BOWDENS SILVER

Part 15
Economic Assessment

State Significant Development No. 5765

Prepared by:

Gillespie Economics

May 2020

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BOWDENS SILVER

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Economic Assessment

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COMMONLY USED ACRONYMS

AHD	Australian Height Datum
AUD	Australian Dollar
BGW	Box Gum Woodland
BMP	Blast Management Plan
CBA	Cost Benefit Analysis
CCT	correlated colour temperature
CGE	Computable General Equilibrium
CNMLs	Construction Noise Management Levels
DPIE	Department of Planning, Infrastructure and Environment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
FTE	Full-time Equivalent
GHG	Greenhouse Gas
GRIT	Generation of Input-Output Tables
ha	Hectare
HCN	hydrogen cyanide
HMP	Heritage Management Plan
HNAL	Highly Noise Affected Level
IO	Input-Output (Analysis)
km	Kilometres
LEA	Local Effects Analysis
LGA	Local Government Area
m^3	Cubic Metres
MEG	Department of Regional NSW - Mining, Exploration and Geoscience
MIC	Maximum Instantaneous Charge

Mpa	million per annum
NO_x	Nitrogen Dioxide
NPV	Net Present Value
OVA	other value-added
PAF	potentially acid forming
PM_{10}	particulate matter less than 10 μm in diameter
$PM_{2.5}$	particulate matter less than 2.5 μm in diameter
ROM	Run-Of-Mine
SEARs	Secretary's Environmental Assessment Requirements
t	Tonnes
TMP	Traffic Management Plan
TSF	Tailings Storage Facility
TSP	Total Suspended Particulates
USD	United States Dollar
WRE	Waste Rock Emplacement

KEY ECONOMIC DEFINITIONS

Consumption-induced flow-on	the spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries.
Cost benefit analysis	a method to assess the relative economic desirability (economic efficiency) of competing alternatives.
Discount rate	the percentage rate of compound interest at which future benefits and costs are adjusted to their equivalent present-day values.
Discounting	the process of adjusting future benefits and costs to their equivalent present-day values.
Economic activity	measures of economic activity include output, value-added, income and employment.
Economic efficiency	is concerned with whether the well-being of society is improved by a proposal relative to without the proposal.
Economic impact	refers to the effect of a project on economic activity within a local area or region.
Employment	the number of people employed (including full-time and part-time).
Externalities	an outcome that arises when an activity between two parties affects the activity of a third, without any compensation to or payment by the third party.
Gross regional product	one of several measures of the size of an economy. It is the market value of all final goods and services produced by all firms in an economy.
Household income	the wages paid to employees including imputed wages for self-employed and business owners.
Input-output analysis	a method to assess the direct and indirect economic activity generated by a proposal through spending.
Intermediate good	a good that is used as an input into the production of other goods and services
Local area	the Mid-Western Regional Local Government Area.
Multiplier	a summary measures used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry. There are many types of multipliers.
Mine Life	Approximately 16.5 years comprising the site establishment and construction stage (approximately 18 months – including 12 months of mining pre-strip) and mining / processing for approximately 15 years (to the end of concentrate production).

Neoclassical welfare economics	a branch of economics that uses microeconomic techniques such as benefit cost analysis to evaluate the economic well-being of the society.
Net present value	the sum of a flow of annual net benefits, each of which is expressed in present value. The sum is exactly equivalent to the difference between the present value of benefits and the present value of costs.
Net production benefit	net benefits accruing from production which is based on revenues and costs to the proponent. It includes royalties, company tax and net producer surplus and any economic benefits to existing landholders, workers, and suppliers. It also takes account of mitigation, offset and compensation costs.
Net social benefit	net production benefits plus any positive or negative environmental, social and cultural impacts that have not been mitigated, offset or compensated for.
Opportunity cost	the potential return in the best, foregone alternative.
Output	total revenue or business turnover.
Partial equilibrium analysis	the analysis of relationships within a particular subsector of the economy, holding relationships in other subsectors of the economy constant.
Present value	the equivalent value today of a future benefit or cost.
Production-induced flow-own	the sum of the first-round effects and industrial support effects (i.e. the total amount of output from all industries in the economy required to produce the initial change in output).
Project Life	Approximately 23 years comprising the site establishment and construction stage, mining and processing operations (to the end of concentrate production) and includes the period for final rehabilitation.
Resource costs	resource costs are costs where there is an exchange of goods and services (resources). They are distinct from transfer payments, such as royalties, which are a cost to an individual firm but do not involve any exchange of resources
Threshold value method	a form of cost benefit analysis, where the quantified net benefits of a Project are compared to the unquantified costs. The quantified net benefits provide a threshold value that unquantified costs must exceed to make the Project questionable from an economic efficiency perspective.
Type 11a ratio multiplier	summarise the total impact on all industries in an economy in relation to the initial own sector effect e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc.
Value-added	the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

EXECUTIVE SUMMARY

The Bowdens Silver Project (the Project) involves the recovery of silver, zinc and lead minerals from defined ore reserves within a proposed Mine Site, located approximately 2km to 3km northeast of Lue and 26km east of Mudgee within the Mid-Western Regional Local Government Area.

This Economic Assessment for the Project has been prepared for Bowdens Silver Pty Ltd (Bowdens Silver), to accompany a Development Application for State Significant Development Consent for the Project under Division 4.1 of Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Specifically, the Economic Assessment provides the following.

- A cost benefit analysis (CBA) which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest.
- A local effects analysis (LEA) using a methodology developed by the NSW Government (2015), to assess some of the impacts of the Project in the locality, specifically:
  - net employment to existing residents;
  - non-labour project expenditure; and
  - environmental and social impacts on the local community.
- A supplementary LEA, using traditional input-output (IO) analysis to assess the broader economic activity project footprint in relation to output, value-added, income and employment.

Cost Benefit Analysis

A CBA of the Project indicates that it would have net production benefits globally of $98M including direct production benefits to NSW of $44M, present value at 7% discount rate. Therefore, provided the residual[1] environmental, social and cultural impacts of the Project that accrue to NSW are considered to be valued at less than $44M, the Project can be considered to provide an improvement in economic efficiency and hence, relative to the “without Project” scenario, is justified on economic grounds.

Adverse uncompensated and residual environmental, social and cultural impacts of the Project have been minimised through project design and mitigation, offset and compensation measures. The cost of implementing these measures has already been incorporated into the estimate of net production benefits, including the cost of using land and water resources, noise, air quality and visual impact mitigation, provision of biodiversity offsets, road relocation and access upgrade. Expert technical investigations indicate no material impacts are envisaged in relation to Aboriginal heritage, historic heritage, public infrastructure or loss of surplus to other industries.

[1] Residual impacts are any remaining impacts following the implementation of the proposed mitigation, compensation and/or offset measures.

Residual impacts that were quantified included greenhouse gas (GHG) generation. These costs have been accounted for within the net social benefits. There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $103M present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of $44M to $146M net present value at 7% discount rate (the latter including employment benefits) and hence, relative to the "without Project" scenario, is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $44M to $146M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The sensitivity analysis indicated that the CBA results are most sensitive to revenue estimates i.e. USD price of concentrates and the AUD:USD exchange rate, followed by operating costs and capital costs. Since mitigation, offset and compensation costs are a small component of the capital costs of the Project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Local Effects Analysis

While the Project would provide direct employment on site for an average of 131 full-time equivalent (FTE) and peak employment of 246 during construction and 210 (FTE) and peak employment of 230 during operation, the net impact on local employment would depend on prevailing levels of unemployment and labour force participation rates, as well as the scope for in-migration of labour. Approximately 20 staff would also be retained for ongoing exploration and associated activities, however, this has not been factored into the calculations in this report. One scenario, under the LEA, assumes full local area employment[2] and ignores income to the region associated with in-migration of labour. These are very restrictive assumptions that would serve to understate actual Project employment benefits to the local area. Nevertheless, the impact of the Project under these assumptions is reported in **Table ES1.**

The impact assuming that all future employees already residing in the local area are directly drawn from the unemployed, is also reported in **Table ES1**. The total regional economic impacts, including from in-migration of labour are reported in a supplementary LEA (Section 6 of this document).

Based on the two sets of assumptions of the LEA, the Project is estimated to contribute 20 to 33 net direct local jobs ($1.8M to $3.0M in income) to existing residents of the local area during construction and 73 to 129 net direct local jobs ($6.2M to $11.0M in income) annually during operation.

With multiplier effects included, construction would contribute 31 to 52 local area jobs and $2.5M to $4.3M per annum in local area income to existing residents, and the Project operation would contribute 147 to 260 local area jobs and $10.3M to $18.2M per annum in local area net income to existing residents.

[2] Where the region is defined as the Mid-Western Regional Local Government Area.

Table ES1
Summary of Local Effects

	Project Direct	**Project Direct: Local**	**Net Direct Effect**	**Total Net Effect (with multiplier)**
Construction (Average Annual Onsite)				
Employment	131	39	20 - 33	31 - 52
Net income (M)			$1.8 - $3.0	$2.5 - $4.3
Operation (Average Annual Onsite)				
Employment	210	158	73 - 129	147 - 260
Net income (M)			$6.2 - $11.0	$10.3 - $18.2
Net non-labour expenditure (M)	$30 Mpa			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	No material impact			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**		
Agricultural impacts	Farmers whose land is required for the Project	Impacted farmers compensated via purchase of land. No material residual impact		
Surface water	Local surface water users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Groundwater	Local groundwater users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Air quality impacts	Adjoining landholders	Impacted owners compensated via acquisition or negotiated agreement. No material residual impacts		
Noise impacts	Adjoining landholders	Impacted owners compensated via acquisition, negotiated agreement or mitigation actions. No material residual impacts		
Ecology and biodiversity	Local and NSW households	Some loss of non-use values but offset by provision of biodiversity offsets		
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts		
Historic heritage impacts	Local and NSW households	No material impacts		
Transport and traffic	Local residents	No material impacts		
Visual amenity	Adjoining landholders	Impacted landowners compensated via mitigation measures. No material residual impacts		

Supplementary Local Effects Analysis

The supplementary LEA, using IO analysis, relaxes the restrictive assumptions of the LEA and allows for divergence from full employment, job chains effects, and in-migration of labour to the region.

Using this approach, the total average annual impact of construction on the local area economy is estimated at up to:

- $113M in annual direct and indirect output or business turnover;
- $49M in annual direct and indirect value added;
- $20M in annual direct and indirect household income; and
- 131 direct and 79 indirect local jobs.

The Project operation is estimated to make up to the following average contribution to the local area economy throughout the life of the Project:

- $185M in annual direct and indirect output or business turnover.
- $94M in annual direct and indirect value-added.
- $37M in annual direct and indirect household income.
- 210 direct and 214 indirect jobs.

The actual local area impact of the Project operation is likely to lie between that assessed in the LEA and the Supplementary LEA.

1. INTRODUCTION

Gillespie Economics has been engaged by R.W. Corkery Pty Limited on behalf of Bowdens Silver Pty Ltd (Bowdens Silver) to complete an Economic Assessment for the Bowdens Silver Project (the Project), located approximately 2km to 3km northeast of Lue and 26km east of Mudgee within the Mid-Western Regional Local Government Area (see **Figure 1.1**). The purpose of the Economic Assessment is to accompany a Development Application for State Significant Development Consent for the Project under Division 4.1 and 4.7 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

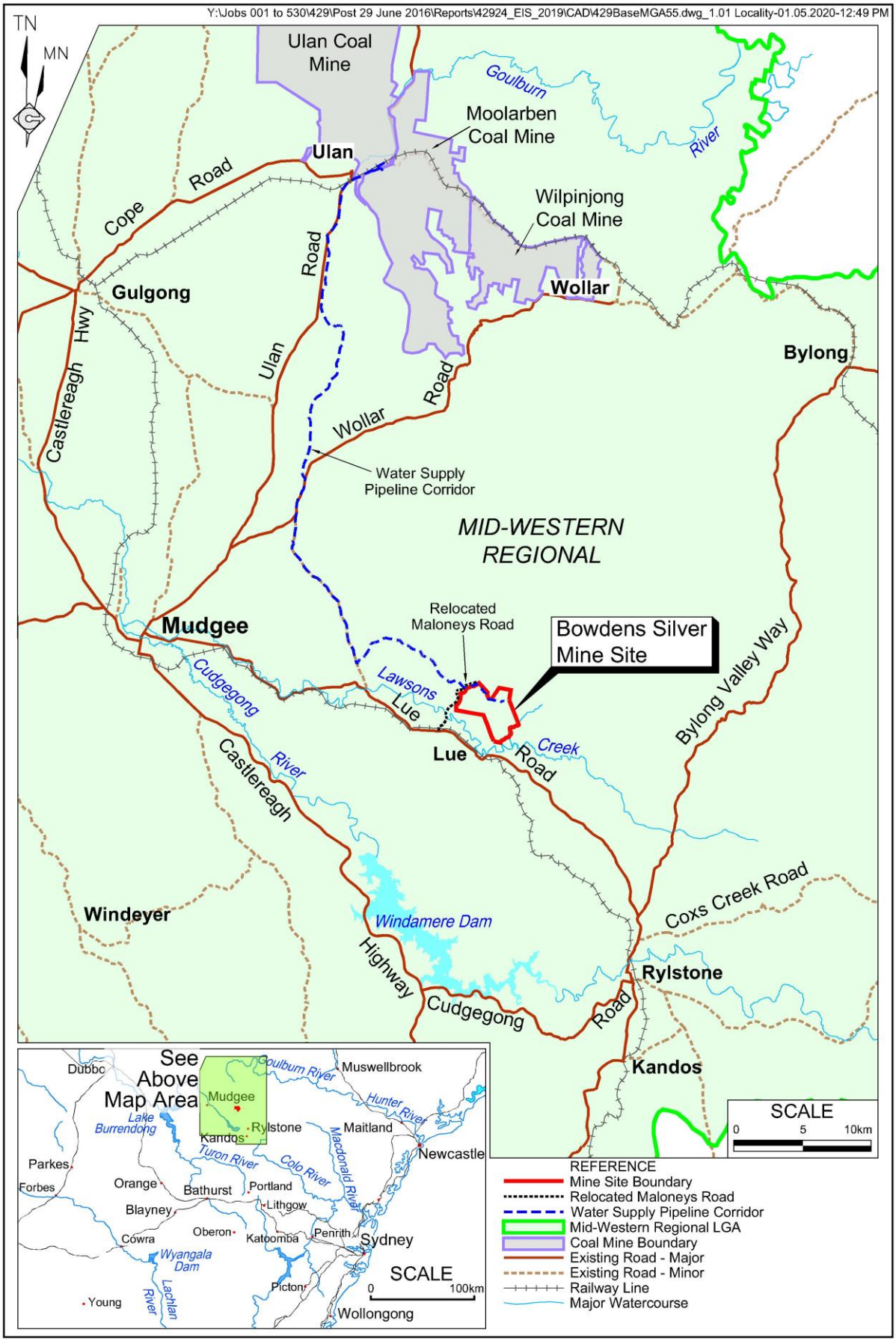
1.1 LEGISLATIVE CONTEXT AND GUIDELINES

This Economic Assessment has been carried out in accordance with the following.

- The Secretary's Environmental Assessment Requirements (SEARs) for the Project dated 21 June 2019 that relate to economics i.e.:
  - an assessment of the likely economic impacts of the development, paying particular attention to the:
    - significance of the resource;
    - economic benefits of the development for the State and region; and
    - demand for the provision of local infrastructure and services.
- Clause 7(1)(f) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* which requires environmental impact statements to provide "the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations…" Note to Clause 7(1)(f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- Section 4.15 of the EP&A Act which requires the following two matters to be taken into consideration by the consent authority in determining a development application.
  - The public interest (taken as the collective public interest of households in NSW).
  - The likely impacts of the development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- The following standards, guidelines and policies.
  - NSW Government (2015) Guideline for the economic assessment of mining and coal seam gas proposals;
  - NSW Government (2018) Technical Notes supporting the Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals; and
  - NSW Treasury (2017) NSW Government Guide to Cost-Benefit Analysis.[3]

[3] Refer to Attachment 1 for the legislative context for economic methods in Environmental Impact Assessment (EIA) in NSW.

Figure 1.1 Locality Plan



To meet the above requirements, two types of analysis are needed, namely:

- a cost benefit analysis (CBA) which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest; and
- a local effects analysis (LEA) to assess the impacts of the Project in the locality[4], specifically:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.[5]

Economic analysis tools such as CBA and LEA are not mechanised decision-making tools, but rather a means of analysis that provides useful information for decision-makers to consider alongside the performance of a project in meeting other government goals and objectives.

1.2 REPORT OUTLINE

Section 2 outlines the scope of the Project, the proposed economic impact mitigation measures, and key economic assumptions. This is the information on which the Economic Assessment is based. Section 3 provides an overview of the CBA and LEA approach used whilst Sections 4 and 5 document the CBA and LEA of the Project, respectively. Section 6 provides a supplementary LEA using Input-Output (IO) analysis. Conclusions are provided in Section 7.

1.3 COVERAGE OF SEARS AND COMMUNITY ISSUES

Table 1.1 provides a summary of the SEARs and requirements provided by Department of Planning, Infrastructure and Environment (DPIE) and **Table 1.2** provides a summary of issues raised by the Lue and district community which are relevant to the economic assessment. A cross reference is provided where each requirement / issue has been addressed in this report.

Table 1.1
Coverage of SEARs and Other Government Agency Requirements

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Relevant Requirement(s)	Coverage in Report
Secretary's Environmental Assessment Requirements	
The EIS must include assessment of the: • likely economic impacts of the development, paying particular attention to the: – significance of the resource;	Section 2.2
– economic benefits of the development for the State and region; and,	Sections 4, 5 and 6
– demand for the provision of local infrastructure and services.	Section 4.4 and Social Impact Assessment

[4] For the purposes of this assessment, the locality is defined as the Mid-Western Local Government Area.
[5] Refer to Attachment 2 for an introduction to economic methods.

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

Relevant Requirement(s)	Coverage in Report
Relevant Requirements Nominated by Other Government Agencies	
• Price forecasts by product type	Section 2.4
• Product tonnages split into market segment. These estimates are necessary to arrive at total revenue value and royalty calculations. Include justification for market segment based on quality parameters.	Section 2.2
• CAPEX & OPEX necessary for the Project – broken down into the various sub-categories and equipment type.	Sections 2.2 and 4.4.1. Breakdown of OPEX not required for economic assessment
• Estimates of employment generation broken down into direct, indirect, ongoing, construction and contract workers.	Sections 5 and 6
• Total royalty generated to the state over the life of the Project.	Section 2.4

Table 1.2
Issues raised by Lue and District Community

Issue(s)	Coverage in Report
Cost-benefit conditions extending beyond the life of the mine.	Section 4
Distribution of costs and benefits to local, state, national and international stakeholders.	Section 4.7
What impact will the mine have on property values? Will property values increase or decrease?	Annexure 10
What impact will the mine have on the ability of landowners to sell their property?	Annexure 10
What will the impacts of the mine be on agriculture (e.g. soil quality, marketing restrictions due to presence of lead, loss of land etc.)?	Section 5.5.1
What is the area of economic impact around the mine?	Section 6 and Annexure 10
What is the area of impact on property values around the mine?	Annexure 10
How will the mine impact local businesses?	Section 6.4
Will Bowdens Silver continue its involvement with local business groups?	Section 2.3
What positive impacts will the mine have on local businesses and when can we expect to see these impacts?	Section 6.4
The mine will give our economy a significant boost. How many direct and indirect jobs and training opportunities will be created for locals?	Section 6.3.3
Does Bowdens Silver support the idea of school-based traineeships, apprenticeship?	Section 2.3
Does Bowdens Silver have a policy about hiring local staff and contractors?	Section 2.3

Table 1.2 (Cont'd)
Issues raised by Lue and District Community

Issue(s)	**Coverage in Report**
In what other ways will Bowdens Silver positively impact the local and regional economy?	Section 6.4
Bowdens Silver has already provided sponsorship for a number of local projects (installation of water bore, IT equipment, event nights, teaching infrastructure, playground equipment) – is this something Bowdens Silver plans to continue in the future?	Section 2.3
How can our business be involved with the project?	Sections 2.3 and 6
"Project isn't financially viable"; "They say that it is a high grade resource, which it isn't. It's a low grade resource, its marginal".	Section 4.8
I'm sure any sponsorship to any local schools, businesses, sporting groups, not for profit groups etc will be appreciative of support.	Section 2.3
Would like to see Bowdens Silver invest in local communities.	Section 2.3 and 6

2. PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

The Project would involve the recovery of silver, zinc and lead minerals from defined ore reserves within a proposed open cut pit. Key features of the Project include:

- a main open cut pit and two satellite open cut pits, collectively covering approximately 52ha;
- a processing plant and related infrastructure, including administration, workshop and laydown area, covering approximately 22ha;
- a waste rock emplacement (WRE) covering approximately 77ha;
- a low grade ore stockpile covering approximately 14ha (9ha above WRE)[6];
- an oxide ore stockpile covering approximately 8ha;
- a tailings storage facility (TSF) covering approximately 114ha; and
- the southern barrier to provide visual and acoustic protection to properties south of the Mine Site covering approximately 32ha.

Figure 2.1 displays the indicative Mine Site layout and the location of the above components.

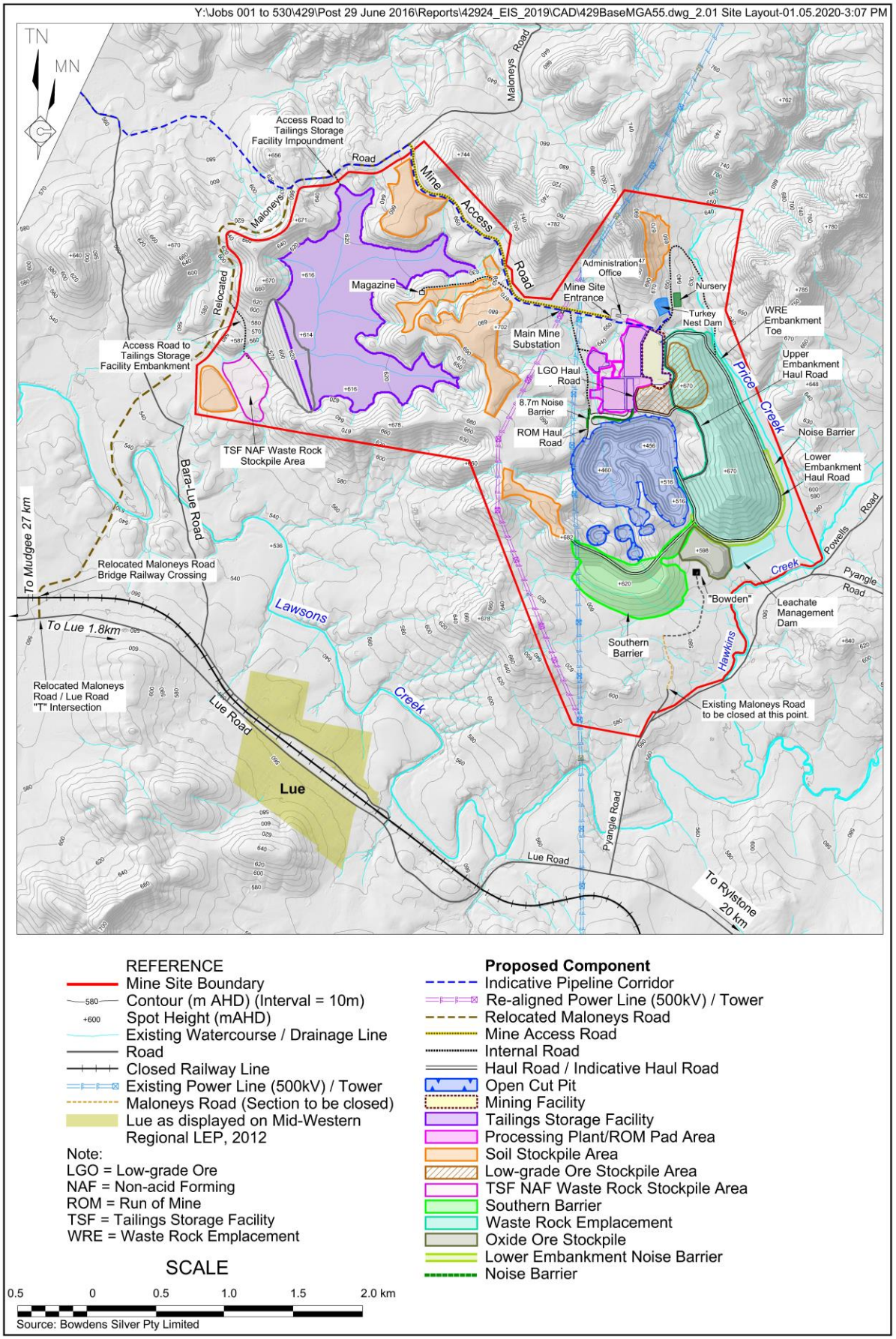
The above components would be supported by a range of on-site and off-site infrastructure. The on-site infrastructure comprises haul roads, water management structures, power/water reticulation, workshops, stores, compounds and offices/amenities. The off-site infrastructure comprises a relocated section of Maloneys Road (including a new railway crossing and new 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.

The Project would incorporate a conventional open cut pit operation with a main open cut pit and two small satellite pits where overburden/waste rock is 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 located to the west of the main open cut pit.

It is intended that silver/lead concentrate would be transported in sealed containers by road to either Parkes or Kelso and then transported by rail to the smelter at Port Pirie in South Australia, while zinc concentrate would be transported by road in sealed containers to either the Port of Newcastle or Port Botany for export and smelting off-shore.

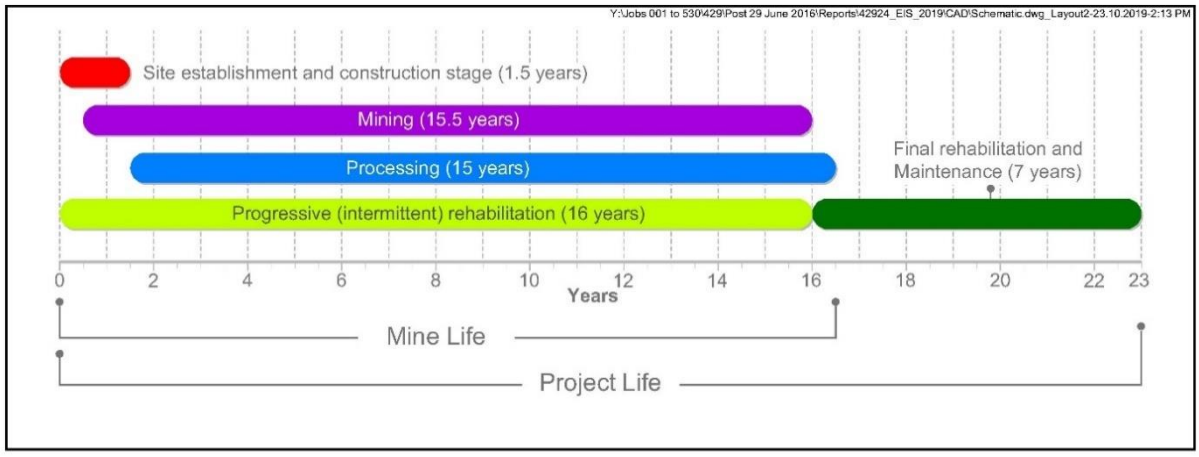
[6] The low grade ore stockpile would be constructed adjacent to but largely upon the northern sections of the WRE.

Figure 2.1 Mine Site Layout



The Project would require a site establishment and construction period of approximately 18 months during which the processing plant and all related infrastructure and the initial embankment of the TSF would be constructed. Once operational, Bowdens Silver anticipates the mine would produce concentrates for approximately 15 years. In total, it is proposed the mine life would be approximately 16.5 years, i.e. from the commencement of the site establishment and construction stage to the completion of concentrate production. It is envisaged rehabilitation activities would be completed over a period of approximately 7 years. **Figure 2.2** displays the duration of each of the main components throughout the mine life and Project life.

Figure 2.2 Mine Life and Project Life



2.2 SIGNIFICANCE OF THE RESOURCE

An Ore Reserve Statement, which complies with the JORC[7] standard, was completed for the Bowdens silver deposit in May 2018 by AMC Consultants Pty Ltd (see **Table 2.1**). The silver, zinc and lead grades are expressed in either grams per tonne (g/t) or percentage (%) in accordance with the conventions set out in the JORC standard.

Table 2.1
Ore Reserve Statement – 18 May 2018

Reserve Category	Tonnes (Mt)	Reserve Grades			Contained Metal		
		Ag (g/t)	Zn (%)	Pb (%)	Ag (Moz)	Zn (kt)	Pb (kt)
Proved	28.6	69.75	0.44	0.32	64.05	125.11	91.43
Probable	1.3	53.15	0.43	0.29	2.27	5.74	3.91
Total	**29.9**	**69.01**	**0.44**	**0.32**	**66.32**	**130.84**	**95.33**
Mt = million tonnes g/t = grams per tonne Moz = million ounces kt = thousands of tonnes							
Source: AMC Consultants Pty Ltd							

[7] 2012 Joint Ore Reserves Committee, i.e. the "Australian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves".

For the purposes of the EIS, Bowdens Silver has defined three types of recoverable ore.

- Primary Ore: Unweathered silver, zinc and lead sulphide minerals within the host rock with a silver grade exceeding a nominated cut-off grade of 30g/t.
- Low Grade Ore: Unweathered silver, zinc and lead sulphide minerals within the host rock with a silver grade marginally below the nominated cut-off grade of 30g/t.
- Oxide Ore: Weathered silver, zinc and lead minerals within the host rock with a silver grade exceeding a nominated cut-off grade.

Bowdens Silver proposes to extract and process all primary ore and extract and stockpile all low grade ore. The low grade ore would be processed subject to prevailing commodity prices and potentially blended with the primary ore. The oxide ore would not be able to be processed within the processing plant on site, however, it would be separately stockpiled adjacent to the southwestern side of the WRE for processing should this become feasible in the future.

Based upon the studies to optimise the recovery of the defined ore from the open cut pits and ultimate design of the open cut pits, the recoverable primary and low grade ore within the proposed open cut pits is estimated to be approximately 29.9 million tonnes at an average grade of 69g/t silver, 0.44% zinc and 0.32% lead. This corresponds to total in situ quantities of approximately 66.3 million oz of silver, 130 000t of zinc and 95 000t of lead.

The Project is Australia's largest advanced silver project (GRES, 2018). In 2018, total production of silver from New South Wales mines was 111 tonnes (NSW Government, 2018). The average annual silver production from the Project will be 3,006,410 ounces or 85.2 t. So, the Project would on average account for an 77% increase in the States silver output.

2.3 ENVIRONMENTAL, SOCIAL AND CULTURAL IMPACTS AND MITIGATION MEASURES

Assessment of the environmental, social and cultural impacts of the Project, together with a range of measures to mitigate, offset and compensate for potential impacts of the Project, is provided in the technical assessment reports and summarised in the EIS.

In addition to the mitigation measures identified in other technical assessment reports and the EIS, Bowdens Silver proposes to work in partnership with local government and the local community to maximise the regional economic benefits of the Project and to minimise any adverse impacts, as far as possible. In this respect, Bowdens Silver is proposing a number of specific economic impact mitigation measures including the following.

Local Employment, Training and Engagement

- Bowdens Silver would continue with its policy that preference is given to local employees.
- Bowdens Silver would provide ongoing training and certification opportunities for local community members to ensure they have the necessary skills to work in mining.
- Bowdens Silver would actively engage with the local community and affected individuals and groups and address any complaints and feedback on operations.

Potential Business Impacts

- Bowdens Silver would collaborate with Council, economic development organisations, local chambers of commerce and State Government to:
  - inform local businesses of the goods and services required for the Project, service provision opportunities and compliance requirements of business to secure contracts;
  - collaborate with local businesses and encourage local businesses to meet the requirements of the Project for supply contracts; and
  - develop relevant networks to assist qualified local and regional businesses tender for provision of goods and services to support the Project.

Investment in Local Communities

- Bowdens Silver would:
  - enter into a Voluntary Planning Agreement with the Mid-Western Regional Council to ensure that the community directly benefits from the Project; and
  - Develop a Community Investment Fund that would include and expand upon the current local community sponsorship program to support local sporting, social and community groups.

2.4 KEY ASSUMPTIONS

The Economic Assessment has been based on year by year financial and employment data provided by Bowdens Silver. This year by year data is commercial-in-confidence but key assumptions are summarised in **Table 2.2**. It should be noted that economic costs and benefits are discounted to today's (2019) values. Estimates of net production benefits are not equivalent to estimates of pre-tax financial net present value of the Project due to difference in timing, exclusion of royalties as a cost and inclusion of opportunity cost of land and capital equipment, and are not equivalent to accounting profit which require inclusion of depreciation, debt financing and accounting practices.

Table 2.2
Key Assumptions Underpinning the Economic Assessment

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Item	Assumption
Mining Methods	Open cut operations
Total Production	29.9 Mt of primary and low grade ore at average grade of: 69g/t silver i.e. 66.3 million oz silver 0.44% zinc i.e. 130,000 t of zinc 0.32% lead i.e. 95,000 t of lead
Ore Processed	2 Mtpa
Payable Metals Recovered	92 000 t zinc 75 000 t lead 48M oz silver

Table 2.2 (Cont'd)
Key Assumptions Underpinning the Economic Assessment

Item	Assumption
Mine Life	16.5 years – comprising *Construction* - 1.5 years and *Operation* – 15 years
Project Life	23 years
Workforce	Construction • average annual FTE of 131 (on site) – 30% already reside in local area • up to 246 personnel (on site) • average annual FTE of 74 (off site) Operations • average annual FTE of 210 – 75% already reside in local area – 15% migrate into local area – 10% commute from outside local area
Prices	USD 2,756/t zinc USD 2,205/t lead USD 20.91/oz silver
AUD:USD Exchange Rate	0.75
Average Annual Revenue	AUD 119M
Capital Expenditure	Initial Capital - AUD 247M Sustaining Capital - AUD 54M Mitigation, compensation and offset costs - AUD 25M
Average annual operating costs (site, treatment and refining costs, transport costs)(net of royalties)	AUD 79M
State Royalties	4% ex mine value (value less allowable deductions) Average annual royalty of AUD 2.3M
Third Party Royalty	0.85% of net revenue ex-site (including deductions) and 2% of net revenue ex-site (including deductions) for the first nominal $5M of royalty payments and then at 1% of net revenue ex-site thereafter Average annual royalty of AUD 1.2M

2.5 ASSESSMENT OF EXTERNALITIES

The consideration of externality impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts of the Project. The EIS results in detailed (non-monetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts.

Where impacts are compensated, offset or mitigated so as to have immaterial residual impacts, there are no externality impacts for consideration in the CBA. The biophysical assessments undertaken for the EIS are considered in economic terms in Section 4.4.2.

3. ECONOMIC ASSESSMENT METHODS

3.1 INTRODUCTION

The economic methods used to assess the Project and its impacts (as summarised in Section 2) are outlined below.

3.2 COST BENEFIT ANALYSIS

3.2.1 Background

Economic assessment is primarily concerned with identifying changes in aggregate community welfare, associated with alternative resource use patterns. CBA is the standard technique applied to estimate these wealth changes.

CBA has its theoretical underpinnings in neoclassical welfare economics. CBA applications in NSW are guided by these theoretical foundations as well as NSW Treasury (2017). CBA applications within the NSW Environmental Impact Assessment (EIA) framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals and* NSW Government (2018) *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.

CBA is concerned with a single objective of the EP&A Act and governments, i.e. economic efficiency. It provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These benefits and costs are defined and valued based on the microeconomic underpinnings of CBA. In particular, the values held by individuals in the society are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceeds the present value of aggregate costs (i.e. a net present value of greater than zero), a project is considered to improve the well-being of society and hence relative to the 'without project' scenario is desirable from an economic efficiency perspective.

3.2.2 Definition of Society

CBA includes the consideration of costs and benefits to all members of society i.e. consumers, producers and the broader society as represented by the government.

The most inclusive definition of society includes all people, no matter where they live or to which government they owe allegiance to (Boardman et al. 2001). However, in practice most analysts define society at the national level based on the notion that the citizens of a country share a common constitution that sets out fundamental values and rules for making collective choices and that the citizens of other countries have their own constitutions that make them distinct societies (Boardman et al. 2001).

While most applications of CBA are performed at the national level, "*to incorporate national distinctions in a CBA is far easier said than done. Thus, many CBAs end up estimating the net benefits for global society, if only implicitly*" (Bureau of Transport Economics 1999, p. 2).

With respect to the application of CBA in relation to mining and coal seam gas proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW. NSW Treasury (2017) also makes it clear that a CBA should focus on impacts (costs and benefits) to the NSW community. The SEARs for the Project also refer to the requirement to provide consideration of the economic benefits of the Project for the State.

Consequently, the CBA is initially undertaken from a global perspective i.e. including all the costs and benefits of a project, no matter who they accrue to, and then truncated to assess whether there are net benefits to Australia and NSW.

3.2.3 Definition of the Project Scope

The definition of the project for which approval is being sought has important implications for the identification of the costs and benefits of a project. Even when a CBA is undertaken from a global perspective and includes costs and benefits of a project that accrue outside the national border, only the costs and benefits associated with the defined project are relevant. For mining projects, typically only the costs and benefits from mining and delivery to port or domestic customers, are relevant.

Mine products are intermediate goods i.e. they are inputs to other production processes. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects (NSW Treasury 2007; NSW Treasury 2017). The definition of the Project is therefore as summarised in Section 2.1 and includes mining, processing and delivery to the Port of Newcastle or Port Botany (for export and smelting offshore) or Port Pirie (for smelting onshore), as well as all mitigation, offset and compensation measures.

3.2.4 Net Production Benefits

CBA of mining projects invariably involves a trade-off between:

- the net production benefits of a project to society including royalties, company tax and net producer surplus and any economic benefits to existing landholders, workers, and suppliers; and
- the environmental, social and cultural impacts including net public infrastructure costs.

Net production benefits can be estimated based on market data on the projected financial[8] value of the resource less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of the applicant. This is normally based on commercial-in-confidence data provided by the applicant. Production costs and benefits over time are discounted to a present value.

[8] In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the resource.

3.2.5 Components of Net Production Benefits

Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals,* identifies net production benefits as comprising royalties, company tax and net producer surplus. Consistent with the Guidelines focus on net benefits to NSW, all royalties are included as a benefit to NSW and company tax and net producer surplus estimates are apportioned to NSW based on population or some other approach (e.g. in relation to net producer surplus, level of foreign ownership and location of Australian shareholders). However, unlike other cost and benefit parameters that are based on economic surplus, company taxation is based on financial and accounting principles. In particular, company taxation is generally estimated based on yearly profit and loss where capital costs are include via a depreciation schedule and annual losses are carried forward.

3.2.6 Environmental, Social and Cultural Impacts

The consideration of externality impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts. The EIA process results in detailed (non-monetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts.

At its simplest level, CBA may summarise the consequences of the environmental, social and cultural impacts of a project (based on the assessments in the EIS), for people's well-being. These qualitatively described impacts can then be considered alongside the quantified net production benefits, providing important information to the decision-maker about the economic efficiency trade-offs involved with a project.

At the next level of analysis, attempts may be made to value some of the environmental, social and cultural impacts. These environmental, social and cultural impacts generally fall into three categories of impacts being those which:

- can be readily identified, measured in physical terms and valued in monetary terms;
- can be identified and measured in physical terms but cannot easily be valued in money terms; and
- are known to exist but cannot be precisely identified, measured or valued (NSW Treasury, 2007).

Impacts in the first and second category can potentially be valued in monetary terms using benefit transfer or, subject to available resources, primary non-market valuation methods. Benefit transfer involves using information on the physical magnitude of impacts and applying per unit value estimates obtained from non-market valuation studies undertaken in other contexts.

Primary non-market valuation methods include choice modelling and the contingent valuation method where a sample of the community is surveyed to ascertain their willingness to pay to avoid a unit change in the level of a biophysical attribute. Other methods include the property valuation approach where changes in environmental quality may result in negative changes in property value.

In addition to biophysical externalities, payments to landholders or workers over and above their opportunity cost can represent an economic benefit to landholders and workers, respectively. Where this occurs, it can be estimated using market data on payments to be made and opportunity costs.

Where a project imposes a cost on public infrastructure in excess of payments made for that infrastructure, there is an additional social cost for inclusion in CBA. These costs can potentially be estimated based on analysis of infrastructure costs and payments.

In attempting to value the impacts of a project on the well-being of people, there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government, 2012). NSW Government (2012) suggests that values that are less than 5% of the quantified net present value of a project are unlikely to be material. Where benefits and costs cannot be quantified, these items should be included in the analysis in a qualitative manner (NSW Treasury, 2007; NSW Government, 2015).

The principle of proportionality also applies to CBA, and so the scope of Economic Assessment is tailored to reflect the scale of a project.

3.2.7 Consideration of Net Social Benefits

The consideration of the net social benefits of a project combines the value estimate of net production benefits and the qualitative and quantitative estimates of the environmental, social and cultural impacts.

In combining these considerations, the estimate of net production benefits of a project generally include accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. This includes the costs of purchasing properties adversely affected by noise and dust, providing mitigation measures for properties moderately impacted by noise and dust or experiencing visual impacts, the costs of providing ecological offsets, the cost of purchasing groundwater and surface water entitlements in the water market and the costs of public infrastructure impacts. Including these costs in the capital and operating costs of a project effectively internalises the non-monetary environmental, social and cultural costs of a project, because by including these costs, often larger social costs are minimised or avoided. To avoid double counting of impacts, only residual impacts, after mitigation, offset and compensation, require additional consideration.

Even when no quantitative valuation is undertaken of the environmental, social and cultural impacts of a project, the threshold value approach can be utilised to inform the decision-maker of the economic efficiency trade-offs. The estimated net production benefits of a project provides the threshold value that the non-quantified environmental, social and cultural impacts of a project (based on the assessments in the EIS), after mitigation, offset and compensation by the applicant, would need to exceed for them to outweigh the net production benefits.

Where the main environmental, social and cultural impacts of a project are valued in monetary terms, stronger conclusions can be drawn about the economic efficiency of a project i.e. the well-being of society.

Any other residual environmental, cultural or social costs that remain unquantified in the analysis[9] can also be considered using the threshold value approach. The costs of these unquantified environmental, cultural and social impacts would need to be valued by society at greater than the quantified net social benefit of a project to make it questionable from an economic efficiency perspective.

3.2.8 Consideration of the Distribution of Costs and Benefits

While CBA, undertaken at different scales, can provide qualitative and quantitative information on how costs and benefits are distributed, welfare economics and CBA are explicitly neutral on intra and intergenerational distribution of costs and benefits. There is no welfare criterion in economics for determining what constitutes a fair and equitable distribution of costs and benefits. Judgements about intra and intergenerational equity are subjective and are therefore left to decision-makers.

The costs and benefits in CBA are defined and valued based on the values held by individuals in the current generation. There is no way to measure the value that future generations hold for impacts of current day projects as they are not here to express it. However, as identified by Boardman *et al.,* (2001) this is not considered a serious problem for CBA because:

- few policies involve impacts that only appear in the far future. Consequently, the willingness to pay, of people alive today, can be used to predict how future generations would value them;
- most people alive today care about the well-being of their children, grandchildren and great grandchildren, whether or not they have yet been born. They are therefore likely to include the interests of these generations to some extent in their own valuations of impacts. Because people cannot predict with certainty the place that their future offspring would hold in society, they are likely to take a very broad view of future impacts; and
- discounting used in CBA also reduces the influence of costs and benefits that occur a long way into the future.

Furthermore, increased wealth (e.g. royalties and taxes) generated by projects that have a net benefit to the current society can be used to improve the services (e.g. health, school and community services) and environment (e.g. protected areas) that are passed on to future generations.

As identified by the Productivity Commission (2006), a policy option that provides the highest net benefit, as indicated by CBA, would also be consistent with the principles of ecologically sustainable development.

[9] Including potential impacts that were unknown at the time of the preparation of the EIS or arise during the EIA process due to differences in technical opinions.

3.2.9 Consideration of other Objectives of Government

CBA does not address other objectives of the EP&A Act and governments. Decision-makers therefore need to consider the economic efficiency implications of a project, as indicated by CBA, alongside the performance of a project in meeting other conflicting goals and objectives of the EP&A Act and government policy more widely.

3.2.10 Key steps in Cost Benefit Analysis

The key steps in CBA are summarised below.

Step 1: **Establish the base case** against which to assess the potential economic, social and environmental impacts of changes due to the project.

Step 2: **Define the project** including all significant inputs required to achieve the project's objectives.

Step 3: **Quantify the changes** from the base case resulting from the project. This would focus on the incremental changes to a range of factors (for example, environmental, economic, social) resulting from the project.

Step 4: **Estimate the monetary value of these changes** and aggregate these values in a consistent manner to assess the outcomes. Where market prices exist, they are a starting point for valuations of both outputs and of inputs used for production. For non-market goods, as for many environmental impacts and some social impacts, the aim is to value them as they would be valued in monetary terms by the individuals who experience them.

Step 5: **Estimate the Net Present Value (NPV)** of the project's future net benefits, using an appropriate discount rate.

Step 6: **Undertake sensitivity analysis** on the key range of variables, particularly given the uncertainties related to specific benefits and costs.

Step 7: **Assess the distribution of costs and benefits** across different groups.

Step 8: **Report CBA results**, including all major unquantified impacts so the appraisal addresses and incorporates all material relevant to the decision maker.

Source: NSW Government (2015)

Section 4 reports on the CBA of the Project based on the financial, technical and environmental advice provided by Bowdens Silver and its specialist consultants.

3.3 LOCAL EFFECTS ANALYSIS

3.3.1 Introduction

LEA aims to address the consequences of the Project in its "locality" as required by Section 4.15 of the EP&A Act. It is intended to complement CBA by translating effects at the NSW level to impacts on the communities located near the Mine Site. It also provides additional information to describe changes that are anticipated within a locality, such as employment changes. LEA is intended to inform the scale of change rather than being representative of costs and benefits to the local community.

For the purpose of an LEA, the locality is defined as the Local Government Area[10] (LGA) that contains the proposed Mine Site, relocated Maloneys Road and water supply pipeline corridor. The relevant population group is defined as those people ordinarily resident in the locality at the time of the Project.

The local effects required to be analysed in a LEA are:

- local employment and income effects
- other local industry effects, for example on suppliers; and
- environmental and social change in the local community.

3.3.2 Direct Effects Relating to Local Employment

The Guidelines (NSW Government 2015) prescribe that only employment of people ordinarily resident in the region at the time of the Project should be included in the initial estimation of direct local employment increases.[11]

The Guidelines assume that these people would otherwise be employed in the region and so the increased disposable wages for the region as a result of a project is the difference between the average net income of these people in the mining industry and the average net income in other industries.[12]

The incremental full time equivalent direct employment from a project to the locality is estimated as the increase in net income divided by the average net income in the mining industry.

The aim of this approach is to gauge the incremental impacts for existing residents of the locality. However, as a direct measure of regional employment and wages for existing residents, LEA is likely to understate effects because it assumes that:

- existing local residents employed by a project are already employed in the region i.e. they are not unemployed or new participants in the labour force;

[10] In this case the Mid-Western Regional Local Government Area has been chosen to represent the locality. This is the area that would primarily be the regional source of labour and non-labour inputs to the Project.
[11] Employment filled by those migrating into a region to live are excluded as are jobs filled by those who reside outside the region.
[12] Wages paid to those migrating into a region to live are excluded as a wages benefit to the region.

- jobs vacancies in the region created by those filling the positions in a project remain unfilled for the duration of the project i.e. it essentially assumes that the regional economy and the wider Australian economy is at full employment. Refer to **Annexure 3** for a discussion of the job chain effect and a comparison to IO analysis.

From a regional economy perspective (rather than focused on existing residents) it is also likely to understate effects since it does not take into account the income spending of those who migrate into the region and are employed by the project.

3.3.3 Estimating Effects Related to Non-labour Project Expenditure

In addition to the incremental direct regional employment and wages generated by a project, the other major economic effect would be expenditure in the region on other, non-labour inputs. These can be estimated for construction and operation phases of a project. Identified local expenditure may not all accrue to the region, particularly for margin sectors such as wholesale and retail trade purchases where only the margin would accrue to the regional business entities unless products are also manufactured locally.

3.3.4 Second Round/Flow-on Effects

The Guidelines (NSW Government 2015) identify that flow-on effects can also be extremely important for local communities and should therefore also be considered either qualitatively or using techniques such as IO analysis or computable general equilibrium (CGE) modelling (suitable for larger projects), provided the assumptions and limitations of the methods are identified. As well as being supported in the NSW Government Guidelines (2015) for *Economic assessment of mining and coal seam gas proposals*, IO analysis is identified by the World Bank economist Mustafa Dinc (2015) as providing a solid framework to analyse the interdependence of industries in an economy and one of the most widely used tools in regional economic analysis. The method is further supported by independent peer reviews (commissioned by the NSW Department of Planning and Environment) of economic assessments of mining proposals. A comparison of IO analysis and CGE modelling is provided in **Annexure 4**. This Annexure also provides a detailed response to the criticisms that have been inappropriately levelled against the IO methodology.

3.3.5 Effects on Other Local Industries

The LEA should also give consideration to potential impacts such as:

- displacement of other land uses, where the mining project uses land that would otherwise be used for other purposes;
- where the mining project affects choices of external parties, particularly tourism and business travel; and
- where the mining project creates temporary effects on other industries that cause short run market adjustments in the cost of living for local residents, particularly food and housing markets.

3.3.6 Environmental and Social Impacts on the Local Community (Externalities)

Finally, every LEA should assess positive and negative externalities created by the proposed project on the locality, with a focus on material, unmitigated effects. This information is available from the EIS and summarised in the CBA.

3.3.7 Input-output Analysis

Section 5 undertakes an LEA as identified above which is consistent with the NSW Government Guidelines (2015). In addition, an IO analysis (refer to **Annexure 4**) of the Project is undertaken in Section 6 to identify the gross incremental regional economic activity that the Project would provide to the region. As identified in **Annexure 3**, incorporation of consideration of the "job chain" effect means that the direct incremental employment and income to a region approximates the total income of those employed in the region who already reside in the region or migrate into the region to live i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect.

IO analysis essentially involves the following two steps.

- Construction of an appropriate IO table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy.
- Identification of the initial impact or stimulus of the project (construction and/or operation) in a form that is compatible with the IO equations so that the IO multipliers and flow-on effects can then be estimated (West, 1993).

The IO method is based on a number of assumptions that are outlined in **Annexure 5**. Most notably IO analysis assumes that the regional economy has access to sufficient labour and capital resources (from both inside and outside the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions (“crowding out”) of economic activity in other sectors in the same region. Any "crowding" out is assumed to occur outside the region where the Project is concentrated and the regional impact analysis is focused. A dynamic CGE approach may overcome the limitation of IO analysis but is unlikely to be warranted at local or regional scale or with small scale impacts.

The consequence of the assumptions of IO analysis, is that IO modelling results provide an upper bound economic activity impact estimate.

IO analysis identifies the economic activity of a project on the economy in terms of four main indicators, namely:

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

These indicators of economic activity are not equivalent to the economic measures of consumer and producer surplus that are relevant in the CBA framework.

Gross regional output is a measure of total revenue or turnover. All costs of production would be subtracted to make it approximate the measure of producer surplus. Value-added is an indicator of net value to producers, but unlike the producer surplus measure, it does not take account of all production costs – only non-labour costs are subtracted from revenue. Income or wages paid to employees is a cost to the producer in the CBA framework and is one of the costs subtracted from revenue or output to calculate the producer surplus or net benefit to producers. Employment is a non-financial indicator identifying the physical number of jobs associated with an activity.

Unlike CBA there are no decision rules to identify whether an increase or decrease in economic activity is desirable, although it is often implicitly assumed that more economic activity is good and less economic activity is bad. However, not all economic activity is desirable from a community welfare perspective since it may be associated with, for example, environmental degradation, crime, etc.

As well as providing an indication of gross economic activity in a region, economic activity analysis can have important links to social impact assessment since changes in income and employment levels can impact population levels and their ability to maintain community infrastructure (schools, hospitals, housing etc), broader community and cultural value systems and inter-relationships.

4. COST BENEFIT ANALYSIS OF THE PROJECT

4.1 INTRODUCTION

This Section reports on a CBA of the Project based on financial, technical and environmental advice provided by Bowdens Silver and its specialist consultants. At its core is the financial model prepared for the Project to assess its financial feasibility. Assumptions used in the financial model have been used in the CBA.

4.2 IDENTIFICATION OF THE BASE CASE AND PROJECT

Identification of the "base case" or "without Project" scenario is required to facilitate the identification and measurement of the incremental economic benefits and costs of the Project.

In this Economic Assessment, the base case or "without Project" scenario involves the continuation of existing rural land uses in the Mine Site and the land to be used for the relocated Maloneys Road, and water supply pipeline corridor, including the presence of native vegetation. In contrast to the "base case", the Project is as outlined in Section 2.

CBA is primarily concerned with the evaluation of a Project relative to the "without Project" scenario. Where there are a number of alternatives to a project, these can also be evaluated using CBA. However, the alternatives evaluated must be feasible to the applicant and to this end a number of alternatives to the Project were considered by Bowdens Silver in the development of the current Project. The EIS provides more detail on the alternatives considered.

The Project assessed in the EIS and evaluated in the CBA is considered by Bowdens Silver to be the most feasible alternative for minimising environmental, cultural and social impacts whilst maximising resource recovery and operational efficiency. It is therefore this alternative that is proposed by Bowdens Silver and was subject to detailed economic analysis.

4.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or "without Project" scenario, the Project may have the potential incremental economic benefits and costs shown in **Table 4.1**. The main potential economic benefit is the producer surplus (net production benefits) generated by the Project and any wage benefits to employment, non-market benefits to employment, economic benefits to existing landholders or benefits to suppliers, while the main potential economic costs relate to any environmental, social and cultural costs, including any net public infrastructure costs and loss of surpluses to other industries.

Framed in another but equivalent way, the potential incremental costs and benefits of the Project are as per **Table 4.2**.

Table 4.1
Potential Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits[1]	• Opportunity costs of capital equipment • Opportunity cost of land • Development costs including labour, capital equipment, sustaining capital, and mitigation, compensation and offset costs[1] • Operating costs, including administration, mining, onsite treatment and refining costs, transportation to port, port charges, labour costs • Decommissioning and rehabilitation costs at cessation of the Project	• Value of silver, zinc and lead concentrate • Residual value of capital and land at the cessation of the Project
Potential environmental, social and cultural impacts	• Agricultural impacts[2] • Surface water impacts • Groundwater impacts • Air quality impacts • Noise and vibration impacts • Ecology and biodiversity impacts • Aboriginal heritage impacts • Historic heritage impacts • Traffic and transport impacts • Visual amenity impacts • Greenhouse gas generation • Net public infrastructure costs • Loss of surplus to other industries	• Wage benefits to employment • Non-market benefits of employment • Economic benefits to existing landholders • Economic benefits to suppliers

1 Some of the net production benefits of the Project would be redistributed to the local area via the Planning Agreement with MWRC and in the form of support for local initiatives in the areas of education, community, sport, safety and arts and culture.

2 The value of foregone agricultural production is included in the value of land.

Table 4.2
Alternative Frame of Potential Economic Benefits and Costs of the Project

Costs	Benefits
Net environmental, social, cultural and transport related costs	Net production benefits *Royalties* *Company tax* *Net producer surplus* *Planning Agreement and support for local initiatives*
Net public infrastructure costs	Wage benefits to employment
	Non-market benefits of employment
	Economic benefits to existing landholders
	Economic benefits to suppliers

The potential environmental, social and cultural costs listed in **Table 4.1** and **Table 4.2** are only economic costs to the extent that they affect individual and community well-being. If the potential impacts do not occur or are mitigated, compensated or offset to the extent where community wellbeing is insignificantly affected (i.e. costs are borne by the applicant), then no environmental, social or cultural economic costs should be included in the Project CBA apart from the mitigation, compensation or offsetting costs.

4.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

Consistent with NSW Government (2015) and NSW Treasury (2017) the analysis was undertaken in 2019 real values, with discounting at 7% and sensitivity testing at 4% and 10%.

The analysis period is 19 years, coinciding with one year pre-Project, the mine life (16.5 years) plus one year post mine life where all final rehabilitation and decommissioning costs are included as a terminal value.

Where competitive market prices are available, they have generally been used as an indicator of economic values. Environmental, cultural and social impacts have initially been left unquantified and interpreted using the threshold value method. An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[13] and incorporate them into an estimate of the net social benefit of the Project. This estimated net social benefit of the Project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the Project questionable from an economic efficiency perspective.

The assumed costs and benefits identified in the following subsections have been used to derive the present value of costs and benefits as reported in Section 4.5.

4.4.1 Production Costs and Benefits[14]

Production Costs

Opportunity Cost of Capital

No existing capital equipment in Bowden Silver ownership would be carried forward into the Project. All capital equipment required for the Project would be purchased and is included in the development costs of the Project.

Opportunity Cost of Land

Some land required for the Project is already in Bowden Silver's ownership while other land identified for the Project is yet to be purchased[15].There is an opportunity cost associated with using land already acquire or proposed to be acquire, for the Project instead of its next best use (e.g. agriculture). An indication of the opportunity cost of the land can be gained from the market value of the land that would be taken out of agricultural production. The market value of land already acquire or proposed to be acquire is estimated by Bowdens Silver at $16 million (M).

[13] Benefit transfer refers to transferring economic values that have been determined for other study sites.
[14] All values reported in this section are undiscounted Australian dollars unless otherwise specified.
[15] Land purchases are not included in the development cost estimates below.

Development Cost of the Project

The development costs of the Project are estimated at $247M over an 18 month period. Costs are itemised in **Table 4.3**. In addition, there is an estimated $25M in allowances for biodiversity offsets, water acquisition, noise and visual impact mitigation and other mitigation measures including $500,000 for the preparation and implementation of management plans for all potential environmental, social and cultural impact categories. There is also an estimated $54M in sustaining capital over the life of the Project, including mining sustaining capital, costs to re-align a 500 kV power transmission line, tailings storage facility raises, mobile equipment replacement, mill refurbishment and minor projects. Development costs are included in the economic analysis in the years when they are expected to occur.

Table 4.3
Development Costs of the Project ($M)

Project Capital	**Year 1**	**Year 2**	**Total**
Mining Capex (incl. Dewatering & Mobilisation)	4.30	0.24	4.54
Communications	2.27	0.97	3.24
Engineering, Procurement and Construction Management	29.38	12.59	41.97
First Fills*	2.50	1.07	3.57
Buildings	6.87	2.94	9.82
Owners Capex	7.21	3.09	10.30
Plant	43.80	19.27	63.07
Power	27.09	11.61	38.70
Roads	5.93	2.54	8.47
TSF	15.43	6.61	22.04
Vehicles	2.78	1.19	3.97
Water	8.87	3.80	12.67
Other	11.21	13.01	24.21
Total Capital	**167.61**	**78.93**	**246.55**

* Includes the initial supply of consumables, grinding media, resins, reagents and lubricants

Annual Operating Costs of the Project

The annual operating costs of the Project include those costs associated with site operating costs (mining, processing and rehabilitation), treatment and refining costs and transport costs. Operating costs were estimated independently by GR Engineering Resources from first principles, as part of the development of a financial evaluation of the Project (GRES, 2018). Average annual operating costs of the Project (excluding royalties) for inclusion in the CBA are estimated at $76M. Reported a different way, the all in sustaining cost (ASIC) for the Project is estimated at USD12.94/oz (Silver Mines Limited, 2018). This is 15% above the ASIC for global sliver production in 2018 of USD11.21/oz (S&P Global, 2019).

The Project would generate royalty payments to the NSW Government and royalties to two 3rd parties (an ASX listed company which is itself predominantly owned by other ASX listed companies and Australian investment companies, and a North American company).[16] While royalties are a cost to Bowdens Silver, they are part of the overall producer surplus benefit of the Project that for NSW Government royalties are paid to and then redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project.

The Project would generate total royalties over its life in the order of:

- $37M, or $21M in present value terms (at 7% discount rate) to the NSW Government;
- $19M, or $11M in present value terms (at 7% discount rate) to an Australian third party; and
- $16M, or $9M in present value terms (at 7% discount rate) to a North American third party.

The royalty payable to the NSW government was estimated at 4% of assessable revenue minus allowable deductions (in accordance with Clause 73 of the NSW *Mining Regulation 2016*). Assessable revenue includes gross sales of silver, zinc, and lead and allowable deductions include smelter charges, transport and freight costs, on-site processing costs, 1/3 of general and administration costs and depreciation of non-mining items at a reducing balance rate of 11.25% per annum.

The Australian third party royalty was estimated at 2% of net revenue ex-site for the first nominal $5M of royalty payments and then at 1% of net revenue ex-site thereafter. Net revenue ex site includes deductions for smelter charges and transport and freight costs but does not allow a deduction for the NSW state royalty. The Australian third party royalty was assumed to accrue 100% to Australian shareholders and to NSW based on NSW share of the population.

The North American third party royalty was estimated at 0.85% of net revenue ex-site. Net revenue ex site includes deductions for smelter charges and transport and freight costs but does not allow a deduction for the NSW state royalty or other third party royalties.

Decommissioning and Rehabilitation Costs of Facilities

Mine rehabilitation and closure costs are estimated to be $39.4M. Mine rehabilitation would occur progressively during the Project life starting in the second production half year and extending for 29 half years at 1% of the total. In the final operations half year, a further 20% of cost would be expended followed by the remaining 51% in the half year following the end of production when the tailings storage facility would be capped. These costs are already included in the site operation costs and hence no separate item is included in the analysis. Bowdens Silver would be required to pay a rehabilitation security deposit to the Department of Regional NSW – Mining, Exploration and Geoscience (MEG).

[16] Third party royalties arise from historical involvement in the Project.

Production Benefits

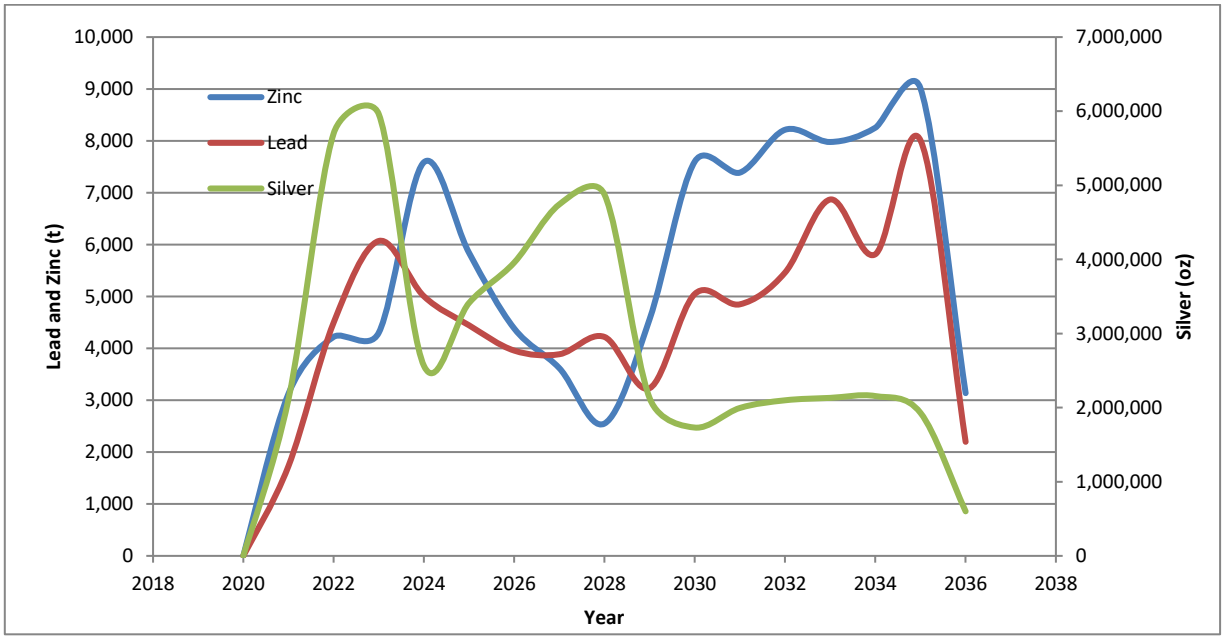
Value of Production

The main economic benefit of the Project is the market value of the metals recovered in concentrates - silver, zinc and lead. This reflects the ore production, treatment profile, concentrate production and level of payable metals produced, together with market prices which are quoted in USD and the USD/AUD exchange rate.

Annual payable metal production is provided in **Figure 4.1.**

Pricing and exchange rate assumptions were based on consensus forecasts in the Marketing and Product Handling chapter of the Project Feasibility Study (GRES, 2018).

Figure 4.1 Payable Metal Production



Note: Payable metal production is a function of mined ore grade which varies considerably from year to year for each metal.

Silver Price

Silver is the principal driver of value for the Project, accounting for a little over 69% of revenue. Bowden Silver reviewed available price forecasts for silver, from major financial institutions, as shown in **Table 4.4**. As can be seen, Macquarie are the only institution who forecast beyond CY19. Silver is priced in nominal US dollars at USD 21.50/oz, USD 22.00/oz and USD 22.50/oz for 2020, 2021 and 2022 respectively. The weighted average real silver price on a life of mine basis is USD 20.91/oz (GRES, 2018).

Table 4.4
Consensus Silver Price Forecast (USD/oz)

Source: RBC, Bloomberg, Thomson One, EMCF, Macquarie

US$/oz Silver Price Forecast					
Broker	CY18	CY19	CY20	CY21	CY22
Bank of America Merrill Lynch	20.71	20.00	n/a	n/a	n/a
CPM	19.20	23.00	n/a	n/a	n/a
ING Bank	20.50	22.00	n/a	n/a	n/a
Macquarie	19.10	21.60	21.50	22.00	22.50
TD	19.25	20.50	n/a	n/a	n/a
Consensus	**19.75**	**21.42**	**21.50**	**22.00**	**22.50**

Lead Price

The lead price, although making only a minor contribution to revenue was subjected to similar analysis. A greater number of forecasts were available as shown in **Table 4.5**. As the mine was not expected to be in production until CY20, it was decided to average the CY19, CY20 and CY21 consensus pricing, which, on rounding, gave a price of USD1.00 /lb (GRES, 2018).

Table 4.5
Consensus Lead Price Forecast (USD/lb)

US$/lb Lead Price Forecast					
Broker	CY18	CY19	CY20	CY21	CY22
RBC Capital Markets	1.14	1.15	1.15	1.15	1.15
Societe Generale	1.22	1.22	1.18	1.13	1.09
Intesa Sanpaolo	1.17	1.18	1.21	1.22	n/a
TD	1.16	1.16	n/a	n/a	n/a
Citigroup	1.15	1.15	1.18	n/a	n/a
Macquarie	1.13	0.98	0.88	0.87	0.87
Itau Unibanco	1.13	1.05	1.07	1.07	n/a
Commerzbank	1.09	1.10	1.03	n/a	n/a
Westpac	1.09	0.85	0.90	n/a	n/a
Standard Chartered	1.03	0.99	0.98	0.95	n/a
Bank of America Merrill Lynch	0.96	0.97	n/a	n/a	n/a
Deutsche	0.89	0.82	0.82	0.81	0.81
CIMB	0.89	0.92	0.97	n/a	n/a
Consensus	**1.08**	**1.04**	**1.03**	**1.03**	**0.98**

Zinc Price

A similar approach was taken to zinc, as was taken to lead and silver seeking major financial institution forecasts. The rounded, average consensus forecasts for zinc, as shown in **Table 4.6**, were US$1.25 /lb for CY19, CY20 & CY21 and it was this value that was adopted for the study (GRES, 2018).

Exchange Rate

As with all projects that produce products sold in USD, the exchange rate can have a significant impact on project metrics. Bowdens Silver sought forecast of the AUD:USD exchange rate from a number of major financial institutions, as shown in **Table 4.7**. An exchange rate of USD0.75 to AUD1.0 was adopted for the study based on this analysis (GRES, 2018).

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land (excluding environmental offsets) would have some residual value that could be realised by sale or alternative use. Conservatively, this is assumed to be zero.

Net Production Benefits

The above assumptions have been used to estimate the net production benefits of the Project. These net production benefits can generally be thought of as comprising company tax, royalties and residual net production benefits. The basis of royalty calculations is provided above.

Table 4.6
Consensus Zinc Price Forecast (USD/lb)

US$/lb Zinc Price Forecast					
Broker	CY18	CY19	CY20	CY21	CY22
RBC Capital Markets	1.50	1.50	1.25	1.25	1.25
Scotiabank	1.60	1.50	1.35	n/a	n/a
Intesa Sanpaolo	1.54	1.59	1.62	1.64	n/a
HSBC	1.54	1.57	n/a	n/a	n/a
TD	1.53	1.55	n/a	n/a	n/a
Itau Unibanco	1.47	1.43	1.44	1.45	n/a
Societe Generale	1.45	1.41	1.36	1.32	1.27
Westpac	1.44	1.13	1.18	n/a	n/a
Macquarie	1.41	1.17	1.05	0.98	0.99
Deutsche Bank	1.41	1.22	1.18	1.15	1.15
Commerzbank	1.41	1.34	1.03	n/a	n/a
Canaccord	1.40	1.35	n/a	n/a	n/a
Citigroup	1.37	1.33	1.27	n/a	n/a
Standard Chartered	1.34	1.26	1.26	1.27	n/a
Deutsche	1.31	1.23	1.18	n/a	n/a
UBS	1.27	1.06	n/a	n/a	n/a
Raymond James	1.25	1.15	n/a	n/a	n/a
CIMB	1.15	1.09	1.07	n/a	n/a
Bank of America Merrill Lynch	1.13	1.11	n/a	n/a	n/a
JP Morgan	n/a	n/a	n/a	n/a	n/a
Consensus	**1.40**	**1.31**	**1.25**	**1.29**	**1.17**

Table 4.7
***Consensus AUD:USD* Exchange Rate Forecast**

AUD:USD Exchange Rate Forecast						
Broker	CY18	CY19	CY20	CY20	CY20	Long-term
RBC Capital Markets	0.74	0.75	0.77	0.77	0.77	0.75
Macquarie	0.75	0.77	0.76	0.76	0.76	n/a
J.P. Morgan	0.74	0.73	n/a	n/a	n/a	n/a
UBS	0.76	0.76	n/a	n/a	n/a	n/a
Credit Suisse	0.77	0.75	0.75	0.75	0.75	0.75
Deutsche Bank	0.78	0.78	0.78	0.78	0.78	0.75
Canaccord	0.79	0.79	n/a	n/a	n/a	n/a
Norddeutsche Landesbank	0.77	0.75	0.75	0.75	0.75	n/a
Barclays	0.78	0.77	0.76	0.76	0.76	n/a
Julius Baer	0.79	0.73	0.73	0.73	0.73	n/a
Commerzbank	0.80	0.86	n/a	n/a	n/a	n/a
National Bank Financial	0.78	0.73	n/a	n/a	n/a	n/a
Nomura	0.75	0.82	n/a	n/a	n/a	n/a
ANZ	0.78	0.70	0.70	0.70	0.70	n/a
Desjardins	0.79	0.82	n/a	n/a	n/a	n/a
Rabobank	0.77	0.70	n/a	n/a	n/a	n/a
UniCredit	0.84	0.82	n/a	n/a	n/a	n/a
Westpac	0.75	0.74	0.78	0.78	0.78	n/a
Consensus	**0.77**	**0.77**	**0.75**	**0.75**	**0.75**	**0.75**

Company tax in Australia is payable at 30% of taxable income. Taxable income is calculated by subtracting operating costs (including royalties) and allowable capital allowances (depreciation) from revenue (metal sales) and then applying any relevant carried forward tax losses. Tax losses can be carried forward indefinitely. It is assumed that the Project would have relevant tax losses of $42M at the start of production and these have been applied to reduce taxable income.

Under Australian legislation depreciation can be calculated either by using the straight line (prime cost) method or the reducing balance (double declining balance) method. The reducing balance method is applied in this case with an assumed residual value of zero (with non-depreciated balances being written off in the final tax period).

In accordance with general practice for undertaking discounted cash flow and profit loss analysis, the Project is assumed to be ungeared (i.e. that no debt is held against the Project).

Residual net production benefits are estimated as the total net production benefits less royalties and company tax.

4.4.2 Environmental Social and Cultural Costs and Benefits

4.4.2.1 Agricultural Production

Predicted Biophysical Impact

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 (RWC, 2020). 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. It is noted that the majority of the land to be removed from agricultural production is located on steeply sloping and/or heavily vegetated land with low agricultural capability and use (RWC, 2020).

Beyond the end of the Project life, it is anticipated that approximately 1 170ha of land within the Bowdens Farm would be returned to agricultural production 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 removed from agricultural production resulting in a total of 865ha of land permanently removed from agricultural production (RWC, 2020).

Mitigation and Management Measures

Land owned by Bowdens Silver that is not required for the establishment of Project-related infrastructure or biodiversity offsets would continue to be used for agricultural production to the greatest extent practicable throughout the Project life. A range of environmental, social and economic management and mitigation measures would also be implemented that would ensure any residual impacts do not impact upon surrounding agricultural land uses.

Valuation of Impact

There is an opportunity cost - foregone agricultural production - associated with using land for the Project rather than in its next best use. The present value of foregone agricultural production is reflected in land prices. The value of foregone agricultural production, as a result of the Project infrastructure, disturbance areas and offsets, has therefore been incorporated in the CBA through inclusion of its market value in the opportunity cost of land as well as the development cost which includes an allowance for additional land acquisitions. To include specific agricultural impacts separately would result in double counting of these impacts.

4.4.2.2 Groundwater

Predicted Biophysical Impact

The Groundwater Assessment (Jacobs, 2020) found that, at the completion of mining operations (15.5 years), groundwater drawdown exceeding 2m may be experienced in one registered bore on privately-owned land surrounding the Mine Site. Drawdown would continue as the main open cut pit lake fills with water with an expected peak approximately 50 years post-mining, at which time drawdown may be experienced at nine Project related bores and two privately owned bores. The Project is predicted to meet the Level 1 Minimal Impact Considerations of the NSW Aquifer Interference Policy, including potential water level and water pressure impacts to other groundwater users and to groundwater dependent ecosystems, and water quality impacts. The groundwater modelling is conservative as specific features of the geological setting are considered to result in over-prediction of drawdown extent. It is also noted that given the depth of the privately-owned bores, it is unlikely that the predicted drawdown would significantly impact water availability. Hence the potential impact on groundwater users is unlikely to be significant. Regardless, Bowdens Silver has committed to make good provisions, if groundwater users are impacted.

The Groundwater Assessment found that, reduced baseflow contributions would peak approximately 28 to 34 years from the commencement of mining with a maximum reduction in baseflow to Hawkins Creek of 0.030ML/day predicted over a 3.1km reach of Hawkins Creek located within the area of predicted drawdown. This is compared to a median flow of approximately 0.090ML/day. However, given the semi-perennial to ephemeral nature of Hawkins Creek, the predicted baseflow reduction is only likely to be noticeable in sustained dry periods and would be manifested as a reduction in the depth of remnant pools.

In Lawsons Creek, the maximum reduction in baseflow is predicted to be 0.024 ML/day which is considered to be insignificant with respect to average daily flow (19.5ML/day) (Jacobs, 2020).

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 (Jacobs, 2020).

Mitigation and Management Measures

A Water Management Plan would be prepared and implemented with a dedicated Groundwater Management Plan incorporated within which it would include:

- monitoring of groundwater dewatering volumes;
- groundwater quality and level monitoring in a network of piezometers within and surrounding the Mine Site which would enable determination of any mine-related impacts on surrounding groundwater users (including Hawkins and Lawsons Creeks); and
- trigger action response plans to establish what further management actions are required when certain triggers are reached.

A final Void Management Plan would also be prepared as part of a Mine Closure Plan prior to the cessation of mining that would detail the intended management of the final mine void over time.

Bowdens Silver has secured options to purchase water access licences through the 2017 Controlled Allocation Order (Various Groundwater Sources), to the value of 907 unit shares in the Lachlan Fold Belt Groundwater Source (equivalent to 907 ML/year) and 194 unit shares in the Sydney Basin Groundwater Source (equivalent to 194 ML/year). This is sufficient to cover the peak predicted dewatering requirement over the life of the mine and exceeds the predicted annual average dewatering requirement from each of the groundwater sources.

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

Valuation of Impact

The CBA includes the costs of purchasing groundwater (and surface water) WALs to offset groundwater impacts. An indicative opportunity cost of the required entitlements (i.e. $650/ML for the abovementioned WAL requirements from the Lachlan Fold Belt Groundwater Source and Sydney Basin Groundwater Source, and $1,000/ML for the abovementioned WAL from Lawsons Creek Water Source) are included in the capital costs of the Project i.e. a total cost of $730,000). The cost of purchasing WALs reflects their value in alternative uses.

4.4.2.3 Surface Water

Predicted Biophysical Impact

There would also be capture and retention of some surface water from within Mine Site and hence some reduction in surface water outflows (WRM, 2020). Whilst these flows and groundwater inflows to the main open cut pit (and recovery of water from the TSF) would provide the bulk of the water used on site, there would still need to be a source of make-up water to ensure the Project can operate without any water deficient. The Project make-up water requirements would be met by the construction of a water pipeline from the Ulan Coal Mine and/or Moolarben Coal Mine, to utilise treated water from those operations.

Mitigation and Management Measures

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 include:

- 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; and
- trigger action response plans to establish what further management actions are required when certain triggers are reached.

Valuation of Impact

Licensing for approximately 121ML of water from the Lawsons Creek Water Source would be required as a result of the retention of surface water runoff in the TSF catchment affecting flows into Lawson Creek. The cost of purchasing a WAL reflects its value in alternative uses. The CBA includes, in the capital costs of the Project, the costs of purchasing surface water WALs estimated at $1,000/ML[17] (i.e. total cost of $121,000).

[17] Based on water trades made in the past 2 years as sourced from the NSW Water Register.

4.4.2.4 Air Quality

Predicted Biophysical Impact

Ramboll (2020) developed emissions inventories for four representative mining years, selected to assess the potential air quality impacts of worst-case operational conditions, for example when material movement and equipment use is highest, when extraction or wind erosion areas are largest, or where operations are located closest to non-project related or private receivers. Emissions of total suspended particulates (TSP), particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), particulate matter less than 2.5µm in aerodynamic diameter ($PM_{2.5}$), silica, hydrogen cyanide (HCN) and assorted metals and metalloids were estimated and modelled.

The modelling results compiled by Ramboll (2020) show that there are no private residences where the cumulative annual average PM_{10} concentration is greater than the air quality criteria of 25µg/m³ or where the cumulative 24-hour average PM_{10} is greater than the air quality criteria of 50µg/m³. There are also no private residences where the cumulative annual average $PM_{2.5}$ concentration is greater than the 8µg/m³ criteria or where the cumulative 24-hour average $PM_{2.5}$ concentration is greater than the 25µg/m³ criteria. The predicted cumulative annual average TSP concentrations and dust deposition levels indicate that no private receptors would experience exceedances of the respective impact assessment criteria.

No exceedances of the impact assessment criteria are predicted at Project-related or private residences for metal dust concentrations, respirable crystalline silica or hydrogen cyanide (HCN) (Ramboll, 2020).

Mitigation and Management Measures

A best practice dust control measures review was undertaken by Ramboll (2020) for the Project, and this 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.

Valuation of Impact

Residual air quality impacts, after mitigation, can potentially be estimated via the partial property value impacts using hedonic pricing or the damage cost method that looks at health and amenity impacts as a result of pollution.

Even if air quality criteria are met, potential impacts to the community can still occur. PAE Holmes (2013) estimated the cost of $PM_{2.5}$ emissions outside any ‘significant urban area’ as $360 per tonne. Using this cost estimate per tonne of $PM_{2.5}$, the health cost of air pollution over the Project life is around $96,000 in present value terms (using a 7% discount rate). This cost is insignificant in the context of CBA and can be considered to overlap with valuation using the property valuation method.

4.4.2.5 Noise and Vibration

Predicted Biophysical Impact

Impacts of the Project potentially arise from construction, operation and road traffic noise as well as vibration. The Noise and Vibration Impact Assessment undertaken by SLR (2020) determined the following.

i) Predicted noise levels from on-site construction activities are expected to comply with the relevant criteria during the first 6 months of the site establishment and construction stage (i.e. Construction Noise Management Levels (CNMLs) in accordance with the *Interim Construction Noise Guideline (DECC 2009))* at all receivers. During the most intensive period of off-site road network construction predicted noise levels would marginally exceed (i.e. <5dB(A)) the CNML at one residence and moderately exceed (i.e. >5dB(A)) at four residences for 1 to 2 months. However, construction noise would remain below the Highly Noise Affected Level (HNAL) at all residences.

ii) Operational noise levels are expected to significantly exceed (i.e. >5dB(A)) the Project Noise Trigger Levels (PNTLs) at one privately-owned residence and marginally to moderately exceed (3 to 5dB(A) at a further four privately-owned residences.

iii) Day-time noise levels during the Power Transmission Line Re-alignment (in Year 3 of operations) would significantly exceed the PNTL at five residences and marginally to moderately exceed at a further five residences during the most intensive period of the re-alignment works with an approximate duration of one to two months.

iv) Exceedances of the PNTLs of up to 2dB are considered negligible[18] and would not be discernible by most receivers relative to the compliant emission level of 35dB LAeq(15min).

v) For typical ore (Maximum Instantaneous Charge (MIC) 117kg) and typical waste rock (MIC 216kg) blast designs, blast overpressure and ground vibration are predicted to exceed the human comfort criteria (which are more stringent than structural criteria) at two surrounding privately-owned residences. These two residences have also been predicted to experience noise levels in excess of the PNTLs.

Mitigation and Management Measures

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. In accordance with the NSW Voluntary Land Acquisition and Mitigation Policy, one landowner would be offered acquisition rights and the owners of a number of properties would be offered site mitigation measures.

[18]In accordance with the significance assessment in the NSW Governments *Voluntary Land Acquisition and Mitigation Policy* (2018).

Ground vibration and air blast 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.

Valuation of Impact

Noise impacts can potentially be estimated via the partial property value impacts using hedonic pricing. However, where properties are predicted to be significantly impacted, a condition of contemporary development consents is for a negotiated agreement with the affected landowner or acquisition of the affected land. From an economic perspective, a negotiated outcome should make the landowner no worse-off, with the economic cost of the Project (in terms of property impacts) internalised into the costs of the Project.

Similarly, for properties moderately impacted by noise impacts i.e. a 3 to 5 dB exceedance of noise criteria, a condition of contemporary development consents is for at-receiver noise mitigation to be undertaken on request by the landholder. For noise impacts, this can include planting of trees, double glazing of windows and / or installation of air conditioning units. To the extent that these measures mitigate noise then affected properties are no worse off than they were before and no material externality costs arise that warrant inclusion in a CBA. It is recognised that to the extent that any residual noise impacts occur, after mitigation, these externality costs of a project would not all be mitigated.

For the purpose of the analysis, an allowance of $2.15M has been included in the capital costs of the Project for acquisition of four significantly impacted properties (three of which agreements with landholders have be reached), mitigation costs for four moderately impacted properties and six negligibly impacted properties, and the provision of on-site sound barriers. It should be noted that total acquisition costs for significantly impacted properties overstates the partial property value effects of noise impacts.

As a check on the order of magnitude of assumed costs included in the CBA, if it were assumed that the median rental income for the Mid-Western Regional LGA (i.e. $270/week) was foregone from all 14 noise affected properties for 17 years because of the Project, the impact would be $1.8M, present value at 7% discount rate.

4.4.2.6 Aquatic Ecology

Predicted Biophysical Impact

Cardno (2020) predicted there would be no direct impacts to Hawkins and Lawsons Creeks and these creeks would not be displaced or re-aligned during construction, operation or decommissioning. Several un-named and ephemeral watercourses would be displaced and re-aligned. These watercourses have limited aquatic habitat and their loss/disturbance is expected to result in very minor to negligible associated impacts to aquatic ecology in the context of the local and regional area within which comparable habitat is highly abundant. Further, these would be replaced by newly created watercourses resulting in no net-loss of watercourse habitat.

The loss of stygofauna and their habitat within the footprint of the open cut pits would result in a relatively minor impact to stygofauna given the apparent unsuitability of the associated aquifer for stygofauna, compared with that present within Hawkins and Lawsons Creek alluvium (Cardno, 2020).

Predicted groundwater drawdown in alluvial aquifers associated with Hawkins and Lawsons Creeks would be expected to result in a reduction in the availability of stygofauna habitat. Given the predicted drawdown is smaller than the thickness of the alluvial aquifers there should not be a complete loss of stygofauna and their habitat associated with Hawkins and Lawsons Creek alluvium. There would be a minor (a few %) reduction in surface flow in Hawkins and Lawsons Creeks as a result of interception of surface flow on-site and groundwater depressurisation as a result of excavation of the open cut pits. Associated impacts to aquatic habitat and biota in these creeks would therefore be expected to be minor (Cardno, 2020).

The greatest potential impact to aquatic habitat and biota presented by the Project is associated with accidental release of poor quality water (potentially with elevated suspended sediments following mobilisation of sediments from disturbed areas during rainfall, containing toxicants in chemicals and hydrocarbons used on site or with low pH due to interaction with PAF waste rock or following processing of mined material). However, this would be effectively managed through the implementation of an Erosion and Sediment Control Plan and a Surface Water Management Plan. These controls would also ensure that no impacts to Key Fish Habitat and any threatened species of fish that may occur in Hawkins and Lawsons Creeks would occur (Cardno, 2020).

The water supply pipeline would be constructed below perennial watercourses and other watercourses where significant water flows are present at the time of construction using underboring techniques. Whilst trenching would be used to cross watercourses without significant flows of water, the pipeline would be buried and the watercourse profile would remain unchanged. In the event temporary watercourse diversions or coffer dams are required to manage minor flows, NSW DPI (Fisheries) would be consulted on appropriate methodology. As such, impacts to fish passage and aquatic habitat within the water supply pipeline corridor are expected to be no more than minor and temporary (Cardno, 2020).

Mitigation and Management Measures

While the design of the Project indicates that impacts to aquatic ecosystems would generally be managed through design and implementation of water management planning, a range of specific aquatic ecological factors would be monitored throughout the life of the Project.

Valuation of Impacts

Aquatic ecology and stygofauna are likely to have non-use values to the community that can potentially be estimated using non-market valuation methods. However, impacts of the Project on aquatic ecology and stygofauna are not considered significant and hence no economic impacts are included in the CBA, apart from the costs of mitigation and management measures, which are included in the capital and operating costs of the Project.

4.4.2.7 Terrestrial Ecology and Biodiversity

Predicted Biophysical Impact

The total disturbance footprint of the Project would be approximately 495 hectares of which approximately 381.71 hectares is native vegetation with the remaining 113.83 hectares being existing cleared land dominated by non-native species (EnviroKey, 2020). Of the native vegetation to be disturbed, approximately 182.26 hectares classifies as the BC Act listed Box Gum Woodland (BGW), of which 147.82 hectares also meets the classification of the EPBC

Act listed BGW. In total, approximately 88.18 hectares (48%) of the BGW comprises only derived grassland and not trees and shrubs, having already been cleared by past agricultural activities (EnviroKey, 2020).

A number of listed threatened and migratory species were also identified during surveys or are considered to have suitable habitat present. A significance assessment was completed for each of these species listed under the EPBC Act. In summary, EnviroKey (2020) concluded that the Project would not impact on the Rainbow Bee-eater, White-throated Needletail, Latham's Snipe, Cattle Egret or any migratory species. It was also concluded that the Project is unlikely to result in a significant impact upon the Koala, Large-eared Pied Bat, Spotted-tail Quoll or Swift Parrot. For both the Box-Gum Woodland and Regent Honeyeater[19], despite all reasonable attempts to avoid impacts, the Project has the potential to have a significant impact in the absence of suitable biodiversity offsets. Consequently, both Box-Gum Woodland and the Regent Honeyeater are key components in the proposed Biodiversity Offset Strategy.

Mitigation and Management Measures

At the outset, potential impacts 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.
- Preparation of and implementation of a Cyanide Management Plan providing measures to contain cyanide within water entirely within the Mine Site, to maintain levels within prescribed limits and to monitor cyanide levels.
- Implementation of a biodiversity offset strategy to offset unavoidable impacts.

Valuation of Impacts

The impacted vegetation and associated fauna is likely to have non-use values to the community that can potentially be estimated using non-market valuation methods. Similarly, the provision of offsets is also likely to have non-use values to the community. The cost of providing offsets is included in the capital cost of the Project i.e. an allowance of $20M for purchase of land and associated management funding, and purchase of credits. This cost is sourced from a detailed analysis of offsetting options prepared by Niche Environment and Heritage (2020). Options examined included purchasing credits from the market, creating credits though the establishment of Stewardship Sites on land already owned by Bowdens Silver, generation of credits through rehabilitation under the Framework for Biodiversity Assessment, and purchase of credits from the Biodiversity Conservation Trust.

[19] EnviroKey (2020) records that some potential habitat for the Regent Honeyeater is within areas to be disturbed throughout the Mine Site, however, no observations or records of observation of the Regent Honeyeater have occurred.

To the extent that the offsets provide community values that are equivalent to the values lost from clearing, there would be no net loss in community values.

Sensitivity testing of these costs in Section 4.8 is sufficient to incorporate substantial changes in the costs of offsets.

No impacts on GDEs are likely (Jacobs, 2020; EnviroKey, 2020; Cardno, 2020).

4.4.2.8 Aboriginal Heritage

Predicted Biophysical Impact

The Aboriginal and Historical Cultural Heritage Assessment undertaken by Landskape (2020) identified that there are 58 Aboriginal cultural heritage sites located within the Mine Site of which 25 would be directly impacted. There would be no direct impacts to Aboriginal cultural heritage sites within the water supply pipeline corridor and the proposed relocated Maloneys Road corridor. The Aboriginal cultural heritage sites are almost all scatters or isolated finds of stone artefacts, but include one rock shelter with potential archaeological deposits[20] and two scarred trees. The Aboriginal and Historical Cultural Heritage Assessment concluded that these sites are not of high scientific, aesthetic or education significance, but consultation with Aboriginal stakeholders has identified that the sites have high cultural significance.

Mitigation and Management Measures

A Heritage Management Plan (HMP) would be prepared in consultation with Aboriginal stakeholders to coordinate the proposed management of the cultural heritage sites within the Mine Site and along the water supply pipeline corridor and relocated Maloneys Road. The HMP would cover all relevant activities and requirements to be conducted in conjunction with ongoing activities at the Mine Site. With respect to Aboriginal heritage, it has been determined through consultation with the Aboriginal stakeholders that this should include a requirement to engage a suitably qualified archaeologist and representatives of the registered Aboriginal stakeholders to record and salvage the stone artefacts impacted by the Project, including any sites identified through test excavation at the rock shelter site. These items would be properly curated and stored in an on-site “Keeping Place”. Artefacts would be replaced within rehabilitated areas in consultation with representatives of the local Aboriginal community and Biodiversity and Conservation Division (of DPIE).

Valuation of Impact

Impacts on highly significant Aboriginal heritage sites have been shown to affect the well-being of the broader community (Gillespie Economics 2009a, 2009b, 2010). However, no Aboriginal heritage sites of high scientific, educational or aesthetic significance are predicted to be directly or indirectly impacted by the Project.

Notwithstanding, the Aboriginal and Historical Cultural Heritage identifies that impacted sites have high cultural significance to Aboriginal stakeholders. This cultural significance represents an intangible personal connection that is difficult to monetise. Consequently, no economic implications associated with Aboriginal heritage have been included in the CBA apart from costs to prepare and implement the HMP, which would include measures for further investigation and salvage of artefacts.

[20] The rock shelter has a floor area of approximately 3m x 4m and contained several stone artefacts. Landskape (2020) has recommended test excavation to determine the presence of subsurface artefacts with any identified artefacts to be included in broader heritage management.

4.4.2.9 Historic Heritage

Predicted Biophysical Impact

Three historical cultural heritage sites are located within the area being considered for potential disturbance (Landskape, 2020). These are the ruins of a possible gold prospector's dwelling and two nearby shallow gold mining shafts. This assessment concluded that the historical cultural heritage sites are of low historic cultural heritage significance except for the moderate technical and research significance of the hut ruins.

Mitigation and Management Measures

A HMP would be prepared to coordinate the proposed management of the historical cultural heritage sites within the Mine Site and along the water supply pipeline. With respect to historical cultural heritage, this would include a requirement for an archaeologist to be engaged to salvage any relics of historical interest at the ruined dwelling located within the disturbance area. Salvaged items would be properly curated and archived at a location to be determined.

Valuation of Impact

Any impacts on historical cultural heritage sites may impact the well-being of the community and could potentially be estimated using non-market valuation methods. However, no historical cultural heritage sites of high significance are predicted to be directly or indirectly impacted by the Project. Consequently, no economic implications associated with historical cultural heritage have been included in the CBA apart from costs to prepare and implement the HMP.

4.4.2.10 Traffic and Transport

Predicted Biophysical Impact

TTPP (2020) assessed the impacts of the Project on the local road network, both before and after construction of the proposed changes to the road network, particularly the construction of the relocated Maloneys Road to create a new access to the Mine Site to minimise the number of vehicles travelling through Lue throughout the life of the Project. This assessment included roadway capacity and efficiency, daily and peak hour traffic volumes in the vicinity of, and within Lue and road safety. TTPP (2020) concluded that, with the implementation of the proposed mitigation and management measures, the Project would be accommodated on the surrounding road network with no adverse impacts on the capacity, efficiency and safety of the road network.

Mitigation and Management Measures

The following key mitigation and management measures are proposed.

- Upgrades to the existing road network including:
  - relocation of a section of Maloneys Road, the full 5.2km length of which would be progressively sealed to achieve a Type 4 class road suitable for B-double vehicles; and
  - a new intersection for the relocated Maloneys Road and Lue Road, new rail bridge crossing and Lawsons Creek crossing.

- Structured operational shift commencement and finish times to be spread at different times throughout the day in order to limit traffic impacts to local road users.
- Provision of a bus service for approximately one half of the workforce coinciding with the planned shift commencement and finish times.
- Preparation and implementation of a Traffic Management Plan (TMP) which would apply to all light and heavy vehicles travelling on the public road network by employees or contractors engaged by Bowdens Silver.

Valuation of Impact

Economic costs of transport impacts can potentially relate to required upgrades of roads and intersections as well as changes in travel times and distances for road users. No additional economic costs associated with traffic and transport have been included in the CBA, apart from the costs of the Project mitigation and management measures which are included in the capital costs of the Project.

4.4.2.11 Visual Amenity

Predicted Biophysical Impact

The potential for visual impacts arise from both direct line of sight to the Mine Site and lighting and sky glow.

The Visual Impact Assessment undertaken by RLA (2020) completed a view analysis for 53 locations. The main components of the Project, being the open cut pits and ore processing area, WRE, TSF, southern barrier and ore stockpiles would not be visible from Lue itself, as a result of a series of ridges north and north-west of Lue. The relocated Maloneys Road would include a new intersection and railway crossing, west of Lue, a crossing on Lawsons Creek and a new section of road linking west of the proposed TSF to a new Mine access road and the existing Maloneys Road. None of these would be visible from the residential area of Lue.

An analysis (RLA, 2020) of the visibility of the Project components within the Mine Site from private rural residences outside of Lue showed that only six analysed have direct visibility of any of the components within the Mine Site, one with no view of the eastern section of the Mine Site. Of the other five, one (Residence R4) would have close views that would be significantly affected in character and quality.

As the re-aligned 500kV power transmission line would be through country of a similar character and appearance to the existing line and be carried on similar lattice towers, it would be unlikely to have significant visual impacts compared with the existing towers (RLA, 2020).

The Lighting and Sky Glow Assessment (LAS, 2020) found that the proposed Project lighting falls well within the limits of the Australian Standard AS/NZS4282:2019 Control of the obtrusive effects of outdoor lighting, with the exception of the luminous intensity limits at some viewing angles that are slightly above the limit. However, it is noted that direct lighting impacts are of limited relevance to the Project due to the intervening topography between the Mine Site and surrounding residences. The Project would have minimal lighting impacts on the surrounding environment and Lue. It has also been determined that the Project would have a negligible impact on the operation of the Siding Spring Observatory located approximately 168km from the Mine Site and other closer amateur astronomical observatories.

Mitigation and Management Measures

The following visual mitigation and management measures are planned.

- Emphasis upon the staged construction and rehabilitation of the TSF embankment, southern barrier and of the WRE, to limit the area of light-coloured material that would be visible from the public road network and affected local residences.
- Maximised retention of existing natural vegetation within the Mine Site.
- Continuing and expanding (through planting of an additional 3,000 trees) the existing buffer tree planting program adjacent to Powells Road and Pyangle Road frontage of the Mine Site to minimise visibility of the WRE and southern barrier from sections of those roads.
- Placement of subsoil/topsoil on strategically placed rock slopes to establish pasture grasses to limit views of operational areas where the light-colour materials are being stockpiled or placed.
- Advance planting a permanent tree buffer to the east, south and southwest of the southern barrier and WRE, to break up and disguise visibility of the foot of the barriers and provide a permanent softening to views of the residual landscape.
- Placing NAF waste rock and plant trees and shrubs on upper terminal benches within the main open cut pit above approximately 578m Australian Height Datum (AHD), the final maximum predicted water level within the main open cut pit.
- Painting buildings and structures in appropriate colours to integrate them into existing view contexts.

In order to mitigate lighting impacts on the local environment and at the Siding Spring Observatory, Bowdens Silver would adopt the following measures within the Mine Site.

- All lighting within the Mine Site would be designed to comply with Zone A1 in AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting.
- All light sources would have a correlated colour temperature (CCT) of 3000K or less, except for the 2000Watt floodlights which would have a CCT of less than 4500K.
- All floodlights would be forward throw with a maximum upcast (tilt) of 7.5 degrees. Wherever possible, the upcast would be zero.
- Lights with diffusing covers or with visible bare lamps that emit light above the horizontal plane would not be used on the outside of buildings or structures.
- The use of floodlight towers would be restricted to periods of active operation.

Value of Impacts

Visual impacts can potentially be estimated via the partial property value impacts using hedonic pricing. However, adverse effects can be mitigated via planting of vegetation screens, and the appropriate colouring of infrastructure and equipment. An allowance of $840,000 has been included in the capital costs of the Project for visual mitigation measures. An additional $600,000 has been included for the planting of roadside barriers. The most visually impacted property is also significantly affected by noise impacts and an allowance has already been included in the capital costs of the Project for its acquisition (although a management

agreement may be entered into instead). It is recognised that there will be some residual visual impacts of the Project. These remain unquantified and can be considered using the threshold value framework. However, the scale of impact is likely to be insignificant in the CBA framework due to the fact that other factors such as land size, location etc are likely to be the main determinants of property value. Also, the assessment of visual impacts considered that the residual impacts are such that further "at residence" mitigation is not necessary / proposed.

4.4.2.12 Greenhouse Gas Generation

Predicted Biophysical Impact

Ramboll (2020) have calculated that the project would generate in the order of 444,500 tonnes (t) of Scope 1 emissions and 812,000 t of Scope 2 emissions over the life of the Project.[21]

Mitigation and Management Measures

The proposed GHG management measures for the Project include the following.

- Areas cleared of vegetation would be rehabilitated and supplemented with additional biodiversity offset areas which would be improved through ongoing management of the vegetation.
- Energy efficiency would be considered during the design of processing plant with energy efficient systems installed where reasonable and practicable.
- Plant and equipment would be operated and maintained to maximise efficiency and reduce emissions, with mine planning used to minimise vehicle wait times and idling.
- Locally produced goods and services would be procured where feasible and cost effective to reduce transport fuel emissions.
- Cut and fill balances for earthworks would be reviewed to make sure that material is transported the least possible distances.

Valuation of Impact

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. Three shadow prices were used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US EPA Social Cost of Carbon. Under these shadow prices the present value of greenhouse gas emission cost is between $9M and $36M dollars, present value. This is a global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the Guidelines (NSW Government 2015), the focus of this CBA of mining projects is on costs and benefits to the population of NSW. In the absence of any studies that have focused on the social damage cost of carbon emissions to NSW residents, some means of apportioning global damage costs borne by Australians is required. For the purpose of the

[21] It should be noted that greenhouse gas generation associated with Scope 3 emissions is considered to be outside of the scope of the CBA of the Project, as they relate to downstream processing and are part of a separate project that has its own set of costs and benefits.

Economic Assessment, this has been undertaken using Australia's share of the global population (around 0.31%) and NSW's share of the Australian population (32%). NSW DP&E has previously supported this approach (NSW DP&E 2017).

On this basis, the present value of the cost of greenhouse gas emissions from the Project to Australia is estimated at between $27,000 and $111,000 dollars (present value). The cost of greenhouse gas emissions to NSW is estimated at between $9,000 and $36,000 dollars (present value).

4.4.2.13 Market Benefit to Workers

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). This approach assumes labour markets clear, with no involuntary unemployment i.e. full employment, and no other distortions (Bartik, 2012). However, where there is involuntary unemployment, a Project may result in a wage benefit to workers. Workers who transfer to the mining sector and earn higher wages are in effect increasing their productivity. The value of their output for given work hours is increasing i.e. the marginal value product of labour. The real benefit for the worker is the difference between the wage that workers are paid in mining and their minimum reservation wage (i.e. the minimum wage they would accept) for working in the mining sector (which reflects their relative occupational preference) (NSW Government, 2012, p. 7).

The NSW Guidelines (2017) identify that:

> *"Although a zero wage premium is a useful starting assumption, the appropriateness of this assumption must be assessed on a case by case basis. This is because* ***benefits to workers can be one of the major economic benefits from a project.*** *If a proponent considers that a project will generate positive benefits for workers, the economic assessment should clearly explain the reasons for this conclusion and present evidence in support of the valuation that has been adopted."*

The fundamental justification for inclusion of wage benefits in a CBA is that the economy is rarely at full employment and, even if it is temporarily, there is a constant stream of new entrants to the labour market that are looking for jobs i.e. the market for labour is dynamic. A mining project can directly employ people from the unemployment pool, new entrants to the labour force or already employed people e.g. in mining, agriculture, construction, manufacturing etc. All these potential sources of labour are reflected on the labour supply curve for a project. The labour supply curve represents the lowest wage rate (allowing for risks and disutility) at which workers would be willing to accept a job in the mining sector. The labour supply curve is upward sloping. For those people at the margin, say those already employed in the mining sector, their reservation wage is likely to be similar to the wage that they receive in the new project. However, for infra-marginal labour there would be a wage benefit, with a larger wage benefits to people sourced from the involuntary unemployment pool i.e. lower down the labour supply curve. The wage benefit for otherwise unemployed people can be even greater when search and retraining costs, scarring, stigma and physical and mental health effects of unemployment are taken into account (Haveman and Weimer, 2015). For people already employed in other sectors, the direct wage benefit would likely be between those of the unemployed and those already in the mining sector. However, even the direct wage benefit for

those employed from the mining sector or other sectors but may be larger than the estimated direct wage benefits, due to job chain effects and occupational upgrading i.e. where a person is employed from another job, which creates a vacant job for others to upgrade their employment, which creates a further vacancy to be filled, and so on (Bartik, 2012). With job chain effects, what is important is not the reservation wage of those immediately hired by the project, but the reservation wage of those at the end of the job chain (Bartik, 2012).

Any estimation of the potential economic value of employment from the Project requires a number of assumptions such as what proportion of the Project workforce that would otherwise be unemployed or underemployed, the duration of time during which this would occur and the opportunity cost of labour in an unemployed or underemployed state (i.e. the reservation wage rate).

Some indication of the potential magnitude of these benefits can be gained by making a number of assumptions. Following the general approach of Streeting and Hamilton (1991)[22] if it were assumed that 10% of the direct workforce of the Project[23] (21 out of a total of 210 jobs) would otherwise be unemployed for three years[24] and that the reservation wage for these people was $47,526[25] compared to a mining wage of $120,000, then the market employment benefit in terms of income would be $3.5M present value, at a 7% discount rate. Values at alternate discount rates and percentages of unemployed are provided in the following table. These calculations exclude any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

This estimate makes no allowance for the wage benefits to already employed workers and job chain effects. Assuming, the remaining workers, after job chain effects, are evenly located along the labour supply curve, the average wage in NSW ($64,500[26]) gives an indication of a potential average reservation wage. Further, assuming a 10% increase in average reservation wage is required to reflect any disutility in the mining sector (relative to that in existing employment)[27], and that these wage benefits are only obtained for three years, then the additional wage benefits associated with the 90% of workers who would otherwise be employed in other jobs is estimated at $21.3M present value, at a 7% discount rate. Values at alternate discount rates and percentages of already employed people are provided in the **Table 4.8**.

Based on these assumptions the potential market-based benefits of employment are in the order of $25M present value at 7% discount rate.

[22] Streeting and Hamilton (1991) *An Economic Analysis of the Forests of South-Eastern Australia*, Resource Assessment Commission, Research Paper Number 5.
[23] All sourced from NSW.
[24] This is in the context of a NSW unemployment rate of 4.5% (190,000 people) in March 2019 and a Mid-Western Regional LGA unemployment rate of 5.4% (679 people) in March 2019 (Department of Employment, Skills, Small and Family Business (2019).
[25] As estimated by the unemployment benefits plus income tax payable on a mining wage, following the reservation wage rate approach used by Streeting and Hamilton (1991).
[26] Average NSW personal income in 2016 (ABS Estimates of Personal Income for Small Areas, 2011-2016).
[27] It is questionable whether there is any disutility in a open cut mining job relative to other industry sectors from which labour may be drawn e.g. agriculture, transport, manufacturing, construction etc, as these sectors all have higher worker fatality rates than mining (Safe Work Australia, 2019).

Table 4.8
Potential Economic Benefits to Workers ($M)

	Discount Rate		
% Unemployed for 3 years	**4%**	**7%**	**10%**
Scenario 1 - 5% UE	$2.0	$1.7	$1.6
Scenario 2 - 10% UE	$3.9	$3.5	$3.1
Scenario 3 - 15% UE	$5.9	$5.2	$4.7
Wage premium benefit for Rest of Employment			
Scenario 1 - 5% UE	$25.1	$22.4	$20.1
Scenario 2 - 10% UE	$23.8	$21.3	$19.1
Scenario 3 - 15% UE	$22.5	$20.1	$18.0
Total Wage Benefit			
Scenario 1 - 5% UE	$27.1	$24.2	$21.7
Scenario 2 - 10% UE	$27.7	$24.7	$22.2
Scenario 3 - 15% UE	$28.3	$25.3	$22.7

4.4.2.14 Non-market Value of Employment

The above treatment of employment in CBA relates to the impacts on the unemployed individuals themselves. However, there may also be spill over effects and externalities to third parties. These are public good values. Spill-over effects referred to in the literature relate to empathy based losses to family or friends (close associates) of impacted workers because of the workers being unemployed and increased crime and community dislocation (Haveman and Weimer 2015: Streeting and Hamilton 1991). Empathy based impacts may also spill over more broadly into the existence values of others in the community who feel sympathy for the unemployed. As identified by Portney (1994), the concept of existence values should be interpreted more broadly than just relating to environmental resources and may also apply to the employment of others. Refer to **Annexure 7** for further discussion on non-market values of employment.

Empirical evidence for these values was found in three choice modelling studies of mining projects in NSW. In a study of the Metropolitan Colliery in the NSW Southern Coalfields, Gillespie Economics (2008) estimated the value the community would hold for the 320 jobs provided over 23 years at $756M (present value). In a similar study of the Bulli Seam Operations, Gillespie Economics (2009a) estimated the value the community would hold for the 1,170 jobs provided over 30 years at $870M (present value). In a study for the Warkworth Mine extension, Gillespie Economics (2009b) estimated the value the community would hold for 951 jobs from 2022 to 2031 at $286M (present value). These studies are considered reasonable for benefit transfer since they relate to mining in NSW with the population sampled being NSW households.

The Project would provide an average annual 210 direct jobs during operations, for approximately 15 years. Using the more conservative Bulli Seam Operation[28] employment value gives an estimated $78M for the employment benefits of the Project. There is some

[28] It is noted that the reference to Bulli Seam Operation is relied upon in the absence of data for open cut metalliferous mines.

political contention around these values, even though they have a solid foundation in theoretical and applied economics. Refer to Annexure 7. Consequently, the results have conservatively been reported "with" and "without" employment benefits.

4.4.2.15 Economic Benefits to Existing Landholders

Payments by the applicant for the purchase of land, that exceed the opportunity cost of the land, are an economic benefit to the landholder. Most of the land required for the Project is already owned by the applicant and has been for some time. The market value of land owned by Bowdens Silver is included in the CBA as an opportunity cost. To the extent that the purchase price exceeded the opportunity cost of the land and the consumer surplus of the owner, then resource costs of the Project may be overstated and some benefits may accrue to the current landholder. However, conservatively these potential benefits are excluded from the CBA.

4.4.2.16 Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. Conservatively, this convention is adopted and hence no secondary benefits to the economic are included. Economic activity to suppliers from the Project is estimated in Section 6 using a different methodology, i.e. IO analysis.

4.4.2.17 Net Infrastructure Impacts

Potential impacts of the Project on public infrastructure include the use of utilities. However, the use of utilities would be paid for by user fees which are included in the Project operating costs. Consequently, no net infrastructure costs to government are envisaged as a result of the Project. Notwithstanding, some of the net production benefits of the Project would be redistributed to the local area in the form of sponsorship of community programs, local amenities, safety programs, sporting groups, education etc. These are discussed in the Social Impact Assessment (Umwelt, 2020).

4.4.2.18 Loss of Surplus to Other Industries

A proportion of the land within the Mine Site is currently used for agricultural production. There is a producer surplus associated with this use which would be foregone when the land is used for mining.

However, as identified above the value of this surplus is reflected in the market value of the land which is included as an opportunity cost of the Project. This opportunity cost is borne by Bowdens Silver, as owner of the land. Consistent with the partial equilibrium nature of CBA and the general approach of not including secondary costs and benefits in CBA no other impacts on other industries are included in the analysis.

4.5 CONSOLIDATION OF VALUE ESTIMATES

4.5.1 Global Results

The present value of costs and benefits, using a 7% discount rate, is provided in **Table 4.9**. The top half of the table identifies production costs and benefits of the Project, which includes an estimated $25M capital and operating costs associated with the mitigation, offset and compensation of environmental, social and cultural impacts. The bottom of the table summarises the residual environmental, social and cultural impacts of the Project after mitigation, offsetting and compensation. Specific mitigation, offsetting and compensation costs are a small proportion of the capital and operating costs of the Project and even substantive changes in them would have only modest impacts on the Project. Sensitivity testing of overall capital and operating costs in provided in Section 4.8.

The Project is estimated to have total net production benefits of $98M (present value at 7% discount rate). Residual environmental, cultural and social impacts of the Project are estimated at $20M present value (global social damage costs of greenhouse gas emissions). In addition, there are potential employment benefits (market and non-market value) of $103M. In total, the Project is estimated to have global net social benefits of between $78M and $181M (the latter including employment benefits).

Table 4.9
Global and National Cost Benefit Analysis Results of the Project
(Present Values @7% discount rate)

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	Costs	**$M**	**Benefits**	**$M**
Production	Opportunity cost of land	$14	Value of silver, zinc and lead concentrate	$1 033
	Opportunity cost of capital	$0	Residual value of land	$0
	Development costs including sustaining capital and mitigation, compensation and offset costs	$264	Residual value of capital	$0
	Operating costs ex royalties	$657		
	Rehabilitation and decommissioning costs	$0		
	Production Sub-total	***$935***		***$1 033***
	Net Production Benefit			**$98 ($89)**

Table 4.9 (Cont'd)
Global and National Cost Benefit Analysis Results of the Project
(Present Values @7% discount rate)

	Costs	**$M**	**Benefits**	**$M**
Externalities	Agriculture	Reflected in land costs which are included in opportunity costs of land and development costs	Wage benefits of employment	$25
	Surface water	WAL cost included in development costs. No material residual impacts	Non-market benefits of employment	$78
	Groundwater	WAL cost included in development costs. No material residual impacts	Economic benefits to existing landholders	Not quantified
	Air quality	Cost of acquiring impacted properties or negotiated agreement included in development costs. No material residual impacts	Economic benefits to suppliers	No material impacts
	Noise and vibration	Costs of acquiring impacted properties or negotiated agreement, and at receiver mitigation costs included in development costs. No material residual impacts		
	Ecology and biodiversity	Some loss of values but offset. Cost of offset included in development costs		
	Aboriginal heritage	No material impacts		
	Historic heritage	No material impacts		
	Transport and traffic	No material impacts. Costs of road relocation and access upgrade included in development costs		
	Visual amenity	Mitigation measures included in development costs. No material residual impact		
	Greenhouse gas	$20 ($0*)		
	Net public infrastructure costs	No material impacts		
	Loss of surplus to other industries	No material impacts		
	Externality sub-total	**$20($0*)**		***$103***
Net Social Benefits – including employment benefits				**$181 ($192)**
Net Social Benefits – excluding employment benefits				**$78 ($89)**

Note: totals may have minor discrepancies due to rounding. When impacts accrue globally, the numbers in brackets relates to the level of impact estimated to accrue to Australia

"No material impacts" does not mean that there would be no impacts, but that impacts are not likely to amount to more than 5% in aggregate of the quantified net production benefits of the Project (NSW Government, 2012).

* The value is estimated at $0.06M but is rounded down.

Royalties are part of the net production benefits

Rehabilitation and decommissioning costs are included in the operating costs.

4.5.2 National Results

Not all of the identified net social benefits accrue to Australia. Bowdens Silver is 7% foreign owned and hence the net production benefits that accrue to Australia are limited to government royalties, private royalties to an Australian third party, company tax, and 93% of residual producer surplus. Royalties to government are estimated based on 4% of the concentrates ex-mine value, where the ex-mine value includes allowable deductions for processing and treatment. Private royalties to an Australian third party are assumed to accrue 100% to Australian ownership. Company tax from the Project was estimated based on estimation of taxable income (revenue less depreciation, operating costs, royalties), and the application of a 30% tax rate to estimated taxable income.

On this basis, the net production benefits that accrue to Australia are estimated at $89M (present value at 7% discount rate), comprising $21M in NSW Government royalties, $11M in Australian third party royalties, $48M in company tax and $9M in residual producer surplus.

The estimated net production benefits that accrue to Australia can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, compensation and offsetting, may be assessed. It is a minimum threshold value as it conservatively omits potential employment benefits of the Project. This minimum threshold value is the opportunity cost to Australia of not proceeding with the Project.

For the Project to be questionable from an Australian economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the Project, that impact Australia[29], would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $89M in present value terms.

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to quantitatively consider the environmental, social and cultural impacts of the Project. From **Table 4.8** it can be seen that most of the potential impacts are internalised into the capital and operating costs of the applicant via mitigation, offset or compensation, and hence are incorporated into the estimate of net production benefits. Other quantified impacts to Australia are estimated at less than $1M for greenhouse gas impacts, considerably less than the estimated $89M net production benefits of the Project to Australia.

Overall, the Project is estimated to have net social benefits to Australia of between $89M and $192M (the latter incorporating the benefits of employment), and hence relative to the “without Project” scenario is desirable and justified from an economic efficiency perspective.

While the major environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $89M and $192M for the Project to be questionable from an Australian economic perspective.

[29] Consistent with the approach to considering net production benefits, environmental impacts that occur outside Australia would be excluded from the analysis. This is mainly relevant to the consideration of greenhouse gas impacts.

4.6 NSW COSTS AND BENEFITS

The NSW Government (2015) guidelines have a particular focus on the costs and benefits to NSW. **Table 4.10** identifies the costs and benefits to NSW. Impacts that have a national or global dimension are apportioned to NSW, in particular:

- 100% of government royalties are attributed to NSW;
- 32% of third party royalties are attributed to NSW i.e. NSW's share of the Australian population;
- 32% of the estimated company tax generated from the Project is attributed to NSW (NSW Guidelines 2015);
- 45% of the Australian residual net producer surplus is attributed to NSW i.e. the percentage of shareholders that are from NSW (based on Silver Mines Limited's share registry);
- 100% of potential wages benefits are attributable to NSW based on an assumption that all incremental employment would be filled by NSW residents;
- 100% of the potential non-market values of employment are attributable to NSW based on benefit transfer from a study that surveyed the willingness to pay of NSW households;
- greenhouse gas impacts (which accrue globally) are attributed to NSW based on NSW's share of the global population; and
- all other potential environmental, social and cultural impacts would accrue to NSW households. However, in accordance with Government policy and regulation these impacts are largely mitigated, compensated or offset by the applicant.

On this basis, the costs and the benefits of the Project to NSW are summarised in **Table 4.10**. The estimated Net Social Benefits of the Project to NSW are between $44M and $146M, present value at 7% discount rate (the latter including employment benefits). Consequently, as well as resulting in net benefits to Australia, the Project would also result in net benefits to NSW.

Any unquantified residual impacts of the Project to NSW after mitigation, offsetting and compensation would need to be valued at greater than $44M and $146M, present value for the Project to be questionable from a NSW economic efficiency perspective.

4.7 DISTRIBUTION OF NSW COSTS AND BENEFITS

As identified in Section 3, CBA is only concerned with the single objective of economic efficiency. CBA and welfare economics provide no guidance on what is a fair, equitable or preferable distribution of costs and benefits. Nevertheless, CBA can provide qualitative and quantitative information for the decision-maker on how economic efficiency costs and benefits are distributed

The costs and benefits of the Project to NSW are potentially distributed among a range of stakeholders as identified in **Table 4.11**.

Table 4.10
NSW Cost Benefit Analysis Results of the Project (Present Values @7% discount rate)

Costs	Value ($M)	Benefits	Value ($M)
Environmental, Social and Cultural Impacts		***Share of Net Production Benefits***	
Agriculture	Reflected in land costs which are included in opportunity costs of land and development costs	Royalties to NSW Govt	*$21*
Surface water	WAL cost included in development costs. No material residual impacts	Royalties to third party	*$4*
Groundwater	WAL cost included in development costs. No material residual impacts	Company tax	*$15*
Air quality	Cost of acquiring impacted properties or negotiated agreement included in development costs. No material residual impacts	Residual producer surplus	*$4*
Noise and vibration	Costs of acquiring impacted properties or negotiated agreement, and at receiver mitigation costs included in development costs. No material residual impacts	***Sub-total***	***$44***
Ecology and biodiversity	Some loss of values but offset. Cost of offset included in development costs	***Additional benefits***	
Aboriginal heritage	No material impacts	Wage benefits to employment	*$25*
Historic heritage	No material impacts	Non-market benefits of employment	*$78*
Transport and traffic	No material impacts. Costs of road relocation and access upgrade included in development costs	Economic benefits to existing landholders	Not quantified
Visual amenity	Mitigation measures included in development costs. No material residual impact	Economic benefits to suppliers	No material impacts
Greenhouse gas	$0*		
Net public infrastructure costs	No material impacts		
Loss of surplus to other industries	No material impacts		
Total	**$0***	***Sub-total***	***$103***
Net Social Benefits – including employment benefits			***$146***
Net Social Benefits – excluding employment benefits			***$44***

Any errors in total are due to rounding.

" No material impacts" does not mean that there would be no impacts, but that impacts are not likely to amount to more than 5% in aggregated of the quantified net production benefits of the Project (NSW Government, 2012).

* The value for NSW is estimated at $0.02M but is rounded down.

Table 4.11
Incidence of NSW Costs and Benefits

Benefits and Costs	Incidence of Costs and Benefits	Magnitude of Impact ($M)
Share of Net Production Benefits		
Royalties*	NSW Government and NSW households	$21
Third party royalties	NSW shareholders	$4
Company tax	NSW Government and NSW households	$15
Residual producer surplus	Bowdens Silver NSW shareholders	$4
Residual producer surplus	Local households through the planning agreement and support for local initiatives	Unquantified
Additional Benefits		
Wage benefits to employment	Some of the local and NSW labour force	$25
Non-market benefits of employment	NSW households	$78
Economic benefits to existing landholders	Local landholders who sell land required for Project including buffer land	Not quantified
Economic benefits to suppliers	Regional and State suppliers of inputs to production	Not quantified
Environmental, Social and Cultural Costs*		
Agricultural impacts	Impacted farmers but compensated via purchase	No material residual impact
Surface water	Local surface water users but compensated via purchase of WALs	No material residual impact
Groundwater	Local groundwater users but compensated via purchase of WALs	No material residual impact
Air quality impacts	Adjoining landholders	Cost of acquiring impacted properties or negotiated agreement included in development costs. No material residual impacts
Noise impacts	Adjoining landholders	Costs of acquiring impacted properties or negotiated agreement, and at receiver mitigation costs included in development costs. No material residual impacts
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	No material residual impact
Historic heritage impacts	Local and NSW households	No material residual impact
Transport and traffic	Local residents	No material impacts. Costs of access upgrade and road relocation included in development costs
Visual amenity	Adjoining landholders	Mitigation measures included in development costs. No material residual impact
Greenhouse gas impacts	Local and NSW households	$0
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts

* Based on 45% of shareholders being from NSW (advice from Bowdens Silver).

** NSW regulations require many impacts to be borne by the applicant via mitigation, offset and compensation. Where these measures perfectly mitigate, offset or compensate then no residual impacts occur, and all impacts are borne by the applicant. This table identifies who bears residual impacts where mitigation, offset and compensation is imperfect.

It is evident from **Table 4.11** that the potential costs and benefits of the Project accrue to different groups within the community. Local residents and adjoining landholders primarily bear any residual environmental impacts associated with noise, air quality, visual amenity and transport and traffic.

4.8 RISK AND SENSITIVITY ANALYSIS

The main areas of environmental risks associated with mining projects relate to:

- the financial viability of a project from unexpected downturns in prices and any consequent environmental impacts from premature cessation of operations;
- ecological risk associated with whether the biodiversity offsets would adequately compensate for the direct ecological impacts; and
- other environmental, social and cultural impacts estimations and required mitigation measures.

The DPIE has previously identified that the financial viability of projects is a risk assumed by the project owners. It is highly unlikely that Bowdens Silver would invest in the Project if it were not financially viable. However, any risk that the Project may commence and then cease operation for financial reasons leaving unmet rehabilitation liabilities is mitigated by the fact that Bowdens Silver would be required to pay a rehabilitation security deposit to the as the holder of a mining authority under the *Mining Act 1992*. This security deposit would be held by the MEG to ensure that the legal obligations in relation to rehabilitation and safety of the site can be met following mine closure. If rehabilitation obligations were not met to the satisfaction of the Minister, then the security deposit funds would be used by the MEG to meet the relevant requirements.

The provision of biodiversity offsets can be associated with a number of risks, including in relation to the biodiversity benefits of additional management of offsets, success in reconstruction of ecological communities, time-lags between impacts and provision of offsets as well as between management actions and achievement of ecological outcomes. These risks would be mitigated through offset ratio requirements in the provision of offsets and commitment to the offset actions prior to the commencement of works under approval. The biodiversity offset package, with an appropriate offset ratio to account for ecological risks would be developed in consultation with the Biodiversity Conservation Division of DPIE and would be committed to prior to the commencement of the Project.

At this stage, it is proposed that the offset requirements would be principally met through retiring of biodiversity credits which have been generated via Biodiversity Stewardship Agreements established on land owned by Bowdens Silver and other private landholders. The Biodiversity Stewardship Agreements would be established in accordance with the requirements of the *Biodiversity Conservation Act 2016* and include the completion of the necessary assessment, management plan and payment to the Biodiversity Stewardship Payments Fund. Ongoing management of the Stewardship Sites, whether established on land owned by Bowdens Silver or other private landholdings, would be funded through the Biodiversity Stewardship Payments Fund and would be subject to auditing by the Biodiversity Conservation Trust and/or Biodiversity and Conservation Division.

Biodiversity offset requirements may also be partially met through purchase of relevant credits available for purchase (generated through other parties establishment of Stewardship Sites) and/or payment to the Biodiversity Conservation Trust.

There is some risk associated with the estimation of environmental, social and cultural impacts of the Project and the level of mitigation measures proposed. However, it should be noted that impacts have generally been assessed based on the maximum annual levels of production and worst case scenarios and hence are likely to be overstated. Ongoing monitoring would ensure that appropriate mitigation measures are implemented as required.

The net present value of the Project to NSW (presented in **Table 4.6**) is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a CBA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV[30].

In this sensitivity analysis, the CBA results for NSW were tested for changes to the following variables at a 4%, 7% and 10% discount rate.

- Opportunity costs of land.
- Development costs.
- Operating costs.
- Value of silver, zinc and lead concentrate i.e. USD price/exchange rate.

Results are reported in **Table 4.12**. The first point to note is that the results in **Table 4.8** do not pertain to financial viability. The CBA is based on economic surplus rather profitability. The treatment of capital costs in CBA i.e. they are included in the economic model in the years they occur rather than depreciated over time, means that CBA gives a lower estimate of net production benefits than would be reported for the profitability of the Project.

Table 4.12
NSW CBA Sensitivity Testing (Present Value $Millions) (Excluding Employment Benefits)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
Central Analysis	**$69**	**$44**	**$25**
Increase			
Opportunity cost of land - 20%	**$68**	**$43**	**$24**
Development costs - 20%	**$46**	**$22**	**$5**
Operating costs - 20%	**($1)**	**($9)**	**($16)**
Value of concentrates - 20%	**$174**	**$126**	**$90**
Decrease			
Opportunity cost of land - 20%	**$70**	**$45**	**$26**
Development costs - 20%	**$92**	**$65**	**$45**
Operating costs - 20%	**$138**	**$96**	**$66**
Value concentrates - 20%	**($38)**	**($40)**	**($41)**

Notwithstanding, the sensitivity analysis indicated that the CBA results are most sensitive to revenue estimates in AUD i.e. USD price of concentrates and the AUD:USD exchange rate. Silver is the major driver of revenue. Pricing and exchange rate assumptions were based on consensus forecasts in the Marketing and Product Handling chapter of the Project Feasibility

[30] Quantitative risk analysis could also potentially be undertaken. However, this requires information on the pprobability distributions for input variables in the analysis. This information is not available and so the sensitivity testing is limited to uncertainty analysis.

Study (GRES, 2018). The USD price of silver was assumed at 20.91/oz with an AUD:USD exchange rate of 0.75. Some short term forecasts for silver price are bullish i.e. USD22/oz in 2020 and USD28/oz in 2021 (Investing Haven, 2019). However, the long term price is highly uncertain. A 14% sustained reduction in silver price over the life of the Project would be required for the Project to have a zero net social benefit to NSW (excluding employment benefits). A devaluation of the AUD:USD exchange rate to 0.65 would completely offset a 14% reduction in USD silver price. At the time of preparing this report the AUD:USD exchange rate was 0.68. Silver price reductions have also generally been associated with reductions in operating costs and hence any sustained lower silver prices are likely to also be associated with sustained reductions in operating costs.

After revenue, the results are most sensitive to changes in operating costs. A sustained 16% increase in operating costs would result in zero net economic benefits to NSW. However, as identified above, the operating costs assumed for the Project are 15% greater than the average globally. Also, S&P (2019) indicates that silver's global average all-in sustaining cost have been on a downward trend since 2012.

The CBA results are less sensitive to capital cost estimates. Since mitigation, offset and compensation costs are a small component of the capital costs of the Project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results. For instance, a 50% increase in offset costs is equivalent to a 3% increase in the estimated capital costs (including sustaining capital) of the Project.

5. LOCAL EFFECTS ANALYSIS

5.1 INTRODUCTION

The CBA in Section 4 is concerned with whether the incremental benefits of the Project exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' the Project compared to 'without' it. This section and Section 6 examine local effects using two different methods.

The Local Area is defined as the Mid-Western Regional LGA, within which the Project is located and which is the region considered likely to be the main source of labour and non-labour inputs for the Project.

5.2 DIRECT EFFECTS RELATED TO EMPLOYMENT

The Project would provide:

- an average annual full-time equivalent (FTE) construction workforce of 131, with an FTE peak of 246. Thirty per cent are assumed to already reside in the local area with the remainder living in temporary accommodation within the local area during their shift; and
- an average annual FTE operational workforce of 210 per year over the life of the Project, with an FTE peak of 230. Seventy five per cent are assumed to already reside in the local area, 15% are assumed to migrate into the local area to live and 10% are assumed to commute from outside the local area.

Assuming that future employees residing in the local area are already employed and that job vacancies created by these people filling the construction and mining positions remain unfilled (consistent with the NSW Government Guideline, 2015), the incremental disposable wages accruing to the local area is $1.8M pa during construction and $6.2M pa during Project operations. This is equivalent to 20 direct full time equivalent (FTE) jobs during construction and 73 direct FTE jobs during operations. This is a minimum estimate as it assumes full employment and no in-migration of labour.

Table 5.1
Analysis of Net Income Increase and FTE Job Increase (Full Employment and No In-Migration)

	Heavy and Civil Engineering Construction	**Mine Operations**
a) Direct employment during operations phase	131	210
Number that already reside in the local area	39	158
b) Average net income in construction and mining*	$91,803	$85,703
c) Average net income in other industries**	$46,203	$46,203
d) Average increase in net income per job (b-c)	$45,600	$39,500
e) Increase in net income per year due to direct employment	$1,792,095	$6,221,311
f) FTE (e/b)	20	73

* Average construction wage was based on advice from GR Engineering Services. Average mine operation wage was based on advice from the Applicant.

** This information is not available from the ABS and hence average income across all sectors is used from ABS Cat. no. 6524.0.55.002 - Estimates of Personal Income for Small Areas, 2011-2016.

If alternatively it were assumed that all future employees already residing in the local area are directly drawn from the unemployed[31], the incremental disposable wages accruing to the local area is $3.0M pa during construction and $11.0M pa during Project operations. This is equivalent to 33 direct full time equivalent (FTE) jobs during construction and 129 direct FTE jobs during operations. This is estimate ignores income associated with in-migration of labour.

Table 5.2
Analysis of Net Income Increase and FTE Job Increase
(Labour Drawn from the Unemployed and No In-Migration)

	Heavy and Civil Engineering Construction	Mine Operations
a) Direct employment during operations phase	131	210
Number that already reside in the local area	39	158
b) Average net income in construction and mining*	$91,803	$85,703
c) Average net income in other industries**	$15,629	$15,629
d) Average increase in net income per job (b-c)	$76,174	$70,074
e) Increase in net income per year due to direct employment	$2,993,654	$11,036,718
f) FTE (e/b)	33	129

* Average construction wage was based on advice from GR Engineering Services. Average mine operation wage was based on advice from the Applicant.

** For this analysis unemployment benefits from the Newstart Allowance was used.

5.3 DIRECT EFFECTS RELATED TO NON-LABOUR EXPENDITURE

The total annual non-labour expenditure (operating costs of the Project after subtraction of wages to employees) is in the order of $51M per annum.

However, not all of this expenditure would accrue to the local area. From the IO analysis undertaken in Section 6, $30M pa of non-labour Project expenditure is estimated to accrue to the local area economy.

5.4 SECOND ROUND AND FLOW-ON EFFECTS

The incremental expenditure by employees and non-labour expenditure that is captured by the local area provides flow-on economic activity to the local economy, which can be estimated in terms of economic activity indicators of output, value-added, income and employment. Section 6 provides a full assessment of flow-on effects arising from both labour expenditure and non-labour expenditure. From this analysis, the adjusted Type 11A[32] employment and income multiplier for incremental impacts, construction and operation impacts were identified. Applying these multipliers to the direct net employment and net income effects calculated above in results in construction contributing 31 to 52 local area jobs and $2.5M to $4.3M in local area income, and the Project operation contributing 147 to 260 local area jobs and $10.3M pa to $18.2M in local area net income.

[31] This approach was suggested by the Peer Reviewer to give a range of potential impacts under the LEA method.
[32] Type 11A multiplier includes both production-induced and consumption-induced flow-on impacts. The adjusted multiplier reduces consumption-induced flow-on impacts for the Project employees who would reside outside the region and hence not consume significant quantities of goods and services in the region.

Table 5.3
Flow-on Effects Associated with Net Direct Employment and Income

All Local Labour Sourced From Employment			
	Net Direct	**Flow-on**	**Total**
Construction			
Employment	20	12	31
Net income (M)	$1.8	$0.8	$2.5
Operation			
Employment	73	74	147
Net income (M)	$6.2	$4.0	$10.3
Net non-labour expenditure (M)	$30		
All Local Labour Sourced From Unemployment			
	Net Direct	**Flow-on**	**Total**
Construction			
Employment	33	20	52
Net income (M)	$3.0	$1.3	$4.3
Operation			
Employment	129	132	260
Net income (M)	$11.0	$7.2	$18.2
Net non-labour expenditure (M)	$29		

5.5 EFFECTS ON OTHER INDUSTRIES

5.5.1 Local Area Economic Impacts of Displaced Agriculture

The Project would potentially result in a reduction in local area economic activity associated with a reduction in land available for agricultural activity - from the disturbance area, biodiversity offset area and the purchase of surface water and groundwater WALs - and hence a reduction demand for inputs to agricultural production.

The key impact of the Project on agricultural resources would be the removal of grazing land from the Mine Site and the footprint of the relocated Maloneys Road during the Project life. The Agricultural Impact Statement estimates a maximum reduction in gross revenue during mining operations of in the order of $160,000 per annum. The impact would be reduced to around $88,000 in gross revenue post mining given that a similar level of soil condition and land capability would be maintained following the rehabilitation of land disturbed within the Mine Site i.e. with the exception of the final void which would be retained as a lake.

A $160,000 reduction in output was modelled using the Sheep, Grains, Beef and Dairy Cattle sector of the input-output model of the local area economy. A reduction in $160,000 per annum is estimated to have the direct and indirect impacts of the order of magnitude indicated in **Table 5.4**.

Table 5.4
Impact of a Reduction in Agricultural Activity from the Disturbance Area

	Direct	Production Induced	Consumption Induced	Total Flow On	Total Effect
Output ($M)	0.16	0.07	0.03	0.09	0.25
Type 11A Ratio	*1.00*	*0.43*	*0.16*	*0.59*	*1.59*
Value Added ($M)	0.07	0.03	0.02	0.05	0.12
Type 11A Ratio	*1.00*	*0.45*	*0.22*	*0.66*	*1.66*
Income ($M)	0.02	0.01	0.01	0.02	0.04
Type 11A Ratio	*1.00*	*0.76*	*0.31*	*1.08*	*2.08*
Empl. (No.)	0.46	0.19	0.10	0.28	0.74
Type 11A Ratio	*1.00*	*0.40*	*0.21*	*0.62*	*1.62*

Total annual impact of the Project on agricultural economic activity in the local area economy is up to:

- $0.25M in annual direct and indirect output or business turnover;
- $0.12M in annual direct and indirect value added;
- $0.04M in annual direct and indirect household income; and
- 0.74 direct and indirect jobs.

The magnitude of these impacts is very small and inconsequential to the local area economy and agricultural support industries.

Other agricultural activities would not be impacted by the Project.

5.5.2 Wage Impacts

In the short-run, increased local area demand for labour as a result of the Project (relative to the “without Project” scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the local area and the availability and mobility of labour from outside the local area. The incremental direct employment and income impacts of the Project operation, as estimated in Section 6, would contribute in the order of 2.2% and 3.2% of direct local area employment and direct local area wages, respectively. The contribution is smaller using the LEA approach above. As shown in **Figure 6.6**, the main employment sectors in the local area economy have on average 10% of their labour residing outside the local area, reflecting the mobility of labour. Wage impacts are therefore not likely to be significant. Where upward pressure on local area wages occurs, it represents an economic transfer between employers and owners of skills and would attract skilled labour to the local area leading to downward pressure on wages.

5.5.3 Housing Price Impacts

The Project would generate some migration of workers and their families into the local area and hence increase demand for housing. However, the level of increased demand during construction is temporary and the increased demand during operation is modest i.e. in the order of 32 workers and their families (say 76 people with the assumed 15% of the operational workforce migrating into the region and an average household size of 2.4), in comparison to the existing population (24,076) and forecast growth in population over time i.e. 90 people per annum between 2016 and 2021, 60 people per annum between 2021 and 2026, and 50 people per annum between 2026 and 2031 (NSW Planning and Environment, 2016). In addition, at the time of the 2016 Census, 15.9% (1,660) of the private dwellings in the Mid-Western Regional LGA were unoccupied. Consequently, the impact on housing and rental prices across the local area is expected to be positive but negligible. Refer to the Social Impact Assessment (Umwelt (Australia) Pty Ltd, 2020) for a more detailed discussion of housing impacts.

5.5.4 Property Value Impacts Around the Mine

An issue raised in consultations with the community, was concern about the impact of the Project on property values around the Mine Site. This issue is discussed in Annexure 10 and summarised here.

The value of land is a function of the attributes of the property including structural, access and environmental attributes. For remote rural properties, there is a simple relationship between the agricultural income earning potential of the land and the capital value of the property

There has been much conjecture about the impact of mines on surrounding property values but little rigorous study. Conceptually, if surrounding properties are likely to be impacted by noise, odour, vibration or visual impacts, then there would be some impact on property values, with the greatest impact on property values being felt by properties experiencing the greatest impacts from the mine. Logically, where impacts exist or are expected to exist they are likely to be greatest with closer proximity to the mine and therefore there is likely to be some gradient of property value impact that decreases with distance from the mine.

However, the existence of property value impacts and the distance gradient of these impacts are expected to be related to actual or expected physical impacts from the site rather than a simple distance relationship. Where noise, dust, vibration, odour and visual impacts are contained, no impacts would be expected to occur.

5.6 ENVIRONMENTAL AND SOCIAL IMPACTS ON THE LOCAL COMMUNITY (EXTERNALITIES)

Externalities that potentially accrue to the local area are summarised in **Table 5.5.** The main potential residual impacts after mitigation, compensation and offsets relate to noise, air quality and visual impact on adjoining residents.

Table 5.5
Main Potential Environmental and Social Impacts on the Local Community

Environmental, Social and Cultural Costs	Incidence of Costs and Benefits	Comment
Agricultural impacts	Farmers whose land is required for the Project	Impacted farmers compensated via purchase of land. No material residual impact
Surface water	Local surface water users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact
Groundwater	Local groundwater users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact
Air quality impacts	Adjoining landholders	Impacted owners compensated via acquisition or negotiated agreement. No material residual impacts
Noise impacts	Adjoining landholders	Impacted owners compensated via acquisition, negotiated agreement or mitigation actions. No material residual impacts
Ecology and biodiversity	Local and NSW households	Some loss of non-use values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts.
Historic heritage impacts	Local and NSW households	No material impacts.
Transport and traffic	Local residents	No material impacts.
Visual amenity	Adjoining landholders	Impacted landowners compensated via mitigation measures. No material residual impacts

5.7 SUMMARY OF LOCAL EFFECTS

A summary of local effects of the Project is provided in **Table 5.6**.

Table 5.6
Summary of Local Effects

	Project Direct	**Project Direct: Local**	**Net Direct Effect**	**Total Net Effect (with multiplier)**
Construction (Peak Year)				
Employment	131	39	20 - 33	31 - 52
Net income (M)			$1.8 - $3.0	$2.5 - $4.3
Operation (Average Annual)				
Employment	210	158	73 - 129	147 - 260
Net income (M)			$6.2 - $11.0	$10.3 - $18.2
Net non-labour Expenditure (M)	$30 Mpa			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	No material impact			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality Impacts	**Incidence of Impacts**	**Magnitude of Impact**		
Agricultural impacts	Farmers whose land is required for the Project	Impacted farmers compensated via purchase of land. No material residual impact		
Surface water	Local surface water users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Groundwater	Local groundwater users who hold WALs	Willing sellers compensated via purchase of WALs. No material residual impact		
Air quality impacts	Adjoining landholders	Impacted owners compensated via acquisition or negotiated agreement. No material residual impacts		
Noise impacts	Adjoining landholders	Impacted owners compensated via acquisition, negotiated agreement or mitigation actions. No material residual impacts		
Ecology and biodiversity	Local and NSW households	Some loss of non-use values but offset by provision of biodiversity offsets		
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts.		
Historic heritage impacts	Local and NSW households	No material impacts.		
Transport and traffic	Local residents	No material impacts.		
Visual amenity	Adjoining landholders	Impacted landowners compensated via mitigation measures. No material residual impact		

6. SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 INTRODUCTION

This section uses input-output (IO) analysis to identify the gross economic activity footprint associated with the Project on the local economy. While Section 5 assumes full employment in the local area (and Nation) and no in-migration of labour, IO analysis assumes there is not full employment, allows for job chain effects and in-migration of labour to the local area.

6.2 STRUCTURE OF THE LOCAL AREA ECONOMY

For the purpose of the analysis, the local area economy is defined as comprising the Mid-Western Regional LGA. This is the local area where the Project is located and the majority of the Project operational workforce is expected to reside.

A 2016 IO table of the local area economy was developed using the Generation of Input-Output Tables (GRIT) procedure (**Annexure 8**), using a 2016-17 IO table of the Australian economy (ABS Cat. 5209.0.55.001 Australian National Accounts: Input-Output Tables - 2016-17) as the parent table and 2016 Census employment by industry data for NSW and the local area. The 114 sector IO table of the local area economy was aggregated to 50 sectors and 8 sectors for the purpose of describing the economy.

A highly aggregated 2016 IO table for the local area economy is provided in **Table 6.1**. The rows of this table indicate how the gross output of an industry is allocated as sales to other industries, to households, to exports and other final demands (OFD - which includes stock changes, capital expenditure and government expenditure). For example, the mining sector in the local area sells $85M worth of output to the mining sectors of the local area economy, $5M of output to the manufacturing sectors etc. It also exports $1,866M worth of output from the local area.

The corresponding column shows the sources of inputs to produce that gross output. These include purchases of intermediate inputs from other industries, the use of labour (household income), the returns to capital or other value-added (OVA - which includes gross operating surplus and net indirect taxes and subsidies) and goods and services imported from outside the local area. The number of people employed in each industry is also indicated in the final row. For the mining sector to produce $1,998M worth of output, it purchases $1M of inputs from the agriculture, forestry and fishing sector of the local area economy, $85M of inputs from the mining sector of the local area economy etc. It also imports $409M of inputs from outside the local area, generates $1,092M in other value added, employs 1,748 people and pays $187M in wages and salaries.

Output for the local area economy is estimated at $7,758M. Value-added for the local area economy is estimated at $2,398M, comprising $701M to households as wages and salaries and $1,697M in OVA.

The total employment in the local area economy in 2016 was 9,530 jobs.

The economic structure of the local area economy can be compared with that for NSW through a comparison of results from the respective IO models (**Figures 6.1** and **6.2**). This reveals that the agriculture/forest/fishing and mining sectors in the local area economy are of greater relative importance than they are to the NSW economy, while manufacturing sectors, business services sectors and public and personal services sectors are of less relative importance than they are to the NSW economy.

Table 6.1
Aggregated Transactions Table: Local Area Economy 2016 ($M)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Trade / Accom	Bus. Srvcs	Public/ Pers. Srvcs	*Total*	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	43	1	16	0	0	4	1	1	***66***	5	64	162	**297**
Mining	0	85	5	0	1	0	0	0	***92***	0	40	1,866	**1,998**
Manuf.	4	26	10	1	16	4	2	3	***65***	14	14	80	**173**
Utilities	5	10	3	21	2	3	5	4	***52***	13	20	1	**86**
Building	9	39	1	2	69	4	14	5	***143***	1	149	1	**295**
Trade/Accom	9	38	6	1	8	10	8	10	***90***	136	17	43	**286**
Bus.Srvcs	16	78	11	5	17	31	55	26	***237***	204	58	33	**533**
Public/Pers Srvcs	2	35	2	1	3	2	9	9	***64***	91	190	15	**361**
TOTAL	**89**	**311**	**53**	**31**	**117**	**58**	**93**	**57**	***809***	**465**	**553**	**2,202**	**4,029**
Household Income	38	187	29	10	58	98	103	178	***701***	-	-	-	**701**
OVA	99	1,092	22	28	40	61	221	48	***1,610***	56	29	2	**1,697**
Imports	72	409	69	17	80	70	116	78	***910***	303	59	59	**1,331**
TOTAL	**297**	**1,998**	**173**	**86**	**295**	**286**	**533**	**361**	***4,029***	**825**	**640**	**2,263**	**7,758**
Employment	**859**	**1,748**	**384**	**101**	**654**	**2,026**	**1,074**	**2,684**	***9,530***				

Figure 6.1 Summary of Aggregated Sectors: Local Area Economy (2016)

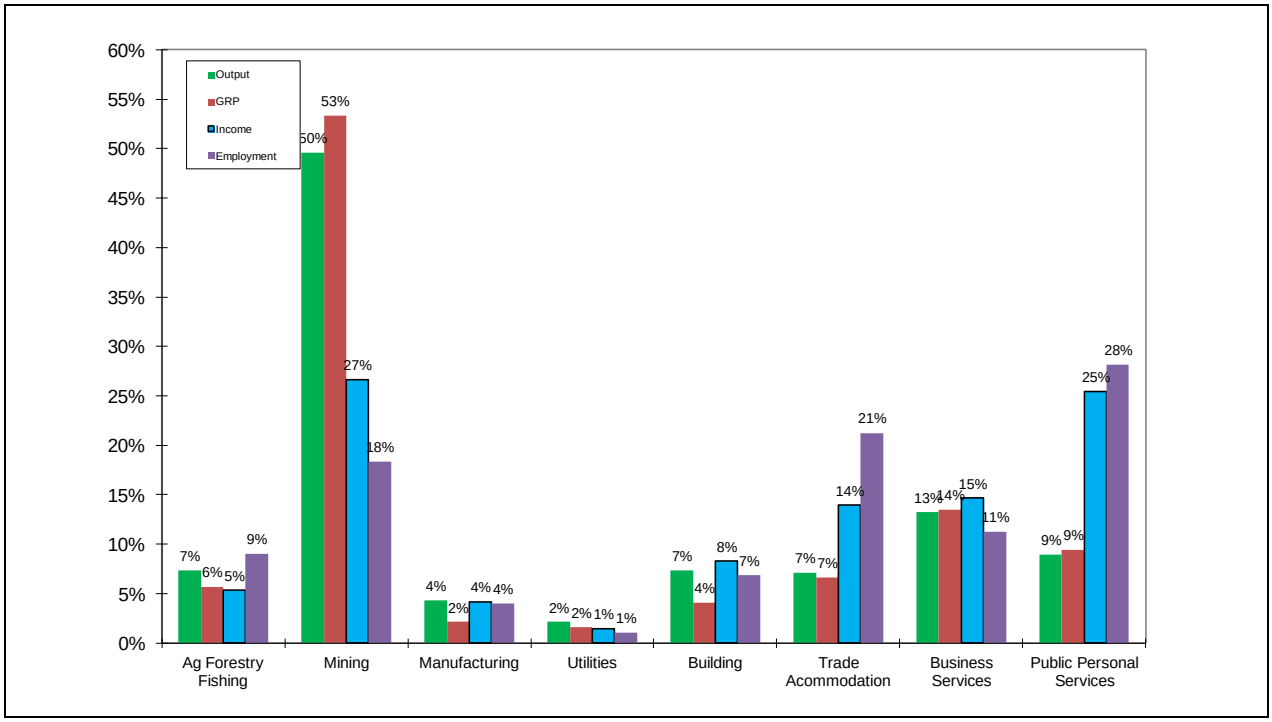
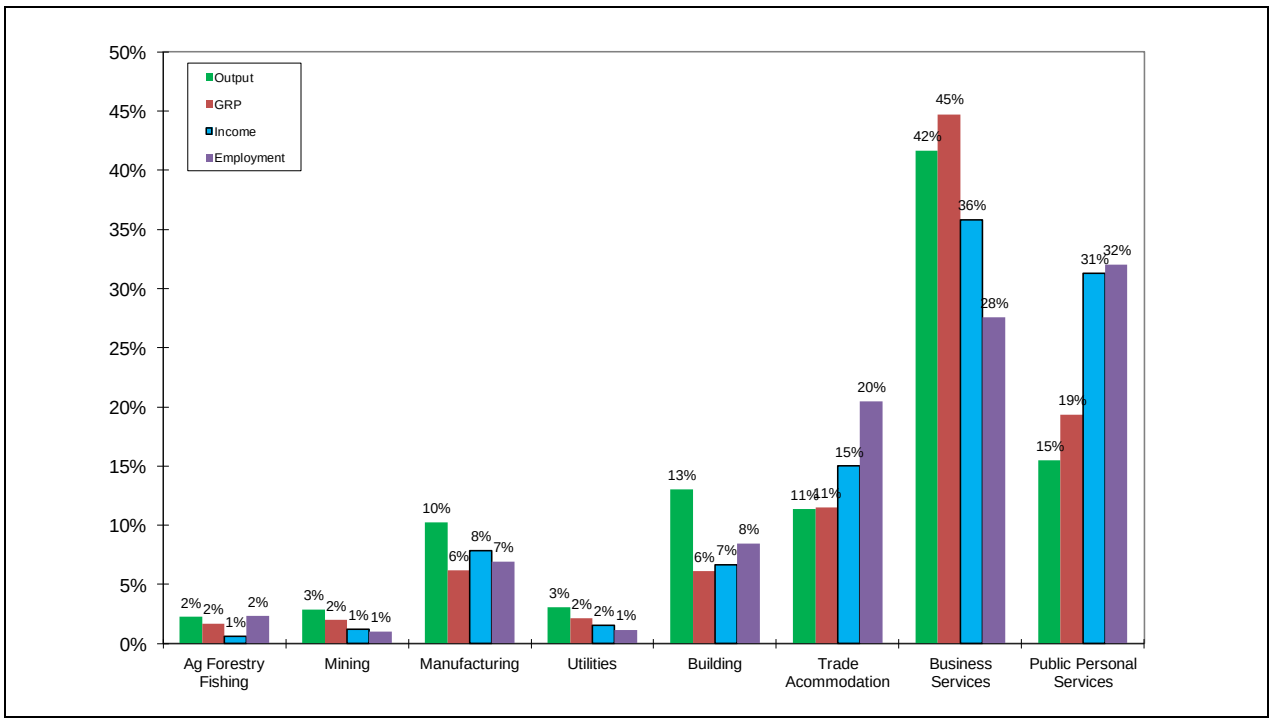


Figure 6.2 Summary of Aggregated Sectors: NSW Economy (2016)



Figures 6.3 to **6.5** provide a more expansive sectoral distribution of gross output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the local area economy. From these figures, it is evident that, in terms of gross output and value-added, coal mining, sheep/grains/beef, ownership of dwellings, construction services, and retail trade are the most significant sectors (**Figure 6.3**).

Figure 6.3 Sectoral Distribution of Gross Output and Value Added: Local Area Economy 2016 ($M)

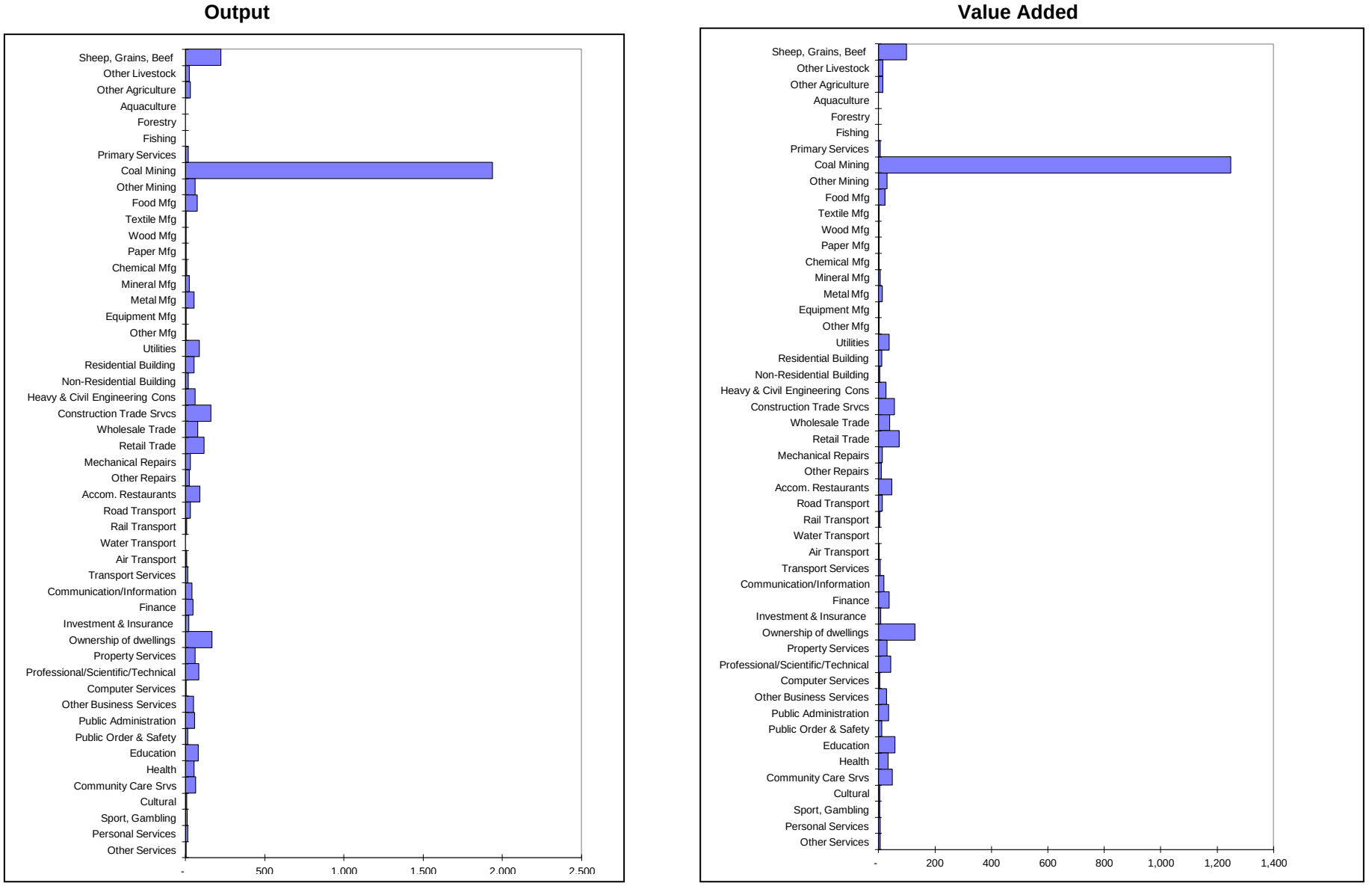
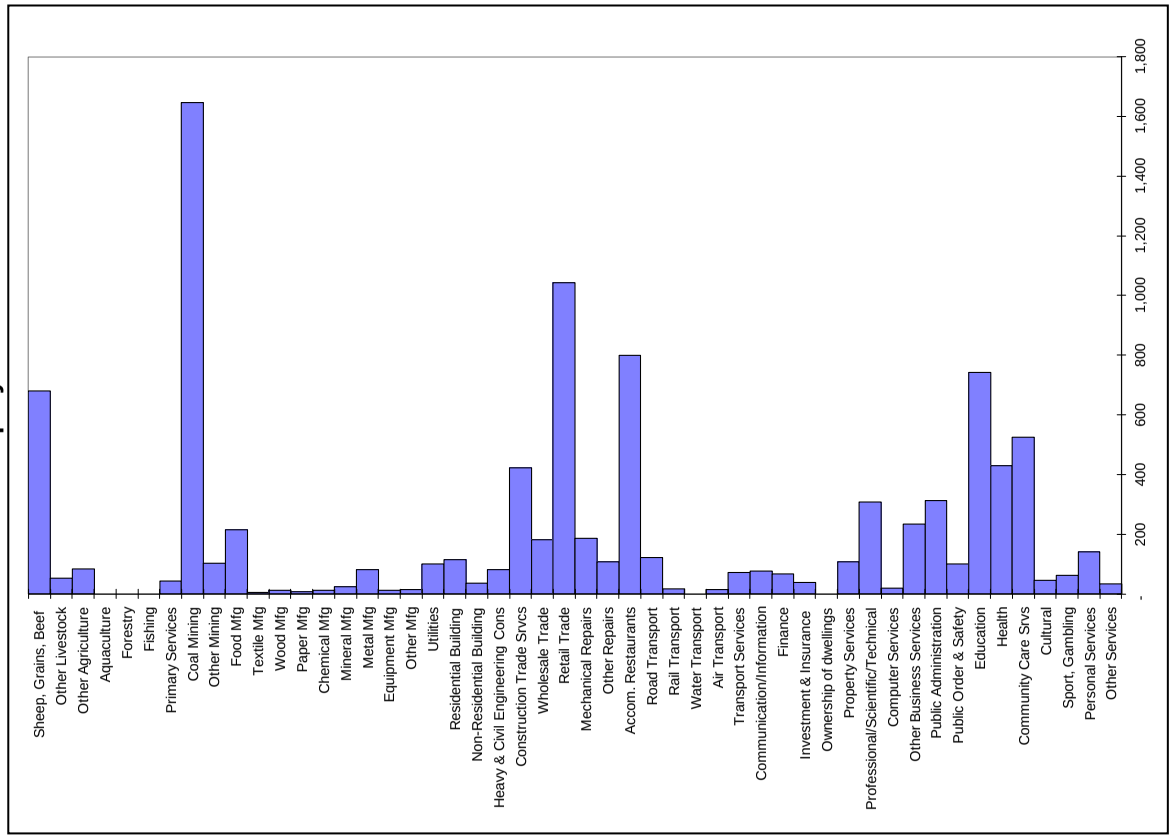


Figure 6.4 Sectoral Distribution of Income ($M) and Employment: Local Area Economy 2016 (No.)



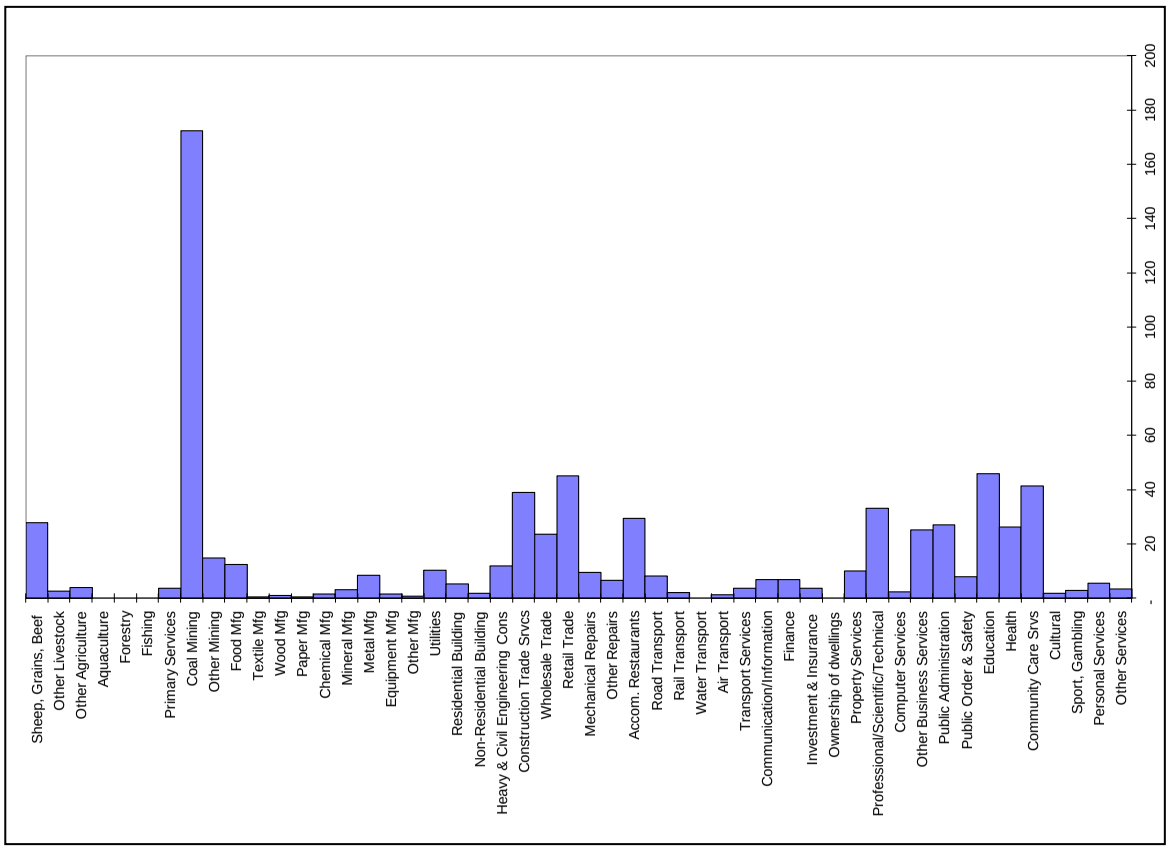
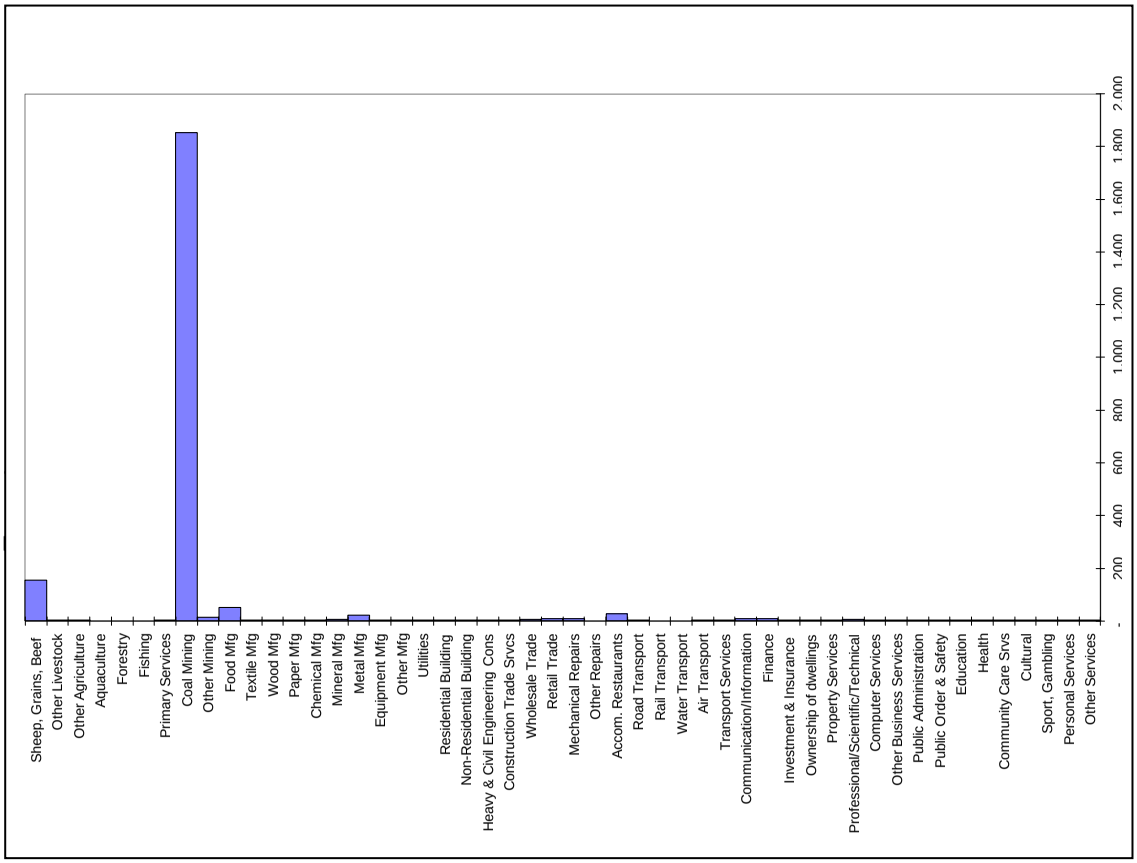


Figure 6.5 Sectoral Distribution of Imports and Exports: Local Area Economy 2016 ($M)



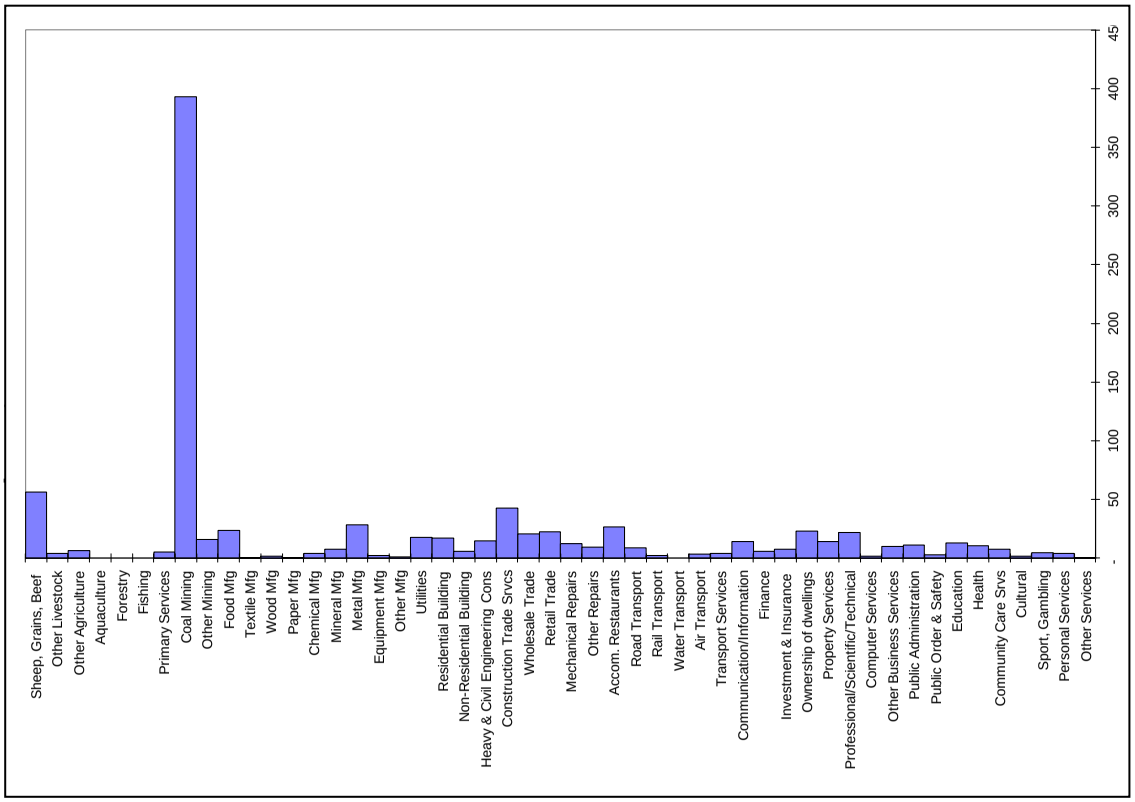
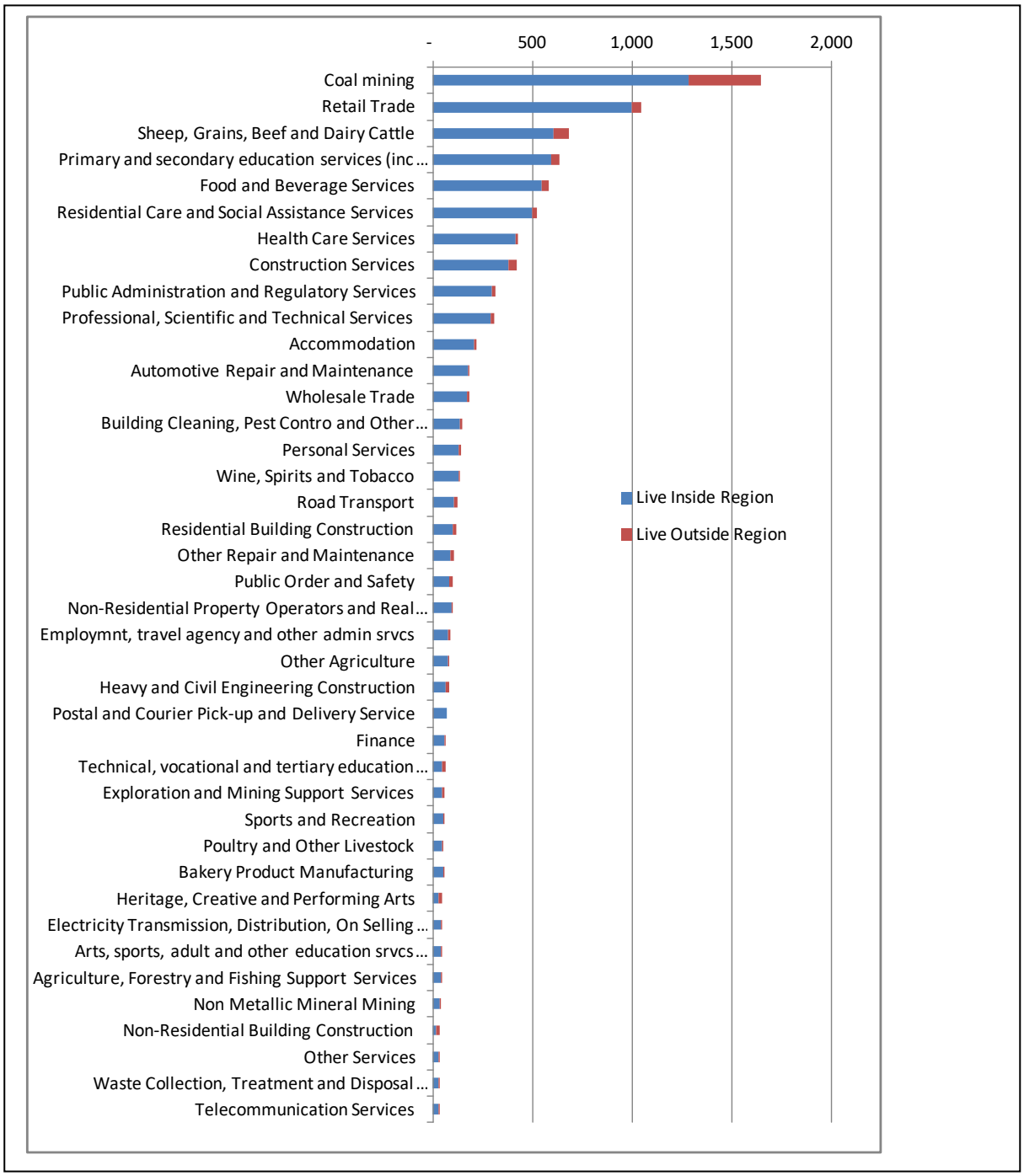


Figure 6.6 shows the top 40 individual industry sectors by employment number for the local area. The five most significant employment providers in the local area are the coal mining, retail trade, sheep/grains/cattle, primary and secondary education, and food and beverage services. In the top 40 individual industry sectors by employment, 10% of the workforce resides outside the local area. Twenty two percent of employment in the coal mining sector resides outside the local area.

Figure 6.6 Main Employment Sectors in the Local Area (Job Numbers)



Source: Generated from ABS 2016 census 4-digit employment by industry by place of usual residence data.

6.3 EXPENDITURE DURING MINING OPERATION

6.3.1 Introduction

Mining projects provide direct economic activity to local area economies i.e. the output, value-added, income and employment associated with the mining operation. All other things being equal, the economic activity arising from a project would depend on:

- the expenditure profile in the local area economy that is associated with the project;
- the expenditure profile and residential location of the workforce; and
- the size of the local area economy and the ability of local businesses to supply inputs to production demanded by mining operation and the associated workforce.

6.3.2 Mining Operation Expenditure

The Project is a new development. Some indication of the main sectors of the local area economy that may directly benefit from the Project operation can be obtained by examining the local area expenditure pattern of the non-ferrous mineral mining sector in local area IO table. This has been developed based on the expenditure pattern of the non-ferrous metal ore mining sector in a National IO table and the application of NSW and then local area location quotients[33] to assess the ability of sectors in the local area economy to supply the goods and services demanded. Based on this approach, the main sectors in the local area economy to benefit from direct operational expenditure are shown in **Figure 6.7**. The main sectors benefitting are construction services, other repairs and maintenance, heavy and civil engineering construction, professional/scientific/technical services, wholesale trade, coal mining and exploration and mining support services.

6.3.3 Mine Employee Expenditure

Economic activity in the local area would also arise from the expenditure of the Project's workforce in the local area. It is estimated that the Project would provide average annual direct local area operation employment for 210 people. It is estimated that 90% of the workforce would live in the local area [34]. An indication of the main sectors of the local area economy that may benefit from employee expenditure can be obtained by examining the expenditure pattern of the household sector in the National IO table adjusted to the local area using location quotients. Based on this approach the main sectors in the regional economy to benefit from direct expenditure of wages in the regional economy are shown in **Figure 6.8**. The main sectors benefitting from workforce expenditure are ownership of dwellings[35], retail trade, food and beverage services, wholesale trade, primary and secondary education services, residential care and social assistance services, health care services, and personal services.

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[33] Location quotients (LQs) are a way of quantifying how "concentrated" an industry is in a region compared to a larger geographic area, in this case NSW. They are calculated by comparing the industry's share of regional employment with its share of NSW employment. A LQ of one indicates that the concentration of an industry's employment in a region is the same as for the state. A LQ of greater than one indicates the region has a greater concentration of employment in an industry compared to NSW and hence the likelihood of this sector in a region being able to provide the goods and services demanded by a project are greater than where the concentration is less than one.

[34] This includes local hires plus those migrating into the region.

35 Ownership of dwellings includes payments to landlords plus imputed rents for owner occupiers.

Figure 6.7 Percentage of Operational Expenditure in the Local Area by Sector

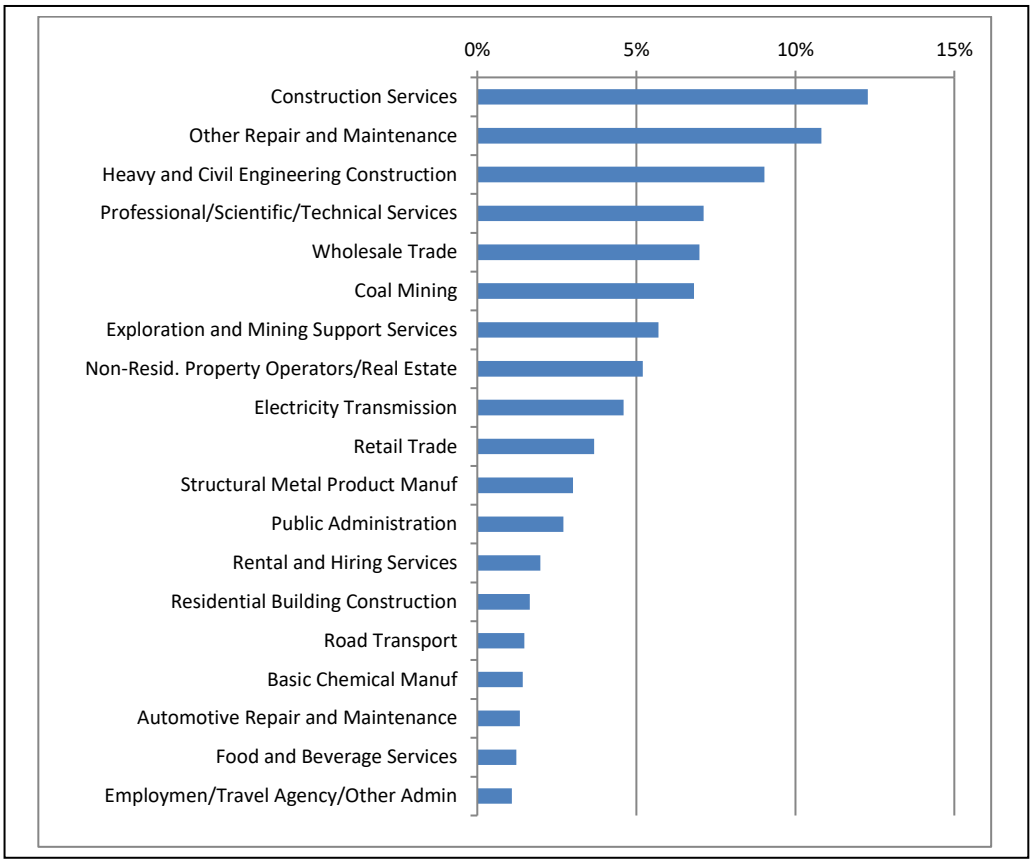
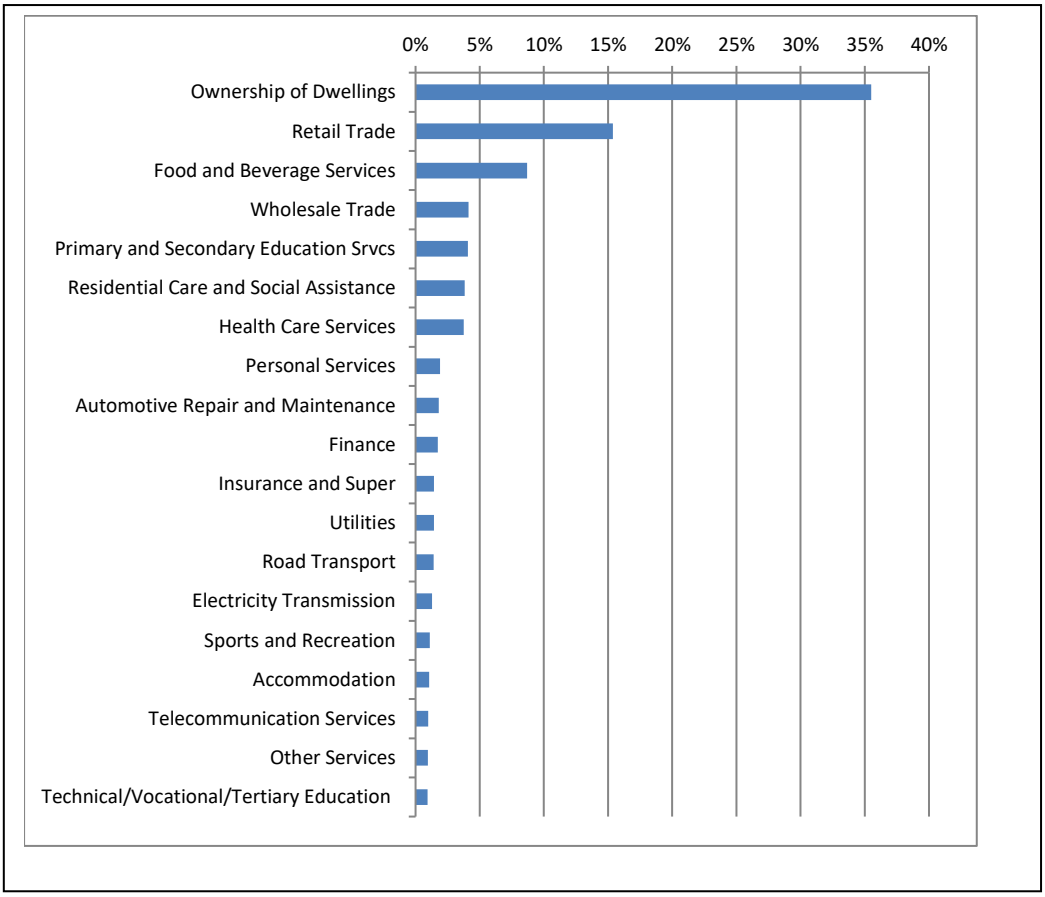


Figure 6.8 Percentage of Employee Expenditure in the Local Area by Sector



6.4 LOCAL AREA IMPACT OF THE PROJECT

The revenue, expenditure and employment associated with the construction and operation phases of the Project would stimulate economic activity for the local area economy, as described in this section.

6.4.1 Construction Phase

Introduction

Economic activity associated with the Project construction is estimated to mainly occur within three sectors of the economy, namely:

- the *heavy and civil engineering construction sector* which includes businesses involved in the mine sites;
- the *construction services sector* which includes businesses involved in site preparation services, plumbing, electrical, and other trades; and
- the *specialised and other machinery and equipment manufacturing sector* which includes the manufacturing of mining machinery and equipment.

Given the largely specialist nature of capital equipment and the relatively small size of the local area economy for the purpose of this analysis an assumption is made that all such purchases and the leasing of machinery are made outside the local area economy.

Impact on Local Area Economy

The average annual Project construction workforce is estimated at 131. To support 131 construction workers across both the *heavy and civil engineering construction sector* and *construction services sector*, reference to the input-output coefficients for the local area shows that approximately $88M of capital expenditure would be required in these sectors. The direct and indirect economic impact of this level of expenditure in the local area economy is reported in **Table 6.2**.

Table 6.2
Economic Impacts of the Construction Workforce on the Local Area Economy

	Direct	Production Induced	Consumption Induced	Total Flow on*	Total Effect*	Adjusted Total for Non Local Hires
Output ($M)	88	20	16	36	124	113
Type 11A Ratio	1.00	0.23	0.18	0.41	1.41	1.28
Value Added ($M)	37	9	10	19	55	49
Type 11A Ratio	1.00	0.25	0.26	0.51	1.51	1.32
Income ($M)	14	5	3	8	23	20
Type 11A Ratio	1.00	0.35	0.24	0.59	1.59	1.42
Empl. (No.)	131	61	62	123	254	210
Type 11A Ratio	1.00	0.46	0.47	0.94	1.94	1.61
Note: Totals may have minor discrepancies due to rounding.						

Impacts

In estimating the total local area impacts, it is important to separate the flow-on effects that are associated with firms buying goods and services from each other (production-induced effects) and the flow-on effects that are associated with employing people who subsequently buy goods and services as households (consumption-induced effects). This is because these two effects operate in different ways and have different spatial impacts.

Production-induced effects occur in a near-proportional way within a local area, whereas the consumption-induced flow-on effects only occur in a proportional way if workers and their families are located in the local area or migrate into the local area. Where workers commute from outside the local area some of the consumption-induced flow-on effects leak from the local area. For the purpose of this analysis it is assumed that 30% of the construction workforce are sourced from the local area and that the remainder who temporarily relocate to the local area or commute from outside the local area do not expend any significant amount of their income in the local area. On this basis the total local area economic impact during construction comprises the direct effects, production-induced effect and 30% of the consumption-induced effect identified in **Table 6.2**. That is, total annual impact of construction on the local area economy is estimated at up to:

- $113M in annual direct and indirect output or business turnover;
- $49M in annual direct and indirect value added;
- $20M in annual direct and indirect household income; and
- 131 direct and 79 indirect local jobs.

Multipliers

Multipliers are summary measures used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry (ABS, 1995). There are many types of multipliers that can be generated from input-output analysis (refer to **Annexure 5**). Type 11A ratio multipliers summarise the total impact on all industries in an economy in relation to the initial own sector effect e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc.

The Type 11A ratio multipliers for the construction phase of the Project range from 1.28 for output up to 1.61 for employment.

Main Sectors Affected

The input-output analysis indicates that construction is most likely to directly impact the heavy and civil engineering construction sector and construction services sector. Flow-on impacts from the construction of the Project are likely to affect a number of different sectors of the local area economy. The sectors most impacted by output, value-added, income and employment flow-ons are likely to be wholesale and retail trade, professional, scientific and technical services, and food and beverage services.

6.4.2 Operation Phase

6.4.2.1 Impact on the Local Area Economy

Introduction

For the analysis of the Project, a Project sector was inserted into the local area IO table[36] reflecting average annual production levels for the Project, during years of mineral extraction. The revenue, expenditure, and employment data for this new sector was obtained from financial information provided by Bowdens Silver. For this new sector:

- the estimated gross annual revenue of the Project was allocated to the output row;
- the estimated wage bill of employees residing in the local area was allocated to the household wages row with the remainder allocated to a secondary household wages row that does not get incorporated into flow-on effects;
- non-wage expenditure was allocated across the relevant intermediate sectors in the economy and imports based on ratios in the National input-output table for the Non Ferrous Metal Ore Mining Sector. This was then adjusted for local area location quotients for each intermediate sector;
- the difference between total revenue and total costs was allocated to the other value-added row; and
- direct employment in the Project was allocated to the *employment* row.

Impacts

The total and disaggregated annual impacts of the average operation of the Project on the local area economy in terms of output, value-added, income and employment (in 2019 dollars) are shown in **Table 6.3**.

Table 6.3
Annual Local Area Economic Impacts of the Project During Operation Phase

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	Total Effect
Output ($M)	119	41	26	66	185
Type 11A Ratio	1.00	0.34	0.22	0.56	1.56
Value Added ($M)	60	19	16	34	94
Type 11A Ratio	1.00	0.31	0.26	0.57	1.57
Income ($M)	23	9	6	15	37
Type 11A Ratio	1.00	0.40	0.25	0.65	1.65
Empl. (No.)	210	113	101	214	424
Type 11A Ratio	1.00	0.54	0.48	1.02	2.02
Note: Totals may have minor discrepancies due to rounding.					

[36] Inflated to 2019

Again, local area economic impacts are separated out between production-induced effects and consumption-induced effects. Production-induced effects occur in a near-proportional way within a local area. Where workers commute from outside the local area some of the consumption-induced flow-on effects leak from the local area. The Project sector modelled included an allowance for 10% of workers residing outside the local area. Where workers are already located in the local area i.e. unemployed or employed, some of the consumption-induced flow-ons in the local area may already be occurring through expenditure of their current wage or unemployment benefits.

The Project is estimated to make up to the following contribution to the local area economy (**Table 6.3**).

- $185M in annual direct and indirect output or business turnover.
- $94M in annual direct and indirect value-added.
- $37M in annual direct and indirect household income.
- 210 direct and 214 indirect jobs.

Multipliers

Type 11A ratio multipliers for the Project range from 1.56 for output up to 2.02 for employment.

Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to relatively high ratio multipliers for employment. A lower ratio multiplier for income (compared to employment) also generally occurs as a result of comparatively higher wage levels in the mining sectors compared to incomes in the sectors that would experience flow-on effects from the Project.

Capital intensive mining projects also typically have a relatively low ratio multiplier for value-added, reflecting the relatively high direct value-added for the Project compared to that in flow-on sectors. The low output ratio multiplier largely reflects the high direct output value of the Project compared to the sectors that experience flow-on effects from the Project.

Main Sectors Affected

Flow-on impacts from the Project are likely to affect a number of different sectors of the local area economy. The sectors most impacted by output, value-added and income flow-ons are likely to be the:

- Construction Services;
- Professional, Scientific and Technical Services Sector;
- Retail Trade Sector;
- Wholesale Trade Sector;
- Other Repair and Maintenance Sector;
- Heavy and Civil Engineering Construction Sector;
- Exploration and Mining Support Services Sector; and
- Food and Beverage Services Sector.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities would be generated by the Project operation (**Table 6.4**).

Table 6.4
Sectoral Distribution of Total Local Area Employment Impacts of the Project

Sector	Average Direct Effects	Production Induced	Consumption Induced	Total
Primary	0	1	1	2
Mining	210	5	0	215
Manufacturing	0	7	3	9
Utilities	0	3	1	4
Wholesale/Retail	0	18	31	50
Accommodation, cafes, restaurants	0	6	19	24
Building/Construction	0	20	2	22
Transport	0	5	3	8
Services	0	49	41	90
Total	**210**	**113**	**101**	**424**
Note: Totals may have minor discrepancies due to rounding.				

Table 6.4 indicates that direct, production-induced and consumption-induced employment impacts of the Project on the regional economy are likely to have different distributions across sectors. Production-induced flow-on employment would occur mainly in the *services*, *building / construction*, and *wholesale / retail* sectors, while consumption induced flow-on employment would be mainly in the *services, wholesale / retail,* and *accommodation / cafes / restaurants* sectors (**Table 6.4**).

Businesses that can provide the inputs to the production process required by the Project and/or the products and services required by employees would directly benefit from the Project by way of an increase in economic activity. However, because of the inter-linkages between sectors, many indirect businesses would also benefit.

6.5 POTENTIAL CONTRACTION IN OTHER SECTORS

Economic impacts for local area economies modelled using IO analysis represent only the gross or positive economic activity associated with the Project. Where employed and unemployed labour resources in the local area are limited and the mobility of in-migrating or commuting labour from outside the local area is restricted, there may be competition for local area labour resources as a result of the individual project that drives up local area wages. In these situations, there may be some 'crowding out' of economic activity in other sectors of the local area economy.

'Crowding out' would be most prevalent if the local area economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the local area. However, the local area economy is not at full employment and is an open economy with access to external labour resources. Consequently, 'crowding out' of economic activity in other sectors as a result of the Project would not be expected to be significant.

However, even where there is some 'crowding out' of other economic activities this does not indicate losses of jobs but the shifting of labour resources to higher valued economic activities. This reflects the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore considered a positive outcome for the economy not a negative.

6.6 MINE CESSATION

As outlined in Section 6.4, the operation of the Project would provide direct and indirect economic activity in the local area economy for approximately 15 years. Conversely, the cessation of the mining operations in the future would result in a contraction in local area economic activity.

The magnitude of the local area economic impacts of cessation of the Project would depend on a number of interrelated factors at the time, including:

- the movements of workers and their families;
- alternative development opportunities; and
- economic structure and trends in the local area economy at the time.

Ignoring all other influences, the impact of Project cessation on the local area economy would depend on whether the workers and their families affected would leave the area. If it is assumed that some or all of the workers remain in the local area, then the impacts of Project cessation would not be as severe compared to a greater number leaving the local area. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption, the local area economic impacts of Project cessation would approximate the direct and production-induced effects in **Table 6.3**. However, if displaced workers and their families leave the local area then impacts would be greater and begin to approximate the total effects in **Table 6.3**.

The decision by workers, on cessation of the Project, to move or stay would be affected by a number of factors including the prospects of gaining employment in the local area economy compared to other regions, the likely loss or gain from homeowners selling, and the extent of "attachment" to the local area (Economic and Planning Impact Consultants, 1989).

Ultimately, the significance of the economic impacts of cessation of the Project would depend on the economic structure and trends in the local area economy at the time. For example, if the Project cessation takes place in a declining economy, the impacts might be significant. Alternatively, if Project cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Project may have little impact.

Nevertheless, given the uncertainty about the future prospects in the local area economy, it is not possible to predict the likely circumstances within which Project cessation would occur.

7. CONCLUSION

Cost Benefit Analysis

A CBA of the Project indicated that it would have net production benefits to NSW, after mitigation, compensation and offset, of $44M, present value at 7% discount rate. Provided the residual environmental, social and cultural impacts of the Project, after mitigation, compensation and offset, that accrue to NSW are considered to be valued at less than $44M, the Project can be considered to provide an improvement in economic efficiency and hence relative to the "without Project" scenario is justified on economic grounds.

Adverse uncompensated and residual environmental, social and cultural impacts of the Project have been minimised through project design and mitigation, offset and compensation measures. The cost of implementing these measures has already been incorporated into the estimate of net production benefits, including the cost of using land and water resources, noise, air quality and visual impact mitigation, provision of biodiversity offsets, road relocation and access upgrade. Expert technical investigations indicate no material impacts are envisaged in relation to Aboriginal heritage, historic heritage, public infrastructure or loss of surplus to other industries. Additional impacts that were quantified included greenhouse gas generation. However, this is minor compared to the estimated net production benefits of the Project.

There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $103M present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of $44M to $146M present value at 7% discount rate (the latter including employment benefits) and hence, relative to the "without Project" scenario, is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $44M to $146M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The sensitivity analysis indicated that the CBA results are most sensitive to revenue estimates i.e. USD price of concentrates and the AUD:USD exchange rate, followed by operating costs and capital costs. Since mitigation, offset and compensation costs are a small component of the capital costs of the Project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Local Effects Analysis

While the Project would provide direct employment for an average of 131 during construction and 210 during operation, the net impact on local employment would depend on prevailing levels of unemployment and labour force participation rates, as well as the scope for in-migration of labour. One scenario, under the LEA, assumes full local area employment[37] and ignores income to the region associated with in-migration of labour. These are very restrictive assumptions that would serve to understate actual project employment benefits to the local

[37] Where the region is defined as the Mid-Western Regional Local Government Area (LGA).

area. Another scenario is that all future employees already residing in the local area (again ignoring income associated with in-migration to the local area) are directly drawn from the unemployed.

Based on the two sets of assumptions of the LEA, the Project is estimated to contribute 20 to 33 net direct local jobs ($1.8M to $3.0M in income) to existing residents of the local area during construction and 73 to 129 net direct local jobs ($6.2M to $11.0M in income) annually during operation.

With multiplier effects included, construction would contribute 31 to 52 local area jobs and $2.5M to $4.3M per annum in local area income to existing residents, and the Project operation would contribute 147 to 260 local area jobs and $10.3M to $18.2M per annum in local area net income to existing residents.

Supplementary Local Effects Analysis

The supplementary LEA, using IO analysis, relaxes the restrictive assumptions of the LEA and allows for divergence from full employment, job chain effects and in-migration of labour to the local area.

Using this approach, the total annual impact of construction on the local area economy is estimated at up to:

- $113M in annual direct and indirect output or business turnover;
- $49M in annual direct and indirect value added;
- $20M in annual direct and indirect household income; and
- 131 direct and 79 indirect local jobs.

The Project operation is estimated to make up to the following contribution to the local area economy.

- $185M in annual direct and indirect output or business turnover.
- $94M in annual direct and indirect value-added.
- $37M in annual direct and indirect household income.
- 210 direct and 214 indirect jobs.

The actual local area impact of the Project operation is likely to lie between that assessed in the LEA and the Supplementary LEA.

8. REFERENCES

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Annexures

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Annexure 1

Legislative Context for Economic Analysis in EIA

(Total No. of pages including blank pages = 4)

Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 2000

- The basis for economic analysis under the *Environmental Planning and Assessment* (EP&A) *Act 1979* emanates from:
  - the definition of the term “environment” in the EP&A Act which is broad and includes the social and **economic** environment, as well as the biophysical environment;
  - the “objects” of the EP&A Act which includes *“to promote the social and **economic welfare** of the community”*; and
  - Clause 7(1)(f) of Schedule 2 of the EP&A Regulations which requires environmental assessment to provide “*the reasons **justifying** the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, **economic** and social considerations…”*
  - *Section 4.15 of the EP&A Act requires the following two matters to be taken into consideration by the consent authority in determining a development application:*
    - the public interest (taken as the collective public interest of households in NSW); and
    - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- Objects of promoting economic welfare and requirements to justify a project having regard to economic considerations are consistent with the use of CBA. A note to Clause 7(1)(f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- A cost benefit analysis is consistent with the consideration of the public interest, although the limitation of public interest to NSW households requires consideration of the costs and benefits to NSW households, whereas CBA would normally be undertaken at the National level.
- Elements of CBA can provide information on the economic impacts in the locality, although CBA should not be undertaken at the local level. This can be supplemented by other forms of analysis to examine economic impacts in the locality such as the consideration of:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.

Secretary's Environmental Assessment Requirements

- The Project SEARs include a requirement for:
  - an assessment of the likely economic impacts of the development, paying particular attention to:
    - the significance of the resource;

- economic benefits of the project for the State and local area;
- the demand for the provision of local infrastructure and services; and
- consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.

Other Economic Guidelines

- In 2015 the NSW Government prepared *Guidelines for the economic assessment of mining and coal seam gas proposals*. This provides an outline of how to undertake a CBA and local effects analysis of mining and coal seam gas proposals.
- In 2018 the NSW Government prepared *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals.* This provides supporting information on how to conduct a CBA of mining and coal seam gas proposals.
- NSW Treasury (2017) *NSW Government Guide to Cost-Benefit Analysis*, provides guidance for Government agencies on how to undertake CBA of significant spending proposals, including proposed capital works, projects and new programs across all public sector agencies. However, many of the principles have broader application.

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Annexure 2

Introduction to Economic Methods

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Cost Benefit Analysis

- Cost Benefit Analysis (CBA) is the primary way that economists evaluate projects and policies.
- CBA evaluates whether the well-being (**economic welfare**) of the community is in aggregate improved by a project. It does this by comparing the costs and benefits of a project to the community.
- The community whose welfare is included is broadly defined as anyone who bears significant costs and benefits of a project. However, in practice most CBA is undertaken at a national level. CBA at a sub-national level is not recommended however if undertaken at this level should provide decision-makers with estimates of all significant effects, including those to non-residents of the sub-national region.
- It is not possible to justify a project on economic grounds without doing a CBA.

Economic Activity Analysis

- Economists also often provide information to decision-makers on the **economic activity** that a project would provide to the regional, state or national economy. This is particularly relevant at the regional level since many regions and towns are experiencing long term decline as a result of structural change in the economy. Additional economic activity can help the prosperity of these regions.
- **Direct** economic activity provided by a project can be estimated from financial and labour estimates for a project. Methods that can be used to estimate **direct** and **indirect** economic activity include IO analysis and CGE modelling. Refer to Annexure 3 for a comparison of these methods and their assumptions.
- While economic activity measures from IO analysis and CGE modelling e.g. direct and indirect output, value-added and income, are generally not measures of benefits and costs relevant to a CBA this information can be of interest to decision-makers[38].

Economic Analysis and Decision-Making

- CBA and local effects analysis (including IO/CGE analysis) are not mechanised decision-making tools, but rather means of analysis that provide useful information to decision-makers.
- Decision-making is multi-dimensional. CBA is concerned with the single objective of **economic efficiency** (economic welfare) while IO analysis and CGE are concerned with the objective of **economic activity** (growth). They do not address equity and other objectives of government. Decision-makers therefore need to consider the economic efficiency and economic activity implications of a project, as indicated by CBA and IO/CGE analysis respectively, alongside the performance of a project in meeting other, often conflicting, government goals and objectives.

[38] It should be noted that it is possible to analyse industry benefits and costs within a general equilibrium framework where impacts are of a sufficient scale that they flow through into multiple sectors in the economy. However, for individual projects a partial equilibrium framework is the preferred approach for the estimation of costs and benefits (US EPA (2010) Guidelines for Preparing Economic Analyses, US EPA).

Annexure 3

Comparison of Input-Output Analysis and the LEA Method

(Total No. of pages including blank pages = 4)

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the mine site then all these jobs are counted in IO analysis as a direct effect i.e. direct employment in the region, because the jobs are located in the region. However, in IO analysis only the income of employees living in the region are counted as direct income effects since it is only wages expenditure of those living in the region that flows through the regional economy. In IO analysis, if 40% of a project's jobs are filled by people who already reside in the region then the total wages of these people is counted as a direct regional income effect of the project. Similarly, if 40% of the new jobs are taken by people who migrate into the region this is also counted as direct income for the region, as it is income that would accrue to people living in the region even though they are new residents. In IO analysis, the income of those residing outside the region is excluded as most of their income would be taken home after shift and spent where they live or elsewhere.

These direct employment and income effects for the region are those **associated** with the project i.e. the gross footprint, rather than specifically an assessment of **incremental** effects. This is partly because assessment of incremental effects becomes highly contentious and difficult. However, as will be shown below, these gross direct effects associated with a project can also be a reasonable approximation of incremental effects when "trickle down" or "job chain" effects are considered.

However, first is a comparison between how IO analysis treats direct employment and income effects (as explained above) and that of LEA in the NSW (2015) guideline.

The guideline splits labour into those ordinarily resident in the region and those not ordinarily resident in the locality. For those ordinarily resident in the region the guideline suggests calculation of incremental income as the difference between a mining income and the average level of income in other industries in the region. Incremental direct employment is then calculated by dividing this incremental income by the average wage in mining.

The guideline ignores workers who migrate into the region to work. However, using the rationale of the guideline, workers who migrate into the region to take jobs in a project provide a greater level of incremental income and spending in the region than those that to take jobs in a project and who already reside in the region. The entire wage of those migrating into the region is additive to regional income in comparison to wage increments for those already residing in the region.

Table 1 provides an example of incremental wages using the guideline method and when income from those migrating into the region is counted. If only the incremental wages of those who already reside in the region are counted the incremental impact is $1.4M in annual wages. However, if the incremental wages to the region from those who migrate into the region are included, this increases to $5.4M.

Table 1 - Incremental Income when Immigrating Workforce is Included

Categories of Workers	Direct Empl	Current Wages @$65k	New Wages @$100k	Incremental New Wages for Workers	Incremental New Wages to the Region
Already Live in Region	40	2 600 000	4 000 000	1 400 000	1 400 000
Migrate into Region to Live	40	2 600 000	4 000 000	1 400 000	4 000 000
Commute from outside	20	1 300 000	2 000 000	700 000	0
Total Direct Empl	100	6 500 000	10 000 000	3 500 000	5 400 000

Even for those already living in the region who are already employed, the incremental income estimated using the guideline substantially understates additional regional income effects. This is because new jobs in a region create a chain of job opportunities (referred to in the literature as the "trickle down" effect, "job chain" or "occupational upgrading"- see Persky et al, 2004 What are jobs worth?, Employment Research Vol. 11 , p. 3).

An already employed person in the region moving into a mining job, creates a job vacancy, which can be filled by those in the region (already employed, unemployed or attracted into the labour force) or by in-migration. Where this job is filled by those already employed in the region this in turn creates another vacancy etc. Following the entire chain through, the cumulative increase in wages to a region would approach the wages of the total direct mining jobs. It would only be discounted if the chain ends with employment of those from local residents in the unemployment pool (who are receiving an allowance and hence already are spending income in the region) or if jobs remain unfilled. In periods of higher unemployment rates, jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new jobs.

Table 2 demonstrates the "job chain" effect in relation to 40 new mining jobs filled by already employed local workers. It shows that the total annual wages of the new mining jobs is $4M. Under the trickle down approach where all jobs are backfilled including ultimately by 40 local residents from the unemployment pool the incremental wages to the region are $3.5M. If some of these jobs filled from the unemployment pool are ultimately filled by in-migration the difference between the incremental wages to the region and the total annual mining jobs wages would lessen.

The guideline does not take account of the "job chain" effect and essentially assumes that the previous jobs of "job movers" in the region remain vacant for the life of the project.

Incorporation of consideration of the "job chain" effect means that the direct incremental income to a region approximates that assumed in IO analysis (i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect).

Table 2 - Demonstration of the Job Chain Effect for 40 Jobs Filled by Locals Who are Already Employed in the Region

	Total wages	**Increment Wages Gain to Region**
1. New mining wage for 40 workers @$100k	$4 000 000	$1 400 000 (1-2)
2. Current Wages for 40 workers @$65k	$2 600 000	$1 000 000 (2-3)
3. Wage of people filling above 40 positions @$40k	$1 600 000	$800 000 (3-4)
4. Wage of people filling above 40 positions @$20k	$800 000	$ 255 664 (4-5)
5. Wages of the unemployed filling above 40 positions (Newstart - single no children)	$544 336	
Total		**$3 455 664**

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Annexure 4

Input-Output Analysis and Computable General Equilibrium Analysis

(Total No. of pages including blank pages = 6)

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- Data specific to a project's revenue, expenditure and employment profile can be inserted into an IO table and analysed.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a project's operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[39] and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a CBA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

[39] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

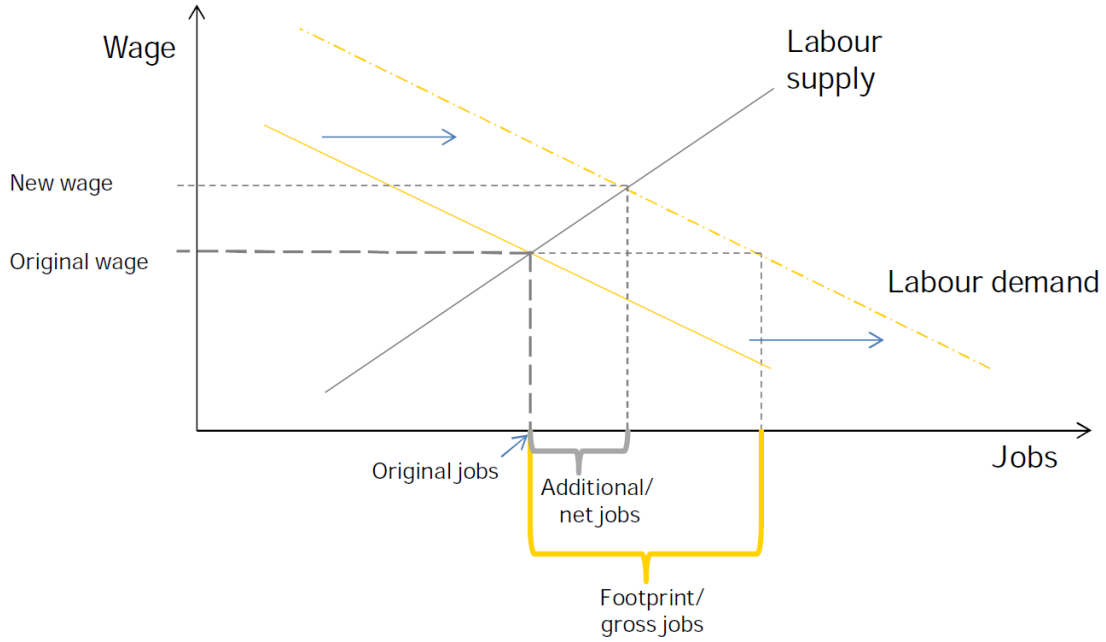
Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.
- CGE modelling can be dynamic or comparative static[40] and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- Modelling of the impact of a project uses the production function of the model for that sector, rather than project specific production function.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a CBA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a CBA, where the magnitude of a project affects a large number of sectors and the effects are spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

[40] Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

Comparison of IO Analysis and CGE Modelling

Figure A4.1 – Comparison of Employment Estimates in IO Analysis and CGE Modelling



Source: Ernst Young (2014) Capital Metro Job Creation Analysis, p. 30.

- **Figure A4.1** illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity[41]. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and "crowding out" across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

[41] This is akin to the marginal assumption in CBA.

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I's *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.
- Other guidelines to recognise the role of IO analysis include:
  - US Environment Protection Agency (2010) Guidelines for Preparing Economic Analyses;
  - Australian Bureau of Rural Science (2005) Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia.
- NSW Treasury (2007) identify that IO analysis is commonly used to assess the regional impacts of a project. However, IO analysis is concerned with measuring economic activity, and is not a tool for the evaluation of projects (in the way that CBA is).
- NSW Treasury (2009) *Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government*, identifies IO analysis as an appropriate method for estimating the number of jobs that may be supported by the actions, programs and policies of the NSW Government.
- Mustafa Dinc an economist with the World Bank has recently release a publication titled *Introduction to Regional Economic Development: Major Theories and Basic Analytical Tools*. This publication recognises IO analysis as one of the most widely used models around the world to undertake regional economic analysis and a solid framework to analyse the interdependence of industries in an economy.

Government Applications of IO Analysis

- Applications of IO analysis commissioned by Government agencies include:
  - Department of Sustainability, Environment, Water, Population and Communities (2011) Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale
  - NSW Natural Resources Commission (2009) River Red Gum Assessment: Socio-economic impact assessment;
  - Victorian Environmental Assessment Council (2007) River Red Gum Forests Investigation – Socio-Economic Assessment.
  - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy.
  - Reserve Bank of Australia (2012) Industry Dimensions of the Resource Boom: An Input-Output Analysis.
  - DECCW (2009) Economic benefits of national parks and other reserves in New South Wales - Summary report, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.

- DECCW (2006) Socio Economic Assessment of the Batemans Bay Marine National Park
- DECCW (2006) Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park
- National Parks Service, US Department of the Interior (2014) 2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation.

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO is its use as a substitute for CBA, not its use for estimating direct and indirect regional economic activity impacts.
  - NSW Treasury (2009) "Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (CBA)".
  - The main "abuse" reported by the Productivity Commission is using IO analysis to "make the case for government intervention" when CBA is the appropriate method for doing this.
  - ABS's concerns with IO being "biased" refer to it being a "biased estimator of the benefits or costs of a project". IO does not estimate benefits and costs but economic activity.
  - Concerns of the Warkworth Judgement with IO analysis being "deficient" related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point)), but more fundamentally for not "assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors". This is an inappropriate criticism of the IO method, since it does not pretend to do this.
  - IO analysis does not depend on the assumption "that there is a ghost pool of highly skilled yet unemployed people" in a region as suggested in the Warkworth Judgement. It allows for labour to come from within or outside the region.

Reviews of IO

- CIE (2015, p.28) Peer review of economic assessment: Bylong Coal project, identified that:

"The IO methodology is reasonable but should be considered an upper bound of the regional effects."

Annexure 5

Underlying Assumptions and Interpretations of Input-Output Analysis and Multipliers

(Total No. of pages including blank pages = 4)

"The *basic assumptions* in IO analysis include the following:

- there is a fixed input structure in each industry, described by fixed technological coefficients (evidence from comparisons between IO tables for the same country over time have indicated that material input requirements tend to be stable and change but slowly; however, requirements for primary factors of production, that is labour and capital, are probably less constant);
- all products of an industry are identical or are made in fixed proportions to each other;
- each industry exhibits constant returns to scale in production;
- unlimited labour and capital are available at fixed prices; that is, any change in the demand for productive factors will not induce any change in their cost (in reality, constraints such as limited skilled labour or investment funds lead to competition for resources among industries, which in turn raises the prices of these scarce factors of production and of industry output generally in the face of strong demand); and
- there are no other constraints, such as the balance of payments or the actions of government, on the response of each industry to a stimulus.

2. The multipliers therefore describe *average effects, not marginal effects*, and thus do not take account of economies of scale, unused capacity or technological change. Generally, average effects are expected to be higher than the marginal effects.

3. The IO tables underlying multiplier analysis only take account of one form of *interdependence,* namely the sales and purchase links between industries. Other interdependence such as collective competition for factors of production, changes in commodity prices which induce producers and consumers to alter the mix of their purchases and other constraints which operate on the economy as a whole are not generally taken into account.

4. The combination of the assumptions used and the excluded interdependence means that IO multipliers are higher than would realistically be the case. In other words, they tend to *overstate* the potential impact of final demand stimulus. The overstatement is potentially more serious when large changes in demand and production are considered.

5. The multipliers also do not account for some important pre-existing conditions. This is especially true of Type II multipliers, in which employment generated and income earned induce further increases in demand. The implicit assumption is that those taken into employment were previously unemployed and were previously consuming nothing. In reality, however, not all 'new' employment would be drawn from the ranks of the unemployed; and to the extent that it was, those previously unemployed would presumably have consumed out of income support measures and personal savings. Employment, output and income responses are therefore overstated by the multipliers for these additional reasons.

6. The most *appropriate interpretation* of multipliers is that they provide a relative measure (to be compared with other industries) of the interdependence between one industry and the rest of the economy which arises solely from purchases and sales of industry output based on estimates of transactions occurring over a (recent) historical period. Progressive departure from these conditions would progressively reduce the precision of multipliers as predictive device" (ABS 1995, p.24).

Multipliers indicate the total impact of changes in demand for the output of any one industry on all industries in an economy (ABS, 1995). Conventional output, employment, value-added and income multipliers show the output, employment, value-added and income responses to an initial output stimulus (Jensen and West, 1986).

Components of the conventional output multiplier are as follows:

Initial effect - which is the initial output stimulus, usually a $1 change in output from a particular industry (Powell and Chalmers, 1995; ABS, 1995).

First round effects - the amount of output from all intermediate sectors of the economy required to produce the initial $1 change in output from the particular industry (Powell and Chalmers, 1995; ABS, 1995).

Industrial support effects - the subsequent or induced extra output from intermediate sectors arising from the first round effects (Powell and Chalmers, 1995; ABS, 1995).

Production induced effects - the sum of the first round effects and industrial support effects (i.e. the total amount of output from all industries in the economy required to produce the initial $1 change in output) (Powell and Chalmers, 1995; ABS, 1995).

Consumption induced effects - the spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries (Powell and Chalmers, 1995; ABS, 1995).

The *simple multiplier* is the initial effect plus the production induced effects.

The *total multiplier* is the sum of the initial effect plus the production-induced effect and consumption-induced effect.

Conventional employment, value-added and income multipliers have similar components to the output multiplier, however, through conversion using the respective coefficients show the employment, value-added and income responses to an initial output stimulus (Jensen and West, 1986).

For employment, value-added and income, it is also possible to derive relationships between the initial or own sector effect and flow-on effects. For example, the flow-on income effects from an initial income effect or the flow-on employment effects from an initial employment effect, etc. These own sector relationships are referred to as ratio multipliers, although they are not technically multipliers because there is no direct line of causation between the elements of the multiplier. For instance, it is not the initial change in income that leads to income flow-on effects, both are the result of an output stimulus (Jensen and West, 1986).

A description of the different ratio multipliers is given below.

$$\text{Type 1A Ratio Multiplier} = \frac{\text{Initial + First Round Effects}}{\text{Initial Effects}}$$

$$\text{Type 1B Ratio Multiplier} = \frac{\text{Initial + Production Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11A Ratio Multiplier} = \frac{\text{Initial + Production Induced + Consumption Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11B Ratio Multiplier} = \frac{\text{Flow-on Effects}}{\text{Initial Effects}}$$

Source: Centre for Farm Planning and Land Management (1989).

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Centre for Farm Planning and Land Management (1989) *Consultants report to State plantations impact study.* CFPLM, University of Melbourne.

Jensen, R. and West, G. (1986) *Input-output for Practitioners: Theory and Applications*. Prepared for Department of Local Government and Administrative Services, Local Government and Regional Development Division, Australian Government Publishing Service.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.

Annexure 6

CBA and Assessment of Externalities

(Total No. of pages including blank pages = 4)

Consideration of Externalities in the Economic Assessment

Introduction

- The "perfect" CBA is an ideal. Different situations call for different styles and depths of analysis.
- Valuation of all environmental impacts is neither practical nor necessary.
- In attempting to value impacts, there is the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government 2012). The guideline gives an example of impacts of less than $1M being immaterial for a project with an estimated net present value of $20M.
- The CBA of the Project took three approaches to the consideration of environmental costs:
  - Threshold value analysis;
  - Qualitative consideration of impacts and valuation of the main impacts based on market data (e.g. purchase costs, offset costs, mitigation costs etc) and benefit transfer (e.g. from non-market valuation studies); and
  - Additional threshold value analysis to recognise that some impacts may not have been fully valued and incorporated into the analysis.

Threshold Value Analysis

- The first approach used to consider the environmental impacts of the Project was the threshold value method.
- Threshold value analysis is a recognised approach to CBA where it is not possible or pragmatic to attempt to value potential external impacts.
- Threshold value analysis was developed by Krutilla and Fisher (1975)[42]. It is specifically referred to as an appropriate approach in the DP&I's (2002) *Draft Guideline for Economic Effects and Evaluation in EIA,* and is a widely recognised approach.
- Threshold value analysis avoids the sometimes contentious matter of physically quantifying environmental impacts and then placing dollar values on them.
- Threshold value analysis leaves the trade-off between quantified economic benefits and unquantified environmental costs for the decision-maker.
- In the Economic Assessment of the Project, the estimated net production benefits provides a threshold value or reference value against which the relative value of the residual environmental, social and cultural impacts of the Project, after mitigation, offset and compensation, may be assessed. The threshold value indicates the price that the community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the 'no development' option.

[42] Krutilla, J.V. and A.C. Fisher (1975) *The Economics of Natural Environments*, Johns Hopkins University Press, Baltimore.

Qualitative consideration of impacts and valuation of the main impacts based on market data and benefit transfer

- The second approach used was to qualitatively consider, and where possible value, the main environmental, cultural and social impacts of the Project for the well-being of people.
- Qualitative consideration of potential impacts and any subsequent valuation of impacts relied on the assessment of biophysical impacts provided in the Project EIS and by technical specialists.
- The approach to valuing environmental impacts in the Economic Assessment of the Project is summarised in Table A6.1.

Table A6.1 – Method for Valuing Environmental Impacts in the Economic Assessment of the Project

Impact	Potential Valuation Method	Comment
Greenhouse gas emissions	Damage cost method	Estimate of global social damage cost of carbon from literature and govt policy, adjusted to Australian and NSW damage cost.
Agricultural impacts	Property valuation method	Foregone agricultural production is reflected in land values. So opportunity costs of land reflect, among other things, foregone agriculture.
Noise impacts		
Significant	Property valuation method	Cost of acquiring properties encompasses property value impacts due to noise.
Moderate	Defensive expenditure	Noise mitigation costs included in capital costs of project.
Significant air quality impacts	Property valuation method	Cost of acquiring properties encompasses property value impacts due to air quality impacts. Health impacts assessed as negligible.
Use of surface water	Market value of water	Cost of Water Access Licences reflects marginal value product of water. Included in CBA.
Use of groundwater	Market value of water	Cost of Water Access Licences reflects marginal value product of water. Included in CBA
Groundwater drawdown	Defensive expenditure	No material impacts on private bores predicted. One bore would be monitored for potential impacts.
Water discharges		Regulated under the *Protection of Environment Operations Act 1997*.
Flora and fauna	Replacement cost	Capital and operating costs of offsets included in capital costs. Assumes that offsets levels are sufficient to compensate the community for values lost. This is a requirement of Govt. Policy.
Road transport impacts	Defensive expenditure	Cost of road investment required as a result of the Project included in capital costs of project.
Aboriginal heritage	Defensive expenditure or Stated Preference techniques	Not quantified but no significant impacts.
Historic heritage	Defensive expenditure or Stated Preference techniques	Not quantified but no significant impacts.
Visual	Defensive expenditure	Costs of mitigation measures included in the economic analysis.

Additional Threshold Value Analysis

- To the extent that there may be some disagreement about the estimated economic values of the environmental impacts of the Project, the estimated net benefits of the Project provides another threshold value that the residual environmental impacts of the Project after mitigation, compensation and offset would need to exceed to make the Project questionable form and economic efficiency perspective. This again allows the decision-maker to consider any material impacts that it identifies in the course of its consideration that were not valued in the Economic Assessment.

Annexure 7

Non-Market Benefits of Employment

(Total No. of pages including blank pages = 4)

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus).

- Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005[43]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project. The analysis included consideration of the magnitude of these additional benefits under a number of scenarios but conservatively excludes them from the core analysis. Other factors being equal, these estimates are conservative since they ignore any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).
- These treatments of employment in CBA relate to the market value or opportunity cost of labour resources.
- The above treatment of employment in CBA relate to the impacts on the unemployed individuals themselves. However, there may also be spillover effects and externalities to third parties. These are public good values. Spill-over effects referred to in the literature relate to empathy based losses to family or friends (close associates) of impacted workers because of the workers being unemployed and increased crime and community dislocation (Haveman and Weimer 2015: Streeting and Hamilton 1991). Empathy based impacts may also spill over more broadly into the existence values of others in the community who feel sympathy for the unemployed.
- These are non-market values i.e. the values that individuals in a community hold for things even though they are not traded in markets. For example, people have been shown to value environmental resources even though they may never use the resource. These are referred to as existence values and are underpinned by the view in neoclassical welfare economics that individuals are the best judge of what has value to them.
- As identified by Portney (1994[44]), the concept of existence values should be interpreted more broadly than just relating to environmental resources.

"If I derive some utility from the mere existence of certain natural environments I never intend to see (which I do), might I not also derive some satisfaction from knowing that refineries provide well-paying jobs for hard-working people, even though neither I nor anyone I know will ever have such a job?. I believe I do. Thus, any policy change that "destroys" those jobs imposes a cost on me – a cost that, in principle, could be estimated using the contingent valuation method.... Since regulatory programs will always impose costs on someone – taking the form of higher prices, job losses, or reduced shareholder earnings – lost existence values may figure every bit as prominently on the cost side of the ledger as the benefit side (Portney 1994, p. 13).

[43] Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-benefit analysis: concepts and practice*, Prentice Hall, New Jersey.
[44] Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.

- The utility (welfare) of individuals may therefore be affected by changes in their own well-being as well as changes in the well-being of others (Rolfe and Bennett 2004[45]). This is consistent with the observed behaviour of altruism (Freeman III 2003[46]).
- Whether people have existence values for the employment of others, as hypothesised by Portney, is an empirical issue. A number of non-market valuation studies have found evidence that people hold existence values for the employment of others:
  - Johnson, F. and Desvouges, W. (1997) Estimating Stated Preferences with Rated-Pair Data: Environmental, Health and Employment Effects of Energy Programs. Journal of Environmental Economics and Management, 34, 75-99, estimated the non-market value of employment effects of energy programs.
  - Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. (1998) Stated Preference Approaches to Measuring Passive Use Values: Choice Experiments Versus Contingent Valuation, American Journal of Agricultural and Economics, 80, 64-75, in a study on the protection of old growth forests included an attribute for forest industry employment losses.
  - Morrison, M., Bennett, J. and Blamey, R. (1999) Valuing improved wetland quality using choice modelling, Water Resources Research (Vol. 35, No. 9, pp. 2805-2814) valued irrigation related employment losses as a result of wetland protection.
  - Blamey, R., Rolfe, J., Bennett, J., and Morrison, M., (2000) Valuing remnant vegetation in Central Queensland using choice modelling, The Australian Journal of Agricultural and Resource Economics(44(3): 439-56) in a study of broadscale tree clearing in the Desert Uplands of Queensland, Australia included an attribute for jobs lost to the region.
  - Do, T.N. and Bennett, J. (2007) Estimating Wetland Biodiversity Values: A Choice Modeling Application in Vietnam's Mekong River Delta, Australian National University, Economics and Environmental Network Working Paper estimated values for the number of farmers affected by a change in wetland management of Tram Chim.
  - Othman, J., Bennett, J., Blamey, R. (2004) Environmental values and resource management options: a choice modelling experience in Malaysia, Environ. Dev. Econ. 9, 803–824, valued local employment losses from different conservation management strategies for the Matang Mangrove Wetlands in Perak State, Malaysia.
  - Marsh, D. (2010) Water Resource Management in New Zealand: Jobs or Algal Blooms? Presented at the Conference of the New Zealand Association of Economists Auckland 2 July 2010, valued employment losses as a result of improvements in water quality in a dairy catchment in Waikato region of New Zealand the catchment.

[45] Rolfe and Bennett (2004) *Assessing Social Values for Water Allocation with the Contingent Valuation Method,* Valuing Floodplain Development in the Fitzroy Basin Research Reports, Research Report No. 11, Central Queensland University, Emerald.

[46] Freeman III, A. Myrick. (2003) *Economic Valuation: What and Why*. In A Primer on Non-market Valuation, Eds Champ, P., Boyle, K. and Brown, T. Kluwer Academic Publishers, London.

  - Longo A, Markandya A, Petrucci M (2008) The Internalization of Externalities in the Production of Electricity: Willingness to Pay for the Attributes of a Policy for Renewable Energy, Ecological Economics 67:140-152, in the context of renewable energy projects valued additional electricity sector jobs.
  - Colombo, S., Hanley, N., and Requena, J.C. (2005) Designing Policy for Reducing the Off-farm Effects of Soil Erosion Using Choice Experiments, Journal of Agricultural Economics, 56(1), 81-96, valued local employment generated from watershed policies to reduce soil erosion.
  - Caparrós A, Oviedo JL, Campos P (2008) Would you choose your preferred option? Comparing choice and recoded ranking experiments. Am J Agricult Econ 90(3):843–855, valued increases in local employment from a NP reforestation program.
  - Windle, J. and Rolfe, J. (2014) Assessing the trade-offs of increased mining activity in the Surat Basin, Queensland: preferences of Brisbane residents using non-market valuation techniques, Australian Journal of Agricultural and Resource Economics, 58, pp. 111-129, valued jobs generated by mining developments in the Surat Basin, as well as social impacts of mining developments such as increased housing prices and increase wages in non-mining sectors.

- Three non-market valuation studies have found evidence that people in NSW hold existence values for the employment of others in mining projects:
  - Gillespie, R. (2009) Bulli Seam Operations Socio-Economic Assessment, prepared for Illawarra Coal Holdings Pty Ltd.
  - Gillespie, R. and Kragt, M. (2012) Accounting for non-market impacts in a benefit-cost analysis of underground coal mining in New South Wales, Australia, Journal of Benefit Cost Analysis, 3(2): article 4.
  - Gillespie, R. and Bennett, J. (2012) Valuing the Environmental, Cultural and Social Impacts of Open Cut Coal Mining in the Hunter Valley of NSW, Australia, Journal of Environmental Economics and Policy, Volume 1, Issue 3, 1-13.
- The values from these studies are summarised in **Table A7.1**.
- These values are public good values i.e. they are the sum of values held by individual households in NSW. Comparison of public good values to private good values such as wages are meaningless.
- The motivation behind people's willingness to pay (WTP) for the employment of others is unknown. Split sample analysis undertaken by Gillespie (2009) providing different information to survey respondents on the re-employment prospects of impacted workers did not impact household willingness to pay for the employment provided by the mine. It is possible that respondents were not concerned so much with the prospects of re-employment elsewhere in the economy or net employment impacts but with the 'forced' change to other people's employment. However, further investigation is required to unpack respondent motivations in relation to attributes representing employment.

- Notwithstanding the above justification for the inclusion of non-market employment values in CBA, it is recognised that some people view this as contentious and so the results of the CBA for the Project are reported "with" and "without" the non-use values for employment being included.

Table A7.1 – Existence Values for Mine Employment

	Mean Implicit Price ($) (95% CI)	**Aggregate Willingness to Pay per Job Year ($) (95% CI)**	**Coal Mine**	**Reference**
WTP per household per year for 20 years for each year the mine provides 320 jobs	$5.94	$8,157	Metropolitan Colliery	Gillespie (2009)
	$4.96 to $7.22	$3,659 to $5,326		
WTP per household (once-off) for each year the mine provides 1,170 jobs	$36.21	$1,299	Bulli Seam Operations	Gillespie and Kragt (2012)
	$29.89 to $43.97	$1,037 to $1,578		
WTP per household (once-off) for each year the mine provides 975 jobs	$27.45	$3,546	Warkworth	Gillespie and Bennett (2012)
	$17.52 to $36.95	$2,263 to $4,773		
*Implicit prices are aggregated to 50% of NSW households.				

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Annexure 8

The Grit System for Generating Input-Output Tables

(Total No. of pages including blank pages = 4)

The Generation of Regional Input-Output Tables (GRIT) system was designed to:

- combine the benefits of survey based tables (accuracy and understanding of the economic structure) with those of non-survey tables (speed and low cost);
- enable the tables to be compiled from other recently compiled tables;
- allow tables to be constructed for any region for which certain minimum amounts of data were available;
- develop regional tables from national tables using available region-specific data;
- produce tables consistent with the national tables in terms of sector classification and accounting conventions;
- proceed in a number of clearly defined stages; and
- provide for the possibility of ready updates of the tables.

The resultant GRIT procedure has a number of well-defined steps. Of particular significance are those that involve the analyst incorporating region-specific data and information specific to the objectives of the study. The analyst has to be satisfied about the accuracy of the information used for the important sectors; in this case the other mining sector. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study.

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). This means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A8.1 (Powell and Chalmers, 1995).

Table A8.1

The GRIT Method

Phase	Step	Action
Phase I		Adjustments To National Table
	1	Selection of national input-output table (106-sector table with direct allocation of all imports, in basic values).
	2	Adjustment of national table for updating.
	3	Adjustment for international trade.
Phase II		Adjustments For Regional Imports
		(*Steps 4-14 apply to each region for which input-output tables are required*)
	4	Calculation of 'non-existent' sectors.
	5	Calculation of remaining imports.
Phase III		Definition of Regional Sectors
	6	Insertion of disaggregated superior data.
	7	Aggregation of sectors.
	8	Insertion of aggregated superior data.
Phase IV		Derivation of Prototype Transactions Tables
	9	Derivation of transactions values.
	10	Adjustments to complete the prototype tables.
	11	Derivation of inverses and multipliers for prototype tables.
Phase V		Derivation of Final Transactions Tables
	12	Final superior data insertions and other adjustments.
	13	Derivation of final transactions tables.
	14	Derivation of inverses and multipliers for final tables.
Source: Bayne and West (1988).		

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Bayne, B. and West, G. (1988) *GRIT – Generation of Regional Input-Output Tables: Users Reference Manual*. Australian Regional Developments No. 15, Office of Local Government, Department of Immigration, Local Government and Ethnic Affairs, AGPS.

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Annexure 9

Company Tax Rates and Distribution among States

(Total No. of pages including blank pages = 4)

Effective Tax Rates for Mining Companies in Australia

- Company taxes represent part of the producer surplus benefit of mining projects that accrue to Australia.
- The current Australian Tax Office (ATO) corporate tax rate is 30% of taxable income.
- NSW Treasury (2007) *Commercial Policy Framework: Guidelines for Financial Appraisal* requires the use of the prevailing corporate tax rate for government agencies and businesses.
- Financial Appraisal text books such as Mott (1997) *Investment Appraisal*, recommend the use of the full corporate tax rate.
- An analysis of ATO data by Dr Sinclair Davidson[47], Professor of Institutional Economics at RMIT University and a Senior Fellow at the Institute of Public Affairs found that the Australian mining industry pays corporate tax at a rate close to 30% of its **taxable income**.
- Taxable income is revenues - operating costs - royalties - depreciation. There are generally two components to the depreciation associated with a mining project:
  - depreciation of assets - capital equipment - over the asset life; and
  - depreciation of the project pool (non-asset capital expenditure) over the project life.

  Because assessments are normally undertaken on a standalone project basis - losses in any particular year are carried forward and hence tax does not apply until taxable income in a particular year (with losses in previous years carried forward) is positive.
- The procedure in the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposal*, for estimating company tax is the application of a 30% of company tax rate to earnings before interest and tax (year i.e. revenue - capital costs - operating costs - royalties) in each year.

  This is a simplified approach to the estimation of company tax which treats capital costs as and when they occur and results in negative company tax in early years where capital investment occurs and positive company tax in later years. It understates company tax generated from a Project.
- Submissions to previous mining projects have questioned the use of the company tax rate when estimating the company tax generated from mining projects. One of the studies referred to in these submissions that purports to show an effective tax rate of less than 30% e.g. Richardson and Denniss (2011)[48] calculates the effective tax rate for the mining sector in relation to Gross Operating Surplus (GOS) NOT taxable income. GOS does not consider the costs of production such as consumption of fixed capital, interest, royalties, land rent payments and direct taxes payable on inputs.

[47] Davidson, S. (2014) *Mining Taxes and Subsidies: Official evidence*, A Minerals Council of Australia Background Paper.
[48] Richardson, D. and Denniss, R. (2011) *Mining the truth: The rhetoric and reality of the commodities boom*, prepared for The Australia Institute.

- The Australian Treasury[49] has rejected GOS as an appropriate denominator for estimating effective tax rates.
- The other study referred to in submissions to previous mining projects to support the claim for effective tax rates of less than 30% is Markle and Shackelford (2009[50]). In response to the inappropriate quoting of this working paper the authors have issued a press release that states, among other things, that:
  - The purpose of the study was not to precisely calculate rates of tax paid but to provide a broad comparison of effective tax rates across countries. All numbers are appropriately interpreted on a relative – rather than absolute basis.
  - The version of the paper cited is a draft that has not been through a peer review process;
  - It is possible that the data for Australia represents average data for as few as four companies over a five year period. As such we reach no conclusion nor make any comments about individual industries in individual countries. Our purpose in producing the table was to make relative comparisons only;
  - The most recent draft of the report uses a different data source which did not have enough observations to include a number for the mining industry in Australia;
  - We have read the analysis of Professor Sinclair Davison and do not disagree with his conclusions.

Distribution of Company Tax to NSW

- In Australia the Commonwealth Government collects over 80% of tax revenue but it is responsible for only half of government direct expenditure (Abelson 2012, p. 598[51]).
- State and territory governments raise about 15% of tax revenue but account for some 45% of government direct expenditure (Abelson 2012, p. 598).
- This Vertical Fiscal Imbalance is addressed via intergovernmental grants.
- In 2014/15 Taxation revenue estimate was $368,814M. The source of revenue is provided in **Table A9.1**.
- The category of Income and capital gains tax levied on enterprises (in Table A9.1) includes company tax, FBT, superannuation taxes, MRRT and the Petroleum resource rent tax. In 2012/13, when these items were reported separately in the Commonwealth Budget Papers, 84% of this category of revenue was from company tax. These proportions are relatively stable over time (refer to Figure 10 in 2012/13 Budget Papers).
- The Commonwealth provides funding to the States and Territories, in key sectors such as health, education, community services and affordable housing, and deliver productivity-enhancing projects and reforms in sectors including infrastructure, and skills and workforce development (Budget papers). In 2014-

[49] Clark, J., B. Pridmore and N. Stoney. 2007. 'Trends in aggregate measures of Australia's corporate tax level', *Economic Roundup*, Winter, pp 1 – 28)
[50] Markle, K. and Shackelford, D. (2009) Do Multinationals or Domestic Firms Face Higher Effective Tax Rates? National Bureau Of Economic Research, Working Paper Series.
[51] Abelson, P. (2012) Public Economics: Principles and Practice, McGraw Hill, Australia.

15, the Commonwealth proposed to provide the States and Territories with payments totalling $101.1B comprising:

- $46.3B in payments for specific purposes; and
- $54.9B in general revenue assistance, comprising GST payments of $53.7B and other general revenue assistance of $1.2B.

Table A9.1 - Commonwealth Taxation Revenue by Source ($M)

Taxation Revenue Source	2014/15	%
Income and capital gains levied on individuals	188 050	51.0%
Income and capital gains levied on enterprises (including company tax)	83 140	22.5%
Taxes on employers payroll and labour	738	0.2%
Sales/goods and services tax	58,120	15.8%
Excises and levies	26,939	7.3%
Taxes on international trade	9,270	2.5%
Other sale of goods and services	2,557	0.7%
Total	368,814	100.0%
Source: Australian Government (2014) Budget 2014-15, http://www.budget.gov.au/2014-15/index.htm.		

Table A9.2 – Commonwealth Payments to the States (2014-15)

$million	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	Total
2014-15									
Payments for specific purposes(a)	13 654	11 166	9 792	5 313	3 171	1 039	755	1 041	46 285
General revenue assistance(b)	16 808	11 853	11 736	2 310	4 956	1 911	1 137	3 166	54 861
Total payments to the States	30 462	23 019	21 527	7 623	8 128	2 950	1 892	4 207	101 147
(a) As State allocations for a small number of programmes have yet to be determined, these payments are not reflected in State totals. As such, total payments for specific purposes will not equal the sum of State totals.									
(b) As State allocations for royalties are not published due to commercial sensitivities, these payments are not reflected in State totals. As such, total general revenue assistance will not equal the sum of the State totals.									
Source: Australian Government (2014) Budget 2014-15, http://www.budget.gov.au/2014-15/index.htm.									

- Payments for specific purposes are funded from revenue sources other than GST. Company tax makes up 22% of this remaining revenue. NSW share of total Commonwealth payments for specific purposes is 13,654/46285 = 29%, so an estimate of company tax redistributed to NSW is 22%*29% i.e. 7%. This is a conservative estimate. A higher proportion occurs if it is assumed that all payments for special purposes arise from company tax revenue alone rather than the pool of revenue after adjustment for GST.
- The NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*, suggests that the proportion of company tax attributable to NSW should be estimated by applying the proportion of Australia's population based in NSW, equivalent to 32%.

Annexure 10

Property Value Impacts

(Total No. of pages including blank pages = 6)

The value of land is a function of the attributes of the property including structural, access and environmental attributes (Abelson, 1996). For remote rural properties, there is a simple relationship between the agricultural income earning potential of the land and the capital value of the property i.e.

$$CV = A/I,$$

where
CV = Capital Value;
A = average annual net income received in perpetuity; and
I = the interest or discount rate expressed as a decimal.

While income earning potential may be a dominant determinant of land value for some properties, other attributes such as location, house characteristics and environmental characteristics may also be important.

Where properties are located close to an urban or industrial zone, the property value increasingly reflects potential urban or industrial values until such time as they are absorbed by those zones.

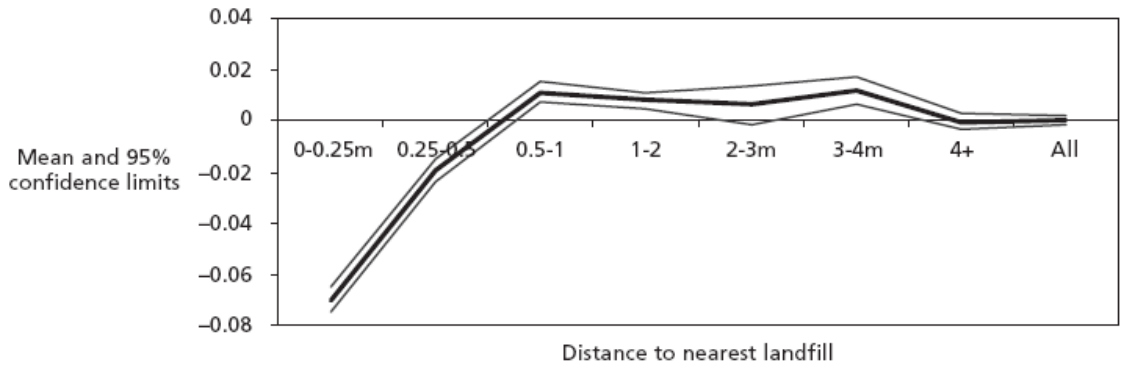
There has been much conjecture about the impact of mines on surrounding property values but little rigorous study. Conceptually, if surrounding properties are likely to be impacted by noise, odour, vibration or visually, then there would be some impact on property values with the greatest impact on property values being felt by properties experiencing the greatest impacts from the mine. Logically, where impacts exist or are expected to exist they are likely to be greatest with closer proximity to the mine and therefore there is likely to be some gradient of property value impact that decreases with distance from the mine.

There are few statistically based studies in this respect for mining in Australia, although some guidance may be obtained from overseas studies that have examined the property value impacts of major development such as landfills, albeit largely in an urban context. Reference is also made to property valuation studies in relation to wind farms in Australia.

The UK-based Department for Environment, Food and Rural Affairs (DEFRA 2003) analysed 11 300 landfill sites (6 100 of which were operational) in association with 592,000 housing transactions from 1991-2000 inclusive. The results are summarised in Figure 10.1 and **Table A10.1** and generally indicate that on average there are negative impacts of about seven percent within 0.25 miles (0.4 km) of landfills, and two percent within 0.5 miles (0.8 km) of landfills, and no impact beyond those distances.

A similar result was found by Nelson, Genereux and Genereux (1992) in relation to one landfill site in Ramsey, Minnesota USA, again in an urban context. The study found a 12% reduction in house prices at the landfill boundary, a 6% reduction in house prices at 1 mile and no statistically significant reduction in land price beyond 2 to 2.25 miles.

Figure A10.1: Residual Relative Change in House Prices – Great Britain



Source: DEFRA (2003, Chart 5.1)

Table A10.1: The Effect of Proximity to Landfill on Property Price

Table 5.4: Present value of landfill disamenity in Great Britain by proximity to landfill

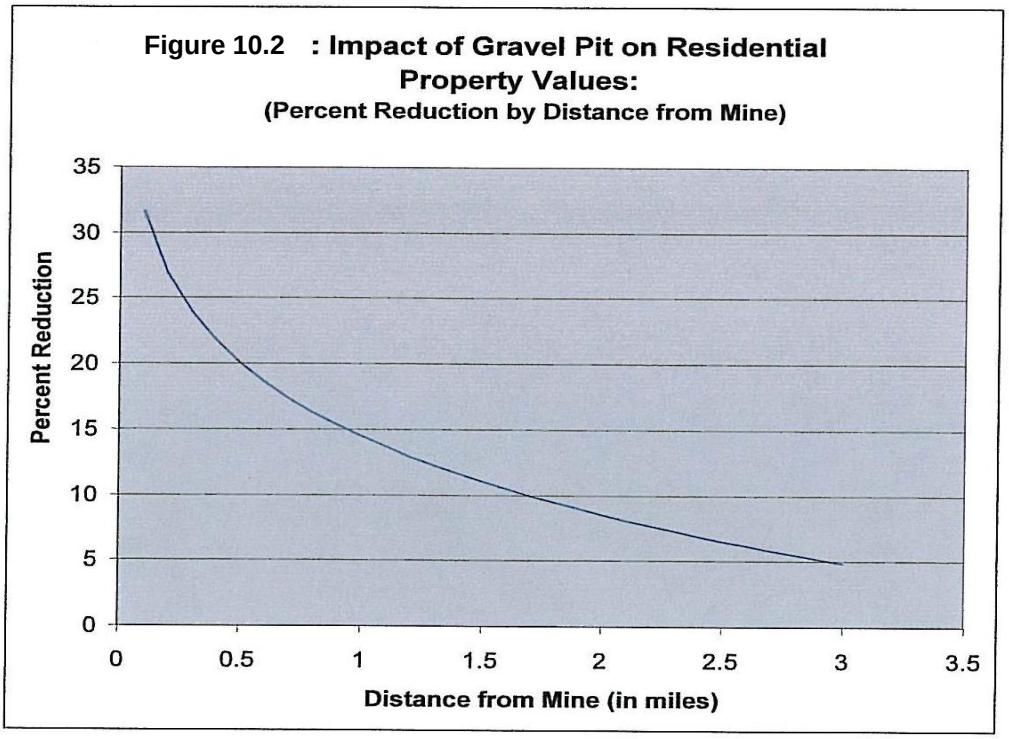
Distance from nearest landfill, miles	% reduction in price	Average Price, £ end-1995	Reduction, £ in 1995	% of sample	Number of Houses GB 000s	PV(£m) 1995 prices	PV(£m) 2001 prices (1)
0–0.25	−7.06	69,807	−4,927	1.0	246	−1,211.8	−1,356.9
0.25–0.5	−2.00	70,546	−1,410	2.9	713	−1,005.9	−1,126.4
0.5–2	0.00	75,222	0	26.9	6,616	0.0	0
2+	0.00	77,064	0	69.2	17,021	0.0	0
				100	24,596	−2,217.7	−2,483.3

Note(s): (1) using UK household final consumption price deflator of 1.1197.
Source(s): Cambridge Econometrics, DEFRA, ONS

Source: DEFRA (2003, Table 5.4)

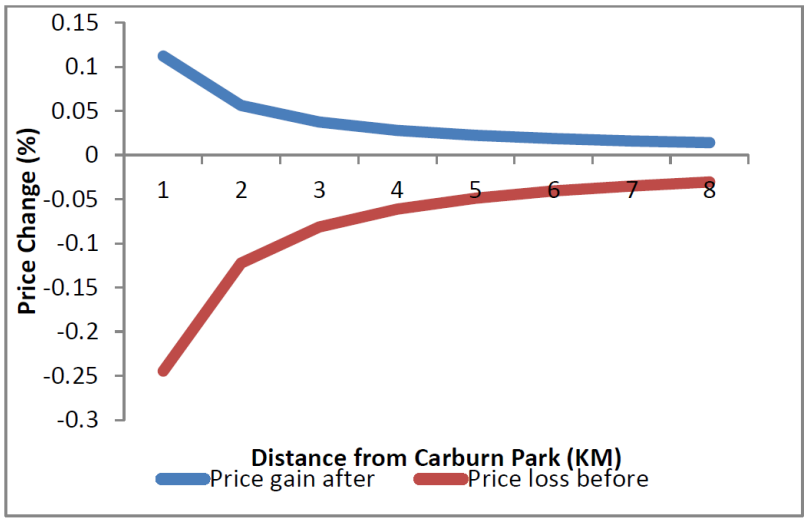
In relation to a 250 acre gravel mine in Delaware County, Ohio, Hite (2006) found that within a 0.5 mile radius from a mine, there was a 36% decrease in residential property values and a 25% decrease for those within 1.5 miles. Hite reports an elasticity of house price with respect to distance from a gravel mine of 0.097, implying that a 10 % increase in distance from the gravel mine is associated with a slightly less than 1% increase in home value. Figure 10.2 displays the estimated effects of distance from the gravel pit on home prices. A residential property located a half mile from the gravel mine would experience an estimated 20% reduction in value; one mile from the mine, a 14.5% reduction; 2 miles from the mine an 8.9% reduction; and 3 miles from the mine a 4.9% reduction (Erickcek, 2006).

Campbell (2014) found some indication of downward pressure on property values for those households surrounding a gravel mine in Canada (refer to Figure 10.3). However, this impact was not robust and became insignificant when time fixed effects were included in the analysis. In contrast, the study consistently provided a positive and significant impact to property values generated from reclamation of the site (as a park). The results did not align with the results found in the hedonic literature which find consistent negative impacts as a result of industrial activities. The results also conflict with those reported by Erickcek (2009) who stated that negative impacts on property values from aggregate extraction exist indefinitely. They further do not support the theory of stigmatization effects produced by Messer et al (2006).



Source: Erickcek (2006)

Figure 10.3 - % Price change of Properties Across Varying Distances from Carbun Park Quarry/Park



Source: Campbell (2014)

Kiel and Williams (2007) point out that while published studies do indicate that Superfund sites (a name given to the environmental program established to address abandoned hazardous waste sites in the United States) lower local house prices, it is possible that studies are only published if they find the 'expected' results. Or it is possible that researchers choose to examine sites that are more notorious, and thus are likely to be regarded as negative externalities in the community, leading again to the 'expected' results.

Kiel and Williams (2007) avoid these possible biases by examining all Superfund sites in the counties being studied to see whether the sites had the impacts reported in previous studies. They found that of the 57 regressions for Superfund sites, 18 produce statistically significant (Chi2 < 0.05) and positive

correlations between LNDISTANCE and sale price, that is, increases in the log of distance from the site increased the homes' value after the site was listed on the National Priorities List. Seven produce significantly negative correlations, and the remaining 32 are not statistically significant at the 5% level.

In conclusion they find that some Superfund sites do have a negative effect on local property values, while others do not. Via a meta-analysis they find that the larger the site, the more likely it is to have a negative influence on local sales prices.

A Report prepared by Taylor Byrne Valuers on behalf of Boral in January 2010 to assess the impact of the West Burleigh Quarry on the surrounding residential property values, concluded that there was insufficient evidence to determine if the West Burleigh Quarry has had an impact on the value of nearby properties (Norling Consulting 2013).

Norling Consulting (2013)[52] when examining sales data of properties surrounding the existing Nerang Quarry and designated haulage road (Hymix Road) reported property value impacts dissipating with distance (i.e. the more removed a property was from the quarry the lower the impact), with properties located beyond 500m of the quarry operations and haulage road recording no impact recorded on property prices as summarised in the following Table.

Table 10.2: Estimated Percentage Impact of Nerang Quarry on Nearby Properties

Distance from Quarry and Haulage Road	Estimated Percentage Impact
0 – 100m	-8.0%
101 – 200m	-7.5%
201 – 300m	-6.0%
301 – 400m	-3.0%
401 – 500m	0.0%
500m	+ 0.0%

Source: Norling Consulting (2013)

The NSW Valuer-General (2009) in a study of the impact of windfarms on property values found that properties in rural/agricultural areas appeared to be the least affected by wind farm development, with no reductions found near any of the eight windfarms investigated. The only properties where a possible effect was observed were lifestyle properties in Victoria within 500 m of a windfarm.

A literature review by Urbis (2016) of Australian and international studies found that the majority of published reports conclude that there is no impact or a limited defined impact of windfarms on property values. Those studies which identified a negative impact are based in the northern hemisphere and are associated with countries with higher population densities and a greater number of traditional residential and lifestyle properties affected by wind farms. This is generally contrary to the Australian experience, with most wind farms being located in

[52] No information is provided on how the results were determined e.g. the statistical analysis undertaken, the statistical significance of results etc and so the results should be treated with caution.

low population density environments that derive the majority of their value from productive farming purposes (Urbis 2016).

Urbis (2016) undertook an assessment of the impact of windfarms on surrounding land values in NSW and Victoria. It found that there is insufficient sales date to provide a definitive answer utilising statistically robust quantitative analysis techniques. However, from its case study assessments it did not identify any conclusive trends that would indicate that wind farms have negative impacted on property values. Its property resale analysis indicated that all of the properties examined demonstrated capital growth that aligned with the broader property market at the time. Consequently, Urbis (2016, p. 21) concluded:

"In our professional opinion, appropriately located windfarms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values."

Conclusion: The existence of property value impacts and the distance gradient of these impacts are expected to be related to actual or expected physical impacts from the site rather than a simple distance relationship. Where noise, dust, vibration, odour and visual impacts are contained, no impacts would be expected to occur. Where impacts are significant, larger property value impacts would likely occur. Older studies undertaken when less stringent environmental regulations applied are likely to show greater property value impacts than those undertaken under stricter and more modern regulations. Overseas studies showing impacts of quarries tended to be in urban environment where amenity is likely to be a greater contributor to property values than rural properties where the main driver is potential agricultural income. Studies of the impact of windfarms on adjoining property values suggest no impacts on agricultural properties. The only properties where a possible effect was observed were lifestyle properties.

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Annexure 11

Peer Review

prepared by

BDA Group (Aust) Pty Ltd

(Total No. of pages including blank pages = 6)

4 December 2019

Mr Robert W. Corkery
Principal Environmental Consultant
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PO Box 239
Brooklyn NSW 2083

Bowdens Silver Project

Economic Impact Assessment – Peer Review

Dear Mr Corkery,

BDA Group was engaged to provide a peer review of the Economic Impact Assessment (EIA) of the Bowdens Silver Project undertaken by Gillespie Economics.

Please find attached our review of the EIA (dated 3 December 2019). If you have any questions in relation to our review, please do not hesitate to contact me.

Yours sincerely,

DREW COLLINS

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Bowdens Silver Project

Economic Impact Assessment – Peer Review

BDA Group was engaged to provide a peer review of the Economic Impact Assessment (EIA) of the Bowdens Silver Project undertaken by Gillespie Economics. BDA Group is professionally independent and has no conflicts of interest in undertaking this review.

Our comments are limited to a 'desk-top' review based on the information presented in the EIA and EIS. No attempt has been made to check the data sources, analysis or conclusions cited in the draft EIS and supporting reports provided, or to review the computational accuracy of the spreadsheet based economic model used in the EIA.

Accordingly, the focus of the review has been on:

- The appropriateness and efficacy of the assumptions, methods and results presented in the EIA;
- That significant matters identified in the EIS have been appropriately addressed and accurately reported in the EIA;
- That the requirements of the Secretary's Environmental Assessment Requirements (dated 21 June 2019) that relate specifically to the economic analysis have been adequately addressed, namely:
  - An assessment of the likely social impacts of the development; and
  - An assessment of the likely economic impacts of the development, paying attention to the:
    - Significance of the resource;
    - Economic benefits of the development for the State and region; and
    - Demand for the provision of local infrastructure and services.
- That the economic analysis is consistent with key guidance documents released by the NSW Government, including:
  - NSW Department of Planning and Environment (2015), Guideline for the economic assessment of mining and coal seam gas proposals;
  - NSW Department of Planning and Environment (2018), Technical Notes Supporting the Guideline for the economic assessment of mining and coal seam gas proposals; and
  - NSW Treasury (2017) NSW Government Guide to Cost-Benefit Analysis.

Overview

Gillespie Economics has prepared a sound report, employing methods and an approach to the presentation of results consistent with best practice economic assessment principles.

A number of issues identified through the course of my review were discussed with Gillespie Economics, and I am satisfied that the issues have been appropriately addressed in the final EIA.

I believe the requirements of the Secretary's Environmental Assessment Requirements (dated 21 June 2019) that relate to the economic analysis have been addressed.

I have also found the analysis and its documentation to be consistent with the NSW Government Guidelines:

- The base case or 'without project' counter factual has been appropriately defined and described;
- Significant matters in the EIS and its supporting documents have been identified and appropriately cited;
- The scope of the analysis and timeframe employed is appropriate; project costs and production benefits are identified; recommended discount rates have been employed; threshold analysis with respect to non-production impacts has been undertaken;
- Non-production impacts and associated mitigation or offset measures have been identified, and where residual impacts found to be material and supporting information available, valuations have been prepared, employing valuation methodologies consistent with the Guidance documents;
- Sensitivity analysis has been conducted, and project exposure to key sources of risk discussed;
- Distributional analysis at the national, state and local levels is presented;

Approach to economic assessment

Impacts at the global level were identified in physical and then monetary terms, and then factored down to national, state and regional levels. Derivation of net economic benefits at the national level has appropriately been adjusted to reflect foreign ownership.

Consideration of benefits at the state level largely considers the distribution of taxation and royalty revenues, as well as economic benefits (producer surplus) realised by NSW based shareholders to Bowdens Silver. Consistent with NSW Department of Planning and Environment (2015), company tax liabilities are estimated and included in the State-level cost-benefit analysis (Table 4.6).

The consideration of local economic benefits has been examined firstly through following the methodology of the NSW Department of Planning and Environment (2015) Guideline recommending a 'Local Effects Analysis', and secondly through a supplementary analysis drawing on an Input-Output (I/O) analysis. The key difference between these approaches is that the former requires an assumption of full employment in the region, where the latter relaxes this assumption, allowing job chain effects and the benefits of in-migration of labour. This is a useful extension of the regional analysis.

Selected cost and benefit parameters

Greenhouse gases

The use of the Forecast European Union Emission Allowance unit price is consistent with the Technical Notes to the NSW (2015) Guideline. The Guideline also notes alternative prices may be used. Gillespie Economics has used the European price as well as two other prices and used these to provide a range of greenhouse cost estimates. Also consistent with the Technical Notes, Gillespie Economics has adjusted estimated impacts to identify those costs attributable to NSW.

Clearly the assumptions regarding the shadow price and the basis for its apportionment in NSW are contestable. My personal perspective is that if it is reasonable to assume that Australia will act to meet an agreed greenhouse gas reduction target, the with / without difference for the project is not a change in

global greenhouse gas emissions and damages, but rather the cost of attaining the target[1]. In this case, the emissions generated by the project will have to be offset by some other activity. In this sense, a greenhouse gas offset is conceptually no different from a biodiversity offset, with the associated cost or benefit pertinent to a partial equilibrium analysis of net economic benefits.

It is recognised however, that the cost differential between the damage cost and replacement cost approaches would not have a material impact on the overall economic viability of the project, and the approach employed by Gillespie Economics is consistent with the pertinent Guidelines of the day.

Non-market benefit to workers

In relation to non-market values of employment, Gillespie Economics has, correctly, presented the notion of existence values as they may relate to employment. However, as noted by Gillespie Economics, the reported values reflect empathy values '*because of the workers being unemployed and increased crime and community dislocation*', and therefore in the context of a low unemployment economy may not be as pertinent

Further, the estimated value of $371,000 per employee NPV over 30 years over and above their wages is contestable, particularly given implicit assumptions in relation to ongoing employment opportunities. Nevertheless, the transferred values are from studies undertaken in a similar context and populations, and Gillespie Economics has presented results with and without these values.

Cost benefit analysis

Summary valuations, expressed in net present values, are provided in Table 4.5 at both a global and national level. The provision of estimates of net social benefits with and without (market and non-market) employment benefits is useful, given differing views on their valuation.

The percentage of shareholders from NSW has been put at 45% (compared to 32% which is the NSW population relative to Australia's). The basis for this - Silver Mines Limited's share registry – has been provided.

Gillespie Economics has provided comment on the key areas of project risk and through sensitivity analysis, canvassed the robustness of the central estimates to changes in key parameter values. Of significance are the results presented in Table 4.8, which indicates net state benefits could fall substantially (possibly negative) under alternative assumptions on operating costs and metal prices received. Given low economic growth over recent years across many markets, uncertainty as to future growth and demand for Australian resources and hence prices are not unreasonable.

This risk has been investigated through threshold analysis, as well as a discussion of the interplay between metal prices and exchange rates that determines effective prices received.

Local Effects analysis

This analysis in Section 5 is consistent with the 2015 Guidelines. However, the LEA section of the Guidelines have received criticism from many economists due to some underlying assumptions. Notably, the Guidelines recommend that only a 'wage uplift' value be estimated, and then expressed in Full Time Equivalents (FTE). This approach assumes workers are already employed in the mining industry, estimates the value of the increase in local workers' income due to the project, and then estimates flow on

[1] It is also notable that the Technical Notes cite another target - that the NSW Government has an aspirational objective of achieving net-zero emissions by 2050.

employment that local expenditure of the increased income will create. As noted by Gillespie Economics, the approach assumes full employment in the region, that project workers employed locally will be drawn from within the mining industry, and there will be no inwards migration of labour filling their previous positions.

These are improbable assumptions, with workers likely to come from a range of industries including from being unemployed, allowing larger changes in incomes, job chain effects and the benefits of in-migration of labour. This would result in additional regional benefits than under the restrictive assumptions recommended in the 2015 Guideline.

To provide insight as to the broader benefits that would accrue to the region if local labour employed by the project were drawn from the currently unemployed, the net income increase under this assumption has also been provided. As the number of jobs that will actually be filled by currently unemployed local workers is likely to lie between these two extremes, the reported range of income effects provides a more balanced perspective for consideration.

Gillespie Economics has also provided a Supplementary Local Effects Analysis (section 6), based on input-output (I/O) analysis, which identifies broader flow-on impacts (including those attributable to the in-migration of labour) to output, value-added, income and employment. The I/O model of the regional economy has been built using appropriate datasets, key modelling assumptions are reported and results appropriately presented.

Review conclusions

Gillespie Economics has prepared a sound report. Given the breadth of potential impacts examined in the analysis, some assumptions will remain contestable. In most instances, the scale of these uncertainties is at the margin of the analysis, such that even significant changes to relevant parameter valuations would not impact the conclusions of the analysis.

The potential exception is if there were significant deviations in anticipated metal prices and / or exchange rates. The sensitivity of net State benefits delivered to these risks has been appropriately examined.