BENGALLA Mining Company

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Agricultural Impact Assessment

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Bengalla Coal Mine – Continuation of Mining
Ecological Offset Properties
Agricultural Impact Assessment

Report prepared for Hansen Bailey Environmental Consultants
on behalf of Bengalla Mining Company Pty Ltd

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March 2014

Executive Summary

Scott Barnett & Associates (SBA) was commissioned by Hansen Bailey, on behalf of Bengalla Mining Company (BMC), to undertake an Agricultural Impact Statement (AIS) for the Continuation of Bengalla Mine Project (the Project). This assessment formed part of the Environmental Impact Statement (EIS) (Appendix W) supporting an application for Development Consent under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the continuation of at a rate of up to 15 Million tonnes per annum (Mtpa) run of mine (ROM) coal for up to 24 years to a total of 316 Million tonnes.

In its review of the EIS, Commonwealth Department of Environment (DoE) noted that the proponent is participating in the Upper Hunter Strategic Assessment (UHSA) as a means of offsetting the NSW State and Federal impacts to biodiversity for the Project. While the details of the Plan, and in particular the Upper Hunter Offset Fund specifications are still being negotiated, DoE recommended that a contingency condition be incorporated into any approval, should offsets be unable to be provided under the Upper Hunter Offset Fund, or its equivalent.

The Project EIS noted that in the event that the UHSA process is not implemented in time for the Project to utilise it as an acceptable offsetting mechanism, an alternative offset strategy would be completed in consultation with relevant regulators. To address the risk that the UHSA was not finalised in time, BMC has developed a comprehensive Biodiversity Offset Strategy of which is the subject of this Offsets AIS. This report examines the loss of agricultural production within the offset properties and Project Disturbance Boundary during the life of the Project in terms of value of agricultural.

The Study Area for this AIS is the entirety of the BOS for the Project which comprises some 6,216 ha (offset properties) consisting of:

- An overall area of 897 ha being the land south of the Merriwa township referred to as the Merriwa River property;
- An overall area of 1,222 ha being the land east of the village of Parkville referred to as the Black Mountain property; and
- An overall area of 4,097 ha to the north east of Glenbawn Dam made up of the three contiguous properties, Echo, Kenalea and Kenelpet referred to as the ‘Kenalea properties’.

These offset properties are only suited to varying degrees of grazing under relatively low stocking rates due to slope, vegetation present and potential for soil erosion. Limited potential for aerial fertilisation exists.

Land manager/owner interviews identified that:

- The Merriwa River property is not currently used for agriculture;
- Black Mountain is currently being used for beef cattle breeding with progeny being turned off as store weaners to be sold through Scone sale yards or grown out on other local Scone properties; and
- The Kenalea Properties are currently being used for beef cattle breeding with progeny being turned off as store weaners to be sold through Scone sale yards or grown out on properties outside the Hunter Valley.

The Offset properties do not contain any mapped Biophysical Strategic Agricultural Land (BSAL) or Viticulture Critical Industry Cluster. All of Black Mountain (897 ha) and a small 5 ha area of Kenelea Property is mapped Equine CIC.

The current gross value of beef production from the offset properties is estimated to be $330,865 per annum turning off 681 head of cattle per year. There is limited scope for any significant development of the offset properties however, with further improvement of the properties this could increase up to $382,150 per annum turning off 786 head of cattle per annum.

The value of agricultural production from the combined loss of agricultural resources and irrigation water units (associated with the Project Disturbance Boundary, offset properties and mine water usage) is predicted to be $1.5 M per annum. This represents 0.449% of the annual gross value of agricultural production in the Hunter region, 0.017% of NSW's agricultural production and 0.004% of the national production.

As the overall combined agricultural contribution of the loss of agriculture associated with the offset properties, Project Disturbance Boundary and the water resource is small when compared to the total agricultural production on a regional, state and national scale, the reduced availability and productivity of this land and water will have a minimal impact to the industry. In addition, the Project will not significantly reduce the availability of land for agricultural purposes or affect the productivity of existing agricultural land outside the Project Boundary within the locality.

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1.1 Overview

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In its review of the EIS, Commonwealth Department of Environment (DoE) noted that the proponent is participating in the Upper Hunter Strategic Assessment, and that the Project's offsets in relation biodiversity are proposed to be provided under the Upper Hunter Biodiversity Plan. As details of the Plan, and in particular the Upper Hunter Offset Fund specifications are still being negotiated, DoE recommended that a contingency condition be incorporated into any approval, should offsets be unable to be provided under the Upper Hunter Offset Fund, or its equivalent.

Following the DoE submission a comprehensive Biodiversity Offset Strategy (BOS) has been developed which has identified five individual properties as potential biodiversity offsets. This Agricultural Impact Assessment (AIA) quantifies the implications of removing these properties from agriculture if they are included in a BOS for the Project. The identified impacts are then combined with the agricultural impacts already presented in the initial AIS (Barnett 2012) to provide a complete assessment of the agricultural impacts of the Project.

1.2 Assessment Objectives

The objectives for this AIA included:

- Addressing the Project Director General's Environmental Assessment Requirements (DGRs) issued 13 March 2012:
- Addressing relevant policies and plans relating to agriculture;
- Identifying the agricultural potential domains of the land within the BOS properties (as defined in **Section 3**);
- Assessing the current and maximum agricultural potential for each domain in terms of quantum, gross and net value of agricultural production;
- Assessing the loss of agricultural production from within the BOS properties in terms of value of agricultural production and downstream activities within the value chain and support activities; and
- Assessing the combined impacts on the total agricultural resources with consideration of the Project AIS.

1.3 Study Area

The Study Area for this AIA is the entirety of the BOS for the Project which comprises some 6,216 ha (offset properties) consisting of:

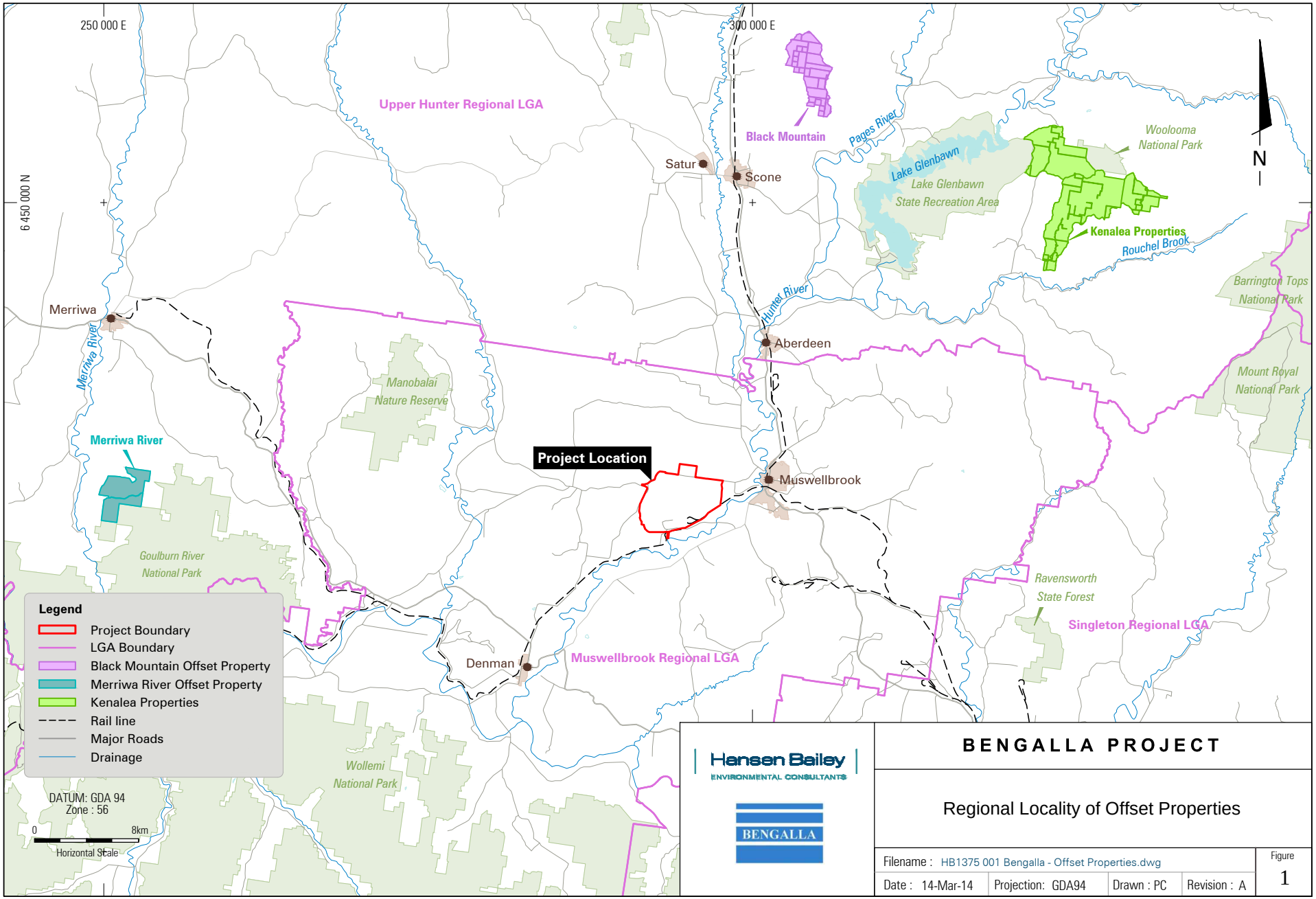
- An overall area of 897 ha being the land south of the Merriwa township referred to as the 'Merriwa River' property;
- An overall area of 1,222 ha being the land east of the village of Parkville referred to as the 'Black Mountain' property; and
- An overall area of 4,097 ha to the north east of Glenbawn Dam made up of the three contiguous properties, Echo, Kenalea and Kenelpet referred to as the 'Kenalea Properties'.

The location of each of the offset properties is presented on **Figure 1**.

1.4 Related Studies

The studies which are to be referenced with this assessment include the following:

- The Continuation of Bengalla Mine Agricultural Impact Statement (Scott Barnett & Associates, 2012);
- The Continuation of Bengalla Mine Biodiversity Offset Strategy (Cumberland Ecology, 2014);
- The Continuation of Bengalla Mine Soil and Land Capability Review of the Biodiversity Offset Strategy (SLR 2014) (**Appendix A**); and
- The Continuation of Bengalla Mine Economic Assessment of Impacts to Agricultural Resources (Gillespie Economics 2014) (**Appendix C**).


250 000 E
300 000 E
6 450 000 N
N
Upper Hunter Regional LGA
Black Mountain
Pages River
Satur
Scone
Lake Glenbawn
Lake Glenbawn State Recreation Area
Woolooma National Park
Kenalea Properties
Rouchel Brook
Barrington Tops National Park
Hunter River
Merriwa
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Project Location
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Project Boundary
LGA Boundary
Black Mountain Offset Property
Merriwa River Offset Property
Kenalea Properties
Rail line
Major Roads
Drainage
DATUM: GDA 94
Zone : 56
0
8km
Horizontal Scale
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Regional Locality of Offset Properties
Filename : HB1375 001 Bengalla - Offset Properties.dwg
Date : 14-Mar-14
Projection: GDA94
Drawn : PC
Revision : A
Figure
1

2 REGULATORY FRAMEWORK

This chapter describes the regulatory framework relevant to this AIS.

2.1 Bengalla EIS DGRs

This report and the EIS were prepared in accordance with the Project DGRs dated 13 March 2012 which stated:

> "*… the EIS to contain a rigorous assessment of the agricultural impacts of the project. Your assessment must be in accordance with the new Agricultural Impact Statement (AIS) guideline, which is available on the Department's website".*

Additionally, the covering letter from DP&I also dated 13 March 2012:

> *"The Department's preliminary assessment of your project under the draft Upper Hunter Strategic Regional Land Use Plan shows the proposed mine extension is located within 2 kilometres of mapped Biophysical Strategic Agricultural Land and the Equine Critical lndustry Cluster. The Department strongly recommends that you consider the draft Plan and in particular the draft gateway criteria in Chapter 11 of the Plan during preparation of your mine plan and ElS."*

2.2 Strategic Regional Land Use Plan – Upper Hunter

In March 2012, the NSW government placed the 'Draft Strategic Regional Land Use Plan - Upper Hunter' (draft SRLUP) (DP&I, 2012a) on public exhibition. The document established a preliminary 'Gateway process' for a scientific assessment of the impacts of a SSD (of the same nature as the Project) on Strategic Agricultural Land (SAL). The SRLUP defined areas of both Biophysical Strategic Agricultural Land (BSAL) and draft Critical Industry Clusters (CICs), including clusters for the equine and viticulture industries.

In September 2012, the Strategic Regional Land Use Plan – Upper Hunter (SRLUP) (DP&I, 2012b) was finalised and released. The document provides a Gateway process for all State significant developments, which involves the verification of SAL, and if it exists, the assessment by an independent panel of experts (referred to as the 'Gateway Panel') against the criteria of the SRLUP.

The SRLUP (DP&I, 2012b) is a component of the broader Strategic Regional Land Use Policy, which consists of various initiatives to manage land use conflicts in regional areas, in relation to agriculture, coal mining and coal seam gas. The SRLUP defines strategic agricultural land as:

> *"…highly productive land that has both unique natural resource characteristics (such as soil and water resources) as well as socio-economic value (such as high productivity, infrastructure availability and access to markets)."* (NSW DP&I 2012b).

The Bengalla EIS (September 2013) considered and assessed the above in relation to the Project site.

On 28 January 2014 amendments were made to the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (SEPP Mining) which included:

Part 4, Clause 21: Savings and transitional—mining and petroleum development on strategic agricultural land:

> *(1) Part 4AA of this Policy does not apply to or with respect to an application for development consent under Part 4 of the Act if the relevant environmental assessment requirements under Part 2 of Schedule 2 to the* Environmental Planning and Assessment Regulation 2000 *for the development were notified by the Director-General on or before 10 September 2012.*
>
> *(2) However, the Minister or the Director-General, in dealing with any such application, may seek the advice of the Gateway Panel."*

Bengalla received its DGRs on 13 March 2012, as such, part 4AA is not relevant to the Bengalla EIS application for Development Consent.

Nonetheless, this AIS considers the final BSAL and CIC mapping attached to the SEPP Mining enacted on the 28 January 2014 as relevant to its proposed offsets only. The relevant maps from SEPP Mining pertaining to this report include Upper Hunter Region Strategic Agricultural Land Map – STA_003 and STA_004.

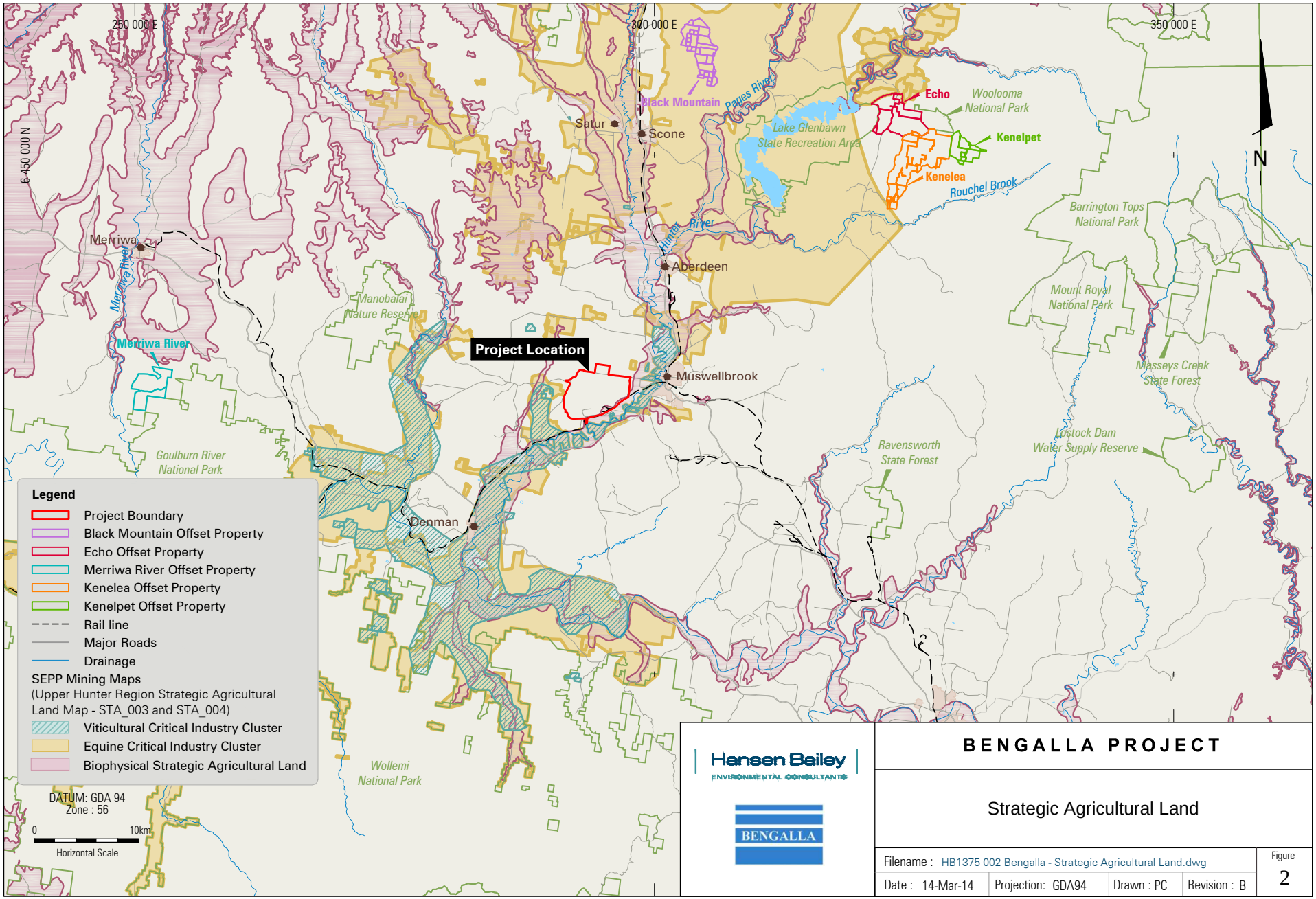
2.3 Strategic Agricultural Land Review

Strategic agricultural is highly productive land that has both unique natural resource characteristics (such as soil and water resources) as well as socio-economic value (such as high productivity, infrastructure availability and access to markets) (DP&I, 2012b). Based on this definition, two categories of strategic agricultural land have been identified by DP&I including BSAL and CIC (viticulture and equine).

2.3.1 Biophysical Strategic Agricultural Land Review

BSAL is defined in the SRLUP (DP&I, 2012b) as land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productive and require minimal management practices to maintain this high quality.

The indicative extent of BSAL illustrated in the Mining SEPP in relation to the offset properties is presented on **Figure 2**. As can be seen on **Figure 2** there is no mapped BSAL on any of the offset properties.



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Strategic Agricultural Land

Filename : HB1375 002 Bengalla - Strategic Agricultural Land.dwg				Figure 2
Date : 14-Mar-14	Projection: GDA94	Drawn : PC	Revision : B	

2.3.2 Viticulture Critical Industry Cluster Review

A CIC is a localised concentration of interrelated productive industries based on an agricultural product that provides significant employment opportunities and contributes to the identity of the region. The viticulture cluster includes a highly integrated concentration of vineyards and associated wineries and tourism infrastructure in a rural landscape (DP&I, 2012b).

The indicative extent of Viticulture CIC illustrated in the Mining SEPP in relation to the offset properties is presented on **Figure 2**. As can be seen on **Figure 2**, there is no mapped Viticulture CIC on any of the offset properties.

2.3.3 Equine Critical Industry Cluster Review

The Equine CIC includes a highly integrated concentration of horse breeding facilities and related infrastructure covering thoroughbred and stock horse breeding centres and numerous other equine developments and support services, such as a specialised veterinary centre (DP&I, 2012b).

From the Equine CIC mapping illustrated in the Mining SEPP (see **Figure 2**) the following can be noted:

- All of Black Mountain (897 ha) is mapped Equine CIC; and
- Approximately 5 ha area of Kenalea is mapped Equine CIC.

Further discussion in relation to the Equine CIC mapping areas on Black Mountain and Kenelea is provided below.

2.4 Equine CIC Mapping Review

2.4.1 Black Mountain

Following a site visit and discussion with the Black Mountain land manager on 10 December 2013 the following was identified.

Black Mountain is currently only used for beef cattle grazing only and has not had any known concentration of any horse breeding enterprises situated on it. There is also no existing horse breeding infrastructure items or facilities located on Black Mountain. All internal and boundary fencing consists of standard top barbed wire fencing (or equivalent) suitable to contain cattle.

Black Mountain is an exceedingly rugged property with land increasing from 287 m to 999 m in altitude from the south to the north of the property. The majority of Black Mountain is very steep and mountainous with large areas of remnant vegetation and as a result does not represent suitable horse breeding land (see **Plate 1**).

The only horse known activity on the property is the use of horses for mustering purposes as the slope is too severe in places to allow safe mustering by motor bike, vehicle or alternative method. It can be concluded that as a result of the above, Black Mountain does not conform to Equine CIC.

Plate 1
Representative Photo of Black Mountain

2.4.2 Kenalea

The small 5 ha area mapped as Equine CIC is related to the individual property Kenalea and as a result this section only relates to discussions with the Kenalea owner / land manager. Following a site visit and discussion with the Kenalea owner / land manager on 9 and 10 December 2013 the following was identified.

Kenalea is currently only used for beef cattle grazing only and has not had any known concentration of any horse breeding enterprises situated on it. There is also no existing horse breeding infrastructure items or facilities located on Kenalea. All internal and boundary fencing consists of standard top barbed wire fencing (or equivalent) suitable to contain cattle.

Kenalea is relatively rugged with land increasing from 334 m to 910 m in altitude from the south to the north of the property (see **Plate 2**). In the 5 ha of mapped Equine CIC the land ranges from 334 m to 480 m in altitude and does not represent suitable horse breeding land.

The only horse known activity on the property is the use of horses for mustering purposes as the slope is too severe in places to allow safe mustering by motor bike, vehicle or alternative method.

It can be concluded that as a result of the above Kenalea does not conform to Equine CIC.

Plate 2
Representative Photo of Kenalea

2.5 Standards

The following documents were referred to in preparation of this assessment:

- AS/NZS 4360:2004 Risk Management (Standards Australia);
- Agricultural Impact Statement Guidelines 2012 (DP&I);
- Agfact AC25: Agricultural Land classification (NSW Agriculture); and
- The Land and soil capability assessment scheme, 2011 (NSW Office of Environment & Heritage).

3 AGRICULTURAL ASSESSMENT

This chapter discusses the agricultural assessment of the land that will be potentially be used for biodiversity offset areas. It also provides alternative land uses for land within the offset areas and the suitability of those enterprises.

3.1 Methodology

The assessment methodology comprised:

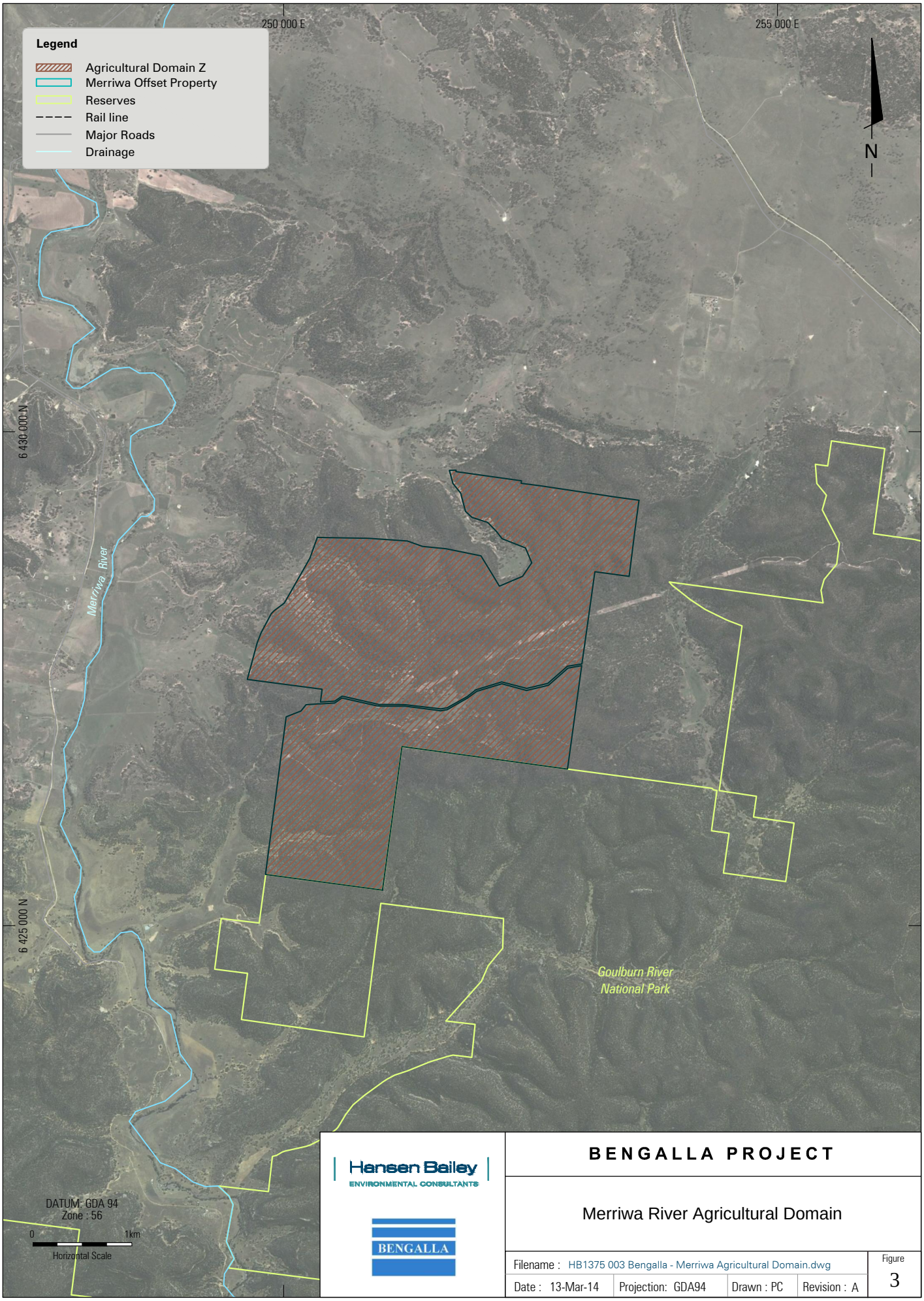
- A review of the Continuation of Bengalla Mine Biodiversity Offset Strategy (Cumberland Ecology (2014)) for the Project;
- A review of Bengalla Biodiversity Offset Strategy Soil and Land Capability Review (**Appendix A**);
- A site visit to offset properties and SBA's previous knowledge of the agricultural land uses to inspect the current agricultural production within the offset properties;
- Interviews with available land managers to confirm current agricultural enterprises currently being undertaken;
- Desktop analysis of the quantum and value of agricultural production from proposed offset areas agricultural land;
- Desktop analysis of the agricultural production's contribution to the local, regional, State and national agricultural output; and
- Consideration of the potential impacts of the offset properties the minor areas of potential Equine CIC as presented in the Mining SEPP.

3.2 Agricultural Domains

3.2.1 Proposed Offset Properties

The offset properties were dissected into agricultural domains based on Continuation of Bengalla Mine Soil and Land Capability Review of the Biodiversity Offset Strategy (**Appendix A**) and SBA's own field observations of agricultural characteristics. The domains are shown as follows:

- Merriwa River property **Figure 3**
- Black Mountain property **Figure 4**; and
- Kenalea properties **Figure 5**.



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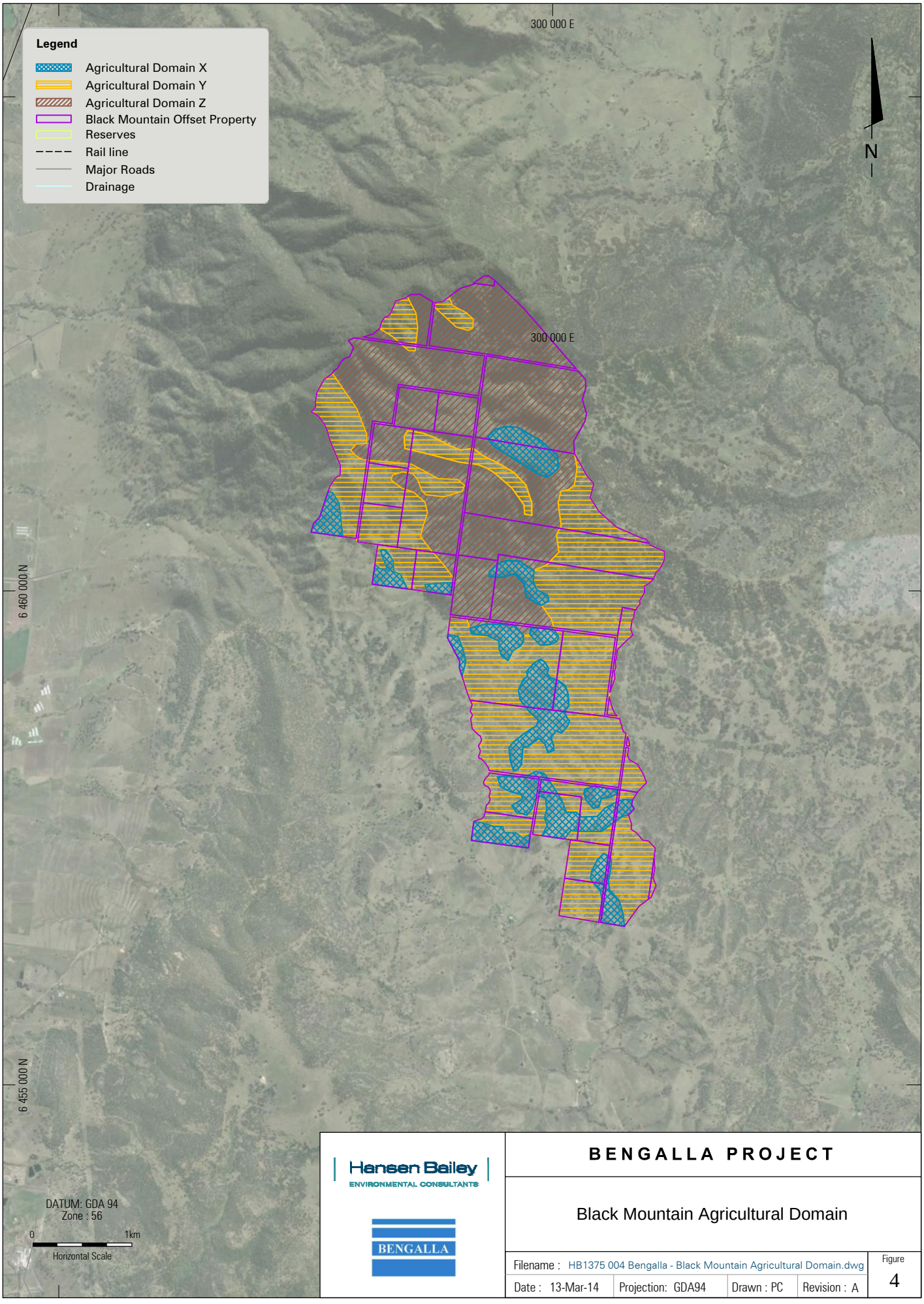
Merriwa River Agricultural Domain

Filename : HB1375 003 Bengalla - Merriwa Agricultural Domain.dwg				Figure 3
Date : 13-Mar-14	Projection: GDA94	Drawn : PC	Revision : A	



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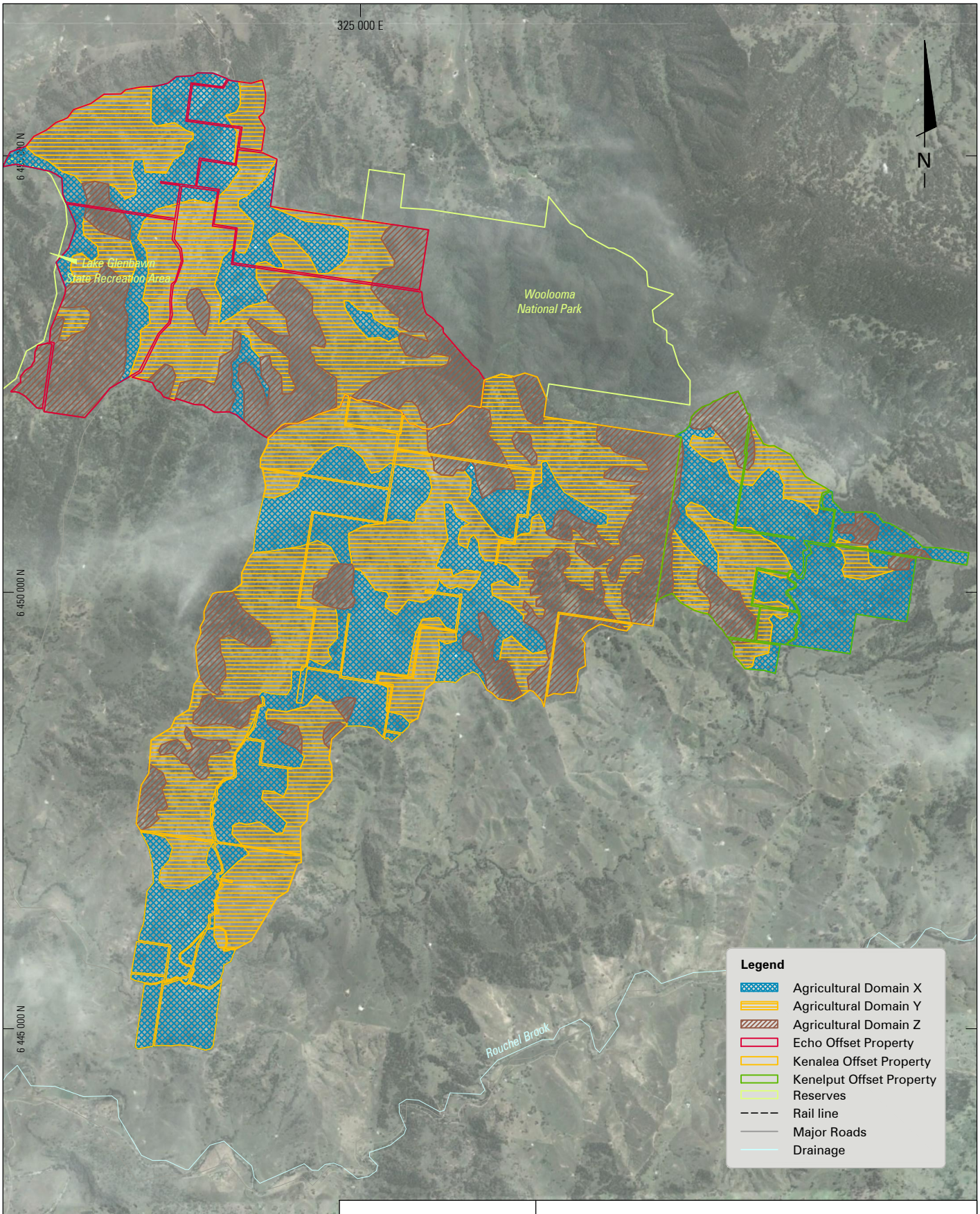
Black Mountain Agricultural Domain

Filename : HB1375 004 Bengalla - Black Mountain Agricultural Domain.dwg				Figure 4
Date : 13-Mar-14	Projection: GDA94	Drawn : PC	Revision : A	



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Kenalea Properties Agricultural Domain

Filename : HB1375 005 Bengalla - Kenalea Agricultural Domain.dwg				Figure
Date : 13-Mar-14	Projection: GDA94	Drawn : PC	Revision : A	5

Table 1 provides an overview of each of the agricultural domains and their quantitative distribution within each of the offset properties.

Table 1
Offset Properties Agricultural Domains

Agricultural Domain	Description	Merriwa River (ha)	Black Mountain (ha)	Kenalea Properties (ha)	Total (ha)	Total %
X	Hilly to steep grazing land suited to aerial application of fertiliser, not suited to soil disturbance due to potential for erosion. Predominantly cleared with shade timber. Some naturalised species with mixed native pasture species.	0	154	1,365	1,519	24.4
Y	Steeper country with shelter timber or regrowth. Not suitable to soil disturbance.	0	582	1,708	2,290	36.8
Z	Predominantly land that has not cleared or heavily timbered steep slopes and/or land with rocky outcrops. Not suited to agriculture.	897	486	1,024	2,407	38.8
Total		**897**	**1,222**	**4,097**	**6,216**	**100.0**

Table 1 shows Agricultural Domain X is the highest quality grazing land and least abundant within the proposed offset properties, comprising an area of approximately 1,519 ha (24.4%). Though the highest quality grazing lands within the offset properties, this land is only suited to grazing of natural pastures and semi improved pastures at light stocking rates. Semi improved pastures have been achieved by the aerial application of fertiliser.

The land is generally not suited to soil disturbance due to slope. There are limited areas of cleared but isolated plateaus. This land primarily coincides with the following from the soil and land capability review (Appendix A):

- Yellow and Red Podzolic Soils, Red Soils and Red Brown Earths;
- Land capability classes VI and VII (Cunningham *et. al.* 1988); and
- Agricultural land suitability Class 4 (Hulme *et. al 202).*

Agricultural Domain Y covers an area of 2,290 ha (36.8%) and is suited light grazing. It is not suitable to aerial applications of fertiliser primarily due to tree cover. The slope limits its agricultural worth. This land is capable of supporting low levels of pasture production and such can be used for beef cattle grazing for weaner production. This land primarily coincides with the following from the soil and land capability review (Appendix A):

- Yellow and Red Podzolic Soils, Red Soils and Red Brown Earths;
- Land capability classes VI and VII; and
- Agricultural land suitability class 4.

The majority (2,407 ha or 38.7%) of the land within the offset properties is composed of land classed as Agricultural Domain Z. This land is not suited to grazing or any agricultural activity by cows for weaner production at low stocking pressure. This land primarily coincides with the following from the soil and land capability review (Appendix A):

- Yellow and Red Podzolic Soils, Red Soils, Red Brown Earths, and shallow siliceous sands and shallow loams (Merriwa River property);
- Land and soil capability classes VI and VII; and
- Agricultural land suitability Class 5.

It is noted that the Land and soil capability mapping identified part of the Merriwa River Offset property as potentially Land and soil capability Class IV and V. During the on site inspection the author did not observe any country this meet the criteria, observing that the land was predominantly not suited to agriculture. Potential for erosion and lack of ground cover in the limited cleared areas, even in the complete absence of livestock, indicated the land is best used as natural forest and grasslands. **Plate 3**shows the representative photo of the Merriwa River Property.

3.3 Agricultural Production and Value

3.3.1 Proposed Offset Properties

To examine the quantum and value of the agricultural production from the proposed offset properties information as to the current agricultural practices and the number of livestock the carried, interviews were held with current land managers.

Plate 3
Representative Photo of Merriwa River Property

This information was used in association with the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) (Primary Industries) (2012) gross margin budgets to calculate the quantum and value of agricultural production from the offset properties. The assumptions used are shown in Appendix B.

The enterprises used for each agricultural domain is shown in **Table 2**.

Table 2 Current Enterprises per Agricultural Domain within Offset Properties

Agricultural Domain	Carrying Capacity (DSE/ha)*	Area (ha)	Description of Agricultural Enterprise	Stocking Rate (ha/Breeding Cow)
X	6.8	1,519	Cattle breeding enterprise producing inland store weaners	2.2
Y	1.0	2,290	Cattle breeding enterprise producing inland store weaners	15.3
Z	0	2,407	Not suitable for agricultural production	N/A

** DSE – Dry Sheep Equivalent. The equivalent daily energy requirement of a 50 kg wether not losing or gaining weight.*

Interviews with the land managers confirmed that:

- The Merriwa River property is not used for agriculture;
- Black Mountain is used for beef cattle breeding with progeny being turned off as store weaners to be sold through Scone sale yards or grown out on other local Scone properties; and
- The Kenalea Properties are used for beef cattle breeding with progeny being turned off as store weaners to be sold through Scone sale yards or grown out on properties outside the Hunter Valley.

The production value of the three agricultural domains per hectare and total value is summarised in **Table 3**.

Table 3 shows that the gross value of agriculture (beef cattle) production from the potential offset properties, based on the current land use which is $330,895 per annum. The net value of agricultural production is $230,428. This is from the sale of 681 head of cattle per annum (weaner, cull cows and bulls). It is noted that this assumes all the potential offset properties will be removed from agricultural production. This is discussed further in Section 4.

The closest regional sale yard with weekly sales is at Scone. Scone also holds monthly store cattle sales. The National Livestock Reporting Service NSW Cattle Saleyard Survey for the financial year ended 30 June 2013 (MLA, 2013) shows that the Scone sale yard had throughputs of 59,571 head. During this period, the Scone sale yard was ranked 9th in NSW for cattle sold by auction through the saleyard system. The National Livestock Reporting Service NSW Cattle Saleyard Survey (MLA, 2013) reports a total of 1,665,581 cattle sold through NSW saleyards in 2013.

Not all cattle from the proposed offset properties are sold through Scone sale yard. Land manager interviews revealed that of the expected 681 head turned off the proposed offset properties only 286 would be sold through Scone sale yards. The balance (394 head) would be expected to be sold direct from paddock to feed lotters or fatteners outside the Upper Hunter area. Based on 286 head been sold through the Scone sale yard, the expected number to be turned off represents 0.48% of Scone's throughput.

Table 3 Value of Current Agricultural Production (2013) within Offset Properties ^

Agricultural Domain	Enterprise	Number Animals Sold*	Gross Value of Production	Net Value of Production
X	Inland weaners	557	$270,847	$188,613
Y	Inland weaners	124	$60,047	$41,816
Z	-	-	-	-
Total		**681**	**$330,895**	**$230,428**

** Includes culled breeding stock.*

^ Based on land manager interviews.

Based on the Upper Hunter Shire Council's yard charges of $6.11 per head (financial year 2013/14), the 286 head sold from proposed offset properties through Scone yards would contribute $1,747 of income to the Scone sale yards. There are local cattle abattoirs at Scone and Singleton, however, cattle from the Upper Hunter are often processed outside the region at abattoirs such as at Wingham, Casino and Dinmore in Queensland.

Table 4 shows the value of the regional, State and National beef slaughtering. It illustrates the relatively small magnitude the agricultural output of Project Boundary compared to regional, State and National production.

3.4 Potential Agricultural Production

The potential agricultural production from the potential offset properties was examined assuming changes to management to represent superior management and or capital investment. The changes identified were aerial fertiliser application where appropriate to allow for a marginal increase in pasture production. The following assumptions were made:

- Domain X: $50 per hectare invested per annum in aerial fertiliser application, and carrying capacity improves to 8 DSE/hectare;
- Domain Y: No change due to steepness of land and general tree cover; and
- Domain Z: No change to management as land not suitable for agricultural production

No allowance has been made for increased risk of seasonal climatic variations and greater sensitivity to timeliness of management decisions and actions. Under the above scenario the management systems would be operating further along the marginal risk reward portion of the production curve.

Table 5 shows that the gross value of agricultural production could be increased to $382,150 per annum and the net value to $266,121 (**Appendix B**).

Table 4Value of Beef Slaughtering

Enterprise	Offsets Area	Hunter Region	NSW	Australia
Beef Slaughtering	$ 0.3 M	$ 95.5 M	$ 1,487.6 M	$ 6,550.5 M
Total Agricultural Production	$ 0.3 M	$ 311.7M	$ 8,359.2 M	$ 39,645.1 M

Source: ABS, 2008; ABS, 2011

Table 5 Maximum Potential of Agricultural Production within offset properties

Domain	Enterprise	Number Animals Sold*	Gross Value of Production	Net Value of Production
X	Inland weaners	662	$332,103	$224,204
Y	Inland weaners	124	$60,047	$41,917
Z	N/A	-	-	-
Total		**786**	**$382,150**	**$266,121**

This change in management would result in an increase gross value of production from the proposed offset properties of $51,255 from the sale of an extra 105 head of cattle. The increase in net value of production would be $35,693.

3.5 Alternate Agricultural Land Use Suitability

The grazing land is also suited to sheep and wool production, which historically, was the traditional land use for the more elevated and sloping country of the Upper Hunter. However over the years the increasing occurrence of wild dog attacks (based on discussions with landowners) has resulted in a changing of farm practices trending towards cattle which tend to be less susceptible to wild dog predation in the Upper Hunter.

The slope of these offset properties limits its agricultural use to grazing of breeding cattle and sheep on unimproved pasture with limited use of fertiliser.

4 IMPACT ASSESSMENT

This chapter assesses the potential impacts on agricultural land within the offset properties combined with those in the Project Disturbance Boundary.

4.1 Availability and Productivity of Agricultural Land and Water

4.1.1 Land Within the Proposed Offset Properties

Assuming all 6,216 ha of land from the proposed offset properties is removed from agriculture the gross value of beef production lost would be $330,895 per annum from the sale of 681 head of cattle. The net value of production lost would be $230,428 per annum (see **Section 3** above).

Gillespie Economics (**Appendix C**), assuming the properties are removed from agriculture in perpetuity, calculated that present value of foregone gross value of production as $4.4M (at 7% discount rate) and the present value of net value of agricultural production is $3.0M (at the 7% discount rate).

4.1.2 Land within the Disturbance Boundary

The AIS (Scott Barnett & Associates, 2013) prepared for the Bengalla Continuation of Mining Project Environmental Impact Statement (Hansen Bailey, 2013) identified that 964 ha of agricultural land within the Disturbance Boundary will be removed from production as a result of the Project. Sustainable farming practices will, however, continue during the life of the Project in available areas outside the Disturbance Boundary. Prior to an area being disturbed it shall remain in agricultural production as long as practical having regard for relevant safety and mine operational considerations. This is the practice currently adopted by BMC during its period of operation of the Approved Bengalla Mine since 1998.

BMC plans to reintroduce agriculture to relevant areas of rehabilitated land (including the Approved Bengalla Mine) as soon as practicable having consideration of safety and legislative requirements relating to mine operations. Affected land will be rehabilitated to establish a post-mining landforms consentient with agricultural values of the surrounding landscape. Should the Project be approved, the specific rehabilitation details will be included in the revised Rehabilitation Management Plan completed for the Project.

It is currently predicted that the major proportion of land within the Disturbance Boundary shall be reinstalled as Land Capability Class IV and Agricultural suitability classes 3 and 4. Based on current land use practices in the locality, this land would be suited to beef grazing at varying levels of stocking pressure reflective of landform and re-instated soil type. Landforms associated with the final void will be unsuitable for agriculture.

Table 6 shows the total value of agricultural production impacted by the Project on the agricultural land within the Disturbance Boundary.

Table 6 Value of Agricultural Production Affected within Disturbance Boundary

Enterprise	Impact of Project
Beef cattle sold per annum	237
Gross value of production per annum	$ 129,313
Net value of production per annum	$ 98,251

Conservatively assuming that agricultural production from the Disturbance Boundary ceases at the commencement of the Project for perpetuity, the present value of the gross value of production foregone is $1.7M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is $1.3M (using a 7% discount rate) (Gillespie Economics, 2012).

4.1.3 Water diverted from agriculture

As identified in the original AIS for the Bengalla Continuation Project, BMC currently holds WAL 001106 from the Hunter River Regulated Water Source which entitles BMC to 1,449 shares from the water source. Based on 100% allocation this equates to 1,449 ML. This water allocation will be required to supplement existing site water for use in the CHPP and for dust suppression. If this water was not used for mining related activities it could be used for agriculture.

In addition to the 1,449 shares, BMC licences a further 4,070 shares of general security water and 5.1 shares of high security water to its agricultural licensees and further 45 shares to its racecourse licensees.

WRM has completed a Surface Water Impact Assessment for the Project (WRM, 2012) which indicates water is required from the Hunter River Intake for all years of the Project life. The maximum (99th percentile) external water requirement is approximately 2,200 ML/annum between Years 5 to 24. The median (50th percentile) external water requirement is approximately 1,500 ML/annum. The 10th percentile external water requirement is approximately 1,000 ML/annum.

The maximum quantum is 751 ML greater than the 1,449 ML, BMC holds under WAL 001106 (assuming 100% allocation). This maximum (2,200 ML) is that required to meet the maximum mine production of 15Mt per annum.

Based on a lucerne hay and maize grain cropping rotation 751 ML could be expected to produce 1,242 tonnes of lucerne hay and 276 tonnes of maize grain from 96.9 ha. The gross value of production from this 96.9 ha would be $413,329 per annum and a net value of production of $109,573.per annum.

To compare the loss of agricultural production if this water is removed water from agriculture it is assumed the 96.6 ha is used for dryland lucerne production and sorghum grain production rotation. Grain sorghum production is used as it is less sensitive to water stress at flowering than maize. The 96.6 ha would be expected to produce 276 tonnes of lucerne hay and 124 tonnes of sorghum for a gross value of production of $101,882 and a net value of production of $33,748.

Based on a lucerne hay and maize grain cropping rotation, the maximum surface water requirement (2,200 ML) could be expected to irrigate 283.1 ha to produce 3,639 tonne of lucerne hay and 809 tonne of maize grain combining to produce a gross value of production of $1,210,817 and Net Value of Production of $320,986. The same land used for dryland lucerne and sorghum grain production could be expected to produce 809 tonnes of lucerne hay and 364 tonnes of sorghum grain for a combined gross value of production of $298,456 and net value of $98,861. Based on these assumptions the quantum and value of agricultural production lost by utilising this water for mining is 2,831 tonnes of lucerne hay and 445 tonnes of grain with a gross value of production of $912,361 and net value of $222,125. Assuming that this water is not available to agriculture for the total life of the Project, the present value of the gross value of production foregone is $9.8M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is $2.4M (using a 7% discount rate) (Gillespie Economics, 2012).

In order to assess the potential impacts of the Project on the existing groundwater regime, a groundwater impact assessment was completed by Australasian Groundwater & Environment Consultants (AGE, 2012) (Appendix N of the EIS (Hansen Bailey, 2013)). This assessment showed that predicted maximum annual take by the Project from alluvial sources.

Based on the same assumptions used for assessing the impact of surface water the quantum and value of production from 220 ML of irrigation water over 28.3 ha is 364 tonnes of lucerne hay and 81 tonnes of maize grain for a gross value of production $99,405 and net value of $23,100. The dryland quantum and value of production of the same area is 81 tonnes of lucerne hay production and 36 tonnes of grain sorghum with a gross value of $29,846 and a net value of $9,886. The quantum and value of agriculture production lost by utilising this water for mining is 283 tonnes of Lucerne hay and 44 tonnes of grain with a gross value of $91,236 and a net value of $22,212. Assuming that this water is not available to agriculture for the total life of the Project, the present value of the gross value of production foregone is $1.0M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is $0.2M (using a 7% discount rate) (Gillespie Economics, 2012).

The combined quantum and value of agricultural production lost by utilising both water sources (2,420 ML) for mining is 3,114 tonnes of lucerne hay and 489 tonnes of grain with a gross value of production of $1,003,597 and a net value of $244,337.

At the end of the Project this water will be available for agricultural use. Assuming that this water is not available to agriculture for the total life of the Project, the present value of the gross value of production foregone is $10.8M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is $2.6M (using a 7% discount rate) (Gillespie Economics, 2012).

4.1.4 Combined Value

The combined gross value of agricultural production from the Disturbance Boundary, proposed offset properties and maximum water resource to be used by the Project is impacted properties is $1.4 M per annum.

As shown in **Table 7** this value is 0.449% of the total agricultural production of the Hunter Region, 0.017% of NSW and 0.004% of Australia.

In total, gross value of foregone net agricultural production from agricultural land and water resources required for the Project is estimated to have $16.9M present value (using 7% discount rate) and the net value to have $6.9M present value (using 7% discount rate)(Gillespie Economics, 2012 and **Appendix C**).

As the overall agricultural contribution of the land within the Disturbance Boundary, proposed offset properties and the water resource earmarked for use by the Project is small when compared to the total agricultural production on a regional, state and national scale, the reduced availability and productivity of this land will have a minimal impact to the industry.

4.1.5 Regional Impacts of Agriculture Foregone as a Result of the Project

The regional impacts of the level of annual agricultural production foregone as a result of the Project were estimated from the sectors in the Upper Hunter regional input-output table by Gillespie Economics.

Table 7 Comparison of Annual Value of Agricultural Production Affected by Project

Resource	Value of Production	Hunter Region	NSW	Australia
Disturbance Boundary	$ 0.1 M			
Water	$ 1.0 M			
Offset Areas	$0.3 M			
Total agricultural production	$ 1.5* M	$ 311.7M	$ 8,359.2 M	$ 39,645.1 M

Source: ABS, 2008; ABS 2011
** Difference due to rounding*

Table 8 compares the annual regional production and economic impacts associated with the Project (including offset properties) with the level of annual agricultural production that would be foregone as a result of the Project.

The direct annual output of the coal mining Project is estimated at $1,174 M per annum. In contrast, the direct annual output of future use of agricultural lands that would be lost as a result of the Project is estimated at $1.5 M per annum. Gillespie Economics (Gillespie Economics, 2012 and **Appendix C**) concluded that based on these comparative values, the Project is considered to be significantly more efficient than continued agricultural production.

Table 8
Annual Regional Production /
Economic Impacts of the Foregone Agriculture and the Project

Parameter	Agricultural Land (Disturbance Boundary and Offsets)	Agricultural Water Requirements	Agricultural Impacts Total	Project
Production Type	Beef cattle production	Lucerne hay and summer cereal grains	-	Coal
Direct Output Value	$0.5 M	$1.0 M	$1.5 M	$1,174.1 M
Direct Income	$0.2 M	$0.2 M	$0.4 M	$92.1
Direct Employment (FTE)	3	5	8	768
Direct and Indirect Output Value	$0.6 M	$1.4 M	$2.0 M	$1,478.8 M
Direct and Indirect Income	$0.3 M	$0.4 M	$0.6M*	$185.5 M
Direct and Indirect Employment (FTE)	4	7	11	1,745

** Difference due to rounding*

5 CONCLUSION

The current gross value of beef production from proposed offset properties is estimated to be $330,865 per annum turning off 681 head of cattle per year. With further development of the properties this could rise to $382,150 per annum turning off 786 head of cattle per year.

The current gross value of beef production from Project area is estimated to be $186,048 per annum turning off 334 head of cattle per year. With further development of the property this could rise to $259,678 per annum turning off 459 head of cattle per year. Not all of the Project Area will be removed from agriculture. The area that will be removed (disturbance footprint) is approximately 964 ha and is predominantly the least productive land within the Project Area. The gross value of production from the beef enterprises within this area $129,313 per annum.

The Project will require the use of up to 2,200 ML of water from The Hunter River Regulated Water Source with an additional 220 ML from the Hunter River alluvium. The gross value of agricultural production foregone from diverting this water for irrigation of Lucerne and maize grain crops compared to utilizing the equivalent area for dryland production of Lucerne hay and grain sorghum crops is $1,003,597 per annum from the sale of 3,114 tonnes of Lucerne hay and 489 tonnes of grain per annum.

Bengalla Mining Company already has a WAL for 1,449 shares (1,449 ML) for use by the Approved Mine. The additional 971 ML required to meet the Projects maximum water demand has a gross value of production foregone of $402,683 from the production 1,249 tonnes of lucerne hay and 196 tonnes of hay.

The value of agricultural production from the combined loss of agricultural resources and irrigation water units (associated with the proposed offset properties, disturbance footprint and mine water usage) is predicted to be $1.5 M per annum. This represents 0.449% of the annual gross value of agricultural production in the Hunter region, 0.017% of NSW's agricultural production and 0.004% of the national production.

The Offset areas will not impact on any BSAL or CIC or on any equine or viticulture industry or enterprise within the Upper Hunter region.

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APPENDICES

Appendix A Bengalla Biodiversity Offset Strategy Soil and Land Capability Review

Appendix B Assumptions for Quantum and Value of Agricultural Production

Appendix C Economics Assessment of Impacts to Agricultural Resources

Appendix A Bengalla Biodiversity Offset Strategy Soil and Land Capability Review

global environmental solutions

Soils and Land Capability Review

Bengalla Biodiversity Offset Strategy

Report Number 634.10000

12 March 2014

Hansen Bailey
PO Box 473
Singleton NSW 2330

Version: Final

Soils and Land Capability Review

Bengalla Biodiversity Offset Strategy

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
634.10000	Final Draft	20 February 2014	Adam Koppers	Clayton Richards	Clayton Richards
634.10000	Final	12 March 2014	Adam Koppers	Clayton Richards	Clayton Richards

TABLES

FIGURES

1 INTRODUCTION

1.1 Project Description

Bengalla Mine (the Project) is owned by Bengalla Mining Company Pty Limited (BMC) and is located in the Upper Hunter Valley of NSW, approximately 130 km north-west of Newcastle and 4 km west of the township of Muswellbrook. The Project is a strip mining, open cut operation where current mining advances in a westerly direction based on dragline strips approximately 60 m in width.

1.2 Background

The Project has submitted an EIS to facilitate the continuation of mining at a rate of up to 15 Million tonnes per annum (Mtpa) run of mine (ROM) coal for up to 24 years to a total of 316 Million tonnes.In its review of the Bengalla EIS, Commonwealth Department of Environment (DoE) noted that the proponent is participating in the Upper Hunter Strategic Assessment, and that the Project's offsets in relation biodiversity are proposed to be provided under the Upper Hunter Biodiversity Plan. As details of the Plan, and in particular the Upper Hunter Offset Fund specifications are still being negotiated, DoE recommended that a contingency condition be incorporated into any approval, should offsets be unable to be provided under the Upper Hunter Offset Fund, or its equivalent.

As a precaution, the Project EIS noted that in the event that the UHSA process is not implemented in time for the Project to utilise it as an acceptable offsetting mechanism, an alternative offset strategy would be completed in consultation with relevant regulators. This was echoed by the Commonwealth Department of Environment (DoE) in its response to the exhibition of the EIS:

> '....the Department recommends that a contingency condition be incorporated into any approval, should offsets be unable to be provided under the Upper Hunter Offset Fund, or its equivalent.'

To address the risk that the UHSA was not finalised in time, Bengalla Mining Company Pty Limited (BMC) developed the Biodiversity Offset Strategy (BOS) that is the subject of this report. The BOS comprises 6,216 ha of land to be permanently conserved and includes broad areas of native forest and woodland, and semi-natural grassland that are suitable for use as offsets. This provides very substantial ecological outcomes compared to the 241 ha of forest to be cleared and 640 ha of grassland.

The constituent Offset Areas that form the BOS are described as follows:

- Kenalea Properties (4,097 ha): consisting of the contiguous properties 'Kenalea', 'Echo' and 'Kenelput';
- 'Black Mountain' (1,222 ha); and
- 'Goulburn River' (897 ha).

1.3 Purpose of this Report

This report has been prepared to provide a soils and land capability assessment of Bengalla's Biodiversity Offset to support the Bengalla Coal Mine – Continuation of Mining - Ecological Offset Properties – Agriculture Impact Assessment.

It has been prepared in accordance with the DGRs for the Project which stated:

> "*… the EIS to contain a rigorous assessment of the agricultural impacts of the project. Your assessment must be in accordance with the new Agricultural Impact Statement (AIS) guideline, which is available on the Department's website".*

2 METHODOLOGY

Consistent with the DGRs, the available information used to determine the soil and land characteristics of each of the BOS properties includes:

- Soil Landscapes of Singleton (Kovac & Lawrie, 1991); published scale of 1:250,000.
- Soil Landscapes of Murrurundi (McInnes-Clarke, 2002); published scale of 1:100,000.
- Rural Land Capability Mapping (DLWC, 1998); published sale of 1:100,000.

Each property in the BOS is covered by a set of different Soil Landscapes. The characteristics of these Soil Landscapes and their Rural Land Capability for each property are discussed below.

3 'BLACK MOUNTAIN' PROPERTY

3.1 Soil Landscapes

The 'Black Mountain' property (**Figure 3.1**) is covered by the Coober Bulga, Galla Gilla, Gundy and Kangaroo Ridge Soil Landscapes (**Figure 3.2; Table 3.1**). The characteristics of these Soil Landscapes and their Rural Land Capability (**Figure 3.3**) are discussed below.

Table 3.1 – Soil Landscape of 'Black Mountain'

Soil Landscape	Area	
	Ha	%
Coober Bulga	81	6.6
Galla Gilla	1	0.1
Gundy	134	11.0
Kangaroo Ridge	1,006	82.3
Total	**1,222**	**100.0**

Coober Bulga Soil Landscape

The Coober Bulga Soil Landscape consists of very steep to precipitous mountains and hillslopes. Slope gradients are greater than 33% with local relief of 80-220 m. The vegetation is complex but dominated by tall, open-forest and woodland. The soils are dominated by moderate to deep Euchrozems and chocolate soils on crests and upper slopes, with Chocolate Soils, Black Earths and Prairie Soils in mid to lower slopes. These soils are associated with a Rural land Capability of VIII.

Limitations to this unit include steep slopes, high erosion hazard, mass movement hazard, shallow soils and rock outcrop.

Galla Gilla Soil Landscape

The Galla Gilla Soil Landscape consists of steep hills. Slope gradients are greater than 33% with local relief of 50-200 m. The vegetation is predominately open-woodland and woodland consisting of yellow box, silvertop stringybark, grey box, white box and red gum. Some areas have been cleared for grazing. The soils are dominated by Lithosols on crest, upper slopes and benches, with Chocolate Soils and Euchrozems on sideslopes. These soils are associated with a Rural Land Capability of VI.

Limitations to this unit include steep slopes, high erosion hazard, high mass movement hazard, shallow soils and rock outcrop.

Gundy Soil Landscape

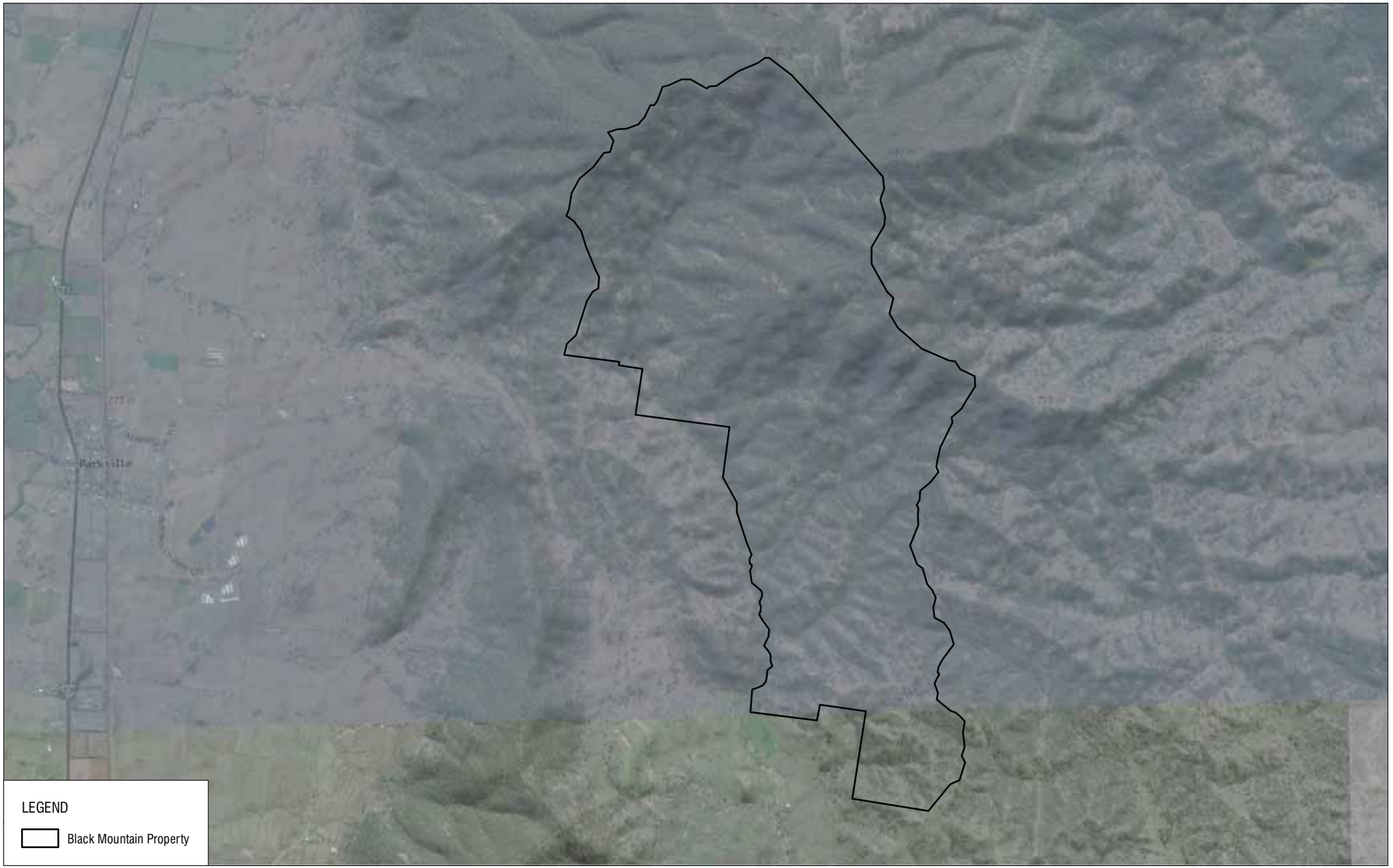
The Gundy Soil Landscape consists of rolling hills. Slope gradients range from 11-16% with local relief of 60-120 m. The vegetation is predominately eucalypt communities of white box, yellow box and blakelys red gum. The soils are dominated by Euchrozems on the upper to midslopes with Non-Calcic Brown Soils on the lower slopes. These soils are associated with Rural Land Capability of V – VI.

The major limitation to this is moderate erosion hazard.

Kangaroo Ridge Soil Landscape

The Kangaroo Ridge Soil Landscape consists of steep to very steep hills and mountains. Slope gradients range from 25 to >60% with local relief up to 130 m. The vegetation is predominately cleared open-woodland consisting of grey box, rough-barked apple, narrow-leaved ironbark, red gum and white box. The soils are dominated by very shallow Lithosols and Bleached Loams in crests and upper slopes, with moderately deep Non-Calcic Brown Soils and Red Brown Earths on sideslopes and drainage lines. On volcanic geologic materials the soils are dominated by deep Non-calcic Brown Soils on sideslopes, moderate deep Chocolate Soils on crests and Yellow Podzolic Soils on lower slopes. These soils are associated with a Rural Land Capability of VI – VIII.

Limitations to this unit include steep slopes, high erosion hazard, mass movement hazard, shallow soils and rock outcrop.



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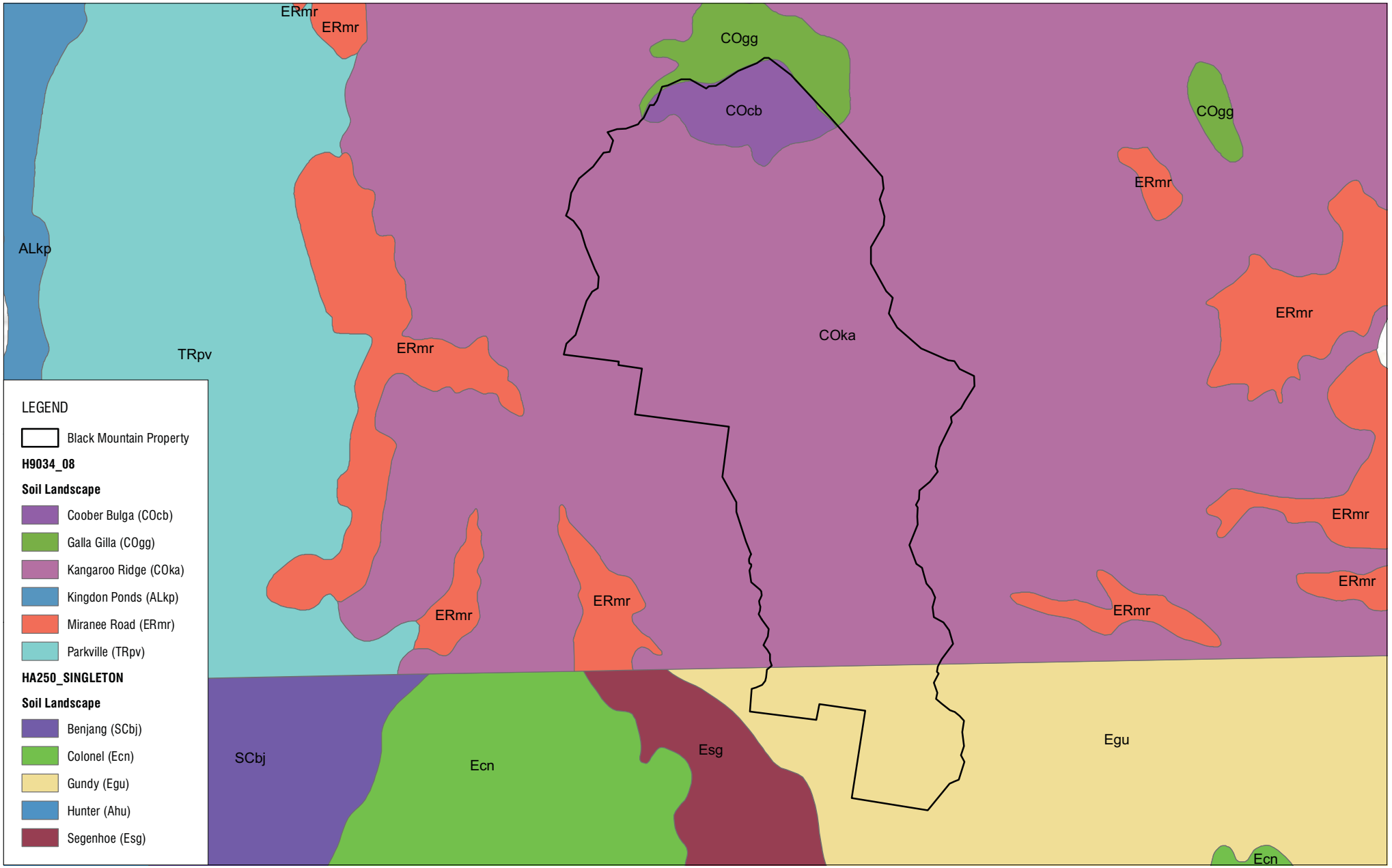
Bengalla Offset Properties

Black Mountain Property

FIGURE 3.1



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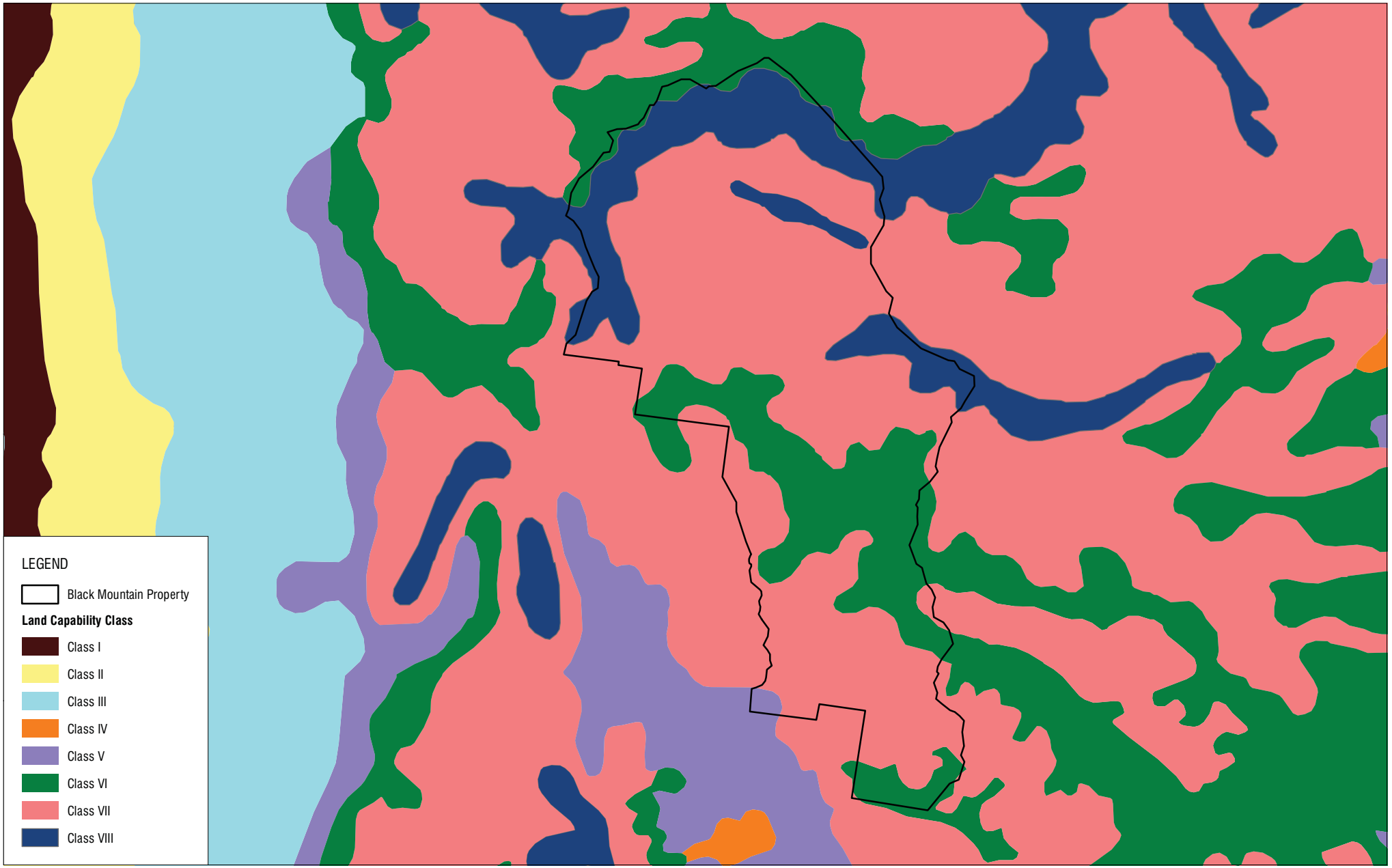
Bengalla Offset Properties

Black Mountain Property Soil Landscapes

FIGURE 3.2



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0 250 500 750 1,000 m

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Bengalla Offset Properties

Black Mountain Property
Land Capability

FIGURE 3.3

4 'ECHO' PROPERTY

4.1 Soil Landscapes

The 'Echo' property (**Figure 4.1**) is covered by the Bridgelands, Glenbawn and Rouchel Soil Landscapes (**Figure 4.2; Table 1**). The characteristics of these Soil Landscapes and their Rural Land Capability (**Figure 4.**3) are discussed below.

Table 4.1 – Soil Landscape of 'Echo' Property

Soil Landscape	Area	
	Ha	%
Bridgelands	120	8.9
Glenbawn	1,220	90.8
Rouchel	4	0.3
Total	**1,344**	**100.0**

Bridgelands Soil Landscape

The Bridgelands Soil Landscape consists of rolling hills with some rolling mountains. Slope gradients range from 15-25% with local relief 160-200 m. The vegetation is Silvertop stringybark and forest oak, however, large portions have been cleared for grazing. The soils are dominated by Lithosols and yellow Solodic Soils on midslopes and red Soloths on mid to lower slopes. Terra Rossa Soils occur on limestone, with some limestone outcrops. Brown Clays and Red Earths occur on Upper Slopes. These soils are associated with a Rural Land Capability of VI – VII. Limitations to this unit include minor to moderate sheet and rill erosion on cleared areas, high structural degradation hazard, high mass movement hazard, shallow soil depth and sodicity.

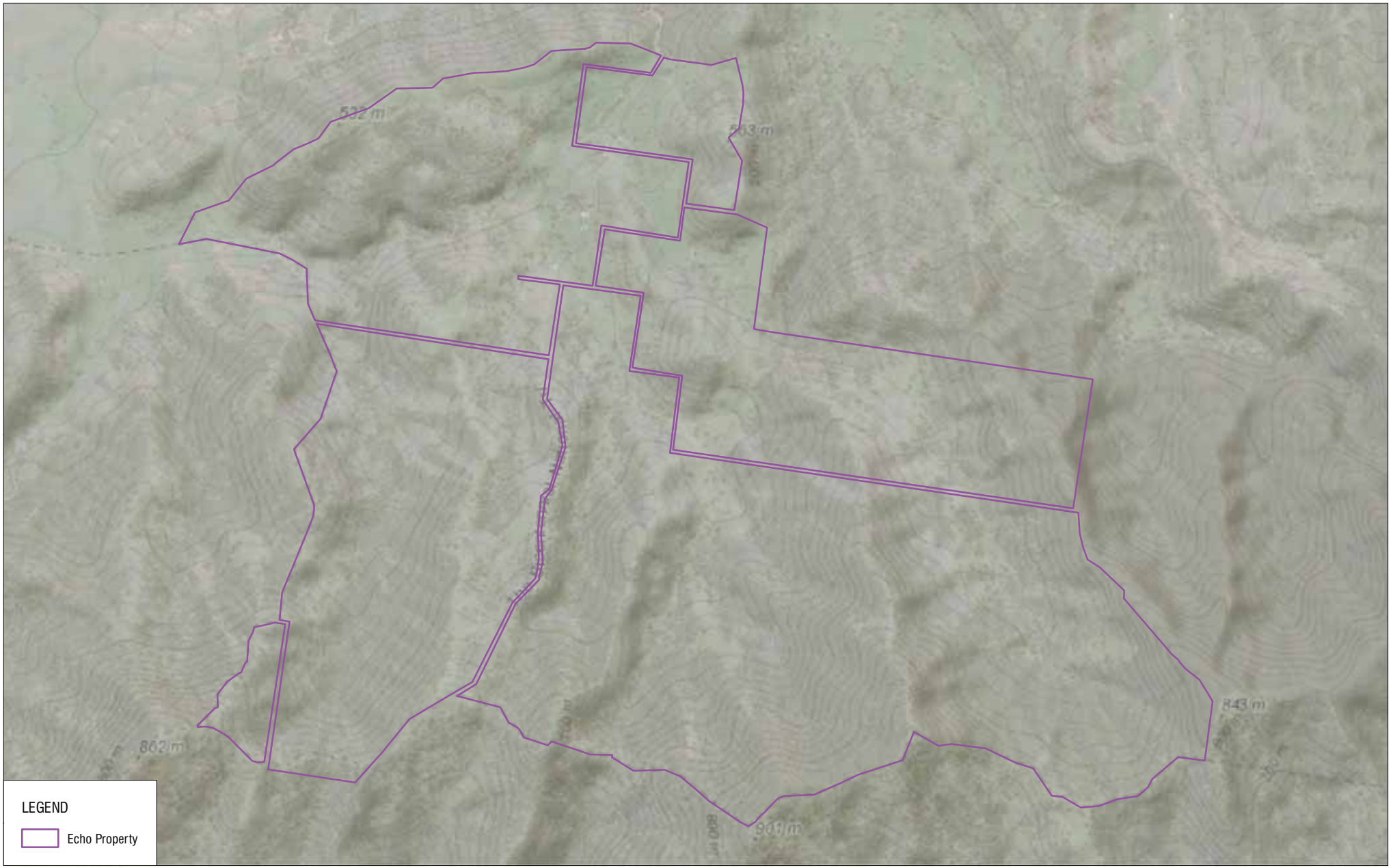
Glenbawn Soil Landscape

The Glenbawn Soil Landscape consists of steep hills with steep ridges covering an area to the east of Glenbawn Dam. Slope gradients range from 20-50% with local relief of 160-300 m. The vegetation is primarily open woodland. The soils are dominated by Yellow and Red Podzolic Soils with some shallow Krasnozem-Euchrozem intergrades and Chocolate Soils on steeper slopes. The fertility of these soils ranges from low to moderate. These soils are associated with a Rural Land Capability of VI – VII. Limitations to this unit include shallow soil depth, moderate to extreme erosion hazard and high mass movement hazard.

Rouchel Soil Landscape

The Rouchel Soil Landscape consists of undulating low hills, rolling low hills and the footslopes of steep hills. Slope gradients range from 4-15% with local relief of 40-60 m. The vegetation if primarily woodland, consisting of spotted gum, silvertop stringbark, stringybark peppermint and Sydney blue gum. Extensive clearing has occurred for cattle grazing enterprises. The soils are dominated by Brown Podzolic Soils on upper slopes, Non-calcic Brown Soils on concave midslopes and Brown Solodic Soils on lower slopes. Minor soils include Red Soloths and Prairie Soils on lower slopes. The fertility of these soils are generally considered to be low. These soils are associated with a Rural Land Capability of III – V.

Limitations to this unit include very high to moderate erosion hazard due to dispersible soils and moderate to high structural degradation hazard.



LEGEND

Echo Property

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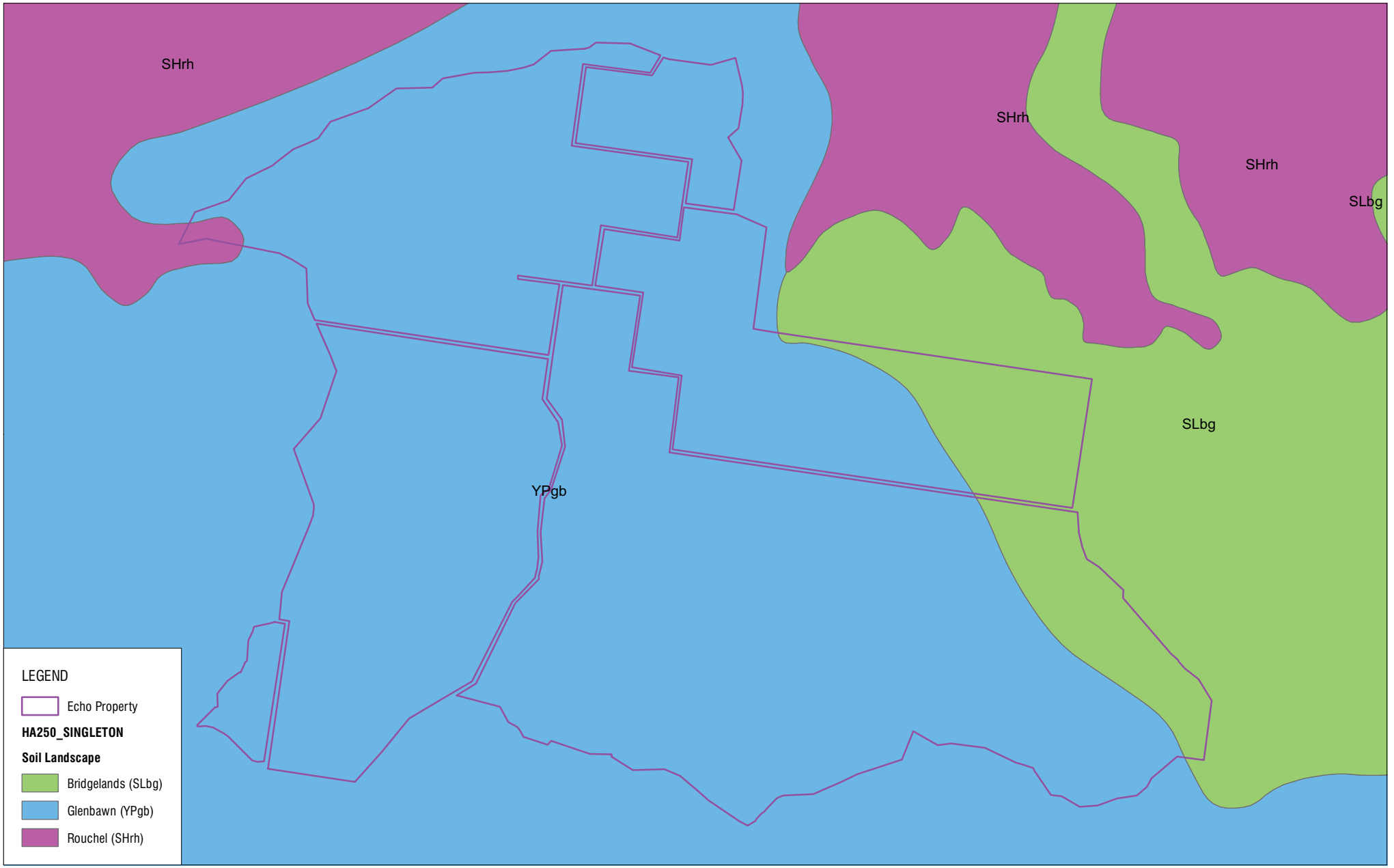
Bengalla Offset Properties

Echo Property

FIGURE 4.1



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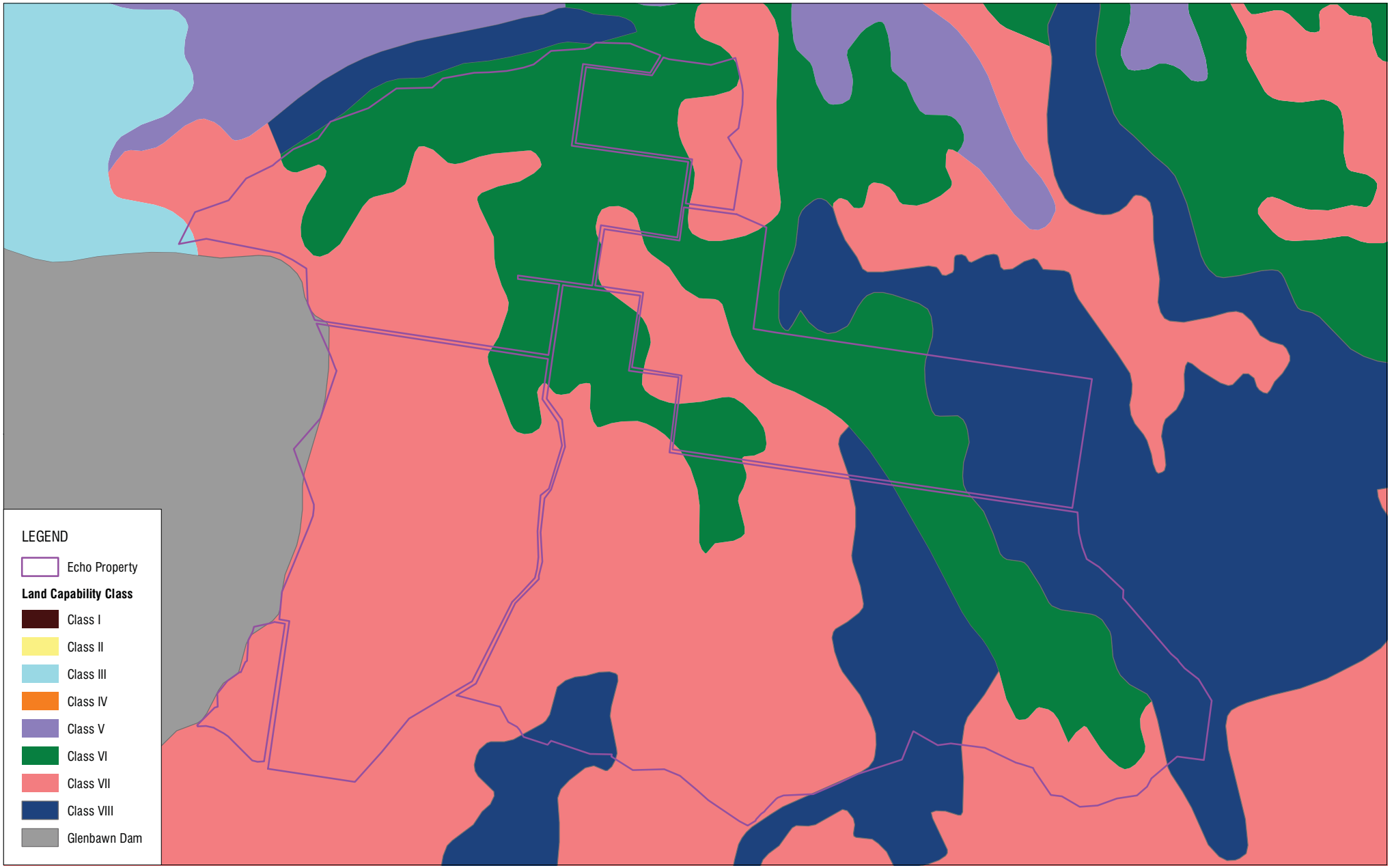
Bengalla Offset Properties

Echo Property Soil Landscapes

FIGURE 4.2



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Bengalla Offset Properties

Echo Property Land Capability

FIGURE 4.3

5 'GOULBURN RIVER' PROPERTY

5.1 Soil Landscapes

The 'Goulburn River' property (**Figure 5.1**) is covered by the Lees Pinch, Munghorn Plateau and Wappinguy Soil Landscapes (**Figure 5.2; Table 5.1**). The characteristics of these Soil Landscapes and their Rural Land Capability (**Figure 5.3**) are discussed below.

Table 5.1 – Soil Landscape of 'Goulburn River' Property

Soil Landscape	Area	
	Ha	%
Lees Pinch	741	82.6
Munghorn Plateau	75	8.4
Wappinguy	81	9.0
Total	**897**	**100.0**

Lees Pinch Soil Landscape

The Lees Pinch Soil Landscape consists of rolling hills to steep hills in the mountains. Slope gradients range from 30-90%, with irregular benches and boulder littered slopes and large sandstone outcrops. Local relief of 100-330 m. The vegetation is dominated by various shrub woodland communities. The mains soils are shallow siliceous sands with shallow loams on finer textured rocks, with Yellow and Brown Earths on the footslopes and Yellow and Grey Soloths on midslopes. The fertility of these soils is generally low. These soils are associated with a Rural Land Capability of VI – VII. Limitations to this Soil Landscape include high mass movement hazard, rock outcrop and moderate to high erosion hazard.

Munghorn Plateau Soil Landscape

The Munghorn Plateau Soil Landscape consists of distinct level surfaces with undulating rises to low hills. Slope gradients are generally 2-5%, with some up to 10% and local relief of 20-60 m. The vegetation is primarily dry sclerophyll forest or shrub woodland. The dominant soils are Siliceous Sands on crests and slopes, sandy Yellow Earths on lower slopes and Yellow Soloths in drainage lines and footslopes. The fertility of these soils is considered to be low. These soils are associated with a Rural Land Capability of IV – V. Limitations to this Soil Landscape include moderate to high erosion hazard, high structural degradation hazard and shallow soil depth.

Wappinguy Soil Landscape

The Wappinguy Soil Landscape consists of rolling low hills with some rocky sandstone knolls, hills, cuestas and benches. Slope gradients are less than 15% with local relief of 40-80 m. Woodland covers the majority of this land with some areas extensively cleared for grazing. The soils are variable but related to different parent material. The dominant soils that occur on sandstone are Solodic Soils on slopes with some Silcieous and Earthy Sands and rock outcrops, Brown Clays on midslopes. Other soils occur on balsaltic colluvium and include Red-Earth-Euchrozem intergrades, Euchrozems, Prairie Soils, Alluvial Loams and Black Earths. The fertility of these soils varies from low to high. These soils are associated with a Rural Land Capability of III – V.

Limitations to this Soil Landscape include moderate to high erosion hazard and structural degradation hazard, low mass movement hazard, shallow soil depth and rock outcrops.

LEGEND

Goulburn River Property

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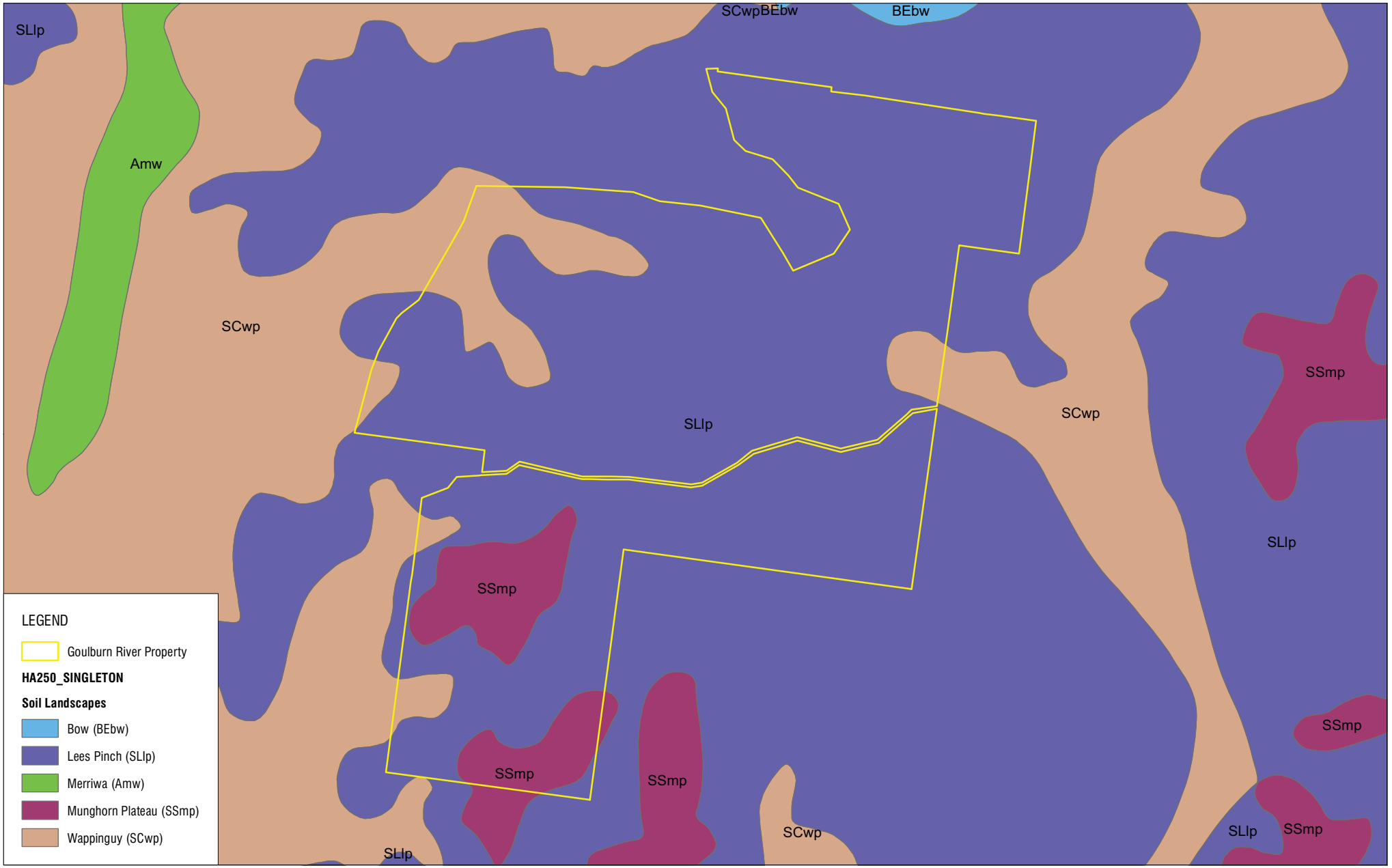
Bengalla Offset Properties

Goulburn River Property

FIGURE 5.1



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Bengalla Offset Properties

Goulburn River Property Soil Landscapes

FIGURE 5.2

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Bengalla Offset Properties

Goulburn River Property Land Capability

FIGURE 5.3

6 'KENALEA' PROPERTY

6.1 Soil Landscapes

The 'Kenalea' property (**Figure 6.1**) is covered by the Bridgelands, Glenbawn, Rouchel and Woolooma Soil Landscapes (**Figure 6.2; Table 6.1**). The characteristics of these Soil Landscapes and their Rural Land Capability (**Figure 6.3**) are discussed below.

Table 6.1 – Soil Landscape of 'Kenalea' Property

Soil Landscape	Area	
	Ha	%
Bridgelands	38	1.8
Glenbawn	2,013	95.0
Rouchel	44	2.1
Woolooma	23	1.1
Total	**2,118**	**100.0**

Bridgelands Soil Landscape

The Bridgelands Soil Landscape consists of rolling hills with some rolling mountains. Slope gradients range from 15-25% with local relief 160-200 m. The vegetation is Silvertop stringybark and forest oak, however, large portions have been cleared for grazing. The soils are dominated by Lithosols and yellow Solodic Soils on midslopes and red Soloths on mid to lower slopes. Terra Rossa Soils occur on limestone, with some limestone outcrops. Brown Clays and Red Earths occur on Upper Slopes. These soils are associated with a Rural Land Capability of VI – VII.

Limitations to this unit include minor to moderate sheet and rill erosion on cleared areas, high structural degradation hazard, high mass movement hazard, shallow soil depth and sodicity

Glenbawn Soil Landscape

The Glenbawn Soil Landscape consists of steep hills with steep ridges covering an area to the east of Glenbawn Dam. Slope gradients range from 20-50% with local relief of 160-300 m. The vegetation is primarily open woodland. The soils are dominated by Yellow and Red Podzolic Soils with some shallow Krasnozem-Euchrozem intergrades and Chocolate Soils on steeper slopes. The fertility of these soils ranges from low to moderate. These soils are associated with a Rural Land Capability of VI – VII.

Limitations to this unit include shallow soil depth, moderate to extreme erosion hazard and high mass movement hazard.

Rouchel Soil Landscape

The Rouchel Soil Landscape consists of undulating low hills, rolling low hills and the footslopes of steep hills. Slope gradients range from 4-15% with local relief of 40-60 m. The vegetation if primarily woodland, consisting of spotted gum, silvertop stringbark, stringybark peppermint and Sydney blue gum. Extensive clearing has occurred for cattle grazing enterprises. The soils are dominated by Brown Podzolic Soils on upper slopes, Non-calcic Brown Soils on concave midslopes and Brown Solodic

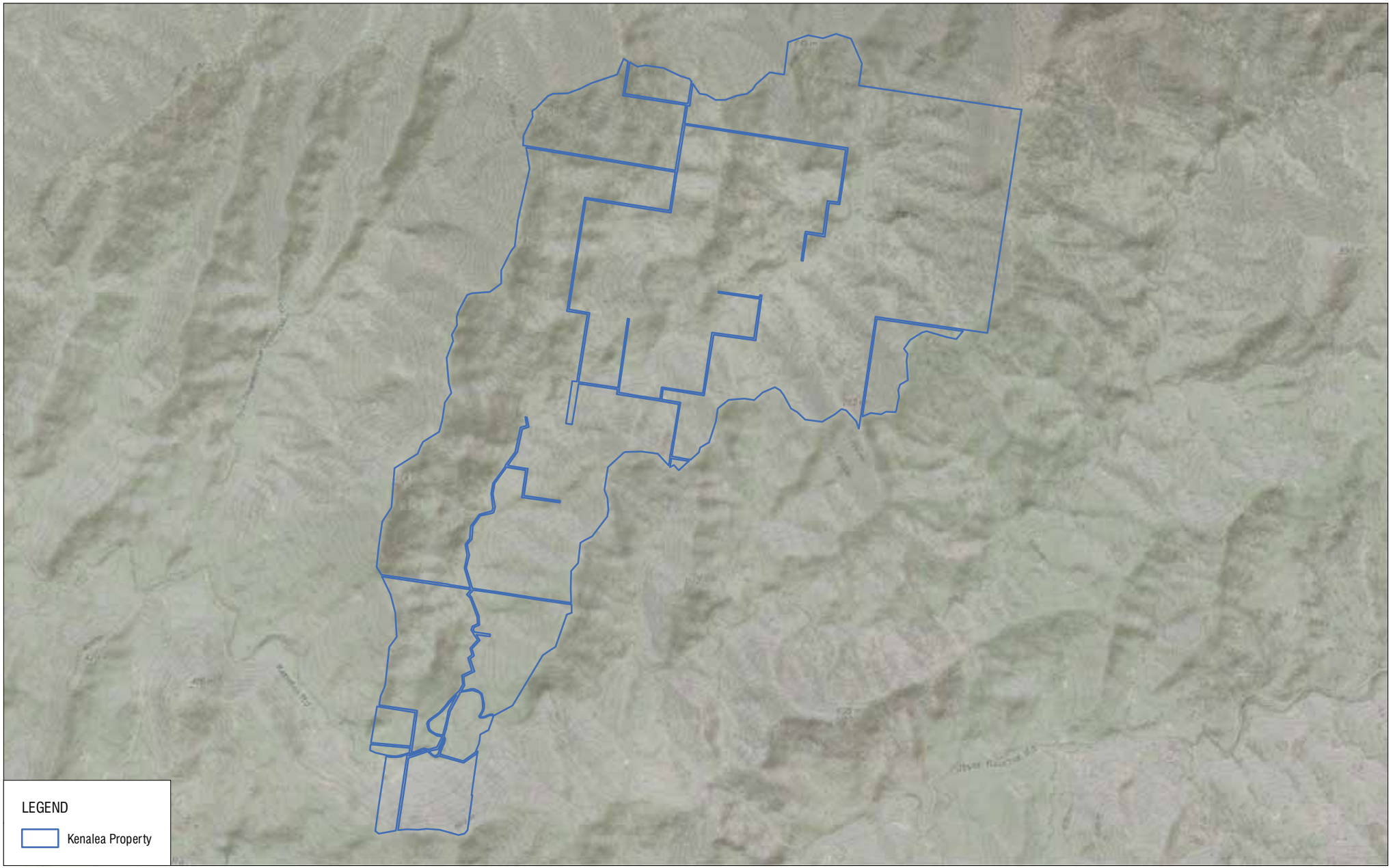
Soils on lower slopes. Minor soils include Red Soloths and Prairie Soils on lower slopes. The fertility of these soils are generally considered to be low. These soils are associated with a Rural Land Capability of III – V.

Limitations to this unit include very high to moderate erosion hazard due to dispersible soils and moderate to high structural degradation hazard.

Woolooma Soil Landscape

The Woolooma Soil Landscape consists of steep mountains. Slope gradients range from 30-48% with local relief 300-460 m. The vegetation is relatively undisturbed wet sclerophyll forest consisting of silvertop stringybark, manna gum, snow gum, mountain gum and black sallee. The soils are dominated by Krasnozems on steep slopes. These soils are associated with a Rural Land Capability of VIII.

Limitations to this unit include mass movement hazard and high to very high erosion hazard.



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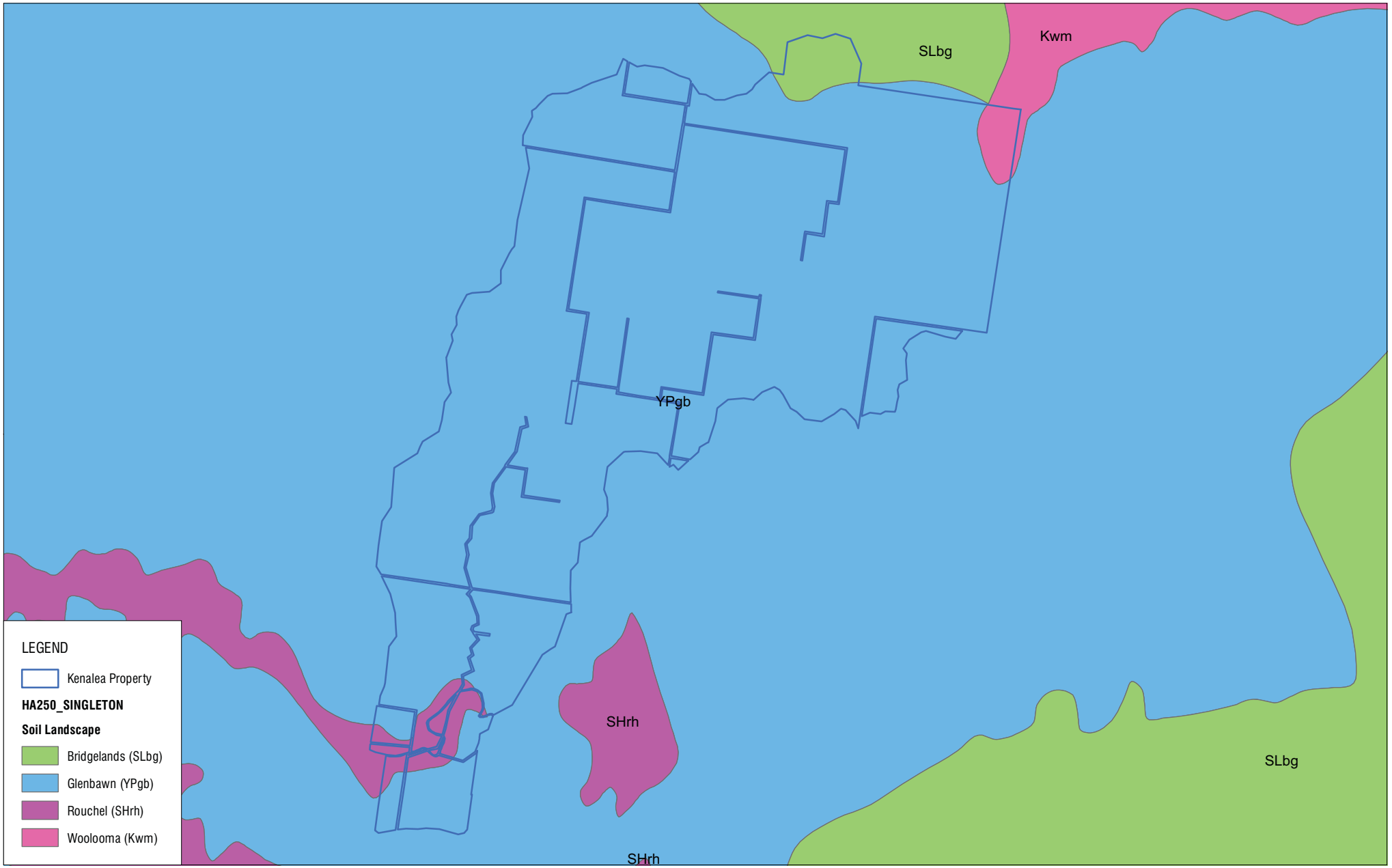
Bengalla Offset Properties

Kenalea Property

FIGURE 6.1



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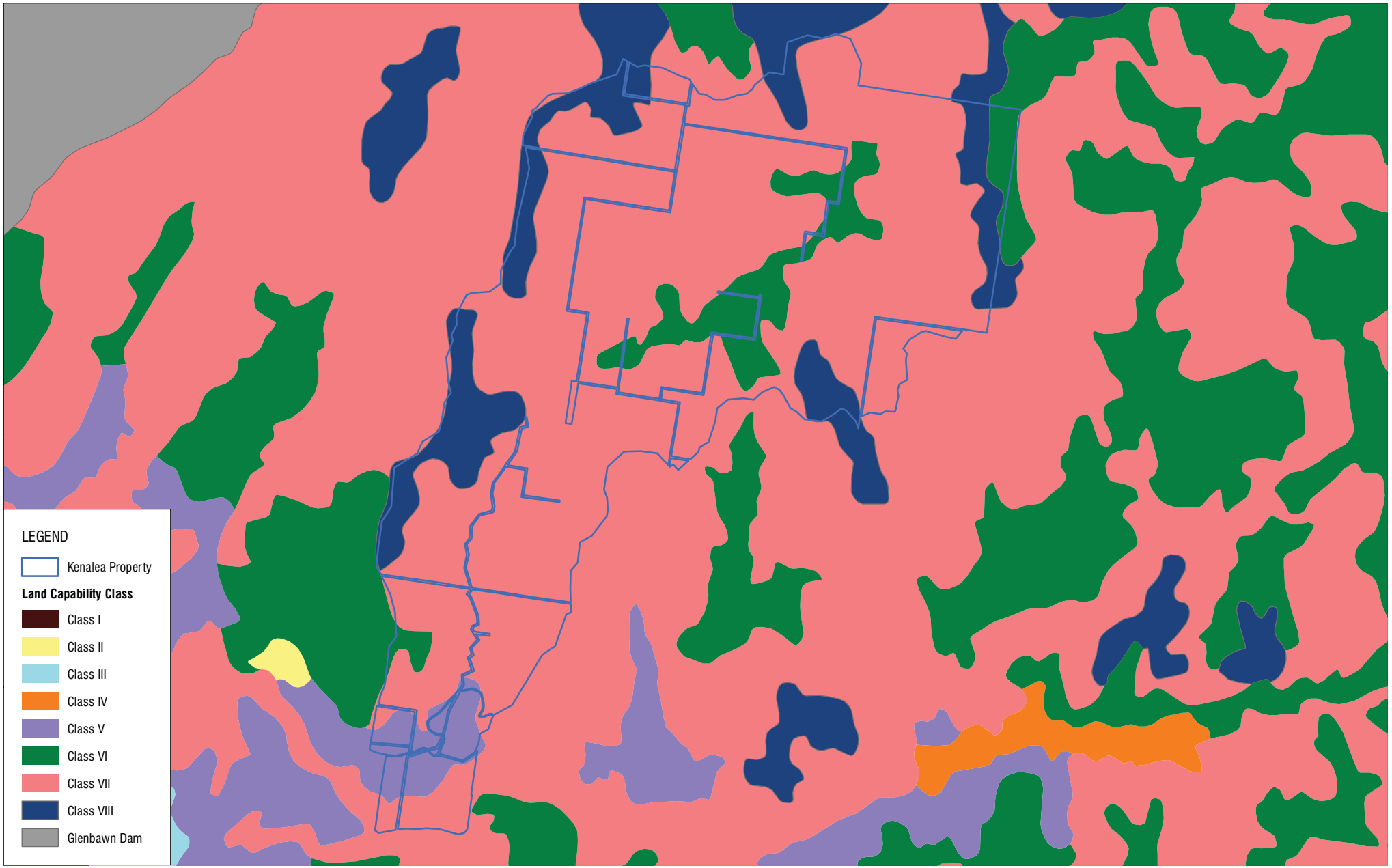
Bengalla Offset Properties

Kenalea Property Soil Landscapes

FIGURE 6.2



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Bengalla Offset Properties

Kenalea Property Land Capability

FIGURE 6.3

7 'KENELPUT' PROPERTY

7.1 Soil Landscapes

The 'Kenelput' property (**Figure 7.1**) is covered by the Glenbawn and Woolooma Soil Landscapes (**Figure 7.2; Table 7.1**). The characteristics of these Soil Landscapes and their Rural Land Capability (**Figure 7.3**) are discussed below.

Table 7.1 – Soil Landscape of 'Kenelput' Property

Soil Landscape	Area	
	Ha	%
Glenbawn	534	97.8
Woolooma	12	2.2
Total	**546**	**100.0**

Glenbawn Soil Landscape

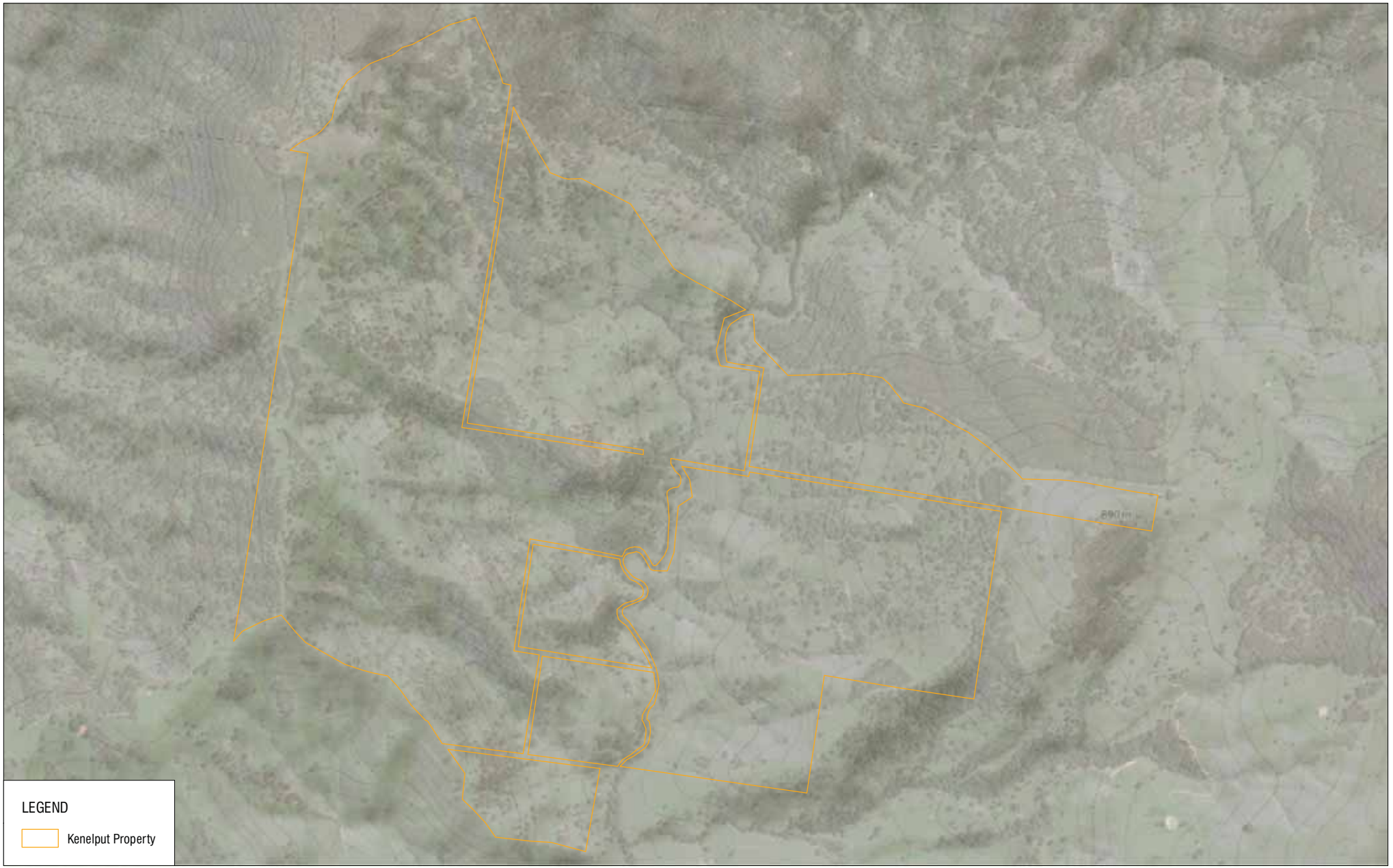
The Glenbawn Soil Landscape consists of steep hills with steep ridges covering an area to the east of Glenbawn Dam. Slope gradients range from 20-50% with local relief of 160-300 m. The vegetation is primarily open woodland. The soils are dominated by Yellow and Red Podzolic Soils with some shallow Krasnozem-Euchrozem intergrades and Chocolate Soils on steeper slopes. The fertility of these soils ranges from low to moderate. These soils are associated with a Rural Land Capability of VI – VII.

Limitations to this unit include shallow soil depth, moderate to extreme erosion hazard and high mass movement hazard.

Woolooma Soil Landscape

The Woolooma Soil Landscape consists of steep mountains. Slope gradients range from 30-48% with local relief 300-460 m. The vegetation is relatively undisturbed wet sclerophyll forest consisting of silvertop stringybark, manna gum, snow gum, mountain gum and black sallee. The soils are dominated by Krasnozems on steep slopes. These soils are associated with a Rural Land Capability of VIII.

Limitations to this unit include mass movement hazard and high to very high erosion hazard.



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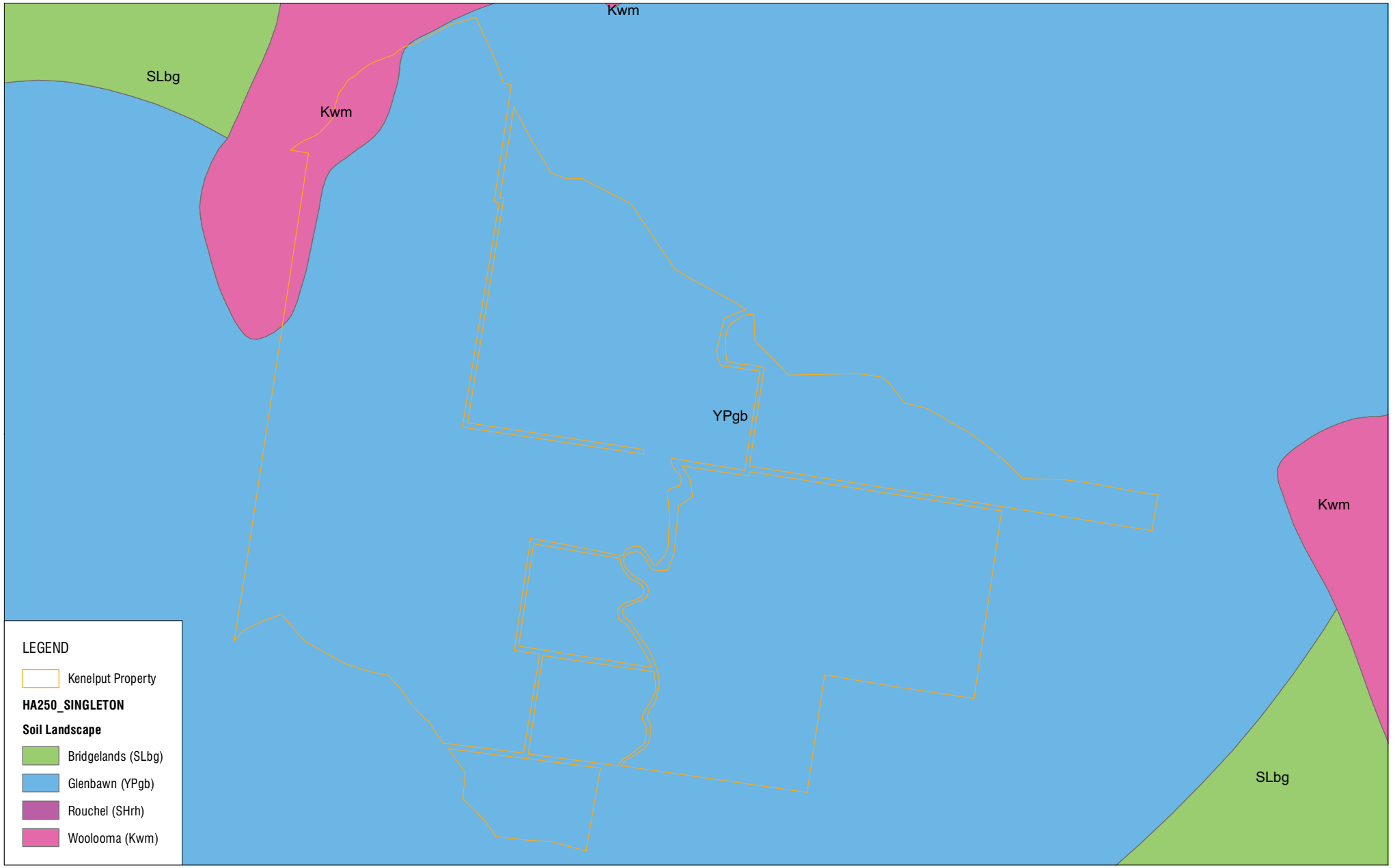
Bengalla Offset Properties

Kenelput Property

FIGURE 7.1



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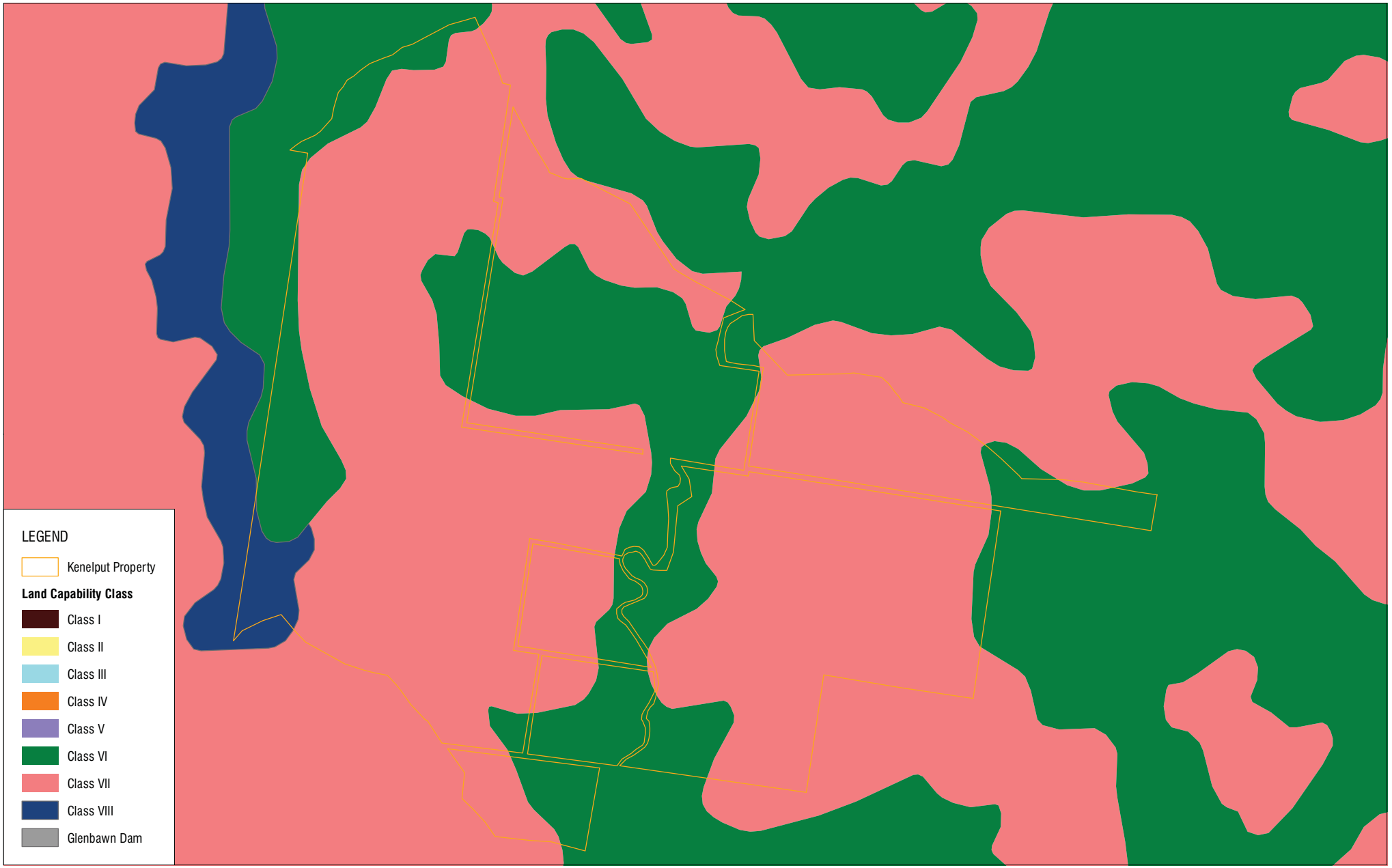
Bengalla Offset Properties

Kenelput Property Soil Landscapes

FIGURE 7.2



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Bengalla Offset Properties

Kenelput Property Land Capability

FIGURE 7.3

8 REFERENCES

Department of Land and Water Conservation (DLWC) (1998) Rural Land Capability Mapping.

Kovac, M. and Lawrie, J.M. (1991). Soil Landscapes of the Singleton 1:250 000 Sheet. Soil Conservation Service of NSW, Sydney.

McInnes-Clarke S.K. (2002). Soil Landscapes of the Murrundi 1:100 000 Sheet. Department of Conservation and Land Management, Sydney.

Appendix B Assumptions for Quantum and Value of Agricultural Production

Appendix B Assumptions for Quatum and Value of Agricultural Production

AS IS	Unit	Cleared	Shelter Timber	Heavy Timber /non ag	Total	Breeders (inland weaners)
Offset Domains		**Domain X**	**Domain Y**	**Domain Z**		
Merriwa River	%	-	-	100	100	
Black mountian	%	13	48	40	100	
Kanalea properties	%	33	42	25	100	
Merriwa River	Ha	-	-	897	897	-
Black mountian	Ha	154	582	486	1,222	80
Kanalea properties	Ha	1,365	1,708	1,024	4,097	740
Total		1,519	2,290	2,407	6,216	820
	Ha/Breeder	2.2	15.3	-		
	DSE/ha	6.8	1.0	-	827	
	DSE/breeder					15.25
	DSE	10,329	2,290	-	12,619	12,505
	Breeders	671	149	-		820
POTENTIAL	**Unit**	**Cleared**	**Shelter Timber**	**Heavy Timber /non ag**	**Total**	**Breeders (inland weaners)**
Merriwa River	%	-	-	100	100	
Black mountian	%	13	48	40	100	
Kanalea properties	%	33	42	25	100	
Merriwa River	Ha	-	-	897	910	-
Black mountian	Ha	154	582	486	1,257	119
Kanalea properties	Ha	1,365	1,708	1,024	1,345	828
Total		1,519	2,290	2,407	3,512	947
	Ha/Breeder	1.9	15.3	-		
	DSE/ha	8.0	1.0	-	947	
	DSE/breeder					15.25
	DSE	12,152	2,290	-	14,442	14,442
	Breeders	797	150	-		947

Quatum and Value of Agricultural Production				
Enterprise	Inland weaners - stores			
Per breeder				
Gross income	$403.53			
Net income	$281.01			
Waeaners sold	0.63			
CFA Bulls	0.01			
CFA cows	0.06			
Other culls	0.13			
Total sold	0.83			
As IS		**Domain X**	**Domain Y**	**Domain Z**
Number Breeders	820	671	149	0
Gross income	$330,895	$270,847	$60,047	$0
Net income	$230,428	$188,613	$41,816	$0
Total turn off	681	557	124	-
Scone Yards	286			
Paddock to paddock	394			
	681			
Potential		**Domain X**	**Domain Y**	**Domain Z**
Number Breeders	947	798	149	0
Gross income	$382,150	$322,102	$60,047	$0
Net income	$266,121	$224,305	$41,816	$0
Total turn off	786	662	124	-
Scone Yards	306			
Paddock to paddock	480			
	786			
Labour	2.3			

Appendix C Economics Assessment of Impacts to Agricultural Resources

1 ECONOMIC ASSESSMENT OF IMPACTS TO AGRICULTURAL RESOURCES

1.1 Opportunity Cost of Agriculture and Water Resources

1.1.1 Land Resources

The Project will primarily impact agricultural land resources through the mine disturbance footprint and the biodiversity offsets package.

Mine Disturbance Footprint

964 ha of agricultural land within the Disturbance Boundary will be removed from production as a result of the Project. Post-mining the land will be rehabilitated to establish landforms with Agricultural suitability classes 3 and 4. However, it is difficult to predict the most the most appropriate land use in 24 years time and so for the purpose of this analysis, agricultural impacts from the mine disturbance footprint are in perpetuity.

Scott Barnett & Associates (2012) identify that impacted land within the Disturbance Boundary could otherwise be used for beef grazing with a gross value of production per annum of $129,313 and a net value of production per annum of $98,251.

The present value of foregone gross value of production is estimated at $1.7M (at 7% discount rate) and the present value of foregone net value of agricultural production is estimated at $1.3M at 7% discount rate).

Biodiversity Offsets

6,216 ha of agricultural land will be required as a biodiversity offset. Scott Barnett & Associates identify that impacted land otherwise be used for beef grazing with a gross value of production per annum of $330,865 and a net value of production per annum of $230,428.

The present value of foregone gross value of production, in perpetuity, is estimated at $4.4M (at 7% discount rate) and the present value of foregone net value of agricultural production, in perpetuity, is estimated at $3.0M at 7% discount rate).

Total Land Resource

The present value of foregone gross value of production from the mine disturbance footprint and biodiversity offsets is estimated at $6.1M (at 7% discount rate) and the present value of foregone net value of agricultural production is estimated at $4.3M at 7% discount rate).

1.1.2 Water Resources

The Surface Water Impact Assessment for the Project (WRM, 2012) indicates the maximum external water requirement for the Project is approximately 2,200ML/annum.

Scott Barnett & Associates (2012) identify this water resource could otherwise be used to produce lucerne hay and maize grain cropping rotation on 283.1 ha to produce 3,639 tonne of lucerne hay and 809 tonne of maize grain with a gross value of production of $1,210,817 and net value of production of $320,986. The same land used for dryland lucerne and sorghum grain production could be expected to produce 809 tonnes of lucerne hay and 364 tonnes of sorghum grain with a gross value of production of $298,456 and net value of $98,861. Based on these assumptions the quantum and value of agricultural production lost by utilising this water for mining is 2,831 tonnes of lucerne hay and 445 tonnes of grain with a gross value of production of $912,361 (present value of $9.8M at 7% discount rate) and net value of $222,125M (present value of $2.4M at a 7% discount rate).

In addition, the Groundwater Assessment (AGE, 2012) indicated a maximum annual take by the Project from alluvial sources of 220 ML/annum. Scott Barnett & Associates (2012) identify this water resource could otherwise be used to irrigate over 28.3 ha to produce 364 tonnes of lucerne hay and 81 tonnes of maize grain for a gross value of production $121,082 and net value of $32,099. The dryland quantum and value of production of the same area is 81 tonnes of lucerne hay production and 36 tonnes of grain sorghum with a gross value of $29,846 and a net value of $9,886. The quantum and value of agriculture production lost by utilising this water for mining is 283 tonnes of Lucerne hay and 44 tonnes of grain with a gross value of $91,236 ($1.0M present value at 7% discount rate) and a net value of $22,212 ($0.2 present value at 7% discount rate).

The combined quantum and value of agricultural production lost by utilising both water sources (2,420 ML) for mining is 3,114 tonnes of lucerne hay and 489 tonnes of grain with a gross value of production of $1,003,597 ($10.8M present value at 7% discount rate) and a net value of $244,337 ($2.6M present value at 7% discount rate).

1.2 Regional Impacts

The regional impacts of the level of annual agricultural production forgone as a result of the Project (Section 1.1) were estimated from the sectors in the regional input-output table (Gillespie Economics, 2012) within which production is located i.e. the beef sector and the combined grains and other agriculture sectors. Table 1.1 and Table 1.2 summarises the estimated direct and indirect regional impacts of the Project land resources footprint and water requirements, respectively.

Table 1.1 - Regional Economic Impacts of Agricultural Land Required for the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	*460*	*78*	*103*	*181*	*641*
Type 11A Ratio	*1.00*	*0.17*	*0.22*	*0.39*	*1.39*
VALUE ADDED ($'000)	289	32	48	80	368
Type 11A Ratio	*1.00*	*0.11*	*0.17*	*0.28*	*1.28*
INCOME ($'000)	189	23	40	63	252
Type 11A Ratio	*1.00*	*0.12*	*0.21*	*0.33*	*1.33*
EMPL. (No.)	3	0	1	1	4
Type 11A Ratio	*1.00*	*0.10*	*0.18*	*0.28*	*1.28*

Table 1.2 - Regional Economic Impacts of Foregone Agriculture from Project Water Requirements

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	1,004	231	150	381	1,385
Type 11A Ratio	1.00	0.23	0.15	0.38	1.38
VALUE ADDED ($'000)	455	93	70	163	618
Type 11A Ratio	1.00	0.20	0.15	0.36	1.36
INCOME ($'000)	243	67	58	125	368
Type 11A Ratio	1.00	0.28	0.24	0.52	1.52
EMPL. (No.)	5	1	1	2	7
Type 11A Ratio	1.00	0.18	0.17	0.35	1.35

Table 1.3 compares the annual regional production and economic impacts associated with the Project with the level of annual agricultural production that would be forgone as a result of the Project (Section 1.1).

Table 1.3 - Annual Regional Economic Impacts of Foregone Agriculture Compared to the Project

	Agriculture Land Footprint	Agricultural Water Requirements	Agricultural Impacts Total	Project
Production Type	Beef	Lucerne Hay, Maize Grain and Sorghum Grain		Coal
Direct Output Value ($000)	460	1,004	1,464	1,174,064
Direct Value Added ($000)	289	455	744	657,035
Direct Income ($000)	189	243	432	92,146
Direct Employment (No.)	3	5	8	768
Direct and Indirect Output Value ($000)	641	1,385	2,026	1,486,220
Direct and Indirect Value Added ($000)	368	618	986	789,345
Direct and Indirect Income ($000)	252	368	620	155,014
Direct and Indirect Employment (No.)	4	7	11	1,745

The Project is estimated to provide considerable activity to the regional economy that is far in excess of the regional economic impacts associated with the level of annual agricultural production that would be forgone as a result of the Project (Table 1.3).

The direct annual output of the Project is estimated at $1,174M. The annual agricultural production from the land and water resources that would potentially be impacted by the Project is $1.5M (Table 1.3).

The direct and indirect regional employment provided by the Project would be approximately 1,745 compared to approximately 11 agricultural-related jobs that would be forgone as a result of the Project impacts on agricultural land and water (Table 1.3).

This stimulus provided by the Project would continue for approximately 24 years. Water required for the Project would then potentially be available for agricultural activities. Rehabilitated land may also be available for agricultural activities.

1.3 Economic Efficiency of Reallocation of Agricultural Resources to the Project

The BCA estimated present value of net production benefits of the Project to Australia at $1,790M (Table 1.4) (Gillespie Economics, 2012)1. In contrast, the present value of future use of agricultural land and water resources utilised by the Project is estimated at $7M (Table 1.4).

Table 1.4 - Net Production Benefits of Agricultural Resources Compared to the Project

	Land and Water Resources (Beef, Lucerne Hay, Maize Grain and Sorghum Grain)	Project
Net Production Benefits[1]	$7M	$1,790M

Source: Gillespie Economics (2012).

[1] Discounting is at 7%.

Based on the comparative values provided in Table 1.4, excluding consideration of externalities of the Project and of agricultural production, the Project is considered to be significantly more efficient than continued agricultural production.

[1] This includes an allowance for the opportunity costs of the agricultural land and water resources.

There are a number of potential negative and positive externalities associated with the Project (and with agricultural production). Including all externalities (including the opportunity cost of agricultural land and water resources) the Project is estimated to have net benefits to Australia of between 1,766M and $2,112M, (Gillespie Economics, 2012) and therefore the Project is considered more efficient than the agricultural production that would be displaced.