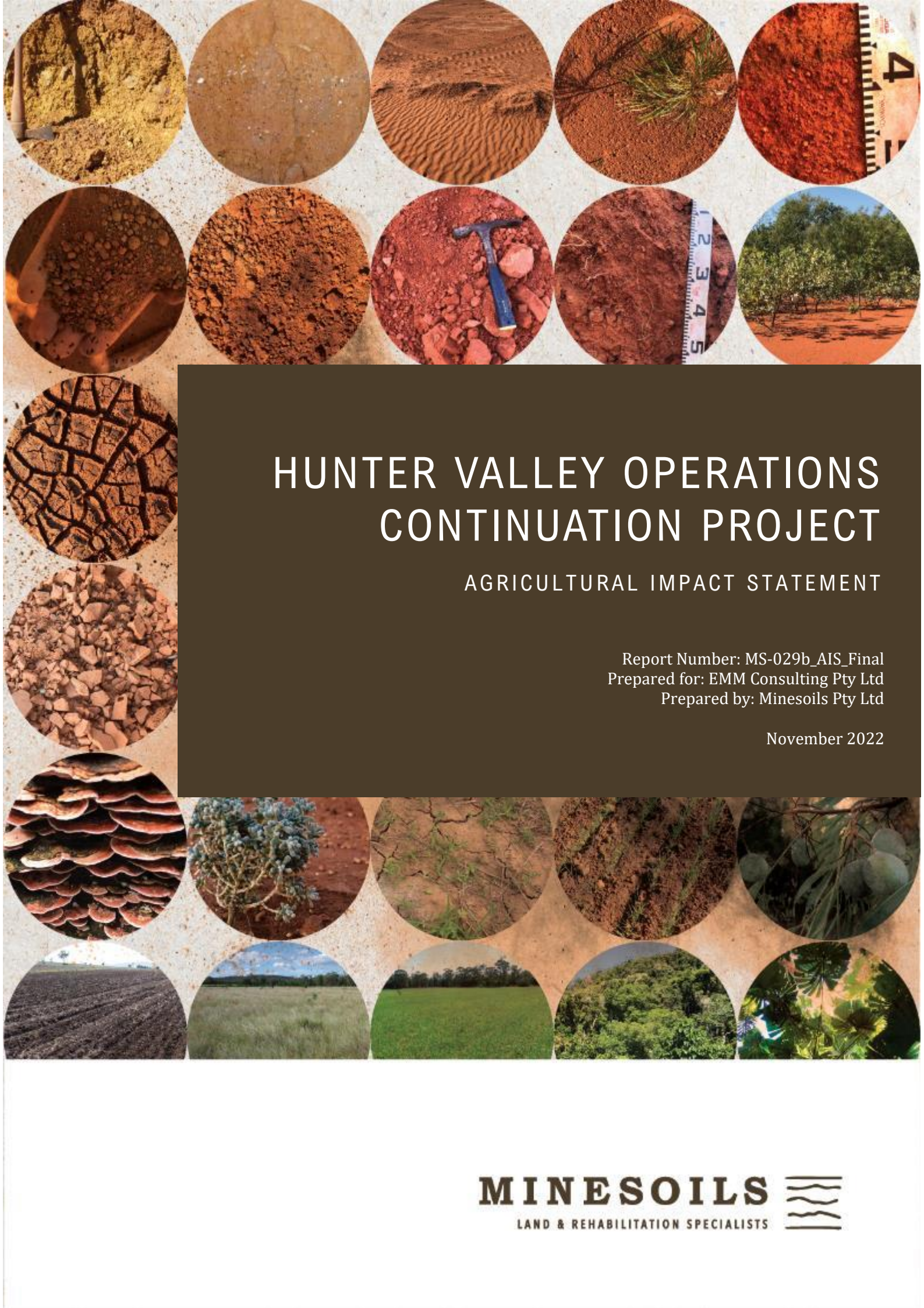

APPENDIX Q

Agricultural Impact Statement



HUNTER VALLEY OPERATIONS CONTINUATION PROJECT

AGRICULTURAL IMPACT STATEMENT

Report Number: MS-029b_AIS_Final
Prepared for: EMM Consulting Pty Ltd
Prepared by: Minesoils Pty Ltd

November 2022

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DISCLAIMER

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Hunter Valley Operations (HVO) is a multi-pit open cut mining complex approximately 24 kilometres (km) north-west of Singleton in the Hunter Valley of New South Wales (NSW) (**Figure 1**). HVO comprises two mine sites separated by the Hunter River, HVO North and HVO South. While the two mine sites are approved under separate development consents, they are operated as one complex with fully integrated environmental management systems.

The existing HVO North operation comprises the approved mining areas of West Pit, Mitchell Pit and Carrington Pit. It operates under development consent DA 450-10-2003 which allows extraction of up to 22 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 12 June 2025.

HVO South operates under Project Approval (PA) 06_0261 and comprises the approved mining areas of Riverview Pit and Cheshunt Pit, where mining activities currently take place, and the Riverview South East Extension and South Lemington Pits 1 and 2. PA 06_0261 allows the extraction of up to 20 Mtpa of ROM coal until 24 March 2030.

Mining across HVO is undertaken using dragline and truck and shovel methods. ROM coal from HVO North and South is currently processed at the Hunter Valley (HV) Coal Preparation Plant (CPP) and/or the Howick CPP (both at HVO North), from which product coal is predominantly transported via overland conveyor to the HV load point (HVLVP) or Newdell LP and via rail to the Port of Newcastle for export. The Lemington CPP (LCPP) and associated rail loop, which is approved under PA 06_0261 and would process and rail coal from HVO South, is yet to be constructed.

HVO is owned by subsidiary companies of Yancoal and Glencore, as participants in the unincorporated HVO Joint Venture (JV). HV Operations Pty Ltd is the appointed manager of the JV.

1.2 PROJECT OVERVIEW

The HVO Continuation Project (the Project) broadly comprises the continuation of the life of HVO North and HVO South, from the current approved mining completion dates of 2025 and 2030 respectively, to the end of 2050 at HVO North and 2045 at HVO South. The continuation of mining across the HVO Complex will increase resource recovery from the existing operation, predominantly by mining through previously mined areas and to the extent of existing mining tenements and extracting coal from deeper seams at HVO North.

At HVO South an extension to the life of the mine is proposed to facilitate improved mine sequencing outcomes and reduction in mining rate. The Project proposes a reduced mining footprint at HVO South compared to what is approved for extraction, with the previously approved coal extraction in the Riverview South East Extension area and South Lemington Pits 1 and 2 proposed to be removed from mine plan (and future approvals) for the Project. However, some rehabilitation works will be required to be undertaken in the South Lemington Pit 1 area, as part of the mine closure process. The approved shorter rail loop option associated with the LCPP has also been removed from the Project.

A number of infrastructure upgrades and changes are also required to facilitate the Project (and are included as part of it), including the realignment of part of Lemington Road, relocation of transmission and telecommunication lines, and an upgrade of the Newdell Load Point (LP) and including construction of a new product stockpile and train loading bin at the facility, or an extension upgrade of the Hunter Valley HVLVP product stockpile including an extension to the existing coal stockpile, and improvements to Lake James and Parnells Dam.



To enable the Project to proceed, two new State significant development (SSD) consents are required; one for HVO North and one for HVO South, under Part 4, Division 4.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). The Project will seek to maintain separate development consents for HVO North and South, as is currently the case. Given that the two mine sites operate as one complex, one Environmental Impact Statement (EIS) has been prepared to support the two development applications required for the Project.

This agriculture impact assessment forms part of the EIS and provides an assessment of the potential agricultural impacts of the Project. It also assesses the potential incremental impacts of the continuation of HVO North and HVO South given separate development consents are being sought for each operation.

The project description is provided in Chapter 4 of the EIS (EMM 2022). The key components of the Project as they relate to HVO North and HVO South are individually listed below.

HVO North

The key changes proposed by the Project to the approved HVO North operations include:

- an extension to the life of the mine until the end of 2050;
- extraction of coal to the base of the Barrett seam across the HVO North mining area. Existing operations are approved to extract coal to the base of the Barrett seam in the West Pit; however, are only approved to the base of the shallower Bayswater seam in Carrington Pit;
- extraction of an additional approximate 400 Million tonnes (Mt) of run of mine (ROM) coal through the extraction of coal from deeper seams and a small increase in the mining extent (between the existing West and Mitchell Pits and Carrington Pit);
- infrastructure upgrades, as listed below:
 - realignment of Lemington Road and new bridge over the Hunter River. While the proposed realigned corridor is partly within the HVO South development consent boundary, the realignment is required to enable the progression of mining from the Mitchell and West pits into the Carrington area at HVO North. The works associated with the road realignment therefore form part of the HVO North Project;
 - HVO North site access road relocation off the existing Lemington Road;
 - an increase in the capacity of Parnells Dam from approximately 1 gigalitres (GL) to 4 GL;
 - realignment of transmission and telecommunication lines that are currently within the proposed mining footprint;
 - HVO North Mine Infrastructure Area upgrade;
 - ancillary activities as required to facilitate operations;
 - access roads to facilitate service provider access;
 - use of demountable/temporary buildings in construction compounds as required;
 - upgrade of the existing Newdell Load Point (LP) train loading facility and construction of a new product stockpile; or
 - extension of the HVLP product coal stockpile, including the closure of a section of Liddell Station Road.
- coal haulage from the HVCPP to the Ravensworth ROM pad, via internal haul roads;
- revised tailings management strategy;
- amendments to the approved final landform; and
- progressive rehabilitation throughout the mine life.
- changes to the development consent boundary to incorporate the changes listed above.



Other than as set out above, all activities that are currently approved under the existing HVO North approval are intended to continue. Key aspects and outcomes of the approved development at HVO North that will remain the same under the Project include the following:

- the maximum allowable annual coal extraction and processing rate;
- annual operational workforce numbers and associated traffic generation;
- approved heights of overburden emplacement areas;
- receipt of ROM coal from HVO South via internal haul roads for processing at all CPP facilities approved for HVO North;
- continued avoidance of the Aboriginal heritage site known as Carrington Mine - Colluvial Deposit 1 (CM-CD1); and
- the ridge between Jerrys Plains and HVO North will remain, continuing to provide an effective amenity barrier.

HVO South

The key changes proposed by the Project to the existing approved operations at HVO South include:

- an extension of the life of the mine until the end of 2045;
- a reduction in the approved maximum ROM coal extraction rate from 20 Mtpa to 18 Mtpa;
- changes to the approved mine sequencing (although noting that mining within the two primary open cut pits; Riverview and Cheshunt, will remain generally within the same footprint as approved);
- removal of coal extraction from the mine plan from the Riverview South East Extension, South Lemington Pit 1 and South Lemington Pit 2 mining areas;
- infrastructure upgrades and changes to that currently approved, as listed below:
 - removal of the LCPP short rail loop option;
 - removal of the approved conveyor from HVO South to the HVCPP at HVO North (the conveyor has not been constructed);
 - construction of the Cheshunt and Riverview flood protection levees;
 - realignment of transmission lines;
 - enlargement of Lake James from approximately 0.7 GL to 2 GL;
 - additional tailings pipelines and pumps;
 - ancillary activities as required to facilitate operations;
 - access roads to facilitate service provider access; and
 - use of demountable/temporary buildings in construction compounds as required.
- revision and implementation of the tailings strategy; and
- amendments to final landform due to rescheduling and or infrastructure relocations, progressive rehabilitation will be undertaken throughout the mine life.

Other than as set out above, all activities that are currently approved under the existing HVO South approval are intended to continue. Key aspects of the approved development at HVO South that will remain the same for the Project include:

- the coal seams to be extracted (ie no increase in the depth of mining);
- the extent of approved mining areas within the Riverview and Cheshunt Pits;
- approved heights of overburden emplacement areas;
- construction of the LCPP and associated rail loop (long rail loop option only);
- transfer of coal from HVO South to HVO North for processing; and
- annual operational workforce numbers and associated traffic generation.



1.3 PROJECT TERMINOLOGY

The following key terms are used throughout this assessment to describe the Project:

- **HVO Complex** – comprises both HVO North and HVO South operations.
- **The Project** – the Project in its entirety; encompassing the continuation of the life of the complex, ie, both HVO North and HVO South, within their respective proposed development consent boundaries, as illustrated in **Figure 1**.
- **Project Area** – The area that is the subject of the two development applications, ie, the proposed development consent boundary for HVO North and the proposed development consent boundary for HVO South.
- **Existing and approved disturbance area** – Areas that are disturbed and/or approved to be disturbed under the current development consents that apply to the HVO Complex.
- **Approved mining area** – The areas within the approved disturbance area that have been previously assessed and approved under the NSW EP&A Act for mining operations.
- **Additional disturbance area** – The areas that will be disturbed by the Project that are outside of the existing and approved disturbance area.
- **Proposed mining area, HVO North** – Areas where coal extraction will take place for the Project at HVO North and includes:
 - areas already disturbed by mining that will be re-disturbed to facilitate coal extraction in the deeper Barrett seam;
 - areas not previously approved for mining (eg the area between the Mitchell Pit and Carrington Pit); and
 - areas approved but not yet disturbed (eg the Carrington West Wing area).
- **Proposed mining area, HVO South** – Comprises the Riverview Pit and Cheshunt Pit, where coal extraction will continue under the Project, down to the Bayswater seam.
- **Previously approved areas not retained** – Areas that are disturbed and/or approved to be disturbed under the current development consents that apply to the HVO Complex, that will no longer be disturbed by the Project, such as the LCPP short rail loop, the Riverview South East Extension and South Lemington Pit 2 mining areas, and the approved temporary crossing across the Hunter River between HVO North and South.
- **Transmission line corridors** – Two categories of transmission line corridors have been defined for the purpose of quantifying the extent of disturbance for the Project:
 - realigned transmission lines (ie new transmission line easements) – the extent of disturbance will be limited to transmission line poles/towers and an access road for maintenance along the alignment, as well as vegetation management to maintain safe powerline clearance; and
 - existing transmission line easements to be decommissioned – disturbance will be confined to existing access tracks and cleared areas.
- **Realigned Lemington Road corridor** – The corridor extends from the Comleroi Road intersection with the Golden Highway at the southern end of the new alignment, along the Comleroi Road alignment around the south-eastern side of HVO South, and then extends in a northerly direction to join the existing Lemington Road at a point approximately 2.3 km south of the New England Highway/Lemington Road intersection. The corridor also allows for two options with respect to the connection to the Golden Highway; one assuming that the Golden Highway is realigned by United Wambo as approved under SSD 7142, and a second option that connects with the current alignment of the Golden Highway.



- **Re-disturbance area** – land previously disturbed or approved for disturbance by mining activity subject to re-disturbance as a result of the Project.
- **Study Area** – the combination of the re-disturbance area and additional disturbance area subject to disturbance as a result of the Project.
- **Project disturbance area** – this area is a combination of the additional disturbance area and the existing and approved disturbance area, minus the areas not being retained by the Project.

1.4 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

This assessment has been prepared in accordance with requirements of the NSW Department of Planning and Environment (DPE). These were set out in the Secretary's Environmental Assessment Requirements (SEARs) for the Project, issued on 11 March 2021. The SEARs for the Project that are addressed in this report were issued by the NSW Department of Planning and Environment and are as follows:

- *an assessment of the agricultural impacts of the development.*

This agricultural impact statement (AIS) forms part of the EIS and has been developed in accordance with the *Guideline for Agricultural Impact Statements* (NSW Department of Planning, Industry and Environment (formerly Department of Trade, Investment, Regional Infrastructure and Services) [DTIRIS], 2012) to present a focussed assessment of potential impacts to agricultural resources and industries as a result of the Program.

To address the SEARs, this AIS is required to assess the Project's potential impact on:

- agricultural resources in the proposed disturbance footprint and the surrounding locality. Agricultural resources are defined as land on which agriculture is dependent; and
- other agricultural land uses and infrastructure, within or in close proximity to the Project Area, or where relevant, more broadly in the region.

1.5 STUDY AREA

The proposed development consent boundaries of the HVO North and HVO South represent a total area of approximately 13,185 ha, and are shown in **Figure 1**. Due to the mining history within these boundaries, land previously disturbed for mining activity as well as previously undisturbed land will be subject to disturbance as a result of the Project. These areas are referred to as the re-disturbance area (approximately 6,537 ha), additional disturbance area (approximately 980 ha) respectively, and comprise the Study Area (approximately 7,517 ha), as shown in **Table 1** and presented on **Figure 2**. The re-disturbance area consists of land that is currently disturbed, land that is approved for disturbance, and land that is currently rehabilitated. The additional disturbance area is 717 ha for the HVO North and 263 ha for HVO South.



Table 1: Study Area Components

Assessment Component	Area (ha)		
	HVO North	HVO South	Overall
Re-disturbance Area	4,195	2,342	6,537
Additional Disturbance Area	717	263	980
Study Area	4,912	2,605	7,517

1.6 ASSESSMENT APPROACH

The assessment of the impact on agricultural resources and enterprises as a result of the Project area is complex, given its mining history and the current level of disturbance. In order to establish a frame of reference by which to determine impacts on agriculture, the following baseline agricultural status of the Study Area was established:

- Additional disturbance areas are represented by present site conditions and land areas currently subject to agricultural use, as shown in **Figure 2**.
- Re-disturbance areas align with the approved final landform and its land use domains, including land areas intended for a final land use of agriculture, as per the Hunter Valley Operations Rehabilitation Management Plan (RMP) (ERR, 2022) and as shown in **Figure 3**.

By comparing the currently approved final landform and uses for the re-disturbance area and the current agricultural status of the additional disturbance areas, that is, the assessment baseline, as shown in **Figure 4**, against the features of the Project, including the proposed final landform and land uses, the impacts of the Project can be assessed.

The approved final landform of Liddell Coal Operations (Glencore, 2022a), Ravensworth Operations (Glencore, 2022b), and United Wambo JV Open Cut (Glencore, 2022c) were also used to establish baseline status where the rehabilitation liabilities of other mines are present in the re-disturbance area.

The AIS has been prepared in accordance with the requirements included in:

- the Secretary's Environmental Assessment Requirements (SEARs);
- the Upper Hunter Strategic Regional Land Use Plan (DPI, 2012) (Upper Hunter SRLUP);
- the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP); and
- the Agricultural Impact Statement Technical Notes (DPI, 2013).

1.6.1 UPPER HUNTER REGIONAL LAND USE PLAN

The Project Area is in the Upper Hunter Region and as such is covered by the Upper Hunter Strategic Regional Land Use Plan (SRLUP). Strategic agricultural land includes land with unique natural resource characteristics, known as biophysical strategic agricultural land, and clusters of significant agricultural industries known as critical industry clusters. The purpose of the plan is to balance economic growth with the protection of valuable agricultural land (DPI, 2012).



Areas with high agricultural values have been regionally mapped and identified as either based on land soil characteristics, or as Critical Industry Clusters (CICs), based on production and socio-economic value.

Biophysical Strategic Agriculture Land (BSAL) is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

CICs are classified as “concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region and provide significant employment opportunities” (DPE, 2014). The Department has identified two critical industry clusters in the Upper Hunter; equine and viticulture.

1.6.2 MINING SEPP

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), known as the Mining SEPP (Resources and Energy, 2021), governs the way that mining resource proposals are assessed and developed in NSW. The aim of the Mining SEPP is to manage and sustainably develop mining resources to the benefit of the community, both socially and economically. The Policy details the developments which are permissible with and without consent, and details the requirements of development applications, including the requirement for a Site Verification Certificate, and potential Gateway Certificates.

Areas with high agricultural values have been regionally mapped and identified as either based on land soil characteristics, or as Critical Industry Clusters (CICs), based on production and socio-economic value.

Biophysical Strategic Agriculture Land (BSAL) is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

CICs are classified as “concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region and provide significant employment opportunities” (DPE, 2014). The Department has identified two critical industry clusters in the Upper Hunter; equine and viticulture.

In accordance with the Mining SEPP, a BSAL verification process has been undertaken for those areas of the Project not currently under a mining lease which was verified as Non-BSAL (Minesoils, 2021).

CICs within the Project locality (refer **Figure 1**) were considered as part of this assessment (refer Section 3.1).

1.6.1 TECHNICAL REPORTS AND RESOURCES

The potential impacts of the Project on agricultural resources have been assessed for this report using several technical reports prepared to support the EIS of the Project, along with publicly available information pertaining to the region, detailed in **Table 2**.

Given the similarities in project nature, location and locality, agricultural characteristics, conceivable risks and anticipated impacts, and recent approval status, the *Glendell Continued Operations Project Agricultural Impact Statement* (Umwelt 2019) was used as a key technical reference for this AIS.



Table 2: Reference information

Technical Reports for the Project	Public Resources
Social Impact Assessment (EMM 2022a) Biophysical Strategic Agricultural Land Assessment Report (Minesoils 2021) Blasting Impact Assessment (Enviro Strata Consulting 2022) Soil and Land Impact Assessment Report (Minesoils 2022) Surface Water Impact Assessment (Engeny 2022) Groundwater Impact Assessment (AGE 2022) Rehabilitation and Mine Closure Strategy (EMM 2022b) Noise Impact Assessment (EMM 2022c) Air Quality and Greenhouse Gas Impact Assessment (Jacobs 2022) Traffic and Transport Impact Assessment (WSP 2022) Economic Impact Assessment (EY 2022) Visual Impact Assessment (EMM 2022d) Water Assessment (EMM 2022e)	Bureau of Meteorology Australian Bureau of Statistics DPIE eSPADE website Glendell Continued Operations Project Agricultural Impact Statement (Umwelt 2019)

1.6.2 REQUIREMENTS OF THE AGRICULTURAL IMPACT STATEMENT TECHNICAL NOTES

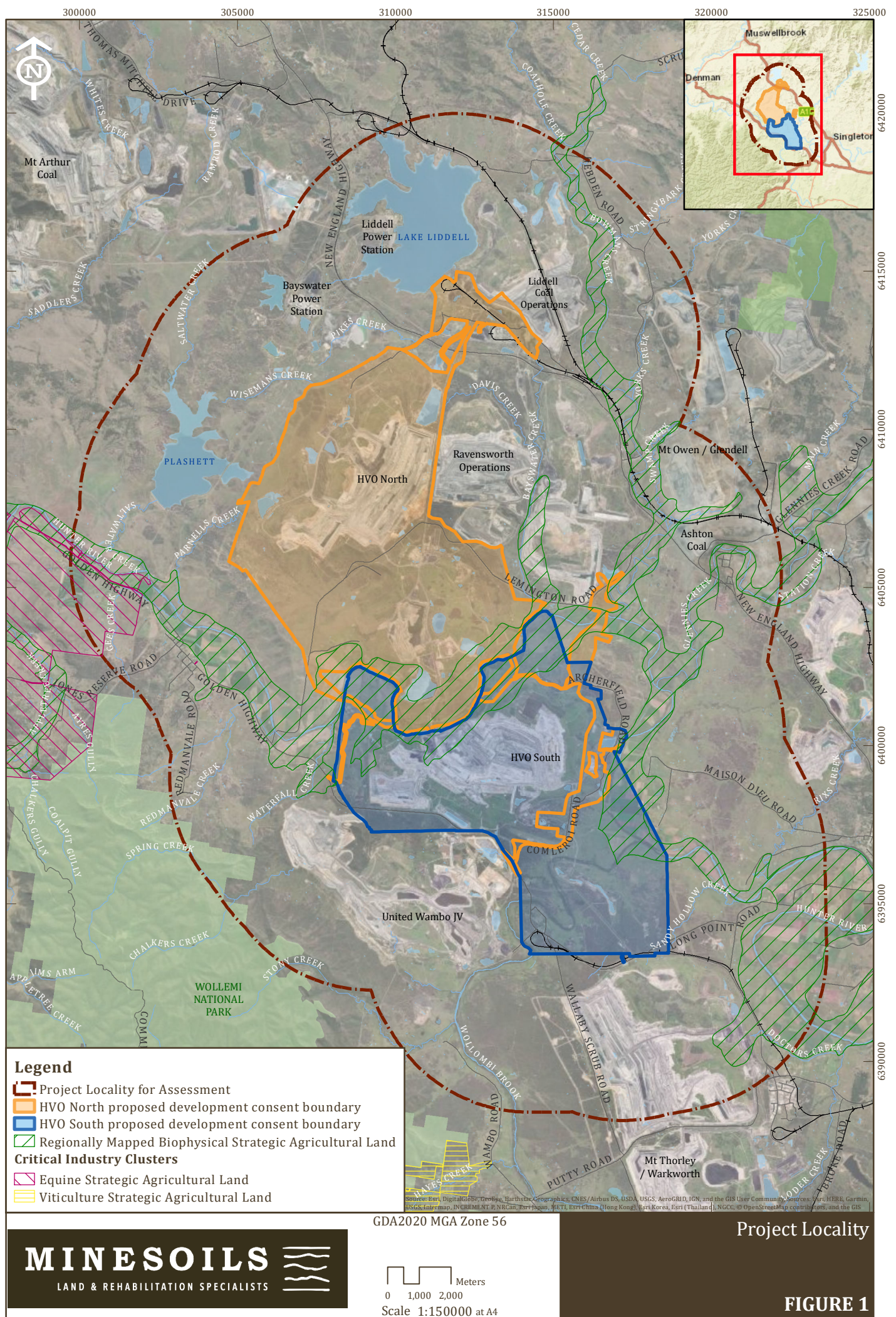
Requirements of the guidelines and technical notes, along with the SEARs, are summarised in **Table 3**, which also identifies the relevant section of this document where the requirements have been addressed.

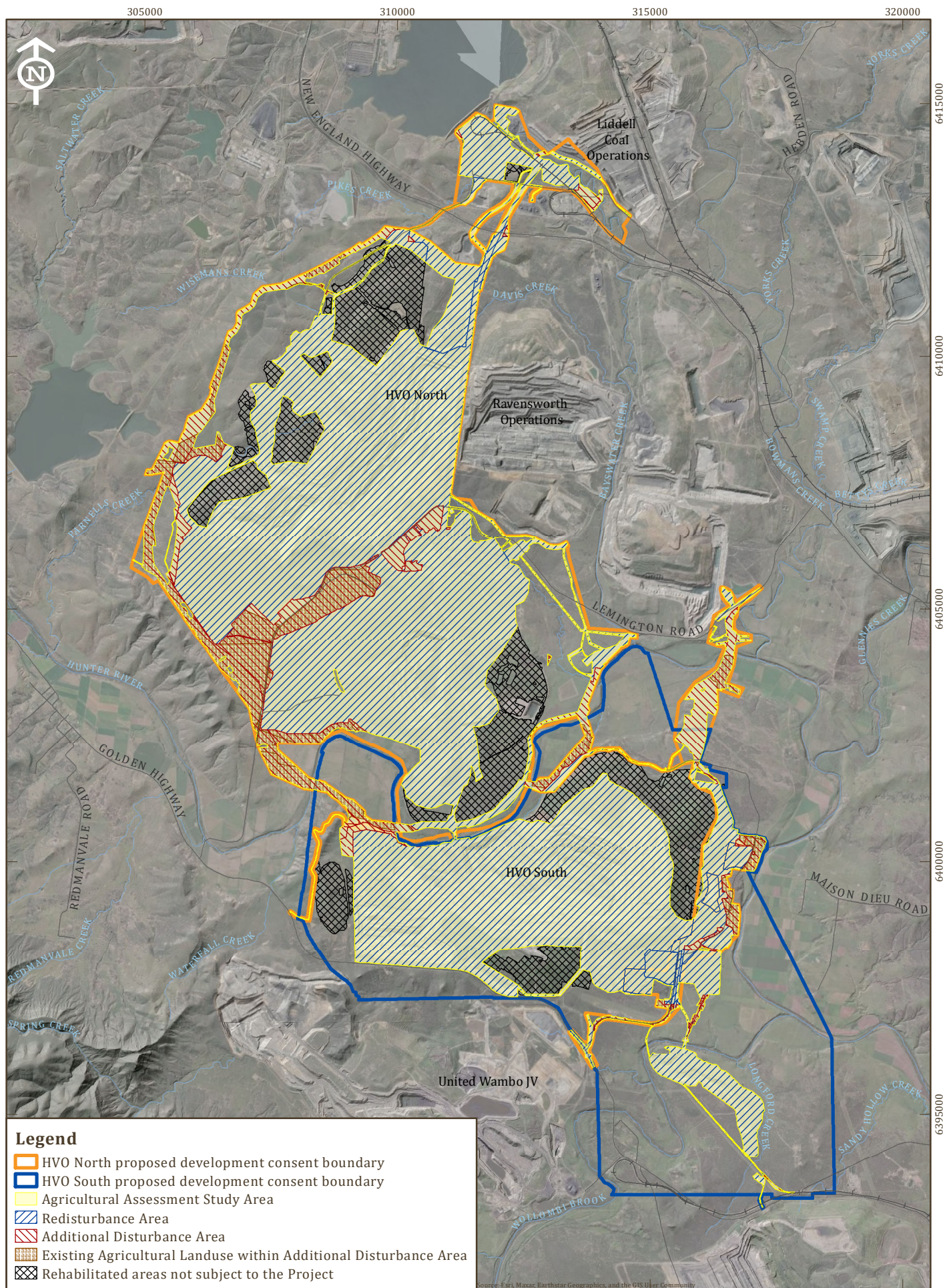


Table 3: AIS technical notes components and section addressed

AIS Technical Notes Assessment Requirements	AIS Technical Notes Section	Section Addressed in this AIS
Project overview and description	1.0	1.1 – 1.3
Detailed assessment of agricultural resources and production of the project area	2.0	2, 4
- Soil information	2.1	2.4
- Slope and land characteristics	2.2	2.5
-History of agriculture in project area	2.3	2.2, 3.4
-Land to be temporarily removed from agriculture	2.4	4.1.2
-Land to be returned to agriculture post project	2.5	4.1.3
-Land that will not be returned to agriculture	2.6	4.1.4
-Agricultural enterprises on any buffer and/or offset zones	2.7	2.7
Identification of agricultural resources and current enterprises in project locality	3.0	3
-Agricultural resources within the locality, including soil characteristics, topography, agricultural support infrastructure, water resources, vegetation and climate	3.1	3.1 – 3.3
-Current agricultural enterprises within surrounding locality	3.2	3.4
Assessment of impacts	4.0	4, 6
-Identification and assessment of impacts	4.1	4.1, 6
-Physical movement of water	4.2	4.2.3
-Socio-economic impacts	4.3	4.4
Mitigation measures	5.0	5
-Project alternatives	5.1	5.1
-Monitoring programs to assess impacts	5.2	5.2
-Trigger Response Plans and trigger points	5.3	5.2
-Remedial actions	5.4	5.2
-Demonstrated capacity for rehabilitation	5.6	5.4
-Planning for progressive rehabilitation	5.7	5.4
Consultation	6.0	7







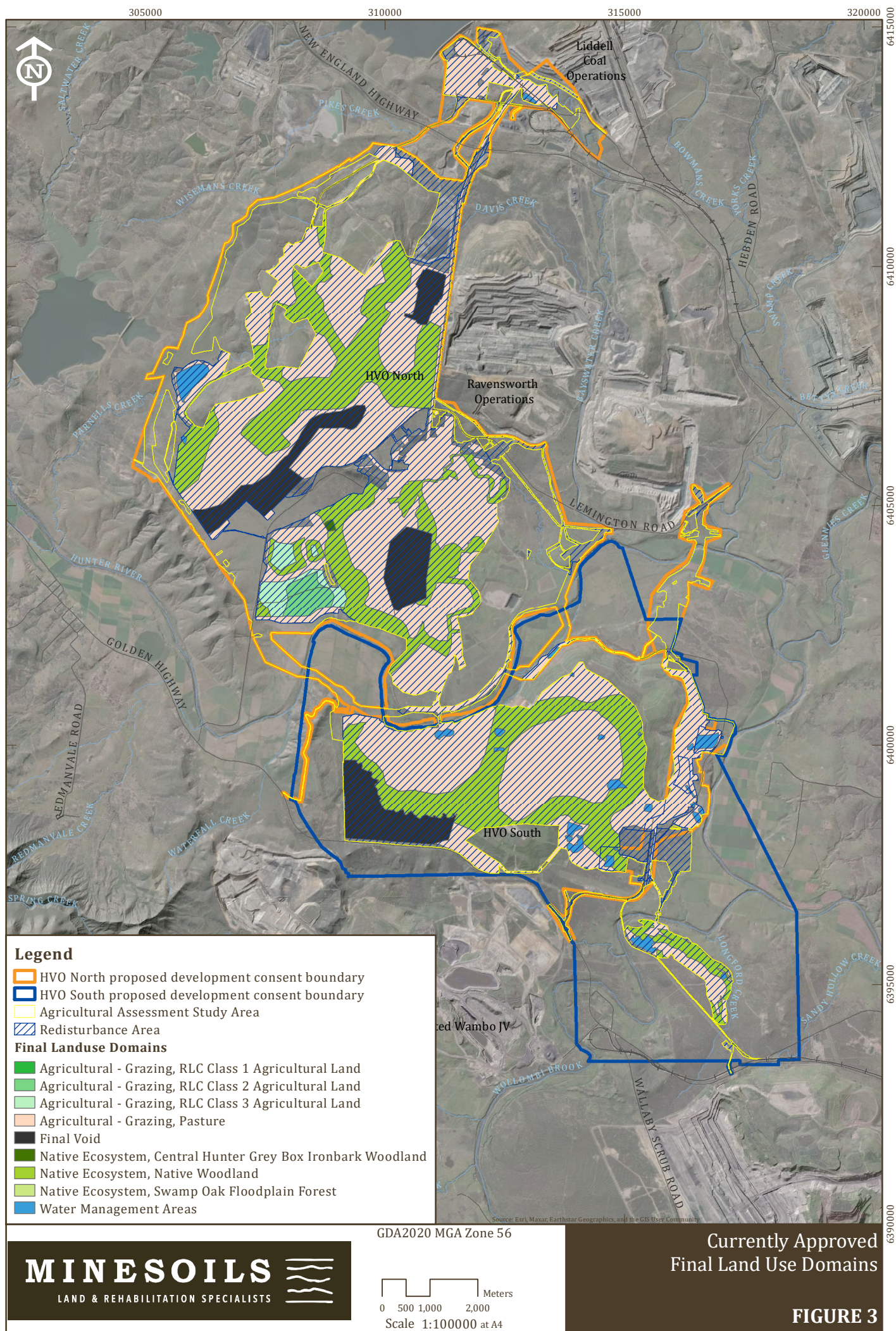
GDA2020 MGA Zone 56

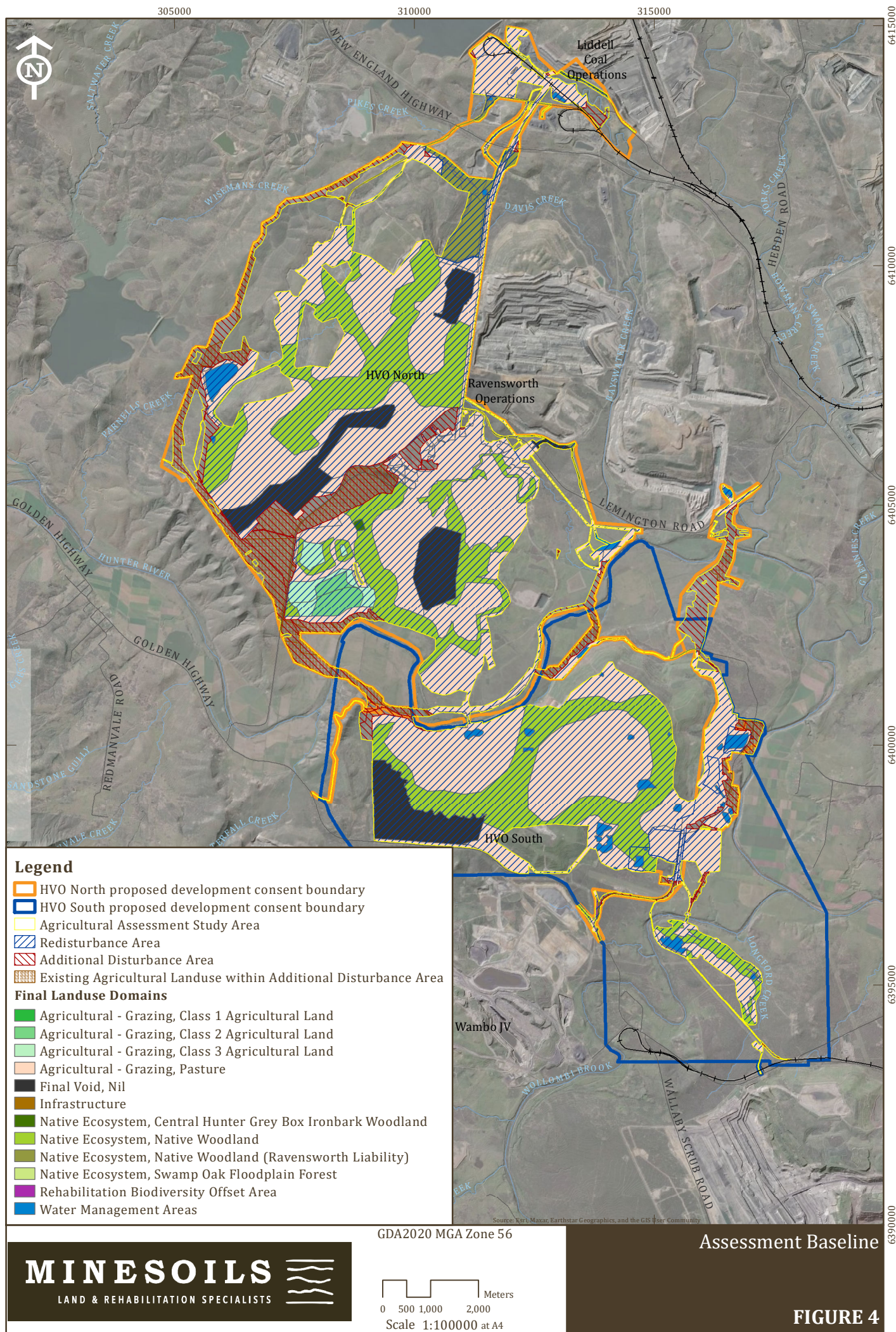
MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

Study Area

FIGURE 2





2 AGRICULTURAL RESOURCES AND PRODUCTION OF THE PROJECT AREA

2.1 AGRICULTURAL USE OF RE-DISTURBANCE AREAS

For re-disturbance areas, in order to establish a frame of reference by which to determine impacts on agriculture as a result of the Project, the anticipated agriculture enterprises and resources of the approved final landform and its land use domains are used as a baseline.

The rehabilitated land of the approved final landform and landuse domains is shown on **Figure 3** and consists of the following rehabilitation domains as per the Rehabilitation Management Plan (ERR, 2022) submitted to the Resource Regulator (August 2022):

- **Native Ecosystem:** Areas to be rehabilitated with woodland species commensurate with adjacent remnant vegetation. Approximately 30% (HVO North) and 30-40% (HVO South) of mined land will be returned to woodland. This will also include a network of tree corridors to ensure connectivity of woodland community areas, as well as 4 ha of land consistent with the Central Hunter Grey Box Ironbark Woodland.
- **Agricultural – Grazing:** Areas to be rehabilitated with selected native and exotic grasses and pasture species. Approximately 70% (HVO North) and 60-70% (HVO South) of mined land will be returned to pasture. Includes 65 ha of Rural Land Capability (NSW Office of Environment and Heritage, 1988) Class II and 65ha of Class III land.
- **Water Management Area:** A network of dams and surface water management structures are planned to be retained to assist in ongoing water and land management (e.g. stock watering).
- **Water Storage (excluding final voids):** Two large water storage dams (Parnells Dam and Lake James) are proposed to remain in the final landform.
- **Final Void:** Three final voids are planned to remain in place at completion of mining at HVO North. Two separate voids will remain in West Pit and a single final void in Carrington Pit. One final void is planned to remain in place at HVO South following the cessation of mining. This is located in the southwestern corner of the Riverview Pit. Final voids will create permanent water bodies. Landforms above pit water level will be vegetated where practical with woodland vegetation communities.

2.2 AGRICULTURAL USE OF ADDITIONAL DISTURBANCE AREAS

To account for additional disturbance areas, the current agricultural practices being undertaken within the Study Area are considered.

There are approximately 597 ha of land within the additional disturbance areas that are currently utilised for cattle grazing (refer **Figure 2**). HVO lease the land to either local agricultural enterprises or to Glencore subsidiary Colinta Holdings.

Based on aerial photography, site observation, soil and land capability, and local knowledge, it is determined that undisturbed areas of land within the Study Area have historically been used for cattle grazing on improved pastures with occasional minimal cropping of oats, ryegrass and clover pasture for cattle feed.

Management strategies are based on seasonal and longer term climate variables, however rotational grazing is a standard practice. Inputs include fertilisers and herbicide use for weeds. Cattle are watered through surface dams



or pumped groundwater. No additional feeding is carried out currently, however feeding has been carried out in recent drought years.

No land improvement strategies for grazing are being undertaken. No sensitive agricultural activities (e.g. intensive plant or livestock agriculture) are being undertaken within the additional disturbance areas.

An area of approximately 14 ha of the additional disturbance area is subject to mixed cropping including lucerne and other fodder crops on alluvial soils adjacent to the Hunter River and requiring large inputs of fertilizer and water.



Plate 1: Improved pasture for cattle grazing on additional disturbance area (2021)

2.3 BASELINE LAND AREA AND PRODUCTION VALUE

The total baseline land used for agriculture within the Project area is approximately 4,182 ha, as outlined in **Table 4** below.

Table 4: Baseline Land Area Used for Agriculture

Study Area	Approved Final Land Use Domain / Current land use	Land Used for Agriculture (ha)		
		HVO North	HVO South	Overall
Re-disturbance areas	Agricultural - Grazing	2,252	1,333	3,585
	Other (including Native Ecosystem, Final Void, Water Storage)	0	0	0
Additional disturbance areas	Land subject to grazing activity	458	125	583
	Land subject to cropping activity	14	0	14
	Other land use (including land vacancy)	0	0	0
Total		2,724	1,458	4,182

The production value of the approved final landform agricultural land use domains has been estimated based on the latest gross margin information by the NSW Department of Primary Industries (2019). The agricultural enterprise accounted for is grazing of cattle to be sold as feeders or re-stock, which includes feeder Steers through to Growing-out Steers (240 – 460kg).

For the purposes of this assessment, and based on current practice, site knowledge and HVO's trials of grazing on rehabilitated lands with variable slopes and topsoil cover, it is anticipated that cattle stocking rates will be equivalent between lands previously disturbed and undisturbed lands within the Study Area.



For the purpose of calculations, cropping enterprises have not been accounted for in the calculations given they represent <1% of baseline land used for agriculture. Further, most recent gross margin reference information is greater than 10 years old.

The estimated productivity of the Study Area ranges from approximately \$716,618 per annum based on a Feeder Steers grazing enterprise to \$1,698,840 per annum based on a Growing-out Steers 240 – 460kg enterprise, as outlined in **Table 5**.

Table 5: Estimated Baseline Agricultural Productivity of Study Area

Enterprise	Estimated Gross Margin (\$/ha/year)	Land Used for Agriculture (ha)	Study Area Gross Margin (\$/year)
Feeder steers	173.81	4,182	726,873
Growing-out Steers 240 – 460kg	412.04	4,182	1,723,151

2.4 SOIL RESOURCES

Due to the complex nature of previous mining activity and subsequent rehabilitation efforts on lands within the Study Area, soil resources are assessed as either soils on additional disturbance areas, or soils on re-disturbance areas (that is, the currently approved rehabilitated final landform) (refer **Figure 3**).

Undisturbed soil resources are present in areas that have not been subject to previous disturbance and soil and landform characteristics are naturally occurring. Previously disturbed soil resources occur in areas that have been subject to previous disturbance and rehabilitation. The landform and/or soil profile is not considered natural in these areas.

Both additional disturbance area and re-disturbance area soil resources are capable of facilitating agriculture (to varying degree). The characteristics of these soil resources are detailed in the following sections.

2.4.1 ADDITIONAL DISTURBANCE AREAS

The additional disturbance areas of the Study Area subject to impacts as a result of mining activity were assessed by Minesoils to determine baseline status of soil resources. The findings have been detailed in the Soils and Land Impact Assessment Report – Hunter Valley Operations Continuation Project (Minesoils 2022). The soil mapping units of the Undisturbed Areas of the Study Area consist of the following:

- Soil Unit 1: Sodosols;
- Soil Unit 2: Vertosol/ Dermosol Complex;
- Soil Unit 3: Alluvial Soils; and
- Soil Unit 4: Natric Kurosols.

These soil mapping units are presented on **Figure 4**. An overview of each mapping unit is presented below.

Soil Unit 1 – Sodosols

The Sodosol unit is represented by 5 soil survey sites and consists of clear or abrupt texture contrast soils with varying degrees of sodicity in the subsoils. Sodosols are characterised by a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acid. Chromosols are soils with a clear or abrupt textural B horizon and in



which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acidic.

Typically, more sodic soils were present throughout this soil unit, with four representative Sodosol soil types encountered. The Chromosol soil type is a sub-dominant.

This soil unit covers approximately 408ha or 42% of the additional disturbance areas.

Soil Unit 2 – Vertosol/ Dermosol Complex

The Vertosol/ Dermosol complex is represented by 9 soil survey sites and consists of clay textured soil profiles with no texture contrast horizons. Vertosols are soils with a clay field texture of 35% or more clay throughout the solum except for thin, surface crusty horizons 30 mm or less thick, and with shrink-swell properties that exhibit strong cracking when dry, and at depth have slickensides and/or lenticular peds. Dermosols are soils that have B2 horizons that have a grade of pedality greater than weak throughout the major part of the horizon, and do not have clear or abrupt textural B horizon. Soils within this unit are typically sodic at depth.

This soil unit covers approximately 169 ha or 17% of the additional disturbance areas.

Soil Unit 3 – Alluvial Soils

The Alluvial Soils unit accounts for deep, depositional soils on the floodplains of the hunter river and its tributaries. This soil unit contains a range of non-texture contrast soils including Rudosols, Tenosols and Dermosols soil types (depending on the level of structure grade), and is mapped according to regionally mapped soil types and information included in the Carrington West Wing Area MOD3 EA (GSS Environmental, 2010).

Rudosols are soils with little, if any, (rudimentary) pedologic organisation apart from (a) minimal development of an A1 horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

Tenosols are soils that do not fit the requirements of any other soil orders and generally with one or more of the following:

1. A peaty horizon.
2. A humose, melacic or melanic horizon, or conspicuously bleached A2 horizon, which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
3. A horizons which meet all the conditions for a peaty, humose, melacic or melanic horizon except the depth requirement, and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
4. A1 horizons which have more than a weak development of structure and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
5. An A2 horizon which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
6. B2 horizon with 15% clay (SL) or less, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate).
7. A ferric or bauxitic horizon >0.2 m thick.
8. A calcareous horizon >0.2 m thick



This soil unit covers approximately 193 ha or 20% of the additional disturbance areas.

Soil Unit 4 – Natric Kurosols

The Natric Kurosols unit is mapped for areas according to regionally mapped soil types for areas where no ground truthed soils investigations were undertaken or previous soil survey data is unavailable.

Natric Kurosols are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2t horizon if it is less than 0.2 m thick) is strongly acid and in which the major part of the upper 0.2 m of the B2t horizon is sodic.

This soil unit covers approximately 210 ha or 21% of the additional disturbance areas.

2.4.2 RE-DISTURBANCE AREAS

The re-disturbance areas within the Study Area include those that consist of one of the following;

- Lands that have been previously subject to mining disturbance and have since been rehabilitated;
- Lands that are currently subject to mining disturbance and have not been rehabilitated; or
- Lands that have been approved for disturbance and have not yet been disturbed.

For conceptual and visual clarity, the approved final landform of the previously disturbed areas of the Study Area is used as a frame of reference to 'place' soil resources previously accounted for. This also allows for a baseline or reference for a pre-Project agricultural status.

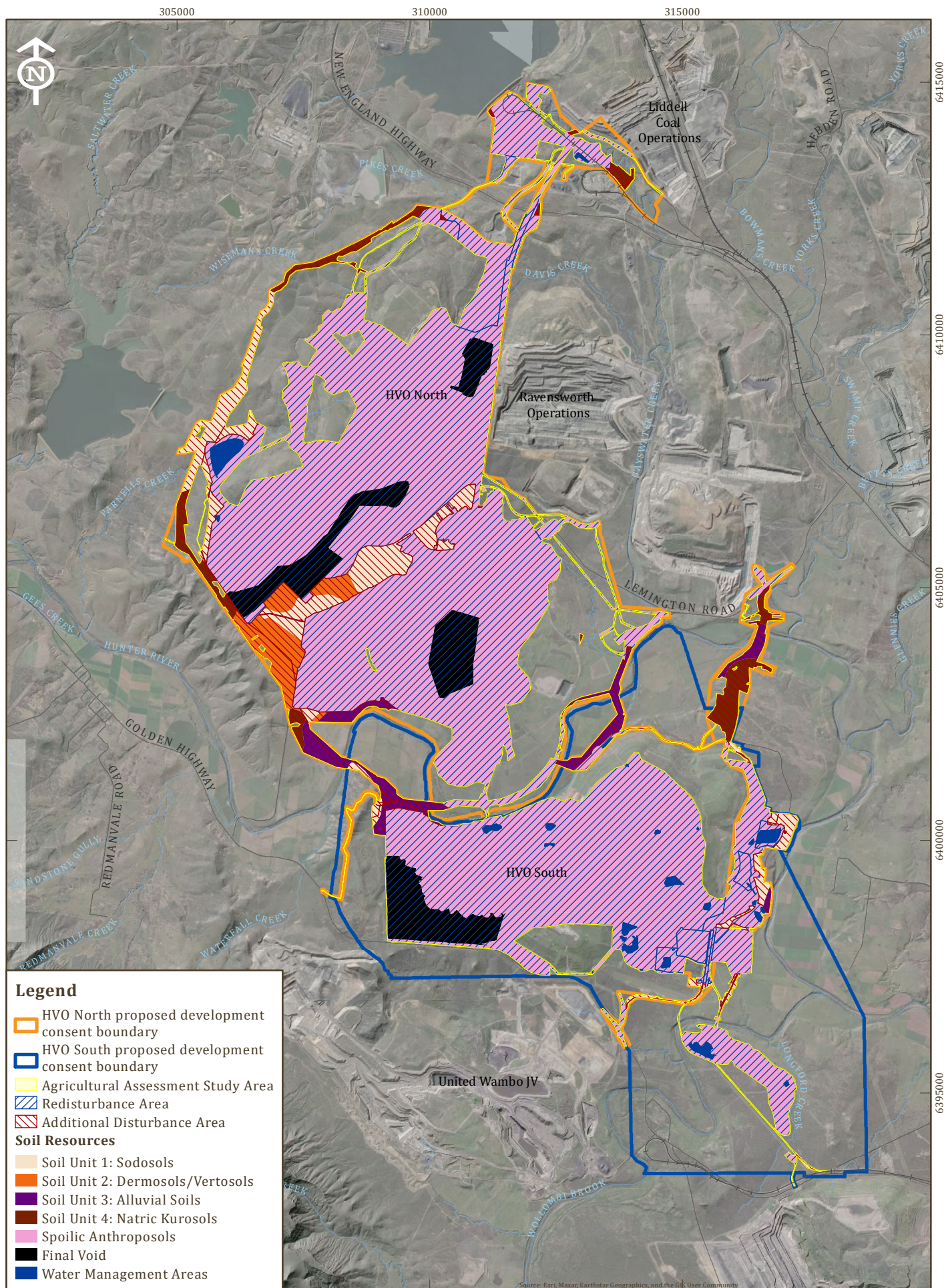
Based on the HVO topsoil management plan (HVO, 2021), Topsoil Management Compliance Audit Report (NSW Resource Regulator, 2019) and the site's RMP rehabilitation commitments (ERR, 2022), the soil resources that have been allocated to established rehabilitated lands within the Study Area are expected to be stable and in suitable condition for stripping and/or re-use. Therefore, for the purposes of this report, all soil resources in areas within the Study Area that are currently approved for a final landform are considered available for utilisation as part of the Project. This includes:

- Soil that has been used for rehabilitation that will be subject to re-disturbance. This material will have been respread on rehabilitated lands; and
- Soil resources that were stripped in previously disturbed but not rehabilitated areas of the re-disturbance area. This material is stockpiled onsite.

Due to the nature of final pit voids and water management areas, it is assumed there are no soil resources in the HVO topsoil balance allocated to these areas, and therefore there will be no soil resources available for stripping and re-use.

Recoverable resources from rehabilitation areas are classified as Spoilic Anthrosols, which are defined as soils that have formed or are forming on mineral materials that have been moved by earthmoving equipment in mining, highway construction, dam building etc (Isbell, R. F., 2021). The materials contain too few manufactured artefacts to qualify as urbic soils. Landscapes are human-formed, and hence may present an 'unnatural' geomorphic expression. These soils are expected to have a wide range of physical and chemical attributes and variable depths, although within the soil parameters for the region. This area covers 5,804 ha and is shown on **Figure 4**.





GDA2020 MGA Zone 56

Assessment Baseline Soil Resources

MINE SOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

FIGURE 5

2.5 SLOPE AND LAND CHARACTERISTICS

2.5.1 SLOPE

The currently approved final landform consists of slopes ranging from 0 – 10% on tabletop crests and low lying flats (seen extensively throughout HVO North) to 20 – 50% on hillslopes common throughout the entire Study Area and >50 on very steep slopes and precipices associated with the final pit voids (refer **Figure 6**).

2.5.2 LAND AND SOIL CAPABILITY

The Land and Soil Capability (LSC) classification was assessed by Minesoils (2022) in accordance with the OEH guideline *The Land and Soil Capability Assessment Scheme; Second approximation* (OEH 2012a) (referred to as the LSC Guideline).

The LSC Guideline uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 6** and their definition has been based on two considerations:

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

Table 6: Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	High capability land: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	Moderate capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	Moderate-low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.



Class	Land and Soil Capability
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	Extremely low capability land: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

The biophysical features of the land that are associated with various hazards are broadly soil, climate, and landform, and more specifically: slope, landform position, acidity, salinity, drainage, rockiness; and climate. The eight hazards associated with these biophysical features that are assessed by the scheme are:

1. Water erosion
2. Wind erosion
3. Soil structure decline
4. Soil acidification
5. Salinity
6. Water logging
7. Shallow soils and rockiness
8. Mass movement

Each hazard is assessed against set criteria tables, as described in the LSC Guideline; each hazard for the land is ranked from 1 through to 8 with the overall ranking of the land determined by its most significant limitation.

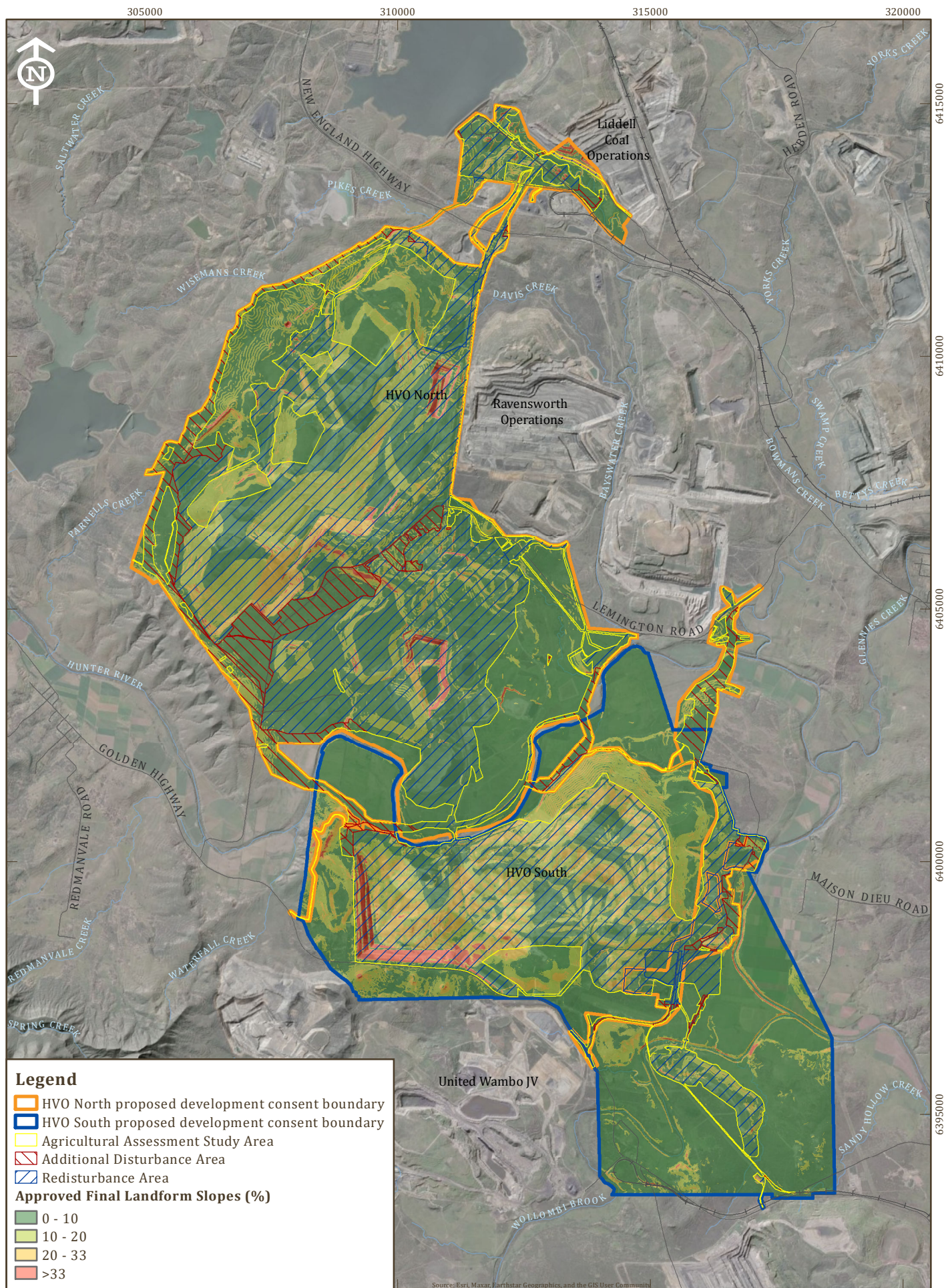
The approved final landform LSC classes for the rehabilitated areas of the re-disturbance areas are provided as a baseline for impact assessment purposes, and are shown in **Tables 7**, and presented in **Figure 7**.



Table 7: Baseline LSC of the Study Area

Study Area		LSC Class	Area (ha)		
			HVO North	HVO South	Overall
Re-disturbance Areas	Native Ecosystem (Native Woodland)	6/7	1,266	690	1,956
	Agriculture: Grazing – Pasture	4/5/6	2,089	1,230	3,319
	Agriculture: Grazing – Class 2	2	65	0	65
	Agriculture: Grazing – Class 3	3	118	1	119
	Final Void and Water Management Areas	8	402	273	675
	Unknown Status (No Final Land Use appointed in RMPs)	-	40	12	52
Additional Disturbance Areas		3	179	77	256
		4	119	70	189
		5	478	233	711
		6	156	19	175
Total			4,912	2,604	7,517





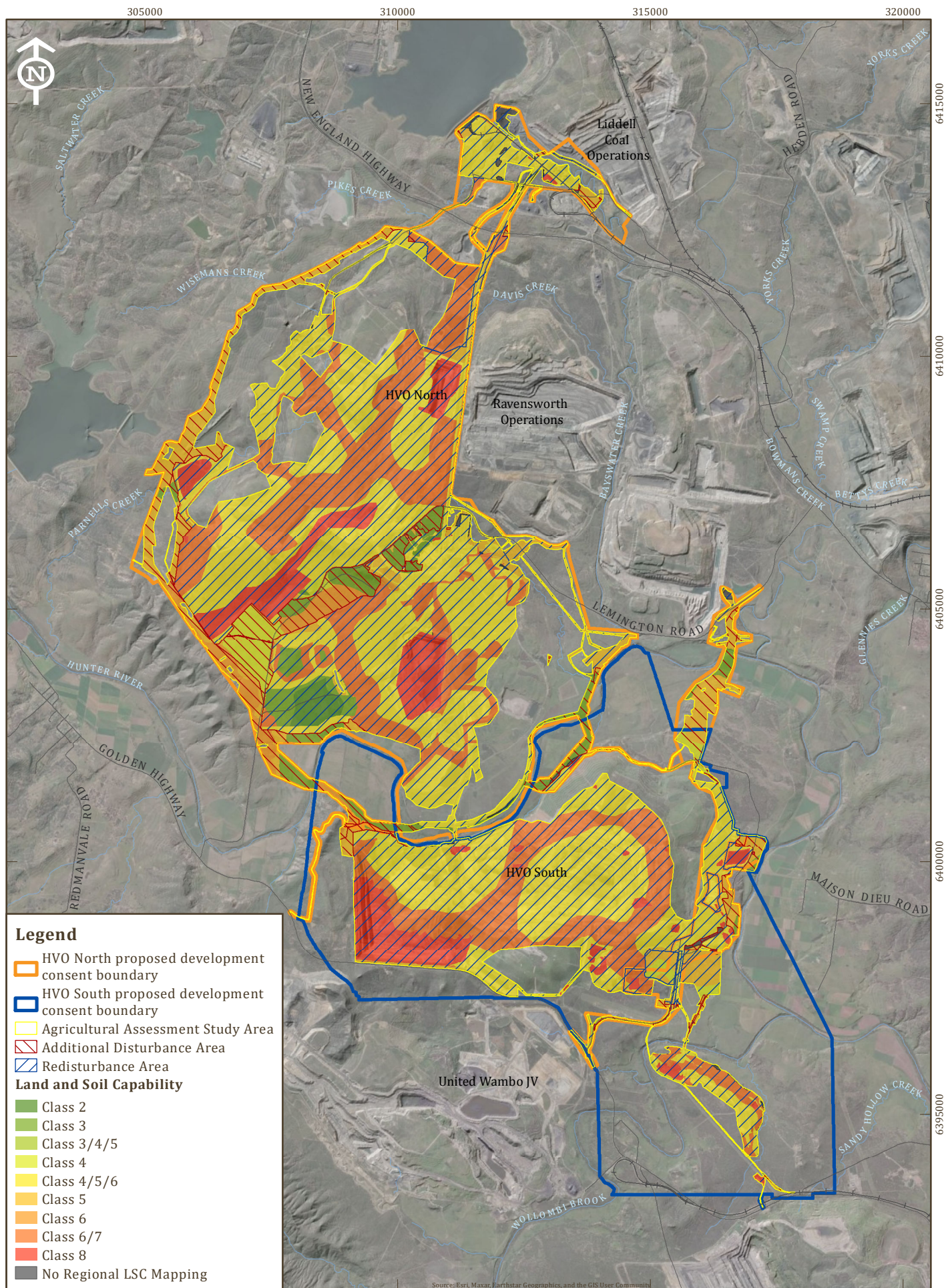
GDA2020 MGA Zone 56

Baseline Slope Analysis

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

FIGURE 6



GDA2020 MGA Zone 56

Baseline Land and Soil Capability

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

FIGURE 7

3 AGRICULTURAL RESOURCES AND PRODUCTION OF SURROUNDING LOCALITY

3.1 PROJECT LOCALITY

The Project locality is defined as the district surrounding the Study Area with an approximate proportional area of a parish. The Study Area crosses the Liddell, Howick, Lemington and Ravensworth parishes. For the purpose of this assessment, the Project Locality in this AIS refers to a five km buffer area around the Study Area (refer to **Figure 1**).

Large areas within the Project locality are owned by various mining companies and used for mining activities. The largely industrial environment also includes the Bayswater and Liddell power stations. Historically the region has been used for intensive agriculture on the rich alluvial soils in narrow corridors along the floodplains of the Hunter River. Less intensive activities, such as grazing on non-improved pasture, occur on the undulating slopes of the surrounding areas.

The prevailing agricultural land use of the locality is cattle grazing, predominantly on areas cleared of vegetation as a result of historic agricultural use, or on rehabilitated areas following mining use. Cropping activities are carried out on alluvial soils throughout the Project locality, with key cropping zones being between the Hunter River and Golden highway to the west of the Project area and a portion of land to the south east of the Project locality. In the south western portion of the Project locality lies Wollemi National Park, which has not been subject to clearing or agricultural use.

Mines that operate within the Project locality include Liddell Coal Operations, United Wambo JV, Ravensworth Operations, Mt Owen, Glendell, Ashton Coal, Mt Arthur Coal and Mt Thorley/ Warkworth (refer **Figure 1**).

Biophysical Strategic Agricultural Land is mapped (as per the regional Upper Hunter SRLUP mapping) within the Project Locality along parts of the floodplains of Glennies Creek, Bowmans Creek, Bayswater Creek and the Hunter River. Some of the mapped BSAL occurs on areas currently disturbed by active mining operations within the Project locality (refer **Figure 1**).

An area of equine Critical Industry Cluster (CIC) is mapped (as per the regional Upper Hunter SRLUP mapping) where the Golden Highway meets the western boundary of the Project locality area (refer **Figure 1**). This includes horse paddocks of the Coolmore Australia horse stud. The Study Area is separated from the CIC by the Wandewoi ridgeline, with the nearest point of this CIC at a distance of approximately 3 km from the HVO North proposed development consent boundary. Other intensive agriculture enterprises, such as irrigated cropping activities livestock breeding, are situated at a closer proximity to the Project area.

3.2 AGRICULTURAL RESOURCES

3.2.1 CLIMATE

The regional climate of the Project Area is characterised by hot summers and mild dry winters. Rainfall is relatively consistent throughout the year, although slightly lower in winter than in summer. Evaporation exceeds rainfall throughout the year and a soil moisture deficit is likely (especially in the summer months). The annual rainfall averages 656 mm, while the annual evaporation is 1,544 mm.

Temperatures range from a maximum average of 32.1°C in January, down to a minimum average of 4.3°C in July and August (Singleton STP Bureau of Meteorology (BOM) station No. 061397, 2022).

The climate is suitable for a range of agricultural enterprises including permanent and annual horticulture, cropping enterprises and improved perennial and native pastures. The climate would support temperate to sub-tropical



plants so long as there is a degree of frost tolerance or dormancy over winter. The growing season length would depend on the crop, however it would be reasonable to expect that temperate species would have suitable conditions for growth from September through to May inclusive and possible over the winter. Sub-tropical species could be expected to have a growing season of October through to March or April. Permanent horticulture plantings and improved pastures would continue to rely on irrigation to provide consistent productivity in this climate (particularly during drought conditions) where there can be significant gaps between rainfall events and the evaporation rate is relatively high.

3.2.2 GEOLOGY, TOPOGRAPHY AND SLOPE

HVO is located in the Central Lowlands of the Hunter Valley. The Hunter Valley has four landform units:

- Liverpool and Mount Royal Ranges (including Barrington Tops);
- Merriwa Plateau and Goulburn Valley;
- North Eastern Foothills; and
- Central Lowlands.

The Liverpool, Mount Royal and Barrington Tops in the north and north east of the valley form the headwaters of the Hunter River. 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. The north eastern part of the Upper Hunter 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 extends from Murrurundi to Branxton and was formed from relatively weak Permian sediments.

With regard for the broader geological context, the Study Area is located within the Sydney Basin which formed in the Late Carboniferous – Early Permian due to igneous rifting and crustal thinning, which resulted in the deposition of Permian and Triassic aged sedimentary sequences. HVO extracts coal seams within the Permian aged Jerrys Plains Subgroup of the Hunter Coalfields. The Jerrys Plains Subgroup comprise economic coal seams, along with overburden and interburden consisting of sandstone, siltstone, tuffaceous mudstone and conglomerate.

Large areas of the Project locality and Study Area have been disturbed by mining operations, creating artificial low points associated with voids and high points relating to overburden dumps. The topography of the Study Area is characterised by an undulating hillslope, gently sloping alluvial plains associated with stream floodplains and large areas of manmade disturbance to the natural topography due to coal mining. Natural local relief typically ranges from 60-150 m Australian Height Datum (AHD), and down to approximately 50 m AHD along the Hunter River.

Within the Study Area, slope on rehabilitated areas and previously undisturbed areas alike ranges from very gently undulating to steep, with significant expanses greater than 10% slope. Elevation of emplacement areas are up to approximately 240 m AHD and pit voids extend down to depths of approximately -130 m AHD.

3.2.3 REGIONAL SOIL CHARACTERISTICS

The Study Area lies within the *Soil and Land Resources of the Hunter Region* 1:100,000 Sheet (DPIE 2020). Four hundred and sixty soil landscape map units have been described within the Hunter Region. Each unit is an inventory of soil and landscape information with relatively uniform land management requirements, allowing major soil and landscape qualities and constraints to be identified. Many representative type profiles are supported by laboratory analysis and soils are described using the Australian Soil Classification and the Great Soil Groups systems. The soil landscapes within the Project locality are shown on **Figure 8** and detailed below.



Benjang (bjj)

Landscape — Undulating rises with occasional flat sandstone crests on undifferentiated Permian Singleton Coal Measures in the central west of the Hunter Region. Slopes 0 - 10%, local relief <30 m, elevation 110 - 530 m. Mostly cleared woodland and open-woodland grazed on mainly voluntary native pastures.

Soils — Shallow (25 - <50 cm), well-drained Rudosols and Tenosols; moderately deep (50 - <100 cm), moderately well-drained Haplic Red and Brown Chromosols and Natric Red and Brown and Chromosols; and deep (100 - <150 cm), imperfectly to poorly drained Red and Brown Sodosols.

Qualities and limitations — localised shallow soils, localised poor moisture availability, localised rock outcrop hazard, localised foundation hazard, widespread recharge zone, localised gully erosion hazard, widespread sheet erosion hazard, localised high run-on, localised seasonal waterlogging.

Branxton (bxp)

Landscape— Gently undulating rises to undulating low hills comprising footslopes and drainage plains on mixed Permian sedimentary rock in the central south of the Hunter Region. Slopes 1 - 5%, local relief 20 - 50 m and elevation 40 - 130 m. Partial to extensively cleared woodlands for viticulture and grazing on native pastures.

Soils— Moderately deep (50 - <100 cm), moderately well-drained to imperfectly drained Red, Brown and Yellow Kurosols and Brown and Yellow Sodosols; deep (100 - <150 cm), imperfectly to poorly drained Grey and Yellow Sodosols; and deep (100 - <150 cm), poorly drained Black and Grey Kurosols.

Qualities and limitations— localised foundation hazard, widespread recharge zone, localised discharge zone, localised salinity hazard, localised gully erosion hazard, localised sheet erosion hazard, localised high run-on, localised poor drainage, localised seasonal waterlogging.

Broke (bkf)

Landscape — Level plain to undulating plain comprising of sandy, broad, floodplains and terraces on Quaternary alluvium in the lower reaches of Wollombi Brook in the central south of the Hunter Region. Slopes <5%, local relief <10 m, elevation 70 - 80 m.

Soils — Deep (100 - <150 cm), highly permeable Brown-Orthic Tenosols.

Qualities and limitations — widespread non-cohesive soils, widespread foundation hazard, widespread recharge zone, widespread streambank erosion hazard, widespread high run-on, widespread flood hazard.

Cressfield Road (cfz)

Landscape— Undulating rises to undulating low hills on the Wittingham Coal Measures in the central north of the Hunter Region. Slopes 3 - 10%, local relief 20 - 50 m (total relief 50 - 110 m), elevation 120 - 560 m. Extensively cleared open-woodland.

Soils— Very shallow to moderately deep (<25 - <100 cm), well to imperfectly drained Leptic and Bleached-Leptic Tenosols; moderately deep (50 - <100 cm), well-drained to imperfectly drained Red and Brown Chromosols; moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Red and Brown Sodosols, Chromosols and Kurosols; moderately deep (50 - <100 cm), poorly drained Grey Sodosols and moderately deep to deep (50 - <150 cm), well to imperfectly drained Brown Dermosols; moderately deep (50 - <100 cm), moderately well-drained Black Kandosols; moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Brown and Black Vertosols and Brown and Black Dermosols; moderately deep to deep (50 - <150 cm),

moderately well-drained Red Dermosols and Chromosols; and moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Red Dermosols and Chromosols, Calcic Calcarosols and Red Vertosols.



Qualities and limitations— localised shallow soils, localised complex soils, localised poor moisture availability, localised productive arable land, widespread recharge zone, localised discharge zone, localised salinity hazard, localised gully erosion hazard, widespread sheet erosion hazard.

Cressfield Road Variant A (cfza)

Landscape — Rolling low hills to rolling hills on the Wittingham Coal Measures and Murulla Beds in the central north of the Hunter Region. Slopes 10 - 33%, local relief 20 - 50 m (total relief 50 - 110 m), elevation 430 - 580 m. Extensively cleared open-woodland.

Soils — Very shallow to shallow (<25 - <50cm), well-drained Leptic Rudosols and Tenosols (Lithosols) occur with shallow to moderately deep (25 - <100 cm), moderately well to imperfectly drained Red and Brown Kurosols (Red Podzolic Soils) and Chromosols; moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Red and Brown Kurosols and Chromosols; moderately deep (50 - <100 cm), imperfectly drained Red and Brown Sodosols and Kurosols; moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Brown and Black Vertosols and Brown and Black Dermosols; moderately deep to deep (50 - <150 cm), moderately well-drained Red Dermosols and Chromosols; and moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Red Dermosols and Chromosols, Calcic Calcarosols and Red Vertosols.

Qualities and limitations— localised shallow soils, localised complex soils, localised foundation hazard, localised productive arable land, widespread recharge zone, localised gully erosion hazard, widespread sheet erosion hazard.

Dochra (dot)

Landscape — Undulating low hills on Permian siltstones and mudstones in the central part of the Hunter Region. Slopes 5 - 10% (occasionally up to 15%), local relief 30 - 70 m, elevation 40 - 170 m. Includes areas of made land (rehabilitated mine spoil). Extensively cleared open-forest.

Soils — Moderately deep (50 - <100 cm), moderately well-drained Eutrophic Subnatric Brown Sodosols; moderately deep (50 - <100 cm), well drained Acidic-Sodic Magnesic Brown Dermosols; moderately deep (50 - <100 cm), imperfectly drained Eutrophic Subnatric Red and Brown Sodosols; and moderately deep (50 - <100 cm), imperfectly drained Haplic Natric Red Kurosols.

Qualities and limitations — localised complex soils, localised mass movement hazard, localised foundation hazard, localised complex terrain, widespread sheet erosion hazard, localised streambank erosion hazard, localised high run-on, localised poor drainage, localised seasonal waterlogging.

Donalds Gully (dnz)

Landscape— Gently undulating plain to undulating rises comprising footslopes, drainage plains and alluvial fans on Permian Wittingham Coal Measures in the central north of the Hunter Region. Slopes 1 - 5%, local relief <30 m, elevation 250 - 510 m. Extensively cleared woodland and open-woodland.

Soils— Moderately deep to deep (50 - <150 cm), imperfectly to poorly drained Brown, Yellow and Grey Sodosols and Natric Kurosols; moderately deep to very deep (50 - 500 cm), imperfectly drained Chromosols; and moderately deep to deep (50- <150 cm), moderately well-drained to imperfectly drained Red Dermosols and Chromosols, Hypocalcic Calcarosols, Red and Brown Vertosols and Black Dermosols.

Qualities and limitations— localised foundation hazard, localised productive arable land, localised recharge zone, localised discharge zone, localised salinity hazard, localised gully erosion hazard, widespread sheet erosion hazard, widespread high run-on, localised poor drainage, widespread seasonal waterlogging, localised flood hazard.



Fordwich (fww)

Landscape — Undulating rises to rolling low hills on undifferentiated Jurassic and Neogene aged basalt and dolerite within the Permian sediment valley floor in the central part of the Hunter Region. Slopes 3 - 10%, local relief 20 - 80 m, elevation 80 - 170 m. Extensively cleared woodland on mostly improved pasture and vineyards.

Soils — Moderately deep to deep, moderately well-drained Red and Brown Dermosols; very shallow (<25 cm), well-drained Leptic Rudosols; moderately deep to deep (50 - <150 cm), moderately well-drained to imperfectly drained Black and Brown Vertosols; and shallow to moderately deep (25 - <100 cm), moderately-well drained Black Dermosols.

Qualities and limitations — localised shallow soils, localised foundation hazard, widespread productive arable land, widespread recharge zone.

Foy Brook (fyz)

Landscape — Level plain to gently undulating plain on Quaternary alluvium in the central area of the Hunter Region. Slopes 0 - 3%, local relief <5 m, elevation 30 - 330 m. Extensively cleared riparian forests.

Soils — Moderately deep to deep (50 - <150 cm), moderately well-drained to well-drained Brown Kandosols and Brown Dermosols; deep to very deep (100 - 500 cm), moderately-well drained Brown Dermosols and Kandosols; and deep to very deep (100 - 500 cm), poorly drained Brown Sodosols and imperfectly drained Brown Kurosols.

Qualities and limitations — localised non-cohesive soils, localised foundation hazard, widespread recharge zone, localised discharge zone, widespread streambank erosion hazard, widespread high run-on, localised poor drainage, localised seasonal waterlogging, localised flood hazard.

Granbalang (gbp)

Landscape — Rolling low hills to rolling hills on Permian Wittingham Coal Measures in the central area of the Hunter Region. Slopes 10 - 20% (locally to 32%), local relief 30 - 120 m, elevation 30 - 350 m. Partially cleared woodlands and open woodlands. Contains extensive areas of land degradation.

Soils — Shallow to deep (25 - <150 cm), imperfectly to poorly drained Red and Brown Sodosols and Red and Brown Kurosols; and shallow to deep (25 - <150 cm), well to moderately well-drained Brown Kurosols and Red and Brown Chromosols.

Qualities and limitations — localised shallow soils, widespread complex soils, localised foundation hazard, widespread recharge zone, localised gully erosion hazard, widespread sheet erosion hazard.

Hands On Rock (hru)

Landscape — Gently undulating plain to rolling low hills comprised of hanging valleys on Triassic sediments mainly in the west of the Hunter Region with a few outliers in the Hawkesbury Nepean catchment. Slopes <15%, local relief <80 m, elevation 180 - 560 m. Mostly uncleared open-forest and woodland.

Soils — Very deep (150 - 500 cm), rapidly drained Arenic Yellow-Orthic Tenosols and Yellow Kandosols and shallow (25 - <50 cm), well-drained Tenosols.

Qualities and limitations — localised shallow soils, widespread non-cohesive soils, localised rock outcrop hazard, localised rockfall hazard, widespread recharge zone, localised discharge zone, widespread gully erosion hazard, widespread high run-on, localised poor drainage, localised seasonal waterlogging.



Howick (hxx)

Landscape — Rolling low hills to rolling hills on Cenozoic and Jurassic dolomite, basalt and diorite in the central area of the Hunter Region. Slopes 10 - 30% (typically <20%), local relief 60 - 140 m, elevation 90 - 320 m. Extensively cleared woodland.

Soils — Shallow to moderately deep (25 - <100 cm), well drained Black Dermosols and shallow to moderately deep (25 - <100 cm), moderately well drained Brown Vertosols.

Qualities and limitations — widespread shallow soils, localised steep slopes, localised rock outcrop hazard, localised foundation hazard, widespread recharge zone, localised sheet erosion hazard.

Isis (isz)

Landscape — Gently undulating plain to undulating plain of lower slopes and drainage plains on colluvial clays and silts derived from Devonian to Carboniferous sediments in the central and central north of the Hunter Region. Slopes 2 - 10%, local relief <2 m, elevation 200 - 500 m. Extensively cleared grassy woodlands.

Soils — Moderately deep to deep (50 - <150 cm), moderately well-drained Brown and Red Chromosols Brown Sodosols and Red Sodosols; moderately deep (50 - <150 cm), imperfectly drained Brown Chromosols, Bleached and/or Mottled Grey; Brown Chromosols and Sodosols.

Qualities and limitations — widespread foundation hazard, widespread discharge zone, widespread gully erosion hazard, widespread sheet erosion hazard, widespread high run-on, widespread poor drainage, widespread seasonal waterlogging.

Lees Pinch (lpt)

Landscape — Steep to precipitous hills on Triassic Sandstones in the south-west of the Hunter catchment. Slopes >30%, local relief 90 - >300 m, elevation 200 - 800 m. Mostly uncleared open-forest and woodland.

Soils — Very shallow to shallow (<25 - <50 cm), rapidly drained Arenic and Clastic Rudosols and Leptic Tenosols; shallow to deep (25 - <150 cm), well-drained Kandosols and deep (100 - <150 cm), imperfectly drained Yellow Kurosols.

Qualities and limitations — widespread shallow soils, widespread poor moisture availability, widespread non-cohesive soils, widespread steep slopes, widespread rock outcrop hazard, widespread rockfall hazard, widespread mass movement hazard, widespread foundation hazard, widespread recharge zone, widespread sheet erosion hazard, localised high run-on, localised permanent waterlogging.

Little Grasstree Hill (lgw)

Landscape — Rolling low hills to rolling hills on Permian siltstones, sandstone and conglomerate of the Maitland Group in the central area of the Hunter Region. Slopes 10 - 32%, local relief 40 - 120 m, elevation 30 - 290 m. Extensively cleared open-woodlands. Areas of widespread land degradation present.

Soils — Shallow to deep (25 - <150 cm), imperfectly to poorly drained Red and Brown Sodosols and Red and Brown Kurosols; and shallow to deep (25 - <150 cm), well to moderately well-drained Red and Brown Chromosols and Brown Kurosols.

Qualities and limitations — localised shallow soils, localised foundation hazard, widespread recharge zone, widespread gully erosion hazard, widespread sheet erosion hazard.



Lovedale (lvv)

Landscape— Gently undulating plain to undulating rises comprised of footslopes, alluvial fans and drainage plains on early-mid Permian sedimentary rocks in the central south of the Hunter Region. Slopes 2 - 5%, local relief 5 - 20 m, elevation 30 - 160 m. Tall woodland partially cleared for grazing, viticulture and other uses and associated swamp complex.

Soils — Deep (100 - <150 cm), poorly to imperfectly drained Mottled Magnesic-Natric Grey Kurosols, occasionally Mottled Grey Chromosols; with moderately deep (50 - <100 cm), poorly drained Eutrophic Subnatric Brown Sodosols; deep (100 - <150 cm), poorly drained Melacic Eutrophic Grey Dermosols; Melacic Dermosolic Oxyaquic Hydrosols; deep (100 - <150 cm), poorly drained Mottled Grey Kurosols/Chromosols; Kurosolic/Chromosolic Redoxic Hydrosols; deep (100 - <150 cm), well-drained Fragic Humic Semiaquic Podolsols; and moderately deep to deep (50 - <150 cm), moderately well-drained Haplic Brown Chromosols.

Qualities and limitations — localised non-cohesive soils, widespread foundation hazard, localised discharge zone, localised salinity hazard, localised gully erosion hazard, w widespread poor drainage, localised permanent waterlogging, localised seasonal waterlogging, localised flood hazard.

Munghorn Plateau (mpm)

Landscape — Level plain to undulating plain comprised of flat-topped crests on Triassic sandstone and sediments in the central west of the Hunter Region. Slopes <10%, local relief <9 m, elevation 280 - 570 m. Generally uncleared woodland/dry sclerophyll forest.

Soils — Very shallow to shallow (<25 - <50 cm), rapidly drained Leptic Tenosols and Rudosols and very deep (150 - 500 cm), rapidly drained Yellow and Brown Tenosols.

Qualities and limitations — widespread shallow soils, widespread poor moisture availability, widespread non-cohesive soils, localised periodically frozen soils, widespread rock outcrop hazard, localised foundation hazard, widespread recharge zone, widespread sheet erosion hazard.

Paterson River (paw)

Landscape— Level to gently undulating alluvial floodplain on Quaternary alluvium along the Paterson River and Allyn River in the central part of the Hunter Region. Slopes <3%, local relief <10 m, elevation <20 m. Extensively cleared tall open-forest.

Soils— Very deep (150 - 500 cm), moderately permeable and well-drained Basic Lutic Rudosols; deep (100 - <150 cm), highly permeable and rapidly drained Basic Stratic Rudosols; and very deep (150 - 500 cm), moderately permeable and well-drained Humose Eutrophic Brown Dermosols.

Qualities and limitations— localised non-cohesive soils, widespread foundation hazard, widespread complex terrain, localised productive arable land, localised woody weeds, localised recharge zone, localised discharge zone, localised wind erosion hazard, localised gully erosion hazard, widespread streambank erosion hazard, localised seasonal waterlogging, widespread flood hazard.

Ravensworth (rvt)

Landscape — Undulating rises to undulating low hills on Permian Wittingham Coal Measures in the central area of the Hunter Region. Slopes 3 - 10% (locally to 20%), local relief 20 - 90 m, elevation 30 - 280 m. Extensively cleared woodlands and open woodlands. Areas of widespread land degradation present.

Soils — Moderately deep to deep (50 - <150 cm), imperfectly to poorly drained Brown and Yellow Natric Kurosols and Brown and Yellow Sodosols; and moderately deep to deep (50 - <150 cm), well-drained to imperfectly drained Red, Brown and Yellow Kurosols and Chromosols.



Qualities and limitations — widespread complex soils, localised foundation hazard, widespread recharge zone, localised discharge zone, localised salinity hazard, localised gully erosion hazard, widespread sheet erosion hazard.

Sandy Hollow (syu)

Landscape — Gently undulating plain to undulating rises comprised of drainage plains and footslopes on Triassic and Permian sedimentary rocks and derived colluvium in the central western part of the Hunter Region. Slopes <10%, local relief <30 m, elevation 100 - 300 m. Extensively cleared open-forest and woodland.

Soils — Moderately deep to deep (50 - <150 cm), rapidly drained Tenosols and Rudosols; moderately deep to deep (50 - <150 cm), well-drained Red Kandosols; and very deep (150 - 500 cm), imperfectly drained Red, Yellow and Brown Sodosols.

Qualities and limitations — localised recharge zone, localised discharge zone, localised salinity hazard, localised gully erosion hazard, widespread sheet erosion hazard, widespread high run-on, localised poor drainage, widespread seasonal waterlogging, localised flood hazard.

Singleton (sgw)

Landscape — Level plain to gently undulating plain on Quaternary alluvium in the central part of the Hunter Region. Slopes <3%, local relief <10 m, elevation 10 - 200 m. Extensively cleared woodland, dominated by improved pastures.

Soils — Deep (100 - <150 cm), moderately well-drained Brown and Black Dermosols and deep (100 - <150 cm), well-drained Red and Brown Kandosols; deep (100 - <150 cm), imperfectly drained Haplic Epipedal Black Vertosols; deep (100 - <150 cm), well-drained Bleached Red Chromosols; and deep (100 - <150 cm), imperfectly to well-drained Stratic Rudosols.

Qualities and limitations — localised complex soils, localised non-cohesive soils, widespread foundation hazard, widespread productive arable land, widespread recharge zone, localised wind erosion hazard, localised gully erosion hazard, localised permanent waterlogging, localised seasonal waterlogging, widespread flood hazard.

Warkworth (wwq)

Landscape — Level plain to rolling plain comprised of thin sand sheets and linear sand dunes 1 - 3 m high formed of Quaternary fluvial sands from the Hunter river in the central area of the Hunter Region. Slopes <25%, local relief <5 m, elevation 20 - 60 m. Extensively cleared open-woodland and heath.

Soils — Deep (100 - <150 cm), rapidly drained Basic Litic Rudosols.

Qualities and limitations — widespread poor moisture availability, widespread non-cohesive soils, localised foundation hazard, widespread wind erosion hazard, localised

Watagan (wny)

Landscape — Rolling to very steep hills on fine-grained Narrabeen Group sediments mainly in the north of the Hawkesbury Nepean Catchment and in the south of the Hunter Region. Slopes >25%, local relief 50 - 220 m, elevation 30 - 1176 m. Mostly uncleared tall eucalypt open-forest with closed-forest in sheltered positions.

Soils — Moderately deep to deep (50 - <150 cm), well to imperfectly drained Red and Brown Kurosols shallow to deep (25 - <150 cm), well-drained brownish-black Rudosols; shallow to deep (25 - <150 cm), imperfectly drained Yellow and Brown Kurosols; shallow (25 - <50 cm), rapidly drained Rudosols; and moderately deep to deep (50 - <150 cm), well-drained Melacic Red and Brown Kandosols.

Qualities and limitations — localised shallow soils, widespread complex soils, localised non-cohesive soils, widespread steep slopes, localised rock outcrop hazard, localised rockfall hazard, widespread mass movement



hazard, widespread foundation hazard, widespread recharge zone, widespread sheet erosion hazard, localised high run-on, streambank erosion hazard, localised flood hazard.

Wollengambe (wox)

Landscape— Rolling low hills to steep hills on Narrabeen Group Sandstone mainly in the north-west of the Hawkesbury Nepean Catchment but also the rugged south-west of the Hunter Region. Slopes 20 - 40%, local relief <220 m, elevation 200 - 600 m. Mostly uncleared open-forest and open-woodland.

Soils— Shallow (<50 cm), rapidly drained Rudosols and Tenosols; shallow to moderately deep (<50 - 100 cm), well to rapidly drained Brown Orthic Tenosols and Kandosols; moderately deep to deep (50 - 150 cm), moderately well-drained Brown Kandosols and imperfectly drained Yellow, Brown and Red Kurosols and Chromosols; and shallow to moderately deep (<50 - 100 cm), rapidly to well-drained Rudosols and Tenosols.

Qualities and limitations— widespread shallow soils, localised non-cohesive soils, localised steep slopes, localised rock outcrop hazard, localised rockfall hazard, localised mass movement hazard, widespread foundation hazard, widespread recharge zone, widespread sheet erosion hazard.

3.2.4 VEGETATION

Within the Project locality, historic clearing has been carried out for grazing and cropping, and more recently for coal mining and infrastructure purposes. Remaining land has also been highly disturbed in the past by land clearing for agriculture and is now largely dominated by exotic pasture with isolated areas of remnant native vegetation on some hill crests and drainage lines. Prior to clearing these areas largely supported open woodland with species including red ironbark, yellow box, white box, and blakeys red gum (Kovac and Lawrie, 1991).

The Wollemi National Park in the south east of the Project locality remains uncleared. Here, open-forest and woodland communities are present containing a wide range of species. These include *Eucalyptus fibrosa* (red ironbark), *E. rossii* (scribbly gum), *E. crebra* (narrow-leaved ironbark), *E. dwyeri* (Dwyer's red gum), *E. caleri* (Caleys ironbark) *Corymbia trachyphloia* (brown bloodwood), *Callitris endlicheri* (black cypress pine), *Bossiaea rhombifolia*, *E. punctata* (grey gum) and *E. sparsifolia* (narrow-leaved stringybark) (*Soil and Land Resources of the Hunter Region* 1:100,000 Sheet (DPIE 2020)).

3.2.5 WATER RESOURCES AND EXTRACTION LOCATIONS

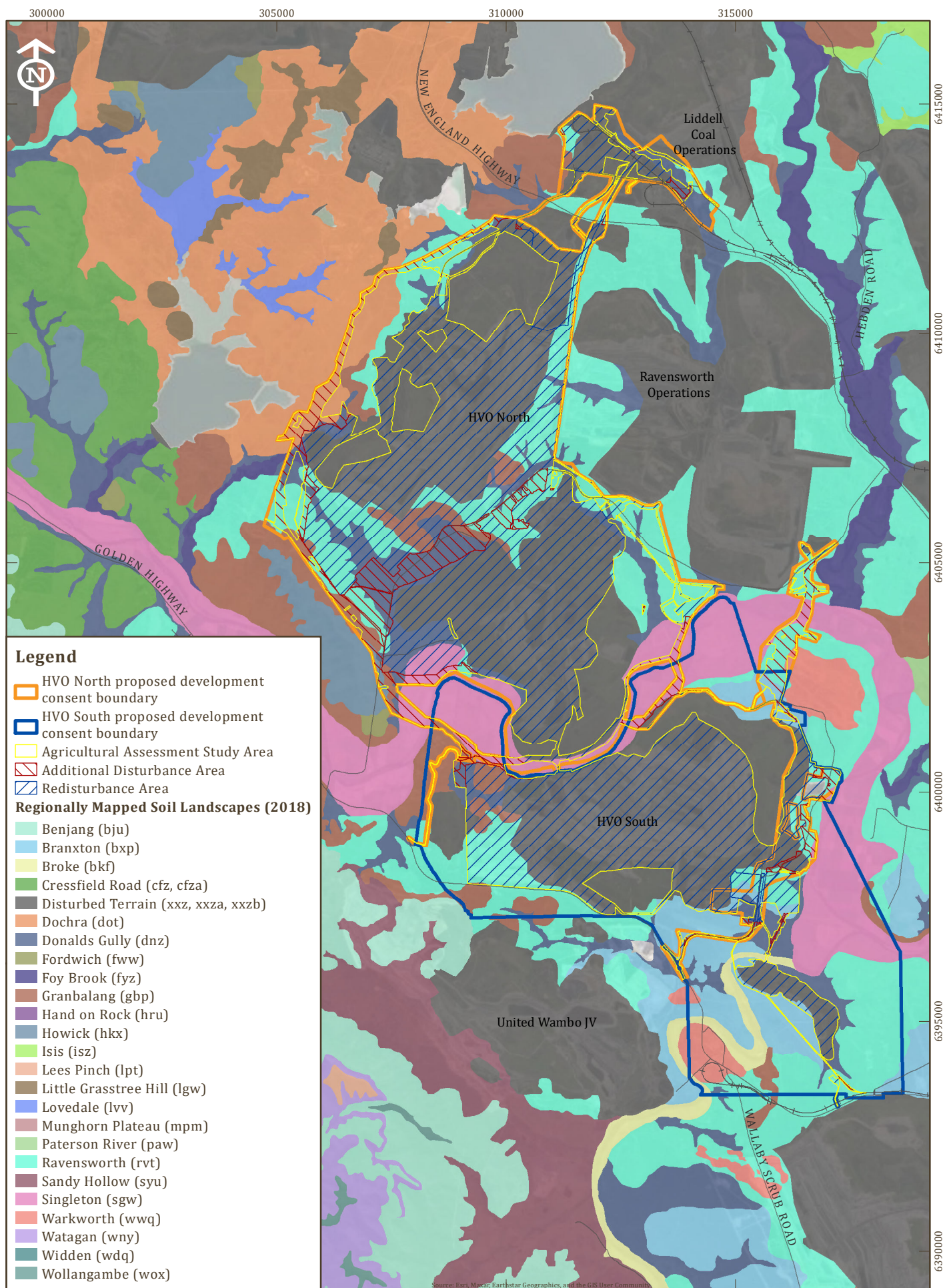
The Study Area is located in the Hunter River catchment, with the Hunter River entering the site at numerous locations (refer Figure 1). Tributaries of the Hunter River that exist within the Study Area include Farrells Creek, Parnells Creek, Pikes Creek, Bayswater Creek and Wollombi Brook and several unnamed ephemeral streams.

Water sharing plans (WSPs) regulate sharing of water between environmental needs and water users. Rules are also established to manage requirements of different water uses such as town supply, rural domestic supply, stock watering, industry and irrigation. WSPs have been established for groundwater as well as for surface water resources.

- Three WSPs apply to the Project Locality:
- Hunter Regulated River Water Source 2016 (Hunter Regulated WSP)
- Hunter Unregulated and Alluvial Water Sources 2009 2022 (Hunter Unregulated WSP), and
- North Coast Fractured and Porous Rock Groundwater Sources 2016 (North Coast Fractured and Porous Rock WSP).

The HVO Complex is located adjacent to Management Zone 3A 1B is the relevant zone for of the Hunter Regulated WSP. The Hunter Unregulated WSP is subdivided into water sources and management zones.





GDA2020 MGA Zone 56

Soil Landscapes of Locality

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:110000 at A4

FIGURE 8

The Hunter unregulated river has the following water sources of relevance to the Project Area:

- Jerrys Water Source;
- Lower Wollombi Brook Water Source;
- Singleton Water Source; and
- Glennies Water Source.

The alluvial groundwater source (Hunter Regulated River Alluvial Water Source) has the following management zones of relevance to the Project Area:

- Upstream Glennies Management Zone;
- Glennies Management Zone; and
- Downstream Glennies Management Zone.

3.3 AGRICULTURE SUPPORT INFRASTRUCTURE

The Study Area is predominantly within the Singleton LGA, with a section of the northern-most reaches of the Study Area being within the Muswellbrook LGA. Both the Muswellbrook and Singleton LGAs have a well-developed road network that connects the agricultural industry to markets, services and suppliers. Road services range from the New England Highway and Golden Highway to local unsealed and sealed roads. The Main Northern Railway also provides connections to northern and southern centres for freight and passengers. The region is well serviced with rail access into the main NSW bulk shipping port at Newcastle.

The main agricultural service centres are the towns of Singleton and Muswellbrook, with local businesses providing agricultural equipment and supplies, including animal fencing, animal vaccinations, livestock ID, stock supplements, seed, fertiliser and crop protection.

Livestock farming for slaughter has the highest importance for agriculture in the Singleton and Muswellbrook LGAs (refer Section 3.5), whereas farming of livestock for product, such as dairy, has experienced decline. The Hunter Regional Livestock Exchange (HRLX), formally known as the Singleton Regional Livestock Market is an important economic and historic facility for the local community providing the regions producers with a competitive market to sell livestock. HRLX has an undercover selling facility, feeding services for livestock (pre and post-sale) and an avdata truck wash system. Prime cattle sales are conducted weekly and store cattle sales are conducted monthly. Other regional livestock saleyards are located in Maitland, Scone and Mudgee. The closest abattoirs are located in Scone and Singleton. Additional abattoirs can be found in Dubbo, Tamworth and Sydney. A further abattoir and a feedlot facility is proposed to be developed near Denman (Yarraman Abattoir and Feedlot). This facility is intended to process 250,000 head of cattle per year (KMH Environmental, 2016).

Other infrastructure critical to agricultural production include energy needs (gas and electricity), telecommunications services, irrigation water infrastructure and urban water and wastewater services. General agricultural improvements such as stock fences, shedding, dams and access tracks are widespread throughout the locality which reflects the historical and current development of the local lands for livestock grazing.





Plate 2: Hunter Regional Livestock Exchange in Singleton (The Singleton Argus 2020)

3.4 AGRICULTURE INDUSTRY

Changing agricultural focus and rural settlement patterns are a key characteristic of the history of the region surrounding the Project Area, responding to changes in short to medium term environmental conditions and to changes in economic, social and policy frameworks, often at a scale well beyond the Project Locality.

Notwithstanding these changes, the general agricultural land use of the Project Locality is low intensity cattle grazing. It should be noted that the broader Upper Hunter Region (north-west of the Project Locality) generally has higher quality soils and a more diverse agricultural sector.

Historical records (LSJ, 2019) indicate cultivation began early in European settlement, with crops including wheat, maize, barely and tobacco. Wheat crops grown in the Hunter Valley were prone to disease 'rust', with a severe outbreak occurring in 1857. Disease together with the relatively dry conditions in the Upper Hunter resulted in the decline of wheat production. Following the decline of wheat, barely production, predominantly for stock feed, increased. As the dairy industry began to grow, Lucerne crops became a more viable option for feed.

Dairy farming became an important land use after sheep/wool production began to decrease and by the early twentieth century, dairy farms of up to ~200 ha were present in the Upper Hunter. Dairying further increased after World War I as soldiers were given small holdings and government assistance to establish small agricultural businesses.

A decline of the dairying industry began in the second half of the twentieth century, with the number of dairy farms almost halving between 1970 and 1976. The decline is thought to be the result of changing policies, with Britain joining the European Economic Community resulting in Australia losing its main dairy export market, the reallocation of milk quotas and the eventual deregulation of the industry.

With the decline of dairy farming, viticulture began to grow in importance in the region. Commercial wine growing in the area developed following the establishment of Soldier Settlement viticultural farms in the 1920s, but the boom of grape growing did not occur until the 1970s.

The development of coal resources began on a limited scale in the early 1900s. Rapid expansion took place in the 1950s with the establishment of large open-cut mines to supply power stations and increasingly to meet export demand. Today coal mining employs approximately 40% of workers in the Singleton LGA and 30% of workers in the Muswellbrook LGA (refer **Table 8**). Conversely, Agriculture, Forestry and Fishing employs approximately 3% of workers in the Singleton LGA and 5% of workers in Muswellbrook LGA (refer **Table 8**) (REMPAN, 2022).



Economic output by industry reflects employment statistics. Mining generates an estimated 12 billion dollars and 6 billion dollars in Singleton and Muswellbrook LGA's respectively (REMPPLAN, 2022). Agriculture, forestry and fishing generated an estimated 159 million dollars and 193 million dollars for Singleton and Muswellbrook LGA's respectively (refer **Table 9**).

Table 8: Employment by Industry for Singleton and Muswellbrook LGA's

Industry	Singleton LGA		Muswellbrook LGA	
	Jobs	%	Jobs	%
Agriculture, Forestry & Fishing	455	2.8	541	5.4
Mining	6,626	40.6	3,120	31.2
Public Administration & Safety	1,061	6.5	479	4.8
Construction	950	5.8	515	5.1
Retail Trade	931	5.7	679	6.8
Accommodation & Food Services	878	5.4	505	5.0
Health Care & Social Assistance	815	5.0	694	6.9
Manufacturing	761	4.7	321	3.2
Administrative & Support Services	739	4.5	363	3.6
Education & Training	720	4.4	441	4.4
Other Services	685	4.2	366	3.7
Transport, Postal & Warehousing	390	2.4	275	2.8
Wholesale Trade	383	2.4	297	3.0
Professional, Scientific & Technical Services	353	2.2	244	2.4
Rental, Hiring & Real Estate Services	201	1.2	95	1.0
Financial & Insurance Services	133	0.8	70	0.7
Electricity, Gas, Water & Waste Services	121	0.7	887	8.9
Arts & Recreation Services	73	0.5	67	0.7
Information Media & Telecommunications	50	0.3	58	0.6
Total	16,325	100.0	10,017	100.0

(Source: REMPLAN 2022, based on ABS 2016 Census Place of Work Employment (Scaled), ABS 2019 / 2020 National Input Output Tables, and ABS June 2021 Gross State Product)



Table 9: Economic Output by Industry for Singleton and Muswellbrook LGA's

Industry	Singleton LGA		Muswellbrook LGA	
	Economic Output (\$)	%	Economic Output (\$)	%
Agriculture, Forestry & Fishing	159,987,833	1.0	193,920,079	2.1
Mining	11,868,473,483	75.3	5,543,536,420	61.2
Manufacturing	714,991,223	4.5	288,956,925	3.2
Public Administration & Safety	575,062,401	3.6	132,736,300	1.5
Construction	517,087,794	3.3	267,483,031	3.0
Rental, Hiring & Real Estate Services	453,630,283	2.9	273,888,208	3.0
Electricity, Gas, Water & Waste Services	173,028,496	1.1	1,498,231,455	16.5
Administrative & Support Services	166,144,706	1.1	80,099,717	0.9
Wholesale Trade	148,652,241	0.9	115,273,409	1.3
Other Services	143,040,375	0.9	73,646,766	0.8
Transport, Postal & Warehousing	123,405,385	0.8	101,262,993	1.1
Retail Trade	122,826,311	0.8	89,580,092	1.0
Health Care & Social Assistance	119,406,455	0.8	101,559,608	1.1
Accommodation & Food Services	117,824,894	0.7	62,481,164	0.7
Education & Training	106,204,720	0.7	65,253,539	0.7
Professional, Scientific & Technical Services	106,150,929	0.7	72,977,643	0.8
Financial & Insurance Services	99,613,654	0.6	51,975,877	0.6
Information Media & Telecommunications	31,669,648	0.2	35,505,670	0.4
Arts & Recreation Services	12,799,159	0.1	11,794,956	0.1
Total	15,759,999,990	100.0	9,060,163,853	100.0

(Source: REMPLAN 2022, based on ABS 2016 Census Place of Work Employment (Scaled), ABS 2019 / 2020 National Input Output Tables, and ABS June 2021 Gross State Product)

3.5 REGIONAL AND LOCAL AGRICULTURAL ENTERPRISES

Beef cattle are an established and dominant agricultural industry in the Hunter region. The industry defines the rural character of the region, contributes significantly to the economy and facilitates the ongoing management of rural resource lands (DPI, 2006).

Across much of the Hunter region the typically shallow soil depths, erodible sub soils, low soil phosphorous levels and naturally moderate to high acidity. Those soils are best suited for permanent pastures and hence grazing enterprises.

Factors in favour of cattle grazing and the region's beef industry include the:

- Suitability of the climate, pasture types and landscape.



- Available service suppliers (eg, produce merchants, contractors).
- Proximity to infrastructure (abattoirs, saleyards, transport etc) and a range of markets.
- Potential for higher returns from group marketing activities.
- Increasing adoption of Industry standards, such as Meat Standards Australia (MSA) grading, which provide a tool for producers to identify and differentiate their products.
- Good international and domestic market prospects and the opportunity for professional beef producers to increase productivity and become more competitive.

This section highlights the dominance of cattle grazing as the most common agricultural enterprise, in terms of area of land used and estimated gross value generated, for both the wider regional setting and at a more local scale to the Project locality.

Agricultural land use in the region is dominated by grazing. The Australian Bureau of Statistics (ABS) data on agricultural land use for the Hunter Valley excluding Newcastle Statistical Area is presented in **Table 10** (ABS 2022a). This highlights the prevalence of land used for grazing against the total land for agriculture. Land used for cropping is a non-dominant land use within the region and is presented as a comparison. A summary of the analysis of land use data for the region over a five year period is as follows;

- Total land holdings has seen a reduction over the five years, with 981,538 ha of agricultural land holdings in 2016-2017 down to a low point of 754,861 ha of agricultural land holdings in 2019-2020 and returning to 826,769 in 2020 – 2021.
- Land used for cropping against the total area of agricultural land holdings has ranged from 2.4% in 2015 – 2016 to its peak of 4.7% in 2017-2018. A subsequent reduction places it at 4.5% for 2020-2021.
- Land used for grazing was 80.5% of the total area of agricultural land holding for 2017-2018, 82.0% for 2018 – 2019, 86.2% for 2019-2020 and 83.6% for 2020-2021.
- Land used for grazing on improved pastures represents 26.7% of all grazing land use for 2017-2018, 36.2% for 2018 – 2019 and 53.8% for 2019-2020. Grazing activities were dominated by ‘grazing on other land.’

Table 10: Agricultural Land Use for Hunter Valley excluding Newcastle Statistical Area (ABS 2022a)

	Financial Year					
	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Total area of agricultural land holding (ha)	870,710	981,538	861,736	795,933	754,851	826,769
Land mainly used for agricultural production (ha)	-	-	763,365	688,067	682,818	750,961
Land mainly used for crops (ha)	21,165	31,076	41,203	30,419	25,214	37,746
Land mainly used for grazing (ha)	-	-	694,078	652,714	651,169	691,325
Land mainly used for grazing on improved pastures (ha)	-	-	185,464	235,990	350,856	291,186
Land mainly used for grazing on other land (ha)	-	-	508,614	416,724	300,313	400,139

Data for the LGA's which encompass the Study Area shows that grazing is the dominant land use not only for the region (as shown above), but also at the scale of the Project locality. **Table 11** below presents land data collected



between 2000 and 2016 for the Muswellbrook and Singleton LGA's (ABS 2022a). A long term overview can be summarised as follows;

- For both the Singleton and Muswellbrook LGA's, as an average over the years assessed, land used for grazing was approximately 75% of the total area of farm holdings.
- For both the Singleton and Muswellbrook LGA's, as an average over the years assessed, land used for cropping was approximately 4% of the total area of farm holdings.
- Other areas of farm holding were either not used for agricultural purposes or used for purposes other than cropping or grazing.

Table 11: Long Term Data on Cropping and Grazing Land Use in Singleton and Muswellbrook LGA's (ABS, 2022a)

LGA	Financial Year	Area of farm holding (ha)	Land Used for Grazing (ha)	Land Used for Cropping (ha)
Singleton	2000 – 2001	155,707	61,501	4,511
	2005 – 2006	156,484	132,631	6,337
	2010 – 2011	148,759	127,525	8,020
	2015 – 2016	100,618	-	2,794
	2020 - 2021	89,000	75,235	3,718
Muswellbrook	2000 – 2001	122,272	59,925	5,088
	2005 – 2006	121,872	95,446	6,256
	2010 – 2011	105,548	88,176	6,653
	2015 – 2016	122,674	-	3,710
	2020 - 2021	123,793	113,959	3,341

Data collected in the last Agriculture Census in these LGA's during the 2020 – 2021 financial year offers further insight into the agriculture industries of the locality. Agriculture in both LGAs encompasses a range of commodities, the most significant being livestock, both for slaughter and livestock product. Livestock for slaughter includes cattle and calves, poultry, sheep and lambs, pigs and goats, with the slaughter of cattle and calves making up for over half of the of the gross agricultural product value for both LGAs. Milk production is the central livestock production commodity, with wool and egg production also occurring.

The most important crop production in both LGAs is hay and silage production. Further agricultural commodities are broadacre crops, fruit and nuts, grapes, vegetables for human consumption, as well as nurseries and cut flowers. Some agricultural commodities have larger percentage at the Hunter Valley (excl Newcastle) agricultural economy. Approximately a third of the Hunter Valley estimated gross value for hay and silage, as well as value from milk production stems from the Singleton LGA. Almost half of the Hunter Valley estimated gross value for fruits and nuts (excluding grapes) is derived in the Muswellbrook LGA, as is almost a quarter of the hay and silage gross value and 22% of the grape value.

While the percentage of the values derived are sizable, the monetary value of these commodities is comparatively small compared to the value derived from farming cattle for slaughter or livestock product (refer to **Table 12**).



The ABS data for 2015 – 2016 and 2020 – 2021 estimates the value of agricultural commodities as local value (price that would be paid at the farm gate) and gross value (price in the wholesale market). For the purposes of this AIS, gross values have been applied. Total estimated gross value of agriculture is presented in **Table 13** and summarised as follows.

- For both Singleton and Muswellbrook LGAs, gross value of crops was approximately 16 % of the gross value of agriculture.
- A comparison of the land used for cropping against its estimated gross value highlights that cropping results in a greater gross value per hectare than grazing.
- For both Singleton and Muswellbrook LGAs, gross value of livestock slaughtering or livestock products was approximately 85 % of the gross value of agriculture.
- For the Singleton LGA, livestock slaughtering represented approximately 50 % of livestock related agriculture, and is therefore the biggest contributor to the gross value of agriculture.
- For the Muswellbrook LGA, livestock slaughtering represented approximately 57 % of livestock related agriculture, and is therefore the biggest contributor to the gross value of agriculture.

Table 12: Total Estimated Gross Value of Agriculture by LGA (ABS, 2022a)

LGA	Financial Year	Crops (\$)	Livestock Slaughtering (\$)	Livestock Products (\$)	Total Agriculture (\$)
Singleton	2015 - 2016	7,123,764	25,796,718	17,686,276	50,606,758
	2020 - 2021	8,594,649	23,070,038	16,717,939	48,382,626
Muswellbrook	2015 - 2016	5,071,845	20,653,421	7,435,358	33,160,624
	2020 - 2021	6,882,464	21,564,404	12,451,857	40,898,724

In a wider regional context, livestock slaughtering also dominates the estimated gross revenue for agriculture. Data for a ten year period for the Hunter Valley excluding Newcastle Statistical Area is provided in **Table 13** (ABS 2022b), and summarised as follows:

- Estimated gross values of crops have shown a moderate decrease over the ten year period, and have lower estimated gross value than livestock slaughters or livestock products.
- Crops represent approximately 10% of the total estimated gross value of agriculture over the period (excluding 2012 – 2013).
- Livestock slaughtering is consistent in having the highest estimated gross value of all agriculture for the region.
- Livestock slaughtering represent approximately 66% of the total estimated gross value of agriculture over the period (excluding 2012 – 2013).
- Livestock products are consistent in having an estimated gross value of all agriculture for the region that is higher than cropping but lower than animal slaughtering.



- Livestock products represent approximately 23% of the total estimated gross value of agriculture over the period (excluding 2012 – 2013).

Table 13: Total Estimated Gross Value of Agriculture Hunter Valley excluding Newcastle Statistical Area (ABS, 2022a)

Financial Year	Crops (\$)	Livestock Slaughtering (\$)	Livestock Products (\$)	Total Agriculture (\$)
2020 - 2021	50,345,656	252,011,102	93,313,091	395,669,848
2019 - 2020	34,070,212	206,211,313	66,501,576	306,783,101
2018 - 2019	31,709,918	181,517,110	96,807,232	310,034,260
2017 - 2018	27,725,861	180,270,871	101,879,781	309,876,513
2016 - 2017	45,824,784	282,501,566	69,725,432	398,051,783
2015 - 2016	31,458,027	287,806,775	42,927,267	362,092,069
2014 - 2015	33,633,355	261,995,303	91,411,011	387,039,670
2013 - 2014	35,019,163	189,573,650	69,974,188	294,567,002
2012 - 2013	-	180,120,000	-	324,790,000
2011 - 2012	50,800,00	183,800,000	56,300,000	290,900,000
2010 - 2011	51,900,000	206,000,000	72,700,000	330,600,000

Given that livestock slaughtering is consistent in having the highest estimated gross value of all agriculture for the region, data is provided to show a breakdown by animal type to further highlight the nature agricultural enterprises in the region. The gross value of livestock slaughtering by type for the Hunter Valley excluding Newcastle Statistical Area is shown in **Table 14**.

The data shows that cattle and calves are consistently the dominant animal type for livestock slaughtering estimated gross value, representing approximately 70% of all livestock slaughtering estimated gross value over a ten year period (ABS 2022b).



Table 14: Estimated Gross Value of Livestock Slaughtering by Type for Hunter Valley excluding Newcastle Statistical Area (ABS, 2022a)

Financial Year	Cattle and Calves	Poultry	Sheep and Lambs	Pigs	Other	Total Livestock Slaughtering (\$)
2020 - 2021	175,464,175	66,013,414	9,048,300	1,283,265	201,948	252,011,102
2019 - 2020	129,889,317	72,283,358	3,627,470	39,086	372,083	206,211,313
2018 - 2019	134,920,333	42,219,224	4,050,955	43,158	283,440	181,517,110
2017 - 2018	129,278,594	45,928,764	4,325,035	472,317	266,162	180,270,871
2016 - 2017	169,191,699	103,653,274	3,808,822	5,350,969	496,802	282,501,566
2015 - 2016	166,403,151	83,195,437	5,234,339	1,280,511	235,310	31,458,027
2014 - 2015	141,228,345	112,656,876	5,265,937.80	1,077,387	1,766,756	261,995,304
2013 - 2014	130,301,120	56,091,631	2,750,651	69,329	360,919	189,573,651
2012 - 2013	124,940,000	50,260,000	4,440,000	70,000	410,000	180,120,000
2011 - 2012	107,600,000	70,500,000	5,500,000	100,000	100,000	183,800,000
2010 - 2011	118,500,000	83,300,000	3,900,000	200,00	100,000	206,000,000

Changes to the estimated gross value of cattle and calves has experienced a general decrease over the previous five years. These changes are a result of climate (such as the drought conditions from 2017 - 2020) and economic trends (such as variations in the strength of the Australian dollar). The total cattle number for Hunter Valley excluding Newcastle Statistical Area is shown in **Table 15** (ABS 2022a). This shows a reduction in total cattle numbers over a five year period, correlating with the wider environmental conditions.

Table 15: Total Cattle Numbers for Hunter Valley excluding Newcastle Statistical Area (ABS, 2022a)

	Financial Year					
	2015 - 2016	2016 - 2017	2017 - 2018	2018 - 2019	2019 - 2020	2020 - 2021
Total Cattle (number)	324,513	378,505	255,826	212,804	183,846	282,324



4 AGRICULTURAL IMPACT ASSESSMENT

The impacts mining activities can have on land resources and agricultural productivity range from short term temporary impacts to long term and permanent impacts. Temporary impacts can include construction disturbance or storage of soil resources, as well as operational impacts such as noise and air quality. Permanent impacts may include changes to water availability and the future land and soil capability of reshaped overburden placement areas. Permanent impacts are irreversible and may not allow the reinstatement of the pre-mining land and soil capability or agricultural uses. They can include final voids and significant changes to the pre-mining landform, drainage patterns or groundwater quality and quantity. This section assesses the temporary and permanent impacts of the Project on agricultural resource, enterprises and agricultural related socio-economic impacts.

4.1 IMPACTS ON AGRICULTURAL LAND USE

4.1.1 PROPOSED FINAL LAND USE

Final land use domains are defined as land management units characterised by similar final land use objectives. The final land use domains for the Study Area have been selected to be consistent with those specified in *Form and Way: Rehabilitation management plan for large mines* (RR, 2021), and are listed with their descriptions in **Table 16**. These domains are presented on **Figure 9**.

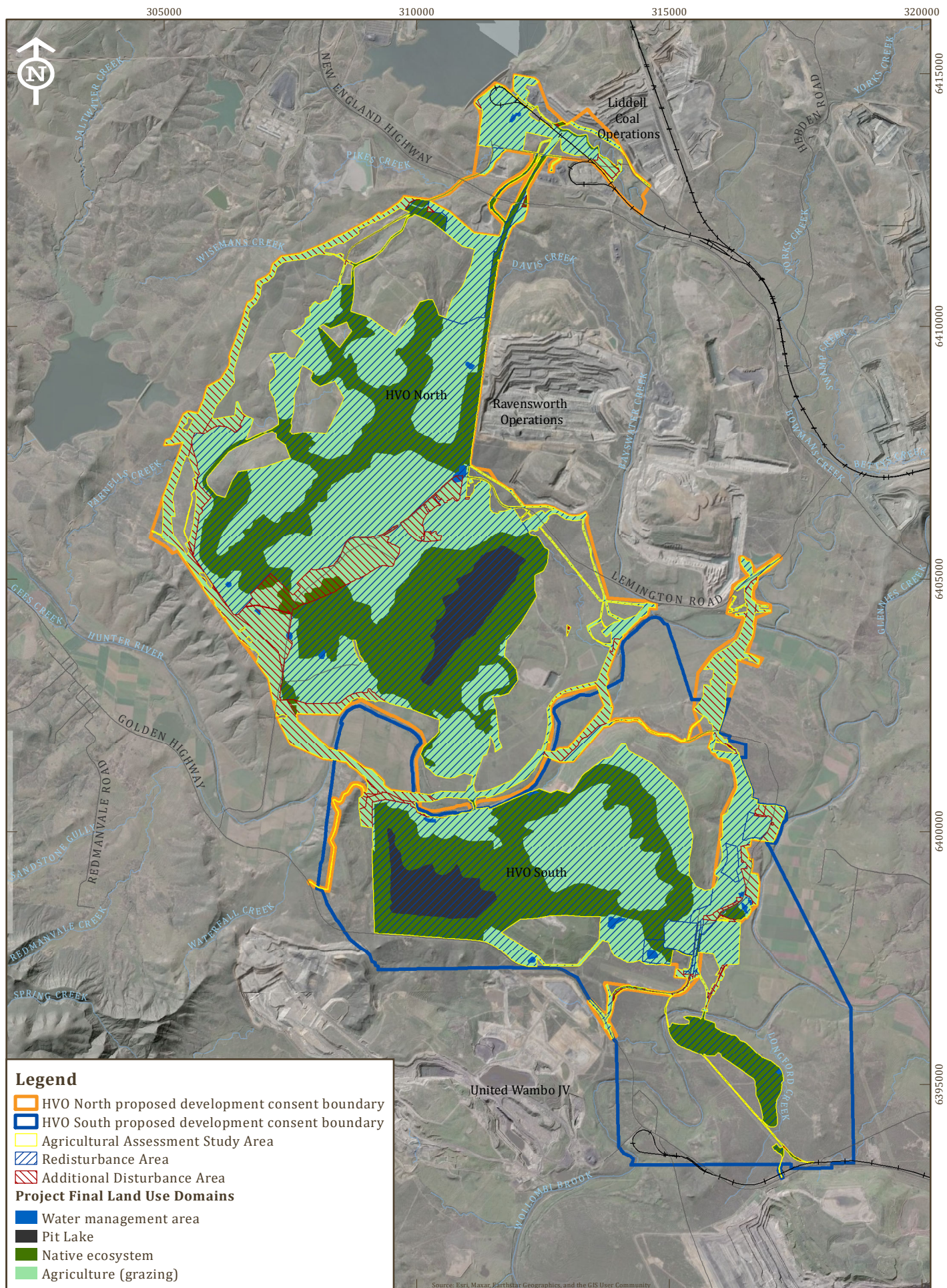
Table 16: Final Land Use Domains

Domain	Name	Description	Total Area (ha)		
			HVO North	HVO South	Overall
A	Native Ecosystem	Areas to be rehabilitated with woodland species commensurate with adjacent remnant vegetation. This will also include a network of tree corridors to ensure connectivity of woodland community areas	1,720	1,061	2,781
B	Agricultural - Grazing	Areas to be rehabilitated with selected native and exotic grasses and pasture species to facilitate grazing.	2,974	1,346	4,320
G	Water Storage Area	A network of dams and surface water management structures are planned to be retained to assist in ongoing water and land management (e.g., stock watering).	15	16	31
J	Pit Lake	Pit lakes, commonly referred to as final voids, will create permanent water bodies. Landforms above pit water level will be vegetated where practical with woodland vegetation communities.	202	182	384
Total			4,912	2,605	7,517

Note: Sub-domains Ka (Other Native Ecosystem – partial vegetation on highwall benches) and Kb (Other – Agriculture – Grazing alluvial areas) discussed within the EIS are captured within Domains A and B identified within Table 16 above respectfully.

Domains B and C represent the area allocated for agriculture land use following the life of the Project. This is a total area of approximately 4,320 ha from Domains B and C (2,975 ha for HVO North and 1,346 ha for HVO South).





GDA2020 MGA Zone 56

Project Final Land Use Domains

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

FIGURE 9

4.1.2 LAND TO BE TEMPORARILY REMOVED FROM AGRICULTURE

The Project will disturb an area of approximately 4,182 ha of land that is used for agriculture as a baseline (3,585 ha within the re-disturbance area and 597 ha within the additional disturbance area – refer Section 2.3). This land will not be suitable for agricultural use for the duration of the Project. Therefore, 4,182 ha will be temporarily removed from agriculture.

4.1.3 LAND TO BE RETURNED TO AGRICULTURE POST PROJECT

Section 4.1.1 details the total area allocated for agriculture land use following the life of the Project (4,320 ha). This is a net increase of 138 ha from the baseline area of land use for agriculture.

4.1.4 LAND THAT WILL NOT BE RETURNED TO AGRICULTURE

There will be areas where land used for agriculture at baseline will result in final void or allocated to biodiversity outcomes. Alternatively, there are areas of land at baseline not used for agricultural purposes, which will have a final land use allocation to agricultural. Overall, there will be no net loss of land used for agricultural purposes as a result of the Project.

4.1.5 BUFFER AND OFFSET AREAS

No biodiversity offsets which would remove land from agricultural use is currently proposed by the Project. Pending approval of the Project HVO may be required to purchase land based offset to satisfy offset credit requirements, or purchase credits from the Biodiversity Offset Fund. This will be determined post approval of the Project in consultation with DPE.

A Biodiversity Development Assessment Report (BDAR) (Umwelt 2022) has been prepared for the Project including an offsetting strategy for the Warkworth Sands Woodland (WSW) in the Sydney Basin Bioregion listed as an endangered ecological community (EEC) under the Biodiversity Conservation Act 2016 (BC Act) and a critically endangered ecological community (CEEC) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The EEC is also listed as a potentially Serious and Irreversible Impact (SAII) entity under the Biodiversity Offset Scheme (BOS), therefore the offset strategy is designed to recognise and address this key biodiversity risk for the Project.

The offset strategy has identified an area of WSW vegetation community adjacent to South Lemington Pit 1 (SLP1). This area is a suitable area for offsetting WSW through the establishment of a stewardship site and includes opportunities to improve and restore the community in the locality.

HVO is proposing to develop a land based biodiversity offset to satisfy credit requirements for impacts to WSW. Land proposed to be relied upon is not utilised for agricultural use.

4.1.6 PROJECT LOCALITY

The majority of land within the Project locality is owned by mining operations. As such, existing agricultural uses are largely dryland grazing either carried out by mining operation, associated subsidiary companies or a third party leasing the land. The agricultural productivity of land owned by the mining companies will not be impacted by the Project as other drivers will determine land uses of these areas. Agricultural use of privately-owned land within the Project locality, whether used for grazing or cropping purposes, is unlikely to be affected by the Project as the associated agricultural resources will not be affected. Therefore, the Project will not impact existing agricultural enterprises within the Project locality.



4.2 IMPACTS ON AGRICULTURAL RESOURCES

4.2.1 SOILS

All soil that is proposed to be disturbed during the Project will be stripped and stored for re-use in rehabilitation efforts in order to mitigate long term impacts on soil resources.

Soil within the mining impact areas have been assessed to determine suitability for stripping and re-use (Minesoils 2022). This assessment is an integral process for successful rehabilitation of the Project. Based on this, soil balance modelling indicates the total estimated volume of material available will be 7,336,370 m³. The total volume of material required to meet the final land use and LSC objectives is calculated to be approximately 7,789,000 m³. Therefore, there will be a soil deficiency of approximately 452,630 m³ or approximately 6% of the soil bank.

Additional alternate growth medium enhancement strategies may be employed to mitigate this deficit, as described within the Mine Closure and Rehabilitation Strategy (EMM 2022b).

All soils within the impact area will be subject to new classification as Spoilic Anthrosols, which are defined as soils that have formed or are forming on mineral materials that have been moved by earthmoving equipment in mining, highway construction, dam building etc (Isbell, R. F., 2021).

There will be no direct or indirect impacts to the soil resources of the Project Locality outside the Study Area.

4.2.2 LAND AND SOIL CAPABILITY

The proposed post mining LSC for the Study Area is based on the application of available soil materials on a rehabilitated landform according to final land use domains. These domains are to be rehabilitated to a suitable LSC to facilitate the final land uses. The post-mining LSC are presented in **Table 17** and shown on **Figure 10**.

As outlined in soil and land impact assessment (Minesoils 2022), the final land use Domain B: Agricultural - Grazing (excluding Domain kb) has been presented as a post-mining LSC class range of 4/5/6. This classification directly aligns with the classes of the LSC scheme that are generally considered the most suitable for a grazing land use.

The LSC 4/5/6 classification considers final landform and soil characteristics but has primarily been applied based on the intended final land use of grazing.

As outlined in the soils and land impact assessment (Minesoils 2022), a soil respread depth of 0.1m will be applied to these areas during rehabilitation. Soil depth is considered for LSC as shallow soil means less volume of soil available for storing nutrients and water. In accordance with the LSC scheme, a soil depth of 0.1m would typically default land to a LSC class of 7. By definition LSC class 7 land has extremely severe limitations for most land uses and is not capable of any cultivation or grazing by stock

The soils and land impact assessment (Minesoils 2022) considered the following in context to this classification:

- local experience with grazing on rehabilitated land and grazing trials evidence
- sedimentary nature of the sites overburden materials which will weather and act as growth media for rootzone and water holding capacity exceeding the 0.1m topdressing material; and
- the purpose of the NSW LSC scheme (2012) and its application to disturbed land.

Based on the consideration of the above, the nominated LSC class range 4/5/6 is considered to be practically more applicable than LSC class 7, despite the soil respread depths over this area of 0.10m.



Table 17: Post-mining LSC of the Study Area

Domain	LSC Range	Total Area (ha)		
		HVO North	HVO South	Overall
A	6/7	1,654	1,103	2,757
B	4/5/6	2,910	1,302	4,212
	2	65	0	65
	3	65	0	65
G, J	8	218	200	418
Total		4,912	2,605	7,517

Note: Sub-domains Ka (Other Native Ecosystem – partial vegetation on highwall benches) and Kb (Other – Agriculture – Grazing alluvial areas) discussed within the EIS are captured within Domains A and B identified within Table 16 above respectfully.

There will be no direct or indirect impacts to the LSC of the Project Locality outside the Study Area.

4.2.3 WATER

The Water Assessment (EMM 2022e) considered potential impacts on water resources and water-dependent assets that could result from the Project during operations and after closure. The assessment demonstrated the Project can operate within and meet the requirements of the water regulatory framework. Key results are summarised below.

Surface water

- Impacts on streamflow will be negligible.
- Potential impacts on surface water downstream users will be negligible as no changes in streamflow regimes are predicted in the Hunter River.
- Potential impacts on surface water quality are expected to be minimal and will be mitigated through an appropriately sized, designed and operated Water Management System (WMS), including release from sediment dams in accordance with their design and discharge of mine water in accordance with approved Environmental Protection Licence (EPL) 640 limits and Hunter River Salinity Trading Scheme credits.
- The Project flood modelling indicates potential impacts to third-party properties will be minor. The small, predicted change in the flood regime (i.e., flood level or extent) is not considered to have an impact on the use of this agricultural (grazing and cropping) or crown land (Engeny Water Management, 2022).

Groundwater

- No impact is predicted at third-party groundwater bores.
- No changes to the environmental and community values referenced in the Water Assessment will result from the Project.

Water licensing during operations

- The peak water take from the Hunter Regulated River is within HVO's existing high security entitlement. During dry periods, when additional extraction from the Hunter River may occur to meet water demand, HVO hold additional high security entitlement and adequate general security entitlement.



- The peak surface water take from the Jerrys Water Source, managed under the Hunter Unregulated River and Alluvial WSP, is below the existing entitlement held by HVO.
- There is no predicted surface water take from the Lower Wollombi Brook Water Source due to the Project.
- The predicted groundwater take from the Hunter Regulated River Alluvial Water Source and alluvium associated with the Lower Wollombi Brook and Singleton Water Sources is below the existing entitlement held by HVO.

Water licensing post mining

- Catchment runoff into the final voids will be accounted for against harvestable rights and HVO's existing entitlement held in the Jerrys Water Source.
- HVO holds sufficient entitlement for the indirect surface water take post-mining.
- Most of the predicted indirect groundwater take post-mining is within HVO's existing water entitlement. However, an additional 20 shares from the Hunter Regulated River Alluvial Water Source (upstream of Glennies Creek) may be required to be purchased from the open market.
- The post-mining predicted take will be reviewed as part of groundwater model validation during operations and as part of closure planning.

4.2.4 INFRASTRUCTURE

The Project will have a negligible impact on local and regional agricultural infrastructure. There will be very minor impacts on the road network and no impacts on the railway that connects the agricultural industry to markets, services and suppliers.

Following the Lemington Road realignment, dependant on direction and final destination of travel some road users may be subject to minor travel time increases. However, as part of the Lemington Road realignment, the quality of Lemington Road will be improved to enable a more reliable travel route and safer road features. Access reliability of Lemington Road will also be improved as it will not be subjected to road closure at Moses Crossing over the Hunter River during flood events.

Stock fences, dams and access tracks will be established as part of the rehabilitation of the site in areas accommodating a final land use of cattle grazing. As per the sites RMP (ERR, 2022), the condition of fence lines, access tracks and other features (e.g. dams, troughs) will be assessed during an annual rehabilitation walkover and targeted agricultural or pastoral assessments completed as part of grazing activities conducted by leases. The requirement for fencing, access and water points for future agricultural activities within rehabilitation areas will be assessed as part of HVO's ongoing budget process, and when establishing lease agreements.

4.3 IMPACTS ON AGRICULTURAL PRODUCTIVITY

4.3.1 STUDY AREA

The estimated production value of the proposed final land use domains of the Project (as shown in **Figure 9**) has been estimated based on the latest gross margin information by the NSW Department of Primary Industries (2021). This accounts for grazing of cattle to be sold as feeders or re-stock. (Feeder Steers through to Growing-out Steers 240 – 460kg).

For the purposes of this assessment, and based on current practice, site knowledge and HVO's trials of grazing on rehabilitated lands with variable slopes and topsoil cover, it is anticipated that cattle stocking rates will be consistent for all grazing land.



The estimated productivity of the post mining Study Area ranges from approximately \$732,783 per annum based on a Feeder Steers grazing enterprise to \$1,737,161 per annum based on a Growing-out Steers 240 – 460kg enterprise, as outlined in **Table 18**.

Table 18: Estimated Agricultural Productivity of Post Mining Study Area

Enterprise	Estimated Gross Margin (\$/ha/year)	Area (ha)	Study Area Gross Margin (\$/year)
Feeder steers	173.81	4,320	750,859
Growing-out Steers 240 – 460kg	412.04	4,320	1,780,013

By comparing the productivity of the final landform for the Project against the baseline productivity, as outlined in Section 2.2, the impact of the Project on productivity of agricultural land based on change in land use area is shown to be an increase of approximately \$23,986 – \$56,862 per annum, as highlighted in **Table 19**.

Table 19: Estimated Agricultural Productivity of Study Area

Assessment Stage	Agriculture Area (ha)	Study Area Gross Margin Range (\$/year)
Pre-Project	4,182	726,873 – 1,723,151
Post-Project	4,320	750,859 – 1,780,013
Net Change		+23,986 – 56,862

4.4 SOCIO-ECONOMIC IMPACTS

4.4.1 AGRICULTURE SUPPORT SERVICES

The Project will have a minimal impact on local and regional agricultural services and infrastructure. Changes to the supply and viability of agricultural support services in the main service centres are the towns of Singleton and Muswellbrook are generally driven by social trends exceeding the scale of the Project locality.

The reduction in cattle being sold will not be a significant impact on the Singleton saleyards, as this reduction is estimated to represents <0.1% of all cattle sold.

4.4.2 VISUAL AMENITY AND LANDSCAPE VALUES

As identified within the Visual Impact Assessment (VIA, EMM 2022c), the Project is within a rural environment close to several other mining operations. The character of the immediate visual environment surrounding HVO is strongly influenced by existing mining operations within the Project area and surrounds including Liddell Coal Operations, Ravensworth Operations, Mount Owen Complex, United Wambo, Mount Thorley Warkworth and Ashton. Bayswater and Liddell power stations are to the north-west. The results of the viewshed analysis (See VIA, Appendix A) indicate that a number of the selected viewpoints already do, and will continue to, experience cumulative visual amenity impacts (ie concurrent views of multiple open cut mining operations).



Residences and dwellings closest to the Project area are subject to a high visual impact; however, the level of visual impact on these properties will not materially change when compared with the approved operations. Given the low or negligible magnitude of change predicted at all viewpoints, significant visual impacts are not predicted as a result of the Project. Visual impacts will continue to decrease over time as progressive rehabilitation proceeds and as mining ceases at the end of 2050 at HVO North and 2045 at HVO South.

4.4.3 LOCAL AND REGIONAL EMPLOYMENT

The Project will have minimal negative impact on existing agricultural enterprises outside of the Study Area, therefore there will be no direct impact to associated employment.

HVO will maintain an existing operational workforce of approximately 1,500 full time equivalent (FTE) personnel during the life of the Project. Noting the workforce is existing and currently employed by HVO, no impacts to labour availability is predicted to be experienced by the agricultural sector. It is noted that approximately 600 temporary construction positions will be created by the Project, however these positions are largely highly skilled positions drawing from the well-established Hunter Valley mining supporting industries with minimal impact to the agricultural sector expected.

4.4.4 CRITICAL MASS THRESHOLDS

Due to the limited reduction in agricultural activity as a result of the Project, there will be no impact to critical mass thresholds of agricultural enterprises needed to attract and maintain investment in agricultural service industries and infrastructure.

4.5 FURTHER RISKS

4.5.1 PEST SPECIES

Pest species could be inadvertently brought into the Study Area with imported materials, machinery, or allowed to invade naturally through removal of native vegetation. The presence of weed species has the potential to be a major hindrance to rehabilitation, regeneration activities and agricultural endeavours. Management strategies currently used to measure success within the Study Area (and specifically rehabilitated land within the Study Area) indicate that the proliferation of pest species as a result of the Project will be negligible.

Weeds in general will be managed across the site through a series of control measures, including:

- Prior to re-spreading stockpiled topsoil onto the disturbance area, an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require weed control.
- Rehabilitation monitoring programs and routine inspections will be undertaken to identify potential weed infestations; and
- There will be an ongoing effort to identify and eliminate existing weed populations on-site over the life of the Project.

The spread of declared noxious weeds will be prevented by using the measures above. The monitoring and control of weed populations using herbicides or other weed control methods within the site will significantly reduce weed infestations. Weed control, if required, will be undertaken in a manner that will minimise soil disturbance. Any use of herbicides will be carried out in accordance with the regulatory requirements. Records will be maintained of weed infestations and control programs will be implemented according to best management practice for the weed species concerned.

Feral animal control will be undertaken in consultation with neighbouring landholders. Programs to control feral animals will include the determination of appropriate control practices, consultation with appropriate authorities,



obtaining appropriate approvals, implementing control practices and undertaking follow-up monitoring and control as required. If a substantial increase in the numbers of feral fauna species, or the occurrence of a previously unrecorded feral fauna species, is discovered, advice will be sought from a suitably qualified and experienced person on the management and control options for that species and appropriate measures for mitigating any impacts caused by its management on native species.

Feral animals may include goats, foxes, cats, rabbits, pigs and dogs and will be controlled in accordance with Livestock Health and Pest Authority procedures.

4.5.2 BIOSECURITY

Biosecurity is defined in the NSW Biosecurity Strategy (DPI, 2021) as ‘the protection of the economy, environment and community from pests, diseases and weeds’. It includes measures to prevent new pests, diseases and weeds from entering our country and becoming established. On a regional level, as per Section 4.5.1, appropriate weed management will reduce biosecurity risks. Any import of equipment or machinery from overseas will follow the standard procurement safeguards and quarantine procedures as per Australian requirements. Given the processes above, it is considered that the proposed Project will not have an impact on the biosecurity of agricultural resources and enterprises within the region.

4.5.3 BLAST AND NOISE

The Noise Impact Assessment (EMM, 2022c) considered the potential noise impact associated with the Project, including operational noise, construction noise, modifying factor adjustments, sleep disturbance, road traffic noise and rail noise. An assessment of operational noise impact over contiguous privately owned landholdings (vacant or otherwise), which generally is inclusive of agricultural land in proximity of the Project, is required in accordance with the Voluntary Land Acquisition and Mitigation Policy (NSW Government 2018) (VLAMP). Additional single point predictions were generated over contiguous private lot areas for each of the five modelled stages to determine the maximum extent of noise impact over the life of the Project. Predictions for all privately owned land areas were below the acceptable amenity noise level plus 5 dB. No further noise impacts to agricultural land are expected to those currently approved and or experienced as a result of existing operations.

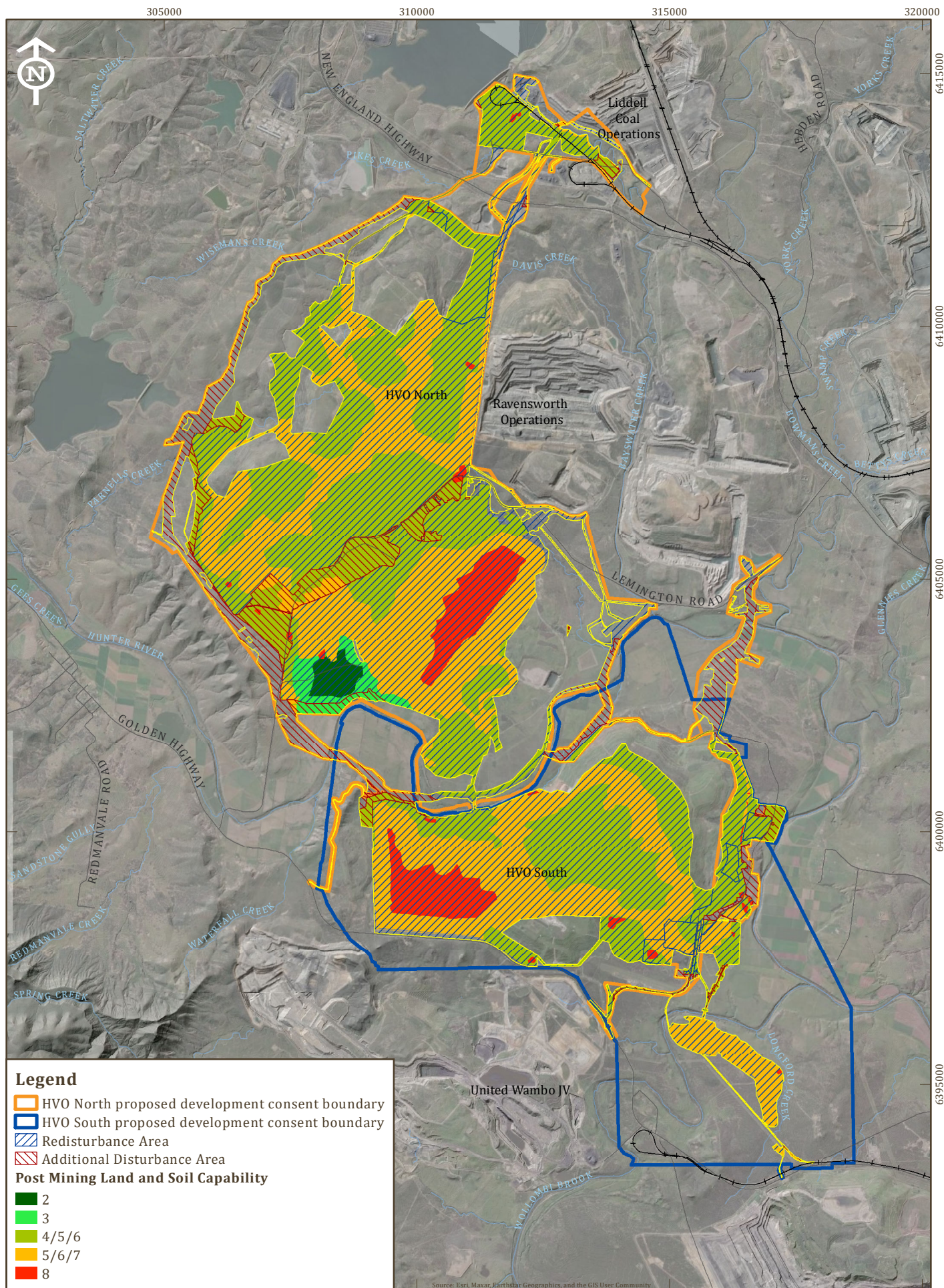
The Blasting Impact Assessment (ESC, 2022) determined that there are no concerns for the wellbeing of livestock (including equine industry) on private land surrounding the Project area. Given the significant distances from any potential blasting area to private grazing land (ie outside the 500 m flyrock exclusion zone) there is no risk of injury to livestock from flyrock. The proposed blasting will not be undertaken any closer to the private land than already approved.

4.5.4 AIR QUALITY

The Air Quality and Greenhouse Gas Assessment (Jacobs, 2022) identified construction dust, operational dust, operational post-blast fume and operational diesel exhaust, as potential key issues of the Project.

Construction activities, largely through the realignment of Lemington Road, have the potential to increase the overall dust emissions in the early phase of the Project (that is, first two to three years) but these increases are not of a magnitude that will change the air quality outcomes for private sensitive receptors. Nevertheless, appropriate management and monitoring would need to continue during the construction phase. Operational dust emissions due to the ongoing mining activities will be continued to be managed as per existing operations and/or as required on the receiver approval.





GDA2020 MGA Zone 56

Project Final Landform
Land and Soil Capability

MINESOILS
LAND & REHABILITATION SPECIALISTS

0 500 1,000 2,000 Meters
Scale 1:100000 at A4

FIGURE 10

5 MITIGATION MEASURES

The impact of the Project on agriculture is negligible and the existing mitigation measures employed at HVO are appropriate for the Project. No new measures are proposed to mitigate impacts to agriculture. Therefore, the items presented in this section are relevant to agriculture, but relate more generally to the broader Project mitigation measures.

5.1 ANALYSIS OF ALTERNATIVES

To meet Project objectives, detailed concept and pre-feasibility studies considering mining options and infrastructure arrangements were carried out. Each of these studies evaluated potential environmental and social impacts to inform the Project design, as summarised in Section 1.2 and described in detail within the EIS being the preferred Project.

5.1.1 MINE PLAN ALTERNATIVES

The preferred Project mine design was chosen as it provides the best balance between optimal resource recovery and financial return, and reducing environmental and social impacts, through the implementation of appropriate mitigation measures. The preferred Project mine design has been continually optimised as further information has been made available via exploration drilling and the completion of environmental and infrastructure studies.

Alternative options considered during the development of the preferred Project mine design included:

- Option 1 – the Project.
- Alternative option 2 – No Project – mining ends at the complex as per the HVO North consent (June 2025).
- Alternative option 3 – Maximise resource recovery – mining in several additional locations around and in addition to the preferred mine design localities.
- Alternative option 4 – No final void remaining at the end of the preferred mine design.
- Alternative option 5 – Impacting the CM-CD1 Aboriginal cultural heritage site.
- Alternative option 6 – Excluding Lemington Road from the mining footprint.
- Alternative option 7 – Underground extraction of target seams.

Each alternative option identified above is considered in detail within the Mine Plan Options Report (HVO 2022a) and appended to the EIS, see Appendix D. The Mine Plan Options Report articulates why the above alternative options do not represent reasonable and feasible alternatives to the Project as proposed.

5.1.2 INFRASTRUCTURE ALTERNATIVES

Infrastructure requirements for the Project were evaluated in consideration of achieving maximum efficiency, utilisation of existing and approved infrastructure where possible including integrating the coal handling and preparation capacity at nearby Ravensworth Operations facilities to minimise the need for the construction of new facilities.

New infrastructure proposed under the Project was designed in consideration of avoiding key site constraints such as cultural heritage and biodiversity constraints, to achieve minimal impacts where practical.

Key alternative infrastructure options considered during the development of the Project are summarised below:

HVO North:

- realignment path of Lemington Road;
- realignment path of transmission and telecommunication lines;



- product stockpile and train loading facility upgrades; and
- improvements to the HVO North MIA;

HVO South

- Lemington CPP and associated rail loop.

Similarly to mine plan alternatives considered, the alternative options considered in relation to the above listed Project infrastructure items are discussed in detail the Infrastructure Options and Avoidance Report (HVO 2022b) and appended to the EIS, see Appendix E. The report identifies why potential alternative options do not represent reasonable and feasible alternatives to the Project as proposed.

5.2 MONITORING PROGRAMS

Monitoring programs are instituted to assess predicted verses actual impacts as the project progresses.

All current operations at HVO are undertaken in accordance with approved Environmental Management Plans and Strategies. The management plans include detailed environmental monitoring programs. HVO continually monitors environmental performance and legislative compliance of the existing operations.

Mining operations are managed through the existing Environmental Management System (EMS) to minimise impacts on the surrounding environment and community. The EMS provides for the monitoring and reporting of all key environmental aspects of the current operations. Key management plans currently in effect that assist in managing impacts on agricultural land include:

- Rehabilitation Management Plan;
- Air Quality and Greenhouse Gas Management Plan;
- Blast Management Plan;
- Noise Management Plan;
- Water Management Plan;
- Pollution Incident Response Management Plan; and
- Bushfire Management Plan.

These management plans will be reviewed and revised where necessary to incorporate the requirements associated with the Project. A key component of this revision will be the development of trigger levels and Trigger Response Action Plans, in consultation with stakeholders. The environmental monitoring program and data collected listed in **Table 20** below will form the basis in this regard. The consequence of poor risk control and poor rehabilitation outcomes is significant. The assessment of agriculture risks contained within the report is dependent on the sound management of rehabilitation of the Study Area during and following the life of the Project. The above management plans form a foundation to control these risks.

In addition, an Annual Review will be prepared for the Project. This document will summarise Project activities and performance in the areas of health, safety, environment and community and will be made publicly available. All management plans and monitoring data will also be made publicly available on the HVO website.



Table 20: Proposed Monitoring Programs and Management Plans

Parameter	Management Plan	Monitoring
Rehabilitation	Rehabilitation Management Plan	- Estimated pasture yield (kg/ha) - Visual assessment of general health - Visual assessment of cultivation performance - Ground cover (%) - Target species present (%) - Presence of weeds - Soil monitoring - Photo records - Geotechnical stability - Surface water and groundwater monitoring
Meteorological Conditions	Air Quality Management Plan	- Rainfall - Temperature - Windspeed - Wind direction - Sigma Theta - Solar radiation
Surface Water	Water Management Plan	- Run-off water quality - Sediment dam water quality - Surface water flows
Groundwater	Water Management Plan	- Seepage/leachate - Groundwater levels - Water quality
Air Quality	Air Quality Management Plan	- Predictive meteorological forecasting - Air quality monitoring
Blasting	Blast Management Plan	- Air blast overpressure
Noise	Noise Management Plan	- Predictive meteorological forecasting - Real-time noise monitoring for day to day planning - Attended monitoring

5.3 AGRICULTURE MANAGEMENT

5.3.1 DISTURBANCE MINIMISATION

The area of agricultural land disturbed by the Project at any one time will be minimised so that agricultural uses can continue where practicable. The RMP provides a framework to manage the site scheduling processes to minimise land disturbance in advance of operations and include provisions for progressive rehabilitation. This will assist in reducing impacts to agricultural lands. Once areas are rehabilitated, they will be returned to a productive agricultural capacity as soon as practical.

5.4 REHABILITATION CAPABILITY

HVO has a demonstrated capacity for the rehabilitation of disturbed lands to achieve the final land use and restore natural resource. Rehabilitation of disturbed lands has been undertaken progressively and successfully at HVO throughout the mine's life. At the end of 2022 HVO estimates that of the 4,265 ha of total disturbance, 2,713 ha will be under rehabilitation (ERR, 2022).

This includes approximately 1,515 ha of existing and planned pasture rehabilitation and 63 ha of Class II agricultural land, in accordance with the former rural land classification scheme (Cunningham et al, 1988), that was able to achieve a lucerne hay productivity yield of 'at least equivalent to the average crop productivity yields for the Upper Hunter Region for three consecutive years' as well as 102 ha of Class IV grazing.



The rehabilitation of areas to be disturbed by the Project is to be conducted progressively throughout the Project life. Key outcomes of this approach are not only to maximise the establishment of revegetated areas from a vegetation establishment perspective, but also to assist in reducing the area of exposed overburden at the mine to reduce air quality impacts, and also to reduce visual impacts when viewed from locations around the mine.



6 RISK ASSESSMENT

Based on the impact assessment of agricultural resources and productivity (Section 4) and the mitigation measures outlined for the Project (Section 5), the key risks considered for agriculture associated with the Project are assessed in this section.

An assessment of potential risks to agriculture has been conducted in accordance with the Agricultural Impact Risk Ranking methodology described in the *Guideline for Agricultural Impact Statements at the Exploration Stage* (DTIRIS, 2012a). **Tables 21** and **22** list the probability and consequence descriptors that were used in the Agricultural Impact Risk Ranking, as described by DTIRIS (2012a).

The level of risk was assessed according to the risk matrix presented in **Table 23** (DTIRIS, 2012a). The outcomes of the risk assessment are presented in **Table 24**. The risk rating constitutes an impact assessment by taking into consideration the findings of this investigation, findings of technical studies and available management and mitigation options for each risk.

Table 21 Agricultural Impact Risk Ranking – Probability Descriptors

Level	Descriptor	Description
A	Almost Certain	Common or repeating occurrence.
B	Likely	Known to occur or it has happened.
C	Possible	Could occur or I've heard of it happening.
D	Unlikely	Could occur in some circumstances but not likely to occur.
E	Rare	Practically impossible or I've never heard of it happening.

Table 22 Agricultural Impact Risk Ranking – Consequence Descriptors

Level 1	Severe Consequences	Example of Implications
Description	- Severe and/or permanent damage to agricultural resources, or industries - Irreversible - Severe impact on the community	- Long-term (e.g. 20 years) damage to soil or water resources - Long-term impacts (e.g. 20 years) on a cluster of agricultural industries or important agricultural lands
Level 2	Major Consequences	Example of Implications
Description	- Significant and/or long-term impact to agricultural resources, or industries - Long-term management implications - Serious detrimental impact on the community	- Water or soil impacted, possibly in the long-term (e.g. 20 years) - Long-term (e.g. 20 years) displacement/serious impacts on agricultural industries
Level 3	Moderate Consequences	Example of Implications
Description	- Moderate and/or medium-term impact to agricultural resources, or industries - Some ongoing management implications - Minor damage or impacts but over the long-term	- Water or soil known to be affected, probably in the short to medium-term (e.g. 1-5 years) - Management could include significant change of management needed for agricultural enterprises to continue



Level 4	Minor Consequences	Example of Implications
Description	- Minor damage and/or short-term impact to agricultural resources, or industries - Can be effectively managed as part of normal operations	- Theoretically could affect the agricultural resource or industry in the short-term, but no impacts demonstrated - Minor erosion, compaction or water quality impacts that can be mitigated - For example, dust and noise impacts in a 12 month period on extensive grazing enterprises
Level 5	Negligible Consequences	Example of Implications
Description	- Very minor damage or impact to agricultural resources, or industries - Can be effectively managed as part of normal operation	No measurable or identifiable impact on the agricultural resource or industry

Source: DTIRIS (2012a)

Table 23 Agricultural Risk Ranking - Matrix

Consequence	A Almost Certain	B Likely	C Possible	D Unlikely	E Rarely
1. Severe and/or permanent damage. Irreversible impacts.	A1	B1	C1	D1	E1
2. Significant and/or long-term damage. Long-term management implications. Impacts difficult or impractical to reverse	A2	B2	C2	D2	E2
3. Moderate damage and/or medium-term impact to agricultural resources or industries. Some ongoing management implications, which may be expensive to implement. Minor damage or impacts over the long-term.	A3	B3	C3	D3	E3
4. Minor damage and/or short-term impact to agricultural resources or industries. Can be managed as part of routine operations.	A4	B4	C4	D4	E4
5. Very minor damage and minor impact to agricultural resources or industries. Can be managed as part of normal operations	A5	B5	C5	D5	E5

Source: DTIRIS (2012a)

	High Risk
	Medium Risk
	Low Risk



Table 24: Agriculture Risk Assessment

Risk	Findings	Assessment		
		P	C	R
Temporary reduction of land used for agricultural purposes	The Project will remove from service 4,182 ha of land within the Study Area used for agriculture during the life of the Project. Of this area, 3,585 ha is land used for agriculture within the re-disturbance area, and 597 ha is land used for agriculture in the additional disturbance areas.	A	4	Medium
Permanent reduction of land used for agricultural purposes	Following the life of the Project and rehabilitation efforts, there will be a total increase of land used for agriculture of 138 ha.	D	4	Low
Temporary decreased productivity of Study Area	The Project will inhibit agricultural productivity within the Study Area during the life of the mine. This results in a loss of approximately \$726,873 – \$1,723,151 per year for the duration of the Project.	A	4	Medium
Permanent decreased productivity of Study Area	Following the life of the Project the Study Area will have an estimated productivity increase of \$23,986 – \$56,862 per year based on an additional 138 ha available for agricultural use.	D	4	Low
Discontinuing of existing agricultural enterprises in the Study Area	Existing agricultural enterprises within the impact areas of the Study Area will cease for part or the whole duration of the Project. This is a negligible impact to broader agricultural industries.	A	5	Low
Impacts to existing agricultural enterprises in the Project locality	The Project will not negatively impact currently existing agricultural enterprises outside of the Study Area.	E	5	Low
Changes to landform, slope and topography of the Study Area	The Project will result in significant changes to landform, slope and topography. These changes are temporary and will result in a more appropriately designed landform for landform stability and agricultural and biodiversity outcomes.	A	4	Medium
Permanent downgrading of LSC classes within the Study Area	Due to the significant changes to landform, slope and topography, there will be a permanent general downgrading of LSC classes within the Study Area, primarily LSC class 3 and 4. However, there will also be a reduction in LSC class 8 land.	A	3	High
Loss of soil resources within the Study Area	Soil resources subject to disturbance by the Project have been subject to investigations. Soils with desirable physical and chemical properties will be salvaged for re-use in rehabilitation. Additionally, specific soil dispersion risks will be managed to control erosion risk and prevent soil resource loss.	D	4	Low
Erosion and sedimentation of agricultural resources	Erosion control measures and a detailed site erosion and sediment control plan that addressed specific soil dispersion risks will be utilised to control erosion risk and prevent soil resource loss and sedimentation of streams.	C	4	Low



Risk	Findings	Assessment		
		P	C	R
Changes to availability of surface water used by local landholders	Potential impacts on surface water downstream users will be negligible	E	4	Low
Changes to availability of groundwater used by local landholders	No impact is predicted at third-party groundwater bores	E	4	Low
Changes to site run-off water quality	Potential impacts on surface water quality are expected to be minimal and will be mitigated through an appropriately sized, designed and operated WMS	C	4	Low
Impacts to agricultural resources outside the Study Area	There will be negligible impact, permanent or temporary, direct or indirect, to agricultural resources outside the Study Area as a result of the Project.	E	5	Low
Impacts to agricultural support infrastructure in the Project locality and wider region	There will be negligible impact agricultural infrastructure in the Project Locality or wider region as a result of the Project.	E	5	Low
Changes to farm improvements within the Study Area	Farm improvements such as fences, access tracks and dams will be included in agricultural lands final land use domain rehabilitation objectives.	E	5	Low
Impacts on agricultural support services	Impacts on agricultural support services are estimated to be negligible and outweighed by the economic benefits of the Project.	E	5	Low
Impacts on equine CIC within the Project locality	Due to the distance away from the Project area, there will be no additional impacts on the existing equine CIC	E	5	Low
Impacts to the visual amenity of the Project locality	Due to the dominance of mining operations with areas of disturbance that are an established part of the existing view and character of the rural landscape, the impacts on visual amenity are anticipated to be suited to the local and regional context.	E	5	Low
Reduction in landscape values of the Project locality	Due to the dominance of mining operations with areas of disturbance that are an established part of the existing view and character of the rural landscape, the impacts on visual amenity are anticipated to be suited to the local and regional context.	E	5	Low
Impacts on agriculture-based tourism	No tourism reliant on the agricultural values of the Study Area was identified. Impacts on the Project localities sense of place and agriculture character will be suited to the local and regional context and have no impact on local or regional tourism.	E	5	Low
Effects on local and regional employment	There will be no direct impact to agriculture associated employment as a result of the Project.	E	5	Low



Risk	Findings	Assessment		
		P	C	R
Proliferation of pest species	Ongoing monitoring inspections will determine the requirement for weed or pest elimination.	C	4	Low
Introduction of biosecurity threat to agricultural enterprises	Standard procurement safeguards and quarantine procedures as per Australian requirements will control the potential impact on the biosecurity of agricultural resources and enterprises within the region.	E	4	Low
Changes to air quality and dust in Project locality	Operational dust emissions due to the ongoing mining activities will be continued to be managed as per existing operations and/or as required on the receiver approval.	E	5	Low
Increase in traffic volume in Project locality	There will negligible impacts on the road network and no impacts on the railway that connects the agricultural industry to markets, services and suppliers.	C	4	Low
Increase in noise levels in Project locality	The predicted noise levels are considered to be a negligible impact on agricultural activities. No further noise impacts to agricultural land are expected to that currently approved and or experienced as a result of existing operations.	C	4	Low
Effects of blasting on livestock	Given the significant distances from any potential blasting area to private grazing land (ie outside the 500 m flyrock exclusion zone) there is no risk of injury to livestock from flyrock.	C	4	Low
Effects on the critical mass threshold of the cattle industry	Due to the limited reduction in agricultural activity as a result of the Project in the scale of cattle farming in the region, there will be no impact to critical mass thresholds	E	4	Low
Poor rehabilitation outcomes	The consequence of poor rehabilitation outcomes is significant. The risk assessment of many of the above factors is dependent on the sound rehabilitation of the Study Area following the life of the Project. Rehabilitation planning and soil management recommendations form a foundation to control this risk. Rehabilitation methods and soil deficit mitigation measures controls will be refined by a detailed site rehabilitation plan and additional soil characterisation works.	D	2	Low



7 CONSULTATION

Community consultation was carried out as part of the EIS in the form of a Social Impact Assessment (SIA). Consultation in relation to the Project was undertaken using a range of mechanisms which included meetings, presentations, information sessions, newsletters, face to face interviews, phone discussions and other forms of personal communication (e.g. emails). Identification of relevant stakeholders for the Project was based on regulatory requirements for the Project, and consultation was undertaken with the following stakeholders:

- NSW Department of Planning and Environment;
- Department of Planning and Environment—Water, and the Natural Resources Access Regulator;
- Department of Regional NSW, Division of Resources and Geoscience;
- Department of Primary Industries;
- Transport NSW;
- Muswellbrook Council; and
- Singleton Council.

Direct consultation to inform the AIS was undertaken with Peter Bowman of HVO and land managers/leasees of HVO lands regarding agricultural enterprises and the current management of cattle grazing on rehabilitated and previously undisturbed lands within the Study Area.

Relevant findings from the stakeholder consultation undertaken for the Project were considered in the preparation of this AIS and are discussed further in the EIS and the SIA.



8 CONCLUSION

The Project will disturb an area of approximately 4,182 ha of land that is used for agriculture as a baseline. This land will not be suitable for agricultural use for the duration of the Project. Therefore, 4,182 ha will be temporarily removed from agriculture. There will be areas where land used for agriculture at baseline will result in final void or allocated to biodiversity outcomes. Alternatively, there are areas of land at baseline not used for agricultural purposes, which will have a final land use allocation to agricultural. Overall, there will be a net increase of 138 ha from the baseline area of land use for agriculture.

The key agriculture impacts of the Project will consist of the following:

- Temporary reduction of land used for agricultural purposes;
- Temporary decreased productivity of agricultural land;
- Changes to landform, slope and topography of the Study Area; and
- Permanent downgrading of LSC classes within the Study Area.

These risks are assessed as certain to cause moderate damage and/or medium-term impact to agriculture, and will require ongoing management implications. However, in the longer term, the impact of the Project on agriculture is positive, due to the increased area of land allocated to agricultural use and the demonstrated capacity for rehabilitation. No additional management measures are required to mitigate impacts to agriculture as existing mitigation measures currently employed at HVO are appropriate for the Project.



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