Additionally, a pulse crop improves soil nitrogen thereby reducing the amount of fertiliser required to achieve PH quality.
- Short Fallow: Fallow or weed-free period of 5-6 months between harvest of one crop and sowing of the next crop. For example, canola harvested in November would allow for a 5-6 month fallow until sowing the next May.

Sowing time:

- Sowing at the optimum time for the selected variety is critical for maximum yield potential.
- There is a 4 to 7% yield loss for every week delay past the optimum sowing time.
- Seed price used above is for purchased seed; if using retained seed, adjust budget accordingly.

Weed control:

- Weed control, if required, should be implemented either pre-emergent or within 4 to 6 weeks after sowing time to limit yield loss.
- Rotate herbicide groups and use other non-chemical methods to avoid herbicide resistance developing.
- Adequate phosphorus is essential before applying extra nitrogen fertiliser.

Fertiliser:

- To achieve APH quality, wheat must have a protein level of 13.0% or higher, or for AH quality, wheat must have a protein level of 11.5% or higher.
- Seasonal conditions will also have a large effect on protein content.
- Nitrogen fertiliser applications may be split i.e. some applied pre-sowing and some post-emergent.
- The later nitrogen fertiliser is applied to a crop, the greater its effect on raising protein levels, and the less effect it has on increasing yield.

This budget is ONLY A GUIDE and should be altered for movements in crop and input prices, changes in seasonal conditions and the farm characteristics.

Wheat: Short Fallow (No-till)

Central Zone - East

Winter 2011

CALENDAR OF OPERATIONS:

Operation	Month	Machinery			Inputs			Total Cost \$/ha
		hrs /ha	Cost \$/hour	Total \$/ha	rate/ha	Cost \$	Total \$/ha	
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Jan	0.05	70.67	\$3.81	1.20 L	\$5.67/L	\$6.80	\$10.60
Wetter eg. alkoxyated alcohol 1000 g/L (BS 1000®)	Jan	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Weed control eg: triclopyr 600 g/L (Garlon®)	Jan	with above			0.08 L	\$21.00/L	\$1.68	\$1.68
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Mar	0.05	70.67	\$3.81	1.00 L	\$5.67/L	\$5.67	\$9.47
Wetter eg. alkoxyated alcohol 1000 g/L (BS 1000®)	Mar	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Weed control eg: 2,4-D amine 300 g/L (Surpass®)	Mar	with above			1.00 L	\$3.76/L	\$3.76	\$3.76
Nitrogen Fertiliser- After Canola eg: Urea	May	0.17	91.67	\$15.41	100 kg	\$0.75/kg	\$75.00	\$90.41
Nitrogen Fertiliser- After Cereal eg: Urea	May	0.17	91.67	\$15.41	100 kg	\$0.75/kg	\$75.00	\$90.41
Nitrogen Fertiliser- After Pulses eg: Urea	May	0.17	91.67	\$15.41	50 kg	\$0.75/kg	\$37.50	\$52.91
Weed control eg: glyphosate 450 g/L (Roundup CT®)	May	0.05	70.67	\$3.81	0.80 L	\$5.67/L	\$4.53	\$8.34
Wetter eg. alkoxyated alcohol 1000 g/L (BS 1000®)	May	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Sowing	May	0.17	91.67	\$15.41	50 kg	\$0.92/kg	\$45.90	\$61.31
Seed treatment eg: Jockey Stayer®	May	with above			0.275 L	\$60.00/L	\$16.50	\$16.50
Starter fertiliser eg: MAP	May	with above			110 kg	\$1.03/kg	\$113.30	\$113.30
Weed control pre-emergent eg: chlorsulfuron 750 g/kg (Glean®)	May	0.05	70.67	\$3.81	20.0 g	\$0.08/g	\$1.60	\$5.41
Broadleaf weed control eg: LVE Agritane® 500g/L	Jun/July	0.05	70.67	\$3.81	0.60 L	\$9.85/L	\$5.91	\$9.71
Grass weed control eg: clodinafop-propargyl (Topik®)	Jun/July	with above			0.09 L	\$250.00/L	\$22.00	\$22.00
Uptake®	Jun/July	with above			0.50 L	\$7.50/L	\$3.75	\$3.75
Foliar Fungicide eg: tebuconazole 430 g/L (Folicur®)	July/Aug	0.05	70.67	3.81	0.145 L	\$39.00/L	\$5.66	\$9.46
Foliar Fungicide eg: tebuconazole 430 g/L (Folicur®)	Sep/Oct	0.05	70.67	3.81	0.145 L	\$39.00/L	\$5.66	\$9.46
Contract-harvest - After Canola	Nov	contract		\$63.60				\$63.60
Contract-harvest - After Cereal	Nov	contract		\$56.40				\$56.40
Contract-harvest - After Pulse	Nov			\$66.00				\$66.00
Crop Levies - After Canola					1.02%	of on-farm value		\$9.88
Crop Levies - After Cereal					1.02%	of on-farm value		\$8.32
Crop Levies - After Pulses					1.02%	of on-farm value		\$12.44
Crop Insurance - After Canola					2.05%	of on-farm value		\$19.86
Crop Insurance - After Cereal					2.05%	of on-farm value		\$16.73
Crop Insurance - After Pulses					2.05%	of on-farm value		\$25.01

*** Input and crop prices are correct at the time of writing (March 2011). Market uncertainty makes estimation of future pricing impractical.

NOTES (cont):

- Machinery:**
- A tractor with 153 kW (181 HP) pto power and 166 kW (225 HP) engine power is assumed.
 - Contract-harvesting does not include the cost of fuel.
- Labour:**
- The labour required for machinery operations is 1.18 hr/ha
 - Using a labour cost of \$22/hr, an additional \$25.89 can be deducted from the budget
- Important notes:**
- These gross margins are only a guide. They do not include overhead costs.
 - **Use your own figures and price assumptions to estimate your own gross margin.**
 - Use of a particular brand name does NOT imply recommendation of that brand by NSW DPI.

This budget is ONLY A GUIDE and should be altered for movements in crop and input prices, changes in seasonal conditions and the farm characteristics.

Chickpeas: Short Fallow (No-till)

Central Zone - East

Winter 2011

CALENDAR OF OPERATIONS:

Operation	Month	Machinery			Inputs			Total Cost \$/ha
		hr/ha	Cost \$/hour	Total \$/ha	rate/ha	Cost \$	Total \$/ha	
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Jan/Feb	0.05	70.67	\$3.81	1.20 L	\$5.67/L	\$6.80	\$10.60
Wetter eg. alkoxylated alcohol 1000 g/L (BS 1000®)	Jan/Feb	with above			0.20 L	\$7.00/L	\$1.40	\$1.40
Weed control eg: triclopyr 600 g/L (Garlon®)	Jan/Feb	with above			0.08 L	\$21.00/L	\$1.68	\$1.68
Weed control eg: glyphosate 450 g/L (Roundup CT®)	Mar/Apr	0.05	70.67	\$3.81	1.00 L	\$5.67/L	\$5.67	\$9.47
Wetter eg. alkoxylated alcohol 1000 g/L (BS 1000®)	Mar/Apr	with above			0.20 L	7.00 L	\$1.40	\$1.40
Weed control eg: 2,4-D amine 300 g/L (Surpass®)	Mar/Apr	with above			1.20 L	\$3.76/L	\$4.51	\$4.51
Sowing seed- inoculated and treated seed	May	0.17	91.67	\$15.41	80 kg	\$1.60/kg	\$127.68	\$143.09
Fertiliser eg: MAP	May	with above			100 kg	\$0.42/kg	\$42.00	\$42.00
Weed control eg:simazine 500 g/L (Simazine 500®) (PSPE)	May	0.05	70.67	\$3.81	1.50 L	\$5.55/L	\$8.33	\$12.13
Broadleaf weed control eg: Isoxaflutole 750 g/kg (Balance® PSPE)	May	with above			100 g	\$0.38/L	\$38.00	\$38.00
Disease control eg: chlorothalinil 720 g/L (Bravo®)	Jun	0.05	70.67	3.81	1.00 L	\$10.00/L	\$10.00	\$13.81
Disease control eg: mancozeb 800 g/L (Dithane®)	Jul	0.05	70.67	\$3.81	1.00 kg	\$10.23/kg	\$10.23	\$14.04
Weed control eg: haloxyfop-R 520 g/L (Verdict®)	Jul	with above			0.05 L	\$80.1/L	\$4.00	\$4.00
Disease control eg: chlorothalinil 720 g/L (Bravo®)	Aug/Sept	0.05	70.67	\$3.81	1.00 L	\$10.00/L	\$10.00	\$13.81
Heliothis control eg: alpha-cypermethrin 100 g/L (Fastac Duo®)	Sep/Oct	contract		\$18.15	0.30 L	\$12.05/L	\$3.62	\$21.77
Disease control eg: mancozeb 800 g/L (Dithane®)	Oct	0.05	70.67	\$3.81	1.00 kg	\$10.23/L	\$10.23	\$14.04
Desiccation eg: glyphosate 540 g/L (Roundup PowerMAX®)	Dec	contract		\$18.15	1.80 L	\$7.21/L	\$12.97	\$31.12
Contract-harvest	Dec			\$50.00				\$50.00
Crop Levies					1.02%	of on-farm value		\$8.49
Crop Insurance					2.56%	of on-farm value		\$21.42

*** Input and crop prices are correct at the time of writing (March 2011). Market uncertainty makes estimation of future pricing impractical.

NOTES:

Soil:	- Suited to the better loam, clay loam or heavy self mulching clay soils. Soils must be well drained.
Place in rotation:	- Useful as a break crop later in cereal rotations for disease control, weed control and nitrogen benefits for following cereal crops. - Should NOT be grown more than one year in four in a paddock.
Seed:	- Short fallow: Fallow or weed free period of 5-6 months between harvest of one crop and sowing of the next crop.
Inoculation:	- Seed price used above is for purchased seed; if using retained seed adjust budget accordingly.
Fertiliser:	- Group N inoculum is essential.
Fungicide:	- Single super is one of many available alternatives. Adequate levels of phosphorus and sulfur should be applied. - Strategic fungicide programs are required to control the disease Ascochyta in chickpeas. Program may vary with variety (see Variety Management Package - VMP at www.pulseaus.com.au). See "Fungicide strategies for the control of ascochyta in chickpeas".
Weed control:	- Chickpeas are poor weed competitors and control is critical. Chloro and a pre-emergent broadleaf herbicide is essential. - Optional grass control with fluazifop, haloxyfop, quizalafop, sethoxydim or clethodim herbicides. - Note: Balance® herbicide is not recommended for use on Yorker chickpeas.
Insect control:	- Heliothis must be monitored from flowering through to podding.
Harvest:	- Desiccation is recommended in most seasons to ensure even ripening. Timing is critical.
Machinery:	- A tractor with 153 kW (181 HP) pto power and 166 kW (225 HP) engine power is assumed. - Machinery costs refer only to variable costs: fuel, oil, filters, tyres, batteries & repairs.
Labour:	- Contract-harvesting does not include the cost of fuel. - The labour required for machinery operations is 0.41 hr/ha - Using a labour cost of \$22/hr, an additional \$9.07 can be deducted from the budget
Important notes:	- These gross margins are only a guide. They do not include overhead costs. - Use your own figures and price assumptions to estimate your own gross margin. - Use of a particular brand name does NOT imply a recommendation of that brand by NSW DPI.

MERINO EWES (18 micron) - Merino Rams

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



Flock size: 1000 ewes
Ewe body weight: 50 kgs
DSE rating: 2.1 dse's / ewe

INCOME

	number	class	kg /hd	\$/kg
Wool				
Shear	960	ewes	4.66	\$10.99
	208	ewe hoggets	4.66	\$12.37
	20	rams	7.00	\$10.99
	407	ewe lambs	0.97	\$4.54
Crutch	980	adults	0.40	\$4.80
	407	ewe lambs	0.30	\$4.80
Sheep Sales				
	177	CFA ewes	\$84.67	(20.5 kg cwt)
	4	CFA rams	\$60.48	
	415	weth weaners	\$75.00	(4 months)
	181	ewe hoggets	\$145.00	(18 months)

Fodder	tonnes	type	value per tonne
Graz/fodder crop	0 t	0	\$0 /t

A. Total Income:

VARIABLE COSTS

Replacements	number	class	cost (\$)	reps
	4	rams	\$1,000.00	

Wool Harvesting & Selling Costs

Shearing	1367	ewes/hoggets	\$5.89	1	\$8,046.11
	20	rams	\$8.50	1	\$170.02
Crutching	1367	ewes/hoggets	\$1.13	1	\$1,546.67
	20	rams	\$1.95	1	\$39.04
Wool tax			2.00%		\$1,338.21
Commission, warehouse, testing charges			\$39.27/ bale		\$1,217.40
Wool - cartage	31	bales	\$18.00		\$558.00
- packs	31	packs	\$13.81		\$428.11

Sheep health

Broadspectrum	573	adults/hoggets	\$0.60	2	\$687.60
	415	ewe lambs	\$0.33	3	\$410.85
	415	wether lamb	\$0.33	1	\$136.95
Narrowspectrum	573	adults/hoggets	\$0.38	1	\$217.74
	860	lambs	\$0.21	1	\$180.60
Dipping	1387	adults/hoggets	\$1.16	1	\$1,608.92
Fly control (long acting)	980	adults/hoggets	\$1.85	1	\$1,813.00
	407	ewe weaners	\$1.55	1	\$630.85
Vaccination- 6 in 1	980	adults/hoggets	\$0.27	1	\$264.60
	860	lambs	\$0.27	1	\$232.20
Mules + Mark (incl. OJD)	860	lambs	\$4.49	1	\$3,863.12
Scanning	1000	ewes	\$0.80	1	\$800.00

Livestock Selling Costs

Livestock cartage	777	sale sheep	\$2.00		\$1,554.00
Commission on sheep sales			5.00%		\$3,629.88
Levies (Yard dues, MLA Transaction levy and RLPB rates)					\$1,558.14

Pasture maintenance	205 ha	@	\$41 /ha		\$8,433.70
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Fodder

			Supp. feed - ewes 2.1kg - ewe lambs 1.4kg grain/hd/wk @ \$150 /t		
Ewes	1168	ewes	\$0.32 /week	8 weeks	\$2,943.33
Lambs	407	ewe lambs	\$0.21 /week	12 weeks	\$1,025.64
	415	wether lambs	\$0.21 /week	0 weeks	\$0.00
Graz/fodder crop	0 ha	@	\$0 /ha		\$0.00

B. Total Variable Costs:

	excl. fodder	incl. fodder
GROSS MARGIN (A-B)	\$96,142.17	\$92,173.21
GROSS MARGIN /EWE	\$96.14	\$92.17
GROSS MARGIN /DSE	\$46.90	\$44.96
GROSS MARGIN /HA	\$468.99	\$449.63

ASSUMPTIONS

1. Flock Parameters

Flock mortality	4%	Ram %	2%
Productive life	5 years	Marking %	86%
Ewe body weight	50 kg	Weaning %	83%
DSE rating /ewe	2.05	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	

860 lambs	→	830 weaners	→	415 ewe weaners kept	→	398 ewe hoggets	→	217 replacements kept
				415 weth. weaners sold				181 ewe hoggets 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	18	MF4B.	\$17.67	68%	\$12.05	1%VMB, 90mm	75%
- Skirtings/bellies	17	MP5B.	\$15.17	58%	\$8.75	4.8%VMB, 80mm	20%
- Cardings	18	MZ2B.	\$7.43	53%	\$3.94	2.9%VMB.	5%
					\$10.99		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				
	\$8.79	\$9.89	\$10.99	\$12.09	\$13.19
3.73 kg	\$36.68	\$38.56	\$40.44	\$42.32	\$44.20
4.19 kg	\$38.49	\$40.60	\$42.72	\$44.83	\$46.95
4.66 kg	\$40.27	\$42.61	\$44.96	\$47.31	\$49.66
5.12 kg	\$42.07	\$44.66	\$47.24	\$49.83	\$52.41
5.59 kg	\$43.85	\$46.67	\$49.49	\$52.30	\$55.12

5. Sensitivity Table - Ewe lamb 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	Ewe lamb Greasy Wool Price \$/Kg greasy				
	\$3.63	\$4.09	\$4.54	\$5.00	\$5.45
0.78 kg	\$44.69	\$44.76	\$44.83	\$44.89	\$44.96
0.87 kg	\$44.76	\$44.83	\$44.91	\$44.99	\$45.07
0.97 kg	\$44.79	\$44.88	\$44.96	\$45.05	\$45.13
1.07 kg	\$44.86	\$44.95	\$45.05	\$45.14	\$45.24
1.16 kg	\$44.93	\$45.03	\$45.13	\$45.24	\$45.34

6. Sensitivity Table - Value of Merino wether weaners and ewe hoggets

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

Ewe hoggets \$/Hd	Value of wether weaners \$/Hd				
	\$60.00	\$67.50	\$75.00	\$82.50	\$90.00
\$116.00	\$39.65	\$41.09	\$42.53	\$43.97	\$45.41
\$130.50	\$40.86	\$42.30	\$43.75	\$45.19	\$46.63
\$145.00	\$42.08	\$43.52	\$44.96	\$46.40	\$47.85
\$159.50	\$43.29	\$44.74	\$46.18	\$47.62	\$49.06
\$174.00	\$44.51	\$45.95	\$47.40	\$48.84	\$50.28

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

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

CFA ewes \$/Hd	Weaning %				
	66%	75%	83%	91%	100%
\$67.73	\$36.36	\$40.02	\$43.57	\$47.23	\$50.89
\$76.20	\$37.06	\$40.71	\$44.27	\$47.93	\$51.58
\$84.67	\$37.75	\$41.41	\$44.96	\$48.62	\$52.28
\$93.13	\$38.45	\$42.10	\$45.66	\$49.31	\$52.97
\$101.60	\$39.14	\$42.80	\$46.35	\$50.01	\$53.66

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.

MERINO WETHERS (18 micron)

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



Industry & Investment

Flock size: 1000 wethers
Wether body weight: 50 kgs
DSE rating: 1.0 dse's / wether

INCOME

Wool	number	class	kg /hd	\$/kg
Shear	980	Adult wethers	5.01	\$10.99
	208	wethers 4 months	1.04	\$4.54
Crutch	990	wethers	0.40	\$4.80
Sheep Sales	number	class	\$ /hd	
	188	CFA wethers	\$86.52	(21.0 kg cwt)
Fodder	tonnes	type	value per tonne	
Graz/fodder crop	0 t	0	\$0 /t	

A. Total Income:

VARIABLE COSTS

Replacements	number	class	cost (\$)	
	208	wethers	\$75.00	(4 months)
Cartage	208	wethers	\$2.00	

Wool Harvesting & Selling Costs

				reps	
Shearing	1188	wethers	\$5.89	1	\$6,993.48
Crutching	990	wethers	\$1.19	1	\$1,182.67
Wool tax			2.00%		\$1,136.29
Commission, warehouse, testing charges			\$39.27/ bale		\$1,217.40
Wool - cartage	31	bales	\$18.00		\$558.00
- packs	31	packs	\$13.81		\$428.11

Sheep Health

Broadspectrum	980	wethers	\$0.60	2	\$1,176.00
	208	weaners	\$0.33	2	\$137.28
Narrowspectrum	990	wethers	\$0.38	1	\$376.20
Dipping	1000	wethers	\$1.16	1	\$1,160.19
Fly control (long acting)	1188	wethers	\$1.85	1	\$2,198.10
Vaccination- 6 in 1	1000	wethers	\$0.27	1	\$270.00

Livestock Selling Costs

Livestock cartage	188	CFA wethers	\$2.00		\$376.00
Commission on sheep sales			5.00%		\$813.29
Levies (Yard dues, MLA Transaction levy and RLPB rates)					\$316.24

Pasture maintenance	100 ha	@	\$41 /ha		\$4,114.00
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Fodder

			Supp. feed - wethers 2.1kg - weaners 1.4kg grain/hd/wk @ \$150 /t		
Wethers	980	Adult wethers	\$0.32 /week	4 weeks	\$1,234.80
	208	weaners	\$0.21 /week	10 weeks	\$436.80
Graz/fodder crop	0 ha	@	\$0 /ha		\$0.00

B. Total Variable Costs:

GROSS MARGIN (A-B)

GROSS MARGIN /WETHER

GROSS MARGIN /DSE

GROSS MARGIN /HA

excl. fodder

\$34,611.23

\$34.61

\$34.61

\$346.11

incl. fodder

\$32,939.63

\$32.94

\$32.94

\$329.40

ASSUMPTIONS

1. Flock Parameters

Cull age	6.5 years	Adult mortality	2%
Replacement age	4 months	Body weight	50 kg
Productive life	5 years	DSE rating	1.00
Stocking rate/ha	10 dse's		

Wool cuts are based on historical NSW wether trial data provided by Advanced Breeding Services.
Pasture maintenance = 90kg single super @ \$346t + \$10.00 application

2. Flock Structure

Sheep numbers are modified to reflect mortality throughout the year.

Age	No. of wethers	
1.5	208	208 replacements bought
2.5	204	
3.5	200	
4.5	196	
5.5	192	
6.5	0	188 CFA's sold
Total	1000	

3. Wool Prices

Merino Wether	Micron	AWEX Type	Clean price	Yield	Greasy price	Specifications (all 35n/ktex)	Proportion of Clip
- Fleece GTM	18	MF4B.	\$17.67	68%	\$12.05	1%VMB, 90mm	75%
- Skirtings/bellies	17	MP5B.	\$15.17	58%	\$8.75	4.8%VMB, 80mm	20%
- Cardings	18	MZ2B.	\$7.43	53%	\$3.94	2.9%VMB.	5%
					\$10.99		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	Wether Greasy Wool Price				
	\$/Kg greasy				
\$32.94	\$8.79	\$9.89	\$10.99	\$12.09	\$13.19
4.01 kg	\$14.34	\$18.57	\$22.80	\$27.02	\$31.25
4.51 kg	\$18.36	\$23.11	\$27.87	\$32.62	\$37.38
5.01 kg	\$22.37	\$27.65	\$32.94	\$38.22	\$43.51
5.51 kg	\$26.46	\$32.27	\$38.08	\$43.90	\$49.71
6.01 kg	\$30.47	\$36.81	\$43.15	\$49.50	\$55.84

Note: Both adult wool cut and greasy wool price have been varied by +/- 10% and +/- 20%.

5. Sensitivity Table - Young wether 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	Ewe lamb Greasy Wool Price				
	\$/Kg greasy				
\$32.94	\$3.63	\$4.09	\$4.54	\$5.00	\$5.45
0.83 kg	\$32.66	\$32.74	\$32.82	\$32.89	\$32.97
0.94 kg	\$32.67	\$32.76	\$32.84	\$32.93	\$33.02
1.04 kg	\$32.75	\$32.84	\$32.94	\$33.04	\$33.13
1.15 kg	\$32.82	\$32.93	\$33.04	\$33.14	\$33.25
1.25 kg	\$32.90	\$33.02	\$33.13	\$33.25	\$33.36

Note: Both wether lamb wool cut and greasy wool price have been varied by +/- 10% and +/- 20%.

6. Sensitivity Table - CFA wether value and replacement cost per head

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

CFA wethers \$/hd	Replacement wethers				
	\$/Hd				
\$32.94	\$60.00	\$67.50	\$75.00	\$82.50	\$90.00
\$69.22	\$32.97	\$31.41	\$29.85	\$28.29	\$26.73
\$77.87	\$34.51	\$32.95	\$31.39	\$29.83	\$28.27
\$86.52	\$36.06	\$34.50	\$32.94	\$31.38	\$29.82
\$95.17	\$37.60	\$36.04	\$34.48	\$32.92	\$31.36
\$103.82	\$39.15	\$37.59	\$36.03	\$34.47	\$32.91

Note: Both CFA and replacement wethers have been varied by +/- 10% and +/- 20%.