West Muswellbrook Project

Gateway Application Supporting Document

Pursuant to Part 4AA of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

IDEMITSU

ESTABLISHED 1907
MUSWELLBROOK COAL COMPANY

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CONTACT LA TIERRA

La Tierra Pty Limited
Ground Floor, Wickham House
155-157 Wickham Terrace
Brisbane Queensland 4000 Australia
e theEarth@latierra.com.au | w latierra.com.au

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
AHD	Australian Height Datum
AIP	Aquifer Interference Policy
AL	Assessment Lease
ARTC	Australian Rail Track Corporation
BoM	(Australian) Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CCC	Community Consultative Committee
CFA	Capacity Framework Agreement
CHPP	Coal handling and preparation plant
CIC	Critical Industry Cluster
CL	Coal Lease
EIS	Environmental Impact Statement
EL	Exploration Licence
EP&A Act	Environmental Planning and Assessment Act 1979
ha	Hectare
HVCC	Hunter Valley Coal Chain
km	Kilometre
km^2	Square kilometre
kph	Kilometres per hour
kV	Kilovolt
L/s	Litres per second
LGA	Local Government Area
LoM	Life of Mine
LUD	Muswellbrook Shire Council Land Use Development Strategy
Mbcmpa	Million bank cubic metres per annum
MIA	Mining infrastructure area
ML	Mining Lease

ML/y	Million litres (or mega litres) per year
mm	Millimetres
Mt	Million tonnes
Mtpa	Million tonnes per annum
NCIG	Newcastle Coal Infrastructure Group
NPC	Newcastle Port Corporation
NSW	New South Wales
OEA	Overburden emplacement area
PAA	Project Assessment Area
pH	Intensity of acidity/alkalinity
PWCS	Port Waratah Coal Services
REF	Rejects emplacement facility
RL	Reduced level
REA	Rejects emplacement area
RMS	NSW Department of Roads and Maritime Services
ROM	Run of mine
SAL	Strategic Agricultural Land
SDD	State Significant Development
SEPP	State Environmental Planning Policy
SRLUP	Strategic Regional Land Use Plan
t	Tonne
tph	Tonnes per hour
UHSA	Upper Hunter Strategic Biodiversity Assessment
V	Volt
WSP	Water Sharing Plan
ZOA	Zone of acquisition
$M	Million dollars
#	Number
%	Percentage

EXECUTIVE SUMMARY

Upper Hunter region is agriculturally important to NSW

Around half a million ha of Strategic Agricultural Land in the region

The Upper Hunter region is a fertile and productive agricultural area and home to iconic industries. The New South Wales (NSW) Government has identified around 500,000 hectares (ha) of Strategic Agricultural Land in the region. This land includes the most agriculturally valuable soils, termed Biophysical Strategic Agricultural Land (BSAL), and land associated with Critical Industry Clusters (CICs) of the equine and viticulture industries. Horses, wine and coal mining are each iconic industries that underpin the economy and identity of the Upper Hunter region.

West Muswellbrook Project, Gateway Application and supporting document

Muswellbrook Coal Company (MCC), a wholly owned subsidiary of Idemitsu Australia Resources, is proposing to develop a new coal mine in the region. The West Muswellbrook Project is a proposed new open-cut coal mine, straddling the Muswellbrook and Upper Hunter Local Government Areas, about 12 kilometres (km) northwest of the town of Muswellbrook. This report assesses the Project's potential impacts on strategic agricultural land, and is the supporting document to MCC's Gateway Application.

Open-cut terrace mining

MCC's preferred mining method is open-cut terrace mining. Compared and contrasted with more common open-cut strip mining methods, terrace mining has tangible advantages with respect to minimising potential impacts on strategic agricultural land. To name a few of these advantages, terrace mining:

Minimising impacts on strategic agricultural land

- Requires a smaller initial box cut and therefore, a smaller out-of-pit overburden emplacement at the commencement of mining;
- Has a smaller active mining area at all times;
- Delivers areas for rehabilitation sooner;
- Leaves a smaller final void, if one is necessary;
- Produces less dust as draglines are not used; and,
- Can use smaller blasts to fracture overburden rock.

Project assessment area

This report defines a Project assessment area for the Gateway Application. This area includes all planned mining disturbance and buffer land. The Project assessment area is 5,621 ha.

25 affected properties described in detail

The predominant current land use within the Project assessment area is beef cattle grazing, covering 78% of land. Exceptions to this include two larger and more diversified enterprises that are partially affected. However, landholdings are typically small, less than 100 ha, and do not provide a 'living area', i.e. economically viable farm size. These smallholdings are disadvantaged by high input unit costs, high operating costs per head of livestock, and dependence on off-farm income that reduces available management time and focus, amongst other reasons. The agricultural land uses, production systems and resources for 25 of the 43 properties affected by the Project are described in detail.

No horse studs or vineyards within the Project assessment area

No horse studs, vineyards or wineries exist within the Project assessment area, and no agribusinesses provide support services to these industries.

204.6 ha of verified-BSAL

The Project assessment area contains 206 ha of mapped- or potential-BSAL and 204.6 ha of verified-BSAL. The BSAL verification process found that most potential-BSAL failed one or more of the BSAL verification criterion threshold limits. It also verified other, previously unmapped soils as BSAL. The closeness of potential- and verified-BSAL totals is purely coincidental and there is little correlation on-ground.

Relevant criteria for BSAL impact assessment

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* lists six relevant criteria for the assessment of impacts on BSAL. The extent to which the proposed Project satisfies the relevant criteria has been determined.

(i) Impacts through surface area disturbance

Planned surface disturbances will impact 68.4 ha of verified-BSAL. Two thirds of verified-BSAL within the Project assessment area will not be impacted.

Disturbance type	Total extent (ha)	Verified-BSAL (ha)
Mine infrastructure area	169.8	8.5
Out-of-pit emplacement	609.6	58.9
In-pit emplacement	2823.7	1.0
Final void	342.4	0.0
Not disturbed	1675.6	136.2
TOTAL[1]	**5,621.0**	**204.6**

[1] Some total values may not sum accurately due to rounding.

(ii) Impacts on soil fertility, effective rooting depth and soil drainage

Preceding mining disturbance, verified-BSAL soils will be removed with care to management in excavation, storage and replacement of soils in correct profile horizon sequences. This will ensure potential impacts on fertility, effective rooting depth and drainage are mitigated.

(iii) Increases in land surface micro-relief, soil salinity, rock outcrop, slope and surface rockiness or significant changes to soil pH

Final landform design parameters will be based on the existing natural topography including shape, slope and landscape complexity. All soils, including verified-BSAL soils, will be replaced onto the post-mining landform in their correct landscape positions. This will ensure potential impacts on micro-relief and slope are mitigated. There will be no impacts on soil salinity, rockiness or soil acidity.

(iv) Any impact on highly-productive aquifers

Preliminary modelling indicates that Government-mapped highly productive alluvial aquifers associated with watercourses within the Project assessment area will incur drawdowns greater than two metres and depressurisation. However, available data indicates that at least some of these aquifers are probably better classified as 'less productive', due to elevated salinity and low yield.

(v) Any fragmentation of agricultural land uses

The predominant land use is beef cattle grazing on smaller holdings of less than 100 ha. Potential impacts on 68.4 ha of verified-BSAL will not cause any fragmentation of agricultural land uses.

(vi) Any reduction in the area of BSAL

The proposed Project will cause 68.4 ha of verified-BSAL to be permanently lost. This represents about one third of verified-BSAL within the Project assessment area, and 0.03% of potential-BSAL within the Upper Hunter region. At each of local, regional and state levels, the consequential outcome of this mining impact on soils and agriculture is insignificant.

1,125 ha of Government-verified equine CIC land

50 ha of Government-verified viticulture CIC land

In early 2014, the NSW Government verified and mapped lands associated with equine and viticulture CICs in the region. The Project assessment area contains 1,124.9 ha and 50.4 ha of Government-verified equine CIC land and viticulture CIC land, respectively. Despite this mapping, no horse studs, vineyards, cellar doors or wine tourism enterprises occur within the Project assessment area or near to it.

Relevant criteria for CIC land impact assessment

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* lists five relevant criteria for the assessment of impacts on CIC lands. The extent to which the proposed Project satisfies the relevant criteria has been determined.

(i) Impacts through surface area disturbance

Planned surface disturbances will impact 704.5 ha and 49.5 ha of Government-verified equine and viticulture CIC lands, respectively.

Disturbance type	Total extent (ha)	Equine CIC (ha)	Viticulture CIC (ha)
Mine infrastructure area	169.8	127.6	0.0
Out-of-pit emplacement	609.6	165.4	0.0
In-pit emplacement	2823.7	411.5	49.5
Final void	342.4	0.0	0.0
Not disturbed	1675.6	420.2	0.9
TOTAL[1]	**5,621.0**	**1124.9**	**50.4**

[1] Some total values may not sum accurately due to rounding.

Surface area disturbances will cause 576.9 ha of equine CIC land and 49.5 ha of viticulture CIC land to be permanently lost. This represents about 0.23% of Government-verified equine CIC land and 0.08% of Government-verified viticulture CIC land within the region. At each of local, regional and state levels, the consequential outcome of this mining impact on equine and viticulture CIC lands is insignificant.

A further 127.6 ha of equine CIC land will be temporarily affected by mine infrastructure and 420.2 ha will not be impacted.

(ii) Reduced access to, or impacts on, water and agricultural resources

The loss of CIC lands will inevitably cause reduced access to, and impacts on, water resources and agricultural resources associated with those lands. However, this is an insignificant impact because:

- None of the lands has ever been used for a purpose connected with either CIC;
- No important aquifers outside the Project assessment area will be affected;
- CIC businesses within the surrounding locality rely on water from Dart Brook, Kingdon Ponds and the Hunter River; and,
- The Project will not take water from Dart Brook or Kingdon Ponds, and will minimise water drawn under licence from the Hunter River.

(iii) Reduced access to support services and infrastructure

As none of the impacted lands has ever been used for a purpose connected with either CIC, including providing support services or infrastructure, there can be no impacts that cause a reduction in either CIC's access to existing support services and infrastructure in the region.

(iv) Reduced access to transport routes

Planned road closures will not affect either CIC because these roads service only existing land uses, none of which is associated with either CIC.

(v) Loss of scenic and landscape values

Scenic and landscape values are important to the function and sustainability of both CICs. The loss of 576.9 ha of equine CIC land and 49.5 of viticulture CIC land will not result in any loss of scenic and landscape values important to the CICs, because none of this Government-verified CIC land is actually used for a purpose connected with either cluster.

Further, with respect to the equine CIC:

- The closest thoroughbred stallion stud, Yarraman Park that stands 3 sires, is 4.8 km away;
- The closest thoroughbred broodmare farm, Dalmore that hosts up to 30 mares, is 3.8 km away; and,
- The Darley Kelvinside thoroughbred stallion stud, a business of critical importance to the sustainability of the equine CIC in the region, is 8.2 km away.

None of the thoroughbred horse studs within 5 km of the Project assessment area is of the nature, scale or importance of Coolmore or Darley Woodlands studs to the sustainability of the equine CIC, as described in a recent determinations by the NSW Mining & Petroleum Gateway Panel and the NSW Planning Assessment Commission.

Preliminary viewshed analysis shows that little planned mining disturbance is visible from any horse stud in the local area.

With respect to the viticulture CIC, the closest enterprise is Birnam Woods Wines vineyard, about 2.3 km away.

Existing distances between the proposed Project and core business within the CICs provide an adequate buffer to mitigate and minimise any impacts on scenic and landscape values.

Additional agricultural considerations

In addition to potential impacts on verified-BSAL and its associated highly productive groundwater sources, and also Government-verified CIC lands, other agricultural impacts are possible.

Notable potential additional impacts include the following:

- Potential impacts on agriculturally useful but verified non-BSAL soils;
- Economic considerations associated with the loss of agricultural production from the affected land; and,
- Affects on non-high yielding groundwater sources, within the meaning of the Aquifer Interference Policy.

EIS to consider broader agricultural impacts

These are amongst a suite of important issues that will be subject to detailed consideration in preparation of the Environmental Impact Statement for the Project.

1 INTRODUCTION

This supporting document has been prepared to accompany a Gateway Application for the West Muswellbrook Project (the Project), located approximately 12 kilometres (km) northwest of Muswellbrook in the Upper Hunter region of New South Wales (NSW) (Figure 1.1). The Project is a proposed multi-seam open-cut coal mining operation within a portion of Assessment Lease (AL) 19.

The Project proponent and Gateway Applicant is Muswellbrook Coal Company Limited (MCC), a wholly owned subsidiary of Idemitsu Australia Resources Pty Limited (Idemitsu). La Tierra Pty Limited (La Tierra), as independent land resource and agricultural consultants, has prepared this report for and on behalf of the Applicant. In preparing this report, La Tierra has liaised extensively with landholders and other stakeholders, and worked with specialist technical consultants responsible for preparing groundwater and soil resource assessments.

The Applicant is required to make a Gateway Application for the following reasons:

- The proposed Project is a development specified in Clause 5 (Mining) of Schedule 1 to *State Environmental Planning Policy (State and Regional Development) 2011* for which a mining lease under the *Mining Act 1992* is required to be issued to enable the development to be carried out because there is no current mining lease in relation to the proposed development; and
- The proposed Project is on land shown on Map 6 Strategic Regional Land Use Plan, Upper Hunter (under the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*) as Strategic Agricultural Land (SAL) comprising Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CICs) equine and viticulture.

This report identifies SAL potentially affected by the proposed Project and presents a detailed description of the agricultural resources, systems and enterprises on land potentially affected by the proposed mining activities. At this location, SAL comprises BSAL and CICs for equine and viticulture industries.

1.1 Purpose of this report

The purpose of this report is to describe the Project's potential impacts on SAL, in terms of the prescribed relevant criteria, and the mitigation measures required to address these impacts. In addition to addressing the relevant criteria, this report also provides a meta-analysis of local and regional agricultural production, land use and management, environmental features and natural resources.

This report has been prepared with direct reference to the following:

- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (the Mining SEPP), Part 4AA Mining and Petroleum Development on Strategic Agricultural Land and *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) Amendment (Resource Significance) 2013*;
- *Strategic Regional Land Use Policy, Guideline for Gateway Applicants*, Fact Sheet, September 2013 (the Guideline) by the NSW Department of Planning and Infrastructure (DP&I, 2013a);
- *Interim protocol for site verification and mapping of biophysical strategic agricultural land*, April 2013 by the Office of Environment & Heritage and the Office of Agricultural Sustainability & Food Security (OEH and OAF&FS, 2013); and
- *NSW Aquifer Interference Policy*, September 2012 by the NSW Department of Primary Industries, Office of Water (DPI, 2012).

Reference has also been made to *Agricultural Impact Statement technical notes: A companion to the Agricultural Impact Statement guideline*, April 2013 by the NSW Department of Primary Industries (DPI, 2013a) where relevant.

This report summarises and presents key technical investigations undertaken for the description of proposed future open-cut mine development, current land uses and agricultural production, identification of BSAL and other soil and land resources, and a preliminary groundwater assessment. These technical studies are provided as Appendices A through C and should be identified as follows:

- Description of existing land uses, agricultural systems and productivities (Appendix A);
- Richards (2014) *Muswellbrook Coal Company Ltd, West Muswellbrook Project, Biophysical Strategic Agricultural Land (BSAL) Verification Report*. A report prepared for Muswellbrook Coal Company Ltd by SLR Consulting, December 2014 (reproduced as Appendix B); and,
- McAlister and Dvoracek (2014) *West Muswellbrook gateway highly productive groundwater impact assessment*. A report prepared for Muswellbrook Coal Company Ltd by Australasian Groundwater and Environmental Consultants Pty Ltd, November 2014 (reproduced as Appendix C).

This report provides a detailed assessment of the Project's potential impacts on BSAL and CICs, and is supported by sufficient detail, including key technical investigations, to reasonably enable the significance of those impacts to be determined. It relies heavily on specialist technical reports by Richards (2014) and McAlister and Dvoracek (2014).

1.1.1 Report structure

This report is structured as follows:

Section 1 – Introductory context and methodology, description of the proposed Project and alternatives, and definition of the proposed Project assessment area (PAA);

Section 2 – Regional agricultural overview;

Section 3 – Agricultural resource assessment of current land use, soils including BSAL, and groundwater resources within the PAA;

Section 4 – Assessment of potential agricultural impacts and mitigation measures;

Section 5 – Account of stakeholder consultation conducted in preparation of this report;

Section 6 – Conclusions and recommendations;

Section 7 – Full references for all citations within the text of this report;

Appendix A – Detailed description of agricultural land uses, production systems and productivities for properties affected by the proposed Project assessment areas;

Appendix B – Assessment of soils, BSAL and land and soil capability (Richards, 2014); and

Appendix C – Highly productive groundwater impact assessment (McAlister and Dvoracek, 2014).

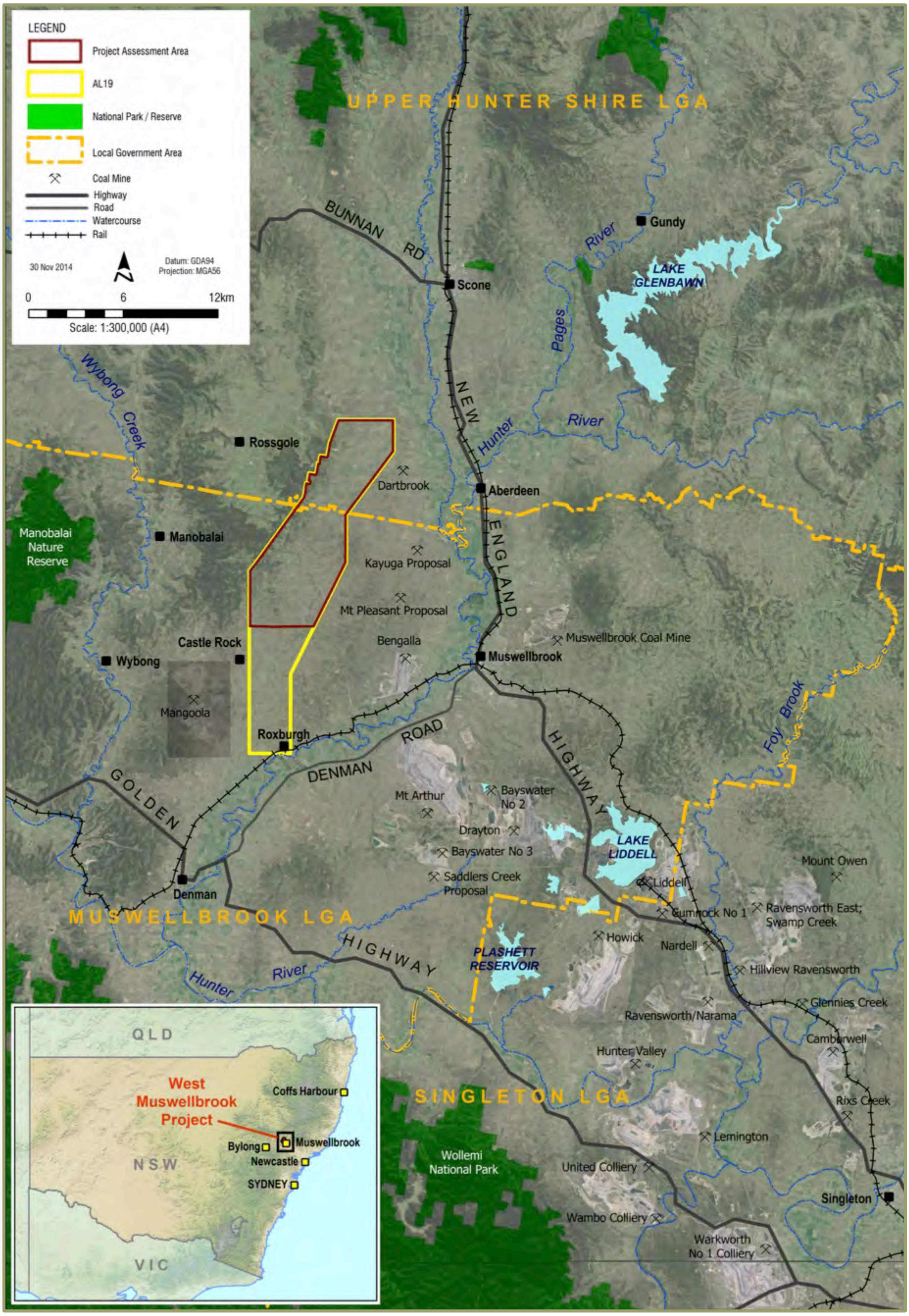


Figure 1-1 Project location in the Upper Hunter region of NSW

1.1.2 Addressing the relevant criteria

To make straightforward the determination of the proposed Project's impacts on SAL, both BSAL and CICs, this report explicitly addresses the relevant criteria contained in Clause 17H4(a) and (b) of the Mining SEPP (Tables 1.1 and 1.2).

Table 1-1 Addressing the relevant criteria for BSAL

Relevant criteria 17H(4)(a)		Where addressed
(i)	Any impacts on the land through surface area disturbance and subsidence	Section 4.2.1
(ii)	Any impacts on soil fertility, effective rooting depth or soil drainage	Section 4.2.2
(iii)	Increases in land surface micro-relief, soil salinity, rock outcrop, slope and surface rockiness or significant changes to soil pH	Section 4.2.3
(iv)	Any impacts on highly productive groundwater (within the meaning of the Aquifer Interference Policy)	Section 4.2.4
(v)	Any fragmentation of agricultural land uses	Section 4.2.5
(vi)	Any reduction in the area of biophysical strategic agricultural land	Section 4.2.6

Table 1-2 Addressing the relevant criteria for CICs

Relevant criteria 17H(4)(b)		Where addressed
(i)	Any impacts on the land through surface area disturbance and subsidence,	Section 4.3.1
(ii)	Reduced access to, or impacts on, water resources and agricultural resources,	Section 4.3.2
(iii)	Reduced access to support services and infrastructure,	Section 4.3.3
(iv)	Reduced access to transport routes,	Section 4.3.4
(v)	The loss of scenic and landscape values	Section 4.3.5

1.1.3 Complying with the Guideline for Gateway Applicants

This report has explicitly addressed requirements for *supporting documents* as described in the Guideline (Tables 1.3 and 1.4).

Table 1-3 Addressing the Guideline requirements for BSAL

Guideline requirement for supporting documents	Where addressed
The supporting document describes the proposal's impact in terms of the relevant Gateway criteria and the mitigation measures to address these impacts.	Section 4
The supporting document should include high- quality aerial photographs, maps or figures that clearly depict the local and regional context of the proposal.	Throughout
The document should briefly explain why the site was chosen for the proposal and briefly discuss any alternatives considered.	Section 1.3
It should present relevant technical investigations undertaken for each component of the project,	Appendices A, B

Guideline requirement for supporting documents	Where addressed
along with the findings, conclusions and recommendations of those investigations. The detailed technical studies should be included.	and C
The supporting documentation should be clear and concise, objective and written in plain English to enable the general public to understand it. It should avoid unnecessary repetition and jargon.	Throughout
Surface area disturbance and subsidence	**Section 4.2.1**
Applicants need to provide maps and text that identify and describe the areal extent of the surface area disturbance and subsidence.	Section 4.2.1 Appendix A
This should include description and mapping of the classes of land and soil capability and soil fertility that will be affected.	Section 3.2.1 Appendix B
An estimation of the likelihood of full rehabilitation of this area post mining activity and an overview of the processes used to achieve the rehabilitation should be provided.	Section 4.1.1.2
Soil fertility, effective rooting depth, soil drainage, land surface micro-relief, soil salinity, rock outcrop, slope and surface rockiness or soil pH	**Section 4.2.2** **Section 4.2.3**
Refer to the Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land, which describes relevant criteria and their analysis and identifies key references.	Appendix B
Refer to the Agricultural Impact Statement: Technical Notes which are technical guidelines supporting agricultural impact assessments.	Section 1.1
Provide information in tabular form that demonstrates the pre-development and post development land and soil capability and soil fertility classes.	Section 3.2.1 Appendix B
Highly productive groundwater	**Section 4.2.3**
Estimates of all quantities of water that are likely to be taken from any water source on an annual basis during and following cessation of the activity.	Appendix C
A strategy for obtaining appropriate water licence/s for maximum predicted annual take.	Appendix C
Establishment of baseline groundwater conditions including groundwater depth, quality and flow based on sampling of all existing bores in the area, any existing monitoring bores and any new monitoring bores that may be required under an authorisation issued under the *Mining Act 1992* or the *Petroleum (Onshore) Act 1991*.	Appendix C
A strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in relevant water sharing plans.	Appendix C
Estimates of potential water level, quality and pressure drawdown impacts on nearby water users who are exercising their right to take water under a basic landholder right.	Appendix C
Estimates of potential water level, quality and pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources.	Appendix C
Estimates of potential water level, quality and pressure drawdown impacts on groundwater dependent ecosystems.	Appendix C
Estimates of potential for increased saline and contaminated water inflows to aquifers and highly connected river systems.	Appendix C
Estimates of the potential to cause or enhance hydraulic connection between aquifers.	Appendix C

Guideline requirement for supporting documents	Where addressed
Estimates of the potential for riverbank instability, or high wall instability or failure to occur.	Appendix C
Outline of the method for disposing of water inflows to a mine or extracted water (in the case of coal seam gas activities).	Appendix C
This information should be based on a simple model that uses best available baseline data collected at an appropriate frequency and scale and that is determined to be fit-for-purpose to the satisfaction of the Minister for Primary Industries.	Appendix C
Proponents should also provide a strategy for moving to modeling using more detailed site-specific data that will be used at the development application stage to better assess potential impacts.	Appendix C
The information detailed above will be used to assess the project against the criteria specified in 'Table 1 – Minimal Impact Considerations for Aquifer Interference Activities' in the Aquifer Interference Policy.	Appendix C Section 4.2.4
Fragmentation of agricultural land uses	**Section 4.2.5**
The applicant must consider the existing and typical agricultural land use of the site.	Section 3.1 Appendix A
Indicate whether the proposal will result in significant fragmentation of agricultural land use based on a consideration of the following: • The decrease in production and efficiency of agriculture in the area; • Reduced access to critical farm and rural infrastructure such as water resources, transport routes and stock reserves; • Changes in the form of agricultural land use (e.g. from non-irrigated to irrigated); • Changes in land use from agriculture to other land use; and • Any agricultural land acquired as a buffer or offset for the mine.	Section 4.2.5
Reduction in the area of BSAL	**Section 4.2.6**
Quantify any likely reduction in the pre-development and post development area of Biophysical SAL.	Section 4.1 Section 4.2.6

Table 1-4 Addressing the Guideline requirements for CICs

Guideline requirement for supporting documents	Where addressed
The supporting document describes the proposal's impact in terms of the relevant Gateway criteria and the mitigation measures to address these impacts.	Section 4.3
The supporting document should include high- quality aerial photographs, maps or figures that clearly depict the local and regional context of the proposal.	Throughout
The document should briefly explain why the site was chosen for the proposal and briefly discuss any alternatives considered.	Section 1.3
It should present relevant technical investigations undertaken for each component of the project, along with the findings, conclusions and recommendations of those investigations. The detailed technical studies should be included.	Appendices A, B and C
The supporting documentation should be clear and concise, objective and written in plain English to enable the general public to understand it. It should avoid unnecessary repetition and jargon.	Throughout
Surface area disturbance and subsidence	**Section 4.3.1**

Guideline requirement for supporting documents	Where addressed
Applicants need to provide maps and text that identify and describe the areal extent of the surface area disturbance and subsidence.	Throughout
The focus of the assessment should be on areas that are physically used for CIC activities.	Section 3.3 Section 4.3.1
The assessment should also describe and map the classes of land and soil capability and soil fertility that will be affected.	Section 3.2.1 Appendix C
An estimation of the likelihood of full rehabilitation of this area post mining activity and an overview of the processes used to achieve the rehabilitation should be provided.	Section 4.1.1.2
Water resources and agricultural resources	**Section 4.3.2**
The applicant should identify all water and agricultural resources with direct utility to the CIC.	Section 2.6 Section 3.3
The impact of the proposal on these resources should be quantified as well as the significance of any temporary or permanent disruption of access to these resources by the CIC.	Section 4.3.2
Support services and infrastructure	**Section 4.3.3**
Any properties acquired (including both operational land and buffer areas) or directly impacted in another way as a result of the project must be identified.	Section 4.3.3
Consider whether these property acquisitions or other impacts of the proposal are likely to isolate any CIC property from, or lead to the closure of, a CIC support service such as an equine veterinarian or winery.	Section 4.3.3
Assess the impacts of any temporary or permanent disruption of access from CIC properties to support services and infrastructure.	Section 4.3.3
Transport routes	**Section 4.3.4**
Identify road and rail traffic volumes and routes and vehicle sizes associated with the project.	Section 2.3.1 Section 4.3.4
Identify existing CIC-related road and rail traffic movements that occur on the same routes as proposed in the project.	Section 4.3.4
Identify the potential impacts on CIC-related road and rail transport routes.	Section 4.3.4
Assess the impact of any temporary or permanent road or rail closures on CIC-related transport routes.	Section 4.3.4
Scenic and landscape values	**Section 2.4.3** **Section 4.3.5**
Assess views of the project site from CIC properties or RMS-signposted Tourist Routes.	Section 4.3.5
Use visual aids such as photomontages to explain the potential impacts.	Section 4.3.5
Show in images any mitigation measures such as visual bunds or plantings.	Section 4.3.5

1.2 Project description

The proposed Project comprises the extraction of up to 621 million tonnes (Mt) of coal from the Upper Hunter Coal Measures using open cut terrace mining methods over a 30-year LoM. Project pre-feasibility studies indicate the new mine could produce up to 15 million tonnes per annum (Mtpa) of saleable thermal coal for export (Table 1.5 and Figure 1.2).

The AL is approximately 12 km northwest of the town of Muswellbrook, 5.3 km west of Aberdeen, 9.5 km southwest of Scone and some 140 km northwest of Newcastle, in the Upper Hunter Valley of NSW (refer to Figure 1.1). AL 19 encompasses about 8,000 hectares (ha) of land and extends over the Muswellbrook Local Government Area (LGA) in the south and the Upper Hunter LGA in the north.

The proposed Project is located in an existing coal mine development area and is proximate to the undeveloped Mt Pleasant mine and the operating Bengalla, Mangoola, Mt Arthur and Muswellbook open-cut coal mines, and the Dartbrook underground coal mine that is currently in 'care and maintenance'.

The Applicant currently operates the Muswellbrook open-cut coal mine, approximately 3 km northeast of Muswellbrook (Idemitsu Australia Resources, 2014). That mine produces around 1.4 Mtpa of saleable coal and employs approximately 130 persons (Idemitsu Australia Resources, 2014).

Table 1-5 Conceptual project description
(from Idemitsu Australia Resources, 2012; AECOM, 2012; Hansen Bailey; 2012)

Project feature	Summary description
Mine life	Up to 30 years.
Mining method and run-of-mine (ROM) coal production	Open cut mining in the Upper Hunter Coal Measures. Production of approximately 621 Mt of ROM coal over the LoM, equating to 15 Mtpa of saleable export quality thermal coal.
Mining area	Northern portion of AL 19 within the PAA for this Gateway Application.
Mine infrastructure areas and mine access	Development and operation of a mining infrastructure area (MIA) comprising administration offices, bathhouses, workshop, store, coal stockpile areas, bunded hydrocarbon tanks, laydown areas, car parking, electrical substation and associated linear infrastructure and access road. Construction and operation of train load-out facilities including a rail spur and loop.
Coal Handling and Preparation Plant (CHPP) and transport infrastructure	Construction and operation of a CHPP for sizing and handling of coal, and for washing of ROM coal. Development and operation of a rail spur and loop and coal loading infrastructure to allow access to the Hunter Valley Coal Chain (HVCC).
Mine waste management infrastructure	Co-disposal of fine and coarse rejects and tailings in a rejects emplacement area (REA). Disposal of waste rock in an overburden emplacement area (OEA) in the northeast of the PAA prior to in-pit disposal of waste rock.
Water management	Potential to pipe water from Muswellbrook Coal Mine to a storage dam in the south of the PAA and to minimise water drawn under licence from the Hunter River. Coal Creek alignment to be diverted around the southern pit.
Hours of operation	24 hours per day, 7 days per week and 363 days per year
Workforce	About 900 for operations plus additional contractors from time to time.
Power supply	66 kilovolt (kV) power supply from Energy Australia's power system. A switching station will be constructed near Kayuga Road and a 66 kV power line will be constructed to the Project site. The power supply will be metered and transformed to 11 kV distribution voltage at a private substation on the Project site.

Project feature	Summary description
Remediation and rehabilitation works	Progressive rehabilitation to be undertaken throughout LoM. The OEA will be contoured to ensure stability and re-vegetated. Rehabilitation of in-pit waste rock will continue through LoM. Prior to mine closure highwalls and lowwalls will be stabilised. A single final void will remain at cessation of mining.

1.2.1 General arrangement

The Project is a 'greenfield' development and will involve application of the terrace mining method to extract the coal resource. The operation will utilise a fleet of electric shovels and ultra-class trucks, a 3,000 tph ROM coal CHPP, a rail spur and loop connected to the Muswellbrook-Ulan rail line, plus supporting infrastructure (Idemitsu Australia Resources, 2012).

Mining is proposed to commence with development of a box-cut in the northern part of the PAA and will progress southwards through years 1 to 10. A second box-cut will be developed in year 8, immediately south of Sandy Creek (North), to commence mining in the southern pit area. Both pits will be mined concurrently for one to two years, prior to backfilling of the northern pit. The mine will progress southwards with one final void remaining at about year 30.

The Project involves:

- Development of an open cut mine to potentially extract up to 15 Mtpa of saleable coal for 30 years;
- Construction of a mine access road;
- Construction and operation of a CHPP to process all ROM coal to produce an export thermal coal product. The CHPP will be required to process 20 Mtpa of ROM coal;
- A 15.9 km rail spur and loop to connect to the existing rail network and the Port of Newcastle;
- Disposal of rejects and waste rock;
- Construction of surface water management structures to:
    - Divert rainfall runoff away from the mining operation to avoid contamination; and,
    - Protect the mine from inundation during rainfall events.
- Acquisition of affected lands;
- Sourcing sufficient water supply, and design and construction of facilities to supply water to the Project;
- A MIA to provide facilities to support the Project;
- Construction of power supply infrastructure; and,
- Construction of temporary construction facilities.

These components are discussed further in the following sections.

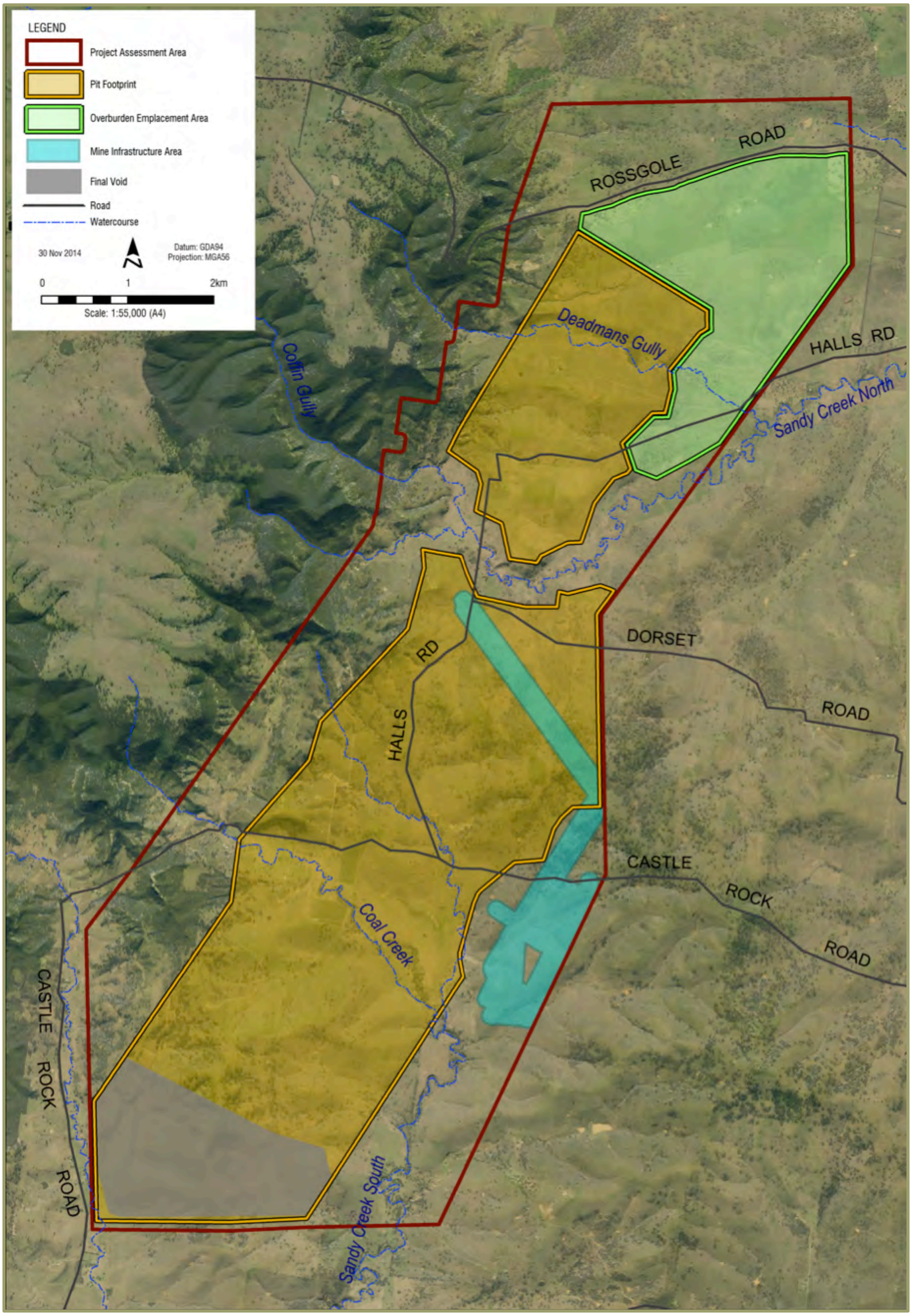


Figure 1-2 Conceptual general arrangement of the proposed Project

1.2.2 Open cut pit layout

The area designated as open cut pit occupies approximately 2,823.6 ha, which is about half of the PAA. The Project will adopt the open cut terrace mining method, which involves the excavation of a boxcut across the deposit from the subcrop of the lowest seam in the mining sequence to the final highwall. This excavation will range from approximately 15 m to 300 m in depth. A significant volume of waste rock will be disposed of in an OEA prior to the establishment of full in-pit dumping. Mining excavation will advance along the strike of the deposit within a single pit for 30 years (Figures 1.3, 1.4 and 1.5) (Idemitsu Australia Resources, 2012).

1.2.3 Mining infrastructure area layout

To support open cut mining operations, infrastructure is required for the industrial area, water and power supply and distribution, access to the open cut, and for surface water management. The MIA will occupy about 162 ha within the PAA. The facilities associated with the MIA will likely include (Idemitsu Australia Resources, 2012) (Figure 1.6):

- Site administration office;
- Change rooms and bathhouse;
- Core shed;
- Site car park;
- Mining office;
- Heavy and light vehicle wash bay;
- Fuel facility;
- Potable water plant;
- Sewage treatment plant;
- CHPP store;
- Roads and drainage; and
- Hardstand areas.

1.2.4 CHPP

The CHPP will be required to process 20 Mtpa of ROM coal, with a nominal throughput capacity of 3,000 tph. The CHPP comprises the following:

- ROM coal receiving facility and raw coal crushing and handling system;
- Coal processing plant (CPP) for washing;
- Coarse rejects and tailings handling system;
- Product coal handling, stacking and stockpiling system;
- Product coal reclaim system; and
- Train load-out system.

ROM coal will be dumped by rear dump trucks into a 1,000 t dump hopper. The hopper will feed a three stage crushing system comprising a primary feeder breaker, a vibrating screen and secondary and tertiary roll crushers. The vibrating screen will separate -50 mm material prior to the secondary-sizer preventing further generations of fines. Crushed coal will be conveyed to a 1,500 to 2,000 t capacity CPP surge bin.

The surge bin will feed two CPP feed conveyors at a nominal rate of 1,500 tph each. The CPP facility will include a coarse circuit, a mid-size circuit and the tailings system. The coarse circuit will comprise dense medium cyclones and the mid-size circuit will comprise reflux classifiers.

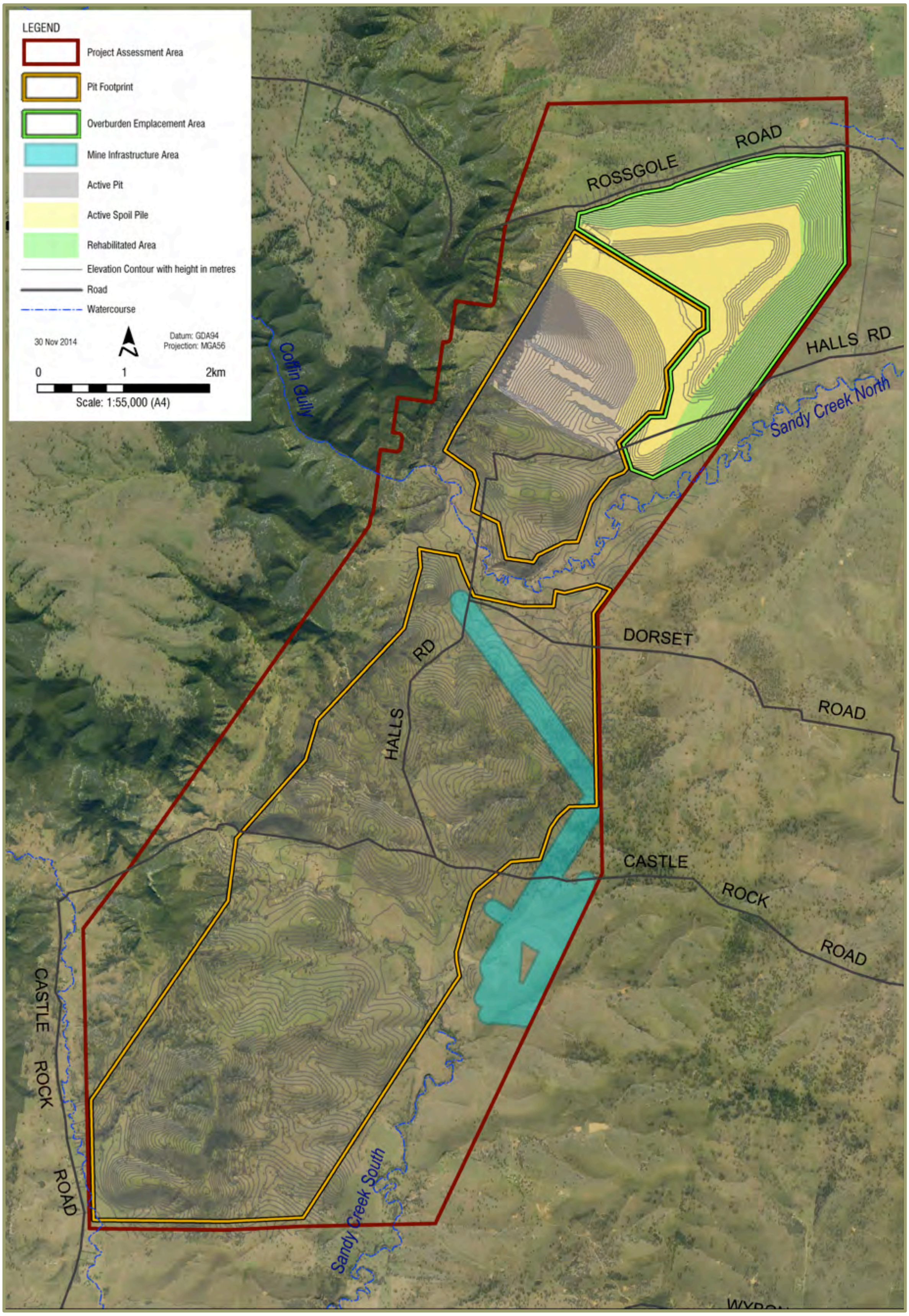


Figure 1-3 Conceptual mine layout and progression at year 5

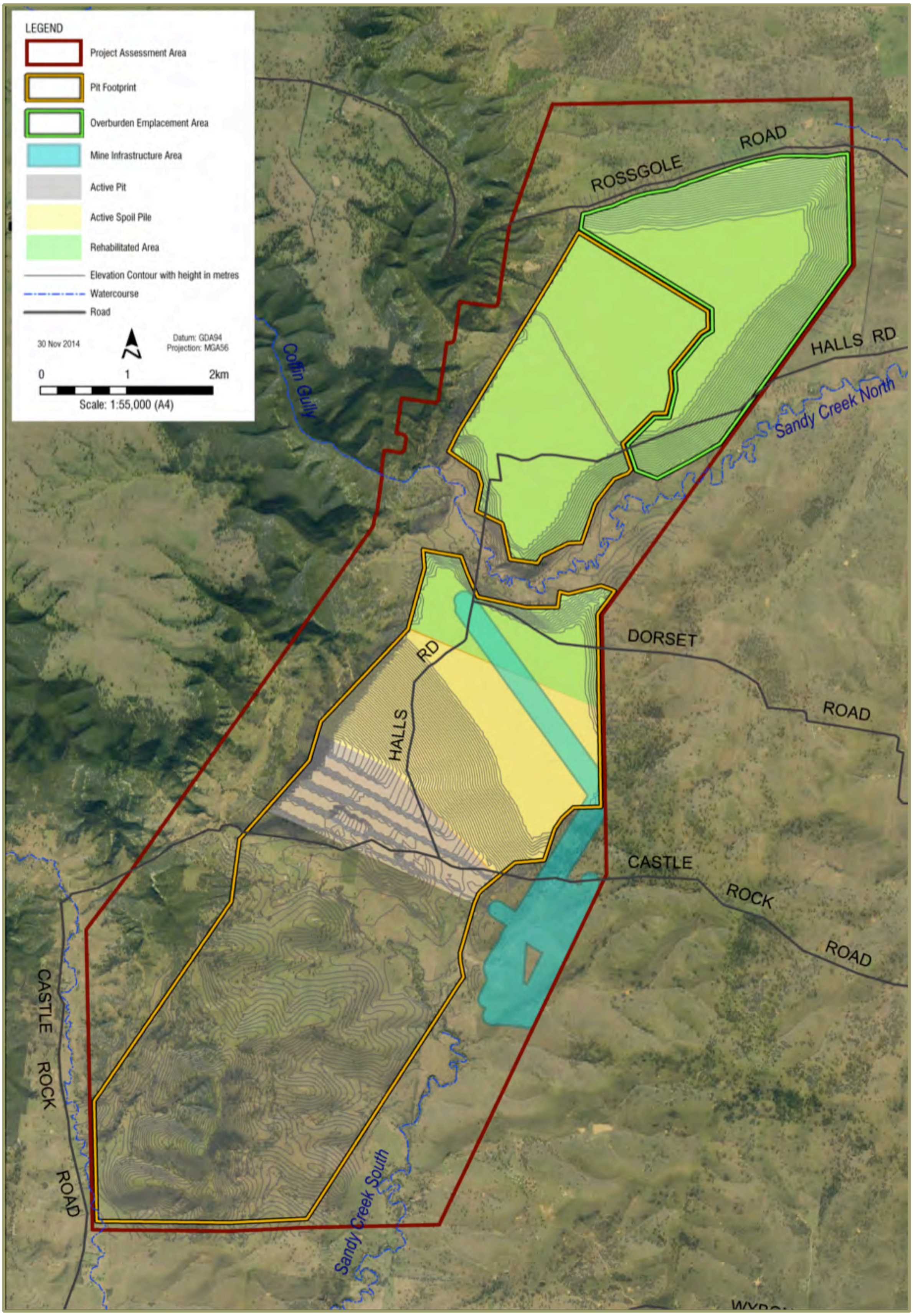


Figure 1-4 Conceptual mine layout and progression at year 16

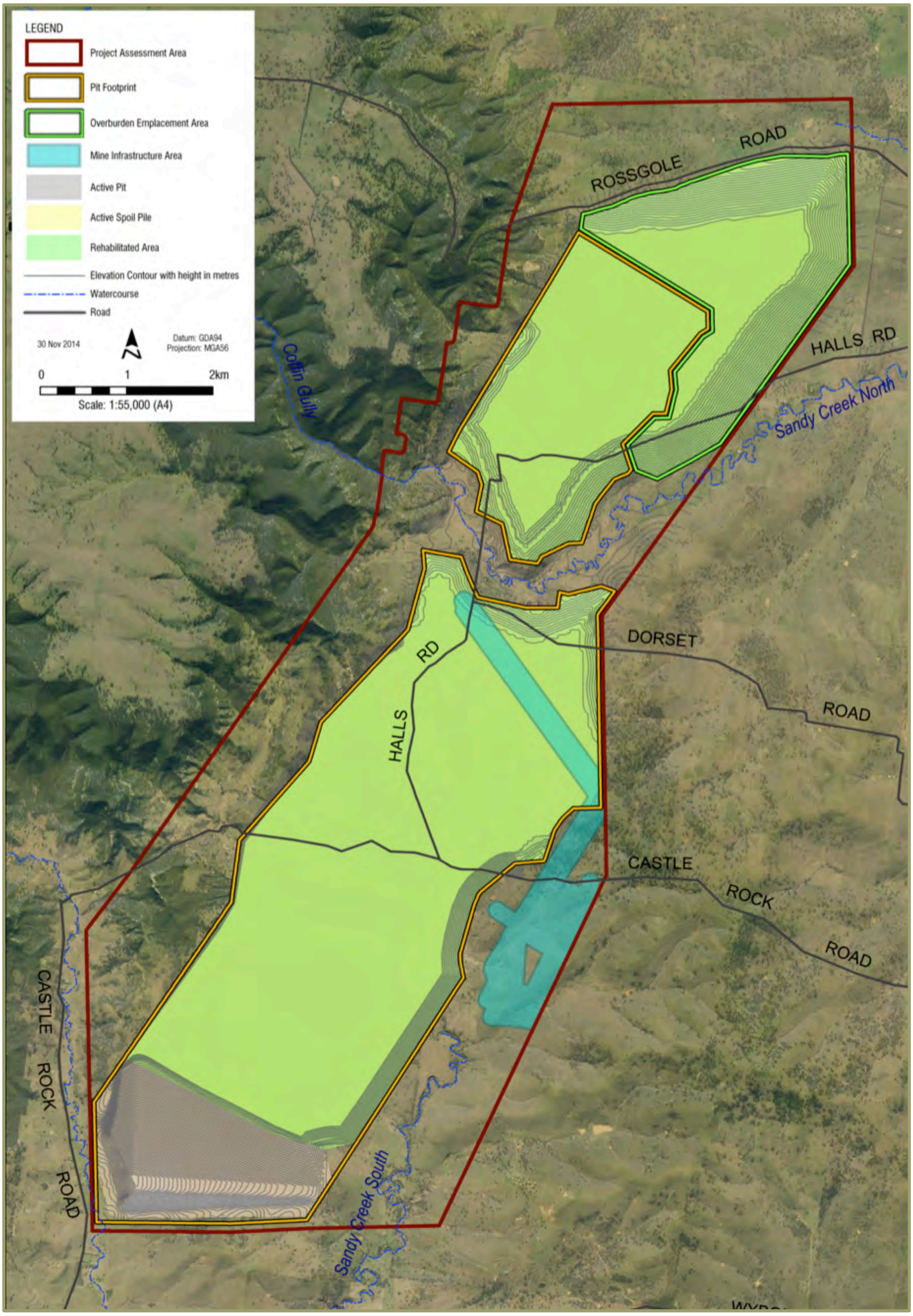


Figure 1-5 Conceptual mine layout and progression at year 30

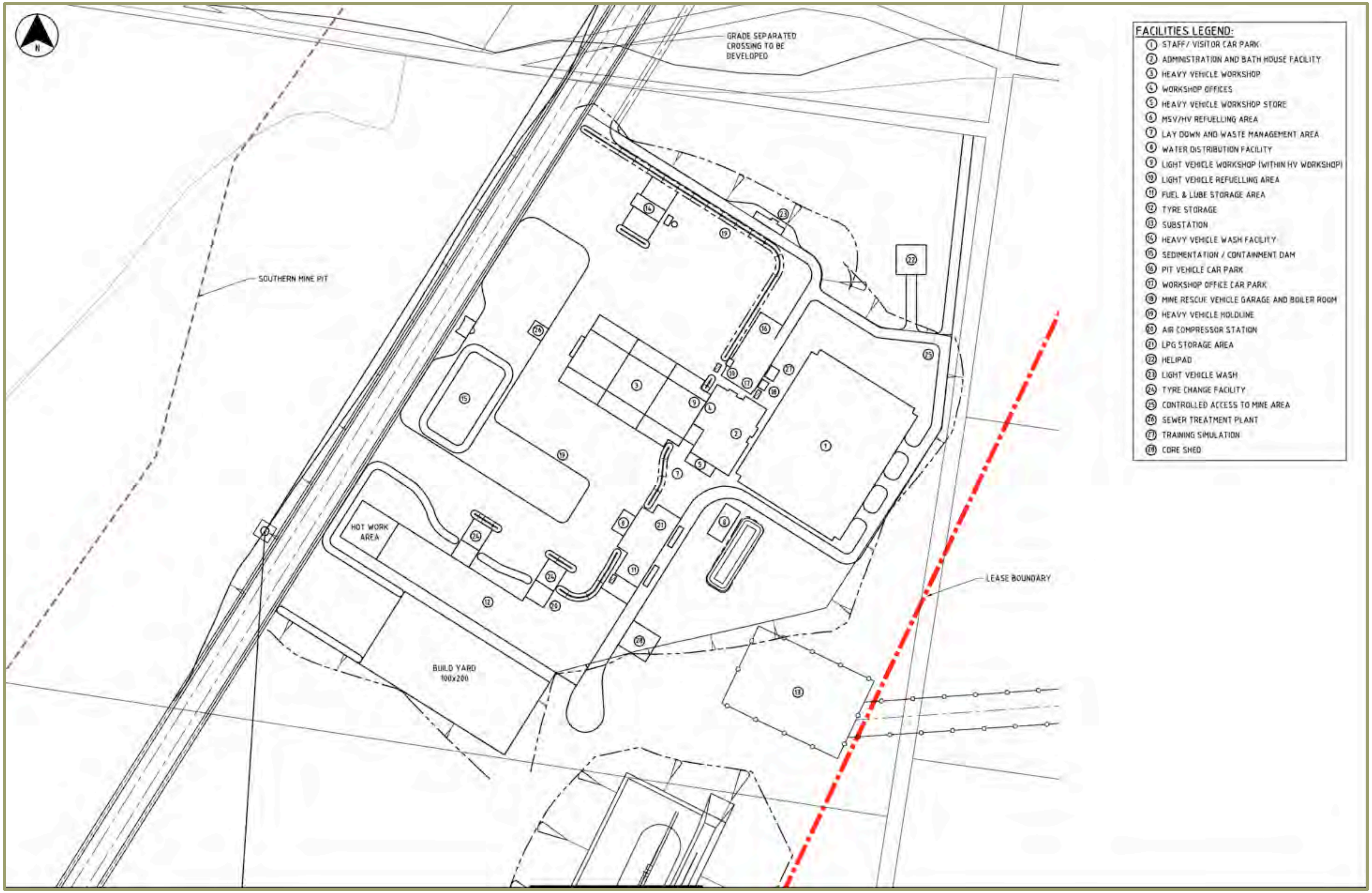


Figure 1-6 Conceptual mine infrastructure layout design

The coal handling system will comprise a single product conveyor and travelling, luffing stacker. The product reclaim system will comprise a reclaim tunnel housing a series of reclaim valves and a reclaim conveyor. The reclaim conveyor will discharge into a batch weight style loadout bin.

1.2.5 Mine waste

Coarse and fine rejects will be conveyed from the CPP to an 800 t capacity rejects bin. Rejects will be discarded in the REF by rear dump trucks. Tailings will be disposed of through tailings cells located within the future mining area. The mining operation will be responsible for rehandling tailings from the cells to be co-disposed with mine waste. Waste rock will initially be disposed of in a OEA located in the north-eastern part of the PAA and designed in part to reduce visibility of the active mine area. Once this area reaches capacity, waste rock will be placed in-pit as mining advances south.

1.2.6 Personnel requirements

The mine will employ about 900 personnel during operations (Idemitsu Australia Resources, 2012). Production employees will work a two- or three-panel rotating roster to allow 24-hour coal production. Some temporary contractor labour may be required from time to time.

1.2.7 Water management

The main water demands during Project operation are related to CHPP operations, industrial water and dust suppression (Idemitsu Australia Resources, 2012). In sourcing water for these demands, the following water management strategies are being considered by the Project (Idemitsu Australia Resources, 2012):

- Minimal water extraction from the Hunter River;
- Pumping of bulk raw water from a void at the Muswellbrook Coal Mine for reuse;
- Diversion of incidental rainfall runoff away from operational areas;
- Sedimentation control prior to the release of mine affected water; and,
- Rainfall collection from MIA roofs for reuse as appropriate.

The Project will minimise its 'water-footprint' by utilising mine-affected water from the Muswellbrook Coal Mine. This strategy relies on bulk water transfer from a void at that mine, to a storage dam at the Project. The size of this storage dam will be based on the ultimate peak production ROM capacity requirement of the Project but may be up to 500 ML (Idemitsu Australia Resources, 2012). This strategy will be further detailed in the EIS.

1.2.8 Power supply

The Project proposes to source its power from the existing Energy Australia power system. A 66 kV switching station will be constructed near Kayuga Road and a 66 kV power line will be erected to the Project site. Distribution substations will be positioned at points of power demand to provide 415 V supply to main switchboards. Remote sites such as water pumps, coal terminal and electric shovels will be supplied by 11 kV overhead power lines (Idemitsu Australia Resources, 2012).

1.2.9 Sewage treatment

The Project will have an on-site sewage treatment plant with a capacity based on an allowance of 47 litres per person per day. The plant will likely produce effluent of a class B grade. The effluent will be disposed of by means of subsurface irrigation (Idemitsu Australia Resources, 2012), potentially to assist with land rehabilitation.

1.2.10 Transport and logistics

Saleable coal produced by the Project will be transported by rail to Port of Newcastle for shipping to destination markets overseas. A rail spurline and load out area will be constructed. The spurline includes a balloon loop and will extend from the CHPP south along the alignment of Sandy Creek (South) before joining the Muswellbrook-Ulan rail line (Idemitsu Australia Resources, 2012).

The Project will be able to directly access the Hunter Valley Coal Chain (HVCC). The Capacity Framework Agreement 2009 (CFA) between Newcastle Port Corporation (NPC), Port Waratah Coal Services (PWCS) and the Newcastle Coal Infrastructure Group (NCIG) provides for the long-term solution of access and expansion of export capacity at the Port of Newcastle. Long-term contracts with port, above rail and below rail service providers will be necessary in order for the Project to secure export capacity (Idemitsu Australia Resources, 2012).

An approved Project will be able to nominate for port capacity through the CFA process. Depending on the availability of port capacity at the time, the CFA provides for a four-year lead-time on the provision of port capacity. Access to the Australian Rail Track Corporation's (ARTC) rail track network will also be necessary to access the port. A number of rail service providers operate in the HVCC but Pacific National and QR National are dominant. Pacific National is the current rail service provider for existing Idemitsu operations at Muswellbrook and Boggabri coal mines (Idemitsu Australia Resources, 2012).

Linear infrastructure outside the PAA is not a component of this Gateway Application.

1.2.11 Rehabilitation

Progressive rehabilitation will be undertaken throughout LoM to minimise noise, air and water quality and visual impacts. The OEA will be reshaped and revegetated to ensure stability and enhance visual amenity. Rehabilitation of in-pit waste rock will continue through LoM following the progression of mining southward.

Prior to mine closure, the highwall and lowwall will be battered back to a grade that provides an appropriate geotechnical engineering safety factor. At cessation of open-cut mining, a single void will remain in the south of the PAA. Groundwater levels in the void are expected to reach equilibrium, forming a residual water body. Infrastructure will be removed from the MIA and land remediated as required.

1.3 Project alternatives

1.3.1 Mining method

Five mining strategies were assessed including strip mining and terrace mining of two and three pit options for production of 5, 7.5, 10, 12.5 and 15 Mtpa. The 15 Mtpa, two consecutive pit, terrace method over a 30-year LoM option was favoured. Compared and contrasted with dragline strip mining, terrace mining has known advantages with respect to minimising direct and indirect impacts on strategic agricultural land. To name a few of these advantages, terrace mining:

- Requires a smaller initial box-cut and therefore, out-of-pit overburden emplacements have smaller disturbance footprints;
- Delivers final landform surfaces sooner, with less re-shaping requirements;
- At all times has a smaller active mining area;
- Leaves a smaller final void, if necessary;
- Provides greater ability to control dust from mining operations as draglines are not used; and,
- Can have smaller mining-benches, requiring smaller explosive loads to fracture overburden rock and therefore, lower potential air-blast and ground vibration impacts.

1.3.2 Out of pit waste rock disposal

Out-of-pit waste rock disposal space is constrained due to the widespread nature of the coal resource in relation to the PAA boundaries (Idemitsu Australia Resources, 2012) and also Government SAL mapping. Only two viable out of pit OEA locations were identified. The OEA in the northeastern corner of the Project area was preferred and sufficient space was achieved for all mine options to dispose of waste rock in this location (Idemitsu Australia Resources, 2012).

1.3.3 Coal handling and processing

The siting of the CHPP and MIA was developed considering the following localised requirements (Idemitsu Australia Resources, 2012):

- The CHPP and MIA were located adjacent to the eastern PAA boundary near Castle Rock Road;
- The western boundary of the CHPP area and MIA was restricted by the proposed mine plan and, as such, was identified as Sandy Creek (South);
- The rail loop location and rail line route had to minimise interactions with the adjacent mining lease to the east of the PAA;
- The ROM pad was located adjacent to an existing hill, thereby reducing bulk earthworks;
- The rejects bin was associated with the ROM pad construction;
- The CHPP was positioned approximately 10 m higher than the lowest ground contour to minimise flooding risks;
- The rotational position of the product stockpile was optimised to minimise bulk earthworks;
- The conveyor was developed to remain parallel to the product stockpile orientation, positioned at the ROM pad level to assist mining operations; and
- Standard designs and equipment selections used for Idemitsu's Boggabri Coal Mine were utilised where applicable.

1.4 Project assessment area (PAA)

The PAA for this Gateway Application has been defined in accordance with the interim BSAL verification protocol (OEH and OFS&FS, 2013). It includes the future Development Application area and an approximate 100 m buffer to allow for potential minor design amendments. Verified-BSAL, contiguous with potential-BSAL outside the PAA, has also been identified. The PAA has a total area of 5,621 ha, which is about 70% of the available AL area.

Correctly, technical studies that support this Gateway Application have extended analyses beyond the PAA as follows:

- Richards (2014) for verification of BSAL, the PAA and additional areas of contiguous mapped potential BSAL; and,
- McAlister and Dvoracek (2014) in consideration of potential impacts to highly productive groundwater resources, an area extending 5 km from the PAA.

The PAA excludes linear infrastructure associated with the Project because these corridors do not require a mining lease and therefore do not fall within the definition of "mining or petroleum development" under clause 17A of the Mining SEPP. Linear infrastructure includes electrical power, water supply, and rail and road infrastructure. Linear infrastructure development does not require a Gateway Certificate and has been excluded from this Application. Potential impacts associated with these development activities will be identified and assessed in the EIS.

2 REGIONAL AGRICULTURAL OVERVIEW

Following is a detailed synthesis of available information relating to agricultural resources, industries, enterprises, production and support infrastructure within the broader region. This region is defined as the Upper Hunter region, specifically the Upper Hunter and Muswellbrook Local Government Areas (LGAs) (DP&I, 2012) within the upper catchment of the Hunter River. The Hunter is the largest coastal catchment in NSW, with an area of about 21,500 square kilometres.

2.1 Upper Hunter region

In the Strategic Regional Land Use Plan (SRLUP), DP&I (2012) describe the Upper Hunter region as an area of 2.18 million ha, comprising the five LGAs of Singleton, Muswellbrook, Dungog, Upper Hunter and Gloucester. The Upper Hunter LGA is the largest by area, covering an area similar in size to the remaining LGAs combined. A variety of landscapes and climates in the region support a diverse range of agricultural activities, however beef cattle grazing predominates (DPI, 2013b; ABARES, 2013). The Project is located in both the Upper Hunter LGA and the Muswellbrook LGA.

In 2011 the Australian Bureau of Statistics (ABS) completed the most recent census of agricultural commodities, production and gross value for the region (Table 2.1). This data reveals approximately 89% of agricultural land within the region is used for grazing livestock and the Muswellbrook LGA produces the most wine while the Upper Hunter LGA has the most horses (ABS, 2012). The value of agricultural production for the region has been determined through compilation of various ABS data (Table 2.2).

The region features established economic clusters of the equine and viticulture industries (DP&I, 2012). The region is variably estimated to provide from 67% (DPI, 2013c) to 80% (DP&I, 2012) of all stud horses exported from Australia. It is an internationally acclaimed and mature thoroughbred-breeding cluster (DPI, 2013c). Most of the State's horses and studs are located in the region (Table 2.2).

The Upper Hunter region produces about a third of all wine grown and made in NSW. Vineyards contribute to the landscape values of the region, and wine tourism additionally injects $1.8 billion annually into the state economy (DPI, 2013d). As highlighted by DPI (2013b), reported agricultural production and economic contribution from the region, e.g. ABS data, typically excludes stud horses and grossly undervalues the contribution of viticulture.

2.2 History of agricultural development

Settlement in the Upper Hunter region began in the 1820s, with parcels of agricultural land in the surrounding locality first surveyed for allocation to early settlers in 1824 (MSC, 2014). Original landholdings were deliberately large. Land grants were made on the basis of '*640 acres (250 ha) for each 500 pounds sterling they possessed in cash or goods*' or by leasehold '*so that, by means of grant, purchase and lease, some settlers were able to build up very large estates*' (Turner, 1995). Smallholdings were rare at this time.

An 1825 census indicates that of the 191 large estates, that is, estates greater than 1,000 acres (404 ha) size, occupying the Hunter Valley, two-thirds were cattle enterprises and only one-third sheep. At this stage, the townships of Muswellbrook and Aberdeen had been established (Turner, 1995).

Table 2-1 Agricultural production for each LGA in the Upper Hunter Region (adapted from ABS, 2012)

Statistic	Dungog	Gloucester	Singleton	Muswellbrook	Upper Hunter	Region
Area of agricultural land (ha)	125,406	128,804	148,759	105,548	586,926	1,095,443
Grazing area (total) (ha)	115,307	108,602	127,525	88,176	534,899	974,509
Cropping area (total) (ha)	3,140	724	8,020	6,653	36,899	55,436
Poultry (total) (no)	926,315	66	223,432	3,426	111	1,153,350
Pigs (no)	26	3	125	16	261	431
Sheep (no)	678	155	607	2,957	190,408	194,805
Dairy cattle (no)	8,306	5,341	6,629	10,546	7,674	38,496
Beef cattle (no)	51,974	49,758	46,685	34,500	182,963	365,880
Grapes, wine area (ha)	23	1	547	883	130	1,584
Vineyards (no)	5	1	56	18	4	84
Grapes, wine production (t)	1,526	6	1,861	2,819	503	6,715
Grapes, wine yield (t/ha)	6	7	3	3	4	5
Horses, stud (no)	250	187	651	3,546	4,944	9,578
Horse studs (no)	30	13	39	38	112	232
Horses, other (no)	761	630	806	517	2,703	5,417

Note: Some total values may not sum accurately due to rounding.

Table 2-2 Gross value of agricultural production for each LGA in the Upper Hunter Region (adapted from ABS, 2013[1-8])

Statistic	Dungog	Gloucester	Singleton	Muswellbrook	Upper Hunter	Region
Agricultural production total gross value ($M)	52	29	37	38	100	256
Crops, total gross value ($M)	3	2	6	6	21	38
Livestock, slaughtering ($M)	35	18	20	16	62	151
Livestock, products ($M)	14	8	12	16	18	68

Note: Some total values may not sum accurately due to rounding.

2.2.1 Beef, grain and dairy

By the 1890s, dairying had established as an important industry in the area. In 1893 a creamery was built at Kayuga, in 1903 one at Overton, and in 1907 the Denman Cooperative Dairy Company was founded. In 1919, the Muswellbrook Dairy Cooperative Factory was built (Turner, 1995).

After both World Wars, larger landholdings were split into smaller lots and returned soldiers were encouraged to the area. Following the First World War, until about 1980, dairy farming dominated agriculture in the Upper Hunter region. However, drought in the 1980s and market deregulation in the 1990s saw the dairy industry decline significantly. The Denman dairy factory closed, as did the dairy factory in Muswellbrook. Following dairy's decline, beef cattle grazing now dominates regional land use (Turner, 1995) (Table 2.1).

The closet town to the PAA in Muswellbrook LGA is Muswellbrook, declared a township in 1833. The 'rich soils' surveyed by Dangar in 1824 resulted in Muswellbrook being established as a farming centre (MSC, 2014). By 1841 Muswellbrook had a flourmill, indicating the prominence of wheat cropping in early agriculture. Wool, wheat and cattle were the main agricultural enterprises in the early years and the centrepiece of the local economy (MSC, 2014). The railway was constructed in 1869 and resulted in significant expansion of the township (Plate 2.1).

Plate 2-1 Bridge Street, Muswellbrook in the late 1800s (left) and the Royal Hotel, Bridge Street, Muswellbrook in 1930 (right) (Upperhunter.org, 2014)

The first coal mine in the region was established in the 1890s using underground methods. In 1908 coal was discovered on the Muswellbrook town common by Mr. Harry Jeans, which led to the formation of the original Muswellbrook Coal Company (Upperhunter.org, 2014). In 1944 open cut mining began in the area (Muswellbrook Chronicle, 2013).

The closest town to the PAA in the Upper Hunter LGA is Aberdeen to the east, established in 1828 at the request of English landlord Major Thomas Macqueen and named after his friend the fourth Earl of Aberdeen, Scotland (Upperhunter.org, 2014). Aberdeen is sited on the Hunter River and by 1840 a steam-driven mill had been built, with residents in the surrounding region travelling with their grain to the site. The existence of the mill and butter factory in Aberdeen is evidence of the well-established agricultural practices in the region. The Aberdeen railway line was opened in 1870 (MSC, 2014).

Of significance to agriculture in the area was the commencement of operations of the Australian Chilling and Freezing Co. in Aberdeen in 1891. It operated for more than 100 years as an abattoir, at various times processing sheep and lamb, beef, rabbits, pigs and butter, with chilling that allowed products to be transported great distances (UHSC, 2014). It closed in 1999 due to processing costs (UHSC, 2014) (Plate 2.2).

Plate 2-2 Aberdeen Chilling and Freezing Co. Works, circa early 1900's

Dartbrook Estate, a cattle property located to the west of Aberdeen, is where the Australian Blue Heeler was dog was originally bred. Lake Glenbawn to the north east of Aberdeen was named after a property that stood on what is now the bottom of the dam. The area below the dam wall, known as the Central Area, was built between 1954 and 1957 to help regulate the flow of water into the Hunter River and usage of water for stock, and for domestic and irrigation requirements for the areas south of Lake Glenbawn (MSC, 2014).

2.2.2 Equine

Horses, generally comprising colonial-bred work horses, were needed to manage the land grants in the Hunter Valley that were opened up for free settlement in the 1820's. The geomorphology of the area favoured the spread of settlement and as a result the demand for workhorses increased (White, 2005). Between 1824 and 1840 there was a noticeable increase in the number and standard of the horse population in the region, with mares and stallions being brought to Australia from England and Ireland. Prior to this, Arab and Persian stallions had been brought in from India (White, 2005).

The introduction of pedigreed thoroughbreds to the Hunter Valley is attributed to brothers Robert and Helenus Scott, who brought horses from England and equine knowledge gained in India to the region. Through land grants, the Scott brothers established the property 'Glendon'. By 1832 there were more than 300 blood horses at Glendon, with horses being bred for racing, saddle and harness (White, 2005).

The Australian Agricultural Company (AACo) was also influential at the time, buying, breeding and selling thoroughbreds and work horses, as well as sheep and cattle. Regular company horse stock sales in Maitland permitted '*an infusion of bloodlines into the horse progeny of the colony…*'. Pedigreed horses, successful on the regions' racetracks, often carried AACo bloodlines (White, 2005).

Hunter Valley settlers were selective and bred horses for various purposes, gradually evolving horses with stamina suitable as roadsters and eventually to race. Important studs in the early 1800s included Kayunga and Edinglassie near Muswellbrook, Segenhoe near Aberdeen, and Yarrandi near Scone (White, 2005).

Segenhoe Estate was granted in 1825 and initially owned by English landlord Major Thomas Potter Macqueen, Member of Parliament for Bedfordshire (Plate 2.3). The estate was managed by agent Peter McIntyre on behalf of Major Macqueen and funded by British capital. Although the management of Segenhoe had focused on sheep and cattle, McIntyre bought the stallion Crawford and stood him at Segenhoe in 1827 for a service fee of eight guineas. By 1833 the estate had 63 horses. The stallions Young Crawford, Abjer and Spaniel also stood for stud purposes at Segenhoe around this time (White, 2005). Mismanagement and promotion of selfinterest by the agent McIntyre, and later agent Hamilton Collins Sempill, resulted in the decline of Segenhoe, followed soon after by the bankruptcy of Major Macqueen. Stock was sold over two days in January 1838 with many of the horse bloodlines reverting to the predominant McArthur family property at Camden Park, south of Sydney (White, 2005).

Plate 2-3 Segenhoe homestead occupied from 1831 (left) and Segenhoe Inn (established 1837) (right) (Upperhunter.org, 2014)

During the depression of the 1840s horse breeders in the Hunter Valley survived financially by selling horses to the British cavalry in India. Country race meetings became significant social occasions distracting the population from the failing economy and drought. Racetracks in each town became the focal point of entertainment. The first race meeting held in the Upper Hunter region was at Scone in 1842 (White, 2005).

Despite the drought and depression, the early 1840s saw a strong demand for horses with the public becoming more involved in the trading and breeding of horses as a result of the popularity of racing. However, by 1849 some local stud thoroughbred owners dispersed their studs. Glendon and Belford studs were forced to disband, resulting in the sale of great bloodlines into the general market at deflated prices (White, 2005).

In 1861 the Melbourne Cup and the Australian Jockey Club's Derby were introduced, with the prestige race attracting stud breeders from the Hunter Valley. The expansion of the railway north into the Upper Hunter at this time opened up the area and increased attendance at regional agricultural shows. Horse breeders began to show their horses for prize money and to improve reputation to a greater degree than before (White, 2005).

At the same time the increase in feral horse numbers and overwork of horses in the region resulted in a decline in the general quality of horses, although the standard of pure thoroughbred blood horses was less affected (White, 2005). Government involvement and standards set by the agricultural shows helped improve horse quality, as did active involvement of prominent individuals.

During the final decade of the 1800s, and based on the reputation and characteristics of the horses, the Australian and British Governments sourced horses and horsemen directly from the Hunter Valley to serve in the Boer War in South Africa. These men were known as the Hunter Valley Lancers. At this time, Hunter Valley racehorses were also in demand by the American 'nouveax riche' of the industrial era in the United States, whose wealth was acquired through gold, silver and copper mining (White, 2005).

Of later significance to the region is Kia-Ora horse stud, located to the north of Aberdeen. Founded in 1912, Kia-Ora horse stud has produced many past Melbourne Cup winners. Darley Kelvinside near Scone is a key component of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Prime Minister of the United Arab Emirates, global Darley thoroughbred enterprise. Darley Kelvinside is operated in conjunction with Darley Woodlands located southeast of Denman.

2.2.3 Viticulture

The Hunter Valley is Australia's oldest wine growing region. Vines were first planted in the area in the early 1820s from cuttings brought to NSW by James Busby (NSW Wine, 2014). By 1823 approximately 20 acres of vineyards had been planted in what is now the Dalwood/Gresford area between Maitland and Singleton (NSW Wine, 2014). Busby brought approximately 500 vine cuttings from Europe and South Africa. Subsequently, William Kelman planted a replica set of more than 300 varieties from the Busby collection and it was from this stock that the Hunter Valley viticulture industry was largely developed (Mount Pleasant Wines, 2014). By 1840 the Hunter Valley's registered vineyard area exceeded 500 acres and in 1847 the Hunter Valley Viticultural Association was formed, representing growers and winemakers in what is today the Lower Hunter (Visit Vineyards, 2014).

George Wyndham of Dalwood, William Kelman of Kirkton and James King of Irrawang were early pioneers in winemaking in the Hunter Valley. In 1855, a sparkling wine from James King's Irrawang Vineyard was served to Napoleon III at the Paris Exhibition in France. Its appreciative recipients deemed it to have '*bouquet, body and flavour equal to the finest Champagnes*' (Visit Vineyards, 2014). The Tyrrell, Wilkinson and Drayton families became significant to winemaking in the latter part of the 19th century, as did the work of Dr Henry Lindeman (HVWIA and HVWCT, 2014).

The earliest evidence of grape growing in the Upper Hunter dates back to 1860 when vines were planted at the meeting of Wybong Creek and the Goulburn River (MCS 2013b). Commercial viticulture in the Upper Hunter is considered to have commenced in 1960 with the establishment of a 250 ha site at Wybong by Penfolds Wines (Visit Vineyards, 2014). Wine brands with significant history in the Upper Hunter region include Penfolds, Richmond Grove, Arrowfields, Tyrells and Rosemount (MSC, 2013).

2.3 Key agricultural infrastructure

Agricultural industries rely on local and regional infrastructure and services for a range of requirements including to access sale yards, abattoirs, supplementary grain supplies, processing facilities and to move produce to domestic and export markets. Reliable water and electricity supply as well as storage facilities are also essential (DPI, 2013b). The two major selling centres for beef cattle in the area are Scone and Singleton. There is also a selling centre in Denman and a large number of agents and livestock carriers around Scone, Muswellbrook and Singleton.

Key elements of upstream and downstream services and infrastructure have been identified for beef cattle production and general agriculture in the region (Table 2.3).

Table 2-3 Example agricultural support services and infrastructure

Element	Type	Example
Support businesses	Agronomy	Windmill Agribusiness, Muswellbrook; K-Far Rural Services, Singleton; Landmark, Scone
	Stock and station	Edward Higgens, Parkinson & Co, Muswellbrook and Denman; MacCallum Inglis, Scone; Landmark Townsend, Scone; Davidson Cameron Clydsdale & Co, Scone; Roger Fuller, Singleton; RM Property and Livestock, Merriwa and district.
	Rural supplies	Pursehouse Rural, Muswellbrook; Farmers Barn, Muswellbrook; Dairy Farmers Country Store, Muswellbrook; Scone Rural Supplies, Scone; Kermodes Rural and Diary, Singleton.

Element	Type	Example
	Farm machinery	Denman Dapkos, Denman; O'Brien's Machinery, Scone; Flint's Farm Machinery, Scone; Valley AG & Tractors, Singleton.
	Transport	Kelbaka Haulage, Muswellbrook; Mobbs Haulage, Scone; Martin Gordon Bulk Haulage, Scone.
Soft support infrastructure	NSW Government Policy	Upper Hunter Strategic Regional Land Use Plan
	Local Government	Land Use Development Strategy - Muswellbrook Shire Council 2012; Muswellbrook Shire Development Control Plan 2009; Muswellbrook Local Environment Plan 2009; Upper Hunter Local Environmental Plan 2013.
	Education	TAFE Hunter Institute, Muswellbrook and Scone; Tocal College, Paterson.
Hard support infrastructure	Transport	Golden Highway (B84); New England Highway (A15); Newcastle Werris Creek rail corridor (Main Northern railway line); Muswellbrook Ulan rail corridor (South railway line); Scone Airport.
	Livestock carriers	J.C. Thomas Livestock Transport, Muswellbrook; numerous livestock carriers in Scone and Singleton.
	Livestock selling centers	Scone and Upper Hunter Regional Saleyards; Singleton Regional Livestock Markets; Denman Saleyards.
	Livestock abattoirs	Primo Scone Abattoir, Scone; E C Throsby Pty Limited, Whittingham.
	Markets	Muswellbrook Markets and Poultry Auction; Denman Market.

2.3.1 Transport Routes

Transport routes critical to agriculture, including the viticulture and equine CICs, include the Golden Highway (Route B84) and the New England Highway (Route A15). Denman Road is a key road linking these two highways to the southwest of Muswellbrook. The Newcastle Werris Creek rail corridor, the Main Northern railway line, is the primary rail route in the region.

The New England Highway runs from Hexham in Newcastle to Yarraman near Toowoomba in southern Queensland. It has a total length of 887 km and is an essential part of the Sydney to Brisbane national highway route. As a national highway, the Commonwealth Government is responsible for its repair and maintenance. The New England Highway (A15) carries about one third of the total freight carried on either the Pacific (M1) or Hume (M31) highways. The New England Highway links Muswellbrook, Aberdeen and Scone, carrying about 8,400 vehicles per day (RMS, 2014).

The nearest NSW Department of Roads and Maritime Services (RMS) tourist route is Tourist Route 33. Although this route commences in Calga at the Sydney-Newcastle freeway and stops at Braxton, tourists can directly access the Upper Hunter region from Branxton by travelling along the New England Highway (Rands, 2014).

More locally, the Muswellbrook-Denman Drive is a tourist self-drive tour that takes in a number of wineries in the area (UHCT, 2013). Existing public roads within the vicinity of the PAA consist of a network of predominantly rural roads maintained by local councils (Idemitsu Australia Resources, 2012).

In March 2014, the NSW Government released the Hunter Regional Transport Plan (Transport for NSW, 2014). Amongst other initiatives, this document outlines specific planned actions by NSW Government to address air, road and rail transport challenges within the Upper Hunter region.

2.4 Natural resources

2.4.1 Geology and geomorphology

The geology of the Upper Hunter region commences in the Carboniferous period (oldest) with the New England Fold Belt, characterised by a complex folding and faulting structure (DP, 2005). The geological formations of the Permian period that followed include, in order of age:

- Terni Formation comprising sandstone, conglomerate, siltstone and poor quality coal;
- Werrie Basalt comprising basaltic pyroclastic deposits and associated lava flows;
- Lower Coal Measures (Koogah formation) consisting of sandstone, conglomerate, siltstone and coal;
- Marine Sequence (Bickham Formation) comprising sandstone with carbonate cement, shales and occasional conglomerates; and,
- Upper Coal Measures (Wollombi Coal Measures and Wittingham Coal Measures) consisting of conglomerate, sandstone, siltstone, claystone, tuff and coal.

Within the Upper Coal Measures, the Western Domain includes the alluvial systems associated with Dart Brook and Middle Brook and the undulating lands where the Upper Coal Measures outcrop. It also includes the topographically high hills and plateaus. The major structural units within this domain include a series of thrust faults, sub-parallel to the Hunter Mooki Thrust Fault, located along the line of the Dart Brook and Middle Brook water courses (DP, 2005).

The Narrabeen group from the Triassic period comprises massive conglomerates and sandstones. The Jurassic and Tertiary geology is characterised by intrusives and extensive areas of basalt (Liverpool Range Beds). The Quaternary geology comprises mainly alluvials (unconsolidated silts, sands and gravel), significant in the Upper Hunter region as resulting in productive agricultural areas (DP, 2005).

The Upper Hunter region is categorised into four geomorphological units:

- Remnant Plateau;
- Plateau Slopes;
- Rugged and Hilly; and
- Undulating Plains.

The unit Undulating Plains is predominantly associated with the Hunter River and its main tributaries, i.e. Dart Brook, Middle Brook and Kingdon Ponds. The upper reaches of those tributaries are located in the Plateau Slopes of the Liverpool Range. The majority of the Upper Hunter region is categorised as Rugged and Hilly (Shellberg and Brooks, 2007). The broader area between Aberdeen and Muswellbrook comprises Undulating Plains (undulating alluvial floodplains) in the vicinity of the Hunter River and Dart Brook, surrounded by Rugged and Hilly terrain. Further west of the PAA the geomorphology is described as Plateau Slopes associated with the hills and mountains of the Great Dividing Range (Shellberg and Brooks, 2007).

The Project proposes to mine coal seams in the base of the Lower Wollombi Coal Measures and the top of the Whittingham Coal Measures. The Abbey Green seam is the lowest seam of the Wollombi Coal Measures subcrop on the western side of the deposit. The upper part of the Wittingham Coal Measures, the Jerry's Plains Subgroup, contains 15 formally named coal seams (Idemitsu Australia Resources, 2012). The top seams (Whybrow, Redbank Creek, Wambo, Whynot and Blakefield), subcrop progressively from the eastern edge of the AL and are suitable for open cut mining. Excavation will follow the strike of the deposit to the north and then as it dips gently to the west (Idemitsu Australia Resources, 2012).

2.4.2 Topography

At a broad regional level and generally, the Upper Hunter has four regional landform units:

- Liverpool and Mount Royal Ranges (including Barrington Tops), with slopes often greater than 30%;
- Merriwa Plateau and Goulburn Valley, with slopes generally less than 3%;
- North Eastern Foothills; and
- Central Lowlands.

The Liverpool Ranges, Mount Royal Ranges and Barrington Tops in the north and northeast of the valley form the headwaters of the Hunter River. Dart Brook, Middle Brook and Kingdon Ponds also rise in the Liverpool Ranges at an elevation of about 1,000 to 1,200 m (DP, 2005), flowing south from the Liverpool Ranges foothills to converge with the Hunter River at an elevation of approximately 160 m Australian Height Datum (AHD).

The Merriwa Plateau is derived from weathered basalt. The Goulburn Valley to the south has softer sandstones forming broad open valleys. A sandstone escarpment and plateau forming the Wollemi National Park defines the south-western part of the Upper Hunter region.

The north-eastern part of the Upper Hunter region is a hilly and low mountainous area derived from hard sedimentary rocks and lava. It extends from Mount Royal and Barrington Tops to the central part of the valley. The Central Lowlands extend from Murrurundi to Branxton and were formed from relatively weak Permian sediments.

The topography of the PAA is defined in the west by a series of major hills and ridgelines steeply eroded by creek lines, and by an escarpment that includes Blackjack Ridge and Rossgole Plateau. Elevations vary along the escarpment from approximately 500 m AHD on the plateau to approximately 250 m AHD on the lower catchment along a horizontal distance of around 500 m. Towards the east the PAA is defined by a series of rolling hills that slope down towards the Hunter River floodplain (Idemitsu Australia Resources, 2012). Topographical contours of the surrounding locality are provided (Figure 2.1).

2.4.3 Landscape Values

The Upper Hunter region retains substantial natural heritage with nearly 60% of the area covered by native bushland (DP&I, 2012). Significant visual and aesthetic attractions in the region include Lake Glenbawn to the northeast, Barrington Tops National Park to the east, Lake Liddell to the southeast, and Manobalai Nature Reserve, Goulburn River National Park and Wollemi National Park to the west. The area has significant natural heritage landscape value and high visual amenity. This amenity and the region's proximity to Sydney, Australia's largest city, encourage tourism and the development of tourism infrastructure (DP&I, 2012).

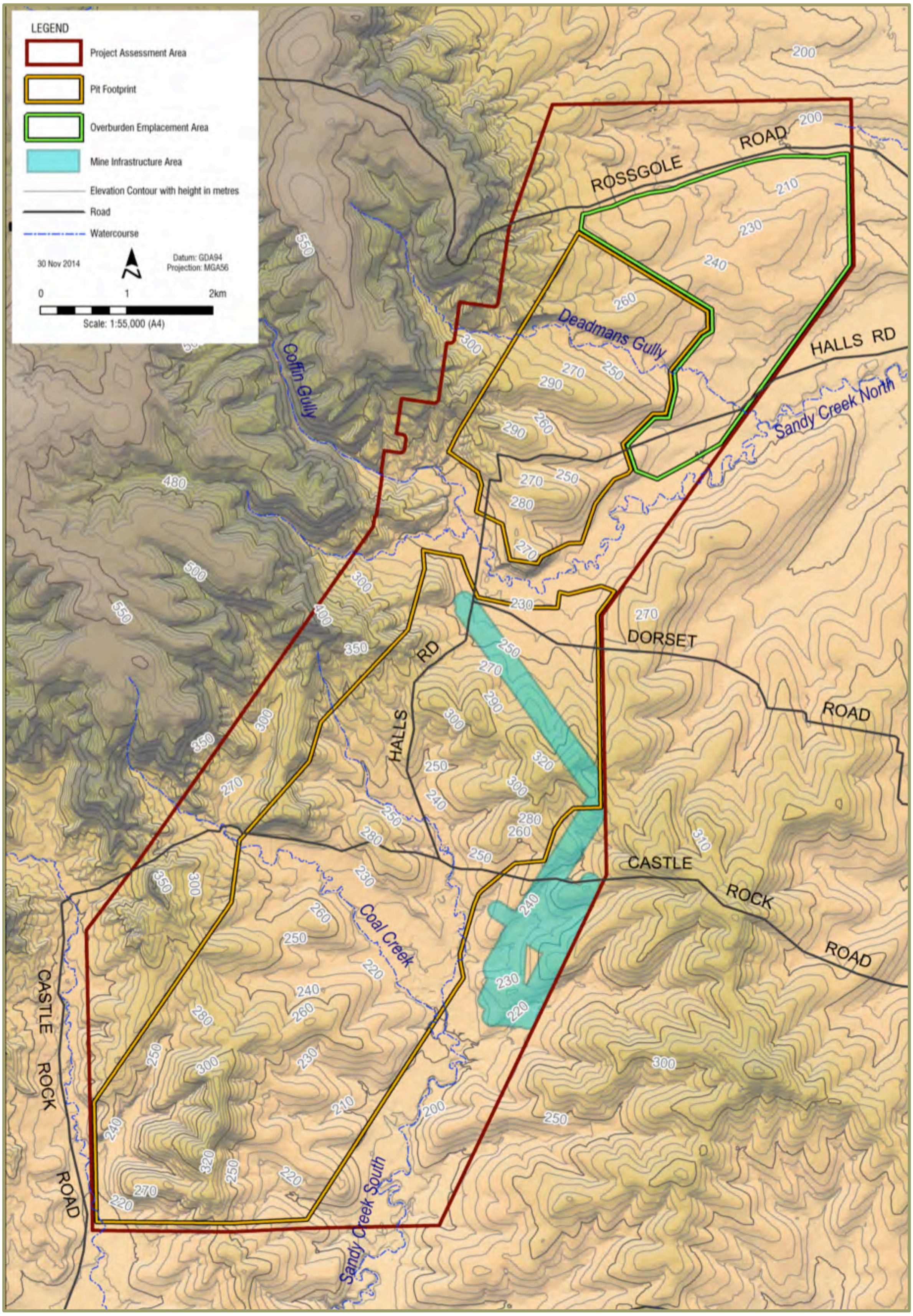


Figure 2-1 Topographic contours of the PAA

2.4.3.1 Equine

The physical landscape is important to the thoroughbred horse breeding industry in the Upper Hunter region. The combination of "*uncleared, naturally vegetated and complexly eroded steep hills as a backdrop, cleared steep to undulating grassy side slopes, and the manicured patchwork of intensively used lower slopes and river flats, with their grid-work of post and rail fenced paddocks, natural riparian landscapes of the Hunter River course, cultural vegetation, houses and other buildings, creates a landscape for the studs that is both distinctive and of substantial intrinsic scenic quality*" (Lamb, 2013). These landscapes exhibit certain values that are intrinsically linked to equine stud and CIC economics, as follows:

- Rural idyll – Conveys, via an image of a well-maintained property, the message that the stud is organised and caring, with the care shown in the landscaping transferred into care for the horses, i.e. the owner's investment;
- Landscape of conspicuous consumption – Projects an image of status and wealth to attract similarly wealthy customers. Those 'allowed' to participate are special and part of the 'experience' economy, where the desirability of experience is paramount;
- Brandscapes – Encompasses the engineered landscape, the stud name, prestige and reputation and contributes to the positive customer experience. The brandscape is important at a cluster-level and critical at an enterprise level, particularly to core businesses within the CIC; and
- Landscapes of work – Recognises that these built landscapes of rural idyll, where conspicuous consumption and brandscaping attract the wealthy, are places of work, where maintenance and business expense are enduring and fundamental considerations (McManus and Connor, 2013).

Landscape values are engineered at considerable expense by individual studs, designed to demonstrate high standards of thoroughbred racehorse production and management in a manicured and cultured landscape. Extensive consideration is given to the size and character of paddocks and fencing, grouping of farm infrastructure and buildings, interconnection of fenced spaces, impressions given by entranceways and landscaped areas, and to maintaining open views in all directions (Lamb, 2013). Although disproportionate, the cost incurred by individual studs within the CIC in promoting these landscape values generates a positive externality enjoyed by the whole CIC.

Potential impacts of the Project on equine landscape values are discussed in Section 4.3.5.

2.4.3.2 Viticulture

Wine heritage and reputation, attractive rural landscapes and accessibility are key factors in supporting a vibrant domestic and international wine tourism sector (DPI, 2013d). Land used for viticulture enterprises within the Upper Hunter region generally has the following features:

- Reliable access to low salinity water sources for irrigation;
- Well drained soils with moderate slopes;
- Can support diverse grape varieties and wine styles; and
- Experiences a temperate climate and suitable microclimate, e.g. low frost risk and moderate evaporation (DPI, 2013d).

The unique topographical features in the Upper Hunter region, particularly in the Muswellbrook LGA, and the favourable climate have contributed to the strength of the Upper Hunter wine industry (MCS, 2012). The attractive setting created by forested backdrops, rural atmosphere and well managed vineyards results in a more rural and relaxed wine experience in the Upper Hunter region than in the Lower Hunter (DPI, 2013d). Branding based on its natural environment and visual landscape attributes, and its proximity to metropolitan areas, is important to the regions' wine tourism (DP&I, 2012).

Potential impacts of the Project on landscape values associated with viticulture tourism are discussed in section 4.3.5.

2.4.4 Soils

Kovac and Lawrie (1991) describe and map the following soil landscapes within the region:

- Alluvial soils - Hunter and Wollombi soil landscapes;
- Shallow soils – Lees Pinch and Ogilvie soil landscapes;
- Red clays – Brays Hill soil landscape;
- Brown clays – Dartbrook soil landscape;
- Soloths – Liddell and Jerry's Plains soil landscapes;
- Brown podzolic soils – Three Ways soil landscape;
- Yellow podzolic soils – Roxburgh soil landscape; and
- Solodic soils – Bayswater, Benjang, Growee and Sandy Hollow soil landscapes.

The Hunter Alluvial soil landscape grouping underlies the floodplains of the Hunter River and its tributaries. This grouping is characterised by brown clays and black earths along watercourses and drainage lines typically adjacent to the Dartbrook and Brays Hill soil landscapes groupings. Red podzolic soils and lateritic soils are known to occur on terraces, with the presence of non-calcic brown soils and yellow solodic soils in some drainage lines.

The Dartbrook soil landscape grouping typically underlies low rolling to undulating hills. This grouping is characterised by prairie soils on the alluvial flats with brown earth intergrades and non-calcic brown soils on the mid to lower slopes. Brown clays with some black and brown earth intergrades are known to occur on mid slopes while red-brown earths are present on upper slopes.

The Liddell soil landscape grouping typically underlies low rolling to undulating hills. This grouping is characterised by yellow soloths and some yellow solodic soils on slopes with earthy and silaceaous sands on mid to lower slopes. Red soloths, solodic soils and podzolic soils are known to occur within the landscape.

Of these soils landscapes, the Hunter Alluvial soil is considered the most agriculturally significant. These soils are typically deep brown/black clays, with moderate to high inherent fertility. With moderate water holding capacity and excellent drainage, these soils are well suited to cropping and irrigation. The extent of Hunter Alluvial is restricted to the floodplains of the Hunter River and its tributaries (DP, 2005). These soils are Vertosols according to the Australian Soil Classification (Isbell, 1992). It is this soil landscape that has been typically mapped as potential BSAL in the region (Figure 2.2).

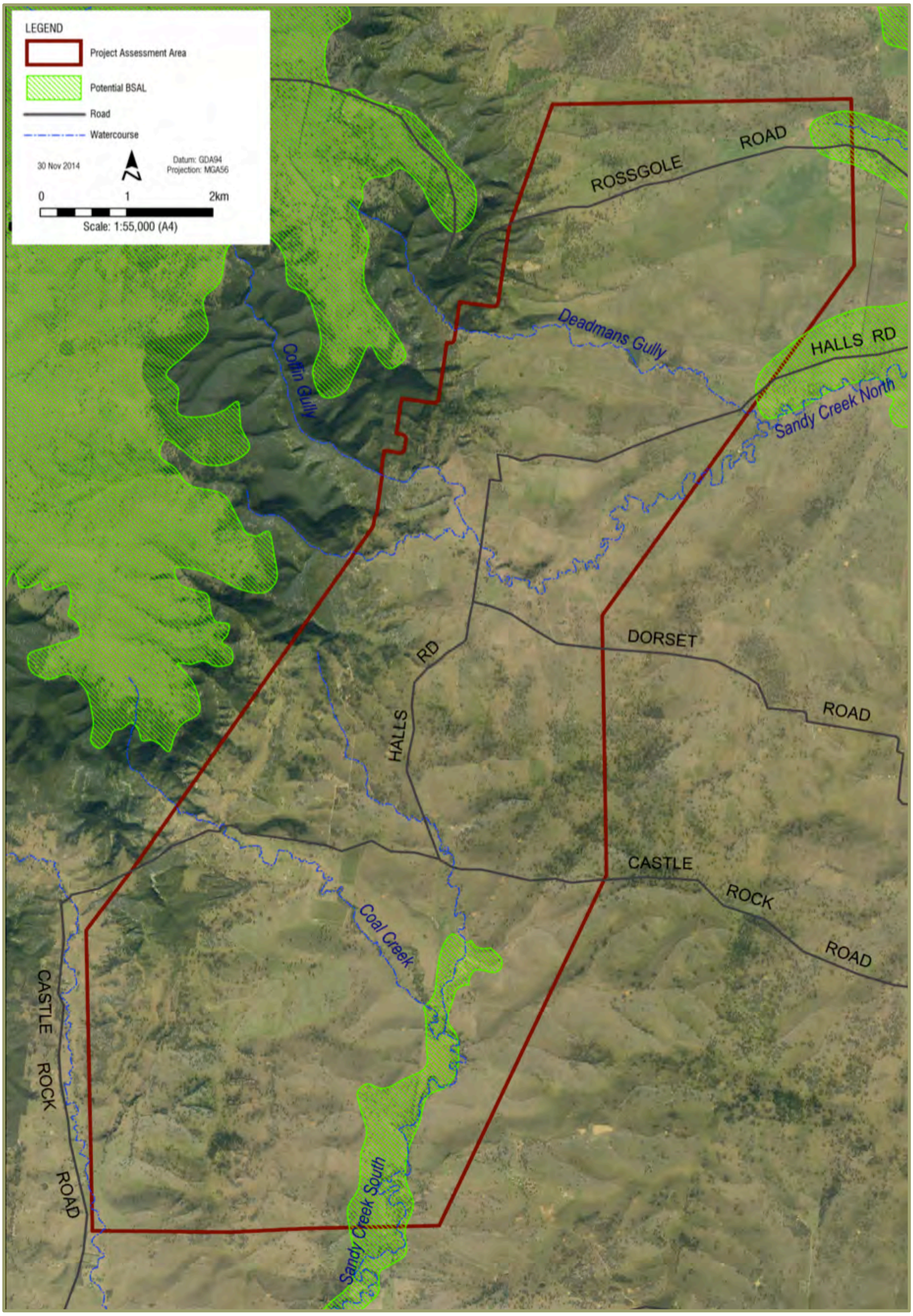


Figure 2-2 Mapped potential-BSAL in the vicinity of the PAA

2.4.5 Climate

The Upper Hunter region has a moderate, sub-tropical climate. In general, summers are hot, winters are cold and rainfall is summer-dominated. Climatic conditions vary across the region due to local topography and elevation, creating microclimates that can affect agricultural productivity.

There are several Bureau of Meteorology (BoM) weather stations in close proximity to the proposed Project, but few have a complete up-to-date set of weather and climate data. The nearest long-term data set for rainfall is Aberdeen (Main Road, #61000), about 5.3 km from the PAA, where recording of observations commenced in June 1894 (BoM, 2014a). Long-term rainfall data for Muswellbrook (Lower Hill Street, #61053), about 12 km away, with records dating to 1875 (BoM, 2014b) is also available. However the nearest complete up-to-date (to 27 June 2013) set of climatic data is at Scone (Philip Street, #61069 – now closed) about 9.5 km north of the PAA (BoM, 2014c).

The combined data sets from the Aberdeen and Scone weather stations are considered appropriate for use here because: the PAA is proximate to each location; more than 100 years of data are available in combination; and the weather and climate statistics important to agriculture are available.

The Upper Hunter region has hot summers and cool to cold winters, and both extremes affect agricultural production. The availability of temperature data is significantly more limited than is rainfall data, and generally only available for the larger population centres. Key climatic variables relevant to agriculture, including temperature, have been summarised (Table 2.4). These climate statistics are for Scone, the administrative centre of the Upper Hunter LGA. Records at this weather station commenced in 1873 and, for some statistics, provide an unbroken 140-year data set (to 27 June 2013).

Table 2-4 Key climatic statistics summary for Scone (from BoM, 2014c)

Climate statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum T^{0}C	32	30.9	29.1	24.9	20.7	17.2	16.7	18.7	22.3	25.9	28.9	31.5	24.9
Mean minimum T^{0}C	16.4	16.1	14	10	6.5	4.5	3.1	4	6.2	9.7	12.4	14.9	9.8
Days ≥35^{0}C	7.6	4.7	2.2	0.1	0	0	0	0	0	0.4	2.5	6.9	24.4
Day ≤2^{0}C	0	0	0	0.1	2.3	7.1	11.4	6	1.1	0	0	0	28
Rainfall P10 (mm)	24.9	8.3	5.7	5.6	7	10.1	9.1	10.6	13.2	12.5	10.5	16.6	434.8
Rainfall P50 (mm)	63.6	54	43.5	34.3	30.5	35.7	32	33	37.2	47.1	50.5	59.9	661.2
Rainfall P90 (mm)	181.6	140.2	129.3	96.5	94.5	97	88.3	80.4	86.2	102	104.7	126.4	841
Evaporation[1]	220.1	170.8	155	105	68.2	48	54	83.7	117	155	183	220.1	1579.9
Solar exposure (MJ/m*m)	25.4	21.7	18.7	14.8	11.2	9.1	10.2	13.9	18	21.5	23.3	25.7	17.8
9am humidity (%)	66	73	73	74	80	80	78	71	66	60	59	59	70
9am wind speed (km/h)	7.4	6.9	6.7	6.8	6.2	6.6	7.4	8.1	8.7	9.2	8.5	8.1	7.6

Rainfall trends are an important consideration in agriculture. The median annual rainfall at Scone is 661 mm and daily pan evaporation exceeds rainfall in each month (Figure 2.3). Rainfall Variability Index [(P90-P10)/P50] is low to medium, indicating rainfall is reliable year-on-year.

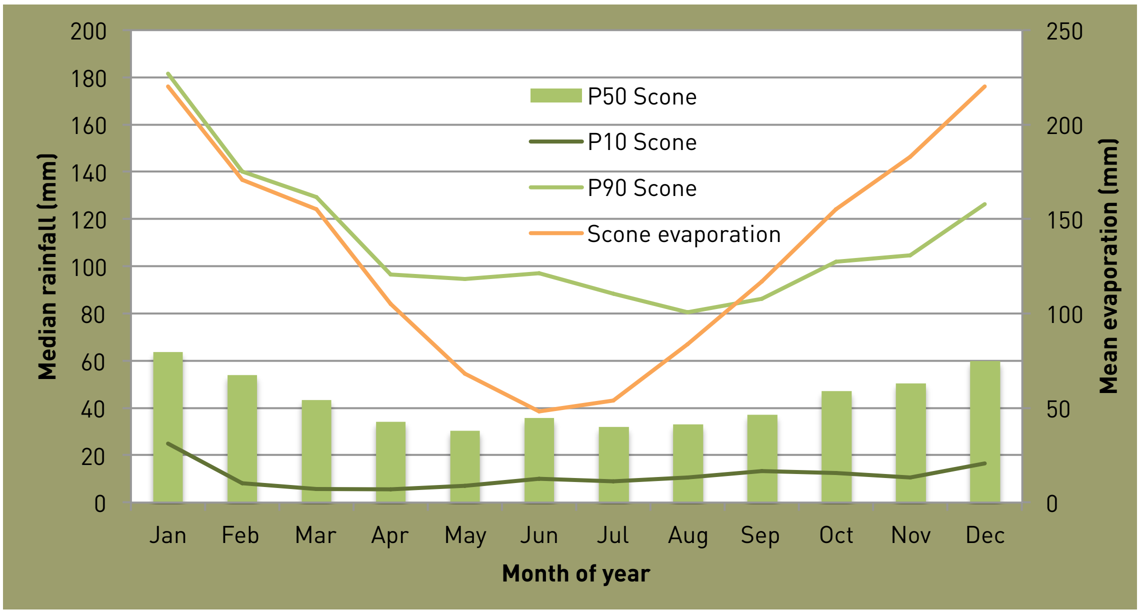


Figure 2-3 **Rainfall percentiles and mean monthly pan evaporation at Scone (from BoM, 2014c)**

Further analysis of historic rainfall trends gives an indication of favourable and unfavourable growing seasons or years, times of drought and also wetter periods. Prolonged wet periods usually result in groundwater recharge while the opposite is true in droughts. Rainfall residual mass curves show long-term trends in rainfall within the period of the data set available (Figure 2.4).

On this curve, the slope gradient is important, not the absolute value. A positive slope gradient indicates a wetter than mean average period. A negative slope gradient indicates a drier than mean average period. A curve period of intermittent positive and negative slopes indicates a period of more-or-less mean average rainfall.

Here, the number and duration of wet and dry periods has been determined for the period since 1890. Major droughts were a feature around the turn of the 20th century, 1927-30, and 1935-41. Since that time the trend has generally been for wetter than average conditions, although dry periods were experienced in 1957-58, 1965-67, 1973-75, 1979-83, 1986, 1991, 1994, and 2001, and in recent years. The 1979-83 drought was countrywide and generally regarded as the worst of the 20th century. For example, in 1980 Aberdeen received only 321 mm of rainfall, almost 300 mm below average.

Conversely, wetter than average periods have led to intense rainfall and major flood events in the region. Significant flooding events occurred in 1949, 1955 and most recently in 2007. Perhaps the most significant event occurred in 1955 when, following months of intense rainfall, the Hunter River broke its banks, inundating the township of Maitland and claiming life and property. This event led to the construction of the *Hunter Valley Flood Mitigation Scheme* – 170 km of levees and flood control structures designed to prevent a recurrence of the 1955 disaster. The scheme is managed as a partnership between the Hunter-Central Rivers Catchment Management Authority and the NSW Government, with funding also provided by federal and local governments. This analysis of rainfall records shows that drought and flood are features of the Upper Hunter region's climate.

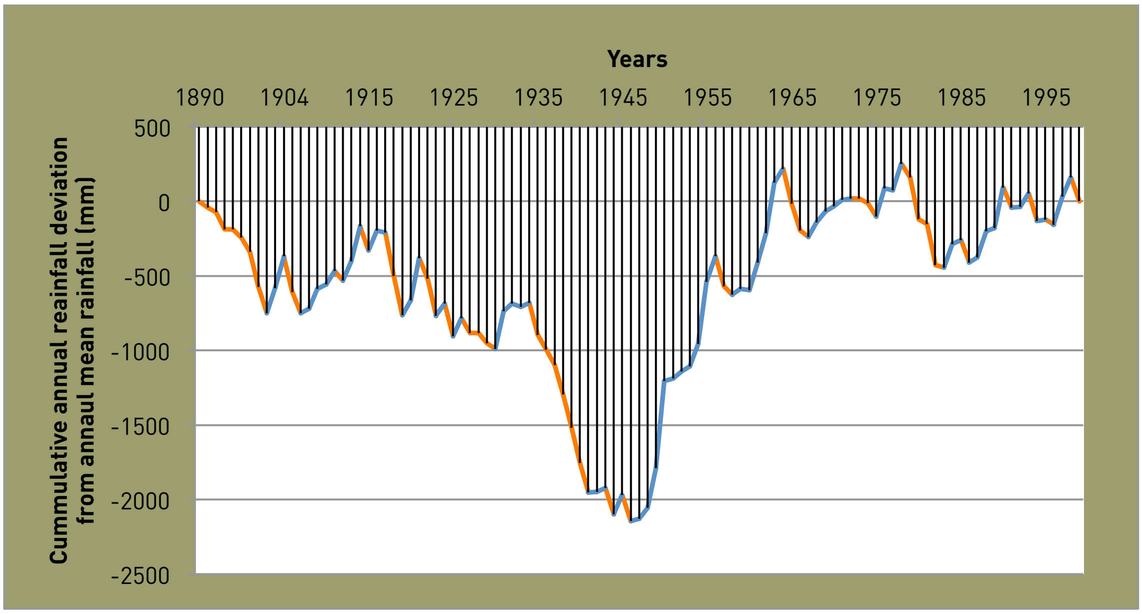


Figure 2-4 Annual rainfall residual mass curve for Aberdeen, 1890 to 2001 (adapted from BoM, 2014a)

2.4.6 Surface waters

The PAA is located within the Hunter River Catchment, which is one of the largest catchments on the NSW coast, extending over approximately 2.2 million ha (DP&I, 2012). The Hunter River itself traverses in a north/south direction past the towns of Aberdeen and Muswellbrook to the east of the PAA. To the east of the PAA, Kingdon Ponds flows parallel to the Hunter River and converges with Dart Brook to the west of Aberdeen. Dart Brook then flows into the Hunter River south of Aberdeen.

A number of creeks traverse the PAA discharging into the Hunter River or its tributaries (Idemitsu Australia Resources, 2014). The ephemeral Sandy Creek (North) traverses the PAA in an easterly direction from Blackjack Ridge to converge with Dart Brook at Kayuga. Deadman's Gully joins Sandy Creek (North) on the eastern boundary of the PAA. Sandy Creek (South) flows east then south through the AL and eventually joins the Hunter River south of the Golden Highway. The catchment outlets of Sandy Creek (North) and Sandy Creek (South) are separated by a distance of approximately 28 km (Idemitsu Australia Resources, 2012).

The catchment boundary between Sandy Creek (North) and Sandy Creek (South) is a small ridgeline at an elevation of between 280 and 310 m AHD running east to west. The western catchment boundary of both Sandy Creek (North) and Sandy Creek (South) is located on the Rossgole Plateau (Idemitsu Australia Resources, 2012). This escarpment is both a rainfall recharge source to the Triassic sandstone and source of run-off to both Sandy Creek systems within the PAA (McAlister and Dvoracek, 2014).

From Blackjack Ridge, the ephemeral Coal Creek traverses the PAA in a southeasterly direction to join Sandy Creek (South), as does Spring Creek, which flows along the western side of the PAA (Figure 2.2). Coal Creek traverses the proposed location of the southern open cut pit and, as such, will be the subject of a major diversion planned around the mine site (Idemitsu Australia Resources, 2012). Sandy Creek (South) has a catchment area of 137 km^2 and is the largest of the Hunter River tributaries (McAlister and Dvoracek, 2014).

2.4.6.1 Water use and supply

Water in the Hunter River and associated tributaries is extracted for industrial and agricultural practices, including for irrigation, stock watering and farm domestic supplies (DP, 2005) and municipal supply. Agricultural land associated with alluvial aquifers in the Upper Hunter region is considered to be the most valuable for production (DP, 2005). Properties in the vicinity of Dart Brook, Middle Brook, Kingdon Ponds and the Hunter River along with their associated aquifers support a large number of horse studs, lucerne production, beef cattle grazing and some dairying (DP, 2005). The local community has high economic dependence on water extraction for irrigation in the Dart Brook sub-catchment (DW&E, 2009).

Flows in Dart Brook are significantly reduced as a result of extraction for agricultural purposes, and peak extraction demand often exceeds available flows in December each year (DP, 2005; DW&E, 2009). This factor combined with variable rainfall in the Dart Brook sub-catchment results in the need for irrigation water to be extracted directly from the alluvial aquifer (DP, 2005). Periods of above average rainfall intensity and longevity resulting in high flows in Dart Brook and its catchment are required to recharge the groundwater reserves in the associated alluvial aquifers (DP, 2005; McAlister and Dvoracek, 2014).

Management of surface water use in the PAA is governed by the NSW *Water Management Act 2000* and a number of subordinate instruments including the 'Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources' (WSP) (DP&I, 2009; DP&I, 2012). The WSP aims to ensure water is available to meet all competing environmental and extractive needs by implementing rules for protecting the environment, extractions, managing licence holders' water accounts, and water trading in the plan area (NSW Office for Water, 2014a).

Within the Dart Brook water source, the total surface water entitlement is 1,538 ML/year of which 93% is used for irrigation purposes. There are 67 surface water licences with a peak daily demand of 20.3 ML/day (DW&E, 2009). The surface water flow in this system is fully allocated. Water for new enterprises can only be obtained by trading existing entitlements (DP, 2005).

2.4.6.2 Water quality

Water quality and supply is of major importance to agriculture in the Upper Hunter region with supplies sourced from the Hunter River, associated tributaries and groundwater systems (DP, 2005). Water is stored in a number of dams, including Lake Glenbawn, to the northeast of Aberdeen, operated by the State to supply water for industry, irrigation and domestic purposes (DP, 2005; Hunter Water, 2011).

The main water quality issue in the region is salinity, with increased salinity impacting on soil fertility and plant growth. Highly saline water is also unsuitable for stock watering (DP, 2005). Salinity occurs naturally in many soils and streams of the Hunter Valley as a result of the marine origin of its geological features. Salt within these ancient marine sediments dissolves in groundwater.

Water quality assessment in lower Dart Brook near the PAA, undertaken during the period 1970 to 2006, indicated that the waterway is degraded with high salinity, high levels of silt and sediment during rainfall and high flows, and high nutrient levels (DP, 2005; DW&E, 2009). Decline in water quality can result from runoff of pesticides and other farming chemicals, and erosion caused by bank instability resulting from clearing riparian areas and livestock access (DP, 2005; Hunter Water, 2011).

The Applicant has monitored surface water quality on the PAA since 1998 (Hansen Bailey, 2012). Results indicate that Sandy Creek (North) and Sandy Creek (South) are moderately saline. Electrical conductivity levels in Sandy Creek (North) range from 2,110 μS/cm to 3,350 μS/cm, while those in Sandy Creek (South) range to 7,070 μS/cm (Hansen Bailey, 2012). To varying extents, this water is unsuitable for irrigation, stock or domestic supply.

Anthropogenic activities including agricultural activities and mining can increase the amounts and concentrations of salt in the waterways, although contributions are proportionally low compared to naturally occurring contributions from groundwater inflow and tributaries (DP, 2005). Impacts of saline discharge on water users and ecosystems of the Hunter Valley are managed under the Hunter River Salinity Trading

Scheme, which regulates the discharge of saline water from coal mines based on a credit system and with reference to the flow regime of the waterway in question.

2.4.7 Groundwater

2.4.7.1 Policy and plans

The Aquifer Interference Policy (AIP) (DPI, 2012) defines significant groundwater resources in NSW. The AIP details the licencing and accounting procedures for use of groundwater and sets out minimal impact considerations against which the Government will assess development proposals to ensure impacts are minimised (DP&I, 2012).

The PAA is located within the Sydney Basin–North Coast Groundwater Source, extending over the Carboniferous to Triassic age rocks within the Hunter River Central Catchment Management Authority area. More specifically, the PAA is within the Sydney Basin–North Coast (Murrundi-Singleton) Trading Zone, as mapped in the Draft Water Sharing Plan for North Coast Fractured and Porous Groundwater Sources (Draft WSP) (NSW Office of Water, 2014b). The Draft WSP regulates activities associated with accessing groundwater through bores including the locations of bores and prohibits trading between or within the groundwater source. Beneficial use categories vary depending on the rocks that the water is sourced from and ranges from 'ecosystem protection' and 'raw water for drinking water supply' in Triassic rocks to 'industrial water' in Permian rocks (NSW Office of Water, 2014b).

2.4.7.2 Sydney Basin

The Sydney Basin is an elongated structural sediment basin geologically bound by the Lachlan Fold belt to the west, and the New England Fold Belt to the east. Groundwater quality is highly variable, ranging from fresh to saline with salinity typically increasing with depth. Groundwater is slightly acidic with a pH around 5.5 to 6.5. Yields are generally limited by connections between fractures in the rock, with private bore yields typically low at 0.1 to 1 L/s. Higher bore yields up to 20 L/s are associated with fractured zones. Recharge is primarily from rainfall with an estimated infiltration rate of 6% (NSW Office of Water, 2014b).

Within the Sydney Basin, the alluvial aquifers of the Upper Hunter region have a strong hydrogeological inter-connection with associated surface water systems and comprise unconsolidated sediments (sands, pebbles, gravels, silts and clays). Rainfall in the upper catchments and subsequent stream flows are the primary sources of recharge for alluvial aquifers in the region (DP, 2005). During drought conditions alluvial aquifer drawdown for agricultural practices can be significant, resulting in increased salinity due to seepage into the alluvium from the underlying Permian age rocks (in particular the soluble salt from the Marine Sequence) (DP, 2005).

Hard rock aquifers associated with Tertiary age basalt flows also occur in the Upper Hunter region. Water quality is generally good with low salinity, although water may be slightly acidic, contain iron or be hard due to the presence of calcium and magnesium carbonates. Where these aquifers interact with Permian rock, groundwater can become saline (DP, 2005).

2.4.7.3 Dart Brook water source

The alluvial groundwater of the Dart Brook water source is of good quality but underlain by saline water associated with Permian coal measures. Therefore, as alluvial freshwater is extracted, its quality is reduced by inflows of inferior quality water (DW&E, 2009).

Estimated rainfall recharge to the Dart Brook alluvial aquifer is approximately 9,000 ML/y. The total groundwater entitlement from the Dart Brook water source is 28,051 ML/y and supports approximately 160 groundwater licences. Of the water extracted, about 98% is used for irrigation purposes and 1% is used for industrial purposes (DW&E, 2009).

2.4.7.4 Surrounding projects

No existing or former mines near the PAA extract coal from the same seams targeted by the Project. Drayton, Bengalla and Mt. Pleasant mines are approved to extract coal seams stratigraphically lower than the seams proposed to be mined by the Project. Numerous interburden layers are present stratigraphically that will prevent cumulative hydraulic impacts between the mining operations. Mangoola Mine is hydraulically separated from the PAA by the Mt. Ogilvie Fault (McAlister and Dvoracek, 2014).

2.5 Resource development

2.5.1 Coal mining

Coal mining is a significant industry in NSW, with a focus on production of high quality thermal coal used for electricity generation. Some of the coal is supplied to domestic power stations, with the majority exported (NSW Mining, 2014). Coking coal for steel production is also mined but to a lesser extent than thermal coal. In value terms, coal is NSW's most significant commodity export and comprises 5.8% gross regional product. In 2011/2012, NSW miners exported over 136 million tonnes (Mt) of coal worth an estimated $16.8 billion (NSW Mining, 2014).

The majority of NSW coal mines are in the Upper Hunter region (NSW Mining, 2014), which accounts for approximately 60% of total coal mined in the State (DP&I, 2012). Within the region, most mines are located in Singleton and Muswellbrook LGAs. The Upper Hunter LGA currently has no operating coal mines and, historically, has not been a focus of mining activity (DP&I, 2012).

2.5.1.1 Resource

The Hunter Coalfield comprises approximately 60 seams, accessible at relatively shallow depths. The Wittingham Coal Measures (Upper) is the major coal-producing unit in the Hunter Coalfield (refer Section 2.4.1). The Hunter Coalfield comprises approximately 40% of the total identified coal reserve in NSW (DP&I, 2012) and has been continuously mined for more than 100 years.

2.5.1.2 Mining activities

Many coal-related authorisations exist in the Upper Hunter region, including ALs, ELs, Mining Leases (MLs) and Coal Leases (CLs). The majority of open cut and underground mines operate in a southeastern/northwestern corridor along the New England Highway, extending from Broke in the south to Aberdeen in the north (DP&I, 2012).

The accessibility and quality of the coal means that mines are generally large-scale multi-seam open-cut operations (DP&1, 2012). High coal prices in previous years have resulted in a significant number of expansion projects subject to approval of the NSW Government. However, recent declines in coal price, particularly that for thermal coal, have resulted in some mines entering into care and maintenance (ABC News, 2014). Mining operations and projects in the vicinity of the PAA have been identified (Table 2.5 and shown in Figure 1.1)

Table 2-5 Current and proposed major resource projects located in Muswellbrook LGA (DP&I, 2014b)

Operation Name	Majority Owner/Operator
Muswellbrook Coal Mine	Muswellbrook Coal Company
Drayton Mine	Anglo American
Bengalla Mine	Rio Tinto Coal Australia
Mount Pleasant Coal Mine	Rio Tinto Coal Australia
Mt Arthur Mine	BHP Billiton
Mangoola Coal Mine	Glencore
Liddell Mine	Glencore
Spur Hill Underground Coal Mine	Malabar Coal
Dartbrook Mine (underground mine in care and maintenance, extends into Upper Hunter LGA)	Anglo American
Dalswinton Quarry	Rosebrook Sand and Gravel
Dolwendee Quarry	Upper Hunter Holdings

The Upper Hunter LGA currently has no operating open-cut coal mines, although Dartbrook underground extends into that LGA (DP, 2005). Within the Upper Hunter LGA, the area with the most exploration and coal resource potential extends over the Upper Coal Measures located between Aberdeen and Murrurundi. Coal quality in this area is expected to be similar to elsewhere in the Hunter Coalfield where the same geological formation is mined, i.e. thermal coal of low ash (<15 %) and low sulphur (<0.5%) (DP, 2005). The development of these coal resources has been previously identified as having potential significant regional economic importance including generation of employment opportunities and flow-on benefits to the region (DP, 2005).

2.5.1.3 Economics

Coal mining in NSW generated $1.3 billion in royalties for the NSW government in 2012/2013 and the direct contribution in NSW by mining companies totalled approximately $12.8 billion. The Upper and Lower Hunter regions contributed $6.3 billion to this total (NSW Mining, 2014). Within the Muswellbrook LGA, more than 30% of businesses rely on providing support services for the mining or power industries (Brereton *et al*. 2008).

2.5.2 Coal seam gas and quarrying

Coal seam gas (CSG) extraction in NSW is regulated, in part, by the SRLUP. In January 2014, the NSW Government finalised the equine and viticulture CIC maps and introduced a ban on new CSG activity within the mapped areas (DP&E, 2014a). Currently, no commercial production of CSG exists in the Upper Hunter region, despite extensive exploration and identification of significant gas reserves (DP&I, 2012).

Other non-energy resource extraction activities in the region include quarrying for gravel, sand and hard rock aggregate. The Dalswinton Quarry and Dolwendee Quarry are currently seeking project approval (DP&E, 2014b).

2.6 Critical industry clusters (CICs)

There are many types of CICs throughout Australia. Johnston (2003) identified more than 100 industry-specific economic clusters across the country, with 24 of these in NSW including the Hunter equine and wine industries. Most economic clusters are non-agricultural.

Agricultural CICs are geographic concentrations where activities coalesce around a natural resource and attract complimentary activities seeking strategic socio-economic benefit (Johnston, 2003; Garkovich, 2009). The SRLUP (DP&I, 2012) identifies two CICs in the region: an equine cluster around Bylong, Scone and Denman; and, a viticulture cluster around Broke, Pokolbin and Denman. In late 2013, the extent of equine CIC land was increased by 9.6% and verified to be 254,900 ha, while the extent of viticulture CIC land was reduced by 5.2% to 60,000 ha and verified (DPI, 2014b) (Figure 2.5).

CICs are complex socio-economic systems and, akin to ecosystems in the natural world, have a lifecycle. CICs are initiated, grow, mature and can die (Kleinhardt-FGI, 2002; Johnston, 2003). Regardless of their type, e.g. equine, viticulture or other, CICs have common components: (i) core businesses or central actors; (ii) support businesses / actors; (iii) soft infrastructure; and, (iv) hard infrastructure (Kleinhardt-FGI, 2002). Not all actors or components within the cluster make the same contribution to the sustainability of the CIC (PAC, 2013). These components, not land mapping, define the CIC.

2.6.1 Equine CIC

The equine CIC is of significant regional, state, national and international importance for the following reasons.

- A significant proportion, 33, of the 53 Australian horses in the 2011 world racing rankings were bred in the region (HTBA, 2014);
- As the largest domestic producer, supplier and exporter of premier quality thoroughbreds, the CIC has economic importance to the region, state and nation and is a significant regional employer; and,
- It is an iconic industry that defines the region's cultural identity (McManus *et al.* 2011; PAC, 2013 and 2014).

Components of the Upper Hunter equine CIC have been identified (Table 2.6). The core business of the cluster is horse breeding to produce a primary product of foals. The core businesses are the horse studs, particularly the large-scale thoroughbred stallion studs. Of these, PAC (2014) states that Coolmore and Darley studs are at the epicentre of the thoroughbred breeding industry in NSW and Australia and are pivotal to the sustainability of the CIC. While other horse breeds are also important to the region, e.g. Australian Stock Horse, the highest value is found in thoroughbred breeding. Core businesses are supported by a significant and interdependent array of support businesses, and soft and hard infrastructure.

Table 2-6 Components of the equine CIC

Cluster Components	Type	Example
Core businesses	Critical Thoroughbred studs	Coolmore, Darley Kelvinside and Darley Woodlands (PAC, 2013 & 2014; MPGW, 2013)
	Thoroughbred studs[1,2]	Arrowfield, Bengalla, Byerley, Emerites Park, Kitchwin Hills, Patinack Farm, Toolooganvale Farm, Turangga Farm, Vinery, Widen, Yarraman Park Amarina Farm, Ashleigh, Attunga, Barador, Baramul, Bellerive, Chatsworth Park, Cressfield, Crowningstone,

Cluster Components	Type	Example
		Edinglassie, Flame Tree, Glastonbury Farms, Golden Grove, Goodwood Farm, Holbrook, Kia Ora, Middlebrook Valley Lodge, Middlebrook Station, Monarch, Murrulla, Redman Park, Riversdale Farm, Riverslea Farm, Segenhoe, Sledmere, Timor Creek, Willowpark
	Other breed studs[2,3]	*Australian Stockhorses*: Barshane Stockhorses, Scone; Mr TJ Blake, Muswellbrook; Mr BW Brooker, Aberdeen; Glew Family Partnership, Scone; DF and FJ Macintyre, Scone; Miss JR Poole, Singleton. *Polo, Polocrosse and Eventing Horses:* Belltrees, Gundy; Pine Lodge Thoroughbreds, Scone; Ilala Stud, Scone; Haydon Horse Stud. *Arabian Horses*: Mulawa (Alabama property), Aberdeen.
Support businesses	Equine health, research and development	Scone Equine Hospital, Scone; Hunter Nursing Nannies (foster mare and milk service), Scone; Brooks Veterinary Services, Scone; Stenhouse Equine Dentistry, Scone; Equine Podiatry and Lameness Centre, Muswellbrook; Jerry's Plains Veterinary Clinic Centre for Equine Reproductive Medicine
	Equine legal	Equilaw, Muswellbrook
	Bloodstock agents	Scone Bloodstock Service, Scone
	Farriers	Ben Anderson Farrier, Denham; Scone Mobile Farrier Service, Scone; A & B Jones, Scone; Brian Atfield Farrier Service, Jerry's Plains; Jerry's Plains Blacksmiths and Farrier Service.
	Feed suppliers	Pursehouse Rural, Muswellbrook; Farmers Barn, Muswellbrook; Scone Rural Supplies, Scone; Mitavite Feeds (various suppliers).
	Feed producers	Numerous including lucerne farmers along the Hunter River.
	Horse transport	RB Horse Transport, Scone; Signature Equine Transport, Scone; Goldners Horse Transport, Sydney; International Racehorse Transport, Docklands VIC.
	Landscape architecture	Ladd-Hudson Architects, Sydney; Timothy Court and Company, Sydney.
	Trades and technical	Carpenters, plumbers, electricians, painters, horticulturalists, greenkeepers
Soft infrastructure	Education	Aberdeen Agistment and Training Centre; TAFE Hunter Institute, Muswellbrook and Scone; Tocal College, Paterson
	Tourism	Hunter Valley Thoroughbred Tours; Hunter Valley Private Tours; Upper Hunter Tours.
	Government policy	Upper Hunter Strategic Regional Land Use Plan; Land Use Development Strategy – Muswellbrook Shire Council 2012;

Cluster Components	Type	Example
		Muswellbrook Shire Development Control Plan 2009; Muswellbrook Local Environment Plan 2009; Upper Hunter Local Environment Plan 2013.
Hard infrastructure	Racing facilities	Scone Race Club, Scone; Muswellbrook Race Club, Muswellbrook; Merriwa Race Club; Merriwa.
	Clubs, Associations, Events and Schools	Scone Polo Club and tournaments; Ellerston Polo Club and tournaments; Timor Polo Club; Hunter Valley Cutting Horse Club and show events; Scone Show Jumping Club and show events; Upper Hunter Dressage Association and show events; Hunter Valley Scone Rosallas (polocrosse); Scone Pony Club[1, 2, 3], NSW Arabian Horse Association. Scone and Upper Hunter Horse Festival including King of the Ranges Challenge, Scone Cup Carnival and Dark Jewel Race Day, Scone Polo Cup and Charity Rodeo; Hunter Thoroughbred Breeders Association Scone Horse Trials; Scone Campdraft; Inglis Guineas Race Day; and Christmas Party and Summer Time Race Days.[4, 5] Scone and District School Horse Sports; Scone Equestrian Vaulting and Horse Riding; Scone Riding Centre, Vantage Hill Thoroughbreds and Equestrian Training.
	Transport infrastructure	Denman Road; Golden Highway (B84); New England Highway (A15). Newcastle Werris Creek rail corridor (Main Northern railway line); Scone Airport.

Sources: [1] MSC (2013c)
[2] HTBA (2014)
[3] ASS (2014)
[4] Scone and Upper Hunter Horse Festival Committee (2014)
[5] The Scone Advocate (2014)

2.6.2 Viticulture CIC

The viticulture CIC is one of Australia's best-known and historically important viticulture clusters. Focussing on quality, not quantity, the cluster produces only 2% of Australia's wine (MSC, 2012) from grape yields about half the NSW average (DPI, 2013d). Nonetheless, the CIC is important because:

- The economic value and cultural significance of viticulture and wine tourism are essential components of both the Upper Hunter and Lower Hunter regional identity and economy (MSC, 2012; DPI, 2013d); and,
- Hunter Valley viticulture and tourism industries, combined, contribute $1.8 billion dollars annually into the NSW economy and the industry employs over 7,000 people with an additional 10,000 indirectly employed (MSC, 2013b).

Components of the viticulture CIC have been identified (Table 2.7).

Table 2-7 Components of the viticulture CIC

Cluster Components	Type	Example
Core businesses	Vineyards and wineries[1,2]	Barrington Estate, Bell's Lane Wines, Birnam Wood Wines, Cruickshank Callatoota Estate, Hollydene Estate (Arrowfield, Hollydene and Wybong), Horseshoe Vineyard, Inglewood Vineyards (Two Rivers), James Estate, Kenmarie Vineyards, London Lodge East, Pukara Estate, Pyramid Hill Wines, Rosemount Estate, Roxburgh Estate, Sevenoak Wines, Stone Hill Vineyard, Winbirra Estate, Winbourne Wines, Yarraman Estate.
Support businesses	Agronomy	Bright Vine Services, Lovedale; Vitibit, Nulkaba.
	Equipment and supplies	Denman Dapkos, Denman; Horse 'n' Round Saddlery, Denman; O'Brien's Machinery, Scone; Flint's Farm Machinery, Scone; Valley AG & Tractors, Singleton.
	Hospitality	Local restaurants, hotels and resorts
	Trades/technical	Carpenters, plumbers, electricians, painters, horticulturalists, greenkeepers
Soft infrastructure	Education	TAFE Hunter Institute, Muswellbrook and Scone; Tocal College, Paterson.
	Associations	Hunter Valley Wine and Tourism Association; Hunter Valley Wine Industry Association; Hunter Valley Vineyard Association; Hunter Valley Wine Country Tourism.
	Tourism	Hunter Valley Private Tours; Upper Hunter Tours; the Upper Hunter Wine and Food Fair, Muswellbrook Carnivale; Upper Hunter Wine Trail and Denman Farmers Markets[3].
	Government policy	Upper Hunter Strategic Regional Land Use Plan Land Use Development Strategy – Muswellbrook Shire Council 2012 Muswellbrook Shire Development Control Plan 2009 Muswellbrook Local Environment Plan 2009 Upper Hunter Local Environment Plan 2013
Hard infrastructure	Transport infrastructure	Denman Road; Golden Highway (B84); New England Highway (A15). Newcastle Werris Creek rail corridor (Main Northern railway line) Scone Airport

Sources: [1] HVWIA and HVWCT (2014)
[2] Find a Winery (2014)
[3] DPI (2013c)

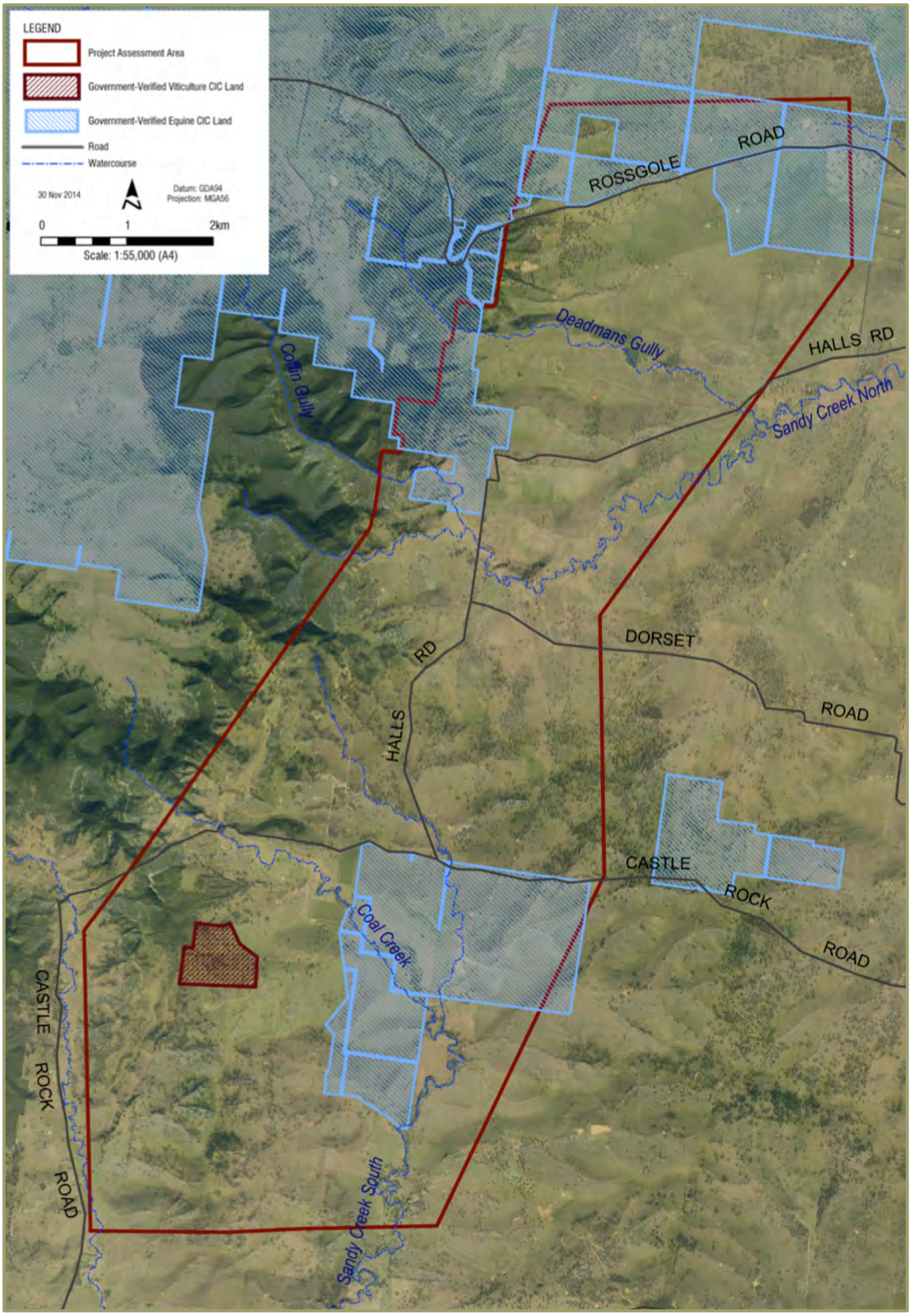


Figure 2-5 Government-verified CIC land in the vicinity of the PAA

3 PROJECT ASSESSMENT AREA AGRICULTURAL ANALYSIS

Following is a summary of detailed technical investigations of existing agricultural land uses and productivities, agricultural resources, soils including BSAL verification, and groundwater within the PAA. These technical investigations are reproduced as appendices to this report (see Appendices A through C).

3.1 Land use, production systems and productivity

Forty-three agribusinesses were identified on lands wholly or partially within the PAA. This includes lands held by resource companies. All land owners were contacted by the Applicant and invited to engage with La Tierra for the purpose of describing agricultural land uses, activities, production systems and resources. Twenty-five land managers agreed to interview and property inspection, and this detailed information is presented (see Appendix A).

3.1.1 Land use

The predominant land use within the PAA is beef cattle grazing, covering about 78% of the land, with some limited sheep grazing, cultivation for non-irrigated forage production, and olive production. No horse studs, vineyards or wineries exist within the PAA, and no agribusinesses provide support services to these industries.

Landholdings are typically small, less than 100 ha, with only 8 larger than 300 ha in aggregation. The largest farm is 576 ha. Of the 152 lots within the PAA, 90 or 59% are less than 20 ha. Most farms do not provide a sustainable 'living area', i.e. an economically viable farm size.

The scale and nature of land use within the PAA is consistent with the broader Hunter region. According to DPI (2006), contributing factors are the extended period of rural subdivision, the high cost of land and the popularity of cattle for owners of small, rural lifestyle lots. Small-scale beef enterprises with less than 40 head of cattle are disadvantaged by:

- The higher unit cost of buying relatively small quantities of items such as fertiliser, drenches, farm equipment and yards;
- Increased costs per head for small scale pasture improvement, cattle management and mustering operations;
- Limited ability to negotiate prices, or to access profitable cattle markets;
- Reduced eligibility for taxation offsets and primary producer assistance;
- Limited capacity to adapt to changing market requirements, or climates, or to cover the cost of rising overheads; and,
- Higher levels of dependency on off-farm income and the associated lack of available time and focus on pastures and cattle enterprise.

The portion of the PAA located within the Upper Hunter LGA is zoned by the *Upper Hunter Local Environmental Plan 2013* as 'Primary Production' or 'Primary Production Small Lots' in recognition of the smaller lot sizes.

Land uses have generally not changed in the past 10 to 20 years.

3.1.2 Production systems and productivity

Most beef cattle production systems are focussed towards Vealer production. Reflecting constraints of small-scale beef cattle production, this is a low-management intensity production system producing unmarked and unweaned cattle at nine to 12 months of age and ≈300 kg LW (live weight) for the local Scone market. Angus and Hereford breeds dominate Vealer production.

There are two significantly larger and more productive agricultural enterprises that are partially affected by the PAA, i.e. "East Rossgole" and "Rossgole". Compared to all other affected properties, these two are larger and have more diverse production systems including sheep for wool and meat, cattle breeding and finishing, and cropping (Plate 3.1). Each is also integrated with extensive additional landholdings outside the PAA.

Plate 3-1 Cross-bred fat lambs and Angus steers grazing sown fodder on "Rossgole"

3.2 Agricultural resource assessment

Detailed investigations of agricultural resources within the PAA are complete, with soils, land and soil capability, and BSAL verification undertaken by Richards (2014) and a preliminary assessment of groundwater resources undertaken by McAlister and Dvoracek (2014). These reports are reproduced as appendices to this report (see Appendices B and C), and the key findings of these important investigations are summarised as follows.

3.2.1 Soils and land capability

Soils within the PAA were described at each of 144 locations and classified according to the Australian Soil Classification (ASC) by Isbell (1996) and the defunct Great Soil Group Scheme (Stace *et al.* 1968). Richards (2014) identifies 14 discrete soil-mapping units to sub-order level (Table 3.1, Figures 3.1 and 3.2). Eighty (55%) of the total 144 sites were identified as Vertosol soils, dominated by black, brown or red sub orders, self mulching or epipedal great groups, and endocalcareous or haplic sub groups. Chromosols and Sodosols were the next most common, identified at 23 and 18 sites respectively. Relatively minor occurrences of Dermosols and Rudosols were also identified.

Table 3-1 Soil types within the PAA (adapted from Richards, 2014)

Australian Soil Classification			Inherent Fertility[1]	Survey Count	Great Soil Groups
Order	Sub order	Great Group			
Vertosol	Black	Epidedal	High	80	Black Earths
	Brown	Self-mulching	Moderately high		Brown Clays
	Red	Self-mulching	Moderately high		Red Clays
Chromosol	Brown	Calcic	Moderately high	23	Red-brown Earths
	Red	Eutrophic	Moderately high		
Sodosol	Brown	Subnatric	Moderately low	18	Solodic Soils
Dermosol	Brown	Eutrophic	Moderately high	13	Chocolate Soils
Rudosol	Static	n/a	Moderately low	10	Alluvial Soils

[1] Additional source: OEH and OAS&FS (2013)

Soils were found by Richards (2014) to have the following characteristics.

- Vertosols, the dominant soil type identified across the PAA, are shrink-swell soils with a clay field texture or 35% clay content throughout the solum, i.e. soil profile.

  Vertosols within the PAA have:

  - Increasing pH and salinity with depth;
  - High Cation Exchange Capacities (CECs); and,
  - Inherent fertilities that were Moderately-High (red and brown Vertosols) and High (black Vertosol).

  Vertosols were identified across the landscape, in ridgeline, lower-slope and lowland locations. Vertosols are favoured agricultural soils due to their ability to storage water within their clay matrix.

- Chromosols have a strong texture contrast between the A and B horizons, and a non-sodic subsoil with pH_{Water} greater than 5.5.

  Here, Chromsols have:

  - Increasing pH with depth to strongly alkaline;
  - Non-saline and non-sodic characteristics; and,
  - Low to moderate CECs.

  Chromosols are amongst the most widespread used for agriculture in Australia (Isbell, 1996) with moderately-high inherent fertility.

- Sodosols have a strong texture contrast between A and B horizons, and B2 horizons that are sodic but not strongly acid.

  Here, Sodosols have:

  - Increasing pH with depth;
  - Sodic B2 horizons;
  - Non-saline profiles; and,
  - High CECs.

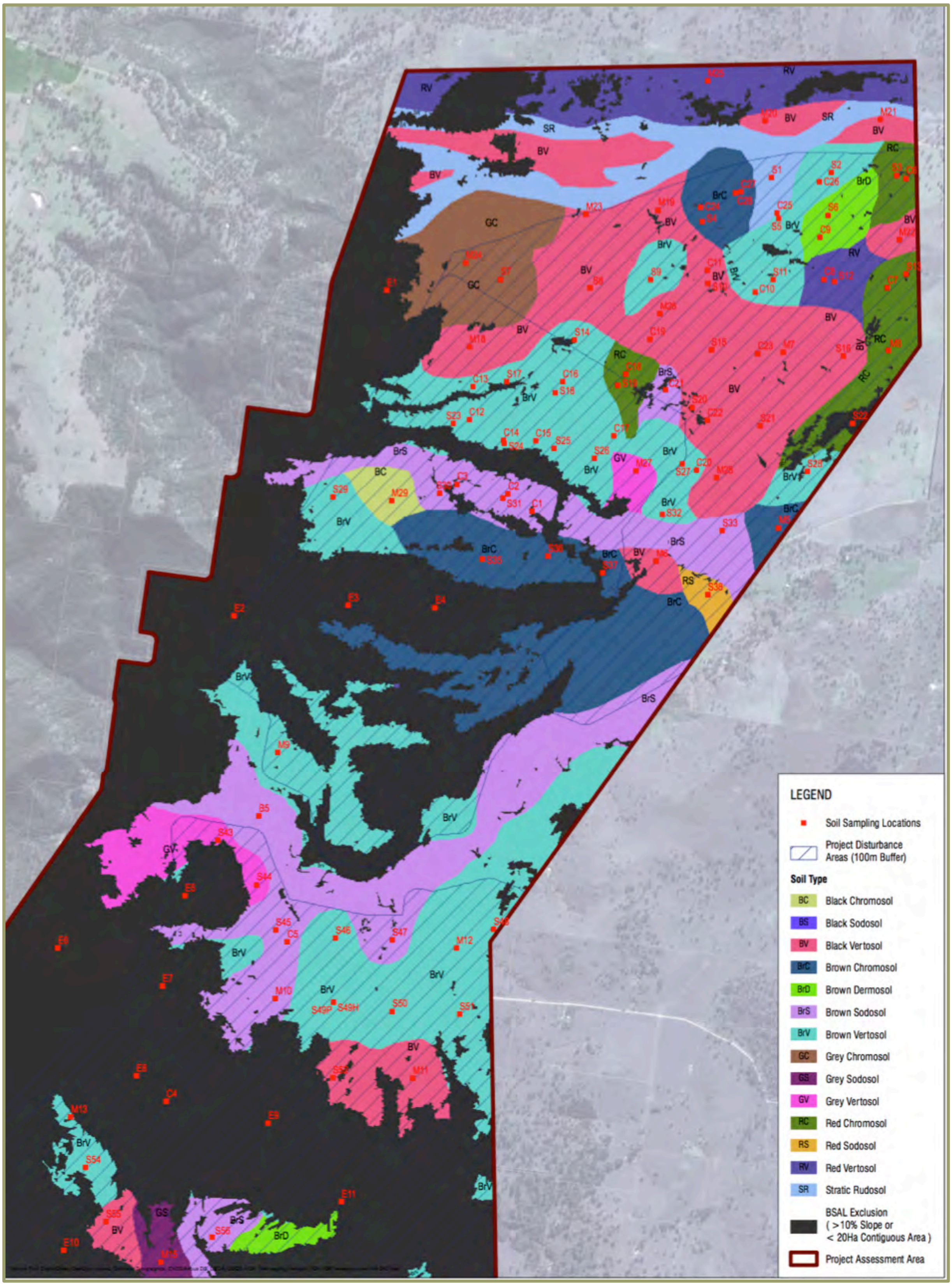


Figure 3-1 Soil types within the PAA (northern extent, scale 1:25,000) (adapted from Richards, 2014)

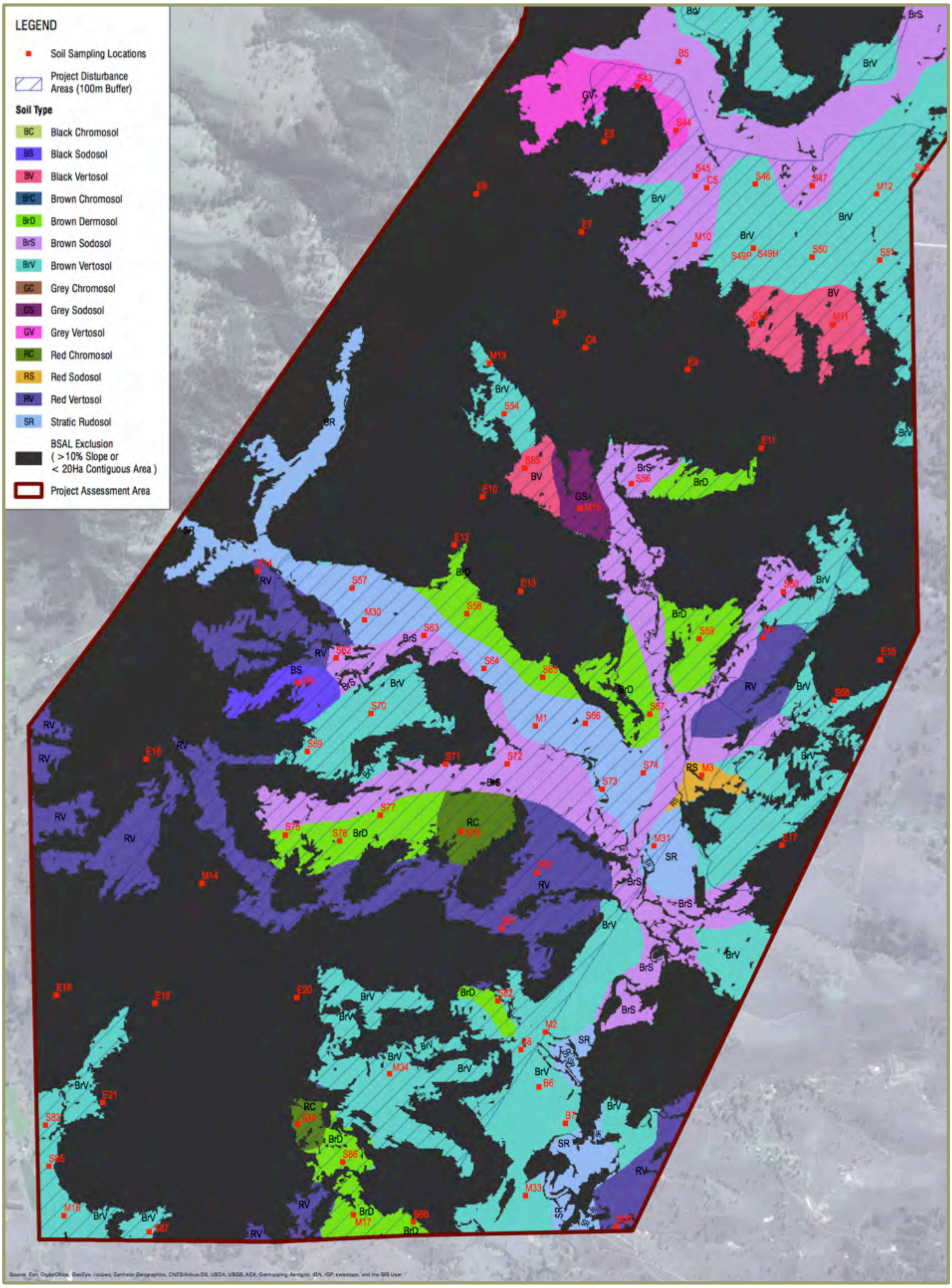


Figure 3-2 Soils types within the PAA (southern extent, scale 1:25,000) (adapted from Richards, 2014)

Within the PAA, Sodosols were found along watercourses and lowland areas. Sodosols have moderately-low inherent fertility and are of lesser agricultural importance.

- Dermosols have structured B2 horizons but lack abrupt texture changes between horizons.

  Dermosols within the PAA have:

  - Increasing pH and sodicity with depth;
  - Non-saline profiles; and,
  - High to very high CECs.

  These soils were identified in lowland areas of <5% slope gradient and have moderately-high inherent fertility. Appearing similar to many Vertosols, Dermosols are agriculturally important soils.

- Rudosols are adedal or weakly structured with negligible pedologic organisation.

  Within the PAA, Rudosols have:

  - Increasing pH, sodicity and salinity with depth; and,
  - Moderate CECs.

  These soils have a moderately-low inherent fertility and are not favoured for agricultural development.

Soil and land capability classes have been determined (Table 3.2; Figure 3.3 and 3.4). According to Richards (2014), planned disturbance areas are predominately Class 4 land. Class 4 land has moderate to high limitations with respect to high-impact land uses such as regular cultivation, and is generally considered suitable only for grazing.

Pre-mining soil and land capability classes have been determined for land affected by the various planned mining disturbance types (Table 3.3). At this time, no post-mining land capability assessment has been completed. Following detailed design of the rehabilitated landscape, post-mining land and soil capability classes will be determined. Rehabilitated land will likely be Class 4 and higher.

Table 3-2 Land and soil capability within the PAA

Land and soil capability class	Extent within PAA (ha)	Description[1]
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)		
1	0.0	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	60.3	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	645.5	High capability land: Land has moderate limitations and is capable of sustaining high- impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some		

Land and soil capability class	Extent within PAA (ha)	Description[1]
horticulture, forestry, nature conservation)		
4	2,776.9	Moderate capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	528.7	Moderate–low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Class 6: Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture). Classes 7 and 8: Land generally incapable of agricultural land use (selective forestry and nature conservation).		
6	1230.7	Class 6: Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation
7	378.9	Class 7: Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	0.0	Class 8: Extremely low capability land: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.
TOTAL	5,621.0	

[1] From OEH (2012)

Table 3-3 Land & soil capability classes according to mining disturbance types (from Richards, 2014)

Disturbance type	Land & soil capability class						Total
	2	3	4	5	6	7	
Mine infrastructure area	0.0	8.9	160.9	0.0	0.00	0.0	169.8
Out-of-pit emplacement	21.2	157.9	366.4	58.6	5.5	0.0	609.6
In-pit emplacement	0.0	236.2	1580.9	349.9	579.3	77.3	2823.7
Final void	0.0	6.5	74.5	53.8	138.6	69.0	342.4
Not disturbed	39.1	235.9	594.1	66.5	507.4	232.6	1675.6
[1]TOTAL	60.3	645.5	2776.9	528.7	1230.7	378.9	5,621.0

[1] Some total values may not sum accurately due to rounding.

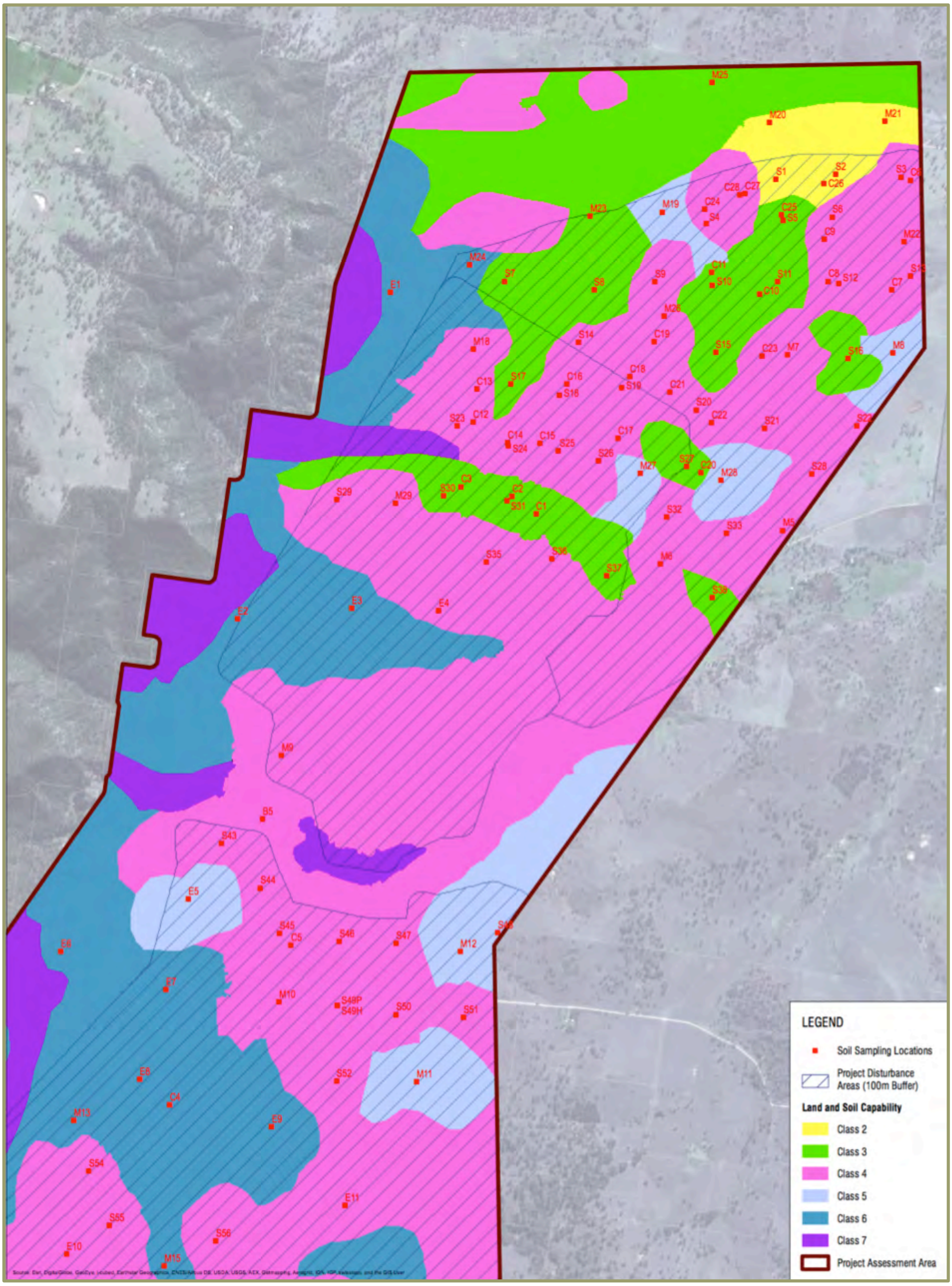


Figure 3-3 Soil and land capability within the PAA (northern extent, scale 1:25,000) (adapted from Richards, 2014)

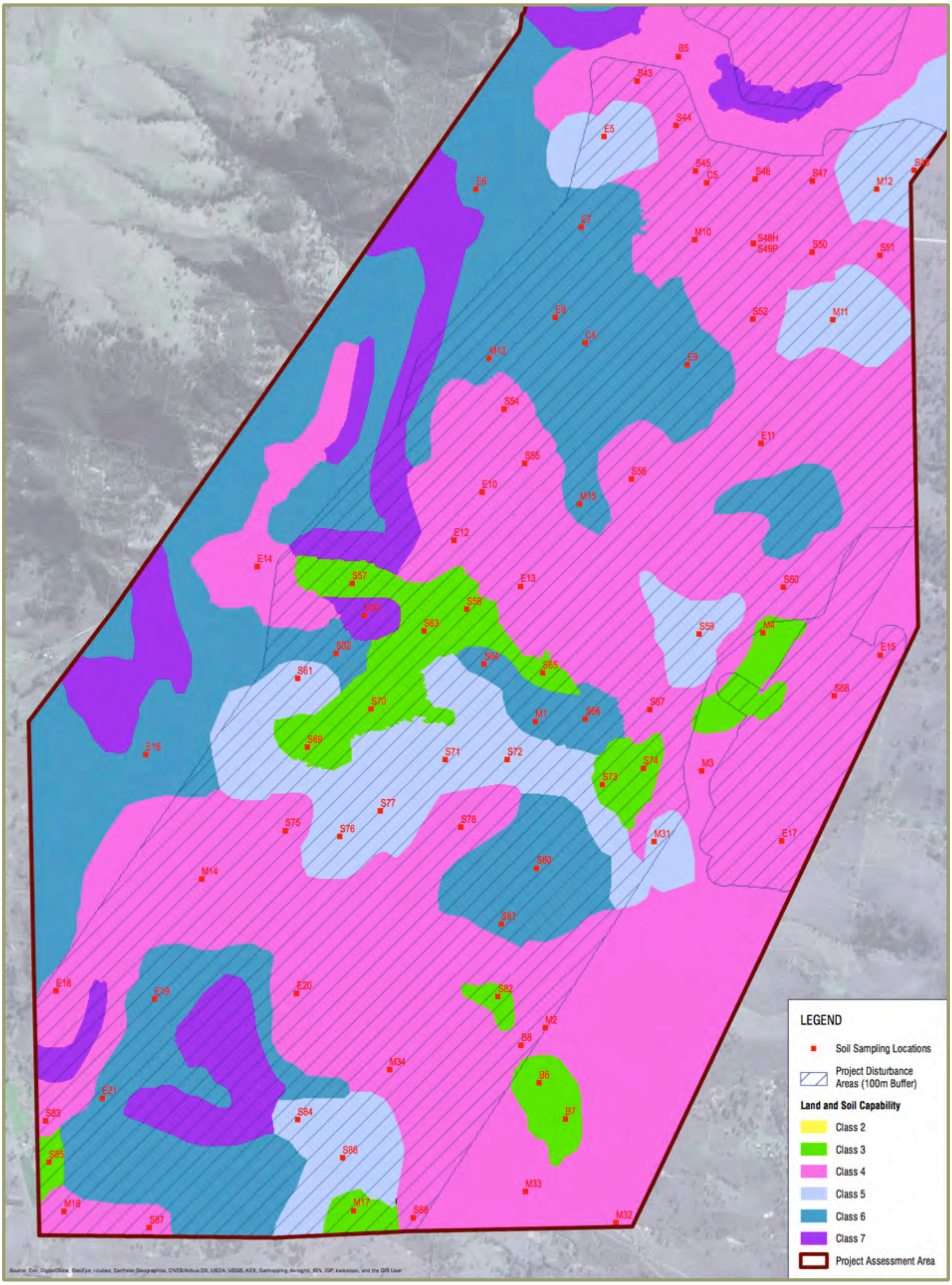


Figure 3-4 Soil and land capability within the PAA (southern extent, scale 1:25,000) (adapted from Richards, 2014)

3.2.2 BSAL

Richards (2014) verifies the presence of 204.6 ha of BSAL within the PAA (Figures 3.5 and 3.6). The total area of verified-BSAL comprised 129.6 ha, confirmed by application of the verification protocol (OE&H and OAS&F, 2013), plus an additional 75 ha interpreted by a desktop method that recognised adjacent verified-BSAL, mapped potential-BSAL and the continuity of relevant soil types. The desktop method was applied where access to properties for on-ground soil survey was not possible. More than 2,800 ha were excluded from BSAL verification where slope gradients exceeded 10%.

Government mapping indicates 206 ha of potential BSAL within the PAA. While highly correlated to the extent of BSAL verified by Richards (2014), there is considerable difference between locations of potential- and verified-BSAL soils. This is unremarkable, as potential-BSAL was mapped using regional-scale soil landscape data from more than 20 years ago. When subject to application of the verification protocol on-ground by Richards (2014), many soils mapped as potential-BSAL failed various criteria including inherent fertility, pH, salinity, effective rooting depth and extent. Conversely, some previously unmapped Black Vertosol soils in the north of the PAA were verified as BSAL. That the net quantum is more or less the same is coincidence. Verified-BSAL represents 3.6% of land within the PAA, and 0.1% of potential-BSAL within the Upper Hunter Region (Table 3.4).

Table 3-4 Location and extent of BSAL

Location	Total extent (ha)	Potential BSAL (ha)	Verified BSAL (ha)
Upper Hunter Region	2,410,000	211,060	
PAA	5,621.0 (100%)	206	204.6 (3.6%)

3.2.3 Groundwater

McAlister and Dvoracek (2014) investigated groundwater systems within the PAA and immediate surrounding area (≈5 km around the PAA). In this study area, highly productive groundwater aquifers are present in alluvium along watercourses and sandstone units overlying coal measures. Although there is no evidence of their use for irrigation, these aquifers are considered agriculturally important as sources of stock water.

The study identified four main groundwater sources, viz.

- Alluvium and colluvium along creeks, e.g. Sandy Creek (North) and Sandy Creek (South);
- Regolith, i.e. near-surface weathered rock;
- Triassic-age sandstones to the west of the PAA; and,
- Permian-age coal seams, i.e. Wollombi and Whittingham Coal Measures (McAlister and Dvoracek, 2014).

The alluvium and colluvium system is a saturated Quaternary sequence, forming an unconfined aquifer associated with creek lines. It is thought to vary in thickness from one to 17 m (McAlister and Dvoracek, 2014). Along Sandy Creek (South) and Sandy Creek (North), including Coal Creek, Government-mapping indicates this system is potentially a highly productive groundwater source (Figure 2.4). However, this classification is not supported by detailed assessment (McAlister and Dvoracek, 2014).

The regolith system has a variable depth to 44 m depending on depth of weathering, extent and frequency of permeable fractures and the occurrence of coal-fired rock (McAlister and Dvoracek, 2014). This system is associated with local watercourses and alluvial aquifers, and is a less productive groundwater source.

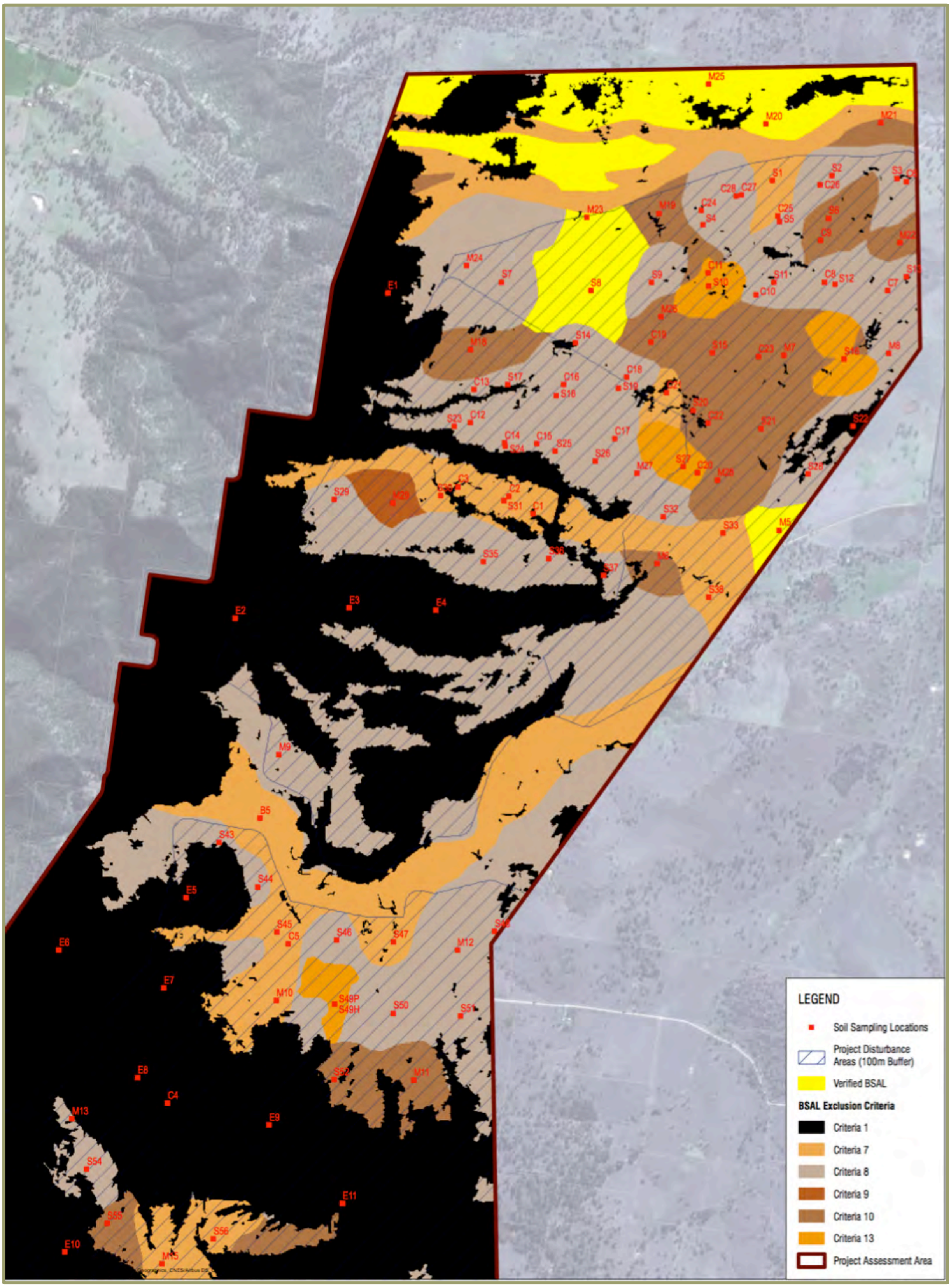


Figure 3-5 Verified-BSAL within the PAA (northern extent, scale 1:25,000) (adapted from Richards, 2014)

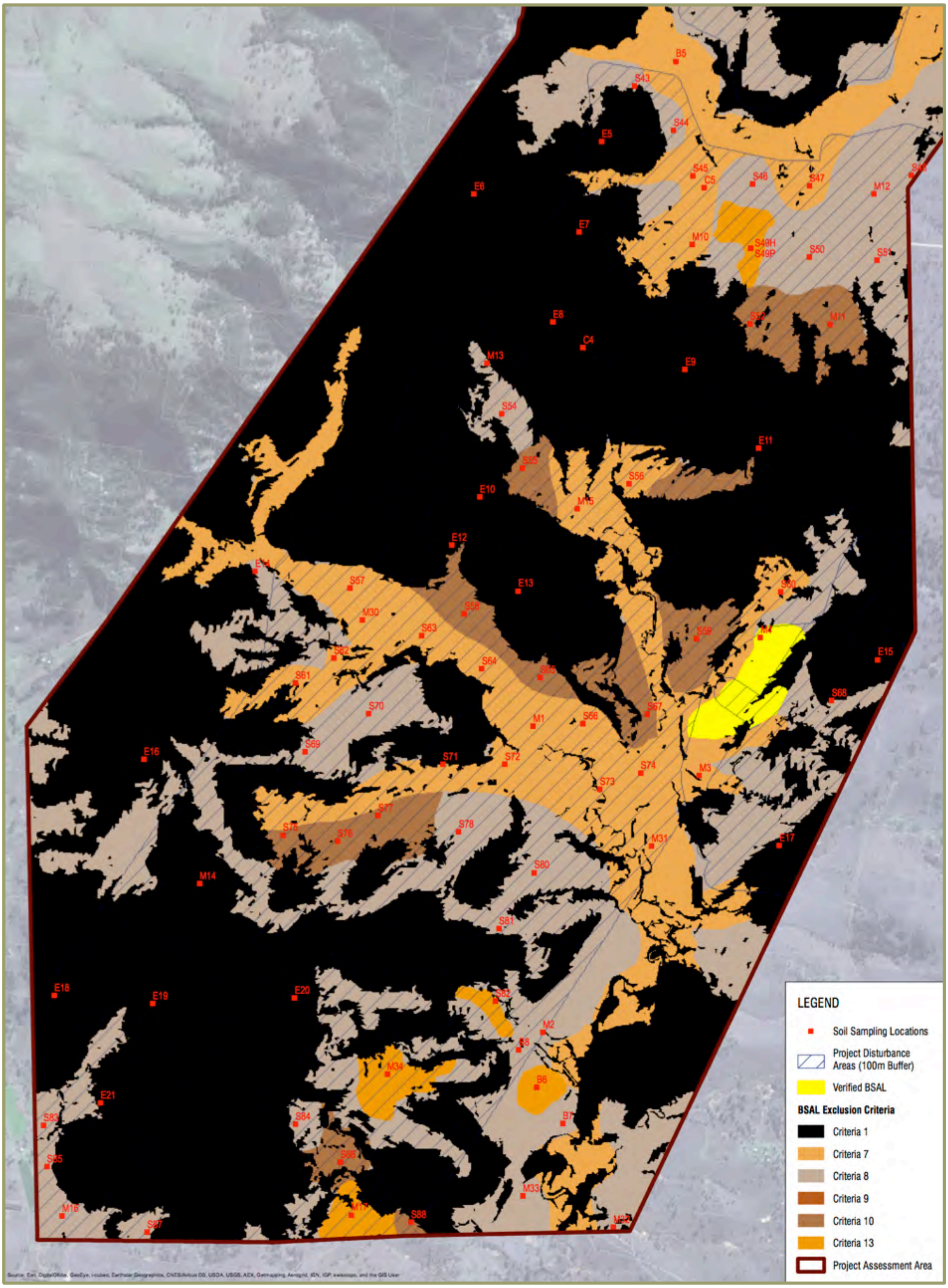


Figure 3-6 Verified-BSAL within the PAA (southern extent, scale 1:25,000) (adapted from Richards, 2014)

The Triassic-age sandstone escarpment to the immediate west of the PAA is, most likely, also a less productive groundwater source. At multiple locations along the base of the escarpment, this system is observed to discharge as 'springs' that can enter and contribute to base flow of creeks, e.g. Coal Creek. In other locations this discharge is masked by colluvium deposits (McAlister and Dvoracek, 2014). Although not supported by detailed assessment by McAlister and Dvoracek (2014), Government-mapping indicates this system is potentially a highly productive groundwater source.

The underlying Permian-age strata, including coal seams, are considered to be a less productive groundwater source.

3.2.3.1 Groundwater bores

During the coal exploration programme previously undertaken on AL19, 18 groundwater-monitoring wells (piezometers) were installed into coal seams and alluvium material in the two Sandy Creek systems to obtain permeability and water quality information from various geological horizons. Three permanent data loggers were also installed into wells located in the streambed of Sandy Creek (South) and Sandy Creek (North). Groundwater levels are continuously monitored by the data loggers, along with the levels of any surface water should the streams flow after rainfall (Idemitsu Australia Resources, 2012).

In a census of 38 bores on 27 properties mostly within the PAA, McAlister and Dvoracek (2014) found:

- Groundwater salinity generally increased downstream along the creek lines, from slightly saline to brackish. Salinity increased substantially along Sandy Creek (South) where groundwater levels within the Permian strata are close to alluvial levels;
- Most bores are shallow, screened within alluvium or regolith systems and used for stock and domestic purposes;
- The majority of ground and surface waters samples were not suitable for human consumption due to elevated salinity, hardness, chloride, sodium and/or iron levels;
- Four bores exceeded salinity limits for irrigation water supply;
- Six bores exceeded salinity limits for stock watering; and,
- Three bores had high levels of ammonia.

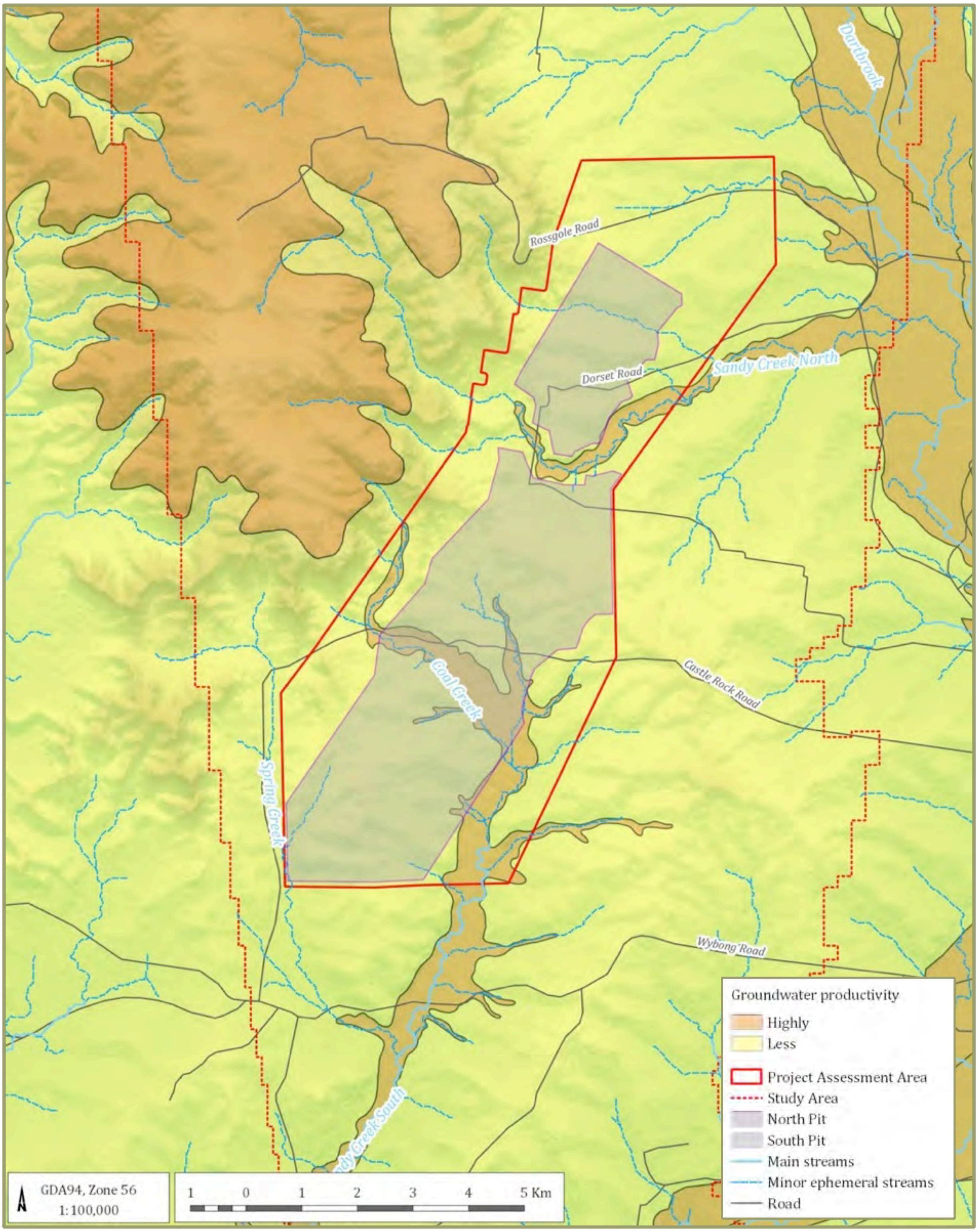


Figure 3-7 Government-mapped highly and less productive aquifers within the PAA and surrounding locality (adapted from McAlister and Dvoracek, 2014)

3.3 Critical industry clusters

Government verification and mapping (DPI, 2014) has identified both equine and viticulture CIC lands within the PAA (refer Figure 2.5). Notwithstanding, no agribusinesses within the PAA are associated with either CIC and no land is used for horse breeding, vineyards, wine making, wine tourism or any associated use.

3.3.1 Equine CIC

Despite Government mapping of 1,125 ha of equine CIC land within the PAA, there are no horse studs within it or near to it (Table 3.5; Figure 3.8). No horse studs are within 2 km of the PAA. The closest stud is Dalmore, a broodmare and yearling-training farm, located approximately 3.8 km to the north of the PAA boundary. Four studs are within 5 km and a further five within 10 km. Importantly, the critical equine CIC core business of Darley Kelvinside Stud is located approximately 8.2 km from the PAA boundary.

Table 3-5 Analysis of Government-verified equine CIC land within the PAA

Landholder name	Area (ha)	Current land use	Former land use
Bluford (dec'd)	1.1	Unformed road	Unformed road
Parry-Okeden, Blair Davenport	183.6	Not available	Not available
Rossgole Pastoral Company Pty Limited	251.2	Beef cattle, sheep, forage cultivation	Beef cattle, sheep, forage cultivation
Sparre	530.3	Beef cattle	Beef cattle, pigs, sheep
Wilcrow Pty Limited	159.0	Beef cattle, sheep	Beef cattle, sheep
TOTAL	**1,124.9**		

Rossgole Pastoral Company Pty Limited operates with the equine industry, but does not keep horses on any land within the PAA. The Rossgole Pastoral Company is involved in small scale thoroughbred race horse breeding, with three race horses kept at East Rossgole (lot 2/DP1128536 and surrounds), located to the west of the PAA. This property is mapped as Government-verified equine CIC land and contains equine infrastructure for both racehorses and stockhorses. Within the PAA, equine CIC land held by the Rossgole Pastoral Company is used for beef cattle and sheep production and associated forage cultivation and contains no equine-related infrastructure.

A meta-analysis of available information concerning each identified horse stud within 5 km of the PAA follows.

Origin	Distance to PAA (km)	Origin	Distance to PAA (km)
Amarina Farm	21.3	Invermien	8.7
Arrowfield	12.4	Kanangra Park	17.9
Ashleigh Thoroughbreds	9.3	Kia Ora	11.7
Attunga	5.5	Limvardy Thoroughbreds	6.5
Balmoral	8.6	Melody Park	18.5
Barador	29.7	Middlebrook Station	19.6
Bellerive	13.8	Middlebrook Valley Lodge	20.5
Belltrees	9.9	Midlands	6.5
Bengalla	6.1	Monarch	8.1
Berkerely Park Stud	11.6	Mulawa	9.7
Broad Crossing	11.7	Newgate Farm	7.6
Brooklyn Lodge	9.4	Patinack	21.2
Carnallway	7.3	Patinack	8.5
Chatsworth Park	4.7	Redbank Stud	6.5
Coolmore	23.9	Redman Park	20.4
Coronet	8.3	Retreat Farm	15.1
Cressfield	17.4	Riversdale	13.5
Crowning Stone	7.3	Riverslea	14.0
Dalmore	3.8	Rosehill Lodge	10.3
Darley Kelvinside	8.2	Sefton Park	7.1
Darley Woodlands	21.5	Segenhoe	12.9
Dartbrook Downs	4.2	Sledmere	12.0
Dunvegan	18.8	St Aubins	7.8
Edinglassie	8.1	Sutton Farm	17.6
Ferndale	20.8	Toolooganvale Farm	20.0
Flame Tree	14.7	Turrangga Farm	10.2
Glastonbury Farm	11.2	Umavale	33.0
Goanna Downs	12.2	Valleys End	14.3
Golden Grove	13.3	Vinery	9.5
Hampton Park	12.3	Wakefield Stud	6.4
Holbrooks	15.0	Wexford	7.9
Hollydene	14.6	Willow Park Stud	21.8
Hunter Nursing Nannies	7.6	Yarraman Park	4.8
Ilala	8.6	Yarrandi	18.4

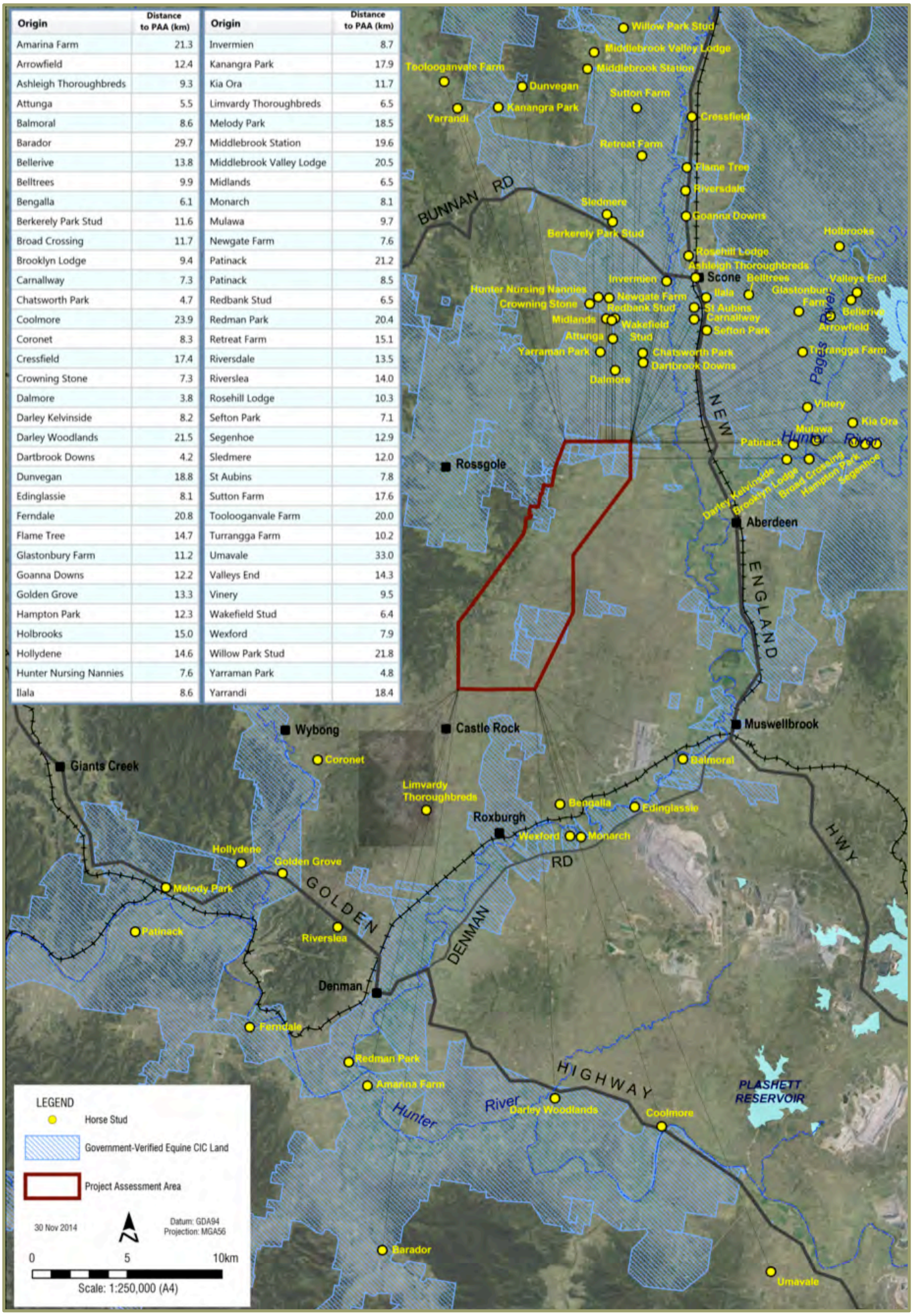


Figure 3-8 Location of equine CIC core businesses in the vicinity of the PAA

3.3.1.1 Dalmore Stud (3.8 km away)

Dalmore Stud is an established broodmare farm on about 198 ha (Table 3.6). In 2014, this farm was advertised for sale (Plate 3.2). In operation it held 15 broodmares and agisted an additional 15 outside mares (Visit by Road, 2014). Services included agistment, breaking, pre-training and yearling preparation (Visit by Road, 2014).

Table 3-6 Description of Dalmore Stud

Key Equine CIC Indicators	Description
Distance to PAA	3.8 km
Owner	For sale in 2014
Size (ha)	198
Enterprises and activities	Broodmare agistment, spelling, yearling breaking, pre-training and preparation[1]
Facilities	Yearling barn, walking machine, vet shed, irrigation infrastructure, holding yards, storage sheds, grain storage silos etc[2].

Source: [1] Visit by Road (2014)
[2] Realestate.com (2014)

Plate 3-2 Dalmore Stud entry – property advertised for sale

3.3.1.2 Dartbrook Downs Thoroughbreds (4.3 km away)

Dartbrook Downs Thoroughbreds is a 42 ha broodmare and yearling preparation farm located on the banks of Dart Brook (Table 3.7 and Plate 3.3). All paddocks are separated by a laneway allowing for: individual and/or shared spelling; agistment for mares, foals, weanlings and yearlings, including short-stay agistment for 'walk-on' mares; assistance with dry mares; and foaling down facilities (Dartbrook Downs Thoroughbreds, 2014).

Table 3-7 Description of Dartbrook Downs Thoroughbreds

Key Equine CIC Indicators	Description	
Distance to PAA	4.3 km	
Owner	Equine Trust, directed by Ms. Jen Butler and Mr. Barry McDonald[1]	
Size (ha)	Approx. 42	
Enterprises and activities	Vendors of yearlings and broodmares. Broodmare spelling, agistment, foaling down, assistance with dry mares[1]	
Sales	To Australian and New Zealand markets.	
	Sales prepared at Dartbrook Downs[2]: 2014 Inglis Classic Yearling Sale Summer 2013 Inglis Classic Yearling Sale Winter 2013 Inglis Classic Yearling Sale Summer	*Estimate[2]:* $147,000 $10,000 $125,000

Source: [1] Dartbrook Downs Thoroughbreds (2014)
[2] Inglis (2014)

Plate 3-3 Dartbrook Downs Thoroughbreds landscape (Dartbrook Downs Thoroughbreds, 2014)

3.3.1.3 Yarraman Park (4.8 km away)

Yarraman Park is a stallion and broodmare thoroughbred farm on about 1,200 ha of land (Table 3.8; Plate 3.4). The stud stands 3 stallions and a band of broodmares. The property has been operating as a thoroughbred stud since the early 1900's.

Table 3-8 Description of Yarraman Park

Key Equine CIC Indicators	Description	
Distance to PAA	4.8 km	
Owner	Mitchell family, directed by Mr. Arthur and Mr. Harry Mitchell	
Size (ha)	1,200	
Enterprise and activities	Vendors of yearlings and broodmares[1]	
Sales	Sold to Australian, New Zealand, Hong Kong, and South African markets	
	Sales prepared at Yarraman Park[1, 2, 3]:	*Estimate[2, 3]:*
	2014 Inglis Classic Yearling Sale Summer	$1,400,000
	2014 Magic Millions Gold Coast Yearling Sale	$4,372,500
	2014 Australian Weanling and Bloodstock Sale	$1,926,300
	2013 Inglis Classic Yearling Sale Summer	$91,000
	2013 Magic Millions Yearling Sale	$2,060,000
	2013 Australian Weanling and Bloodstock Sale	$328,000
Performers	*Group 1 horses prepared at Yarraman Park include[1]:*	*Winnings estimated at[1]:*
	Foreplay	no information
	Delta Form	no information
	Snitzel	$1 million
	St Covet	$1.3 million
	Apercu	$408,350
	Fastnet Rock	$1.7 million
	Kenwood Melody	$553,980
	Dignity Dancer	$1.9 million
	Bollinger	$681,330
	Alinghi	$3.4 million
	Special Harmony	$1.8 million
	Grand Armee	$5.3 million
	Stylish Century	$2.4 million
	Primacy	$1.1 million
	Fairy King Prawn	$9.7 million
	Super Impose	$5.6 million
	Magic of Money	$311,108
	Aragen	$458,516

Sources: [1] Yarraman Park (2014)
[2] Inglis (2014)
[3] Magic Millions (2014)

Plate 3-4 Yarraman Park entrance (Yarraman Park, 2014)

3.3.1.4 Chatsworth Park (4.9 km away)

Chatsworth Park is a broodmare agistment and spelling farm (Table 3.8). The equine component of the property comprises approximately 40 ha of land along Dart Brook. An additional 120 ha is used to grow lucerne hay for horse feed (Chatsworth Park, 2014).

Table 3-9 Description of Chatsworth Park

Key Equine CIC Indicators	Description	
Distance to PAA	4.9 km	
Owner	Ms. Karen and Mr. Kym Justin[1]	
Size (ha)	160	
Enterprises and activities	Vendors of yearlings and broodmares Broodmare agistment, mares under lights, foaling down, weaning and spelling. Lucerne production[1]	
Facilities	Irrigated improved pasture paddocks, floodlight foaling paddocks, purpose built yards[1]	
Sales	Sold to the Australian market	
	Sales prepared at Chatsworth Park[2]: 2014 Inglis Classic Yearling Sale Winter 2014 Inglis Classic Yearling Sale Summer 2014 Australian Weanling and Bloodstock Sale 2013 Inglis Classic Yearling Sale Summer 2013 Australian Weanling and Bloodstock Sale	*Estimate[2]:* $26,00 $121,000 $20,000 $20,000 $4,000

Source: [1] Chatsworth Park (2014)
[2] Inglis (2014)

3.3.2 Viticulture

Despite Government mapping of 50 ha of viticulture CIC land within the PAA, no vineyards or wineries are within the PAA or near to it (Figure 3.9). The indicated 50 ha are in fact an olive grove, and prior to tree planting ten years ago, this lot (3/DP836268) was vegetated with native tree species. No grape vines have ever been planted on this land.

The closest business relevant to the viticulture CIC is Birnam Wood Wines (Table 3.10), about 2.3 km away. Originally a horse stud, this vineyard was established in 1994 with 30 ha of vines. Several varieties are produced and some wine is exported (Find a winery, 2014; Halliday, 2014). There is no cellar door for wine tourism. The next closest vineyard is almost 8 km from the PAA.

Table 3-10 Description of Birnam Wood Wines

Key Viticulture CIC Indicators	Description
Distance to PAA	2.3 km
Winemaker	Monarch Winemaking Services[1]
Established	1994
Size (ha)	Approx. 30
Varietals	Semillon, Shiraz, Verduzzo[1,2]
Labels	Shakespeare, The Witches Brew Chardonnay, The Bards Tipple Semillon, The Kings Cup Shiraz, Family Range Chardonnay and Verdelho, Reserve Chardonnay and Shiraz[1,2]
Exports	Switzerland, Canada and China[2]

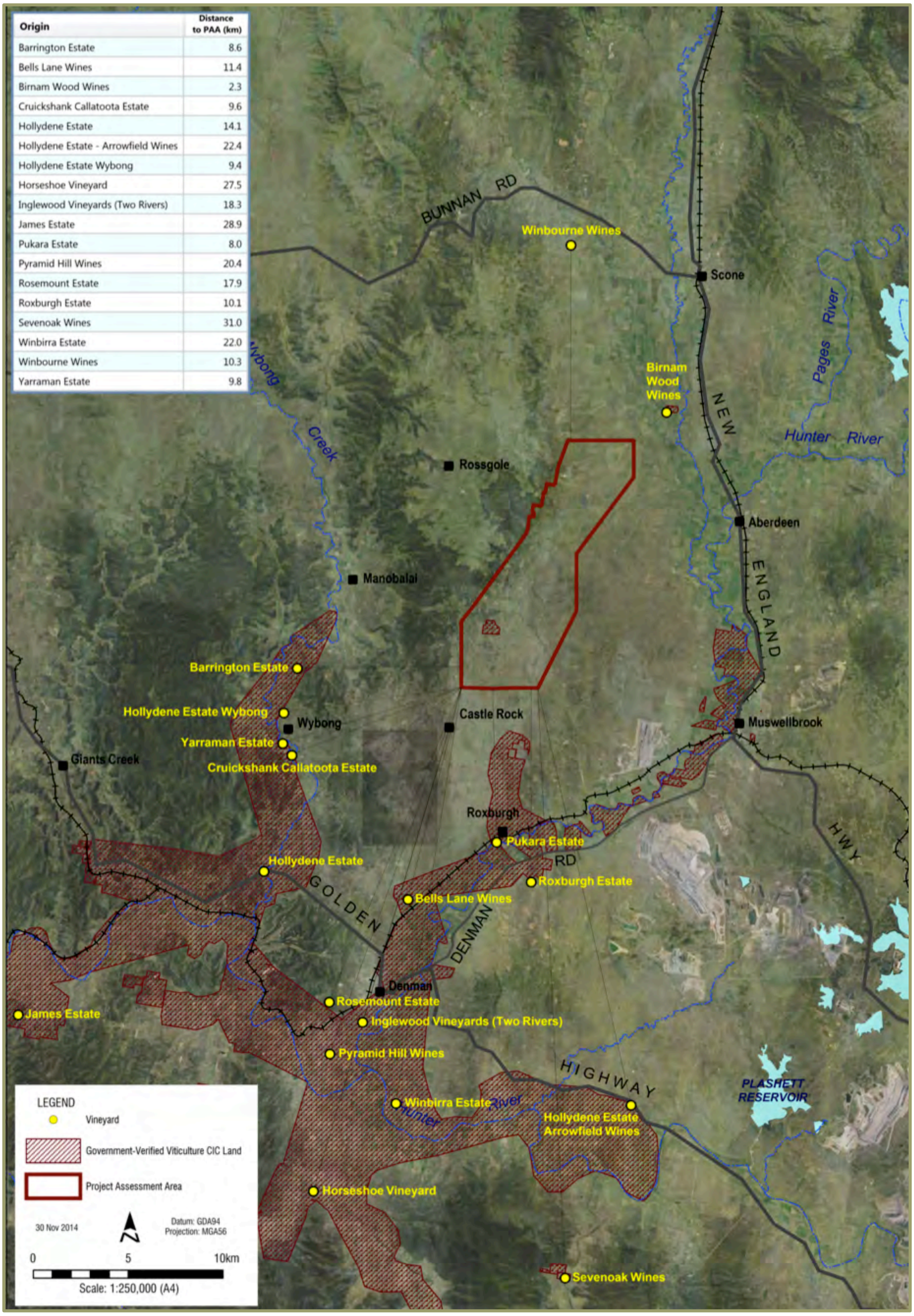
Source: [1] Halliday (2014)
[2] Find a winery (2014)

3.3.3 CIC summary

Government-verified mapping indicates 1,175 ha of CIC land within the PAA. In contrast, no land within the PAA, or within 2 km of it, is used for any purpose connected with either the equine or viticulture CICs (Table 3.11).

Table 3-11 Summary of CIC land affected by PAA

CIC	Mapped in region (ha)	Mapped in PAA (ha)	Actual in PAA (ha)	Closest business
Equine	254,900	1,125	0	3.8 km away
Viticulture	60,000	50	0	2.3 km away



Origin	Distance to PAA (km)
Barrington Estate	8.6
Bells Lane Wines	11.4
Birnam Wood Wines	2.3
Cruickshank Callatoota Estate	9.6
Hollydene Estate	14.1
Hollydene Estate - Arrowfield Wines	22.4
Hollydene Estate Wybong	9.4
Horseshoe Vineyard	27.5
Inglewood Vineyards (Two Rivers)	18.3
James Estate	28.9
Pukara Estate	8.0
Pyramid Hill Wines	20.4
Rosemount Estate	17.9
Roxburgh Estate	10.1
Sevenoak Wines	31.0
Winbirra Estate	22.0
Winbourne Wines	10.3
Yarraman Estate	9.8

Figure 3-9 Location of viticulture CIC core businesses in the vicinity of the PAA

4 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

Following is a process-based identification and description of potential impacts of the proposed Project on SAL, specifically project-verified BSAL and its associated aquifers, and Government-verified CIC lands of the equine and viticulture industries.

4.1 Nature of proposed mining activities and impacts

The Applicant proposes open-cut terrace mining methods targeting four coal seam groups, viz.

- Abbey Green;
- Whybrow;
- Redbank Creek / Wambo; and,
- Whynot / Blakefield.

With a JORC Compliant resource of 621 Mt, pre-feasibility studies suggest the mine could produce 15 Mtpa of saleable, low ash, low sulphur thermal coal for up to 30 years (Idemitsu, 2012). The terrace mining method, using electric/hydraulic shovels and trucks for mining, is favoured over s strip methods. Among other attributes, terrace mining has more favourable outcomes in terms of final landform construction for rehabilitation, and minimisation of out-of-pit waste dumping and final void size.

The conceptual mine layout design indicates proposed mining, out-of-pit dumping and mine infrastructure areas in relation to verified-BSAL and CIC lands (Figure 4.1). The extent of affected SAL within these areas of mining disturbance has been calculated (Table 4.1).

Table 4-1 Potential mining disturbance on SAL

PAA disturbance type	PAA (ha)	Verified BSAL (ha)	Equine CIC land (ha)	Viticulture CIC land (ha)
Mine infrastructure area	169.8	8.5	127.6	0.0
Out-of-pit emplacement	609.6	58.9	165.4	0.0
In-pit emplacement	2823.7	1.0	411.5	49.5
Final void	342.4	0.0	0.0	0.0
Not disturbed	1675.6	136.2	420.2	0.9
[1]**TOTAL**	5621.0	204.6	1124.9	50.4

[1] Total values may not sum accurately due to rounding.

The foremost agricultural impacts of open-cut terrace mining are the location and extent of any 'out-of-pit' overburden dumps, i.e. Overburden Emplacement Areas (OEA), final landform design parameters for rehabilitation, and the size and nature of residual final voids. The location and extent of infrastructure is another, lower order consideration, as the potential impacts are considered to be temporary in most cases. The focus of this report is the potential direct impacts of open-cut terrace mining on verified-BSAL and its associated aquifers, and the potential direct and indirect impacts on equine and viticulture CICs.

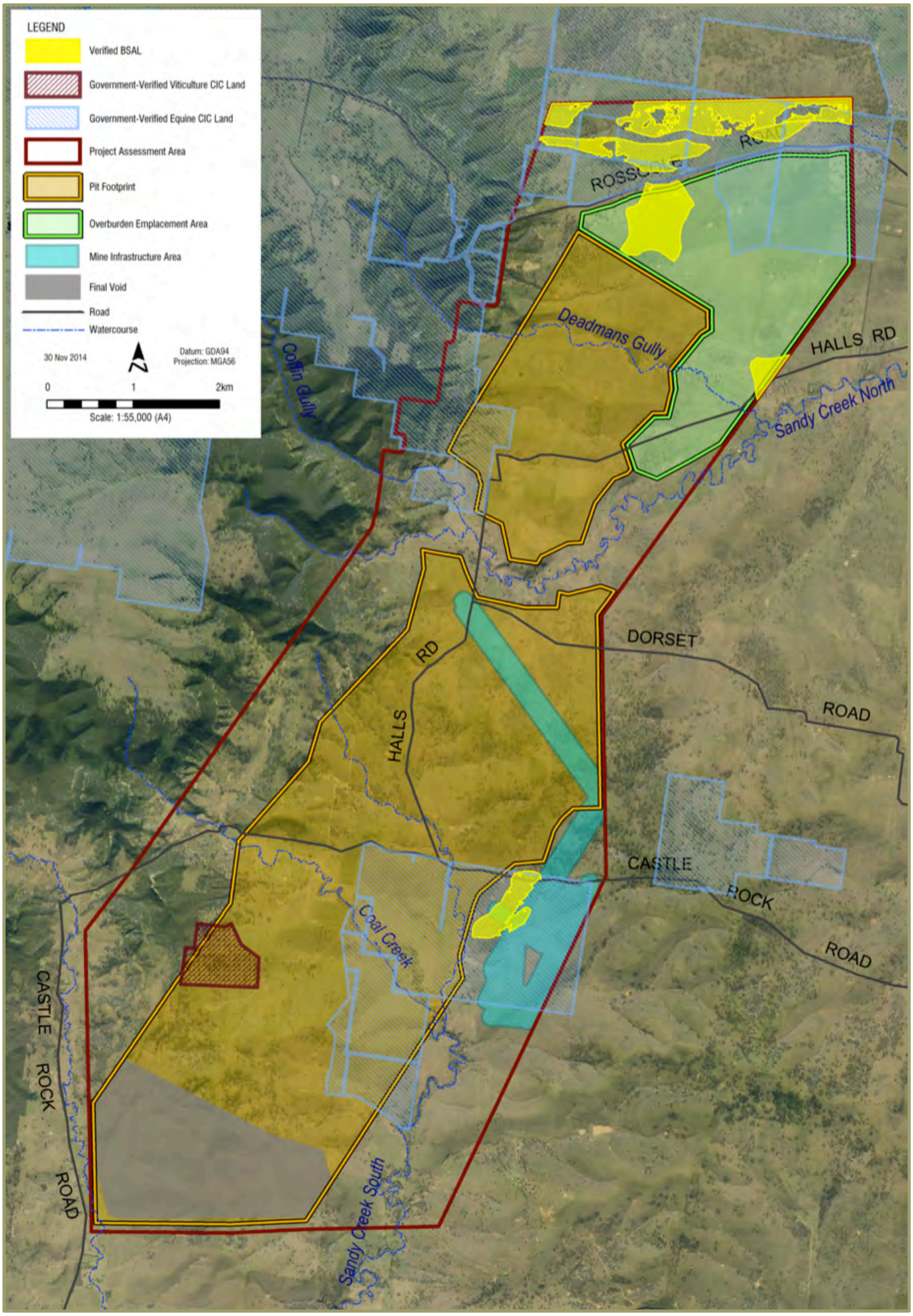


Figure 4-1 Conceptual mine layout design, and verified BSAL and CIC lands

4.1.1 Open-cut terrace mining

Conceptually, open-cut terrace mining will commence in the northern portion of the PAA and progress in a southerly direction over LoM. Two distinct mining pits will be developed, i.e. north pit and south pit. Terrace mining has a smaller initial boxcut and mines transverse strips perpendicular to the strike of the coal deposit, in this instance along an east/west axis (Plate 4.1).

Plate 4-1 Terrace mining at Boggabri Coal

Compared and contrasted with more common open-cut strip mining methods, terrace mining has tangible advantages with respect to minimising potential impacts on strategic agricultural land. For example, terrace mining will:

- Require a smaller initial boxcut and therefore, a smaller out-of-pit overburden emplacement at the commencement of mining;
- Have a smaller active mining area at all times;
- Deliver areas for rehabilitation sooner;
- Leave a smaller final void, if one is necessary;
- Produces less dust as draglines are not used; and,
- Can use smaller blasts to fracture overburden rock.

4.1.1.1 Out-of-pit overburden emplacement

The initial box-cut, the first excavation to uncover coal, in the north pit will require an overburden emplacement to be constructed out-of-pit. Conceptually, this emplacement will have a footprint of 609.6 ha, take three years to construct and be fully rehabilitated by year four of operation. From year three, all excavated overburden will be placed 'in pit', as the mine advances south.

The rehabilitated emplacement will serve to limit the Primary Visual Catchment (PVC) of the Project. This will reduce any impacts associated with loss of visual amenity, scenic and landscape values important to the CICs.

Within the footprint of the out-of-pit overburden emplacement are 58.9 ha of verified-BSAL and 165.4 ha of Government-verified equine CIC land. None of this land is currently used for any purpose connected with the equine industry.

4.1.1.2 Final landform design parameters for rehabilitation

Historically in the Hunter Valley coalfield, final landform design has focussed on optimisation of mining costs through maximisation of dump storage volume and minimisation of reshaping requirements. Regulated maximum emplacement height limits have become the design default used by mine planners. Little consideration has been given to landform aesthetics, or natural fluvial, geomorphic and ecological processes. This approach has resulted in 'mesa-style' landforms, often sown with introduced grass species and intermittent tree plots (Plate 4.2).

Plate 4-2 A typical post-mining 'mesa-style' landform near Muswellbrook, NSW

Not only do these landforms look unpleasantly artificial, they are likely unsustainable in the medium term. These landforms fail to mimic pre-mining landscape functions, instead relying on engineered contour drains, rock-lined waterways and sediment dams to control landform instability. The long-term stability, maintenance requirements and land use of these landforms is unproven.

The Applicant is committed to achieving a high standard of post-mining rehabilitation at the Project. This will be achieved as follows.

<u>Landform design</u>

Developing post-mining landform design parameters based on the pre-mining, natural landscape, including:

- Slope shapes, gradients and lengths;
- Landform complexity; and,
- Drainage lines.

<u>Mine planning</u>

Developing and maintaining mine plans that take account of:

- Rehabilitation landform design parameters; and,
- Progressive rehabilitation.

Existing vegetation

Managing the clearing of existing vegetation in advance of mining to:

- Reuse suitable logs as fauna habitat in later rehabilitation; and,
- Maximise beneficial re-use of residual, unwanted timber logs, e.g. chipping for mulch for use in rehabilitation.

Soils

Managing soils to ensure:

- Matching of the pre- and post-mining landscape position of soil types for use in rehabilitation;
- Handling and replacement of soil profiles in correct horizon sequences;
- Sodic soils do not cause accelerated erosion;
- Minimisation of stockpiling; and,
- Proper seedbed preparation.

Vegetation

Growing vegetation that is:

- Native;
- Sustainable;
- Indigenous to the surrounding area;
- Sympathetic to adjoining remnant ecosystems; and,
- Considers biodiversity, wildlife corridors and ecosystem functions.

The proposed Project will affect 68.4 ha of verified BSAL soils. Although these soils will be used in rehabilitation, the Applicant has assumed that the *BSAL-status* of these soils will be lost in the mining process.

4.1.1.3 Residual or final voids

One final void is currently planned for end of mine life. This void will be located in the south of the PAA (refer to Figure 4.1). The void of 342.4 ha will not be sited on verified-BSAL, or Government mapped CIC lands.

4.1.2 Mine infrastructure area

A mine infrastructure area of 169.8 ha is required to support open-cut mining operations and production of saleable coal. Within this area, there are 8.5 ha of verified-BSAL and 127.6 ha of Government-verified equine CIC land. No viticulture CIC land is affected by mine infrastructure. Mine infrastructure includes the following.

- Buildings – temporary construction facilities, and offices, bathhouse, warehouse, fuel storage, workshop;
- Electrical infrastructure – overhead transmission lines, switchyards and substations;
- Roads – haul roads, light vehicle access roads;
- Coal handling – ROM stockpile, conveyors, stacker/reclaimers; and,
- CPP – coal crushing, sizing and washing plant.

4.2 Identification and assessment of impacts against relevant criteria for BSAL

The Mining SEPP provides the relevant criteria to be used in determining potential impacts to strategic agricultural land. With reference to these criteria and the Guideline (DP&I, 2013a), the Project's potential impacts on BSAL are considered below.

4.2.1 Any impacts on the land through surface area disturbance and subsidence

Within the PAA of 5,621 ha, there are 204.6 ha of verified-BSAL (Richards, 2014). Through various mining disturbances, the Project will affect 68.4 ha of verified-BSAL (Table 4.2). Although these soils will be used in rehabilitation, the Applicant has assumed that the *BSAL-status* of these soils will be lost in the rehabilitation process.

Table 4-2 Impacts on verified-BSAL through surface area disturbances

Disturbance type	Total extent (ha)	Verified-BSAL (ha)
Mine infrastructure area	169.8	8.5
Out-of-pit emplacement	609.6	58.9
In-pit emplacement	2823.6	1.0
Final void	342.4	0.0
Not disturbed	1675.6	136.2
TOTAL[1]	**5,621.1**	**204.6**

[1] Total values may not sum accurately due to rounding.

4.2.2 Any impacts on soil fertility, effective rooting depth or soil drainage

Preceding mining disturbance, verified-BSAL soils will be removed with care to management in excavation, storage and replacement of soils in correct profile horizon sequences. This will ensure potential impacts on fertility, effective rooting depth and drainage are mitigated.

4.2.3 Increase in surface micro-relief, soil salinity, rock outcrop, slope and surface rockiness or significant changes to soil pH

Final landform design parameters will be based on the existing natural topography including shape, slope and landscape complexity. All soils, including verified-BSAL soils, will be replaced onto the post-mining landform in their correct landscape positions. This will ensure potential impacts on micro-relief and slope are mitigated. There will be no impacts on soil salinity, rockiness or soil pH by relocating soils for rehabilitation.

4.2.4 Any impacts on highly productive aquifers

McAlister and Dvoracek (2014) determined potential impacts on groundwater systems, including that for highly productive groundwater within the meaning of the AIP, both within the PAA (Table 4.3) and the surrounding locality (Tables 4.4 and 4.5).

Within the PAA, modelling indicates the Government-classified highly productive alluvial aquifers associated with Sandy Creek (north), the upper reaches of Sandy Creek (south) and Spring Creek will incur drawdowns greater than 2 m and depressurisation. Notwithstanding, McAlister and Dvoracek (2014) assert that at least some of these aquifers are 'less productive', based on AIP classification criteria for salinity and yield. Existing bores screened within alluvium / regolith and potentially affected by aquifer drawdowns greater than two metres have been identified (Figure 4.2).

Importantly, no impacts are anticipated for the highly productive Triassic Sandstone aquifer to the west of the PAA, or to the highly productive alluvium aquifers associated with Dart Brook and the Hunter River to the east.

Table 4-3 Summary of AIP assessment for Alluvial sources within the PAA (after McAlister and Dvoracek, 2014)

Aquifer	Alluvial Sources
Category	Highly productive
Minimum impact consideration	Assessment
Water table	Level 2, >2m drawdown
Water pressure	Level 2, >40% decline
Water quality	Level 1

Table 4-4 Summary AIP assessment for Triassic Sandstone to the west of the PAA (after McAlister and Dvoracek, 2014)

Aquifer	Triassic Sandstone Sources
Category	Highly productive
Minimum impact consideration	Assessment
Water table	Level 1
Water pressure	Level 1
Water quality	Level 1

Table 4-5 Summary AIP assessment for Dart Brook and Hunter River alluvial to the east of the PAA (after McAlister and Dvoracek, 2014)

Aquifer	Dart Brook and Hunter River Alluvial Sources
Category	Highly productive
Minimum impact consideration	**Assessment**
Water table	Level 1
Water pressure	Level 1
Water quality	Level 1

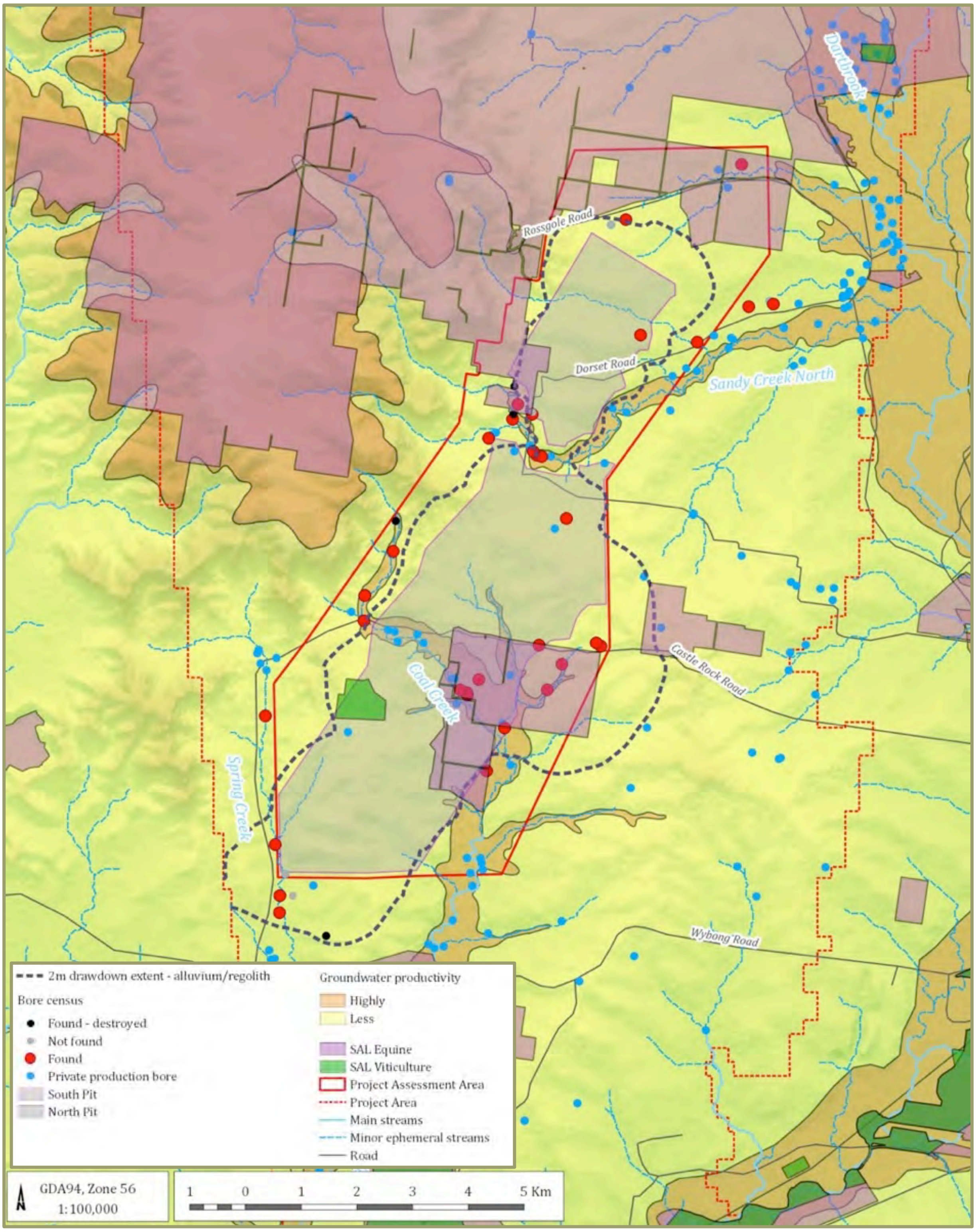


Figure 4-2 Bores within the Project Assessment Area and immediate surround with a predicted >2 m drawdown (adapted from McAlister and Dvoracek, 2014)

4.2.5 Any fragmentation of agricultural land uses

The Project will not cause any significant fragmentation of agricultural land uses associated with verified-BSAL, because within the PAA:

- The predominant land use is low management intensity beef cattle grazing on small holdings that do not provide a *living area* (see Section 3.1.1);
- The extent of verified-BSAL is just 204.6 ha or 3.6% of land (see Section 3.2.2); and,
- The extent of verified-BSAL projected to be permanently lost due to the Project is just 68.4 ha or 1.2% of land.

4.2.6 Any reduction in the area of biophysical strategic agricultural land

The proposed Project will cause 68.4 ha of verified-BSAL to be permanently lost. This represents about one third of verified-BSAL within the PAA, and 0.03% of potential-BSAL within the Upper Hunter region. At each of a local, regional and state level, the consequential outcome of this mining impact on soils and agriculture is considered insignificant.

4.3 Identification and assessment of impacts against relevant criteria for CICs

The Mining SEPP provides the relevant criteria to be used in determining potential impacts on CIC land. With reference to these criteria and the Guideline (DP&I, 2013), the Project's impacts on CIC land are considered as follows.

4.3.1 Any impacts on the land through surface area disturbance and subsidence

4.3.1.1 Equine CIC land

Within the PAA of 5,621 ha are 1,125 ha of Government-verified Equine CIC land. About 705 ha of this verified land will be affected by the Project (Table 4.6), with 577 ha permanently lost. A further 128 ha will be temporarily affected by placement of mine infrastructure.

Table 4-6 Government-verified Equine CIC land affected by the Project

Disturbance type	Equine CIC land (ha)	Equine CIC land (%)	Proportion of PAA (%)
Mine infrastructure area	127.6	11.3	2.3
Out-of-pit emplacement	165.4	14.7	2.9
In-pit emplacement	411.5	36.6	7.3
Final void	0.0	0.0	0.0
Not disturbed	420.2	37.4	7.5
[1]**TOTAL**	**1,124.9**	**100**	**20.0**

[1] Total values may not sum accurately due to rounding

Notwithstanding the Project affects Government-verified equine CIC land, potential impacts on the cluster are considered to be insignificant because:

- The permanent loss of 577 ha represents just 0.23% of equine CIC land within the Upper Hunter region;
- None of the affected land within the PAA has ever been used for a purpose connected with the equine industry; and,

- The loss of this land will have no effect on the functioning, viability or sustainability of the Equine CIC or any core business within it.

4.3.1.2 Viticulture CIC land

There are 50.4 ha of Government-verified Viticulture CIC land within the PAA. The Project will cause the permanent loss of about 49.5 ha of this land (Table 4.7). The Project's potential impacts on Government-verified viticulture CIC land are considered to be insignificant because:

- The permanent loss of 49.5 ha represents just 0.07% of Viticulture CIC land within the Upper Hunter region;
- None of the affected land within the PAA has ever been used for a purpose connected with the viticulture industry;
- The subject land is currently an established olive grove; and,
- The loss of this land will have no effect on the functioning, viability or sustainability of the cluster or any core business within it.

Table 4-7 Government-verified Viticulture CIC land affected by the Project

Disturbance type	Viticulture CIC land (ha)	Viticulture CIC land (%)	Proportion of PAA (%)
Mine infrastructure area	0.0	0.0	0.0
Out-of-pit emplacement	0.0	0.0	0.0
In-pit emplacement	49.5	98.1	0.9
Final void	0.0	0.0	0.0
Not disturbed	0.9	1.8	0.2
[1]**TOTAL**	**50.4**	**100**	**0.9**

[1] Total values may not sum accurately due to rounding

4.3.2 Reduced access to, or impacts on, water resources and agricultural resources

The Project will cause the permanent loss of 577 ha of Government-verified equine CIC land and a further 49.5 ha of Government-verified viticulture CIC land (see Tables 4.6 and 4.7). This will inevitably cause reduced access to, and impacts on, water resources and agricultural resources associated with those particular lands. However, with regard to the CICs, these impacts should be considered insignificant because:

- None of these lands has ever been used for purposes connected with either CIC;
- The Project meets Level 1 minimum impact considerations for highly productive groundwater sources on surrounding lands known to be used for equine and viticulture purposes (McAlister and Dvoracek, 2014);
- Core businesses of the equine and viticulture CICs in the surrounding locality are thought to primarily rely on the Hunter River, Dart Brook and Kingdon Ponds surface water sources, and these are not affected by the Project;
- The Project will not take water from Dart Brook or Kingdon Ponds, and will minimise water drawn from the Hunter River; and,
- Consent conditions of approval will set stringent criteria for release of mine affected water to the environment, protecting downstream water quality and its agricultural usefulness.

4.3.3 Reduced access to support services and infrastructure

While the Project will cause the loss of Government-verified equine and viticulture CIC lands, this should be considered an insignificant impact on access to support services and infrastructure by those clusters because:

- None of the impacted lands has ever been used for any purpose connected to either CIC and this includes support services and infrastructure; and,
- The Project will not cause an impact to any support services or infrastructure of either CIC that is located outside the PAA.

The Applicant will acquire all lands directly affected by mining activities within the PAA.

4.3.4 Reduced access to transport routes

The Project will cause temporary impacts to Rossgole Road and require the permanent closure of Halls and Dorset Roads and part of Castle Rock Road. This will not reduce access to transport routes for either CIC because:

- Rossgole Road will remain open, incurring only temporary and short-term traffic interruptions for blasting operations during the initial years of mining;
- Halls and Dorset Roads are 'no through roads' that service existing land uses, none of which is associated with either CIC;
- Castle Rock Road is unsealed in part with low-level flood causeways, and services existing land uses, none of which is associated with either CIC;
- The Project will have no impact on the New England Highway linking Muswellbrook, Aberdeen and Scone; and,
- The Project will have no impact on existing rail and air transport services.

4.3.5 The loss of scenic and landscape values

Scenic and landscape values are very important to the equine and viticulture CICs (see PAC, 2013 and 2014; MPGP, 2014). The loss of 576.9 ha of equine CIC land and 49.5 of viticulture CIC land will not cause any loss of scenic and landscape values important to the CICs because none of this Government-verified CIC land is actually used for a purpose connected with either CIC.

Further, and with respect to the equine CIC:

- The closest thoroughbred stallion stud, Yarraman Park that stands 3 sires, is 4.8 km away;
- The closest thoroughbred broodmare farm, Dalmore that hosts up to 30 mares, is 3.8 km away; and,
- The Darley Kelvinside thoroughbred stallion stud, a business of critical importance to the sustainability of the equine CIC in the region, is 8.2 km away.

None of the thoroughbred horse studs within 5 km of the PAA is of the nature, scale or importance of Coolmore or Darley Woodlands studs to the sustainability of the equine CIC, as described in recent determinations by the NSW Mining & Petroleum Gateway Panel and NSW Planning Assessment Commission (MPGP, 2013; PAC, 2013 and 2014).

With respect to the viticulture CIC, the closest core business is Birnam Woods Wines vineyard, about 2.3 km away. The vineyard does not have a cellar door for wine tourism.

Preliminary viewshed analysis shows that little planned mining disturbance is visible from any core business within the equine CIC at any stage of mining (for example, Figures 4.3, 4.4, 4.5 and 4.6). This analysis is conservative, as it takes no account of existing vegetation or buildings that further limit views of the Project's planned disturbances.

Existing distances between the proposed Project and core business within the CICs provide an adequate buffer to mitigate and minimise any impacts on scenic and landscape values.

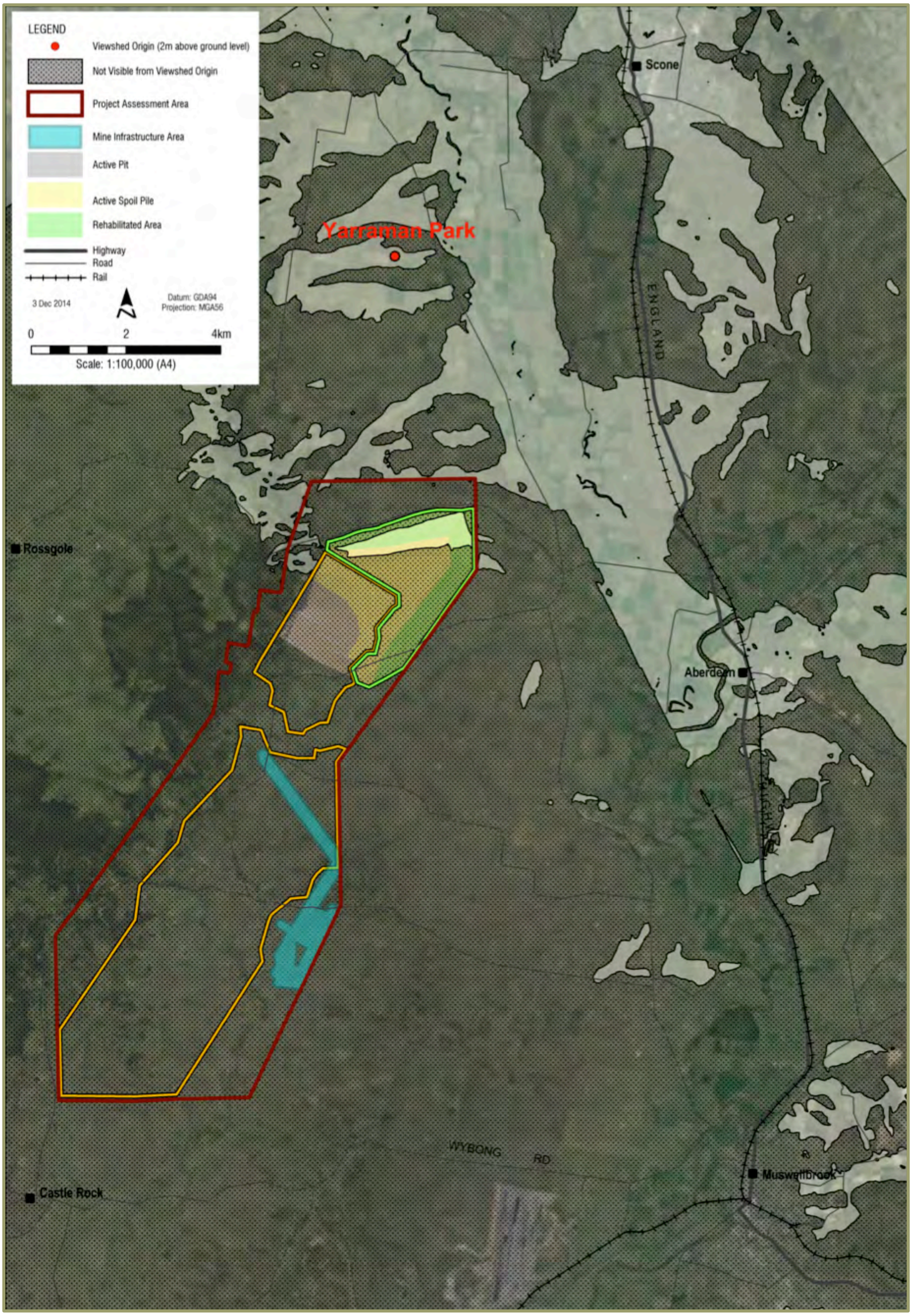


Figure 4-3 Viewshed from Yarraman Park in year 5 of mining operations

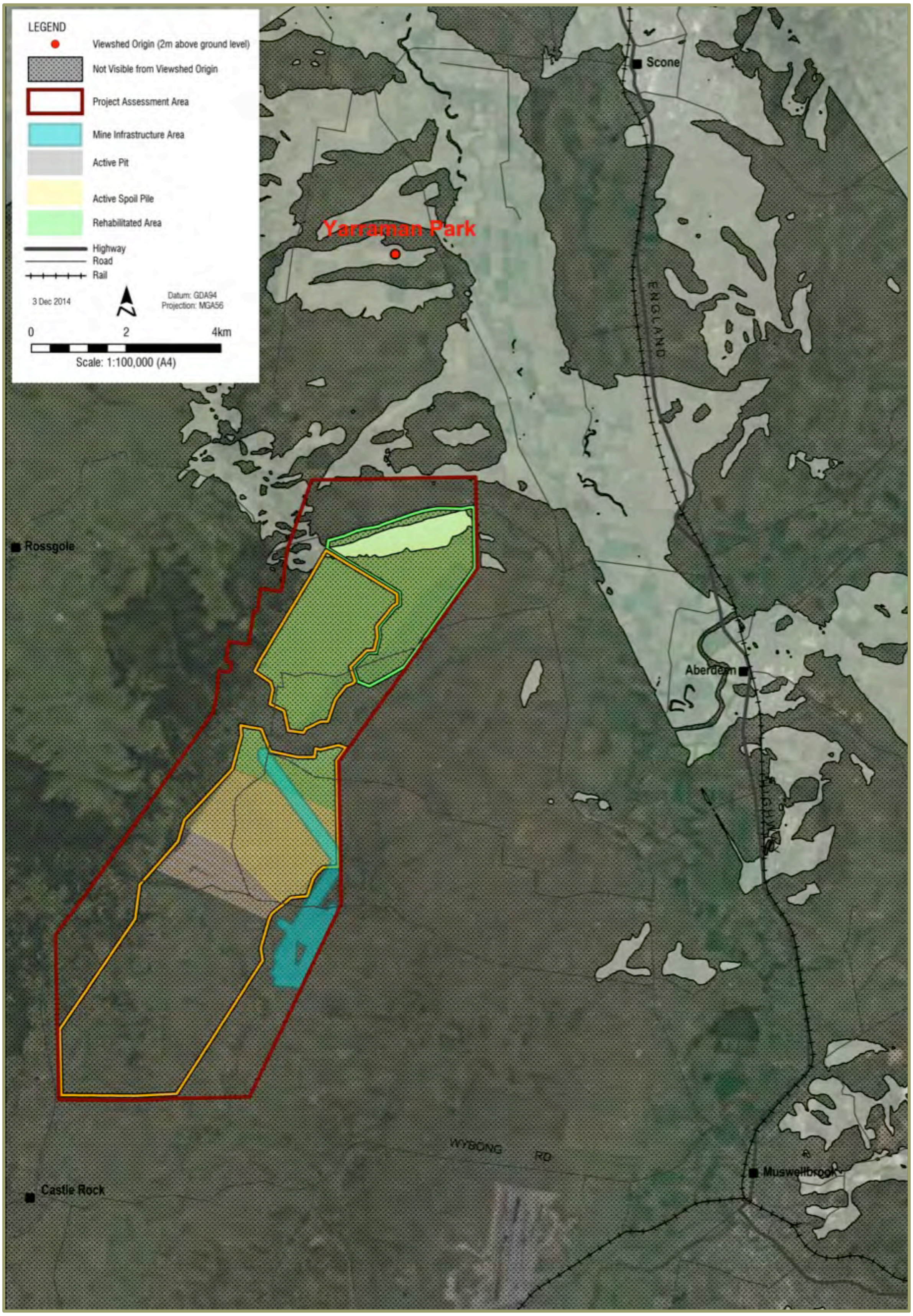


Figure 4-4 Viewshed from Yarraman Park in year 16 of mining operations

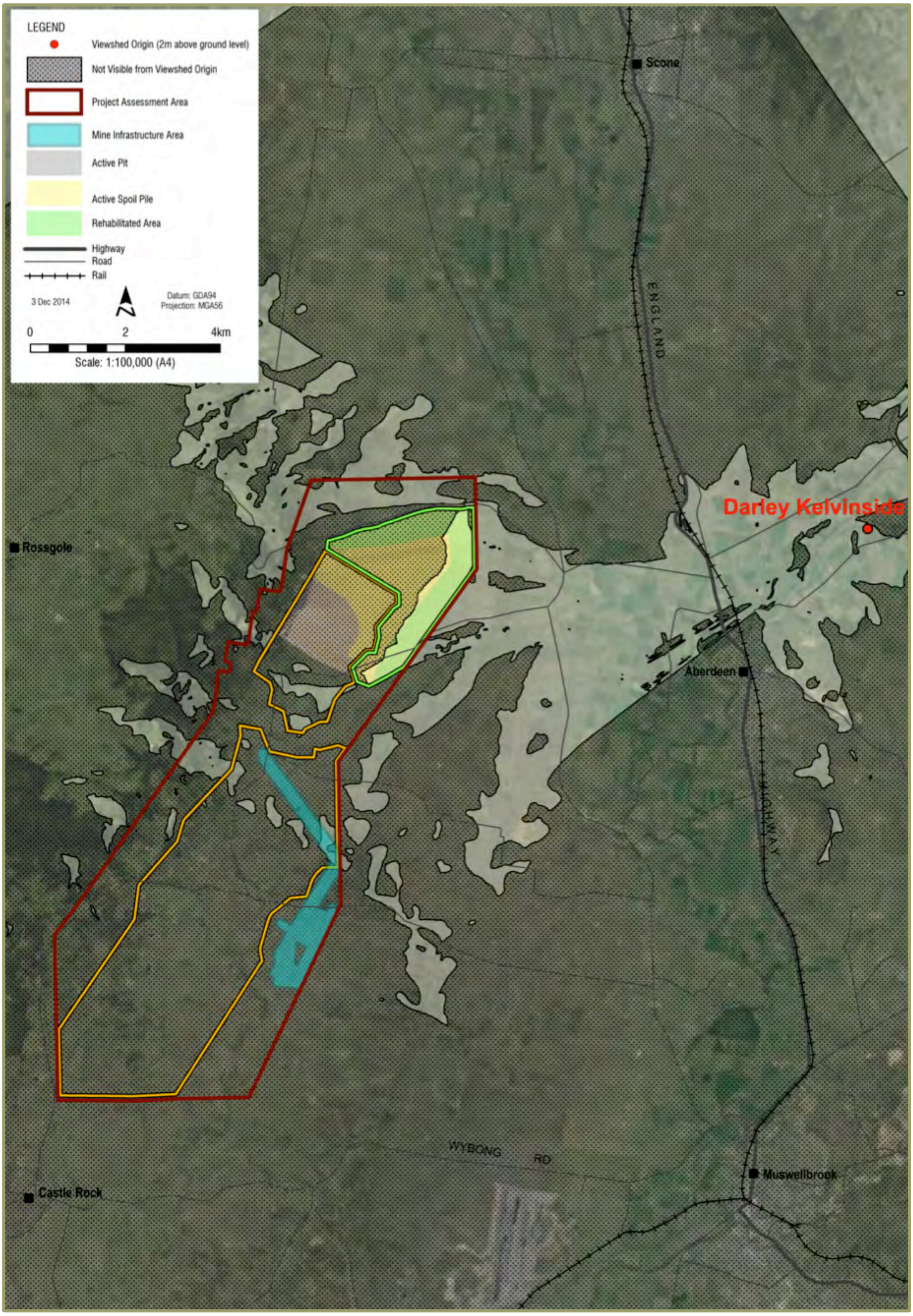


Figure 4-5 Viewshed from Darley Kelvinside in year 5 of mining operations

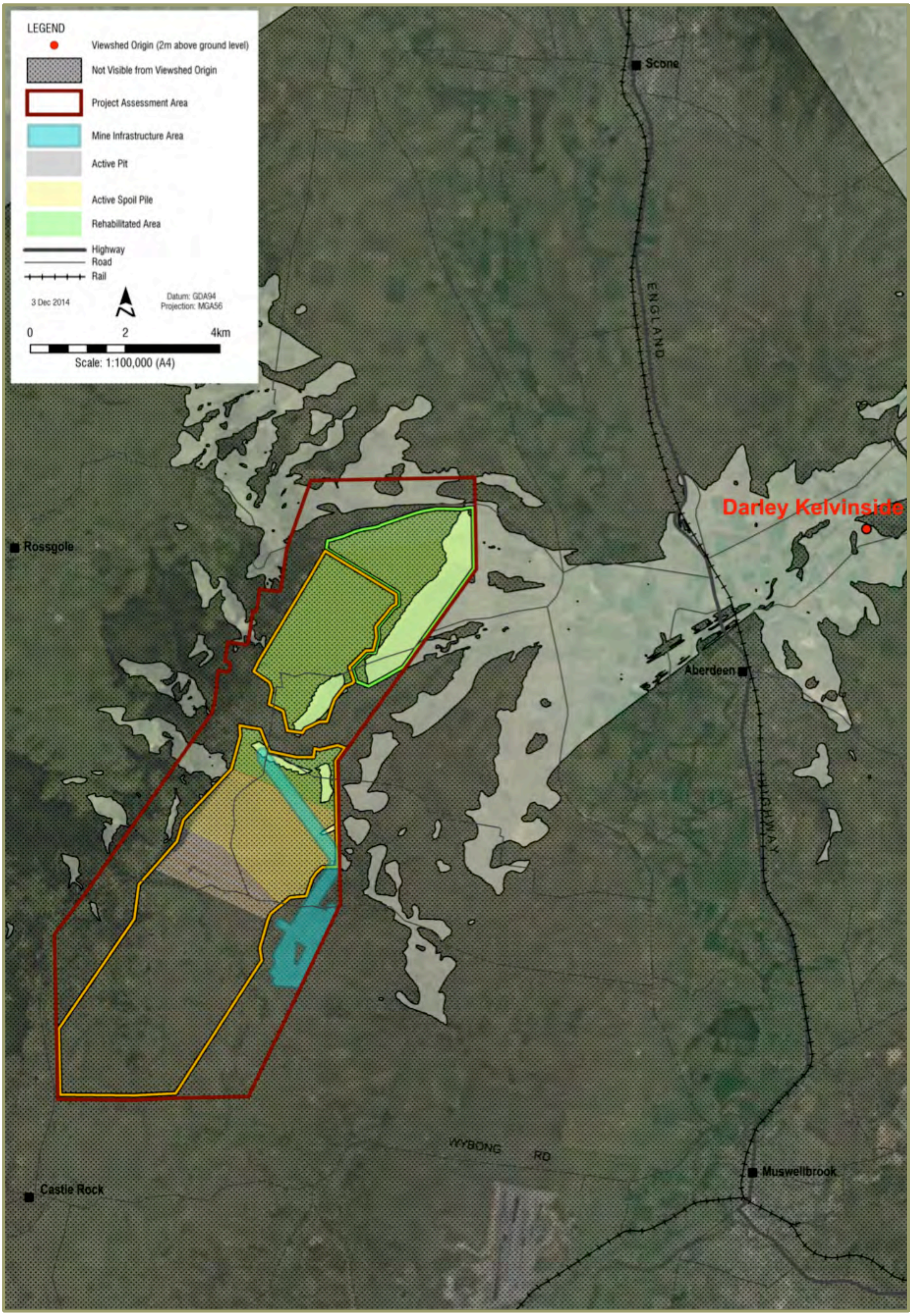


Figure 4-6 Viewshed from Darley Kelvinside in year 16 of mining operations

5 CONSULTATION

5.1 Direct engagement with potential affected landholders

5.1.1 La Tierra

In preparing this report, La Tierra has sought to engage directly with all landholders affected by the PAA to ensure a proper and contemporary analysis of agricultural resources, enterprises and production systems. Engagement was mostly by on-property meetings and inspections. However, due to various circumstances, some landholders were engaged via telephone and property inspections were not possible.

La Tierra conducted its engagement with landholders on-property from 7 to 14 June 2014 and from 14 to 18 July 2014. Of the 43 affected landholders within the PAA, 25 agreed to interview and property inspection (Table 5.1). The remaining landholders either declined to participate or were unavailable. Detailed records of this engagement are provided (see Appendix A).

5.1.2 Applicant

The Applicant has also engaged with landholders regarding this Gateway Application and supporting technical studies. More broadly, affected landholders have been informed of Project development activities via regular community newsletters, e.g. February 2010 (Issue 17), October 2010 (Issue 18), June 2011 (Issue 19), October 2012 (Issue 20) and December 2013 (Issue 21).

Ongoing consultation with the local community and landowners is being undertaken via the MCC Community Consultative Committee (CCC). The Project will shortly establish its own CCC in accordance with the Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects (DP, 2007).

5.2 Further and continuing consultation

Stakeholder consultation, including engagement with landholders affected by the PAA, will continue throughout each phase of the Project.

Following grant of a Gateway Certificate, the Applicant may lodge a development application triggering, amongst other things, preparation of an EIS. The EIS process will necessarily include a comprehensive stakeholder engagement programme. The issues raised and outcomes of the stakeholder engagement programme will be reported in the EIS. The programme will include the use of a variety of consultation mechanisms such as:

- Public exhibition of key documents (e.g. the EIS);
- Provision of Project information on the Applicants website;
- Ongoing consultation with the local community and landowners, including formation of a Project-specific CCC;
- Meetings with the general community, Aboriginal groups and directly affected landowners;
- Meetings with relevant government agencies; and
- Community information newsletters, brochures and community information sessions.

The consultation will include, but not necessarily be limited to, the following Government agencies and authorities:

- Department of Planning and Environment;

- NSW Trade and Investment (including Division of Resources and Energy);
- Department of Primary Industries (including the NSW Office of Water and Office of Agricultural Sustainability and Food Security);
- NSW Roads and Maritime Service;
- NSW Treasury;
- Muswellbrook Shire Council;
- Upper Hunter Shire Council; and,
- Commonwealth Department of Environment.

Consultation with the Australian Rail Track Corporation (ARTC) and coal chain operators will be undertaken to discuss potential rail movements. Consultation will also be conducted with PWCS, NPC and Newcastle Coal Infrastructure Group.

Consultation with the Aboriginal community will be conducted in consideration of the requirements of the Aboriginal Cultural Heritage Consultation Requirements for Proponents, 2010 (DECCW, 2010).

6 CONCLUSIONS

This report assesses the potential impacts of the West Muswellbrook Project on BSAL and its associated highly productive groundwater sources, and equine and viticulture CIC lands. In assessing impacts, it relies upon specialist technical studies to verify the existence and location of BSAL (Richards, 2014) and the nature of highly productive groundwater sources (McAlister and Dvoracek, 2014). It also relies upon Government-verification and mapping of CIC lands. Stakeholder engagement and on-ground property inspection allowed existing land uses, agricultural resources and production systems to be described.

A Project assessment area that encompasses all planned mining disturbances plus a 100 m buffer, but excludes linear infrastructure, is defined. This area of 5,621 ha is the proposed future Development Application area. This area contains 206 ha of potential-BSAL, plus 1,125 ha and 50 ha of Government-verified equine CIC land and viticulture CIC land, respectively.

Through application of the interim protocol for on-ground BSAL verification, Richards (2014) verified 204.6 ha of BSAL soils. The location of verified-BSAL soils is inconsistent with Government mapping of potential-BSAL soils. Of this verified-BSAL, 68.4 ha will be permanently lost through open-cut mining activities. This report makes no speculative claim regarding the reinstatement, relocation or rehabilitation of this area of lost BSAL.

McAlister and Dvoracek (2014) identify local groundwater sources and model potential impacts of the proposed Project. Pursuant to the Aquifer Interference Policy criteria, the Project will cause Level 2 impacts to the localised highly productive alluvial aquifers associated with drainage lines within the Project area. Importantly though, the Project will have no impact on the highly productive Triassic Sandstone and Hunter Alluvial aquifers in the surrounding locality. The Project will have no impact on the Hunter River, will minimise water drawn from it and will not cause downstream water quality to be diminished. The Applicant will commit to 'make good' provisions for any bores affected by the Project on lands not owned by it.

The predominant land use within the Project area is low intensity beef cattle grazing on relatively small property areas. According to DPI (2006), small-scale beef enterprises are disadvantaged for numerous reasons including higher levels of dependency on off-farm income and the associated lack of available time and focus on the agricultural enterprise. Stakeholder engagement and property inspection confirms this within the Project assessment area.

Despite Government-verification of 1,125 ha of equine CIC land and 50 ha of viticulture CIC land within the Project assessment area, none of this land has ever been used for any purpose connected with either industry. The mapped equine CIC land is predominantly used for beef cattle grazing with limited dry-land cropping, and the mapped viticulture CIC land is an established olive grove.

The nearest thoroughbred stallion stud to the Project boundary is 4.8 km away and the nearest broodmare stud is 3.8 km away. Neither is of the scale, nature or importance to the equine CIC that are Coolmore and Darley Woodlands, as described by PAC (2013 and 2014) and MPGP (2013). The critical CIC component of Darley Kelvinside is located some 8.2 km from the Project boundary. This assessment considers these *standoff* distances to be more than adequate buffers to mitigate any potential impact of the Project on the equine CIC. Assessed against the relevant criteria in the Mining SEPP, the Project's potential impacts on the equine CIC are considered insignificant.

There are no vineyards, cellar-doors or wine tourism ventures within the Project boundary. The closest vineyard is 2.3 km away. Assessed against the relevant criteria in the Mining SEPP, the Project will have no discernable impact on the viticulture CIC.

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