BOWDENS SILVER

Part 14
Agricultural Impact Statement

State Significant Development No. 5765

Prepared by:

R.W. Corkery & Co. Pty Limited

May 2020

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BOWDENS SILVER

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Agricultural Impact Statement

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A Silver Mines Limited company

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TABLES

COMMONLY USED ACRONYMS

ABS	Australian Bureau of Statistics
ACO	Australian Certified Organic
ADWG	Australian Drinking Water Guidelines
AIS	Agricultural Impact Statement
B&B	bed and breakfast
BCP	Bylong Coal Project
BMP	Blast Management Plan
BOM	Bureau of Meteorology
BSAL	Biophysical strategic agricultural land
BVTs	Biometric Vegetation Types
DAP	diammonium phosphate
EIS	Environmental Impact Statement
FTE	full time equivalent
JOS	Japanese Organic Standard
LEP	Local Environmental Plan
LGA	Local Government Area
LSC	land soil capability
MIC	maximum instantaneous charge
PAF	potentially acid forming
PCTs	Plant Community Types
RWC	R.W. Corkery & Co Pty Limited
SCSC	Specialist Consultant Studies Compendium
SEARs	Secretary's Environmental Assessment Requirements
SLUs	soil landscape units
SMD	Soil Management Designs Pty Limited
SSC	State Suburbs Code
TSF	tailings storage facility
USDA	United States Department of Agriculture
WRE	waste rock emplacement
WSP	Water Sharing Plan

EXECUTIVE SUMMARY

Introduction

Bowdens Silver Pty Limited (Bowdens Silver) is planning to apply for a development consent under Division 4.7 (State significant development) of Part 4 of the EP&A Act to develop and operate an open cut silver mine known as the Bowdens Silver Project ("the Project") near Lue, approximately 26km east of Mudgee in central western NSW. As the Project satisfies the criteria for State significant development, an Agricultural Impact Statement (AIS) is required to address the potential impacts that the Project may have on agricultural resources and enterprises. Bowdens Silver has commissioned R.W. Corkery & Co Pty Limited (RWC) to prepare the AIS for the Project which has been prepared in accordance with the *Agricultural Impact Statement Guideline* (DPI, 2012).

This summary introduces the Project and provides relevant information about the agricultural setting of the Project. An overview is also provided regarding the proposed management and mitigation measures that would be implemented to minimise impacts on key agricultural resources and the predicted impacts associated with the Project.

Project Description

The Application Area for the Project comprises three principal component areas.

1. The "Mine Site" incorporating a main open cut pit, two satellite open cut puts, processing plant, waste rock emplacement (WRE), a low-grade ore stockpile, an oxide ore stockpile, a tailings storage facility (TSF) and a southern barrier to provide visual and acoustic protection to properties to the south of the Mine Site.
2. The "relocated Maloneys Road" which would provide access to the Mine Site from Lue Road west of Lue and would comprise a relocated section of Maloneys Road, a new railway bridge overpass and a new road crossing of Lawsons Creek.
3. A "water supply pipeline corridor" extending approximately 58.5km from the Mine Site to the Ulan Coal Mine and/or Moolarben Coal Mine to supply the Project with make-up water required for processing and dust suppression.

The AIS focusses on the areas of disturbance within the Application Area. For the purposes of the AIS, the relocated Maloneys Road is considered in conjunction with the Mine Site.

The Project would incorporate conventional open cut pits from which overburden/waste rock would be removed from above and around the silver-zinc-lead ore and either used for on-site construction activities or placed in the out-of-pit WRE or the southern barrier. The mined ore would be transported by haul trucks to the on-site processing plant where it would be crushed, milled and processed to liberate the silver, zinc and lead minerals. These minerals would be collected by conventional froth flotation to produce two concentrates that would be dewatered and transported off site by truck. The residual materials from processing (tailings) would be pumped in the form of a slurry to the TSF that would be located to the west of the main open cut pit.

Agricultural Setting

For the purposes of this document, four distinct areas have been established for consideration and discussion of agriculture-related issues relevant to the Project.

1. The "Region" which generally corresponds to the boundaries of the Mid-Western Regional Local Government Area (LGA) which covers an area of approximately 8 700km^2.
2. The "Lue district" which corresponds with the Lue, Pyangle and Monivae ABS State Suburb Codes (SSCs). The nominal area of the Lue district covers approximately 118km^2.
3. The "Mine Site" which comprises an area of approximately 999ha of land within the Lue district in which approximately 420ha of land would be disturbed throughout the Project life. For the purposes of this assessment, the footprint of the relocated Maloneys Road and the properties owned by Bowdens Silver in the area immediately surrounding the Mine Site, are also considered in conjunction with the Mine Site.
4. The "water supply pipeline corridor" which extends for approximately 58.5km between the Mine Site to the Ulan Coal Mine and/or Moolarben Coal Mine.

Broadly, agricultural land uses within the Region are dominated by grazing with grazing land comprising approximately 95% of total farmland. Other agricultural land uses within the Region include viticulture and horticulture. Agricultural land uses within the Lue district are also dominated by grazing with one vineyard and two olive farms located within the district.

The majority of land within the Mine Site is currently used for agricultural activities except for an area occupied by a single lifestyle lot (49ha) located in the southeastern quadrant. Agricultural activities conducted within the Mine Site are largely restricted to grazing of livestock on approximately 910ha of land. Grazing land comprises approximately 427ha of heavily vegetated and/or steeply sloping land with low agricultural capability (principally land soil capability (LSC) Class 6) and use of approximately 483ha of modified pasture with a low to moderate agricultural capability (LSC Classes 3 to 6) (see SMD, 2020). Approximately 333ha of modified pasture is subjected to periodic pasture improvement, which typically involves weed control and/or the selective application of fertiliser, whilst the remaining 150ha is generally not improved. Approximately 12ha within the Mine Site is used for cropping.

The land traversed by the water supply pipeline corridor is predominantly used for grazing with approximately 48km of the corridor beyond the Mine Site used for this purpose. Of this grazing land, approximately 25km comprises modified pasture whilst 23km comprises land covered by remnant native vegetation. Approximately 2.5km of the water supply pipeline corridor is used for cropping with these areas likely to be used for a combination of forage crops and pasture improvement.

Management and Mitigation Measures

A range of management and mitigation outcomes and measures have been identified which would be implemented in order to avoid or reduce the potential environmental, social and economic impacts of the Project upon the regional and local agricultural resources and enterprises identified throughout the AIS. The principal management and mitigation measures that would be implemented to minimise impacts on soil and water resources are summarised as follows.

Soil Resources

Soil stripping and stockpiling protocols would be developed and implemented to ensure the successful rehabilitation of as much of the disturbed areas as possible. Specific measures would be taken to improve soil quality including the addition of lime and/or gypsum to address salinity or soil structure issues, as required. Rehabilitation would be undertaken with the aim of returning disturbed land to its former use wherever practicable and would include direct seeding of native vegetation or pasture grasses. Fertiliser would be applied as required to address soil fertility issues. It is noted that all rehabilitation activities would be guided by a Rehabilitation Management Plan.

Surface Water Resources

As part of the design process, a range of surface water management measures have been included in the Project including clean water diversions, 'dirty' water catchment and containment systems, and catchment and containment systems for water coming into contact with tailings or potentially acid forming (PAF) waste rock. A Water Management Plan would be prepared to guide surface water monitoring and establish a trigger action response plan for when certain thresholds are reached.

Groundwater Resources

Bowdens Silver has secured options to purchase water access licences through the 2017 Controlled Allocation Order (Various Groundwater Sources), to the value of 885 unit shares in the Lachlan Fold Belt Groundwater Source (equivalent to 885 ML/year) and 118 unit shares in the Sydney Basin Groundwater Source (equivalent to 118 ML/year). An additional 97 unit shares (equivalent to 97ML/year), required to meet the predicted maximum take throughout the mine life, have been sought through upcoming Controlled Allocation Orders.

A Water Management Plan for the Project would be prepared and implemented which would include the requirements to monitor groundwater levels and water quality to enable determination of any mine-related impacts on surrounding groundwater users. A trigger action response plan would be established to determine what further management actions are required in the event certain triggers are reached. A Tailings Seepage Management Plan and final Void Management Plan would also be prepared to monitor and manage these aspects of the Project.

Assessment of Impacts

Land to be Removed from Agricultural Production

The Project would remove a maximum of approximately 1 498ha of land currently used for agriculture (principally low value grazing) out of production throughout the Project life due to land use changes. This land would comprise approximately 901ha of land within the Mine Site, 20ha of land within the footprint of the relocated Maloneys Road and a further 577ha in the area immediately surrounding the Mine Site which would be set aside as part of the Project's biodiversity offset area. A total of 469ha would be retained for agricultural purposes within the Bowdens Farm throughout the Project life. Of this land, approximately 24ha would be located within the Mine Site with a further 445ha of land located in the area surrounding the Mine Site. The majority of this land would comprise modified pasture suitable for improvement and/or cropping thus ensuring stocking rates are maintained or improved, wherever possible.

Beyond the end of the Project life, it is anticipated that approximately 1 170ha of land within the Bowdens Farm would be either retained for or returned to agricultural use with approximately 865ha permanently removed from production. The land within the Mine Site to be permanently removed from production would include the void left by the main open cut pit (50ha) and the on-site biodiversity offset area (218ha). The footprint of the relocated Maloneys Road (20ha) and off-site biodiversity offset area (577ha) would similarly be permanently removed from agricultural production.

Approximately 54.7ha of land beyond the Mine Site would be temporarily and sequentially disturbed during the construction of the water supply pipeline. It is estimated that the water supply pipeline would be constructed within a period of up to approximately 10 months. All land disturbed during the construction of the water supply pipeline beyond the Mine Site would be returned to its previous land use within a few months of the completion of the pipeline. No land used for agriculture would be permanently removed from production.

Soil Resources

No biophysical strategic agricultural land would be impacted by the Project. Apart from the final void area, the soils in the rootzones of the modified landscapes within the Mine Site would retain or improve their qualities required for the long-term land uses. The topsoil and subsoil resources throughout the Mine Site would enable suitable substrates to be created on the final landform to sustain an appropriate level of vegetation across the Mine Site for minimisation of the risk of soil erosion. No adverse soil resource impacts from the Project are anticipated on adjoining land used for agriculture.

The existing land within the Mine Site is predominantly LSC Class 6 with subordinate areas being Class 4 or Class 5 and minor areas being Class 3. A similar level of LSC would be maintained following the rehabilitation of the land disturbed within the Mine Site i.e. with the exception of the final void that would be retained as a lake. The rehabilitated land within the Mine Site would be returned to its previous use and the existing classes of LSC would be maintained upon rehabilitation.

None of the land disturbed to construct the relocated Maloneys Road would be returned to agriculture as the road would remain a long term public road.

All disturbed land within the water supply pipeline corridor would be returned to its previous use and the existing level of LSC would be maintained upon rehabilitation.

Surface Water Resources

The results of the Surface Water Assessment (WRM, 2020) indicate that the impacts of the Project on surface water flows in both Hawkins and Lawsons Creek would be minimal, and therefore the impact of the predicted reductions in flows on the availability of water to downstream water users would be negligible. Changes to water quality and rates of sedimentation in Hawkins and Lawsons Creeks are not expected to occur due to implementation of standard sediment and erosion controls that would prevent potentially sediment-laden water from entering these creeks. All contaminated water would remain on the Mine Site.

Groundwater Resources

Potential groundwater drawdown may impact groundwater availability for registered users beyond the Mine Site. Drawdown predicted in modelling indicates that potential drawdown of more than 2m could occur at two registered bores (GW061475 and GW802888) located on privately-owned land near the Mine Site. As impacts at these two bores are predicted to become evident post-mining (impacts at GW061475 may also be evident at the end of mining), contingency measures including 'make good' provisions would be required for these landowners. Regardless, monitoring of potential impacts at these bores would be an objective of the groundwater monitoring program for the Project.

Conclusion

It has been assessed that the Project would have negligible impacts upon the agricultural resources and enterprises through the Region. The implementation of the proposed management and mitigation measures would result in acceptable levels of impacts (low to medium) within disturbance areas. Whilst the Project would marginally reduce the availability of land used for agriculture throughout the Project life, the continued operation of the Bowdens Farm and the proposed progressive rehabilitation schedule, would ensure that the Project would only have minor impacts on land used for agriculture in the Lue district. It is further anticipated that the Project would provide a significant economic contribution to local farm families through the provision of off-farm income throughout the Project life. This income would provide agricultural enterprises with much needed capital and improve the viability of marginal and/or small operations.

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1. INTRODUCTION

1.1 BACKGROUND

Bowdens Silver Pty Limited (Bowdens Silver) is planning to apply for a development consent under Division 4.7 (State significant development) of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to develop and operate an open cut silver mine known as the Bowdens Silver Project ("the Project") near Lue, approximately 26km east of Mudgee in central western NSW (see **Figure 1.1**). The Project is a greenfield site with the capacity to sustain a 2Mtpa ore processing rate over a 15 year period.

It is proposed that the Project would incorporate a main open cut pit and two smaller satellite pits, an out-of-pit waste rock emplacement (WRE), soil stockpiles, tailings storage facility (TSF), processing plant and other ancillary infrastructure. A new public road (relocated Maloneys Road) and pipeline to deliver make-up water from the Ulan Coal Mine and/or Moolarben Coal Mine also form part of the Project.

Bowdens Silver commissioned R.W. Corkery & Co Pty Limited (RWC) to prepare this Agricultural Impact Statement (AIS) for the Project.

1.2 PROJECT DESCRIPTION

This section provides an overview of the Project in sufficient detail to enable the reader to understand the type and scale of activities proposed. A more detailed description of the Project is included in Section 2 and **Appendix 5** of the EIS.

1.2.1 Objectives

The principal objectives of the Project are to:

i) maximise the recovery of the silver, zinc and lead minerals from the defined ore reserves within the proposed open cut pits;

ii) undertake all activities in an environmentally responsible manner to demonstrate compliance with relevant criteria and satisfy reasonable community expectations;

iii) ensure the health of its workforce and the surrounding community is not adversely affected;

iv) preserve the existing character of Lue;

v) maintain a positive relationship with the agricultural sector and maximise productivity on land retained for agricultural production.

vi) provide a stimulus for the Mudgee, Rylstone, Kandos and district economies; and

vii) achieve the above objectives in a cost-effective manner to ensure the Bowdens Silver Project is economically viable.

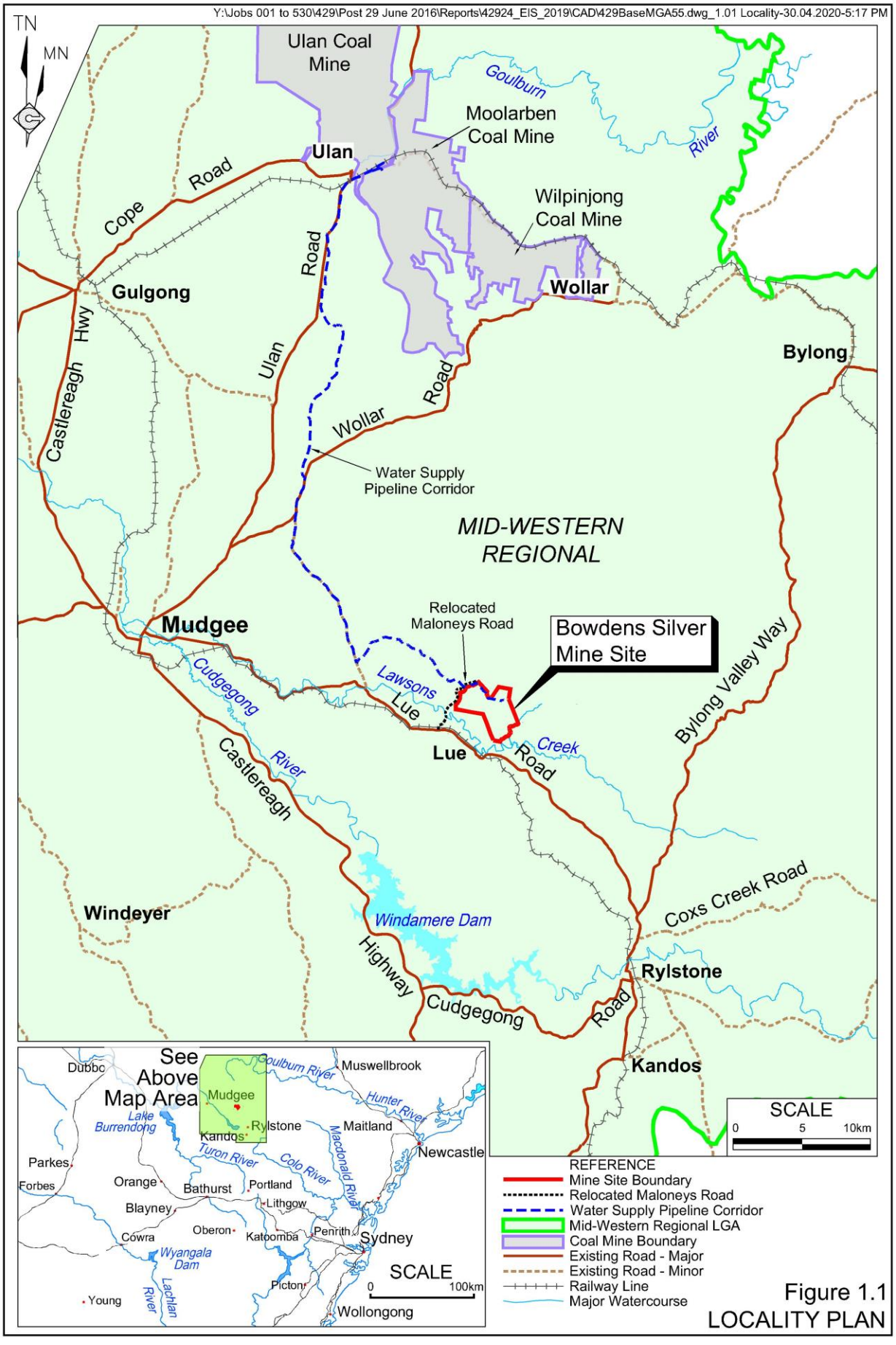


Figure 1.1
LOCALITY PLAN

1.2.2 Project Overview

For the purposes of this report, the Mine Site, proposed relocated Maloneys Road and the water supply pipeline corridor are referred to as the "Application Area". The Mine Site covers approximately 999ha, relocated Maloneys Road covers approximately 20ha and the water supply pipeline corridor is 58.5km in length and up to 10m wide.

The seven principal components within the Mine Site are:

- a main open cut pit and two satellite open cut pits, collectively covering approximately 52ha;
- a processing plant and related infrastructure covering approximately 22ha;
- a WRE covering approximately 77ha;
- a low-grade ore stockpile adjacent to but largely upon the northern sections of the WRE covering approximately 14ha (9ha above the WRE);
- an oxide ore stockpile covering approximately 8ha;
- a TSF covering approximately 117ha; and
- a southern barrier to provide visual and acoustic protection to properties south of the Mine Site covering approximately 32ha.

The above components would be supported by a range of on-site and off-site infrastructure. The on-site infrastructure comprises haul roads, water management infrastructure, power/water reticulation, workshops, stores, compounds and offices/amenities. The off-site infrastructure comprises a relocated section of Maloneys Road (including a new railway bridge overpass and new road crossing of Lawsons Creek), a 132kV power line and a water supply pipeline for the delivery of water from the Ulan Coal Mine and/or Moolarben Coal Mine to the Mine Site. **Figure 1.2** displays the indicative locations of the principal mine components and the location of the relocated Maloneys Road.

It is noted that the 132kV power line required for the mine power supply would be the subject of a Part 5 application submitted under the EP&A Act to the relevant energy provider.

Overburden/waste rock would be removed from above and around the silver-zinc-lead ore within the open cut pits and either used for on-site construction activities or placed in the out-of-pit WRE or the southern barrier. The mined ore would be transported by haul trucks to the on-site processing plant where it would be crushed, milled and processed to liberate the silver, zinc and lead minerals. These minerals would be collected by conventional froth flotation to produce two concentrates that would be dewatered and transported off site by truck. The residual materials from processing (tailings) would be pumped in the form of a slurry to the TSF that would be located to the west of the main open cut pit.

The Project timetable comprises an 18 month site establishment and construction stage, 15 years of operations and a 7 year final rehabilitation period (commencing 6 months prior to the cessation of operations). Overall, a Project life of 23 years is proposed.

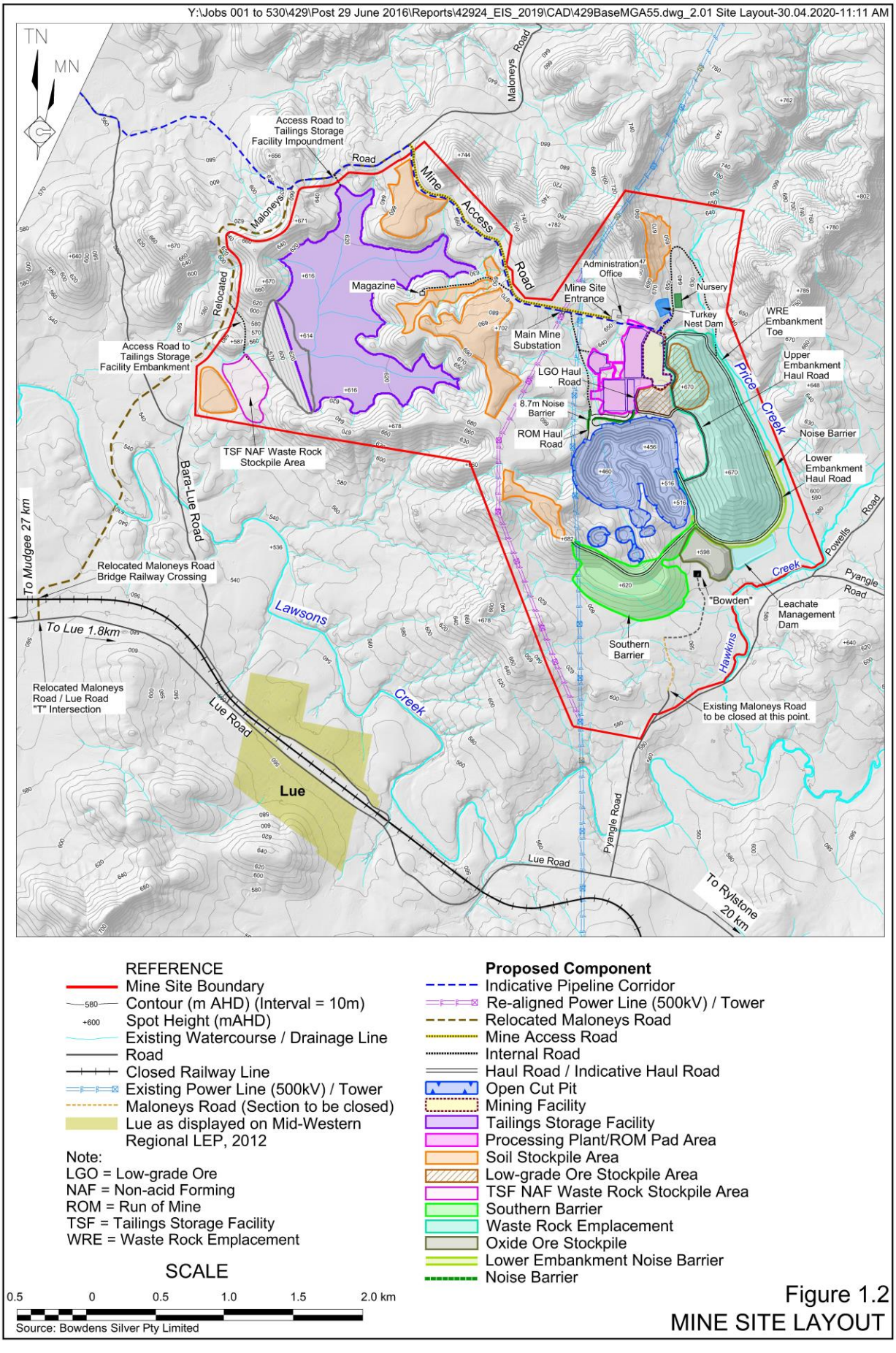


Figure 1.2
MINE SITE LAYOUT

1.2.3 Proposed Rehabilitation Strategy

Figure 1.3 displays the final landform within the Mine Site. The final landform would incorporate a range of land uses including grazing (682ha), biodiversity offset areas (218ha), the residual open cut void (50ha) and a single lifestyle lot (49ha).

Rehabilitation of all areas disturbed by mining-related activities would be an integral part of the Project. Emphasis would be placed upon progressively creating final landforms, wherever practicable, and re-establishing soil profiles and vegetation essential to achieving the preferred final land use(s) during and following the cessation of operations. The nature of the Project dictates, however, that the disturbed areas associated with the main open cut pit, processing area and TSF would remain active throughout the Project life and, as a consequence, the opportunities to undertake progressive rehabilitation of these components would be limited.

The water supply pipeline corridor would be progressively rehabilitated to ensure no soil or other materials remain on the surface and that the temporary access track has not caused any furrows or indentations. As sections of the pipeline are completed, the disturbed area would either be seeded with a pasture mix agreed with the respective landowner or rehabilitated to the pre-disturbance condition. The approach to rehabilitation along the pipeline corridor would reflect a combination of the landowner's wishes as well as the topography, soils and vegetation within and adjacent to the corridor.

1.2.4 Proposed Biodiversity Offset Area

Bowdens Silver has committed to creating a 795ha Biodiversity Offset Area comprising approximately 218ha within the Mine Site with the remaining 577ha to be established in the area immediately surrounding the Mine Site. **Figure 1.4** presents the areas of the proposed Biodiversity Offset Area on land owned by Bowdens Silver. It is noted that there are Crown roads located within the proposed biodiversity offsets within land owned by Bowdens Silver beyond the Mine Site. It is the intention of Bowdens Silver to approach Crown Lands to obtain the necessary lease and/or purchase of these areas to be included as part of the biodiversity offset area. In the event that it is not possible to either lease and/or purchase the subject Crown roads within the timeframe required to establish the biodiversity offsets, Bowdens Silver would seek alternative land to be included to compensate for the area of Crown land within the biodiversity offset area.

Bowdens Silver is also currently investigating the potential for establishing additional biodiversity offset area(s) within the Mid-Western Regional LGA and potentially beyond to offset any remaining residual ecological impacts.

1.2.5 Ongoing Agricultural Activities Throughout the Project Life

Throughout the Project life, Bowdens Silver intends to manage the land it owns, both within the Mine Site and the surrounding area, for agricultural and nature conservation purposes. All efforts are being made to optimise the agricultural productivity of land suitable for agriculture whilst balancing the need for biodiversity offsets as a result of the clearing of native vegetation for the Project.

Agricultural land uses within the water supply pipeline corridor would be permanently re-established within a few months of the completion of the pipeline.

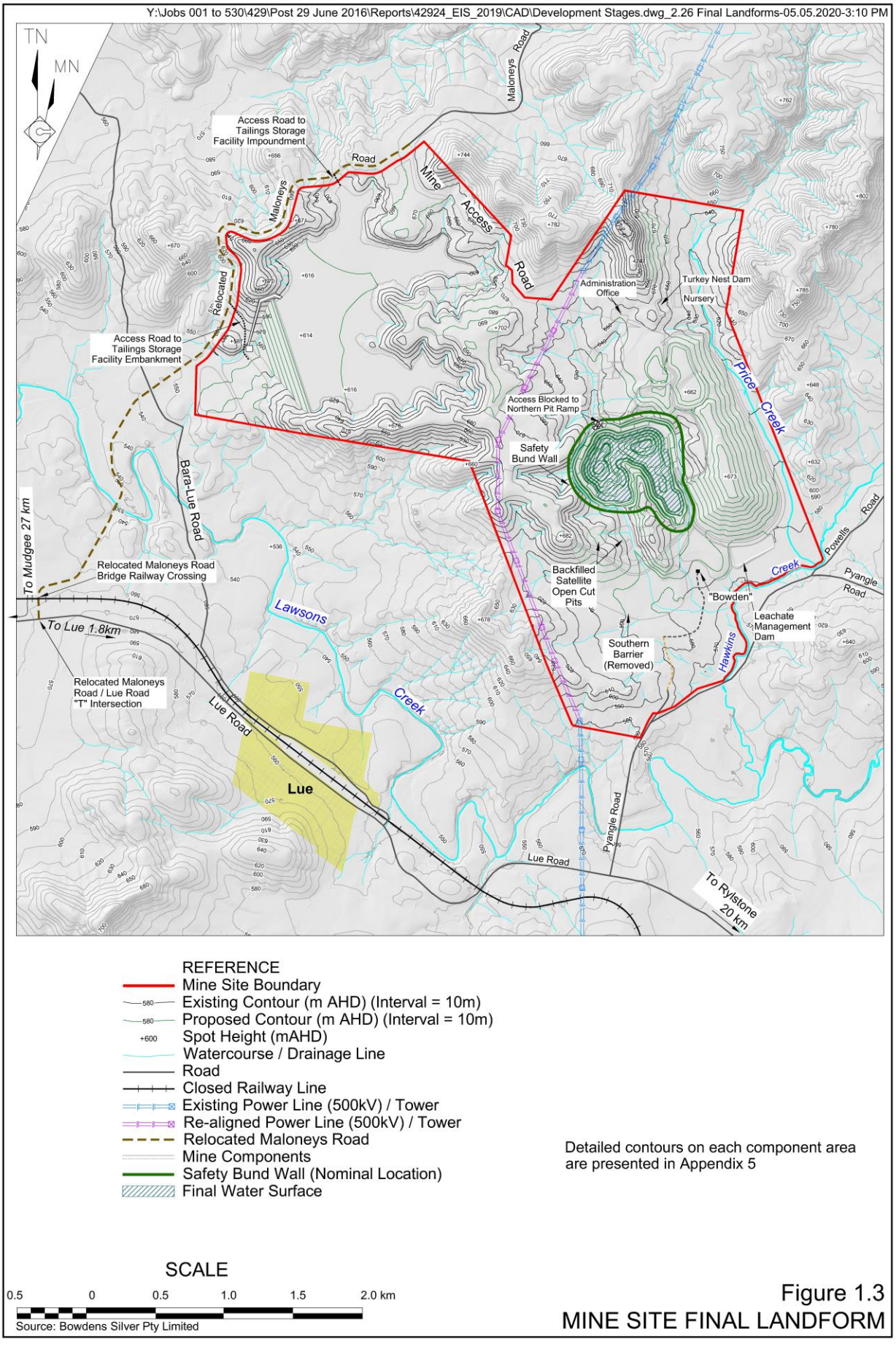


Figure 1.3
MINE SITE FINAL LANDFORM

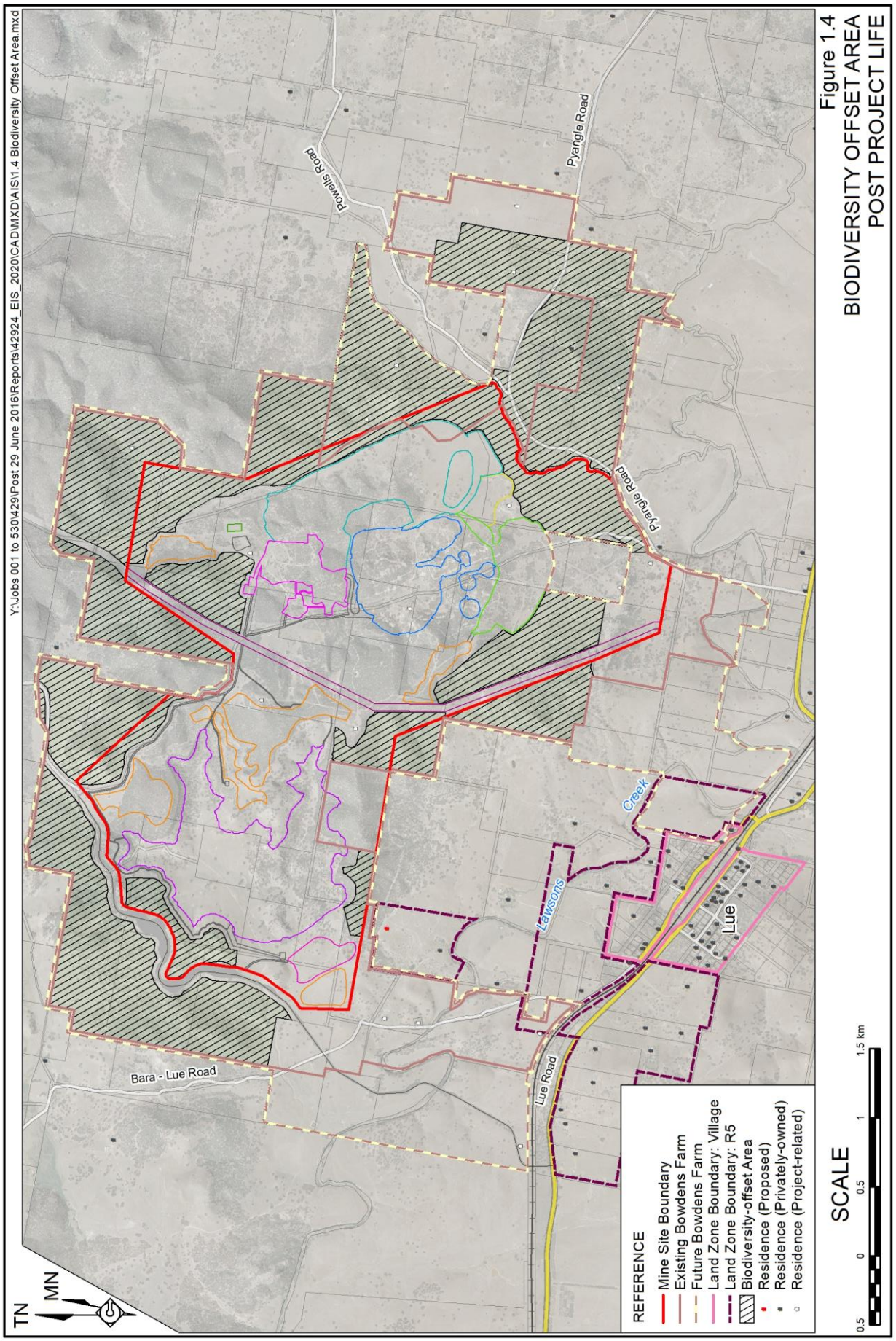


Figure 1.4
BIODIVERSITY OFFSET AREA
POST PROJECT LIFE
Y:\Jobs 001 to 5304\29\Post 29 June 2016\Reports\42924_EIS_2020\CADMX\DAIS\1.4 Biodiversity Offset Area.mxd
Powells Road
Pyangle Road
Pyangle Road
Creek
Lawsons
Lue
Lue Road
Bara - Lue Road
TN
MN
REFERENCE
Mine Site Boundary
Existing Bowdens Farm
Future Bowdens Farm
Land Zone Boundary: Village
Land Zone Boundary: R5
Biodiversity-offset Area
Residence (Proposed)
Residence (Privately-owned)
Residence (Project-related)
SCALE
0.5
0
0.5
1
1.5 km

1.3 SCOPE OF THE ASSESSMENT

This AIS has been prepared as the Project is a State significant development that has the potential to affect agricultural resources and/or enterprises. This document, which has been prepared in accordance with the *Agricultural Impact Statement Guideline* (DPI, 2012) and the *Agricultural Impact Statement technical notes* (DPI, 2013), focuses on describing and assessing the impacts of the Project at the regional, local, Mine Site and water supply pipeline corridor scales.

The material in this document has been drawn from a range of sources including the Environmental Impact Statement (EIS) for the Project and the supporting specialist consultant studies, specifically, the groundwater, surface water, land and soil capability, noise and blasting, Aboriginal heritage and ecological assessments. Relevant information from these documents has been summarised and cross-referenced to the source documents to enable readers to gain further information, as required. A substantial amount of data has been sourced through the Australian Bureau of Statistics (ABS). It is noted that most of the agricultural data from the ABS has been sourced from the 2015-2016 Agricultural Commodities publication (ABS, 2016a) which contains data collected during the 2015-2016 Agricultural Census. This census is conducted every five years and was chosen in order to coincide with data derived from the 2016 Census of Population and Housing (ABS, 2016b). Data from the 2015-2016 Agricultural Commodities publication also provides the most appropriate geographic resolution to allow for accurate assessment at both regional and local levels.

Coverage of the Secretary's Environmental Assessment Requirements (SEARs) and the requirements from other government agencies within this report is outlined in **Table 1.1**.

Table 1.1
Coverage of SEARs, Other Government Agency and Community Requirements

Relevant Requirement(s)		Coverage in Report
Secretary's Environmental Assessment Requirements		
The EIS must include an assessment of: • the likely agricultural impacts of the development, including identification of any strategic agricultural land; • the likely impacts of the development on landforms and topography, including the long-term geotechnical stability of any new landforms on site; and • an assessment of the compatibility of the development with other land uses in the vicinity of the development, paying particular attention to the agricultural land uses in the region.		Section 7 EIS Appendix 5 Section A5.1.3 Section 7
Relevant Requirements Nominated by Other Government Agencies		
Department of Resources and Energy 23/12/2016	• Barriers or limitations to effective rehabilitation – Where the intended land use is agriculture, demonstrate that the landscape, vegetation and soil will be returned to a condition capable of supporting this.	Sections 1.2.3 and 7.2.1
Department of Industry – Agriculture 16/05/2019	The EIS should include: • an Agricultural Impact Statement in accordance with the DPI Agricultural Impact Statement Technical Notes 2013; and the NSW Government Guideline for Agricultural Impact Statements (2012) and	

Table 1.1 (Cont'd)
Coverage of SEARs, Other Government Agency and Community Requirements

Relevant Requirement(s)		Coverage in Report
Relevant Requirements Nominated by Other Government Agencies (Cont'd)		
Department of Industry – Agriculture 16/05/2019 (Cont'd)	• an assessment of the pre-mining agricultural capability of the land to facilitate rehabilitation to pre-existing agricultural use at the close of the project. This should include monitoring programs to measure the return of land back to pre-existing condition.	Sections 4.2, 4.4, 4.6, 5.3, 5.4, 5.5
	• The pipeline route planning and construction should consider the construction impacts on areas of erosion and salinity, including steep lands.	EIS Section 4.13.5.2
	• An assessment of agricultural land uses and production values along the pipeline route, along with estimates of loss of land. Agricultural production information can be used to provide relevant agricultural baseline data for rehabilitated land outcomes. This can include information gained as part of the agricultural landholder consultation process to deal with the pipeline construction and its decommissioning, if required.	Sections 5 and 7.1.2
	• Any land identified as cropping or special use land (such as viticulture) should have the pipeline depths adjusted to deal with these land uses in consultation with stakeholders so as not to impact on agricultural operations. This may have to consider depths to 1.2 metres.	Sections 1.7.3, 2.10.3.2 and 5.2
	• A landholder consultation process should be outlined in relation to pipeline access, construction and ongoing maintenance.	Section 1.9
Mid-Western Regional Council 14/02/13	Assess impacts on adjoining agricultural lands that are likely to occur as a result of the mine including soil resources and land capabilities.	Sections 7.2.1 and 7.4.1
Relevant Requirements Nominated by Lue and District Community		
The viability of the businesses of Lue and surrounding areas and, in particular, the viability of the continued practice of growing and processing extra virgin olive oil.		Section 7.3
The viability of the beef, lamb and grape enterprises in the surrounding area.		
Impacts on soil quality due to contamination.		Section 7.2.1
Marketing restrictions due to contamination e.g. loss of "organic" status.		Section 7.3.2
Impacts on access to water e.g. groundwater drawdown.		Sections 7.2.2 and 7.2.3 EIS Sections 4.6.7 and 4.7.5
Exposure of livestock to cyanide in tailings.		EIS Section 4.7.4.4
Exposure of livestock to metals and metalloids in contaminated water.		EIS Section 4.7.5.4
Maintenance of land within the Mine Site e.g. installation of cattle grids, weeding, etc.		Section 4.8
Effect of blasting on livestock		Section 7.2.5
Loss of agricultural land due to land use changes within the Mine Site.		Section 7.1
Devaluation of surrounding farmland.		Section 7.4.1
Perceived competition with agribusiness and tourism.		Sections 7.3.2 and 7.4.6
Economic benefits associated with industry diversification within rural areas.		Section 7.4.5

1.4 STRUCTURE OF THE REPORT

The document is structured in seven sections, as follows.

Section 1: provides an overview of the Project, details of land ownership within and immediately surrounding the Application Area, details of consultation and an overview of relevant planning issues. This section also records the approach to the environmental risk assessment undertaken for the Project with respect to specific agricultural issues.

Section 2: presents a description of the existing regional environment relevant to the Project as well as providing information on the regional agricultural resources, support services and enterprises within the Mid-Western Regional Local Government Area (LGA).

Section 3: presents a description of the existing environment within the Lue district relevant to the Project as well as providing information on the local agricultural resources, support services and enterprises.

Section 4: presents a description of the existing environment within the Mine Site and the relocated Maloneys Road together with information on the agricultural resources, support services and enterprises.

Section 5: presents a description of the existing environment traversed by the water supply pipeline corridor.

Section 6: provides an overview of the management and mitigation measures Bowdens Silver proposes to implement to minimise adverse impacts upon agricultural resources and enterprises.

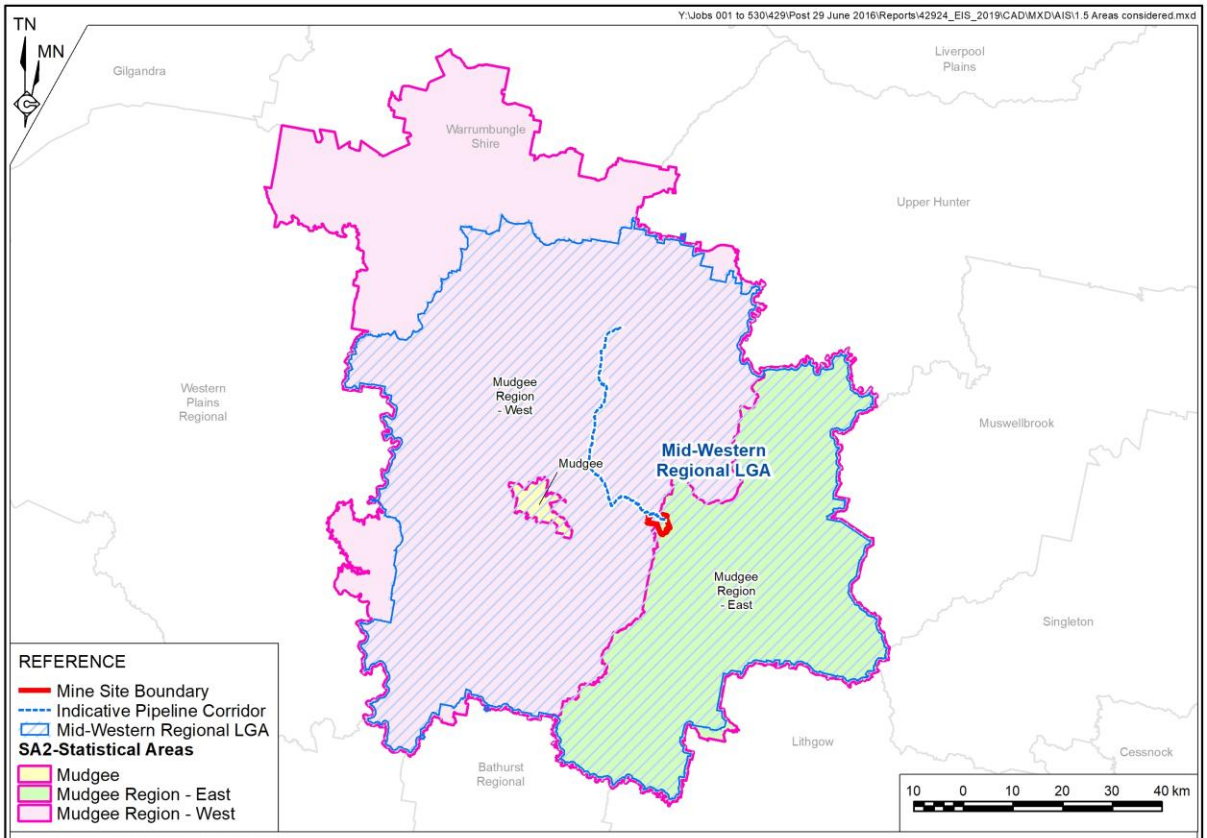
Section 7: provides an assessment of the impacts of the Project on agricultural resources and enterprises together with the social and economic impacts associated with agricultural lands.

Section 8: provides a conclusion to the document which justifies the Project in terms of its interactions with the various agricultural resources and enterprises.

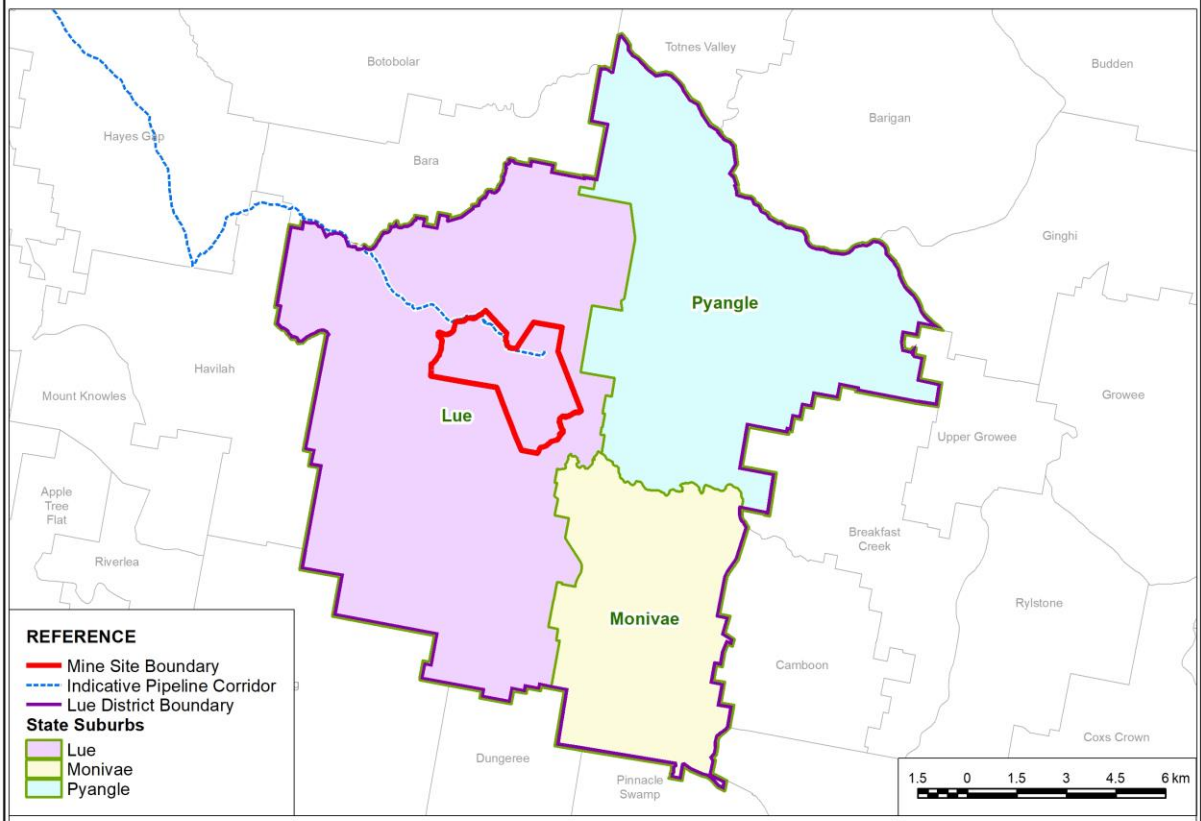
1.5 COMMONLY USED TERMINOLOGY

For the purposes of this document, four distinct areas have been established for consideration and discussion of agricultural-related issues relevant to the Project (**Figure 1.5**).

- The “Region” generally corresponds to the boundaries of the Mid-Western Regional LGA which covers an area of approximately 8 700km^2. When referring to ABS agricultural statistics, the “Region” aligns with the combined areas of the Mudgee, Mudgee Region-West and Mudgee Region-East SA2 Statistical Areas. This footprint was chosen to most closely align available ABS agricultural statistics with the boundaries of the Mid-Western Regional LGA.
- The “Lue district” is the general area of land in the vicinity of the Mine Site which corresponds with the Lue, Pyangle and Monivae ABS State Suburb Codes (SSCs). The nominal area of the Lue district covers approximately 118km^2.



SA2-STATISTICAL AREAS



LUE DISTRICT

Figure 1.5
STATISTICAL AREAS CONSIDERED FOR AGRICULTURAL ASSESSMENT

Source: Australian Bureau of Statistics - Geographical Boundaries 2016

- The “Mine Site” is an area of approximately 999ha of land within the Lue district in which approximately 420ha of land would be disturbed throughout the Project life. For the purposes of this assessment, the footprint of the relocated Maloneys Road and the properties owned by Bowdens Silver in the area immediately surrounding the Mine Site, are also considered in conjunction with the Mine Site.
- The “water supply pipeline corridor” extends over approximately 58.5km between the Mine Site to the Ulan Coal Mine and/or Moolarben Coal Mine. All land within the water supply pipeline corridor would be returned to its previous use following the construction of the pipeline.

It is noted that the “mine life” refers to the period of the 18 month site establishment and construction stage and the 15 year period of processing and concentrate manufacture, i.e. the Mine life would be 16.5 years. The “Project life” refers to the Mine life and the estimated 7 year final rehabilitation and maintenance period (commencing 0.5 years before the end of processing), i.e. a total of 23 years.

1.6 LAND OWNERSHIP

Figures 1.6 and **1.7** present the land ownership within the Mine Site and water supply pipeline corridor, respectively. Land ownership data was sourced from an extensive search register of land titles to provide the most complete, up-to-date land ownership information available.

A full register of the ownership of land together with coordinates of the residences on those properties is provided in Appendix 6 of the EIS together with A3 size figures of land ownership.

1.7 PLANNING AND LEGISLATION

The coverage of agricultural issues in this document is addressed with respect to relevant State, regional and local planning issues.

1.7.1 State Planning Issues

A range of State legislation, regulation and policies apply to the Project. The following presents a brief overview of the principal State planning matters relevant to the AIS.

State Environmental Planning Policy (State and Regional Development) 2011

The State and Regional Development SEPP was gazetted on 1 October 2011 and applies to all projects satisfying nominated criteria made following that date. The purpose of the State and Regional Development SEPP is to define those projects of State significance or proposed on State significant sites and therefore require Ministerial approval under the provisions of the EP&A Act.

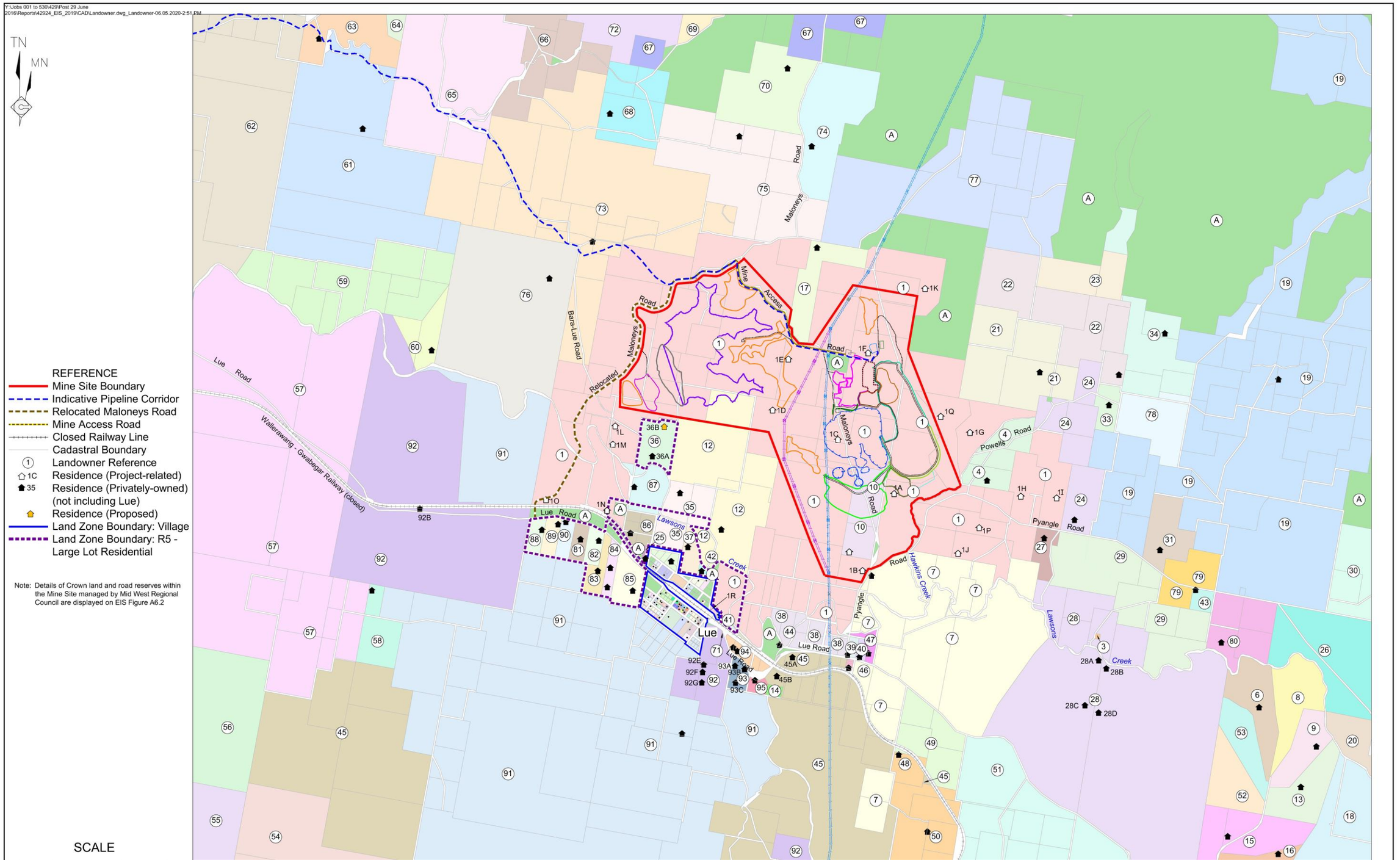


Figure 1.6
LAND OWNERSHIP AND RESIDENCES - MINE SITE AND SURROUNDS

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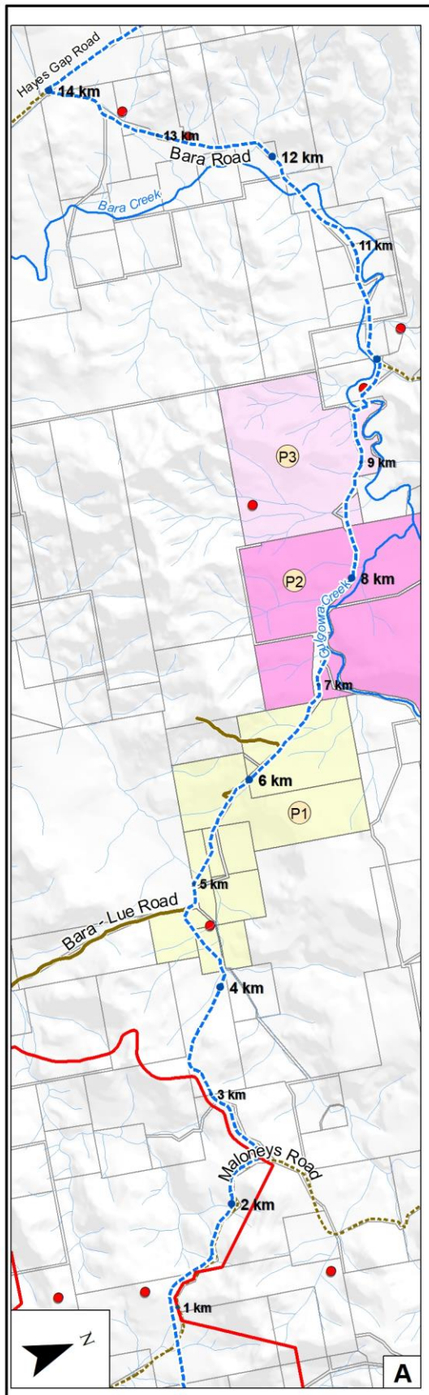

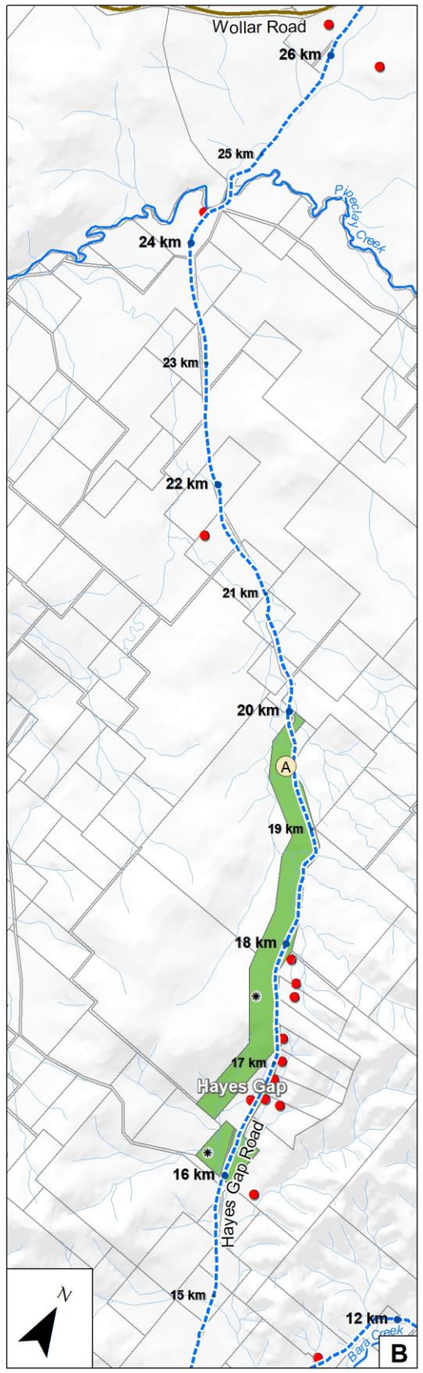

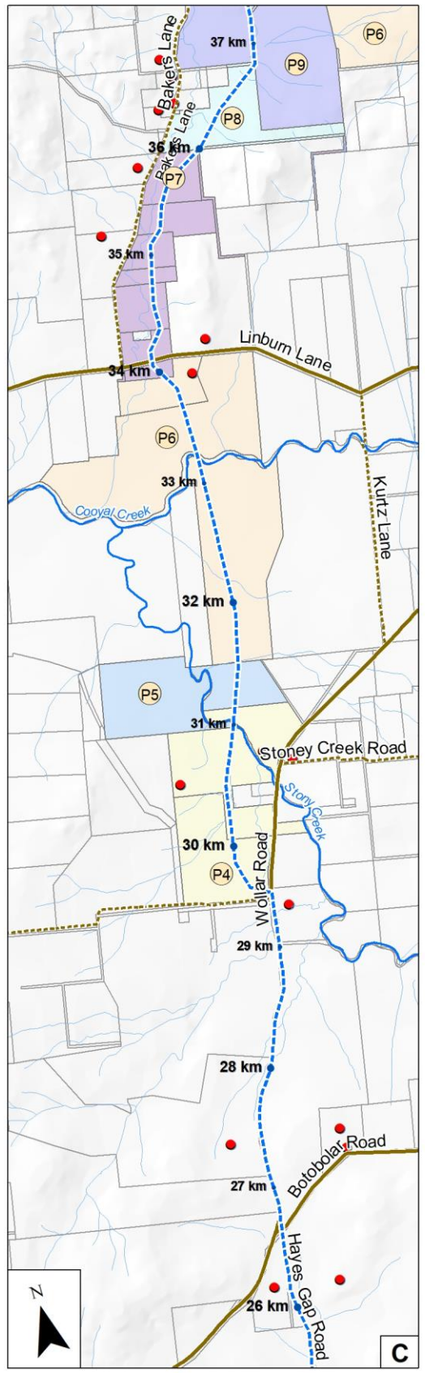

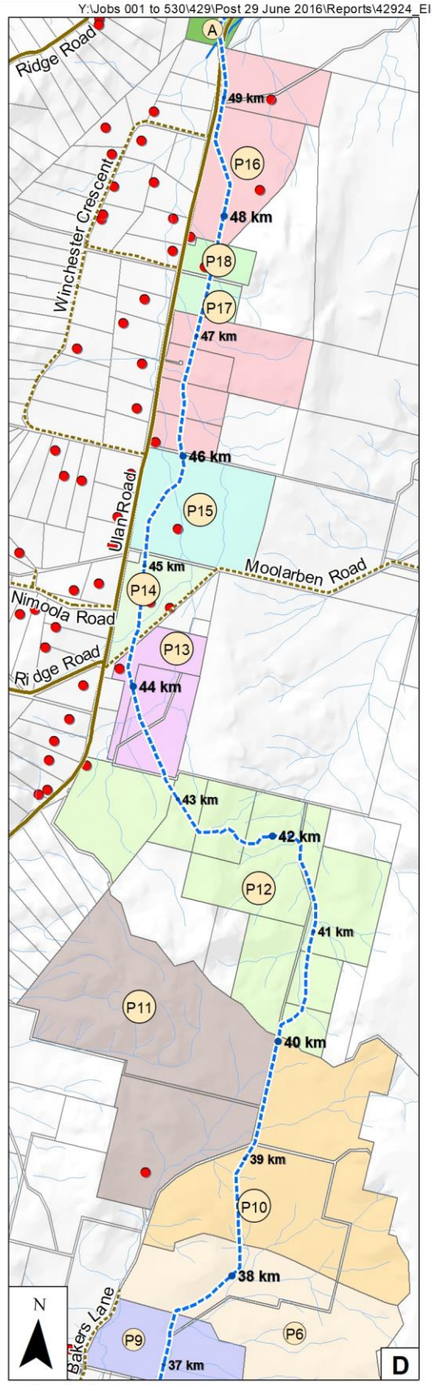

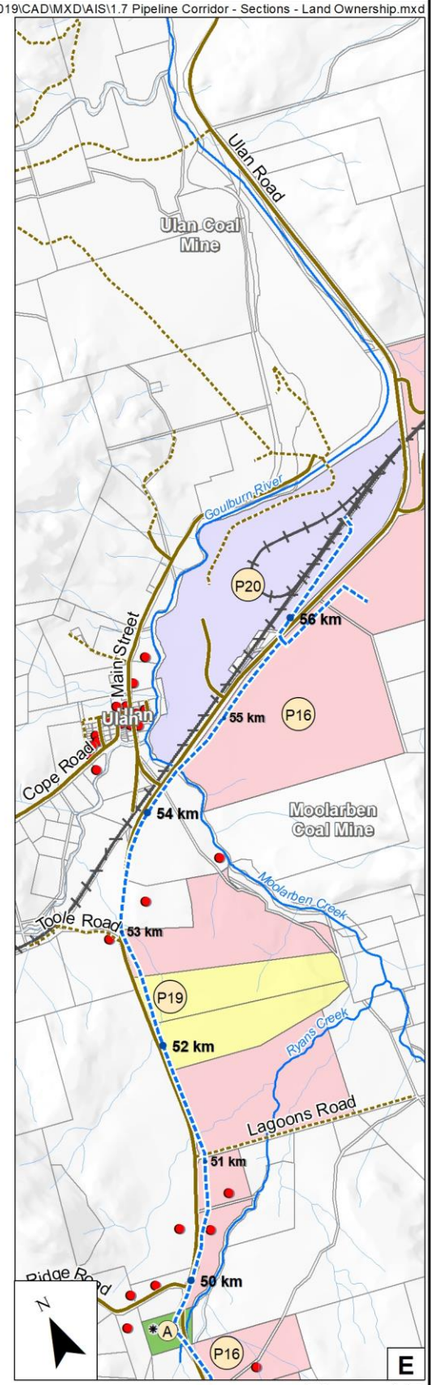

SCALE
500 0 500 1000 1500 2000 m
Landowner Source: Bowdens Silver Pty Limited

REFERENCE
Mine Site Boundary
Indicative Pipeline Corridor
Residence
Railway
Roads
Sealed
Unsealed
Watercourses
Perennial
Ephemeral

✱ Subject to Aboriginal Land Claim

Figure 1.7
LAND OWNERSHIP -
WATER SUPPLY PIPELINE

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The Project currently satisfies the threshold capital investment value for a mining project of greater than $30 million as nominated in Clause 5(1)(c) within Schedule 1 of the State and Regional Development SEPP as a State significant development. As such, an AIS is required to address the potential impacts that the Project may have on agricultural resources and enterprises in accordance with the Agricultural Impact Statement Guideline (DPI, 2012).

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The Mining SEPP was gazetted on 17 February 2007 in recognition of the importance to NSW of mining, petroleum production and extractive industries.

The Mining SEPP specifies matters requiring consideration in the assessment of any mining development including the following that have implications on agriculture.

- Compatibility of the proposed mine with other land uses;
- Natural resource management and environmental management;
- Rehabilitation; and
- Biophysical strategic agricultural land (BSAL)

These issues have been considered in the preparation of this AIS and are fully explored within the EIS.

1.7.2 Regional Planning Issues

Central West and Orana Regional Plan 2036

The *Central West and Orana Regional Plan 2036* seeks to guide the NSW Government's land use planning priorities until 2036 with the intent of creating a diverse regional economy. This policy seeks to balance economic growth with the sustainable management of natural resources including agricultural land and mineral resources. As part of this process, the policy identifies strategic agricultural land throughout the Central West.

The spatial distribution of BSAL throughout the Mid-Western Regional LGA is displayed on **Figure 1.8**. Further discussions regarding BSAL and the Project is presented in the Land and Soil Capability Assessment reproduced as Part 12 of the Specialist Consultant Studies Compendium (SCSC).

1.7.3 Local Planning Issues

Mid-Western Regional Local Environmental Plan 2012

The Application Area is located within the Mid-Western Regional LGA which is subject to the Mid-Western Regional Local Environmental Plan 2012 (LEP). The Application Area comprises land zoned RU1 – Primary Production and R5 – Large Lot Residential.

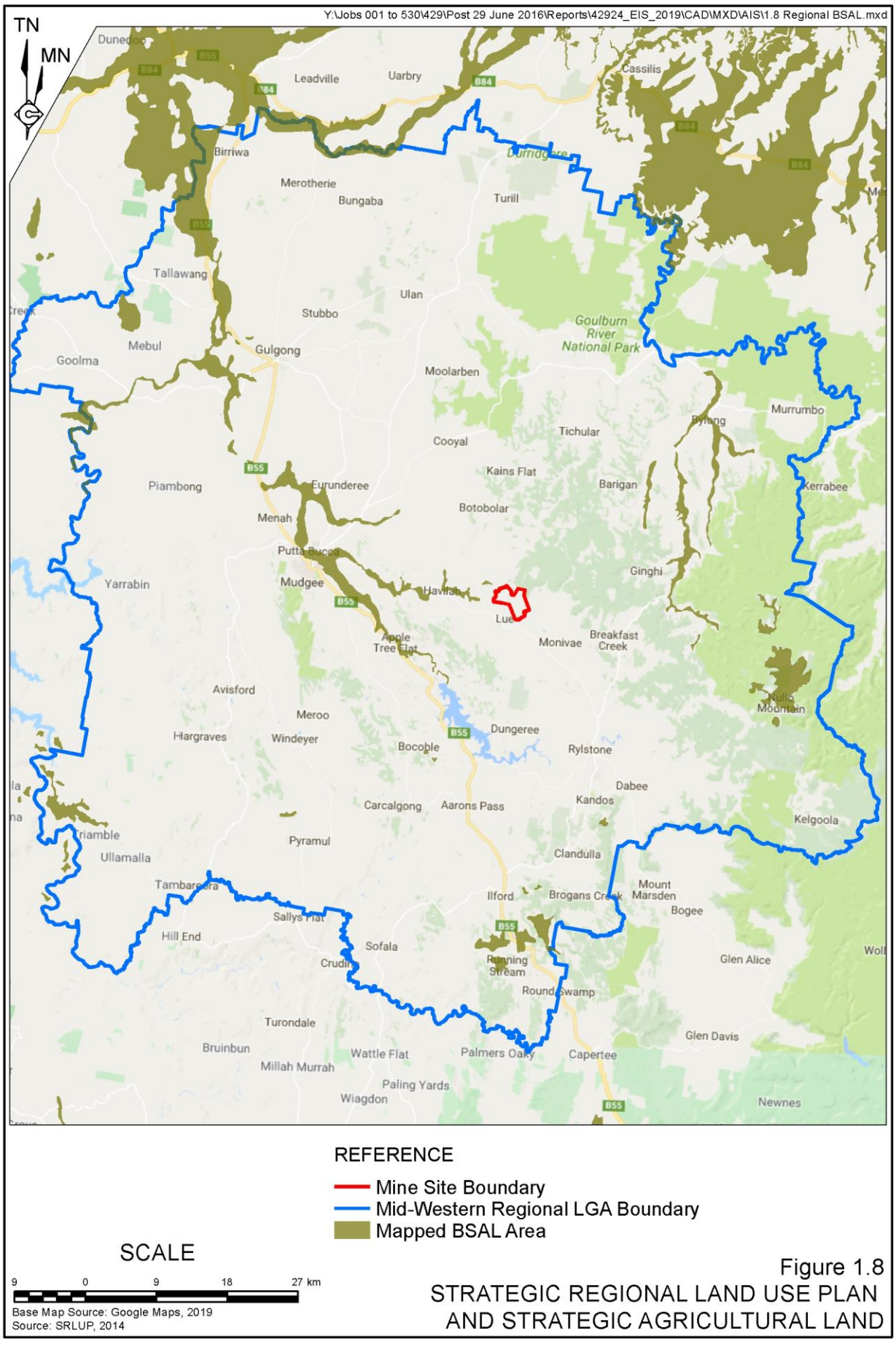

Figure 1.8
STRATEGIC REGIONAL LAND USE PLAN
AND STRATEGIC AGRICULTURAL LAND

Mine Site

The Mine Site is located wholly within Zone RU1 – Primary Production. The planning objectives of this zone that are relevant to this assessment include the following.

- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To minimise the fragmentation and alienation of resource lands.*

The Project would not infringe on these objectives with open cut mining recorded as permissible with consent within Zone RU1 – Primary Production. It is noted that the Mine Site is wholly surrounded by grazing land and would not result in the fragmentation or alienation of any land currently used for agriculture.

Water Supply Pipeline Corridor

The water supply pipeline would traverse land zoned RU1 – Primary Production and R5 – Large Lot Residential. Water supply systems are permissible with consent on land zoned RU1 – Primary Production, however, they are prohibited on land zoned R5 – Large Lot Residential. It is noted that consent may still be granted by the Minister for the development of the water supply pipeline on land zoned R5 – Large Lot Residential as only part of the development is prohibited by the Mid-Western Regional LEP. This is in accordance with Condition 4.38(3) of the EP&A Act which states that “development consent may be granted despite the development being partly prohibited by an environmental planning instrument”.

The construction of the water supply pipeline would not limit the achievement of the objectives for land zoned RU1 – Primary Production or R5 – Large Lot Residential as the pipeline would be laid in a trench approximately 1.4m deep and would not result in the permanent removal of any existing land use.

1.8 RISK ASSESSMENT

A broad-brush risk assessment was undertaken for the Project, with Appendix 7 of the EIS presenting the identified risk sources; the potential consequences and receivers of the identified risk; the risk rankings assuming standard controls; and the residual risk rankings as a result of implementing additional management, mitigation and control measures.

Table 1.2 provides the matrix from which the risk rankings were calculated while **Table 1.3** provides a consolidated list of potential impacts that may be applicable to agricultural activities within the Mid-Western Regional LGA, Lue district, Mine Site and water supply pipeline corridor as a result of the Project assuming the adoption of standard control measures.

The evaluation of the identified risks in **Table 1.3** and the proposed mitigation and management measures across all agricultural-related issues discussed in detail throughout this document and Section 4 of the EIS, revealed that only minor to negligible residual impacts are expected on land used for agriculture.

Table 1.2
Risk Rankings

		Likelihood				
		A – Certain	**B – Likely**	**C – Possible**	**D – Unlikely**	**E – Rare**
Consequence	1 – Critical	1	2	4	7	11
	2 – High	3	5	8	12	16
	3 – Medium	6	9	13	17	20
	4 – Low	10	14	18	21	23
	5 – Insignificant	15	19	22	24	25

Note: Ranking modified after HB 203:2006 - Table 4(C)

Low Medium High Critical

Table 1.3
Risk Assessment – Agricultural Issues

Risk Source	**Consequence / Hazard**	**Risk with Standard Control Measures**	**Proposed Control Measures EIS Section Ref.**
ENVIRONMENTAL ISSUE – LAND AND SOILS			
Inappropriate soil management.	Inadequate soil available for closure and rehabilitation purposes leading to less successful rehabilitation and increased rehabilitation costs and maintenance.	17 (D3)	4.13.4
	Degradation of soil in stockpiles leading to less successful rehabilitation and increased rehabilitation costs and maintenance.	17 (D3)	
	Erosion and loss of materials from soil stockpiles.	18 (C4)	
Changes to land uses impacting soil and land resources.	Reduction of land and soil capability within the Mine Site.	15 (A5)	
Mining operations.	The fragmentation or alienation of land used for agriculture.	17 (D3)	4.18.5
	Reduction in agricultural productivity due to the removal of land used for agriculture.	17 (D3)	
ENVIRONMENTAL ISSUE – SURFACE WATER			
Construction of Mine components within natural catchments.	Reduction in flows downstream of Mine Site.	15 (A5)	4.7.4
Release of contaminated water to downstream watercourses.	Adverse impacts on aquatic ecosystem function and limitations upon use by current water users	16 (E2)	
ENVIRONMENTAL ISSUE - GROUNDWATER			
Interception of groundwater by open cut pit development.	Reduced groundwater levels and availability for existing authorised users and ecosystems.	9 (B3)	4.6.8
ENVIRONMENTAL ISSUE – AIR QUALITY			
Deposited dust impacting agricultural productivity.	Increased dust load on crops and health impacts on livestock on surrounding agricultural land.	21 (D4)	4.4.2.3
ENVIRONMENTAL ISSUE – NOISE AND VIBRATION			
Noise and vibration generated by mining operations.	Impacts to health of livestock on surrounding properties.	21 (D4)	4.2.2.5 & 4.3.4
SOCIAL AND ECONOMIC ISSUES			
Mining operations.	Impacts on surrounding agricultural enterprises and agri-tourism businesses due to changes to existing land uses.	17 (D3)	4.18.5

Low Medium High Critical

1.9 STAKEHOLDER CONSULTATION

Bowdens Silver has actively sought to engage with the community and surrounding private landowners to discuss the Project and any measures that could be implemented to reduce the potential impacts of the Project. **Table 1.1** presents a summary of the key issues relating to agriculture identified in consultation with the local community and surrounding landowners.

1.10 MANAGEMENT OF INVESTIGATIONS

This document has been prepared by Mr Caiden O'Connor, B.Sc., Environmental Consultant with R.W. Corkery & Co. Pty Limited (RWC) and Mr Rob Corkery, M.Appl.Sc., B.Sc (Hons), Principal Environmental Consultant with RWC. Information on a range of agriculture – related aspects of the Project are drawn from the specialist consultant studies relating to surface water, groundwater, land and soil capability, noise and blasting, Aboriginal heritage and ecology.

2. REGIONAL SETTING

2.1 INTRODUCTION

This section summarises the relevant environmental features and agricultural setting within the Region i.e. the area generally corresponding with the Mid-Western Regional LGA. The environmental and agricultural setting of the Lue district, Mine Site and water supply pipeline corridor are presented in Sections 3 to 5 of this document.

The Mid-Western Regional LGA covers an area of approximately 8 700km^2, with the township of Mudgee being the main commercial and urban centre of the LGA. The Mine Site is geographically located in the southeastern quadrant of the LGA, as shown on **Figure 1.5**, approximately 26km southeast of Mudgee.

The key environmental features that influence agricultural productivity in the Region are:

- climate;
- topography;
- soils;
- water resources; and
- vegetation.

The factors contributing to the agricultural setting include:

- local agricultural infrastructure;
- local agricultural business enterprises; and
- local transport infrastructure.

2.2 REGIONAL CLIMATE

This subsection provides a brief overview of the climatic conditions within the Mid-Western Regional LGA, focusing particularly on those aspects of the climate that influence agricultural productivity.

2.2.1 Data Sources

Meteorological data from the Bureau of Meteorology (BOM) is presented in **Table 2.1**. Long term climate data was sourced from the Mudgee Airport AWS (BOM Station # 062101) as it provides the most complete dataset for the area surrounding Mudgee.

2.2.2 Temperature and Humidity

The climate within the Region is referred to as “dry subhumid”. January is the hottest month, with a mean maximum temperature of 31.0°C and a mean minimum temperature of 16.1°C. July is the coldest month with a mean maximum temperature of 14.4°C and a mean minimum temperature of 1.1°C.

Table 2.1
Monthly Meteorological Data – Mudgee Airport AWS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature (°C) Mudgee Airport Station (Station # 062101) Period of Record 27 Years													
Mean maximum temperature	**31.0**	29.5	26.8	23.0	18.6	15.0	14.4	16.3	19.6	23.1	26.4	28.8	22.7
Mean minimum temperature	16.1	15.6	12.8	8.0	4.0	2.4	**1.1**	1.5	4.3	7.7	11.3	13.8	8.2
Relative Humidity (%) Mudgee Airport Station (Station # 062101) Period of Record 19 Years													
Mean 9:00am relative humidity	63	70	72	71	80	87	87	78	70	61	63	62	72
Mean 3:00pm relative humidity	37	42	42	41	49	57	55	47	44	41	40	37	44
Rainfall (mm) Mudgee Airport Station (Station # 062101) Period of Record 24 Years													
Mean monthly rainfall	67.6	63.1	58.9	33.2	37.9	45.0	43.4	35.2	54.6	51.1	75.4	**80.7**	663.2
Highest monthly rainfall	195.6	233.0	187.0	108.4	124.0	127.2	143.8	112.2	197.4	135.8	162.8	**241.6**	1152.4
Lowest monthly rainfall	10.0	2.2	**0.0**	**0.0**	0.4	1.4	2.6	1.0	0.8	0.2	9.4	15.0	349.6
Highest daily rainfall	65.0	**174.2**	72.0	46.2	44.4	37.0	51.2	51.2	61.0	51.0	57.2	100.8	-
Average Rain Days (>1mm)	7.3	6.9	6.9	4.8	6.3	10.1	9.9	7.6	7.4	8.0	9.3	8.6	93.1

The lowest average relative humidity generally occurs in the summer months, with January and December sharing the lowest relatively humidity values throughout the year. The highest average relative humidity occurs in June.

2.2.3 Rainfall

Mean annual rainfall is 663.2mm at BOM Station # 062101, with rainfall distributed relatively evenly throughout the year. The cooler months are typically slightly drier than the warmer months with April being the driest month. Rainfall can, however, be variable, with infrequent, high intensity rainfall events occurring throughout the year. This is confirmed by the highest daily rainfall values shown in **Table 2.1**, and the fact that the maximum daily rainfall values can be two times average monthly rainfall values.

The period of above average rainfall from November to February poses the greatest risk for soil erosion, with the period from April to September posing the least risk.

2.3 REGIONAL TOPOGRAPHY

The Mine Site is situated on the outer western flanks of the Great Dividing Range with the regional topography of the area dominated by elevated rocky ridges and broad, flat alluvial valleys. The topography ranges in elevation from over 900m AHD within the peaks and ridges associated with the Great Dividing Range in the east, to elevations below 550m AHD within the alluvial valleys to the west.

2.4 REGIONAL SOILS

Soil landscapes within the Region are highly varied and reflective of the topography and geology of the Region (Murphy and Lawrie, 1998). A range of localised variations of soil landscape units (SLUs) are present throughout the Region which are identified and described in Murphy and Lawrie (1998). Broadly, regional SLUs on steep and precipitous terrain are not suitable for agricultural activities whilst SLUs within the valleys and plains are more suited to grazing with some areas suitable for horticulture and viticulture. Grazing is the dominant agricultural activity conducted within the Region, principally due to the limited spatial extent of SLUs suited to intensive horticulture and viticulture.

2.5 REGIONAL WATER RESOURCES

2.5.1 Surface Water

The Region is located within the Macquarie-Bogan Rivers Catchment which covers an area of approximately 74 000km^2 within the Murray-Darling Basin. The Cudgegong River is the major drainage feature within the Region. The dominant flow direction of the Cudgegong River is to the northwest towards its eventual confluence with the Macquarie River. The Windamere Dam impedes the flow of the Cudgegong River southeast of Mudgee and is an important regional water source for town water as well as water for agricultural enterprises. The headwaters of the Bogan River are located near Peak Hill and flow generally northwest through Nyngan to its confluence with the Darling river near Bourke.

The major regional drainage feature in the area surrounding the Mine Site is Lawsons Creek, a tributary of the Cudgegong River. Lawsons Creek is covered by the Water Sharing Plan (WSP) for the Lawsons Creek Water Source of the Macquarie Bogan Unregulated and Alluvial Water Sources. A total of 47 water access licences (comprising 35 unregulated river licences and 12 domestic and stock licences) have been granted from the Lawsons Creek Water Source. Of the 42 licences which have associated works approvals, extraction is approved at 27 properties located downstream of the Project, and account for 1 014 unit shares of the 1 496 unit shares granted from the water source. **Figure 2.1** displays the spatial distribution of the Works Approvals within the Lawsons Creek Water Source.

2.5.2 Groundwater

Jacobs (2020) identifies three primary aquifer groups within the Region, as listed below.

- The alluvial deposits of Quaternary age which are typically associated with the major drainages.
- The sedimentary rocks of the Sydney Basin.
- The underlying basement lithologies of Ordovician age within the Lachlan Fold Belt.

Throughout the Macquarie-Bogan Rivers Catchment, the dominant surface drainage direction is to the northwest toward the Darling River. Shallow groundwater reflects surface water flow and trends to the northwest throughout the Region.

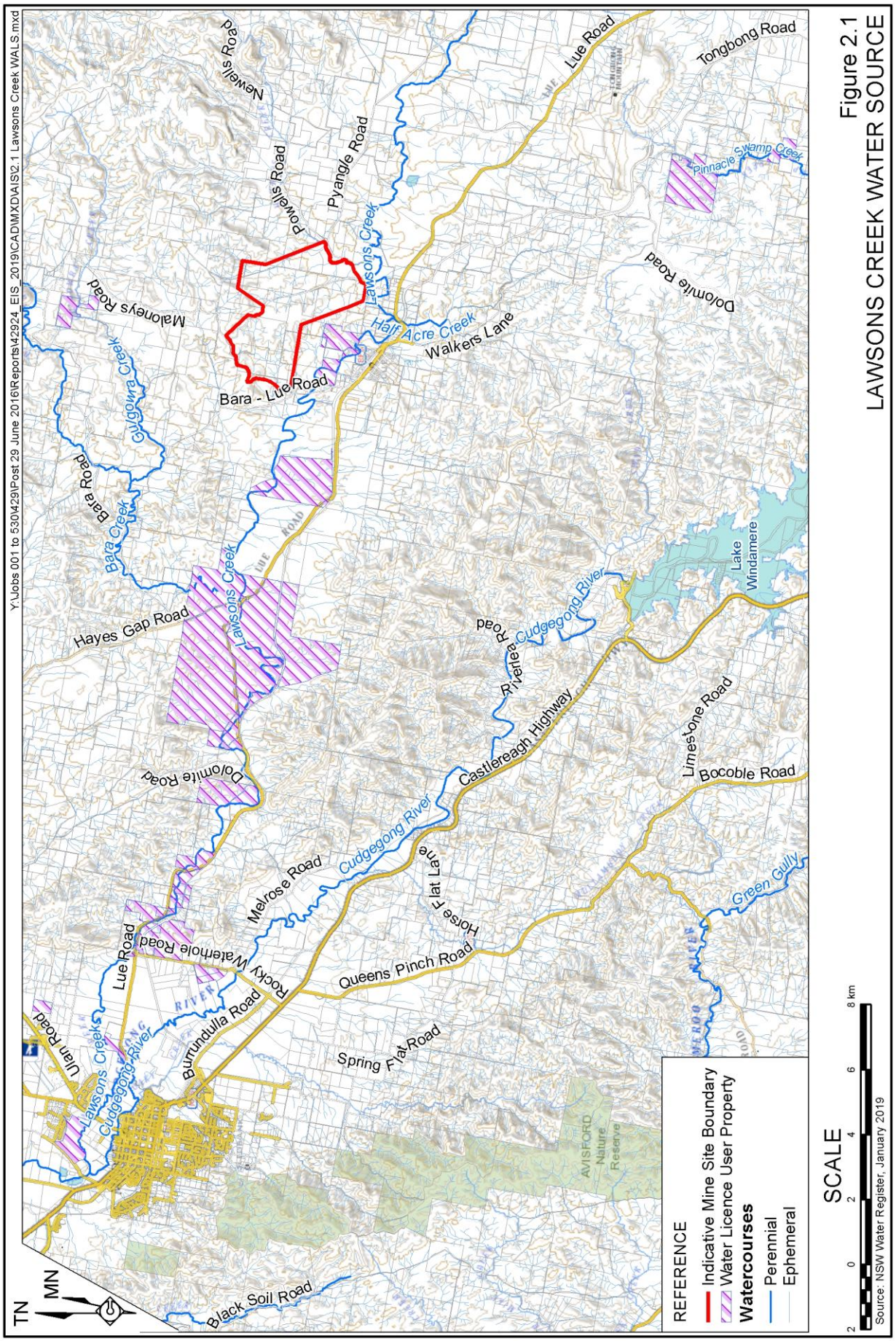
Figure 2.1
LAWSONS CREEK WATER SOURCE
Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2019\CAD\MXD\AIS\2.1 Lawsons Creek WALS.mxd
Newells Road
Powells Road
Pyangle Road
Lue Road
Tongbong Road
Pinnacle Swamp Creek
Dolomite Road
Walkers Lane
Half Acre Creek
Lawsons Creek
Maloneys Road
Cudgowa Creek
Bara - Lue Road
Bara Road
Bara Creek
Hayes Gap Road
Lawsons Creek
Lake Windamere
Cudgegong River
Castlereagh Highway
Limestone Road
Bocoble Road
Dolomite Road
Melrose Road
Cudgegong River
Horse Flat Lane
Green Gully
Lue Road
Rocky Waterhole Road
Queens Pinch Road
Ulan Road
Lawsons Creek
Cudgegong River
Burrundulla Road
Spring Flat Road
Black Soil Road
AVISFORD Nature Reserve
TN
MN
REFERENCE
Indicative Mine Site Boundary
Water Licence User Property
Watercourses
Perennial
Ephemeral
SCALE
2 0 2 4 6 8 km
Source: NSW Water Register, January 2019

Groundwater flow within the Sydney Basin Sediments is more likely to be bedding controlled with downward infiltration/flow inhibited by lower permeability strata. Groundwater flow is predominantly down-dip to the northeast, consistent with the regional bedding dip on the western flank of the Sydney Basin.

Deeper groundwater flow, within the Ordovician Basement, is more structurally controlled with the dominant structures trending in a north-northwesterly direction.

2.6 REGIONAL VEGETATION

Within the Mid-Western Regional LGA, approximately 11.5% of the land is currently utilised for National Parks and other reserve areas. As such, a relatively minor portion of the Mid-Western Regional LGA is covered by remnant native vegetation (ABS, 2016a). These vegetated areas are largely restricted to areas dominated by steep, hilly terrain. Cleared land, predominantly used for grazing, dominates the undulating terrain to the west of the Great Dividing Range.

2.7 REGIONAL AGRICULTURAL HISTORY

As described by Landskape (2020), the first European to visit the southwest slopes was explorer and Surveyor-General of NSW Lieutenant John Joseph William Molesworth Oxley during his 1818 expedition of the Macquarie River (Johnson, 2001). In 1821-1822, James Blackman, George Henry Cox and William Lawson surveyed the area around Cudgegong River for grazing land. They gave their surnames to several features in or near the present Mine Site, including Lawsons Creek and Blackmans Gully. Within a few years, pastoralists had occupied much of the land in the Region.

James Walker, who had earlier taken up the Wallerawang run near Rylstone, was granted the 1000-acre Loowee run in 1825 (Potts, 1984). Over the succeeding years, Walker expanded Loowee Station until it comprised over 21 000 acres of freehold land. Loowee was run as a sister property to Wallerawang by manager Andrew Brown. Convicts and Aboriginal shepherds tended flocks at remote outstations dispersed up to 50km apart across the holdings, with sheep driven back to Loowee or Wallerawang for shearing (Potts, 1984). Walker sold Loowee to James John Riley and H.W. Bloomfield in 1856. Riley donated land for an Anglican church and school, although the first town to develop in the area was Dungeree, two kilometres east of where Lue now stands (Potts, 1984).

Loowee was purchased by Dr James Charles Cox in 1862, at which time it comprised 39 346 freehold and leasehold acres and ran 30 000 sheep (Potts, 1984). A policy of closer settlement was pursued over the second half of the nineteenth century with the passing of the 1861 and 1884 Crown Lands Acts. Some of the leasehold sections of the old pastoral holding of Loowee were resumed, subdivided and sold freehold to selectors (NSW Department of Lands, 1884). Much of the timbered crown land was gazetted as the Apple Tree Flat Gold Field Reserve proclaimed on 15 January 1869 (later renamed the Gulgong Gold Field in May 1899).

Land reform was designed to break the domination of land tenure by a few wealthy individuals, but this failed to stop the establishment of pastoral agglomerations. For example, Cox's brothers Edward King Cox, a member of the NSW Legislative Council, and Richard William Cox, and their wives and children, purchased many of the freehold allotments including parts of the present

Mine Site (NSW Department of Lands, 1883, 1884, 1894, 1895, 1903, 1905, 1915, 1917, 1924, 1933a, 1933b; Teale, 1969). Thomas Jarman Hawkins, a member of the NSW Legislative Council for East Macquarie and Commissioner for Crown Lands in the Western Division, also purchased freehold allotments including parts of the present Bowdens Project Site (NSW Department of Lands, 1883, 1895, 1905, 1917, 1933a). Hawkins gave his surname to Hawkins Creek.

When the railway line from Lithgow was extended to Mudgee in 1884, Lue was chosen as the site for a station because the grade was too steep at Dungeree (Potts, 1984; Sheedy, 1988). A town grew up around the railway station, which included several stores, churches, school and hotel.

The population of Lue and the amount of commercial activity declined with the contraction of the pastoral industry over the twentieth century. The railway line from Rylstone through Lue to Mudgee was closed in 2005.

2.8 REGIONAL AGRICULTURAL SECTORS

2.8.1 Introduction

The major agricultural enterprises located within the Region are predominantly livestock-related with cattle and sheep comprising the greatest market share. Grazing land accounts for the bulk of land used for agriculture within the Region. Other fruit and vegetables are also grown in the Region, including grapes for wine production and olives, however, these industries cover only a small area of the total land used for agriculture.

Table 2.2 lists the National, State and regional total land sizes and number of land holdings attributed to relevant agricultural activities.

Table 2.3 displays the total farm numbers and areas within the Region, as detailed in the ABS Agricultural Survey (2016), and how they are divided between grazing and cropping lands. Grazing is the dominant agricultural land use throughout the Region, accounting for approximately 94.6% of total farmland. Cropping is much more limited in extent, accounting for approximately 5.4% of total farmland. Farmland used to grow grapes for the production of wine comprises approximately 0.13% of total farmland in the Region. It is noted that statistics relating to the total area of land used for olive production are not available.

2.8.2 Livestock

Livestock enterprises (sheep and cattle) account for approximately 94.6% of the total farmland within the Region.

Resources committed by livestock producers, such as pasture improvement, high value genetics etc, can significantly impact the net return per unit of operation. These factors result in a spectrum of production values per unit per annum with low cost operations typically resulting in a lower yield than high cost operations. **Table 2.4** presents the average production per unit per annum for cattle and sheep in the Region.

Table 2.2
National, State and Regional Agricultural Statistics

Agricultural Commodities	National	NSW	Regional	% of NSW
Area of farmland holdings	371,078,257ha	53,438,094ha	500,458ha	0.94
Number of holdings	85,681	26,124	529	2.02
Cropping (total)	24,628,339ha	6,374,089ha	27,097ha	0.40
Number of holdings	54,992	15,009	253	1.69
Gross Production Value $	$27.3 billion	$6.9 billion	$17.7 million	0.26
Fruit and nuts (exclude grapes)	169,539ha	37,461ha	188ha	0.50
Number of Holdings	4,982	1,527	10	0.65
Gross Production Value $	$4,224.6 million	$614.0 million	$542,505.10	0.09
Grapes for wine	123,314ha	29,211ha	645ha	2.21
Number of holdings	3,230	593	27	4.55
Gross Production Value $	$880.5 million	$147.5 million	$967,843	0.66
Olives (no.)	5,658,942 trees	666,165 trees	19,412 trees	2.91
Number of holdings	325	75	7	9.33
Pasture cut for Hay	1,775,381ha	349,367ha	5,587ha	1.60
Number of Holdings	24,095	5,986	152	2.54
Gross Production Value $	$461.2 million	$54.9 million	$653,762.10	1.19
Sheep & Lambs (total)	67,543,092 head	25,968,194 head	635,083 head	2.45
Number of Holdings	31,136	11,658	322	2.76
Gross Production Value $ (slaughtered)	$3,239.4 million	$734.5 million	$16.2 million	2.21
Gross Production Value $ (wool)	$2,964.9 million	$946.1 million	$23.1 million	2.44
Cattle (total)	24,971,349 head	4,997,700 head	112,414 head	2.25
Number of Holdings	42,799	15,985	396	2.48
Gross Production Value $ (slaughtered)	$13,086.8 million	$2,561.9 million	$57.7 million	2.25
Source: ABS (2016b)				

Table 2.3
Regional Land Uses

Land Use	Number of Holdings	Area (ha)	Total Farm Area (%)
Farm land – total	529	500,458	100
Crops (including hay, silage, viticulture and horticulture)	253	27,097	5.4
Grazing Land (sheep and cattle)	718	473,361	94.6
Source: ABS (2016b)			

Table 2.4
Cattle and Sheep Grazing Value per Unit per Annum

Grazing Production System	Average Production per unit per annum
Cattle for slaughter	$513
Sheep for slaughter and wool	$62
Source: ABS (2016b)	

Cattle Industry

ABS data indicate a total cattle population in the Region of 112 414. **Figure 2.2** identifies the number of prime stock[1] and store stock[2] cattle processed through the Mudgee Regional Saleyards, the only saleyards in the Region, from 2011-12 to 2018-19 (J. Best, *personal communication*, 21 May 2018, 7 January 2019, 8 July 2019). Prime stock cattle comprise a large proportion of overall stock sales processed through the Mudgee Regional Saleyards which indicates that many producers are investing significant resources to finishing stock for slaughter. Store cattle typically make up only a minor proportion of overall cattle sales, especially considering sales figures are for single units which may be sold multiple times in any one year. It is noted that the increased sales in 2014-15 and 2017-18 are likely to be reflective of the drier than usual weather conditions experienced during these periods.

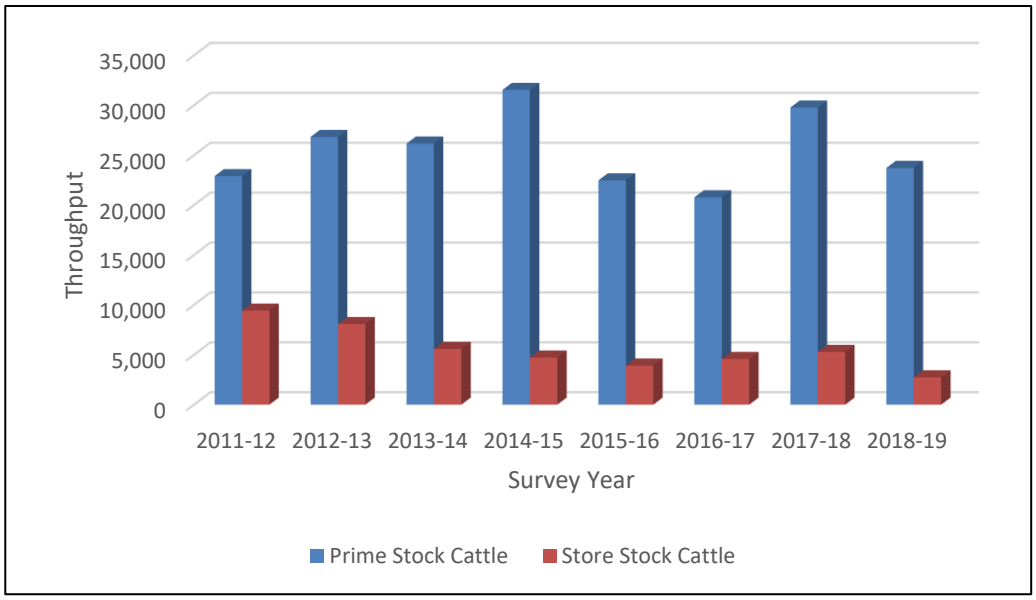

Figure 2.2 Mudgee Regional Saleyards – Cattle Sales

Sheep Industry

According to ABS data, the total regional sheep population in 2015-16 was approximately 635 083. **Figure 2.3** shows the split between lamb and sheep sales processed through the Mudgee Regional Saleyards from 2011-12 to 2018-19 (J. Best, *personal communication*, 21 May 2018, 7 January 2019, 8 July 2019). Lambs for slaughter comprise the bulk of sheep processed through the Mudgee Regional Saleyards which reflects the low demand for mutton. The overall proportion of sheep and lambs processed through the Mudgee Regional Saleyards is much lower than cattle as most sheep in the Region are raised for wool production and not slaughter. Also, most sheep in the district tend to be sold through either the Dubbo or Dunedoo saleyards.

[1] Stock that have adequate fat cover and body composition to be ready for slaughter.
[2] Stock that are sold for breeding or future finishing.

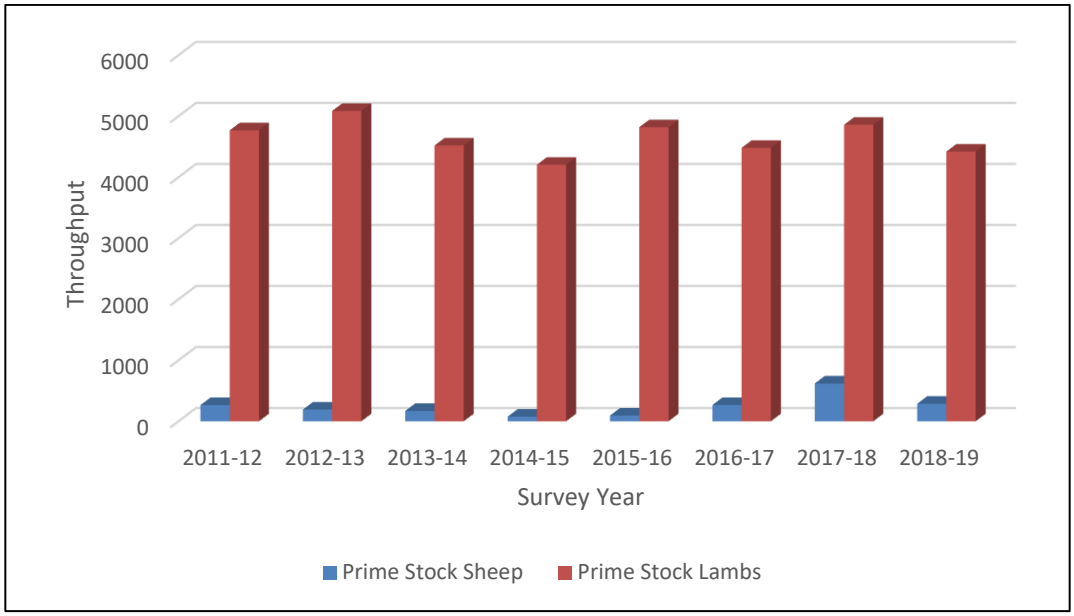

Figure 2.3 Mudgee Regional Saleyards – Sheep and Lamb Sales

2.8.3 Other Agricultural Sectors

Grapes

The Region has a long history of grape production, with the first vineyard planted in the 1850s during the Gold Rush. A total of approximately 645ha of land is utilised for grape production across the Region and comprises a total of 27 agricultural holdings. The vineyards tend to be concentrated to the north of Mudgee, typically between altitudes of 450m AHD to 600m AHD, although some vineyards are located up to 1 180m AHD. The primary grape varieties grown in the Region are Shiraz, Cabernet Sauvignon and Merlot due to the combination of reliable warm daytime temperatures and cool nights.

There are a number of commercial sized vineyards throughout the Region with a total gross production value of approximately $1 million in 2015-16 (ABS, 2016b). Grapes for wine production returned an average of $1,500 per hectare throughout the Region (ABS, 2016b).

Olives

The Region has a growing olive production industry comprising a total of seven holdings. There are approximately 19 000 olive trees in the Region which accounts for approximately 3% of total olive production in NSW.

2.8.4 Agri-Tourism

A notable component of the wider tourism sector throughout the Region is agri-tourism, principally comprising guesthouses and bed and breakfasts (B&Bs) catering principally to the Region's wine industry. Guesthouses and B&Bs are interspersed throughout the Region, however, there is a notable cluster to the northeast of Mudgee. The numerous wineries are the primary agricultural attraction for tourists visiting the Region.

2.9 REGIONAL AGRICULTURAL SUPPORT INFRASTRUCTURE

The Region is serviced by multiple main roads with the townships of Mudgee and Gulgong both serviced by the Castlereagh Highway which in turn provides access to Sydney and Brisbane.

The only rail link that remains in the Mid-Western Regional LGA is used to transport coal from the Ulan-Wollar area to the Port of Newcastle and Eraring Power Station. No passenger services are in service on this rail line. The use of the railway line, which connects Gulgong and Mudgee with Lithgow to the south and Dubbo to the north, discontinued in 2005 due to the closure of the Gulgong-Kandos section of the Wallerawang-Gwabegar line (Roberts, 2012).

The Mudgee Regional Saleyards are the only livestock saleyards in the Region with public stock sales held every Wednesday and store sales held on the last Thursday of every month. Both cattle and sheep are processed through the facility. The Mudgee Regional Saleyards also provides a range of other services including a truck wash facility, stock impounding, stock stopovers for long haul carriers and private kill sales.

2.10 REGIONAL AGRICULTURAL BUSINESS ENTERPRISES

Agricultural business enterprises are typically centred in Mudgee which acts as a regional centre for the Mid-Western Regional LGA. **Table 2.5** identifies the major agricultural businesses in Mudgee.

Table 2.5
Agricultural Business Enterprises in Mudgee

Page 1 of 2

Infrastructure	Location
Rural Services and Supply Stores	
Mudgee CRT Centre	5b Sydney Road, Mudgee
Cudgegong Rural Supplies	36 Sydney Road, Mudgee
On-Trac-Ag	215 Market St, Mudgee
B.A. Stewart Engineering	25 Sydney Road, Mudgee
Mudgee Machinery	9 Sydney Road, Mudgee
Landmark	10 Sydney Road, Mudgee
Solar Pumping Solutions	28 Sydney Road, Mudgee
Double R	42-44 Sydney Road, Mudgee
Roth's Produce	62 Sydney Road, Mudgee
Furneys Mudgee	50 George Street, Mudgee
Corbett Pumps and Irrigation	Cnr Inglis and Perry Street, Mudgee
Mudgee Viticultural Services	"Carranar" Eurunderee Road, Mudgee
Price Farm Machinery	Lot 2, Sydney Road, Mudgee
Royston Petrie Seeds	11B Industrial Avenue, Mudgee
Hodges (EW) Farm Contracting Services	4 Putta Bucca Road, Mudgee
PB Ag Consulting	25 Perry Street, Mudgee
Russell's Chaff and Grain Milling	57 George Street, Mudgee
Rural Financial Counselling Service	62-68 Church Street, Mudgee

Table 2.5 (Cont'd)
Agricultural Business Enterprises in Mudgee

Infrastructure	Location
Rural Services and Supply Stores (Cont'd)	
SA Vagg Contracting – Grader Hire	Mudgee
Complete Steel & Rural	27 Sydney Road, Mudgee
Elders	20C Sydney Road, Mudgee
Livestock Agencies	
CS Livestock Mudgee	PO Box 909, Mudgee
Elders	20C Sydney Road, Mudgee
McDonald Lawson	73 Church Street, Mudgee
Landmark	10 Sydney Road, Mudgee
Sources: Yellow Pages, Google	

3. LOCAL SETTING

3.1 INTRODUCTION

This section summarises the relevant environmental features and agricultural setting within the Lue district. The boundary of the Lue district is displayed on **Figure 1.5** and encompasses the Lue State Suburb Code (SSC), Pyangle SSC and Monivae SSC to draw together the key agricultural enterprises in the vicinity of the Mine Site that could potentially be impacted by the Project.

3.2 LOCAL LAND USES

Figure 3.1 shows the existing land uses within and immediately surrounding the Lue district.

Apart from Lue, all land immediately surrounding the Mine Site comprises a combination of grazing, lifestyle lots and heavily vegetated areas with minimal land use. It is noted that there are likely to be more lifestyle lots within the Lue district, however, there is insufficient data available to define these lots. Grazing is the predominant land use immediately surrounding the Mine Site.

Minor areas surrounding the Mine Site are utilised for horticultural activities, in particular, the Rylstone Olive Press and East Ridge Olives which are both notable olive growers. These two enterprises are located approximately 5.3km southeast and 2.6km east of the Mine Site, respectively. Viticulture enterprises are also established within the Lue district, with Elephant Mountain Wines being the closest vineyard to the Mine Site (3.8km east). Elephant Mountain Wines also operates a bed and breakfast (B&B), known as Elephant Mountain House and a wedding venue. Several vineyards are located on the Castlereagh Highway immediately south of Mudgee with the closest being approximately 12.8km from the Mine Site.

A notable component of the wider tourism sector throughout the Region is agri-tourism, principally comprising guesthouses and B&Bs catering to the Region's wine industry. Guesthouses and B&Bs are interspersed within and immediately surrounding the Lue district and include the 'WYUNA' Lue Farmstay (1.1km south), Odd Frog Lodges (1.1km south), the Old Bara Guesthouse (5.5km northwest), Rokbara Cottage (4.7km north) and Camphill Cottage (11.4km southeast). The numerous wineries and scenic nature of the area are the principal attractions for tourists. Tourist Drive 2 connects Capertee on the Castlereagh Highway with the towns of Kandos, Rylstone, Lue and Mudgee and is a popular drive which showcases the Capertee and Lue Valleys (Rylstone Kandos Chamber of Commerce, 2015).

The Louee Enduro and Motocross Complex is located approximately 3.0km south of the Mine Site. This complex is located within Lue Station, a working sheep and cattle property, and provides over 150km of off-road motorbike trails, a workshop, canteen and accommodation (Shearer's Quarters, Dungeree House, Lue Cottage, Lue Station and a campground). This complex is also a destination of visitors to the local area when staying at local guesthouses and B&Bs.

Other land uses that occur within the area immediately surrounding the Lue district include the extractive industry with three quarries located near the Mine Site. These quarries include the Mt Knowles Quarry, the Bara Quarry and a privately-owned quarry on the southern side of Lue

Road opposite the Rylstone Olive Press. The Mt Knowles and Bara Quarries are located approximately 12.1km and 2.4km to the northwest of the Mine Site, respectively. The privately-owned quarry is located approximately 6.9km to the southeast of the Mine Site.

Large tracts of land also remain heavily vegetated within the Lue district, primarily on steep, hilly terrain. The closest forestry reserve is the Dungeree State Forest which is located in the area immediately surrounding the Lue district approximately 7.1km to the south of the Mine Site.

The Windamere Dam, which collects the natural flow of the Cudgegong River, is located approximately 10km southwest of the Mine Site in the area immediately surrounding the Lue district. The dam supplies water for both agricultural production and town water within the Mid-Western Regional LGA. It also provides for flood mitigation and recreational activities.

3.3 LOCAL TOPOGRAPHY

The Lue district straddles three main topographic units.

- The northern section is located on the outer western flanks of the Great Dividing Range and comprises hilly, steep terrain.
- The central section is located within a broad, undulating alluvial valley which slopes gently to the northeast, effectively following the flow direction of Lawsons Creek.
- The southern section is dominated by steep terrain along a northwest trending ridgeline.

Elevations within the Lue district reach a maximum of approximately 930m AHD in the north and 880m AHD in the south. Elevations within the central section of the Lue district range between approximately 550m AHD to 620m AHD with maximum elevations reaching approximately 675m AHD. The topography and major drainage lines are shown on **Figure 3.2**.

3.4 LOCAL SOILS

The Lue district comprises a number of SLUs. **Figure 3.3** displays the SLUs across the Lue district. **Table 3.1** presents information relating to the mapped SLUs within the district and potential land capability constraints.

The land and soil capability (LSC) within the Lue district is strongly dictated by the topography and geology of the Region (Murphy & Lawrie, 1998). The LSC ranges from between LSC Class 3 to Class 8 across the Lue district with the majority of land comprising Class 4 to Class 7. There is no LSC Class 1 or Class 2 land within the Lue district.

The steep, hilly areas, which comprise the northern and southern areas of the Lue district, are strongly associated with low LSCs. This is primarily due to constraints associated with cropping on steep slopes, high erosion rates, rocky terrain and low chemical fertility (Murphy & Lawrie, 1998). The rural capability in these areas is restricted to limited grazing, timber and forest preservation.

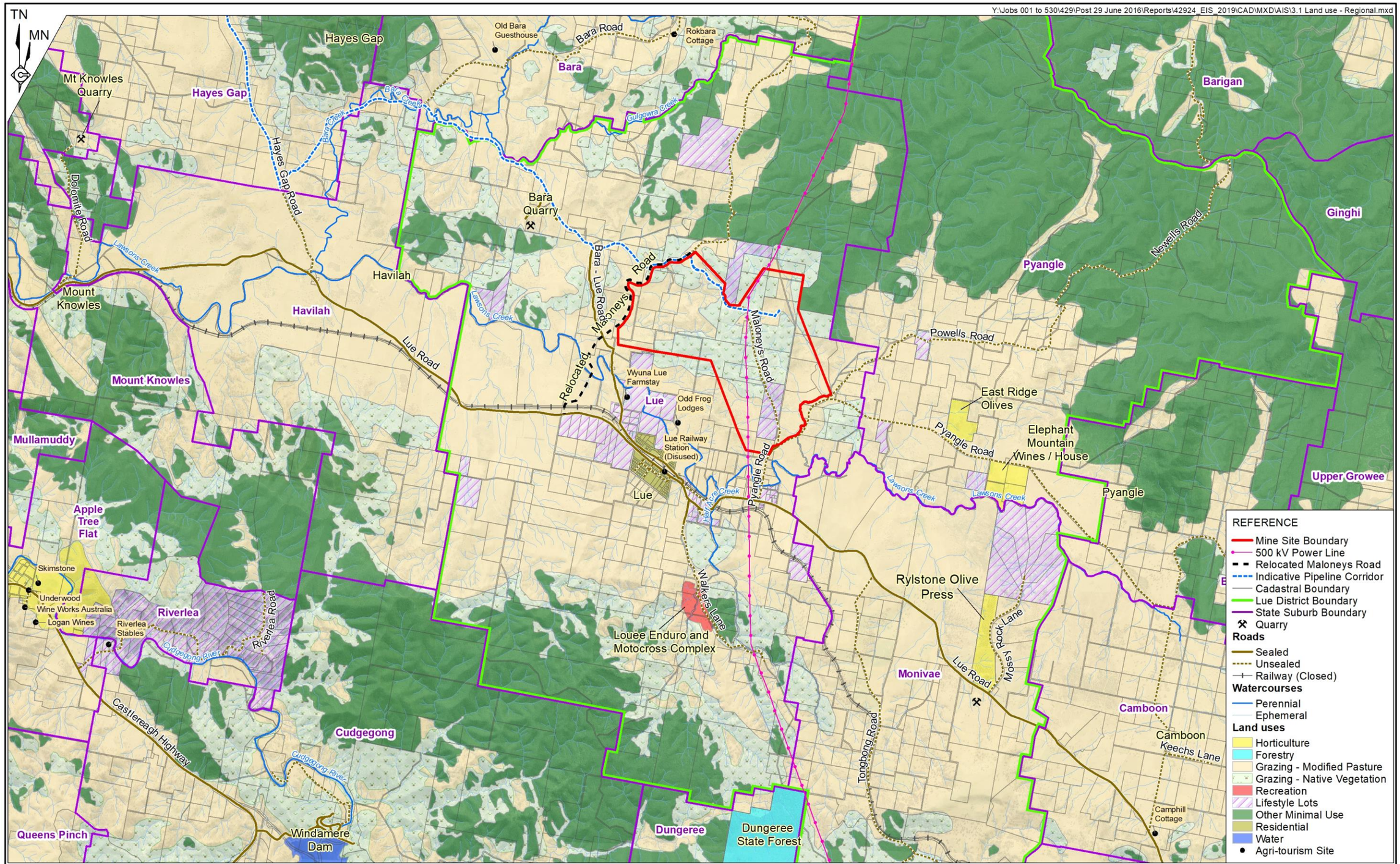

Figure 3.1
LAND USE - LUE DISTRICT

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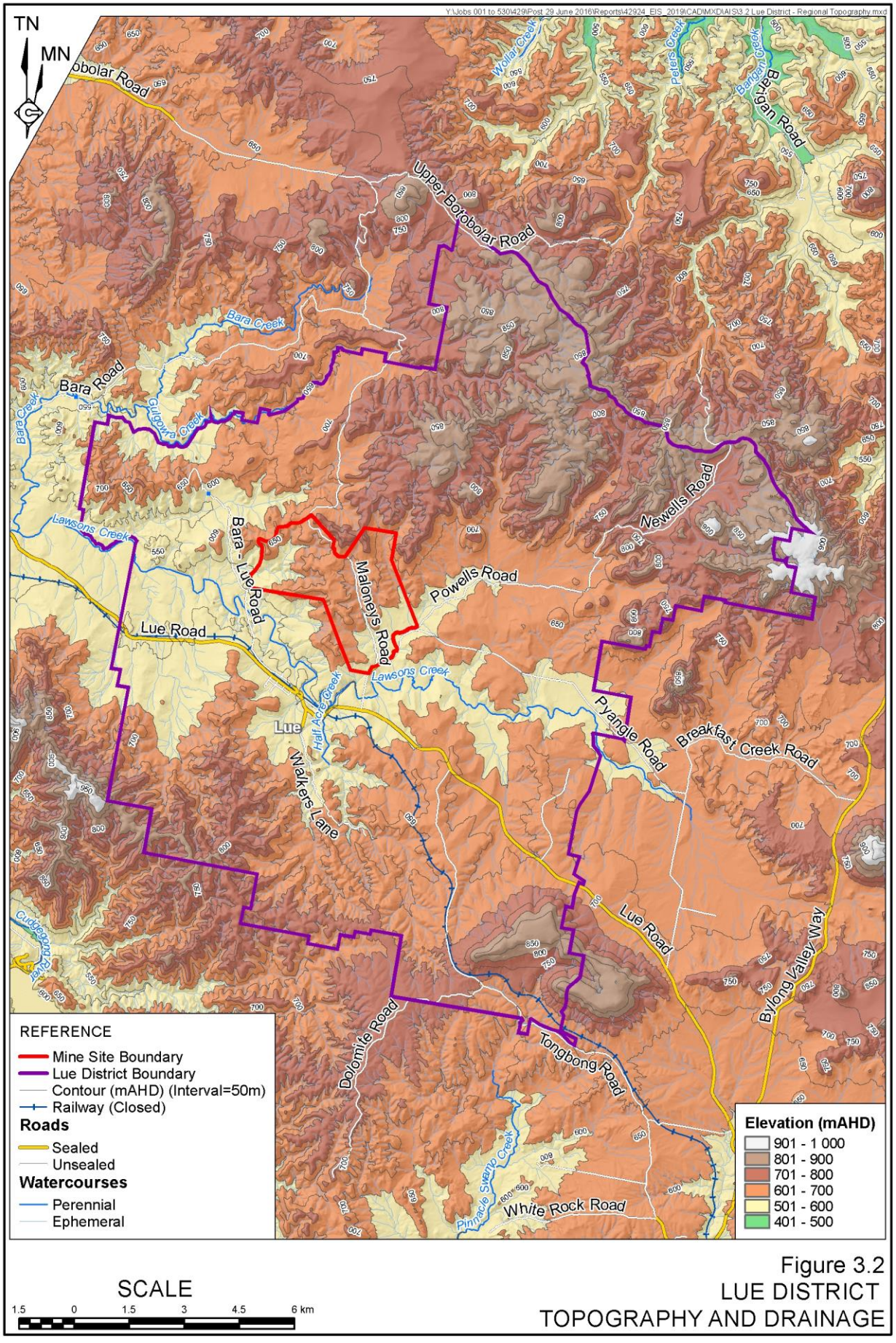

Figure 3.2
LUE DISTRICT
TOPOGRAPHY AND DRAINAGE

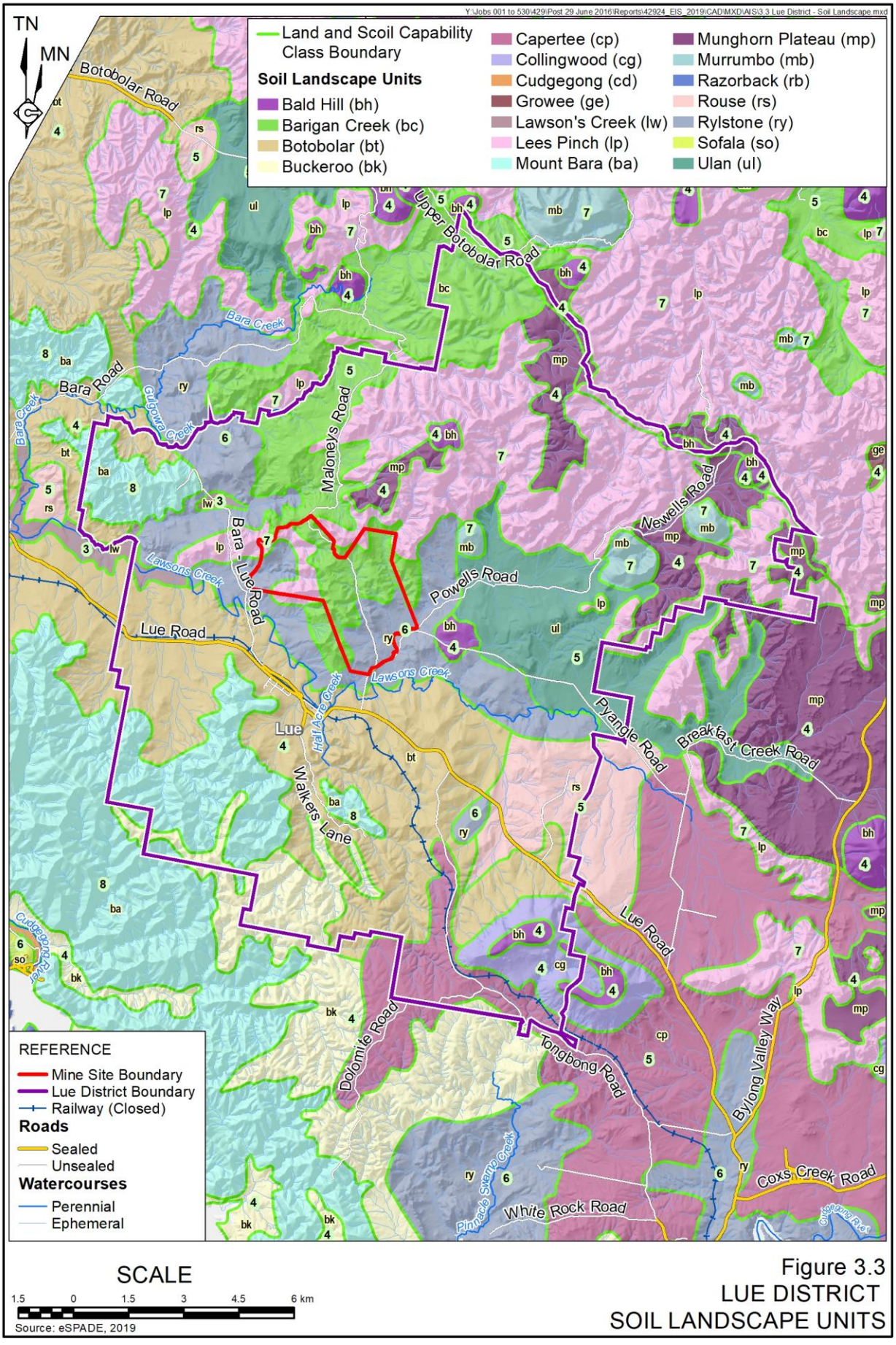

Figure 3.3
LUE DISTRICT
SOIL LANDSCAPE UNITS

Table 3.1
Soil Landscape Units within the Lue District and Land Capability Constraints

SLU	Parent Materials and Soil Types Present	Land Capability Constraints
Bald Hill (bh)	Basalt: Euchrozems on crests; Brown Clays on lower slopes.	LSC Class 4 – Moderate to high limitations. Steep slopes, rock outcrop and stoniness, but moderate to high fertility and waterholding capacity. Low salinity.
Barigan Creek (bc)	Shale, sandstone, siltstone, conglomerate, chert. Common soils are Yellow Podzolic Soils on lower slopes and along drainage lines. Red Podzolic Soils on higher colluvial slopes, benches and rises.	LSC Class 5 – High limitations High erosion hazard under cropping or where there is low surface cover. Salinity in localised areas in drainage depressions.
Botobolar Non-Calcic Brown Soils (bt)	Slate, phyllite, limestone, rhyolite, dacite, shale, sandstone and minor alluvial and colluvial derivatives. Soils include Non-Calcic Brown Soils, Shallow Soils near hill tops and Yellow Podzolic-Solodic Soils on poorly drained soils.	LSC Class 4 – Moderate to high limitations High to very high erosion hazard and low surface cover. Weakly structured surface soils. Moderate waterholding capacity. Isolated low levels of salinity along drainage lines.
Buckeroo (bk)	Grey green shale, felspathic arenite, conglomerate, some dolomitic limestone. The formation also includes small areas of dolomitic limestone, which are quarried. Non-calcic Brown Soils, Shallow Non-calcic Brown Soils, Yellow Podzolic Soils and Yellow Podzolic-Solodic Soils.	LSC Class 4 – Moderate to high limitations Moderate to high erosion hazards. Low levels of salinity. Soils on lower slopes and depressions can be waterlogged.
Lawsons Creek (lw)	Recent and Quaternary (Cza) alluvium of unknown depositional history. Much of the gravel is angular phyllite and quartz. Profiles consist of dark, greyish-brown overbank alluvium which may be reddishbrown at depth, overlying various depositional units such as gravels, sands and fines.	LSC Class 3 – Moderate limitations Erosion hazard is high along some sections of streambanks. Soil salinity is absent and unlikely to occur.
Lees Pinch (lp)	Shallow Siliceous Sands. Some Yellow and Brown Earths on footslopes. Yellow and Grey Soloths in breaks of slope. Yellow Podzolic Soils and Earthy Sands on some upper slopes.	LSC Class 7 – Severe limitations Very poor water holding capacity, acidity and a lack of nutrients. Prone to water erosion when bare. No salinisation.
Mount Bara (ba)	Narrabeen Sandstone. Mainly shallow siliceous sands. Yellow Earths and Yellow Podzolic Soils on lower slopes and in depressions.	LSC Class 8 – Very severe limitations Low waterholding capacity, rock outcrop, seasonal waterlogging, high permeability, acid surface soil. Low salinity.
Munghorn Plateau (mp)	Sandstone, Wollar sandstone, conglomeratic sandstone, redbrown and green mudstone. Siliceous Sands, Yellow Earths and Yellow Podzolic Soils.	LSC Class 4 – Moderate to high limitations High to very high erosion hazard. No soil salinity. Low bearing water bearing capacity and rock outcrops common. Soil fertility is low.
Murrumbo (mb)	Microsyenite. Red earths.	LSC Class 7 – Severe limitations Extreme erosion hazard. No soil salinity. Soil fertility is low.

Table 3.1 (Cont'd)
Soil Landscape Units within the Lue District and Land Capability Constraints

SLU	Parent Materials and Soil Types Present	Land Capability Constraints
Rouse (rs)	Gulgong Granite, biotite granite, adamellite, granodiorite. Mainly shallow Siliceous Sands and Earthy Sands on mid-slopes and upper slopes. Yellow Soloths and yellow Solodic Soils on lower slopes and in depressions. Other soils include bleached sands, and Non-calcic Brown Soils and Red Earths on small areas of less siliceous rock.	LSC Class 5 – High limitations Soil fertility is very low and surface soils are acidic. High to very high erosion hazard under cultivation. Waterholding capacity is low to very low. Low levels of salinity are apparent and common.
Rylstone Siliceous Sands (ry)	Rhyolite and dacitic tuff. Mainly shallow siliceous sands and bleached sands. Some Yellow and Red Podzolic Soils on sloping areas and Solodic Soils / Soloths in drainage lines.	LSC Class 6 – Very high limitations Shallow soils, rock outcrop, low waterholding capacity, seasonal waterlogging, sodic subsoils in depressions, very high erosion hazard under cultivation. Low levels of salinity.
Ulan (ul)	Shale, sandstone, conglomerate, chert, coal and torbanite seams. Yellow Podzolic Soils on lower slopes and drainage lines with patches of yellow Solodic Soils/Solonetz in association with salt scalds. Yellow and Brown Earths on footslopes with minor areas of Earthy Sands on low rises.	LSC Class 5 – High limitations Soil fertility is low. Surface soils are slightly acidic. High levels of soil salinity.
Source: Murphy and Lawrie (1998)		

Much of the undulating terrain, within the central portion of the Lue district, is suited to agriculture. LSC classes in this Region typically range between LSC Class 4 to Class 6 with large areas suitable for grazing. Cropping and viticulture are also viable in parts of the central portion of the Lue district, however, the land is typically not suited to extensive horticultural operations.

The land with the highest capability in the Lue district is classified as LSC Class 3 and incorporates minor segments of land, totalling approximately 1.5km^2, within the western extent of the district. Some of this land is designated BSAL (see **Figure 1.8**) Land classified as LSC Class 3 is invariably associated with the Lawsons Creek SLU and is found exclusively adjacent to Lawsons Creek and Bara Creek.

3.5 LOCAL WATER RESOURCES

3.5.1 Surface Water

The Lue district is located within the Lawsons Creek catchment, a subcatchment of the Cudgegong River and Macquarie River catchment. Lawsons Creek flows in a northwesterly direction immediately north of Lue, and then westerly until its confluence with the Cudgegong River near Mudgee. Lawsons Creek is fed by several semi-perennial watercourses including Breakfast Creek and Hawkins Creek.

3.5.2 Groundwater

Groundwater within the Lue district is located within the following Water Sharing Plans (WSPs).

- Lawsons Creek Water Source of the Macquarie Bogan Unregulated and Alluvial Water Sources.
- Sydney Basin Groundwater Source of the NSW Murray Darling Basin Porous Rock Groundwater Sources.
- Lachlan Fold Belt Groundwater Source of the NSW Murray Darling Fractured Rock Groundwater Sources.

An analysis of groundwater bore data within a 10km radius of the Mine Site boundary has been undertaken in order to identify and quantify groundwater use (**Figure 3.4**). A total of over 100 bores are located within approximately 10km of the Mine Site comprising 9 bores for irrigation, 23 bores for stock and domestic use, 38 bores for general water supply, 29 bores for groundwater monitoring, 1 bore for commercial and industrial use and 1 bore for unknown purposes. Six groundwater bores have associated WALs with relevant details provided in **Table 3.2**.

Table 3.2
Summary of Groundwater WALs within Lue district

WAL	Distance from Main Open Cut Pit	Associated Groundwater Work	Use	Water Source	Extraction Limit (ML)
27907	3.4km	GW011493	Stock, Irrigation, Domestic	Sydney Basin Murray Darling Basin Porous Rock Groundwater Source	50
35671	6.5km	GW065121	Irrigation	Sydney Basin Murray Darling Basin Porous Rock Groundwater Source	60
28443	2.5km	GW802732	Irrigation	Lachlan Fold Belt Murray Darling Basin Fractured Rock Groundwater Source	19
28946	9.9km	GW042966	Stock, Irrigation, Domestic	Lachlan Fold Belt Murray Darling Basin Fractured Rock Groundwater Source	35
29014	3.4km	GW066291	Stock, Irrigation, Domestic	Lachlan Fold Belt Murray Darling Basin Fractured Rock Groundwater Source	6
29247	5.2km	GW062111	Industrial	Lachlan Fold Belt Murray Darling Basin Fractured Rock Groundwater Source	30
Source: Jacobs (2020) – Modified after Table 7					

3.6 LOCAL VEGETATION

Figure 3.5 shows the major vegetation communities of the Lue district. Uncleared land is strongly correlated with steep terrain and is concentrated in the northern and southern areas of the Lue district. Cleared land comprises the majority of the undulating terrain in the centre of the Lue district which is used extensively for grazing and other agricultural activities.

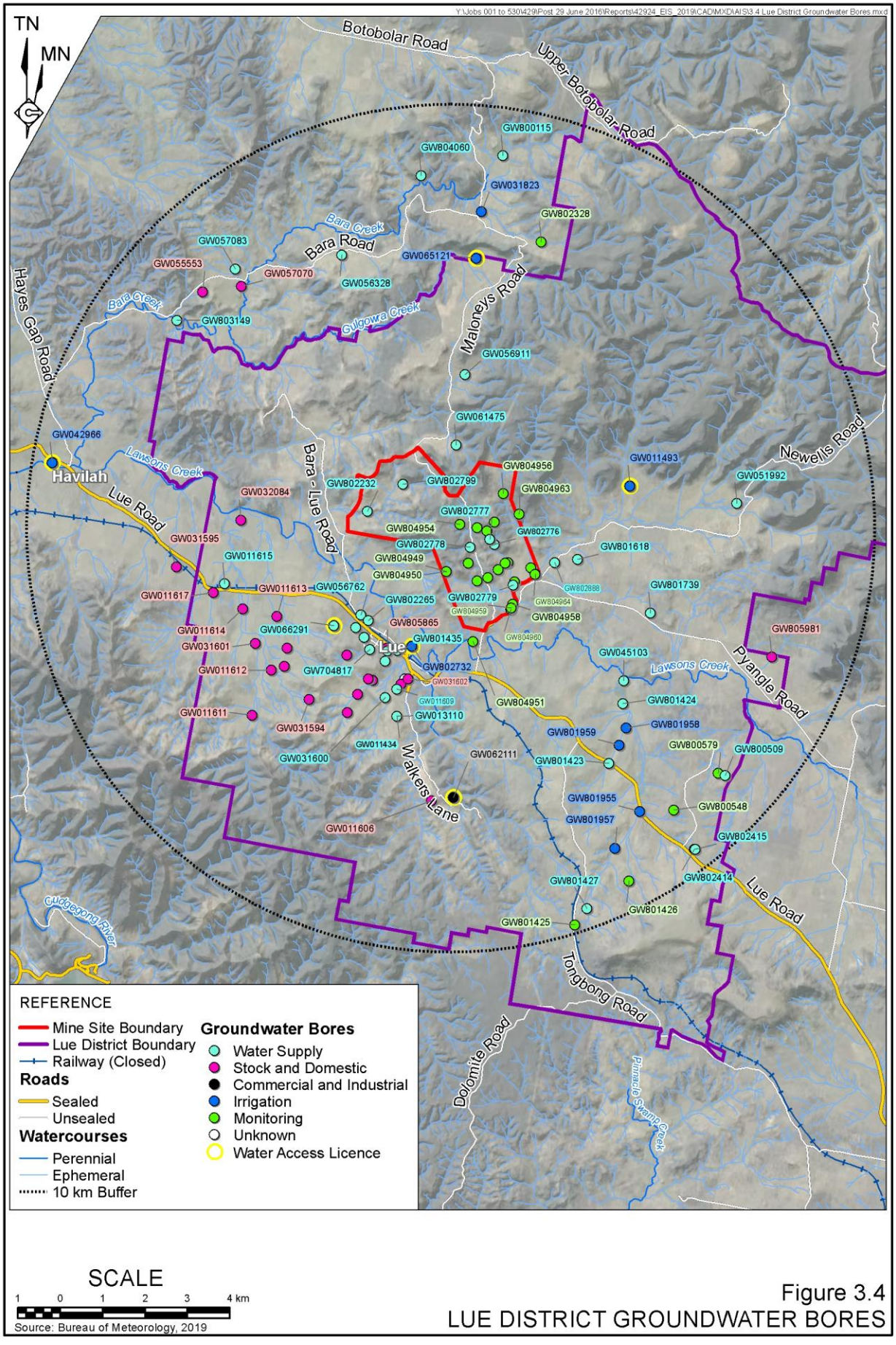

Figure 3.4
LUE DISTRICT GROUNDWATER BORES

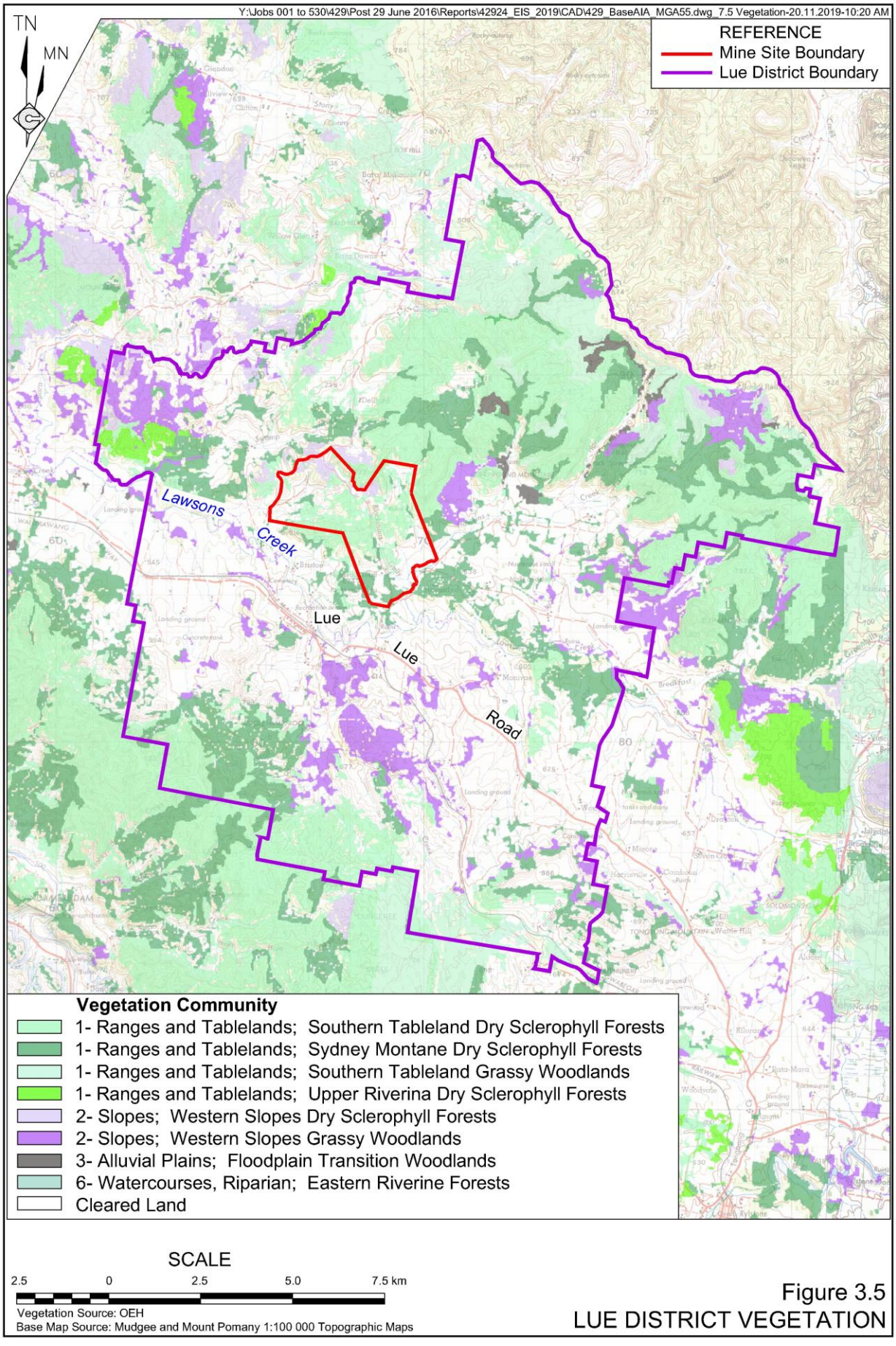

Figure 3.5
LUE DISTRICT VEGETATION

3.7 LOCAL AGRICULTURAL SUPPORT INFRASTRUCTURE

3.7.1 Introduction

Local transport and support businesses/services are the key local agricultural support infrastructure. The following subsections detail the infrastructure identified within the Lue district.

3.7.2 Local Transport Infrastructure

The Lue district is serviced by roads maintained by the Mid-West Regional Council which provide access to the township of Mudgee and the Castlereagh Highway. The main local roads in the Lue district are Lue Road, Pyangle Road, Powells Road, Maloneys Road, Bara-Lue Road and Tongbong Road. Most local agricultural producers utilise these roads to gain access to Mudgee or utilise the regional road network to access larger commercial centres such as Dubbo, Orange, Bathurst and potentially Sydney and Brisbane.

Whilst rail infrastructure is present within the Lue district, the rail line is closed and has not been operational since 2005. There are no current plans to re-open the rail line.

3.7.3 Local Business Infrastructure

Local agricultural enterprises primarily utilise the business infrastructure in Mudgee which acts as a focal point for the Region. Section 2.9 identifies the key business infrastructure in Mudgee which is relied upon by the agricultural enterprises within the Lue district.

3.8 LOCAL AGRICULTURAL BUSINESS ENTERPRISES

An analysis of soil productivity, undertaken as part of the AIS, reinforces the historical view that the land within the Lue district is not highly productive, notwithstanding the fact that some landowners have managed to generate a reasonable return from the land.

Livestock

Agricultural activities within the Lue district are primarily restricted to livestock grazing. The operations are typically small-scale and no known major commercial operations operate in the district.

Grape Production

One vineyard is located within the Lue district, approximately 3.8km southeast of the Mine Site. The operation specialises in Shiraz grapes and comprises a total of approximately 6ha of land. The enterprise, known as “Elephant Mountain Wines”, also operates a guesthouse at the same location which provides self-contained accommodation for up to 16 people.

Olive Production

Two olive groves are located within the Lue district. East Ridge Olives is located on Pyangle Road, approximately 2.6km from the Mine Site. East Ridge Olives produces a range of olive oils which are sold at a number of specialised outlets. Rylstone Olive Press is located on Mossy Rock Lane, approximately 5.3km to the southeast of the Mine Site. The operation comprises approximately 27ha of olive groves and an olive oil production facility. Rylstone Olive Press produces a range of olive oils which are sold in small independent grocers and delicatessens, as well as directly at their cellar door. Rylstone Olive Press has obtained organic certification under Australian Certified Organic (ACO), Japanese Organic Standard (JAS) and the United States Department of Agriculture (USDA).

4. MINE SITE SETTING

4.1 INTRODUCTION

This section summarises the relevant environmental features and agricultural setting of the Mine Site and immediate surrounds which is located approximately 2km to 3km to the northeast of Lue and comprises an area of approximately 999ha. It is noted that approximately 420ha of the 999ha is proposed to be disturbed throughout the Project Life.

For the purposes of this assessment, the footprint of the relocated Maloneys Road (approximately 20ha) and the properties owned by Bowdens Silver in the area immediately surrounding the Mine Site which comprise part of the Bowdens Farm (approximately 547ha), are also considered in conjunction with the Mine Site.

4.2 MINE SITE LAND USES

Figure 4.1. displays the various land uses and their respective areas within and immediately surrounding the Mine Site. **Table 4.1.** lists the area of each land use within the Mine Site together with its proportion of the Mine Site.

Table 4.1
Existing Land Uses within the Mine Site

Land Use	Total Area (ha)	Proportion of Mine Site (%)
Grazing – Native Vegetation	427	42.8
Grazing – Modified Pasture (Improved)	333	33.3
Grazing – Modified Pasture (Not Improved)	150	15.0
Cropping	13	1.2
Dams	3	0.3
Exclusion Zone (Aboriginal Heritage)	25	2.5
Lifestyle Lot	49	4.9
Total	999	100

The majority of land within the Mine Site is currently used for agricultural activities with a single lifestyle lot (49ha) located in the southeastern quadrant. Agricultural activities conducted within the Mine Site are largely restricted to grazing of livestock on approximately 910ha of land. Grazing land comprises approximately 427ha of heavily vegetated and/or steeply sloping land with low agricultural capability (principally LSC Class 6) and use and approximately 483ha of modified pasture with a low to moderate agricultural capability (LSC Classes 3 to 6) (see SMD, 2020). Approximately 333ha of modified pasture is subjected to periodic pasture improvement, which typically involves weed control and/or the selective application of fertiliser, whilst the remaining 150ha is generally not improved. Approximately 13ha within the Mine Site is used for cropping. The cropping program is directed towards winter forage crops to turn off fat lambs and steers as well serving to “clean up” paddocks by removing weeds. It is noted that an area of approximately 25ha in the southeastern corner of the Mine Site has been excluded from agricultural activities at the request of registered Aboriginal parties in order to avoid disturbance to Aboriginal artefacts which have been identified in the area.

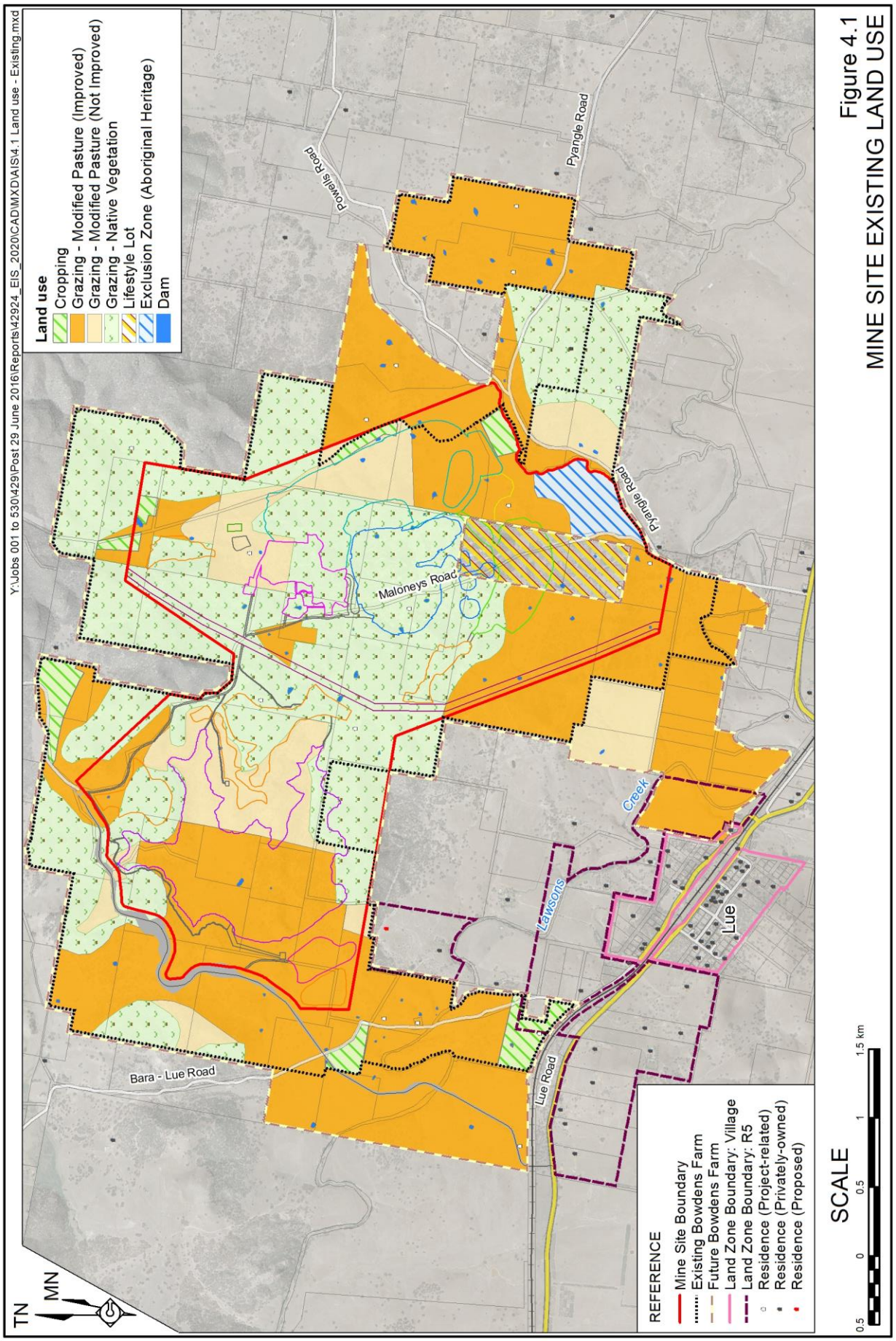
Figure 4.1
MINE SITE EXISTING LAND USE
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Land use
Cropping
Grazing - Modified Pasture (Improved)
Grazing - Modified Pasture (Not Improved)
Grazing - Native Vegetation
Lifestyle Lot
Exclusion Zone (Aboriginal Heritage)
Dam
Powells Road
Pyangle Road
Maloneys Road
Creek
Lawsons
Lue
Bara - Lue Road
Lue Road
REFERENCE
Mine Site Boundary
Existing Bowdens Farm
Future Bowdens Farm
Land Zone Boundary: Village
Land Zone Boundary: R5
Residence (Project-related)
Residence (Privately-owned)
Residence (Proposed)
SCALE
0.5
0
0.5
1
1.5 km
TN
MN

An additional 20ha of land currently used for agriculture is located within the footprint of the proposed relocated Maloneys Road. This land principally comprises grazing land with <1ha currently used for cropping and 3ha being heavily vegetated and/or steeply sloping land.

The Bowdens Farm

Bowdens Silver owns and operates a farming operation (the "Bowdens Farm") on part of the land it currently owns which comprises approximately 1 655ha within and surrounding the Mine Site (**Figure 4.1**).

The Bowdens Farm is currently used for grazing approximately 1 330 Merino sheep and 16 Black Angus cattle, comprising 11 yearling heifers and 5 weaner calves, on areas with (683ha) and without (187ha) pasture improvement as well as lower capability land comprising heavily vegetated and/or steeply sloping land (661ha). Pasture improvement typically involves weed control (principally for blackberry, Bathurst Burr, Scotch Thistle, Serrated Tussock and saffron thistle) and/or the selective application of fertiliser. Control of weed species assist to encourage growth of the pasture species. At times, these areas are sown with a subterranean clover after the level of weed growth is reduced. Areas that are not pasture improved are still subject to selective weed control.

Cropping areas within the Bowdens Farm (46ha) are typically sown with a winter forage crop, such as oats, together with a diammonium phosphate (DAP) fertiliser at a rate of 100kg/ha. After two seasons of cropping, these areas are planted with either a summer crop of coxfoot, phalaris and clover, or a winter crop of premier digit grass and clover. Approximately 80kg/ha of startup fertiliser is applied with both summer and winter crops.

Other land uses within the Bowdens Farm include an Aboriginal heritage exclusion zone (25ha) and water supply dams (4ha).

4.3 MINE SITE TOPOGRAPHY

Figure 4.2 displays the topography within and immediately adjacent to the Mine Site with the key ridges and watercourses within the Mine Site identified. The topography of the eastern and central sections of the Mine Site and its immediate surrounds is primarily influenced by three north/south orientated ridges with small intermediate valleys whilst three generally northeast/southwest orientated ridges influence the topography in the western section of the Mine Site. These ridges contain (from east to west) the confined valleys of the ephemeral Price Creek, an un-named watercourse, Blackmans Gully and Walkers Creek, plus valleys of minor drainage features.

The eastern ridge, located in the eastern section of the Mine Site, with a maximum elevation of approximately 770m AHD, is the highest landform within the northern part of the Mine Site. Elevations within the partially confined valley of Price Creek, situated to the east of this ridge, range between approximately 650m AHD in the north and approximately 590m AHD in the south, where the valley of Price Creek joins that of Hawkins Creek. Blackmans Gully lies to the west of the eastern ridge in a small valley containing the section of Maloneys Road which Bowdens Silver is proposing to relocate. Elevations within Blackmans Gully range from approximately 650m AHD in the north to approximately 590m AHD in the south. The central ridge (at an elevation of up to approximately 700m AHD) is located west of Blackmans Gully, in the centre of the Mine Site where the bulk of the main open cut pit would be located. The central ridge directs runoff into either Blackmans Gully or into the headwaters of Walkers Creek, in the western section of the Mine Site.

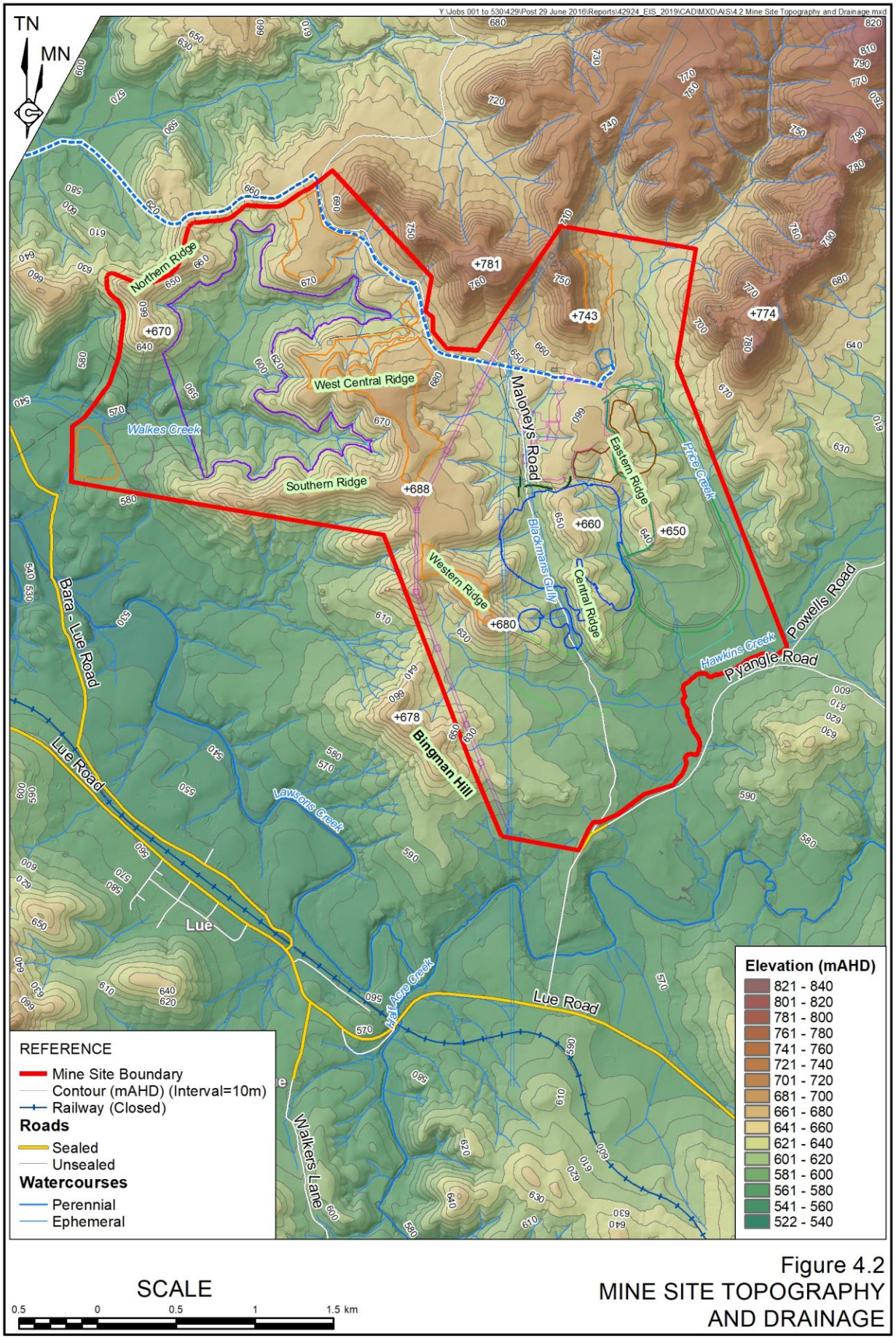


Figure 4.2
MINE SITE TOPOGRAPHY AND DRAINAGE

The three northeast/southwest orientated ridges located in the western section of the Mine Site have elevations ranging between approximately 680m AHD and 670m AHD. The valleys between these three ridges contain two ephemeral watercourses which form the headwaters of Walkers Creek. Within the Mine Site, these small valleys have a range of elevations between approximately 600m AHD and approximately 560m AHD. The southernmost of the northeast/southwest ridges is referred to as the southern ridge.

Adjacent to the Mine Site boundary, the central ridge extends southwards and joins a near northwest/southeast ridge which is a prominent local topographic feature between the Mine Site and Lue. This ridge is referred to locally as 'Bingman Hill'. The ridge rises to elevations of between 630m AHD and 678m AHD. Elevations within Lue vary from approximately 550m AHD to 600m AHD and Lawson Creek flows in a northwesterly direction immediately north of Lue.

Slopes throughout the Mine Site are generally 1:6 to 1:10 (V:H) with the exception of the northeastern corner of the Mine Site that contain relatively steep slopes approaching 1:3 (V:H) to 1:2 (V:H).

4.4 MINE SITE SOILS

A detailed site soil survey was carried out across the Mine Site in mid-February 2017 by accredited soil scientists, Dr David McKenzie and Mr Adrian Harte of Soil Management Designs Pty Limited (SMD).

The site soil survey was designed to:

- establish the presence or otherwise of BSAL considering the requirements of the Interim Protocol; and
- determine the physical and chemical characteristics of the soils within the Mine Site to identify soil types and assess their suitability for use in rehabilitation.

Further details on the methodology employed, the specific objectives of the site soil survey are presented in SMD (2020), Section 3.2.

A total of 41 soil test pit locations were identified and investigated based on their underlying geology and landscape location. Of the 41 soil test pits, 29 were located within the Mine Site with 14 of those being within areas of disturbance associated with open cut pit development, the TSF, internal roads, the processing plant, stockpiling of topsoil, subsoil and NAF waste rock and the WRE. An additional soil test pit location was located in an area of disturbance associated with the development of the relocated Maloneys Road.

Of the 41 soil pits analysed, only five comprised soil with BSAL characteristics. However, none of these pits were located adjacent to each other and the minimum threshold of 20ha for land to be considered BSAL was not satisfied. As a result of these soil investigations, Bowdens Silver sought and obtained a Site Verification Certificate on 8 November 2017 which confirms that there is no contiguous BSAL within the boundary of the Mine Site.

Figure 4.3 shows the location of all soil test pits investigated as part of the site soil survey. Based on the results of the site soil survey, SMD (2020) identified seven SLUs within the Mine Site which host the Australian Soil Classification types (Isbell, 2002) and which are described, along with land capability constraints in **Table 4.2** and presented in **Figure 4.3**. SMD (2020) considered the terminology of the SLUs used by Murphy and Lawrie (1998) was too broad for the assessment and proposed revised SLUs, based on the results of the site soil survey.

Table 4.2
Mine Site Soil Landscape Units, Soil Type and Land Capability Constraints

SLU	Number of soil test pits	Dominant soil type(s)	Sub-Dominant soil type(s)	Land Capability Constraints
Sedimentary – steep land	3	Kurosol (2 of 3 soil test pits)	Tenosol (1)	Strong water erosion hazard; Acidity; Stony soil with poor water holding capacity
Sedimentary – gentle slope (<10%)	5	Tenosol (2) Chromosol (2)	Kurosol (1)	Water erosion hazard; Acidity
Acid (felsic) volcanic – steep land	4	Chromosol (2)	Dermosol (1) Rudosol (1)	Strong water erosion hazard; Acidity; Poor waterholding capacity
Acid volcanic – gentle slope (<10%)	14	Kurosol (4)	Sodosol (3) Dermosol (3) Tenosol (2) Chromosol (1) Rudosol (1)	Water erosion hazard; Acidity; Poor water holding capacity
Ordovician shale	3	Dermosol (3)		Despite shallowness of the soil, the water holding capacity would be favourable because of steeply dipping and partially decomposed shale parent material
Alluvium – high quality	3	Stratic Rudosol (3)		Deep young soil with favourable physical subsoil conditions for root growth; derived from alluvium associated with Price Creek
Alluvium – medium quality	6	Chromosol (2) Sodosol (2)	Dermosol (1) Hydrosol (1)	Deep; slow drainage associated with subsoil sodicity. The alluvium is derived mainly from Hawkins Creek.
Source: SMD (2020) – Table 6				

Further details on the Australian Soil Classification types identified within the Mine Site are presented in Section 4.2 of SMD (2020).

Figure 4.4 displays the LSC Classes within the Mine Site. **Table 4.3** presents the LSC Classes within the proposed disturbance areas. It is noted that approximately 86% of disturbance within the Mine Site would occur on land situated on soils with an LSC Class of 6 (i.e. low capability land with very high limitations for high-impact land uses and which is restricted to low-impact land uses such as grazing, forestry and nature conservation).

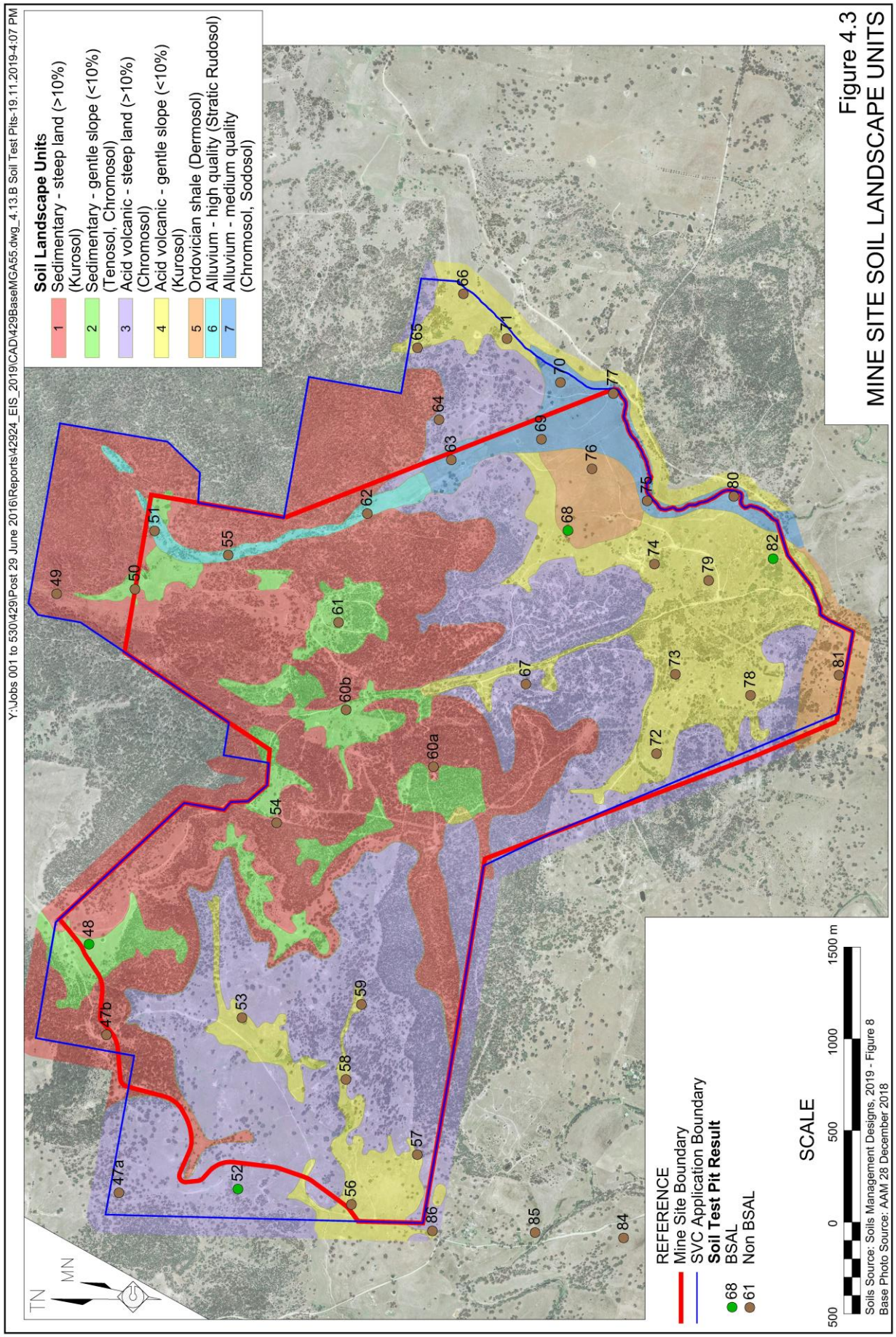


Figure 4.3
MINE SITE SOIL LANDSCAPE UNITS
Soil Landscape Units
1 Sedimentary - steep land (>10%) (Kurosol)
2 Sedimentary - gentle slope (<10%) (Tenosol, Chromosol)
3 Acid volcanic - steep land (>10%) (Chromosol)
4 Acid volcanic - gentle slope (<10%) (Kurosol)
5 Ordovician shale (Dermosol)
6 Alluvium - high quality (Stratic Rudosol)
7 Alluvium - medium quality (Chromosol, Sodosol)
REFERENCE
Mine Site Boundary
SVC Application Boundary
Soil Test Pit Result
68 BSAL
61 Non BSAL
SCALE
500 0 500 1000 1500 m
Soils Source: Soils Management Designs, 2019 - Figure 8
Base Photo Source: AAM 28 December 2018
TN MN
Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2019\CAD\429BaseMGA55.dwg_4.13.B Soil Test Pits-19.11.2019-4:07 PM

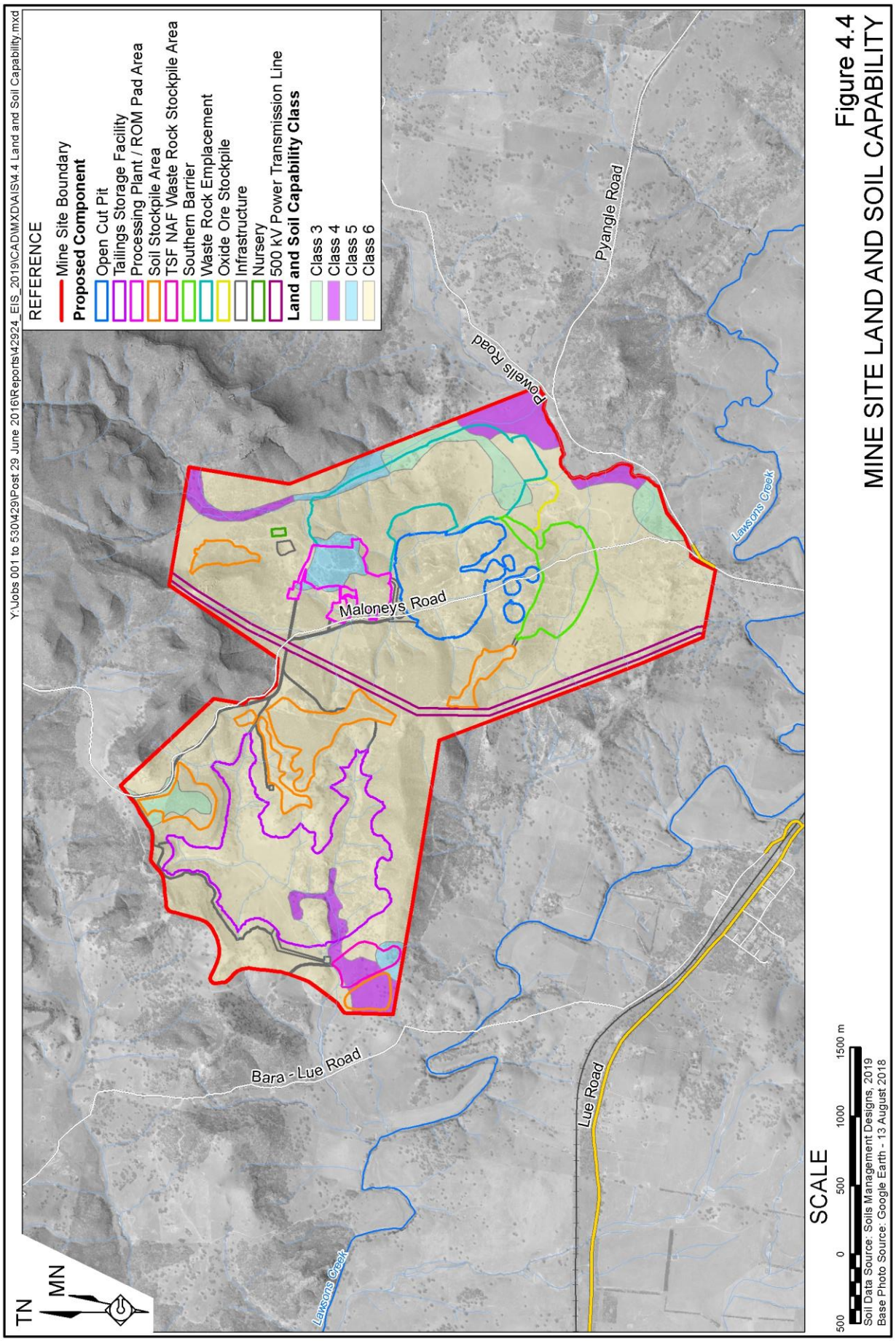

Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2019\CAD\MXD\AIS\4.4 Land and Soil Capability.mxd
REFERENCE
Mine Site Boundary
Proposed Component
Open Cut Pit
Tailings Storage Facility
Processing Plant / ROM Pad Area
Soil Stockpile Area
TSF NAF Waste Rock Stockpile Area
Southern Barrier
Waste Rock Emplacement
Oxide Ore Stockpile
Infrastructure
Nursery
500 kV Power Transmission Line
Land and Soil Capability Class
Class 3
Class 4
Class 5
Class 6
Powells Road
Pyangle Road
Maloneys Road
Lawsons Creek
Bara - Lue Road
Lue Road
TN
MN
SCALE
500 0 500 1000 1500 m
Soil Data Source: Soils Management Designs, 2019
Base Photo Source: Google Earth - 13 August 2018
Figure 4.4
MINE SITE LAND AND SOIL CAPABILITY

Table 4.3
Land and Soil Capability Classes within Proposed Disturbance Areas

Component	Total Area (ha)	Approximate LSC Areas			
		Class 3	Class 4	Class 5	Class 6
Open Cut Pits	52.0				52.0
Processing Plant / Mining Facility	22.3			10.4	11.8
Waste Rock Emplacement*	87.1	12.7	1.7	5.0	67.6
Tailings Storage Facility	117.4		6.6		110.8
Southern Barrier	32.1				32.1
Oxide Ore Stockpile	7.5	1.1			6.4
TSF NAF Waste Rock Stockpile	9.2		4.6	2.1	2.5
Re-aligned 500kV Power Line	21.2				21.2
Roads and Water Infrastructure	9.3	0.4	0.0		8.9
Nursery	0.5				0.5
Soil Stockpiles					
S1	6.4		6.0		0.4
S2	12.8	7.0			5.8
S3	7.1				7.1
S4	6.4				6.4
S5	22.8				22.8
S6	6.4				6.4
Total	**420.5**	**21.2**	**18.9**	**17.6**	**362.8**
* Includes the low grade ore stockpiles and leachate management dam					
Source: SMD (2020) – Table 11					

4.5 MINE SITE WATER RESOURCES

4.5.1 Surface Water

4.5.1.1 Surface Water Drainage

Figure 4.5 displays the principal surface water drainage features within and immediately surrounding the Mine Site. The Mine Site is traversed by the following named tributaries of Hawkins Creek and Lawsons Creek.

- Price Creek (a south-flowing tributary of Hawkins Creek), which has a catchment area of 5.2 km^2 upstream of the Hawkins Creek confluence.
- Blackmans Gully (a south-flowing tributary of Hawkins Creek), which has a catchment area of 2.3 km^2 upstream of the Hawkins Creek confluence.
- Walkers Creek (a west-flowing tributary of Lawsons Creek), which has a catchment area of 4.9 km^2 upstream of the Lawsons Creek confluence.

Several minor unnamed tributary gullies also cross the Mine Site.

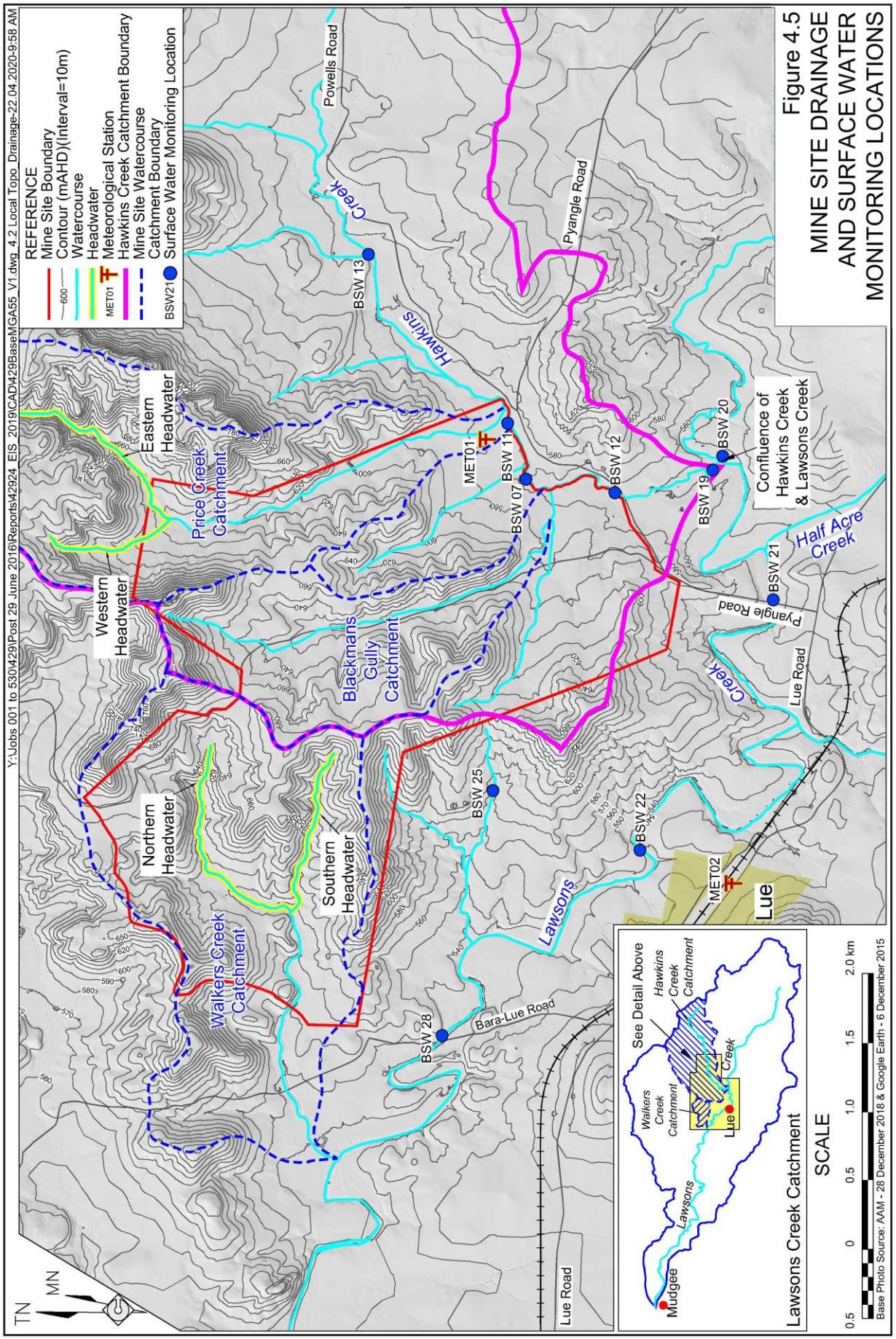


Figure 4.5
MINE SITE DRAINAGE AND SURFACE WATER MONITORING LOCATIONS
REFERENCE
Mine Site Boundary
Contour (mAHD)(Interval=10m)
Watercourse
Headwater
Meteorological Station
Hawkins Creek Catchment Boundary
Mine Site Watercourse
Catchment Boundary
Surface Water Monitoring Location
BSW21
MET01
Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2019\CAD\429BaseMGA55_V1.dwg, 4.2 Local Topo Drainage-22.04.2020-9:58 AM
Powells Road
Pyangle Road
Hawkins Creek
BSW 13
MET01
BSW 11
BSW 07
BSW 12
BSW 20
BSW 19
Confluence of Hawkins Creek & Lawsons Creek
Half Acre Creek
BSW 21
Pyangle Road
Lue Road
Creek
Eastern Headwater
Price Creek Catchment
Western Headwater
Blackmans Gully Catchment
Northern Headwater
Southern Headwater
Walkers Creek Catchment
BSW 25
BSW 22
MET02
Lue
Lawsons
BSW 28
Bara-Lue Road
Lue Road
TN
MN
See Detail Above
Hawkins Creek Catchment
Walkers Creek Catchment
Creek
Lue
Lawsons
Mudgee
Lawsons Creek Catchment
SCALE
0.5 0 0.5 1.0 1.5 2.0 km
Base Photo Source: AAM - 28 December 2018 & Google Earth - 6 December 2015

4.5.1.2 Surface Water Quality

Monitoring of surface water in Hawkins Creek, Lawsons Creek and their tributaries has been undertaken since 2012 (**Figure 4.5**). The baseline water quality assessment (WRM, 2020) concluded that the receiving waters of the Mine Site have been altered as a result of agricultural activities in the contributing catchment, particularly with regards to nutrients and electrical conductivity. WRM (2020) provides a detailed analysis of existing water quality conditions in Hawkins Creek, Lawsons Creek and their tributaries. In summary, the median values for:

- ammonia exceed the trigger value at all monitoring locations;
- nitrate exceed the trigger value at all monitoring locations;
- total nitrogen is above the trigger value at all monitoring locations;
- total phosphorous exceed the trigger value at all sampling locations;
- pH is within the desired range for upland rivers although the results for monitoring locations on Lawsons Creek are generally at the upper end of this range;
- sulphate concentrations are within the desired range; and
- electrical conductivity is generally above the desired range.

4.5.2 Groundwater

4.5.2.1 Groundwater Levels and Flow

Comprehensive groundwater monitoring has been undertaken within the Mine Site and throughout the surrounding area since March 2012. The monitoring network is presented in **Figure 4.6** and includes a network of private bores in addition to the site monitoring bores.

Groundwater levels within the alluvial aquifers have historically shown a close correlation to cumulative rainfall deviation but a less obvious correlation is evident in bores located in hard rock aquifers. A series of paired groundwater bores within the monitoring network (one deep and one shallow) have been used to demonstrate the presence of perched water that may be cut-off from the regional groundwater system, the potential for downward or upward flow of groundwater between the alluvial aquifer and the deeper groundwater, and locations where the shallow and deeper aquifers appear to be highly connected.

Groundwater levels generally correlate with the local topography with groundwater flow from areas of higher elevation to areas of lower elevation. As a result, groundwater flow directions appear to be variable except in the vicinity of the TSF and open cut pit where a general south-easterly flow direction is indicated. The monitoring data indicates that groundwater flow in the open cut pit appears to flatten, indicating a highly connected fracture network and proximity to the major fault structures. However, these results may also be influenced by the high density of drill holes in this location.

The monitoring data also indicates that Hawkins Creek is a groundwater sink, therefore the creek and alluvial areas are likely to be a point of regional groundwater discharge.

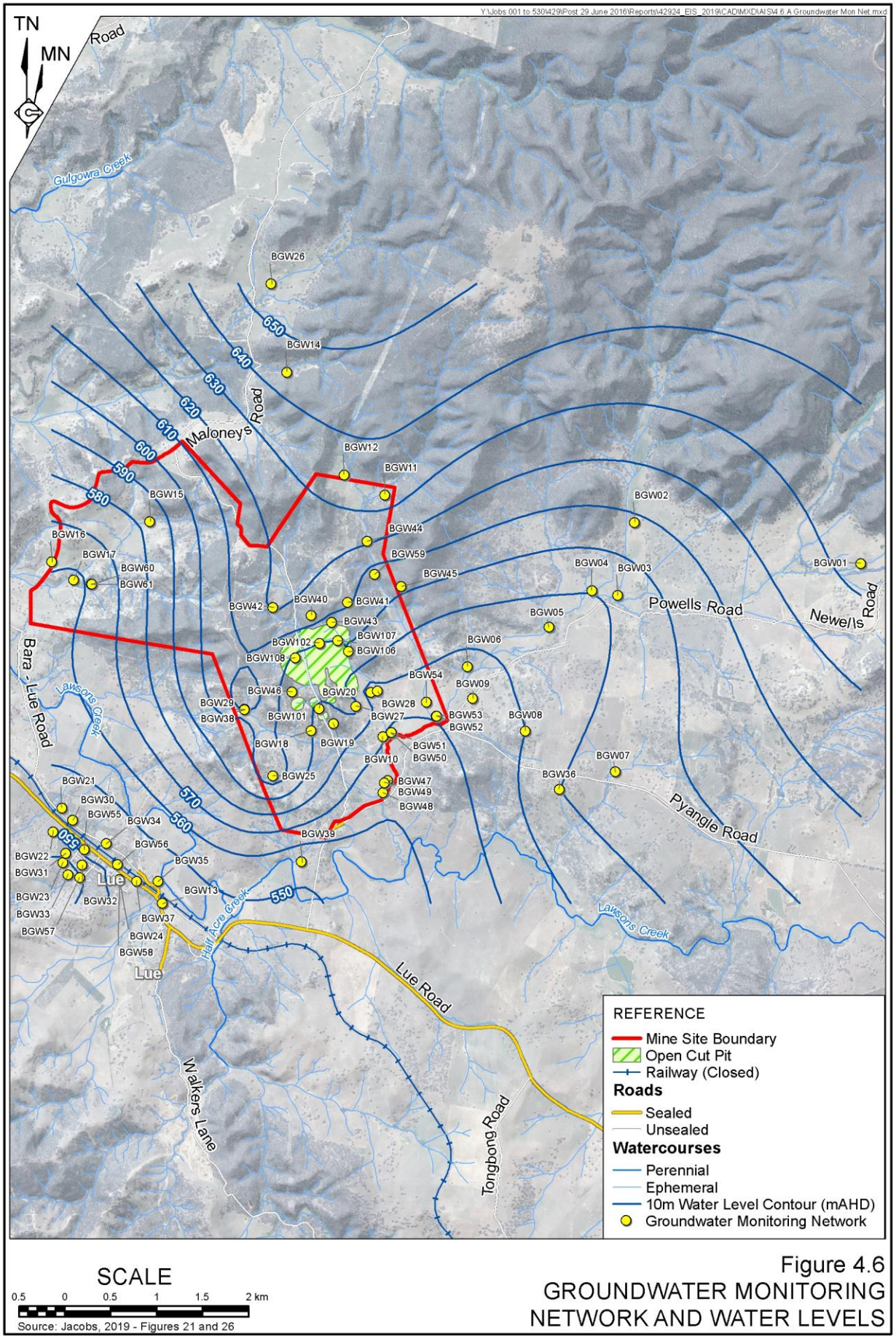


Figure 4.6
GROUNDWATER MONITORING NETWORK AND WATER LEVELS

Groundwater elevations in the open cut pit area range from around 610m AHD in the north to 585m AHD in the south to southeast. The depth of the required groundwater level below ground level is highly variable and dependent on topography, but typically ranges from approximately 2mbgl in the lower reaches of Blackmans Gully to 60mbgl beneath the elevated ridges in the Mine Site. Groundwater elevation beneath the TSF area ranges from approximately 600m AHD beneath the upper valley areas (10mbgl to 60mbgl) to approximately 560m AHD beneath the lower embankment, which is near ground level in the middle of the valley.

4.5.2.2 Groundwater Quality

Comprehensive groundwater quality monitoring has been undertaken from alluvial and hard rock aquifers, springs, and surface water systems within the regional monitoring network on a quarterly basis since January 2014. A comprehensive summary of water quality sampling results for the period between January 2014 and August 2018 are presented in Section 4.6.2 of the EIS and Annexure 6 of Jacobs (2020).

In summary, the following conclusions regarding existing groundwater quality have been made.

- Electrical Conductivity – Average regional EC levels (1 820µS/cm) are slightly higher than the average records within the Mine Site (1 420µS/cm). Average EC within the alluvium (802µS/cm) and springs (150µS/cm) are indicative of fresher water sources or recharge influence in these locations.
- pH – The majority of measurements fall in the range 6.8 to 7.6. pH results for Mine Site monitoring bores show the greatest range, from 5.2 to 8.9, with the alluvial bores showing the lowest range, from 5.6 to 7.1. Median pH values from all groundwater and spring samples were within a similar range, from 6.7 to 7.2. There is some variation in pH for individual bores but this is typically less than 1 pH unit.
- Water Types – Review of records of normalised anion and cation concentrations indicate there are a broad range of water types represented within the monitoring network, with no one sample group displaying distinct characteristics. Elevated sulphate concentrations are evident and may be the result of gypsum dissolution from the soil profile or from mineralisation (which is consistent with characterisation assessments for the Project).
- Hydrogeochemical Characterisation – Groundwater chemistry is influenced by physical factors such as whether the aquifer is confined and proximity to recharge/discharge points as well as the formation mineralogy and local climate. The three major influences to groundwater chemistry include:
  - rainfall dominance, resulting in recharge and dilution;
  - rock weathering, resulting in ion exchange of sodium and chloride; and
  - evaporative concentration.

The outcomes of groundwater quality monitoring have been compared to relevant guideline values within the ANZ Guidelines, and the Australian Drinking Water Guidelines (ADWG, 2011) (the Drinking Water Guidelines). The following conclusions have been made as a result of this review.

- The large number of existing exceedances of the ANZ Guidelines within the baseline data indicate that site specific trigger values, reflecting the formation influences on groundwater chemistry, should be developed for ongoing monitoring.

- Consistent exceedance of ANZ Guidelines of total nitrogen, total phosphorus, nitrates of nitrogen, and EC indicate a predominantly disturbed local catchment, likely to be anthropogenic in origin.
- Modifications to dissolved metal results in accordance with the ANZ Guidelines to account for the hardness of the water (an influence to bio-availability) reduced the frequency of trigger level exceedance in the baseline data.
- Exceedances of the health-based Drinking Water Guidelines in the baseline data include arsenic, cadmium, lead and manganese.

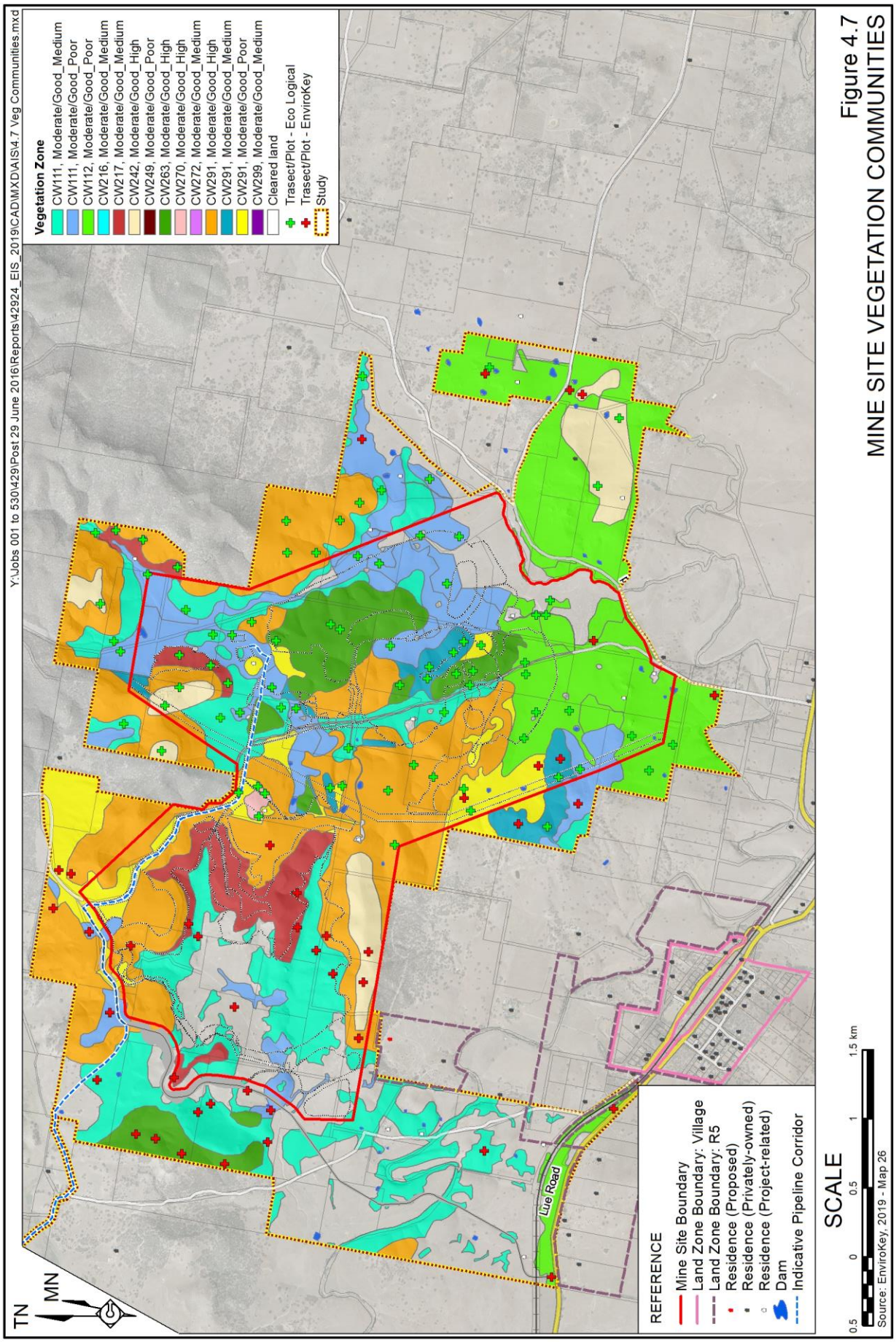
4.6 MINE SITE VEGETATION

Figure 4.7 and **Table 4.4** identify the total areas of each vegetation community to be disturbed within the Mine Site and the relocated Maloneys Road as identified in the ecological studies undertaken by EnviroKey (2020).

Table 4.4
Mine Site Biometric Vegetation Types (BVTs) and Plant Community Types (PCTs) within the Disturbance Footprint

Biometric Vegetation Type	PCT	Mine Site (ha)	Relocated Maloneys Road (ha)
CW217 White Box shrubby open forest on fine grained sediments on steep slopes in the Mudgee region of the central western slopes of NSW	273	21.7	0
CW 112* Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	277	21.7	0.1
CW 111* Rough-barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281	83.9	4.5
		62.5	1.5
CW 291 Red Stringybark – Inland Scribbly Gum open forest on steep hills in the Mudgee – northern section of the NSW South Western Slopes Bioregion	323	79.9	1.8
		11.8	0
		17.4	1.5
CW 263 Inland Scribbly Gum grassy open forest on hills in the Mudgee Region, NSW central western slopes	324	56.7	0
CW 242 Blue-leaved Stringybark open forest of the Mudgee region NSW central western slopes	325	1.0	0
CW 270 Mugga Ironbark – Red Box – White Box – Black Cypress Pine tall woodland on rises and hills in the northern NSW South Western Slopes Bioregion	358	0.8	0
Cleared Land	-	64.6	9.6
Total		**422.0**	**19.0**
Source: EnviroKey (2020) – Modified after Table 6			

It is noted that approximately 74.2ha of cleared land would be disturbed within the Mine Site and footprint of the relocated Maloneys Road. This land predominantly comprises modified pasture and is currently used for livestock grazing.


Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2019\CAD\MXD\AIS\4.7 Veg Communities.mxd
Vegetation Zone
CW111, Moderate/Good_Medium
CW111, Moderate/Good_Poor
CW112, Moderate/Good_Poor
CW216, Moderate/Good_Medium
CW217, Moderate/Good_Medium
CW242, Moderate/Good_High
CW249, Moderate/Good_Poor
CW263, Moderate/Good_High
CW270, Moderate/Good_High
CW272, Moderate/Good_Medium
CW291, Moderate/Good_High
CW291, Moderate/Good_Medium
CW291, Moderate/Good_Poor
CW299, Moderate/Good_Medium
Cleared land
Trasect/Plot - Eco Logical
Trasect/Plot - EnviroKey
Study
Lüe Road
REFERENCE
Mine Site Boundary
Land Zone Boundary: Village
Land Zone Boundary: R5
Residence (Proposed)
Residence (Privately-owned)
Residence (Project-related)
Dam
Indicative Pipeline Corridor
SCALE
0.5 0 0.5 1 1.5 km
Source: EnviroKey, 2019 - Map 26
TN
MN
Figure 4.7
MINE SITE VEGETATION COMMUNITIES

4.7 MINE SITE AGRICULTURAL SUPPORT INFRASTRUCTURE

A range of agricultural infrastructure are located within the Bowdens Farm, as follows.

- 76 x dams (combined capacity = ~ 49.6ML)
- 3 x cattle yards
- 2 x sheep yards
- 2 x 30 tonne (wheat) silos
- 3 x cement troughs
- 2 x shearing sheds
- 1 x hayshed
- 1 x windmill
- 2 x stock watering tanks
- 7 x water bores for water supply

The existing agricultural activities and infrastructure within the Bowdens Farm are serviced by local roads.

4.8 MINE SITE AGRICULTURAL ACTIVITIES AND CONSTRAINTS

4.8.1 Livestock Management

The principal land use within the Mine Site is the grazing of sheep and cattle (see **Figure 4.1**). The Bowdens Farm currently runs approximately 1 330 fine wool merino sheep including:

- 670 ewes;
- 366 wethers;
- 243 merino lambs;
- 40 crossbred lambs; and
- 11 rams.

Wethers are typically grown out to 6-8 tooth, at which point they are sold. Ewes are generally kept on the property until they are no longer able to rear a lamb at which point they are also sold.

The Bowdens Farm also currently runs 11 yearling heifers and 5 weaner calves. This is principally because sheep have generally outperformed cattle on the lighter textured soils within and surrounding the Mine Site.

The farming operation currently returns approximately $107 (gross) per hectare.

4.8.2 Pasture and Cropping

Figure 4.1 displays the extent of modified pasture (both with and without improvement) and cropping within the Mine Site.

Approximately 497ha of land is covered by modified pasture within the Mine Site and the footprint of the relocated Maloneys Road. This pasture is dominated by native grasses with limited clover cover. Microlaena typically provides the highest quality feed although coverage is limited. It is noted that the Bowdens Farm is heavily reliant on Spring and Autumn rains to promote the growth of clover and carry stock through the Summer and Winter.

The cropping program is directed towards winter forage crops to turn off fat lambs and steers and comprises approximately 13ha of land within the Mine Site and footprint of the relocated Maloneys Road. The cropping program also serves to “clean up” paddocks by removing weeds and grass. After two consecutive years of cropping, the land is typically sufficiently devoid of competitor plants to allow for the sowing of improved pasture species. Improved pasture grass species are chosen based on soil conditions and may include phalaris, cocksfoot, fescue, premier digit and consul love grass. These grasses respond well to companion legumes such as subterranean clover, arrow leaf clover and serradella.

Areas that are not suitable for cropping may receive clover seed (red, white and subterranean varieties) via broadcast application.

4.8.3 Fertiliser Application

The Bowdens Farm has no history of fertiliser being broadcast although it is noted that the farm manager intends to allocate funds for this purpose in the coming years. The broadcast application of fertiliser would likely improve soil fertility; increase the amount of feed produced per hectare; improve the land’s response time to rain; and improve the nutritional value of the feed produced. It is anticipated that improvements to these metrics would allow the Bowdens Farm to increase stocking rates and improve profitability.

4.8.4 Fence Maintenance

Farm fences are repaired, as required. New fences are constructed where old fences are beyond repair.

4.8.5 Weed and Pest Control

Weeds are currently managed by both spot spraying and broadacre application. The spot spraying program typically targets Scotch thistle, blackberry, briar, Serrated tussock, prickly pear and castor oil plant. Broadacre application targets broad leaf weeds and is typically undertaken with a boom sprayer.

Baiting programs are conducted in Spring and Autumn for wild dogs, foxes and feral pigs.

5. WATER SUPPLY PIPELINE CORRIDOR SETTING

5.1 INTRODUCTION

This section summarises the environmental and agricultural setting of the water supply pipeline corridor and immediate surrounds. The corridor traverses a distance of approximately 58.5km from the Mine Site to the Ulan Coal Mine and/or Moolarben Coal Mine.

5.2 WATER SUPPLY PIPELINE CORRIDOR TOPOGRAPHY & DRAINAGE

The water supply pipeline corridor is largely located within gently sloping terrain, although portions of the pipeline would traverse hilly terrain, particularly in the areas near Cooks Gap and Hayes Gap. The corridor would commence at an elevation of approximately 640m AHD within the Mine Site and decrease in elevation to approximately 420m AHD within the Ulan area. **Figure 5.1** displays the topography traversed by the water supply pipeline corridor and provides a longitudinal profile for the length of the corridor.

The water supply pipeline corridor traverses the catchment divide between the Macquarie-Bogan Catchment (approximately 74 000km^2) and the Hunter River Catchment (approximately 37 000km^2). Major drainage features within the Macquarie-Bogan Catchment include the Macquarie River, Cudgegong River and the Bogan Rivers. Surface water flows within the Hunter River Catchment generally flow east towards Newcastle with major drainage features comprising the Goulburn River and the Hunter River. It is noted that approximately 4km of the Goulburn River was diverted in the 1980s to allow for the development of the Ulan Coal Mine.

The pipeline would intersect six perennial watercourses and numerous unnamed minor watercourses. **Figure 5.1** displays the following perennial watercourses intersected by the pipeline.

- Bara Creek
- Pipeclay Creek
- Stony Creek
- Cooyal Creek
- Ryans Creek
- Moolarben Creek

5.3 WATER SUPPLY PIPELINE CORRIDOR SOILS

The water supply pipeline corridor intersects a number of soil types and landscapes. **Table 5.1** presents information relating to the mapped soil landscapes traversed by the water supply pipeline corridor and potential land capability constraints. The SLUs traversed by the water supply pipeline are displayed on **Figure 5.2**.

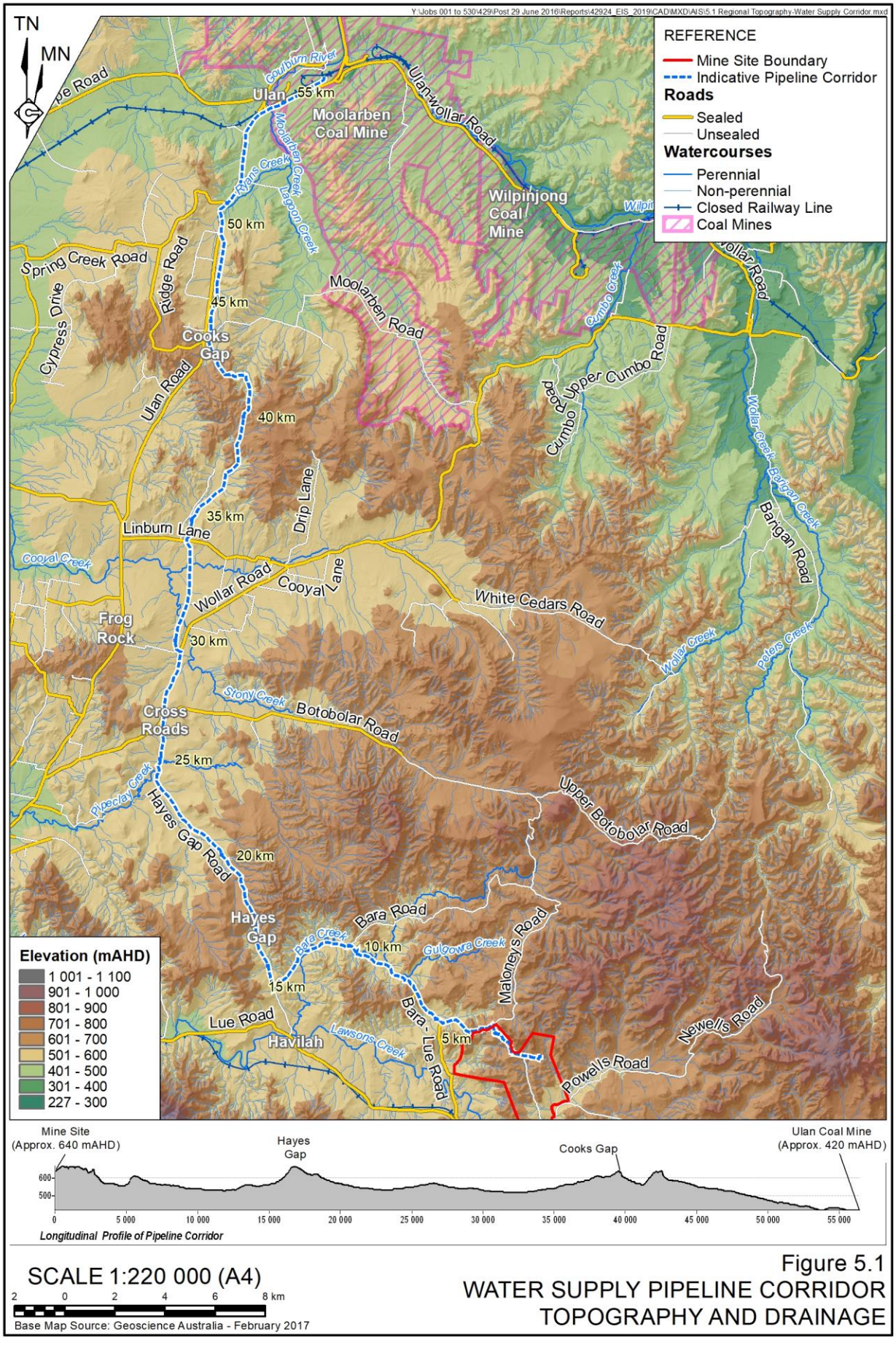


Figure 5.1
WATER SUPPLY PIPELINE CORRIDOR
TOPOGRAPHY AND DRAINAGE

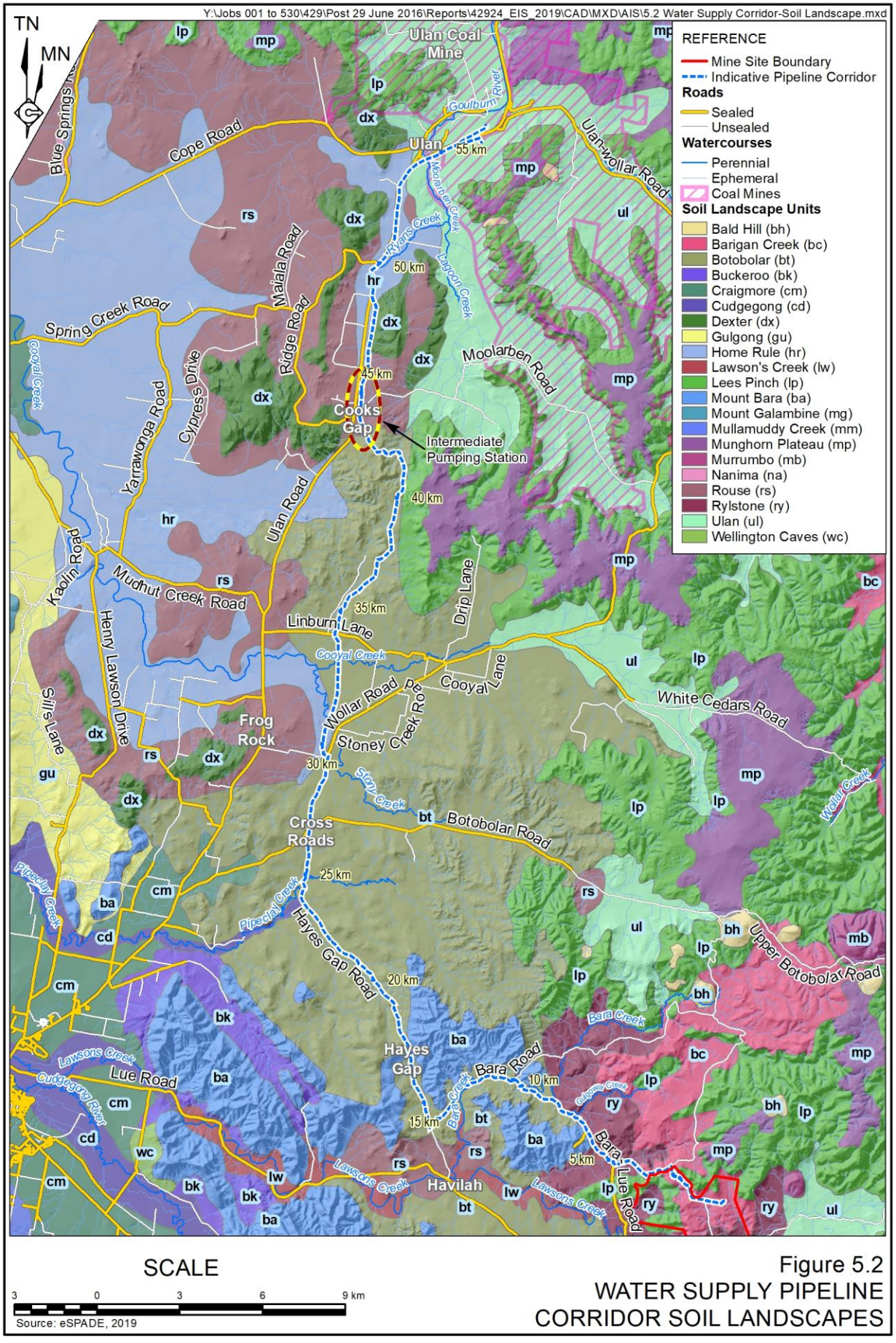


Figure 5.2
WATER SUPPLY PIPELINE
CORRIDOR SOIL LANDSCAPES

Table 5.1
Soil Landscape Units Mapped in the Vicinity of the Pipeline and Land Capability Constraints

Soil Landscape Unit	Parent Materials and Soil Types Present	Land Capability Constraints
Barigan Creek (bc)	Shale, sandstone, siltstone, conglomerate, chert. Common soils are Yellow Podzolic Soils on lower slopes and along drainage lines. Red Podzolic Soils on higher colluvial slopes, benches and rises.	LSC Class 5 – High limitations High erosion hazard under cropping or where there is low surface cover. Salinity in localised areas in drainage depressions.
Lawson's Creek (lw)	Sediment and alluvium derived from metasediments from the Capertree Rise. Much of the gravel is angular phyllite and quartz. No full profile record is available. Soil profiles typically consist of dark, greyish-brown overbank alluvium which may be reddish brown at depth, overlying various depositional units such as gravels, sands and fines.	LSC Class 3 – Moderate limitations Moderate fertility with a moderate to high available water holding capacity. Weakly structured surface soils and streambank erosion are common. Generally has high rural capability for cropping.
Lees Pinch (lp)	Sediment derived from sandstone, conglomeratic sandstone, red-brown and green mudstone, shale, conglomerate, chert, coal and torbanite. Soils consist of shallow siliceous sands, shallow acid soils and yellow earths.	LSC Class 7 – Severe limitations Soil fertility is very low with acidic surface soils. Surface soils are typically sandy with low to very low waterholding capacity. No salinisation. Land is generally not suitable for agriculture.
Mount Bara (ba)	Sediment derived from metasediments and acid volcanics with parent rocks including sandstone, phyllite, slate, rhyolite, dacite, tuff, shale, conglomerate, red slate, red and brown quartz, arenite and siltstone. Soils consist of shallow loams.	LSC Class 8 – Very severe limitations Soils fertility is low with slightly acidic surface soils. Soils are susceptible to degradation and have low waterholding capacity. Very high to extreme erosion hazard when surface cover is low. Land is generally not suitable for agriculture.
Home Rule (hr)	Sediment derived from the Gulong and Rouse Granites. Mainly Siliceous Sands and Earthy Sands on upper and mid-slopes. Yellow Podzolic Soils and yellow Solodic Soils on lower slopes and flats. Layered Siliceous Sands in some larger drainage lines.	LSC Class 5 – High limitations Soil fertility is very low and surface soils are acidic. Waterholding capacity is low to very low. Erosion hazard is high when surface cover is low or flows are concentrated. Low levels of soil salinity.
Rylstone Siliceous Sands (ry)	Rhyolite and dacitic tuff present. Outcrop common on upper slopes and crests. Mainly shallow Siliceous Sands and bleached sands. Red Podzolic Soils and blocky rocks of rhyolite and chalcedony float occur between bedrock outcrops. Some shallow Yellow Podzolic Soils on lower crests and yellow Solodic Soils/Soloths in drainage lines.	LSC Class 6 – Very high limitations Shallow soils, rock outcrop, low waterholding capacity, seasonal waterlogging, sodic subsoils in depressions, very high erosion hazard under cultivation. Low levels of salinity are apparent and localised across the landscape.
Botobolar Non-Calcic Brown Soils (bt)	Slate, phyllite, limestone, rhyolite, dacite, shale, sandstone and minor alluvial and colluvial derivatives. Soils include Non-Calcic Brown Soils, Shallow Soils near hill tops and Yellow Podzolic-Solodic Soils on poorly drained soils.	LSC Class 4 – Moderate to high limitations High to very high erosion hazard and low surface cover. Weakly structured surface soils. Moderate waterholding capacity. Isolated low levels of salinity along drainage lines.

Table 5.1 (Cont'd)
Soil Landscape Units Mapped in the Vicinity of the Pipeline and Land Capability Constraints

Soil Landscape Unit	Parent Materials and Soil Types Present	Land Capability Constraints
Rouse (rs)	Gulgong Granite, biotite granite, adamellite, granodiorite. Mainly shallow Siliceous Sands and Earthy Sands on mid-slopes and upper slopes. Yellow Soloths and yellow Solodic Soils on lower slopes and in depressions. Other soils include bleached sands, and Non-calcic Brown Soils and Red Earths on small areas of less siliceous rock.	LSC Class 5 – High limitations Soil fertility is very low and surface soils are acidic. High to very high erosion hazard under cultivation. Waterholding capacity is low to very low. Low levels of salinity are apparent and common.
Dexter (dx)	Shallow Siliceous Sands, Siliceous Sands and Earthy Sands on upper and mid-slopes. Yellow Solodic Soils on lower slopes and along major drainage lines.	LSC Class 6 – Very high limitations Very low to low soil fertility and surface soils are often very acidic. Very high erosion hazard. Low available water holding capacity. No salinity problems.
Ulan (ul)	Shale, sandstone, conglomerate, chert, coal and torbanite seams. Yellow Podzolic Soils on lower slopes and drainage lines with patches of yellow Solodic Soils/Solonetz in association with salt scalds. Yellow and Brown Earths on footslopes with minor areas of Earthy Sands on low rises.	Class 5 – High limitations Soil fertility is low. Surface soils are slightly acidic. High levels of soil salinity.
Source: Murphy and Lawrie (1998)		

It is noted that the entire length of the water supply pipeline would traverse SLUs with an LSC Class of between 3 and 8 (i.e. land with moderate to very severe limitations). The majority (approximately 34km) of the pipeline would be constructed within land with an LSC Class of 4 (i.e. moderate capability land) with land uses within this LSC Class typically restricted to grazing with restricted cultivation, pasture cropping, grazing, some horticulture, forestry and nature conservation. Approximately 0.6km of the WSPC would intersect Lawson's Creek SLU which has an LSC Class of 3. It is noted that the Lawson's Creek SLU comprises land mapped as BSAL within the *Central West and Orana Regional Plan 2036*. However, the WSPC would be restricted to within the road corridor for Bara-Lue Road within this area and would not impact upon agricultural land.

No acid sulfate soils are mapped within the vicinity of the water supply pipeline corridor.

5.4 WATER SUPPLY PIPELINE CORRIDOR VEGETATION

Table 5.2 identifies the total areas of each vegetation community to be disturbed within the water supply pipeline corridor as identified in the ecological studies undertaken by EnviroKey (2020). It is noted that, for the purposes of the terrestrial ecology assessment, the length of the pipeline corridor within the Mine Site (i.e. from the processing plant to the Mine Site boundary) was assessed as part of the Mine Site.

Table 5.2
Water Supply Pipeline Corridor Biometric Vegetation Types and Plant Community Types

Biometric Vegetation Type	Plant Community Type	Water Supply Pipeline Corridor (ha)
CW 111* Rough-barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281	6.9
CW 216* White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	266	1.2
CW 291 Red Stringybark – Inland Scribbly Gum open forest on steep hills in the Mudgee – northern section of the NSW South Western Slopes Bioregion	323	0.4
CW 249 Derived grassland of the NSW South Western Slopes	796	5.2
CW 299 Rough-barked Apple – Blakely's Red Gum – Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	401	0.8
CW 272 Narrow-leaved Ironbark – Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills	468	0.6
Cleared Land	-	39.4
Total		**54.7**
Source: EnviroKey (2020) – Modified after Table 6		

It is noted that approximately 39.4ha of cleared land would be temporarily disturbed during the construction of the water supply pipeline. This land predominantly comprises modified pasture and is currently used for livestock grazing. Grazing also occurs in areas covered by native vegetation, however, these areas typically demonstrate a lower stocking capacity.

5.5 WATER SUPPLY PIPELINE CORRIDOR LAND USES

Figure 5.3 displays the land uses within the water supply pipeline corridor in five sections with chainages commences at 0km within the Mine Site. Each section traverses approximately 12km.

The land traversed by the water supply pipeline corridor beyond the Mine Site is predominantly used for grazing with approximately 48km of the corridor used for this purpose. Of this grazing land, approximately 25km intersects modified pasture whilst 23km intersects land covered by remnant native vegetation. Approximately 2.5km of the water supply pipeline corridor is used for cropping with these areas likely to be used for a combination of forage crops and pasture improvement. It is noted that the corridor does not traverse any land used for viticulture or any other form of horticulture. Approximately 3.5km of the water supply pipeline corridor traverses land currently used as lifestyle lots.

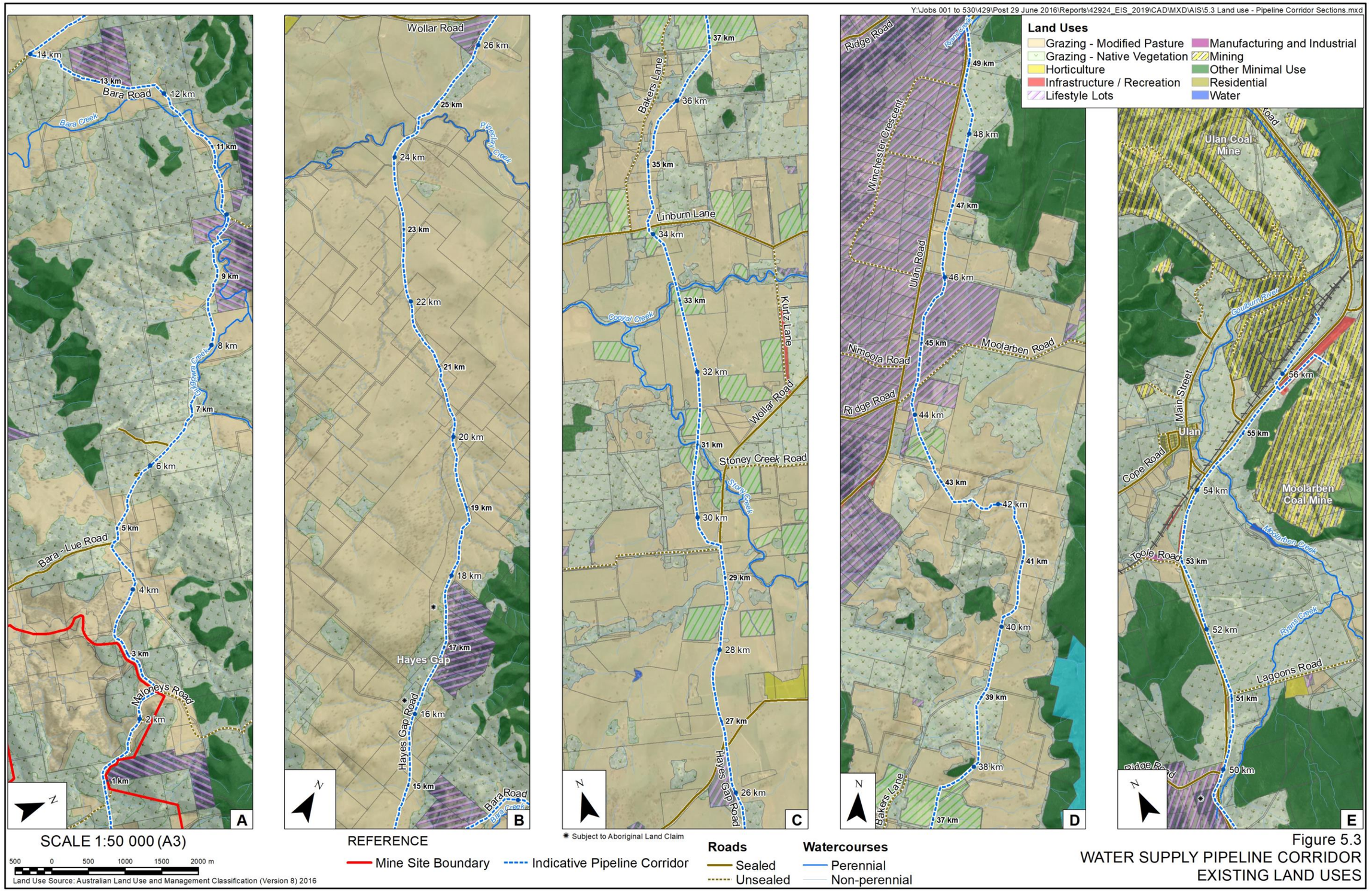


Figure 5.3
WATER SUPPLY PIPELINE CORRIDOR
EXISTING LAND USES

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6. PROPOSED MANAGEMENT AND MITIGATION MEASURES

6.1 INTRODUCTION

Throughout the EIS, a range of environmental, social and economic management strategies and mitigation measures have been identified which would be required to avoid or reduce the potential environmental, social and economic impacts of the Project. The following subsections draw upon the proposed mitigation measures identified throughout the EIS that Bowdens Silver would adopt or implement to reduce the impacts of the Project upon the regional and local agricultural infrastructure, operations and enterprises identified throughout this AIS.

6.2 LAND AND SOIL CAPABILITY

6.2.1 Introduction

In order to create a final landform that is safe, stable and amenable to continued agricultural use, Bowdens Silver would implement a number of management and mitigation measures for its activities within the Mine Site and the water supply pipeline corridor. These measures would include practices to address soil stripping and soil stockpile management as well as specific objectives for rehabilitation. It is noted that a Rehabilitation Management Plan would be prepared and implemented prior to the commencement of on-site activities and a rehabilitation security would also be established in accordance with the latest NSW Resources Regulator requirements.

6.2.2 Mine Site

Specific management and mitigation measures related to LSC within the Mine Site are addressed in Section 4.13.4.1 of the EIS. Some of the key management and mitigation measures are as follows.

- Topsoil and subsoil would be selectively stripped and separately handled prior to stockpiling or direct use in rehabilitation activities.
- Acidity and dispersion / sodicity constraints would be addressed through the addition of lime to overcome deficiencies in soils, as required.
- Gypsum would be applied to the “Alluvium – medium quality” SLU where required to assist with the maintenance of soil structure.
- Avoidance of excessive compaction and/or moulding of the soil by heavy machinery under wet conditions.
- Topsoil only stockpile heights would be limited to under 2m and would be sown with a well-fertilised non-persistent cover crop to encourage organic carbon accumulation, promote microbial activity and minimise erosion.
- Silt-stop fencing would be placed immediately down-slope of all stockpiles until stable vegetation cover is established.

- Progressive rehabilitation would be undertaken with the aim of returning disturbed land to pre-mining LSC Classes, wherever possible.
- Rehabilitation areas would be revegetated with native trees and shrubs (where applicable) and pasture grasses.

6.2.3 Water Supply Pipeline Corridor

The following key management and mitigation measures would be implemented during the construction of the water supply pipeline to limit impacts upon the soils and agricultural production within the pipeline corridor.

- Topsoils would be selectively stripped and handled. Soils would be temporarily stockpiled and placed adjacent to one boundary of the easement and placed within the trench following the installation of the pipeline. Any excess subsoil and other excavated materials would be transported to the Mine Site for use and/or stockpiling for use in rehabilitation.
- Acidity and dispersion / sodicity constraints would be addressed through the addition of lime to overcome deficiencies in soils, as required.
- Silt-stop fencing would be placed immediately down-slope of all stockpiles on slopes greater than 1:10 (V:H).
- All disturbed areas would be scarified and either seeded with a pasture mix or rehabilitated to the pre-disturbance condition. An appropriate amount of fertiliser would be added to the seeded area with seeded areas irrigated as required.
- The status of revegetation within the pipeline corridor would be monitored regularly throughout the pipeline construction program to ensure that there are no unacceptable areas of subsidence/collapse or substantial revegetation. Any areas requiring follow-up attention would be maintained, as required.

Specific management and mitigation measures related to LSC within the water supply pipeline corridor are addressed in Section 4.13.4.2 of the EIS. The pipeline contractor would discuss the proposed construction program with each landowner to ensure that the area of impact and period of time that agricultural activities are curtailed is minimised.

6.3 SURFACE WATER

As part of the design process, a range of surface water management measures have been included in the Project including clean water diversions, ‘dirty’ water catchment and containment systems, and catchment and containment systems for water coming into contact with tailings or potentially acid forming (PAF) waste rock.

A Water Management Plan would also be prepared and implemented which includes the following.

- A water quality monitoring program.
- Water volume monitoring program including recording of inflows and transfers.

- Water management infrastructure monitoring program including clean water diversion and 'dirty' water management infrastructure.
- Trigger action response plans to establish what further management actions are required when certain triggers are reached.

Further details on the management of surface water within the Mine Site is provided in Section 4.7.4 of the EIS.

6.4 GROUNDWATER

A Water Management Plan would be prepared and implemented which would include the following.

- Monitoring of groundwater dewatering volumes.
- Groundwater quality and level monitoring in a network of piezometers and bores surrounding the Mine Site which would enable determination of any mine-related impacts on surrounding groundwater users (including Hawkins and Lawsons Creeks).

Bowdens Silver has secured options to purchase water access licences through the 2017 Controlled Allocation Order (Various Groundwater Sources), to the value of 885 unit shares in the Lachlan Fold Belt Groundwater Source (equivalent to 885 ML/year) and 118 unit shares in the Sydney Basin Groundwater Source (equivalent to 118 ML/year). An additional 97 unit shares (equivalent to 97ML/year), required to meet the predicted maximum take throughout the mine life have been sought through the upcoming Controlled Allocation Orders.

In accordance with the NSW Aquifer Interference Policy, Bowdens Silver would also make good for the two groundwater users potentially impacted by the Project if ongoing monitoring indicates an actual impact of magnitude that exceeds the threshold impact level.

Further details on the management of groundwater within the Mine Site is provided in Section 4.6.8 of the EIS.

6.5 BIODIVERSITY

Potential impacts to biodiversity have been minimised through avoidance of high biodiversity areas to the extent feasible. This was achieved through early survey and creation of a 'traffic light model' to provide a visual overlay to assist the Project design team during the planning phase to avoid and/or minimise impacts to biodiversity, where possible.

During operations, the following key mitigation and management measures would be implemented.

- Preparation of and implementation of a Biodiversity Management Plan addressing pre-clearing protocols, remnant vegetation management, seed collection, weed and feral pest management.

- Preparation of and implementation of a Rehabilitation Management Plan and establishment of a rehabilitation security in accordance with the latest NSW Resources Regulator requirements.
- Implementation of a biodiversity offset strategy to offset unavoidable impacts.

Further details on the management of biodiversity within the Mine Site is provided in Section 4.10.5 of the EIS.

6.6 AIR QUALITY

A best practice dust control measures review was undertaken for the Project which was used to identify a range of preventative, reactive and corrective dust mitigation and management measures for the Project. The proactive air quality management system would be based on a combination of meteorological forecasts, visual monitoring and real-time meteorological and air quality monitoring.

Further details on the air quality management system are provided in Section 4.4.2.4 of the EIS.

6.7 NOISE AND VIBRATION

Bowdens Silver proposes to adopt a range of reasonable noise control and management measures (including the use of low noise mobile equipment and fixed plant enclosing equipment in buildings, amenity and near-field noise barriers, mine operational controls) to appreciably reduce noise emissions from the Project. Noise management and monitoring would be addressed through Noise Management Plans, one for construction and one for operational activities.

Ground vibration and airblast emission levels would be managed by Bowdens Silver in accordance with an approved Blast Management Plan (BMP) to ensure that ground vibration and potential blast emission impacts are minimised.

Further details on the management of noise and vibration within the Mine Site are provided in Sections 4.2.2.5 and 4.3.4 of the EIS.

6.8 SOCIAL AND ECONOMIC

Bowdens Silver proposes to adopt a range of management and mitigation measures to minimise or avoid social and economic impacts. Further details on the management of social and economic impacts are provided in Sections 4.20.4 and 4.19 of the EIS, respectively.

A critical contribution of the Project to the social and economic setting would be the creation of regional jobs. Whilst the bulk of the jobs associated with the Project would be full-time, Bowdens Silver would be supportive, where practical, to offer a range of part-time jobs that would be suited to a number of workers e.g. off surrounding properties to earn an off-farm income.

7. ASSESSMENT OF IMPACTS

7.1 LAND USE IMPACTS

7.1.1 Land to be Removed from Agricultural Production

Areas currently used for agriculture would be temporarily or permanently removed from production during or after the Project life. **Figure 7.1** displays the land uses within and immediately surrounding the Mine Site during the Project life and **Table 7.1** presents the areas of existing land uses within the Mine Site and the proposed land uses during and after the Project life.

Table 7.1
Existing Land Uses within the Mine Site and Proposed Land Uses during and after the Project Life

	Existing		During Project Life		After Project Life	
Land Use	**Area**	**%**	**Area**	**%**	**Area**	**%**
Cropping	13	1	-	-	-	-
Grazing – Modified Pasture (Improved)	333	33	24	2	109	11
Grazing – Modified Pasture (Not Improved)	150	15	0	-	-	-
Grazing – Native Vegetation	427	43	-	-	-	-
Exclusion Zone (Aboriginal Heritage)*^	25	3	-	0	-	-
Dams	3	0	1	0	1	0
Lifestyle Lot*	49	5	22	2	49	5
Mine Component Area*	-	-	329	33	50	5
Grazing Controlled	-	-	-	-	191	19
Temporary Vegetation Area*	-	-	62	6	-	-
Native Vegetation*#	-	-	343	34	382	38
Biodiversity Offset Area*	-	-	218	22	218	22
Total	999	100	999	100	999	100

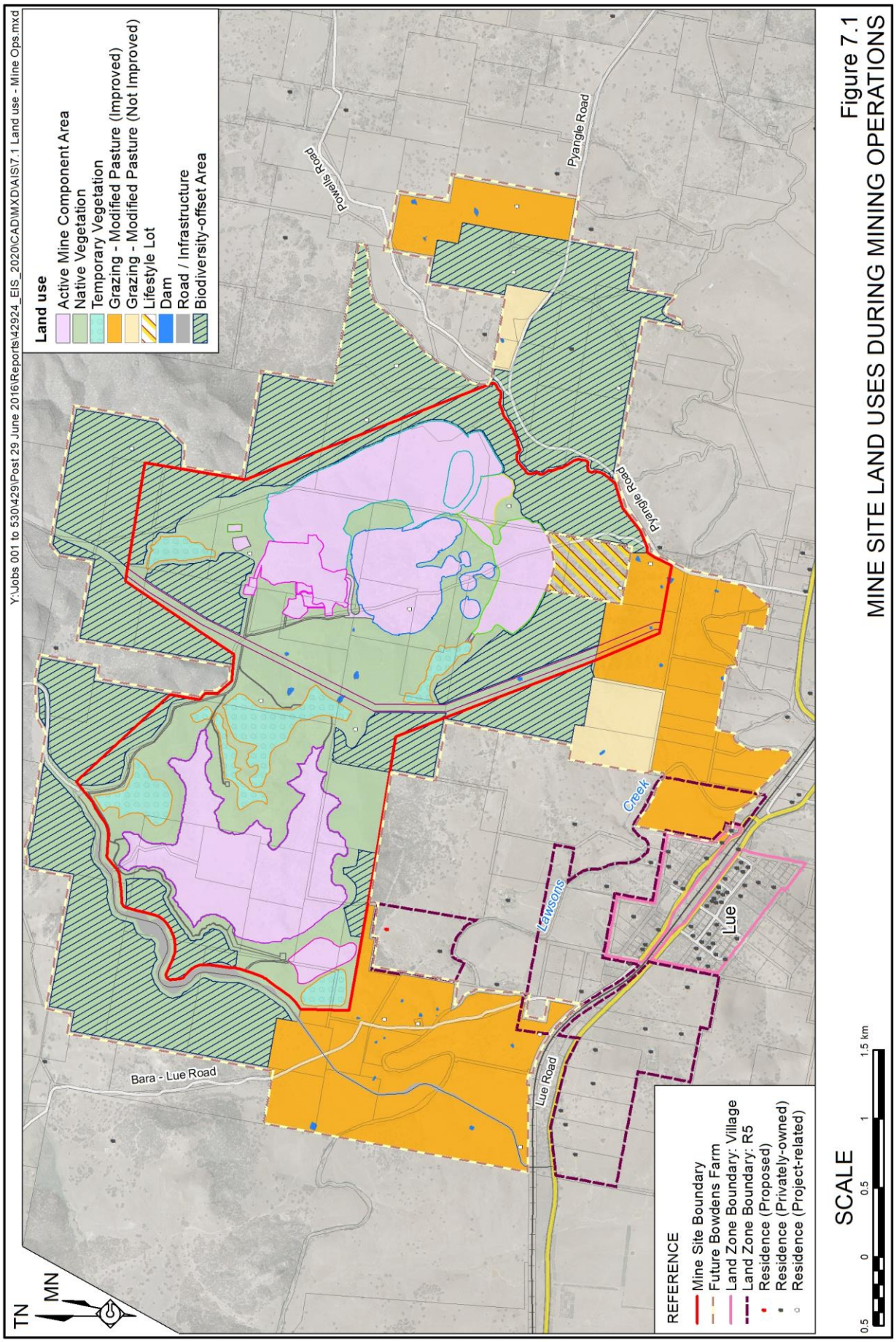
* Area with no agricultural capability.

^ The "Exclusion Zone" would be maintained during and after the Project life and would be incorporated within the Biodiversity Offset Area.

This area would be used for sporadic grazing of livestock principally for the purpose of reducing bush fire fuel loads, however, for the purposes of this assessment, this area is considered to have no agricultural capability.

The Project would remove a maximum of approximately 1 498ha of land currently used for agriculture (principally low value grazing) out of production throughout the Project life due to land use changes. This land would comprise approximately 901ha of land within the Mine Site, 20ha of land within the footprint of the relocated Maloneys Road and a further 577ha in the area immediately surrounding the Mine Site which would be set aside as part of the Project's biodiversity offset area.

A total of 469ha would be retained for agricultural purposes within the Bowdens Farm throughout the Project life. Of this land, approximately 24ha would be located within the Mine Site with a further 445ha of land located in the area surrounding the Mine Site. The majority of this land would comprise modified pasture suitable for improvement and/or cropping thus ensuring stocking rates are maintained or improved, wherever possible.


Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2020\CAD\MXD\AIS\7.1 Land use - Mine Ops.mxd
Land use
Active Mine Component Area
Native Vegetation
Temporary Vegetation
Grazing - Modified Pasture (Improved)
Grazing - Modified Pasture (Not Improved)
Lifestyle Lot
Dam
Road / Infrastructure
Biodiversity-offset Area
Pomeis Road
Pyangle Road
Pyangle Road
Creek
Lawsons
Lue
Bara - Lue Road
Lue Road
TN
MN
REFERENCE
Mine Site Boundary
Future Bowdens Farm
Land Zone Boundary: Village
Land Zone Boundary: R5
Residence (Proposed)
Residence (Privately-owned)
Residence (Project-related)
SCALE
0.5
0
0.5
1
1.5 km
Figure 7.1
MINE SITE LAND USES DURING MINING OPERATIONS

A total of approximately 795ha of land within (218ha) and immediately surrounding (577ha) the Mine Site would be set aside as biodiversity offset areas as part of the Project's Biodiversity Offset Strategy. This land would require active management including weed control, fencing, targeted supplementary planting and active placement of habitat features such as nest boxes, logs or hollow-bearing trees. Grazing would not be undertaken within areas set aside as biodiversity offset areas.

Beyond the end of the Project life, it is anticipated that approximately 1 170ha of land within the Bowdens Farm would be either retained for or returned to agricultural use with approximately 865ha permanently removed from production. The land within the Mine Site to be permanently removed from production would include the void left by the main open cut pit (50ha) and the on-site biodiversity offset area (218ha). The footprint of the relocated Maloneys Road (20ha) and off-site biodiversity offset area (577ha) would similarly be permanently removed from agricultural production. It remains Bowden Silver's long-term objective to remove the leachate management dam following the cessation of leachate generation from the WRE (see EIS Appendix 5 – Section A5.8.5.4. It is noted that controlled grazing would be undertaken in the rehabilitated areas covered by the TSF and WRE, however, stocking rates would be low and grazing would be undertaken principally to reduce bush fire fuel levels. **Figure 7.2** displays the land uses within the Mine Site beyond the end of the Project life.

7.1.2 Water Supply Pipeline Corridor

Approximately 54.7ha of land beyond the Mine Site would be temporarily and sequentially disturbed during the construction of the water supply pipeline. It is estimated that the water supply pipeline would be constructed over a period of up to approximately 10 months, however, the period of disturbance when agricultural activities would be curtailed would be in the order of approximately 1 month. All land disturbed during the construction of the water supply pipeline beyond the Mine Site would be returned to its previous land use within a few months of the completion of the pipeline. No land used for agriculture beyond the Mine Site would be permanently removed from production.

7.2 AGRICULTURAL RESOURCES

7.2.1 Land and Soil Capability

Mine Site

The following impacts upon the soil resources and land capability of the Mine Site are drawn from the Land and Soils Capability Assessment undertaken by SMD (2020).

- No biophysical strategic agricultural land would be impacted as none were identified within the Mine Site.
- Apart from the final void area, the soils in the rootzones of the modified landscapes would retain or improve their qualities required for the long-term rehabilitation of the Mine Site.
- The topsoil and subsoil resources throughout the Mine Site would enable suitable substrates to be created on the final landform to sustain an appropriate level of vegetation across the Mine Site for minimisation of the risk of soil erosion.

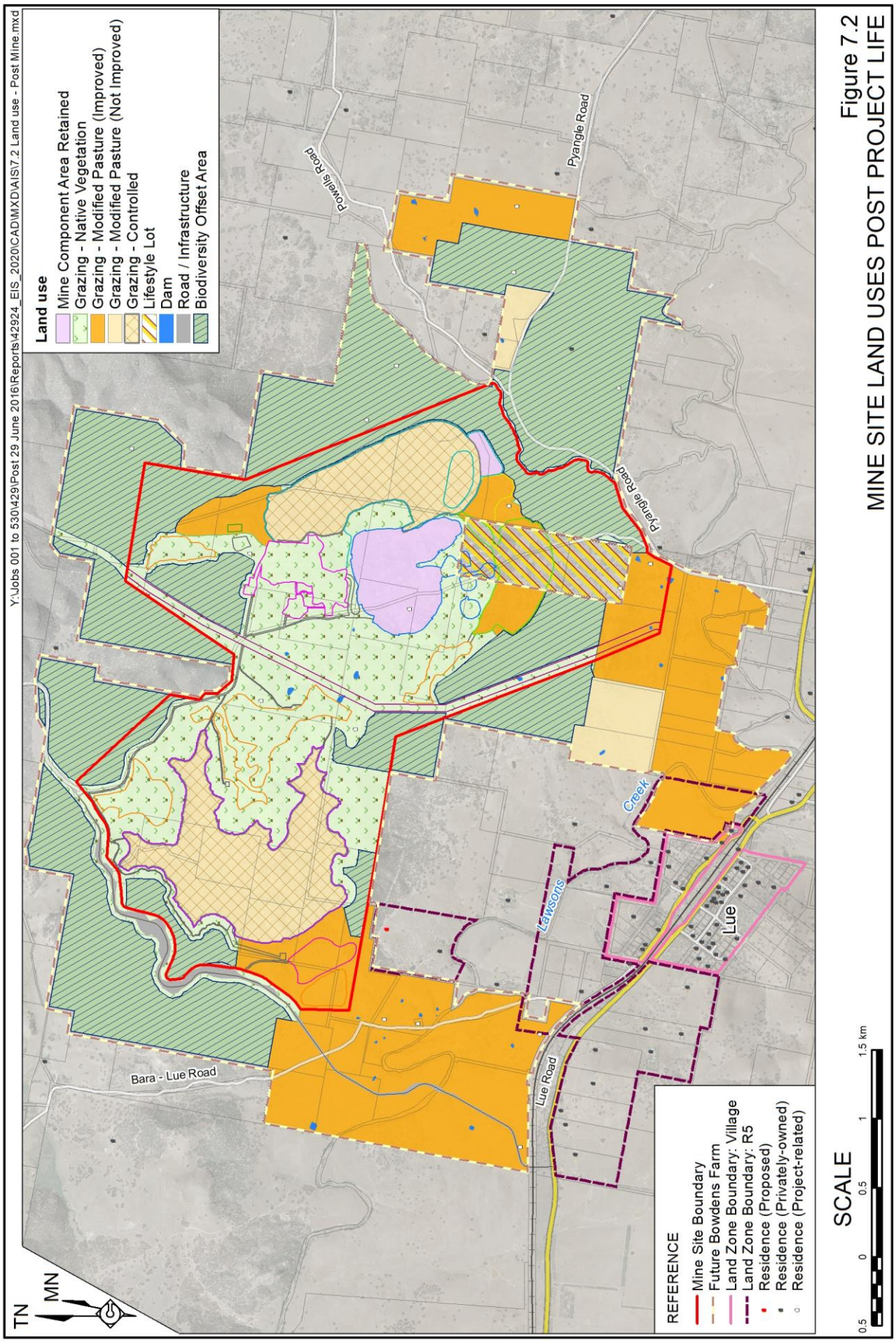


Figure 7.2
MINE SITE LAND USES POST PROJECT LIFE
Y:\Jobs 001 to 530\429\Post 29 June 2016\Reports\42924_EIS_2020\CAD\MXD\AIS\7.2 Land use - Post Mine.mxd
Land use
Mine Component Area Retained
Grazing - Native Vegetation
Grazing - Modified Pasture (Improved)
Grazing - Modified Pasture (Not Improved)
Grazing - Controlled
Lifestyle Lot
Dam
Road / Infrastructure
Biodiversity Offset Area
Pomeis Road
Pyangle Road
Pyangle Road
Creek
Lawsons
Lue
Lue Road
Bara - Lue Road
TN
MN
REFERENCE
Mine Site Boundary
Future Bowdens Farm
Land Zone Boundary: Village
Land Zone Boundary: R5
Residence (Proposed)
Residence (Privately-owned)
Residence (Project-related)
SCALE
0.5
0
0.5
1
1.5 km

- No soil resource impacts from the Project are anticipated on adjoining land used for agriculture.
- The existing land within the Mine Site is predominantly LSC Class 6 with subordinate areas being Class 4 or Class 5 and minor areas being Class 3. A similar level of LSC would be maintained following the rehabilitation of the land disturbed within the Mine Site i.e. with the exception of the final void that would be retained as a lake.

Table 7.2 describes the predicted changes in soils condition and land capability on the final landform within the Mine Site following rehabilitation (see EIS Section 2.16 and EIS Appendix 5).

Table 7.2
Predicted Changes in Soil Condition for Disturbed Areas within the Mine Site

Disturbed Area Component	Total Area (ha)	Predicted changes in soil condition for plant growth and risk of erosion
Tailings Storage Facility	117.4	Improved conditions for plant growth in the upper 60cm of soil would occur following lime and nutrient application; gentler slopes with reduced water erosion hazard; but with tree and shrub root growth not encouraged deeper than 100cm (pasture production areas).
Waste Rock Emplacement*	87.1	Improved conditions for plant growth in the upper 60cm of soil would occur following lime and nutrient application; but with slope increases in some sections, and tree and shrub root growth not encouraged deeper than 100cm (pasture production areas).
Soil stockpiles	61.9	No major long-term changes in soil condition are anticipated.
Open Cut Pits	52.0	This area would become a final void that would be retained as a lake with some tree growth on the upper benches above the final water level, i.e. less potential for plant growth than before.
Southern Barrier	32.1	While the Southern Barrier is in place, the 20cm of topsoil and 100cm of subsoil would provide excellent chemical, physical, nutritional and biological soil conditions for plant growth. Slope would be greater than 10% across much of the structure, but soil in the root zone otherwise is likely to be BSAL quality. No major long-term changes in soil condition are anticipated after removal of this temporary barrier, relative to pre-mining conditions.
Processing Plant / Mining Facility and Nursery	22.8	No major long-term changes in soil condition are anticipated. Where native plants are to be established post-mining, lime and nutrient application to the replaced topsoil and subsoil would be minimised so that their inherent soil requirements are met.
Re-aligned 500kV Power Line	21.2	No major long-term changes in soil condition are anticipated.
Roads and Water Infrastructure	9.3	This area would be partly reduced as retained roads are narrowed and subsoil and topsoil placed on ripped areas.
TSF NAF Waste Rock Stockpile	9.2	No major long-term changes in soil condition are anticipated. This area would largely be returned to pre – mining conditions.
Oxide Ore Stockpile	7.5	Assuming this stockpile remains beyond the end of the Project life, the vegetated steeper side slopes would be more prone to erosion than the existing area. The subsoil and topsoil replaced on the upper surface would easily support plant growth.
Total	**420.5**	
* Includes the low grade ore stockpiles and leachate management dam		
Source: SMD (2020) – Table 14		

Water Supply Pipeline Corridor

The following impacts upon soil resources and land capability would occur within the water supply pipeline corridor as a result of the construction of the pipeline.

- No biophysical strategic agricultural land would be impacted by the construction of the water supply pipeline.
- Negligible impacts on soil resources would occur as all topsoil would be replaced on the top section of the trench without compaction. All subsoil would either be returned to the trench or transferred to the Mine Site for stockpiling or immediate use in rehabilitation.
- All disturbed land would be returned to its previous use and the existing level of LSC would be maintained upon rehabilitation.
- Erosion of soil stockpiles during the construction of the pipeline would be managed by positioning stockpiles away from watercourses and installing silt-stop fencing downslope of any stockpiles located on slopes greater than 1:10 (V:H).

7.2.2 Surface Water

7.2.2.1 Surface Water Flows

The Project has the potential to reduce surface water runoff in the surrounding catchments due to construction of a range of structures on site that would capture surface water that currently flows towards and down the watercourses that provide stock watering.

The Project would involve the capture and retention of some surface water within the Mine Site and hence some reduction in surface water outflows. The principal mechanism by which the Project would affect the quantity of water supplies available to other downstream surface water users would be by reducing flows to the extent that the frequency and duration of cease-to-flow periods is increased.

During operations, the maximum impact of the Project on downstream flow would be a decrease of flows in:

- the downstream 3.5 km of Hawkins Creek from its confluence with Lawsons Creek by up to 4.4%;
- Lawsons Creek downstream of Hawkins Creek and the Mine Site and upstream of the Walkers Creek confluence by up to 1.2%;
- Lawsons Creek downstream of the Walkers Creek confluence by up to 2.2%.

Post-mine closure:

- the flow in Hawkins Creek for a distance of 3.5km from its confluence with Lawsons Creek would decrease by 1.4%.
- the flow in Lawsons Creek between the confluence of Hawkins and Walkers Creeks would decrease by 0.4%; and
- the flow in Lawsons Creek downstream from its confluence with Walkers Creek would decrease by 0.4%.

WRM (2020) concludes that the impacts of the Project on surface water flows would be minimal, and therefore the impacts of the loss on the availability of water to downstream water users would be negligible.

Further details on potential impacts to surface water flows within and immediately surrounding the Mine Site are provided in Section 4.7.5 of the EIS.

Bowdens Silver would obtain the required water entitlements under the Macquarie Bogan Unregulated Rivers Water Sharing Plan for the agreed amount of surface water intercepted by the Project.

7.2.2.2 Surface Water Quality

Changes to water quality and rates of sedimentation in Hawkins and Lawsons Creeks would be minimal due to the implementation of the sediment and erosion controls that would prevent sediment-laden water that would be generated on site from entering these creeks. The risk of any accidental release of chemicals and/or poor-quality water into watercourses is also low due to the implementation of the proposed water quality controls. Any potential adverse impacts to surface water quality are expected to be minimal.

Further details on potential impacts to surface water quality within and immediately surrounding the Mine Site are provided in Section 4.7.5 of the EIS.

7.2.3 Groundwater

7.2.3.1 Groundwater Levels and Flow

Mine dewatering take has been partitioned between the applicable groundwater and surface water sources, including allowance for incidental surface water take through baseflow reduction. The maximum predicted take from each of the applicable water sources, and therefore the volume of share components for each of the water sources required to be held during mining are as follows.

- Lachlan Fold Belt Groundwater Source (Other) – 907 ML
- Sydney Basin Groundwater Source – 194 ML
- Lawsons Creek Water Source – 12.9 ML

Potential groundwater drawdown may impact groundwater availability for registered users beyond the Mine Site. Drawdown predicted in modelling indicates that potential drawdown of more than 2m could occur at two registered bores (GW061475 and GW802888) located on privately-owned land surrounding the Mine Site. As impacts at these two bores are predicted to become evident post-mining (impacts at GW061475 may also be evident at the end of mining), contingency measures including “make good” provisions would be required for these landowners. Regardless, monitoring of potential impacts at these bores would be an objective of the groundwater monitoring program for the Project.

7.2.3.2 Groundwater Quality

During mining, any changes to groundwater chemistry (for example, as a result of oxidation of acid forming materials and subsequent mobilisation in groundwater) would not impact the groundwater system as all water would be removed from the open cut pit for use in processing.

Post-mining, the salinification of the open cut pit lake due to evaporative concentration is expected to occur gradually over time. However, as the open cut pit lake would act as a groundwater sink, the direction of net flow of groundwater would remain towards the open cut pit lake and the saline water would not leave the system.

The impacts of seepage from tailings stored in the TSF over time has been considered by Jacobs (2020) with the following relevant conclusions.

- The tailings material would be considerably less saline than existing groundwater (850µS/cm as opposed to existing records that vary from 1 350µS/cm to 2 900µS/cm).
- Tailings seepage has potential for low pH and elevated metals concentrations, which would be the focus of TSF design features that would include seepage interception and groundwater monitoring in the vicinity of the TSF.
- Any impacts would remain localised to areas of groundwater mounding beneath the TSF with the seepage captured and flowing long term towards the main open cut pit.

7.2.4 Air Quality

The Air Quality Impact Assessment (Ramboll, 2020) identifies that the predicted incremental increase in dust deposition is less than 1g/m^2/month at all private residences for all years (less than 50% of the impact assessment criteria of 2g/m^2/month). Similarly, predicted cumulative dust deposition is less than 2g/m^2/month at all private residences for all years (less than 50% of the impact assessment criteria of 4g/m^2/month). The Air Quality Impact Assessment further identifies that there would be no cumulative exceedances of the impact assessment criteria for lead in deposited dust at surrounding residences.

Based on the results of the Air Quality Impact Assessment (Ramboll, 2020), it is evident that dust deposition levels on properties surrounding the Mine Site would be sufficiently low such that the effects of Project-related dust on agricultural production would be negligible.

7.2.5 Noise and Vibration

The Noise and Vibration Impact Assessment (SLR, 2020) indicates that the Project would satisfy all noise criteria at those residences without VLAMP agreements through the implementation of the proposed management and mitigation measures. Compliance with the human-based criteria would equally ensure that grazing sheep and cattle in the vicinity of the surrounding privately-owned receptors are not adversely affected by noise.

The Blasting Assessment (SLR, 2020) demonstrates that it would be possible to control vibration and airblast overpressure to meet relevant criteria by well controlled blast design and execution and by restrictions on the maximum instantaneous charge (MIC), where necessary. Initial blast designs would be conservative and, from these, the appropriate blast design, including MIC limits, would be developed to satisfy the blast criteria for individual blasts. SLR (2020) identifies that the predicted ground vibration and airblast overpressure levels from typical blast designs indicate that livestock disturbance is most unlikely to occur at distances greater than 514m for ore blasts (MIC 117kg), and 630m for waste rock blasts (MIC 216kg). Bowdens Silver would monitor the interaction between stock on the Bowdens Farm and blasting activities and move stock prior to blasts, if required.

7.3 AGRICULTURAL ENTERPRISES AND INFRASTRUCTURE

7.3.1 Cattle and Sheep Industry

There would be negligible impacts upon the overall total land available for grazing throughout the Region or the Lue district as a result of the Project. The maximum area of land currently used for agriculture to be removed throughout the Project life would be approximately 1 498ha of 500 458ha, or approximately 0.3% of the total land used for agriculture available within Region. Additionally, much of this land used for agriculture has low productivity rates and is used only for sporadic grazing due to steep terrain and dense vegetation. The total amount of land that would be permanently removed from agricultural production after rehabilitation would be approximately 865ha, or 0.17% of the total land used for agriculture within the Region. The scale of the land withdrawn and its productive capacity are considered insignificant when compared to the Region's overall production capacity. As a result, it is expected that there would be no consequential impacts on associated infrastructure or agricultural enterprises.

7.3.2 Other Agricultural Industries

It is anticipated that no agricultural industries or infrastructure within the vicinity of the Mine Site would be adversely impacted by the Project. The closest commercial, non-livestock related operations occurring within the Lue district are East Ridge Olives, Rylstone Olive Press and Elephant Mountain Wines. These operations are respectively located approximately 2.6km, 5.3km and 3.8km from the Mine Site and are not likely to be adversely impacted upon as a result of the adoption of the proposed mitigation measures discussed in Section 6.

In particular, it is noted that potential impacts to the above enterprises as a result of deposited dust (and any minor concentrations of heavy metals) are expected to be negligible given their significant distances from the Mine Site and the ability of the Project to comply with the relevant criteria at surrounding privately-owned residences. Given the above, it is considered very unlikely that the Project would adversely impact upon the organic certifications held by the Rylstone Olive Press.

7.4 SOCIAL AND ECONOMIC IMPACTS

7.4.1 Agricultural Land Values

It is assessed that the value of land beyond the Mine Site that is used for agriculture commercially within the Region would be unlikely to change as a result of the Project as the potential agricultural productivity would not change substantially. Bowdens Silver would continue to graze stock on sections of the land surrounding the Mine Site to ensure that the land remains productive and maintains its land value. Furthermore, Bowdens Silver would return the post-mining landform to the existing or improved agricultural value, wherever possible.

7.4.2 Regional and Local Agricultural Enterprises

As discussed in Section 2.8, approximately 94.6% of farmland within the Region is dedicated to grazing livestock. Within the Lue district, there are few major commercial livestock operations, with most of the land used to run smaller agricultural concerns. It is unlikely that the Project would have any discernible adverse impacts on the agricultural enterprises and industries previously discussed in Section 3.8.

7.4.3 Cost of Lost Opportunities / Productivity

The key impact of the Project on agricultural resources would be either the temporary or permanent removal of grazing land from the Mine Site and the footprint of the relocated Maloneys Road during or after the Project life. It is estimated that a maximum reduction in gross revenue in the order of $160,000 per annum would be experienced based on the continued operation of the Bowdens Farm over an area of approximately 470ha area throughout the Project life, and a conservative return of approximately $107 (gross) per hectare. This impact would be reduced to approximately $88,000 in gross revenue after the mine closure given that a similar level of soil condition and land capability would be maintained following the rehabilitation of land disturbed within the Mine Site over an area of approximately 1 170ha i.e. with the exception of the final void, relocated Maloneys Road footprint and biodiversity offset areas.

7.4.4 Agricultural Support Services

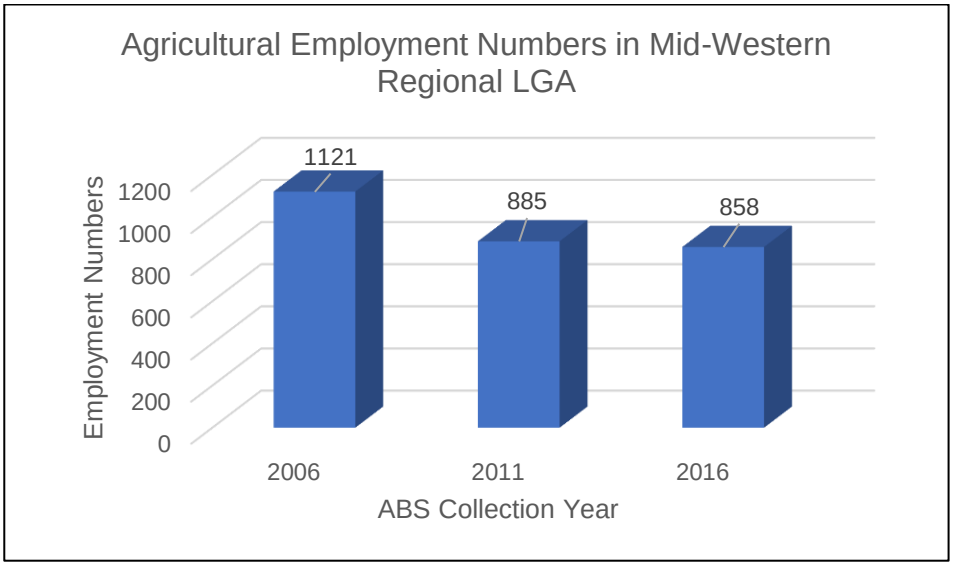
Bowdens Silver is committed to continuing to farm and manage the Bowdens Farm in line with current and widely accepted agricultural practices. Furthermore, Bowdens Silver has committed to the continuation of its support for regional agricultural support services and enterprises through:

- sponsorship of the Rylstone-Kandos Show and the Mudgee Show which are both major agricultural events in the Region;
- implementation of a preferred supplier policy that utilises local suppliers and suppliers employing local people as far as possible; and
- the provision of part-time employment opportunities to generate off-farm incomes for local farmers (see Sections 6.8 and 7.4.5).

It is anticipated that the presence of the Mine would have a net positive influence in regard to agricultural support services through the above actions with flow-on benefits arising from the continued operation of the Bowdens Farm throughout the Project life.

7.4.5 Local and Regional Agricultural Employment

From the ABS (2016a) data, the main employment sector in the Mid-Western Regional LGA is Mining (15.3%) followed by Retail Trade (10.8%), Health Care and Social Assistance (10.2%) and Agriculture, Forestry and Fishing (9.0%). Australian Bureau of Statistics analyses (**Figure 7.3**) suggests that the Mid-Western Regional LGA has followed the national trend, with employment numbers in agricultural production falling over a number of years.



Source: ABS (2016a)

Figure 7.3 Historical Trends in Employment in Agriculture

An analysis of State-based and regional figures in the cattle and sheep industries (**Table 7.3**) provides a close estimate in aggregated terms of production volumes required to support labour numbers. It also provides the data which enables an evaluation of the potential impacts on employment which would occur when land associated with the Project is taken out of production.

Table 7.3
Labour per Potentially Impacted Agricultural Sector Analysis Table

Industry Sector	Labour No. NSW	Sector Production State	State Factor	Labour No. Region	Sector Production Region	Local Factor
Cattle	13 478*	~5 million	1:370	281	~112 400	1:400
Sheep	4 068**	~26 million	1:6 391	Not available	~635 000	-
* Labour numbers shown are for specialised beef cattle farmers ** Labour numbers shown are for specialised sheep farmers (ABS, 2010)						
Sources: ABS (2010, 2016a, 2016b)						

Labour Volume Loss Projections

Bowdens Silver currently employs a farm manager to manage livestock and maintain the land which comprises the Bowdens Farm. This employment would continue throughout the Project life and, therefore, no labour losses are expected, particularly given the extended Bowdens Farm would comprise an area of approximately 470ha throughout the Project life.

Table 7.4 utilises calculations based on NSW and Regional industry figures to identify potential labour losses associated with potential commodity production losses in the area removed from agricultural use following the Project life. A simple calculation has been conducted for the two key industry sectors that comprise the majority of land use within the Region. The industry sector value has been divided by the labour force numbers to identify potential job losses in each sector.

Table 7.4
Production Loss/Gain and Labour Impact (Agricultural Workforce)

Industry Sector	Total Mine Disturbance Stock/Production Values	Current Regional Labour force	Mudgee Region Volumes	Labour per Unit	Potential Labour Loss/Gain
Cattle	9.0	281	~112 400	1:400	-0.023 FTE
Sheep	596.0	99*	~635 000	1:6 391	-0.093 FTE
Net Employees					-0.116 FTE
* Estimated from State ABS (2016b) statistics					

Following the mine closure, approximately 865ha of land currently used for agriculture would be removed from production. Based on current carrying capacity (i.e. 0.8 sheep per hectare with a nominal 0.01 cattle per hectare), this represents a maximum of approximately 9 head of cattle displaced and 692 head of sheep if all the land was unavailable for grazing. At the current production rates, the removal of this land would result in a total net reduction of approximately 0.116 full time equivalent (FTE) positions.

Off-farm Income

A notable trend in regional areas of Australia is the increasing reliance upon off-farm employment to maintaining farm incomes. Since 1990, the proportion of farm families deriving off-farm income has increased from 30 to 45% (Productivity Commission, 2005). In 2017-2018, it was estimated that Australian farming businesses received approximately 11% of their income from off-farm employment or business activities (ABS, 2018). Off-farm income is particularly important to small agricultural enterprises to offset low or variable farm incomes, especially during poor seasons.

Given that Bowdens Silver has committed to the implementation of flexible work arrangements for employees (see Section 6.8), it is anticipated that the Project would provide a significant economic contribution to local farm families throughout the Region. This income would provide agricultural families and their enterprises with much needed capital and improve the viability of marginal and/or small operations.

7.4.6 Tourism

Regional Impacts

Mining and tourism are not mutually exclusive activities. Areas such as Cessnock and Gunnedah in NSW, and Carnarvon Gorge and Arcadia Valley in Queensland, have recorded strong and sustained growth in visitor numbers in parallel with growth in mining and mining employment. This trend is reflected in the Mid-Western Regional LGA, where there has been a steady expansion of mining since 1986 in conjunction with tourism growth. This trend has continued in recent years with the Mudgee Region Visitor Information Centres recording a total of 28 202 visitors in 2015-16 (MRT, 2016), 28 079 visitors in 2016-17 (MRT, 2017) and 33 225 visitors in 2017-2018 (MRT, 2018).

The fact that visitor numbers have not declined, despite the growth of mining, suggests that the major visitor attractions and their customer base would be reasonably secure from perception impacts. This is especially true as most cellar doors, the major regional attraction, are located to the northeast of Mudgee. Given the measures that would be taken to mitigate the impacts of the Project on visual amenity, and the fact that the majority of visitors travelling to Mudgee would utilise the Castlereagh Highway, it is not anticipated that the Project would result in any adverse impacts on tourism.

Lue District Impacts

There would be a high level of change to the scenic character of the eastern section of the Mine Site as a result of the removal of vegetation and the ridge where the main open cut pit would be located and the progressive construction of other landforms. Whilst it is planned to construct the landforms on site with a less geometric and more natural appearance, these components would retain a manufactured and engineered appearance during their construction and cause a localised significant and negative change to the scenic quality as a result of the Project. However, the visual amenity of surrounding B&Bs and guesthouses (i.e. Odd Frog Lodges, ‘Wyuna’ Lue Farmstay, Old Bara Guesthouse, Rokbara Cottage, Elephant Mountain House, Camphill Cottage and the various accommodation options located within Lue Station) would be negligible due to intervening topography between their locations and the Mine Site.

Potential adverse air quality and noise impacts would be managed through the implementation of the measures identified in Section 7.24 and 7.2.5.

Given the above, it is expected that any potential adverse impacts to agri-tourism enterprises throughout the Lue district would be minimal.

7.4.7 Compatibility with Other Land Uses

The Mid-Western Regional Comprehensive Land Use Strategy 2010 provides a blueprint for the Mid-Western Regional LGA to meet long term urban and rural growth needs. The strategy identifies that agriculture, mining, tourism and rural living would continue to be the key land uses in rural areas within the LGA. Mining is identified within the strategy as a key driver of population, employment and economic growth within the Mid-Western Regional LGA.

The strategy further highlights that local planning controls should consider resource protection and management during the development of local land use controls. Local planning and land use controls are identified as the principal instruments to ensure that environmental and

community interests are considered for major mining projects. It is noted that the *Mid-Western Regional Local Environmental Plan 2012* nominates that the Mine Site is located wholly within Zone RU1 – Primary Production with Open cut mining permissible with consent. Correspondence received from Council on 25 November 2019 further confirms that the only recent development application in the area immediately surrounding the Mine Site was in relation to the Bara Quarry located approximately 2.4km to the northwest of the Mine Site. It is therefore considered that the Project would not adversely impact upon existing, approved or preferred land uses in the Lue district.

The water supply pipeline between the Ulan Coal Mine and/or Moolarben Coal Mine and the Mine Site would traverse land zoned RU1 – Primary Production and R5 – Large Lot Residential. Water supply systems are permissible with consent on land zoned RU1 – Primary Production, however, they are prohibited on land zoned R5 – Large Lot Residential. It is noted that consent may still be granted by the Minister for the development of the water supply pipeline on land zoned R5 – Large Lot Residential as only part of the development is prohibited by the Mid-Western Regional LEP. This is in accordance with Condition 4.38(3) of the EP&A Act which states that "*development consent may be granted despite the development being partly prohibited by an environmental planning instrument*". It is noted that as the pipeline corridor would be rehabilitated immediately following construction, the risk of land use conflicts along the pipeline corridor is considered minimal.

7.5 CUMULATIVE IMPACTS

Due to the negligible impacts expected on land used for agriculture in the vicinity of the Mine Site as a result of the Project, it is expected that there would also be negligible negative cumulative impacts on agricultural operations within the Region. No other major mining or extractive industry projects are currently proposed within the Region. It is noted that the Bylong Coal Project (BCP) would have been located approximately 30km to the northeast of the Mine Site, however, this project was recently refused development consent.

8. CONCLUSION

This AIS has introduced the Project and the existing environmental and agricultural settings in which the Project would operate. Detailed analysis of the current agricultural resources and enterprises has been researched and outlined with a risk assessment undertaken to identify the potential risk sources that the Project may have on the surrounding agricultural environment and enterprises.

The results of the risk assessment, together with the assessments undertaken in Section 7, has established that the Project would have a negligible to minor impacts upon the agricultural resources and enterprises through the Region. The implementation of the management and mitigation measures would result in acceptable levels of impacts (low to medium) within the disturbance areas.

The Project would marginally reduce the availability of land currently used for agriculture throughout the Project life, however, the continued operation of the Bowdens Farm and the proposed progressive rehabilitation schedule, would ensure that the Project would only have minor to negligible impacts on land used for agriculture both during and after the mine closure. It is further anticipated that the Project would provide a significant economic contribution to local farm families through the provision of off-farm income throughout the Project life. This income would provide agricultural enterprises with much needed capital and improve the viability of marginal and/or small operations.

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