



# **Appendix P Economic Assessment**

# **Boggabri Coal Mine Modification 10 Economic Assessment**

*Prepared for*

**Boggabri Coal Operations Pty Ltd**

**By**



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## **Disclaimer**

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## 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.
Multiplier	a summary measure 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 24 years, including approximately two years of construction.
Neoclassical welfare economics	a branch of economics that uses microeconomic techniques such as cost benefit 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-on	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 16 years comprising the site establishment and construction stage, mining and processing operations (to the end of concentrate production), decommissioning, and monitoring and maintenance.
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.

## ABBREVIATIONS

<b>Abbreviation</b>	<b>Meaning</b>
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Ltd, a wholly owned subsidiary of Idemitsu Australia Pty Ltd (IA). BCOPL operates the BCM on behalf of IA and its joint venture partners.
EP&A Act	<i>Environmental Planning &amp; Assessment Act 1979</i>
IA	Idemitsu Australia Pty Ltd
km	Kilometre
MOD 10	Modification 10 to SSD 09_0182
Mt	Million tonnes
Mtpa	Million tonnes per annum
NSW	New South Wales
ROM	Run of Mine
SSD	State Significant Development Approval

## EXECUTIVE SUMMARY

### Introduction

Boggabri Coal Operations Pty Ltd (BCOPL) is seeking a Modification (MOD 10) to State Significant Development (SSD) Approval 09\_0182 (Project Approval) under Section 4.55(2) of the *Environmental Planning & Assessment Act 1979* (EP&A Act). MOD 10 proposes the continuation of mining operations at the Boggabri Coal Mine (BCM) towards the north-west beyond the approved Mine Disturbance Boundary but entirely within the existing Project Boundary. This additional mining proposed by MOD 10 would involve the following:

- recovery of an additional 30 Million tonne (Mt) of Run of Mine (ROM) coal to produce approximately 25 Mt of product.
- disturbance to an additional 85 ha of land.
- extension to the life of mining operations by four years until the end of 2040.

Gillespie Economics has been commissioned to undertake an Economic Assessment (EA) of MOD 10. From an economic perspective, and in accordance with the NSW Government (2015) *Guidelines for economic assessment of mining and coal seam gas proposals*, two important aspects of MOD 10 must be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of MOD 10) which is evaluated using cost benefit analysis (CBA); and
- its effects on the local economy, which is evaluated using local effects analysis (LEA) and input-output (IO) analysis.

These economic assessments have been undertaken for MOD 10 relative to a base case of the existing Project Approval (as modified by MOD 11).

### Cost Benefit Analysis

A CBA of MOD 10 has determined that it would have net production benefits to Australia and NSW of \$421M and \$279M, respectively. Provided the residual environmental, social, and cultural impacts of MOD 10 (after mitigation, offset and compensation) that accrue to Australia and NSW are considered to be valued at less than the level of net production benefits, MOD 10 can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

The environmental, cultural, and social impacts were valued using market data and benefit transfer and incorporated into an estimate of the net social benefit of MOD 10. Most impacts were immaterial from an aggregate economic efficiency perspective. The main quantifiable environmental impacts of MOD 10, which have not already been incorporated into the estimate of net production benefits, relate to the opportunity cost of water access licences (WALs) and the impacts of GHG emissions. The opportunity cost of WALs were estimated at \$3M. GHG impacts to Australia and NSW are estimated at \$0.2M and \$0.1M, respectively. These economic costs are considerably less than the estimated net production benefits of MOD 10.

Combining the estimate of net production benefit with the residual environmental costs, MOD 10 is estimated to have net social benefits to both Australia and NSW of \$418M and \$276M, respectively.

While the typical environmental, cultural, and social impacts have been quantified and included in the MOD 10 CBA, any other residual environmental, cultural, or social impacts that remain unquantified would need to be valued at greater than \$418M and \$276M for Australia and NSW, respectively, for MOD 10 to be questionable from an economic efficiency perspective.

## Local Effects Analysis

The local area comprises Narrabri and Gunnedah Local Government Areas. MOD 10 will provide direct economic activity, including jobs, to the local economy, and indirect economic activity to the local area via both wage and non-wage expenditure. A summary of the main local economic effects of MOD 10 is provided in Table ES1.

MOD 10 will provide for the continuation of employment at BCM of an estimated average annual 673 FTE direct jobs (between 2025 to 2040).

The LEA method specified by NSW Government (2015) adjusts the incremental employment (i.e. difference between the base case and MOD 10 case) downwards by only considering those that already live in the region which is estimated at 70%. It then further adjusts incremental employment downwards by calculating the incremental net income for those already living in the region (i.e. the difference between after tax (net) mining wage (\$140,000) and average after tax (net) wage in the region (\$56,000)) and calculating net FTE jobs to local residents by dividing this increase in net income by the average net mining wage. On this basis:

- the average annual impact of the MOD 10 to local residents (2025 to 2040) from an annual average 673 direct FTE jobs, is \$40M in net income and 284 FTE jobs.
- the average annual total impact of MOD 10 to local residents during the mine life extension (2037-2040) from an annual average 398 direct FTE jobs, is \$24M in net income and 168 FTE Jobs

The average annual non-labour operating expenditure associated with the MOD 10 is \$400M between 2025 and 2040 with \$176M per annum estimated to accrue to the local area. The average annual non-labour operating expenditure during the mine life extension (2037 to 2040) is \$277M with \$122M per annum estimated to accrue to the local area.

Standard regional economic impact assessment using IO analysis, is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. In this framework, relative to the base case, MOD 10 is estimated to provide the following gross average annual direct and indirect annual effects to the local economy between 2025 and 2040:

- \$1,484M in output.
- \$913M in value-added.
- \$191M in gross wages.
- 1,882 jobs.

The average annual direct and indirect economic impact of MOD 10 to the local economy from 2037 to 2040 is:

- \$794M in output.
- \$467M in value-added.
- \$112M in gross wages.
- 1,095 jobs.

**Table ES1 - Summary of Effects on the Local Community**

<b>Local Effects (Local Effects Analysis) 2025 to 2040</b>	<b>Direct Total</b>	<b>Direct Already Resident in the Local Area</b>	<b>Net</b>
Average Annual Total FTE of MOD 10	673	473 <sup>1</sup>	284
Average Annual Total After Tax Income of MOD 10 (\$M)	90		40
Average Annual Total Non-labour expenditure of MOD 10 in the Local Area	176		
<b>Local Effects (Local Effects Analysis) 2037 to 2040</b>			
Average Annual Total FTE of MOD 10	398	278	168
Average Annual Total After Tax Income of MOD 10 (\$M)	56		24
Average Annual Total Non-labour expenditure of MOD 10 in the Local Area	122		
<b>Average Total Annual Local Impacts of MOD 10 (Input-Output Analysis) 2025 to 2040</b>			
	<b>Direct</b>	<b>Flow-on</b>	<b>Total</b>
Output (\$M)	1,124	360	1,484
Value-added (\$M)	725	188	913
Income (\$M)	99	93	191
Employment	673	1,209	1,882
<b>Average Total Annual Local Impacts of MOD 10 (Input-Output Analysis) 2037 to 2040</b>			
	<b>Direct</b>	<b>Flow-on</b>	<b>Total</b>
Output (\$M)	586	207	794
Value-added (\$M)	358	109	467
Income (\$M)	58	53	112
Employment	398	697	1,095
<b>Other Local Economic Impacts</b>			
Contraction in other sectors e.g. tourism	No material impact*		
Displaced activities e.g. agriculture and forestry	No material impact*		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Price impacts on food and other services	No material impact*		
<b>Local Environmental, Cultural and Social Impacts</b>			
No material impacts*			

<sup>1</sup> This is based on the proportion (70%) of coal mine workers that reside in the Local Area (ABS Census of Population and Housing).

\* NSW regulations require many impacts to be borne by the proponent 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 proponent.

# 1 INTRODUCTION

Gillespie Economics has been commissioned by Xenith Consulting Pty Ltd (Xenith) (formerly James Bailey & Associates Pty Ltd) on behalf of Boggabri Coal Operations Pty Ltd (BCOPL) to undertake an Economic Assessment (EA) of a proposed extension to operations at the Boggabri Coal Mine (BCM) (MOD 10). The EA will be appended to a Modification Report being prepared by Xenith in support of an application to modify the BCM approval (State Significant Development (SSD) approval 09\_0182) under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

BCM is located approximately 15 km northeast of Boggabri in the Gunnedah Basin of New South Wales (NSW) and is located wholly within the Narrabri Local Government Area (LGA). BCM is part of the Boggabri, Tarrawonga, Maules Creek Coal Mining Complex (BTM Complex) and is immediately adjacent to the Tarrawonga Coal Mine (TCM) to the south and Maules Creek Coal Mine (MCCM) to the north.

MOD 10 to SSD 09\_0182 proposes the continuation of mining operations at BCM towards the north-west beyond the approved Mine Disturbance Boundary but entirely within the existing Project Boundary. This additional mining proposed by MOD 10 would involve the following:

- the continued recovery of coal down to the Templemore Coal Seam within the approved Mine disturbance Boundary recovering up to 15.4 Million tonne (Mt) of Run of Mine (ROM) coal resource.
- the progression of mining operations outside of the approved Mine Disturbance Boundary into the Modification Disturbance Footprint to enable the recovery of an additional 14.5 Mt of ROM coal down to the Templemore Coal Seam
- disturbance to an additional 85 ha of land within the Project Boundary.
- extension to the life of mining operations by four years until the end of 2040.
- amendments to the Conceptual Final Landform design resulting from the additional mining proposed.

There are no proposed changes to the currently approved mining methods, annual ROM coal extraction rate of up to 8.6 Million tonne per annum (Mtpa), the operational workforce, nor the coal seams approved to be mined at BCM. Further to this, MOD 10 does not seek to change the approved operational hours, mining related infrastructure, water management system, coal handling and processing, transport methods and rates and access to the mine site.

Consistent with the NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals* (Economic Guidelines), two types of economic assessment of MOD 10 are required:

- 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) to assess the impacts of MOD 10 in the locality, specifically:
  - effects relating to local employment.
  - effects relating to non-labour project expenditure.
  - effects on other local industries.
  - environmental and social impacts on the local community (externalities).

A supplementary LEA using Input-Output (IO) Analysis was also undertaken to assess flow-on impacts of employment and expenditure to the local economy.

These economic assessments have been undertaken for MOD 10 relative to a base case of the existing Project Approval (as modified by MOD 11).

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.

## **2 COST BENEFIT ANALYSIS**

### **2.1 Introduction**

CBA of MOD 10 involves the following key steps:

- identification of the “with” and “without” MOD 10 scenarios.
- identification and valuation of the incremental benefits and costs.
- consolidation of value estimates using discounting to account for temporal differences.
- application of decision criteria.
- sensitivity testing.
- consideration of non-quantified benefits and costs.
- consideration of the distribution of costs and benefits.

What follows is a CBA of MOD 10 based on the production schedule proposed by BCOPL, and financial, technical, and environmental advice provided by BCOPL and its specialist consultants. An explanation of the CBA methodology is provided in Attachment 1.

### **2.2 Identification of the “Without” Modification Scenario**

A starting point for CBA is to establish the “without” MOD 10 scenario for the BCM, including the land impacted by MOD 10. This becomes the base case against which to assess the potential incremental changes of any economic, social, and environmental impacts due to MOD 10.

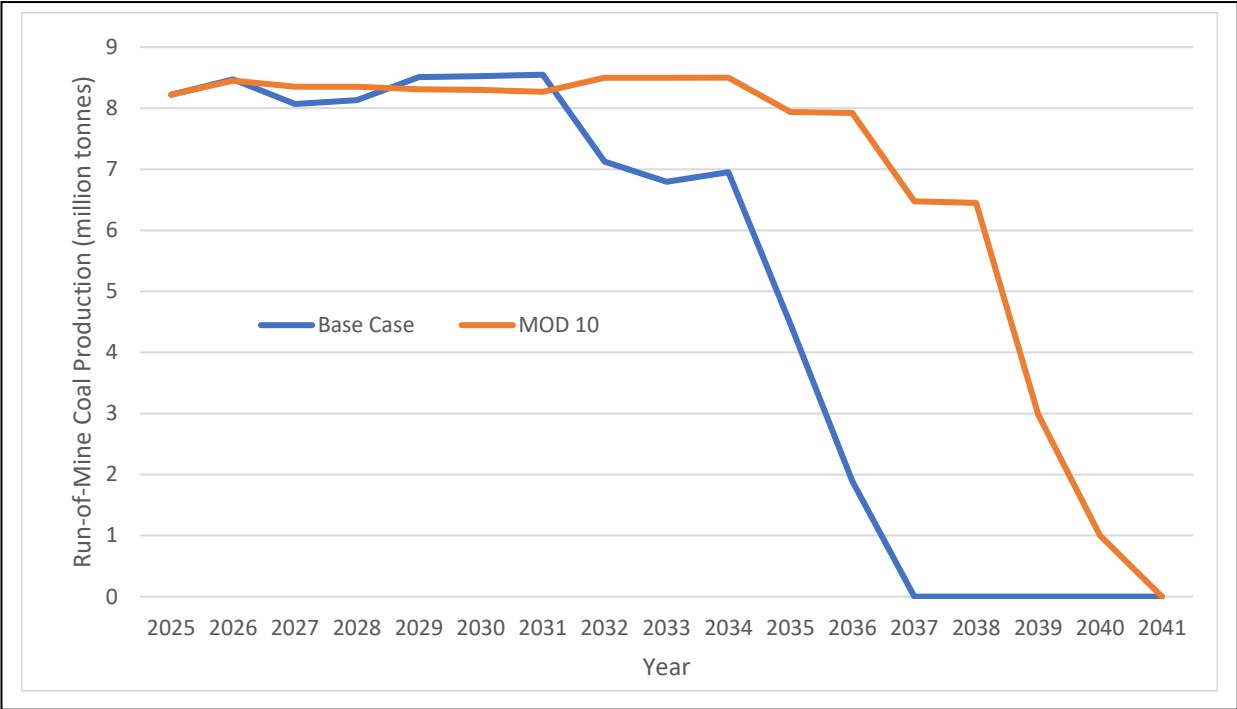
The existing Approval allows for mining of up to 8.6 Mtpa ROM coal until the end of December 2036. At this time, the mine would be rehabilitated and the processing plant and associated mine infrastructure decommissioned. BCM is part of the BTM complex with TCM and MCCM being operational mines in close proximity.

### **2.3 Identification of the “With” MOD 10 Scenario**

“With” the proposed MOD 10, an additional 30 Mt of ROM (including 25 Mt of production coal) would be recovered, the mine life would be extended until the end of 2040, and an additional 85 ha of land would be disturbed.

Figure 2.1 illustrates the production of MOD 10 relative to the base case.

**Figure 2.1 – Production from MOD 10 Relative to the Base Case**



**2.4 Identification of Benefits and Costs**

Relative to the base case, MOD 10 has potential incremental economic benefits and costs as shown in Table 2.1.

It should be noted that the potential indirect costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or by non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no indirect economic costs arise. Further, as discussed below, for MOD 10 a number of the indirect impacts were either negligible or had no impact.

**Table 2.1 - Potential Incremental Economic Benefits and Costs of MOD 10**

<b>Category</b>	<b>Costs</b>	<b>Benefits</b>
Production	<ul style="list-style-type: none"> <li>• Opportunity cost of land after base case final rehabilitation</li> <li>• Opportunity cost of capital after base case completion</li> <li>• Development costs</li> <li>• Operating costs, including administration, mining, processing, transportation, mitigation measures and offsets (but excluding royalties)</li> <li>• Decommissioning and rehabilitation costs at cessation of MOD 10</li> </ul>	<ul style="list-style-type: none"> <li>• Avoided decommissioning and rehabilitation costs after base case completion</li> <li>• Sale value of coal</li> <li>• Residual value of capital and land at the cessation of MOD 10</li> </ul>
Indirect Impacts	<ul style="list-style-type: none"> <li>• Greenhouse gas generation</li> <li>• Operational noise impacts</li> <li>• Road transport impacts</li> <li>• Air quality impacts</li> <li>• Groundwater impacts</li> <li>• Surface water impacts</li> <li>• Biodiversity impacts</li> <li>• Aboriginal heritage impacts</li> <li>• Historic heritage impacts</li> <li>• Visual impacts</li> <li>• Net public infrastructure costs</li> <li>• Loss of surplus to other industries</li> </ul>	<ul style="list-style-type: none"> <li>• Wage benefits to employment</li> <li>• Economic benefits to existing landholders</li> <li>• Economic benefits to suppliers</li> </ul>

Framed in another, but equivalent way, the potential incremental costs and benefits of MOD 10 are as per Table 2.2.

**Table 2.2 - Alternative Frame of Potential Economic Benefits and Costs of MOD 10**

<b>Costs</b>	<b>Benefits</b>
<b>Direct costs</b>	<b>Direct benefits</b>
Nil	Net production benefits <ul style="list-style-type: none"> <li>• <i>Royalties</i></li> <li>• <i>Company tax</i></li> <li>• <i>Net producer surplus</i></li> </ul>
<b>Indirect costs</b>	<b>Indirect benefits</b>
Net environmental, social, cultural and transport related costs	Wage benefits to employment
Net public infrastructure costs	Economic benefits to existing landholders
Loss of surplus to other industries	Economic benefits to suppliers

## 2.5 Quantification/Valuation of Benefits and Costs

Consistent with the Economic Guidelines (NSW Government, 2015), the CBA was undertaken in 2025 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%. Discounting of the costs and benefits is applied to account for differences in the timing of costs and benefits flowing from a project and reflects the fact that a dollar received in the future is worth less than a dollar today.

The analysis period is 16 years, coinciding with the proposed life of the mining with MOD 10 (i.e. 2025 to 2040). Any impacts that occur after this period are included in the final year of the analysis 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.<sup>1</sup>

The environmental, cultural, and social impacts were then valued using market data and benefit transfer<sup>2</sup>, and incorporated into an estimate of the net social benefit of MOD 10. This estimated net social benefit of MOD 10 provides another threshold value that any residual or non-quantified economic costs would need to exceed to make MOD 10 questionable from an economic efficiency perspective. In terms of cumulative environmental, cultural, and social impacts, this economic impact assessment relies on the findings of other technical studies referred to below to take account of them to the extent that they exist, in the consideration of the incremental impacts of MOD 10.

### **2.5.1 Production Costs and Benefits<sup>3</sup>**

#### ***Economic Costs***

##### *Opportunity Cost of Land and Capital*

Under the base case, the mining would cease at the end of 2036 and residual land and capital value would be realised.

With MOD 10, the BCM life would be extended to the end of 2040 and hence there would be an opportunity cost of continuing to use the land and capital equipment at the BCM. This opportunity cost is estimated at \$4.8M for privately owned land<sup>4</sup> and assumed to be zero for capital equipment i.e. capital equipment is not replaced and run down leading into the cessation of mining activity, and zero for State Forest land (which will be returned to the Forestry Corporation of NSW).

##### *Capital Cost of MOD 10*

Compared to the economic base case, MOD 10 would require additional capital expenditure primarily associated with:

- the purchase of additional capital equipment.
- sustaining capital.
- biodiversity offsets.

This incremental capital cost is estimated at \$181M over MOD 10 life.

##### *Annual Operating Costs of MOD 10*

Compared to the base case, operating costs of MOD 10 are mainly associated with higher annual levels of ROM mining and overburden handling from 2032 and the four additional years of mining. Incremental operating costs are associated with:

- Pit top costs.

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<sup>1</sup>The threshold value method uses the value of quantified net production benefits as the amount that unquantified environmental, social and cultural costs would need to exceed to make a project questionable from an economic efficiency perspective.

<sup>2</sup>Benefit transfer refers to transferring economic values that have been determined for other study sites.

<sup>3</sup>All values reported in this section are undiscounted unless specified.

<sup>4</sup>Based on the area of private land to be rehabilitated and per ha land values for nearby private land zoned RU1(sourced from the NSW Valuer-Generals, NSW land values and property sales map). The market value of the land reflects its potential economic returns from agricultural activity.

- CHPP and coal handling.
- overheads.
- rail.
- port.
- marketing.
- decommissioning and rehabilitation costs.

The incremental operating costs of MOD 10 (excluding royalties) over the proposed mine life are estimated at \$2.3B. While royalties are a cost to BCOPL, they are part of the overall net production benefit of the mining activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating MOD 10.

Depreciation has also been omitted from the estimation of operating costs since depreciation is an accounting means of allocating the cost of a capital asset over the years of its estimated useful life. The economic capital costs are included in the years in which they are proposed to occur.

#### *Decommissioning and Rehabilitation Costs*

With MOD 10, rehabilitation would be ongoing with decommissioning of surface infrastructure occurring from 2040. These costs are included in the operating costs above.

#### **Economic Benefits**

##### *Avoided Decommissioning and Rehabilitation Costs*

Without MOD 10, the existing Approval will expire at the end of 2036 and the BCM would be decommissioned and rehabilitated. With MOD 10, these costs from 2036 are not incurred at that time. These avoided costs at that time are already included in the operating costs of the base case and hence are accounted for in the calculation of incremental operating costs.

##### *Revenues*

Compared to the base case, MOD 10 will result in additional revenues resulting from sale of additional coal to be mined. Incremental revenues are associated with three coal products from MOD 10:

- semi-soft coking coal (SSCC).
- pulverised coal injection (PCI).
- thermal coal.

Revenues were estimated based on a coal price derived from:

- average saleable tonne yield of 88%.
- KPMG consensus forecast as per Table 2.3 with price adjustments for different ash levels for thermal coal.
- average AUD: USD exchange rate of 0.69 (KPMG, 2025).

**Table 2.3 – Assumed Coal Prices for MOD 10**

		Nominal	Nominal	Nominal	Nominal	Nominal	Real
Denomination	Coal Product	2025	2026	2027	2028	2029	LT (real 2025)
USD/t	SSCC	147.0	149.4	143.5	139.6	135.0	130.0
USD/t	PCI	157.0	159.4	153.5	150.3	145.5	135.4
USD/t	Thermal - benchmark	126.7	119.6	112.0	103.9	102.5	98.5
Exchange Rate		2025	2026	2027	2028	2029	LT
AUD:USD		0.65	0.67	0.67	0.7	0.7	0.7

Source: KPMG (2025).

There is considerable uncertainty around future coal prices in USD and the AUD/USD exchange rate. Hence, the value of incremental revenue has been subjected to sensitivity analysis (Section 2.8).

#### *Residual Value at End of the Evaluation Period*

At the end of MOD 10, the land and capital equipment required for MOD 10 would have some residual value that could be realised by sale or alternative uses. This is estimated at \$4.8M for private land and has been conservatively assumed to be zero for State Forest (which will be returned to the Forestry Corporation of NSW) and zero for capital equipment.

### **2.5.2 Indirect Costs and Benefits**

#### **Greenhouse Gases**

Only the costs and benefits associated with MOD 10 for which approval is sought i.e. emissions from extension of mining and transport of product coal to the Port of Newcastle for sale to the export market, are relevant to a CBA of MOD 10.

NSW Government (2018) confirm that only Scope 1 and Scope 2 GHG emissions of a project should be included, consistent with the accounting framework under the *UN Framework Convention on Climate Change*.

The total incremental Scope 1 and Scope 2 GHG emissions associated with MOD 10 have been estimated at approximately 0.8 Million tonnes of CO<sub>2</sub> equivalent (Mt CO<sub>2</sub>-e) and 0.0 Mt CO<sub>2</sub>-e, relative to the base case.

To place an economic value on CO<sub>2</sub>-e emissions, a shadow price of CO<sub>2</sub>-e is required that reflects the social cost of carbon to the referent group community the subject of the CBA, in this case the residents of NSW.

The NSW Treasury (2023) Guide recommends using prices from the European Union Emissions Trading Scheme (EUETS). The Technical Note to the Guide (NSW Treasury 2023b) provides an Australian dollar value estimate for the year 2023 of \$123/t CO<sub>2</sub>-e increasing in real terms by 2.5% per annum. Under this shadow price, the present value of GHG emission costs over the life of MOD 10 is \$54M dollars, present value.

However, the EUETS permit price is an “exchange price” that reflects the regulations and rules of the trading scheme. It is also a financial price rather than an economic value i.e. no real resources are exchanged for payment. This price is therefore far removed from the appropriate value for a NSW CBA which is the value of emission impacts to the households and businesses of NSW. Even if EUETS scheme

were designed efficiently, the price of a permit would reflect the global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world), not the damage cost to NSW residents. The global damage cost of carbon is the sum of damage cost of carbon to each country (Ricke et al, 2018, p. 896). The national (and provincial) level damage costs of carbon are therefore much smaller than the global damage costs (Tol, 2019).

Consistent with the NSW Government (2015) Guidelines and NSW Government (2018) Technical Notes, the focus of CBA 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 EA, this has been undertaken using Australia's share of the global population (around 0.32%) 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 GHG emissions to Australian and NSW from the construction and operation of the stockpile is estimated at \$0.2M and \$0.1M dollars, respectively.

Scope 3 emissions are associated with the overseas burning of coal from MOD 10 to generate electricity and produce steel. From an economic perspective, costs associated with Scope 3 emissions would be part of a CBA of a different project (e.g. an electricity generation project, with its own set of costs and benefits, including the benefits of electricity) and, consistent with the Technical Notes (NSW Government 2018), have not been included in the EA.

The BCM is subject to the Australian Government's Safeguard Mechanisms. As such, under both the base case and MOD 10 case it is required to implement measures to reduce its GHG emissions over time. This will impose costs on the mining activity and result in benefits of reduced emissions. At this stage the exact mechanisms that will be used by BCOPL to meet its obligations are unknown and hence cannot be considered further here. However, as a general principle these mechanisms will be the same under the base case and MOD 10 case until 2036. Furthermore, the Safeguard Mechanism is essentially a form of regulation/tax that imposes a financial cost on an organisation to achieve a reduction in emissions and is not relevant for inclusion in a CBA of a project if the impact of the emissions is already included in the analysis.

### ***Operational Noise***

Noise modelling was undertaken to assess the potential acoustic impacts of all operational activities proposed by MOD 10. The modelling predicts that with the application of all reasonable and feasible noise mitigation and management measures, the BCM, including changes to mining operations that are sought by MOD 10 will continue to comply with the intrusive noise criteria under SSD 09\_0182 at all private residence. MOD 10 is predicted to comply with the criteria for construction noise, sleep disturbance and road traffic noise.

Consequently, there are no material acoustic related economic impacts for inclusion in the analysis.

### ***Road Transport***

MOD 10 will not generate any additional road traffic volumes beyond the levels already approved under SSD 09\_0182. However, the level of road traffic currently approved will extend for an additional four years. The most recent traffic assessment which was completed for MOD 8 (as amended) confirmed that the road network will continue to operate within an acceptable Level of Service A with forecast cumulative traffic volumes. It concluded that the impacts of MOD 8 on the road transport environment in the vicinity of the BCM would be very minor and that no additional controls would be required to mitigate the impacts of the increased traffic arrangements.

This will not change as a result of MOD 10. Consequently, there are no material traffic related economic impacts for inclusion in the analysis.

### **Air Quality**

Dispersion modelling was undertaken to assess the air quality impacts of the BCM mining operations including changes to mining operations proposed by MOD 10. The BCM mining operations including changes to mining operations proposed by MOD 10 is predicted to continue to comply with all air quality criteria for the "project only" and cumulative scenarios. This includes modelling for Particulate Matter less than 2.5 microns (PM<sub>2.5</sub>), Particulate Matter less than 10 microns (PM<sub>10</sub>), Total Suspended Particulates (TSP) and depositional dust.

The modelling predicts that three private sensitive receptors may experience in the order of one day per year where the cumulative 24-hour average PM<sub>10</sub> criterion of 50 µg/m<sup>3</sup> is exceeded. It should be noted that most locations around Boggabri, and NSW, have historically recorded one or more days each year when the 24-hour average PM<sub>10</sub> concentration exceeded 50 µg/m<sup>3</sup>. The nearest private sensitive receptor is not expected to experience PM<sub>10</sub> concentrations above 50 µg/m<sup>3</sup>.

The only potential for BCM (including the changes sought by MOD 10) to cause an exceedance of EPA criteria (specifically 24-hour average PM<sub>10</sub>) is when the background levels are already approaching the criteria. Under these conditions, the modelling indicated that the contribution from BCM (including the changes sought by MOD 10) would be a very small proportion (<3 µg/m<sup>3</sup>) and that this risk can be managed through the ongoing implementation of air quality management measures currently in place at BCM.

It should also be noted that the modelled annual average PM<sub>2.5</sub> and TSP concentrations due to BCM (with MOD 10) is predicted to contribute no more than 1 µg/m<sup>3</sup> at the nearest private sensitive receptors. These concentrations are negligible and are not likely to exacerbate air quality impacts.

Modelled maximum 1-hour average and annual average Nitrogen Dioxide (NO<sub>2</sub>) concentrations due to diesel exhaust emissions indicates that compliance with the EPA's assessment criterion is expected at all private sensitive receptors. Modelled maximum 1-hour average NO<sub>2</sub> concentrations due to post-blast fume at BCM (including maximum background levels) indicates that concentrations will not exceed the EPA's criterion at any offsite sensitive receptor and therefore are not expected to result in any adverse air quality impacts.

Consequently, there are no material air quality related economic impacts for inclusion in the analysis.

### **Groundwater**

Groundwater modelling results indicate that the cumulative impacts of MOD 10 would largely meet the *Aquifer Interference Policy* (NOW 2012) (AIP) Level 1 minimal impact considerations, while incremental impacts relative to approved mining would meet all of the AIP's Level 1 minimal impact considerations. In particular:

- water table declines of more than 2 m (Level 1 minimal impact consideration) are not predicted at any water supply work within alluvial water sources.
- exceedances of the Level 1 minimal impact considerations threshold are predicted within the Gunnedah-Oxley Basin Porous Rock Water Source for the cumulative mining scenario. The predicted decline in the water table within the Gunnedah-Oxley Basin Porous Rock Water Source is predominantly due to approved mining, with the incremental impact of MOD 10 considered minimal.

- the nature of the impacts associated with MOD 10 indicates that the beneficial use (in terms of quality and quantity) of surrounding groundwater systems will not be affected.
- the maximum cumulative water table drawdown during mining could impact several high-priority Groundwater Dependent Ecosystems (GDEs) and exceed the Level 1 minimal impact consideration provided in the AIP, as listed under the relevant Water Sharing Plans (albeit no incremental change as a result of MOD 10).
- cumulative drawdown in the Nagero Creek alluvium is consistent with currently approved mining; and
- additional groundwater take is generally accommodated by existing licences, excluding the final year of mining when it is predicted to exceed licences by 2 ML.

Incremental impacts associated with MOD 10 are not significant or not present and demonstrate minimal incremental change from currently approved mining.

Notwithstanding, there is an opportunity cost of continuing to hold 1,890 ML of groundwater licences for a further four years and a capital cost of purchasing an additional 2 ML from the Maules Creek Water Source Zone 11 under the Namoi Alluvial Water Sources Water Sharing Plan. The opportunity cost of WALs already held and the capital cost purchasing additional WALs has been included in the analysis at an assumed value of \$2,900/ML.

### **Surface Water**

BCOPL has established and maintains a water management system (WMS) at the BCM. The WMS is designed to use and manage water from numerous sources and of varying quality. MOD 10 does not propose any material changes to the existing WMS. Any future changes to the WMS are associated with the progression of mining and the extension of the mine life out to 2040. The existing WMS will continue to be used to store and manage surface water and to divert runoff around BCM wherever reasonable and feasible. Potential impacts associated with the extension in LOM by an additional four years are anticipated to be generally consistent with those currently approved.

MOD 10 will extend mining related disturbance outside of the approved Mine Disturbance Boundary and directly disturb an additional 76 hectares (ha) of the Nagero Creek catchment (including the removal of the upper sections of several ephemeral watercourses). However, the additional mining disturbance within the catchment of these watercourses will not impact flows downstream of BCM as runoff from this area is currently captured within the WMS as part of the approved mining operations. Similarly, mining operations for MOD 10 will impact approximately 9 ha of the Back Creek catchment. This is approximately 0.1% of the total Back Creek catchment and is therefore expected to have negligible impacts on downstream flows.

BCOPL currently holds 1,028 unit shares in the Upper Namoi Zone 4, Namoi Valley Groundwater Source which is used to extract water from the BCM borefield to meet water demands. BCOPL also holds 322 unit shares of surface water entitlement to extract water from the Namoi River. The maximum predicted volume of 2,040 ML/year exceeds BCOPL's existing groundwater and surface water entitlements by up to 690 ML during extreme dry climatic conditions. Water balance modelling therefore indicates that MOD 10 will result in the need to purchase additional WALs for external water supply during the extreme dry periods. It is noted that the Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020 facilitates the carryover of water entitlements not used within the previous years. This option may be (and has in the past) utilised in preference to securing additional WAL entitlements from the open market.

Similarly, BCOPL currently hold 93 ML of entitlement in the Bluevale Water Source which is predicted to be sufficient to cover licensing requirements for surface water catchment runoff during the drier years.

However, BCOPL may also need to obtain an additional 191 unit-shares to achieve the predicted 284 ML/year licensable water take from the Bluevale Water Source during wet conditions.

There is an opportunity cost of continuing to hold the above WALs. Additional WALs will also be required to be purchased. The opportunity cost of WALs already held and the capital cost purchasing additional WALs has been included in the analysis at an assumed value of \$2,900/ML. However, it is important to note that large changes in the assumed price will not have material impacts on the outcome of this economic analysis.

The predicted volume of intercepted runoff is anticipated to generally decrease over time as mining progresses to the north and established rehabilitation areas are released downstream, reducing the overall contributing catchment area. Water balance modelling indicates that the volume of uncontrolled discharges (overflows) of sediment-laden water from sediment dams is expected to reduce over time, largely a result of the rehabilitation of catchment areas, and the subsequent release of surface runoff to the downstream environment. No overflows from dirty water storages are predicted under median conditions. Discharges from dirty water storages are predicted to occur only during periods of significant rainfall. The frequency and volume of discharges predicted for MOD 10 is comparable with currently approved operations.

Surface water related impacts associated with MOD 10 are minor in nature and consistent with those of the approved BCM. The existing WMS is considered sufficient to manage and monitor any potential changes to surface water resources during the progression of mining.

### ***Biodiversity***

MOD 10 will disturb approximately 85 ha of remnant native vegetation within Leard State Forest that provides a range of habitat for threatened fauna and flora. This will result in an ecosystem and species credit liability that can be met via retirement of credits generated via the establishment of a Biodiversity Stewardship Agreement (BSA) or existing credits available for purchase off the open market, direct payment into the Biodiversity Conservation Trust (BCT) Biodiversity Conservation Fund (BCF), and the funding of biodiversity conservation actions (capped at 10% of the offset requirement). It has therefore been estimated that the credit obligation for MOD 10 will have a cost liability of approximately \$21 M, comprising an ecosystem credit liability of approximately \$9 M and a species credit liability of \$12 M.

The impacted vegetation and associated fauna are likely to have non-use values to the community that can potentially be estimated using non-market valuation methods. Similarly, the provision of offsets via one of the abovementioned mechanisms is also likely to have non-use values to the community. The estimated cost liability is included in the capital costs of MOD 10. To the extent that the offsets provided by the abovementioned mechanism result in community values that are equivalent to the values lost from clearing, there will be no net loss in community values.

### ***Aboriginal Heritage***

There is one site previously recorded in the Modification Disturbance Footprint which is an isolated find. The archaeological potential for the Modification Disturbance Footprint to contain significant archaeological deposits of conservation value has been assessed as low.

Consequently, there are no material economic impacts for inclusion in the CBA.

### ***Historical Heritage***

There are no historic sites located within the Modification Disturbance Footprint. Consequently, there are no material economic impacts for inclusion in the CBA.

### ***Visual Impacts***

BCM will integrate with the existing landscape based on scale, position in the landscape and contrast. The North, East and West Sectors will continue to not experience any visibility to BCM's operations as a result of MOD 10, due to screening from the Willow Tree Range, adjacent mining operations and intervening topography.

The South Sector will continue to experience moderate to low impacts with the approval of MOD 10, however these will be reduced following the rehabilitation of the exposed overburden emplacement areas as the mine progresses to the north. Some direct lighting may be experienced as mining operations progress into the Modification Mining Area. However, these impacts are anticipated to significantly decrease in magnitude once the depth of mining increases as mining progresses.

Consequently, there are unlikely to be any material economic impacts for inclusion in the CBA.

### ***Net Public Infrastructure Impacts***

No additional public infrastructure is required for MOD 10. Potential impacts of MOD 10 on existing infrastructure include the ongoing use of utilities for at least four years. This will be paid for by user fees which are included in MOD 10 operating costs. Heavy vehicle impacts on State roads is a component of heavy vehicle charges and hence is internalised into transport costs. Consequently, no net infrastructure costs to government are envisaged from MOD 10.

### ***Loss of Surplus to Other Industries***

No loss of surplus to other industries will occur as a result of MOD 10.

### ***Market Benefits to Workers***

MOD 10 will provide for the continued employment for the regional and NSW economy. There are potentially wage benefits for these workers if wages received are in excess of their reservation wage. However, for the purpose of this assessment, wage benefits remain unquantified. Employment impacts are further assessed in Section 3 of this report.

### ***Economic Benefits to Existing Landholders***

Payments by the proponent for the purchase of land, that exceed the opportunity cost of the land, are an economic benefit to the landholder. However, no additional land needs to be purchased for MOD 10 and hence no additional benefits accrue to landholders. While historical land purchase costs may have been in excess of opportunity costs, these can be considered "sunk" and do not vary with or without MOD 10.

### ***Economic Benefits to Suppliers***

The focus of CBA is generally on primary costs and benefits i.e. first round impacts which are both direct and indirect. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. This is the approach taken in this assessment.

## 2.6 Consolidation of Value Estimates

### 2.6.1 Net Production Benefits

The present value of production costs and benefits, using a 7% discount rate, is provided in Table 2.4.

MOD 10 is estimated to have global net production benefits of \$964M (present value at 7% discount rate), relative to the base case.

The BCM, which is owned by a joint venture between Idemitsu Australia Pty Ltd, Chugoku Electric Power Australia Pty Ltd and NS Boggabri Pty Ltd, is 100% foreign owned. Consequently, the net production benefits that accrue to Australia are government royalties, i.e. 10.8% of the ex-mine value of coal<sup>5</sup> (Revenue NSW, 2025), and company tax, i.e. 30% of taxable income in accordance with the *Commonwealth Income Tax Rates Act 1986*. On this basis, the net production benefits of MOD 10 that accrue to Australia are estimated at \$421M (present value at 7% discount rate).

The net production benefits can be further apportioned to NSW by assuming that company tax benefits accrue to NSW based on its population share and that all government royalties accrue to NSW. On this basis, the net production benefits of MOD 10 that accrue to NSW are estimated at \$279M (present value at 7% discount rate).

The estimated net production benefits that accrue to Australia and NSW can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of MOD 10, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with MOD 10. It is a minimum threshold value as it does not include potential wage benefits and benefits to suppliers.

Provided the value of the residual environmental impacts of MOD 10 to Australian and NSW households, after mitigation, does not exceed the respective net production threshold values, then MOD 10 will have net benefits to the Australian and NSW communities.

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<sup>5</sup> Ex-mine value of coal is determined by subtracting total deductions from the value of the coal recovered. Deductions include for beneficiation of coal and levies.

**Table 2.4 - Net Production Benefits of MOD 10 (\$M Present Values at 7% Discount Rate)**

	<b>\$M</b>
<b>Costs</b>	
Opportunity cost of land	\$3
Opportunity cost of capital equipment	\$0
Capital costs	\$978
Operating cost (ex-royalties), including rehabilitation and decommissioning	\$82
<b>Sub-total</b>	<b>\$1,063</b>
<b>Benefits</b>	
Revenue	\$2,025
Residual value of land	\$2
Residual value of capital equipment	\$0
<b>Sub-total</b>	<b>\$2,027</b>
<b>Global Net Production Benefits</b>	<b>\$964</b>
Royalties to NSW Government	\$213
Company Tax	\$208
Residual net production benefits	\$543
<b>Global Net Production Benefits</b>	<b>\$964</b>
Royalties to NSW Government	\$213
Company Tax	\$208
Residual net production benefits	\$0
<b>Australian Net Production Benefits</b>	<b>\$421</b>
Royalties to NSW Government	\$213
Company Tax	\$66
Residual net production benefits	\$0
<b>NSW Net Production Benefits</b>	<b>\$279</b>

### **2.6.2 Indirect Impacts**

The CBA qualitatively considered and where possible quantified the main environmental, cultural, and social impacts of MOD 10 to Australia and NSW. Table 2.5 summarises the results of the consideration of indirect impacts in Section 2.5.2.

**Table 2.5– Indirect Impacts of MOD 10 (\$M Present Values at 7% Discount Rate)**

<b>Benefits</b>	<b>Australia</b>	<b>NSW</b>
Wage benefits to employment <sup>1</sup>	Unquantified	Unquantified
Economic benefits to existing landholders	\$0	\$0
Economic benefits to suppliers	Unquantified	Unquantified
<b>Sub-total</b>	<b>\$0</b>	<b>\$0</b>
<b>Costs</b>		
Greenhouse gas emissions (Scope 1 and 2)	\$0.2	\$0.1
Operational noise	No material impact*	
Road transport and traffic	No material impact*	
Air quality	No material impact*	
Groundwater	\$2	
Surface water	\$1	
Biodiversity	Impact offset – cost included in capital costs	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
<b>Sub-total</b>	<b>\$3.1</b>	<b>\$3.0</b>

<sup>1</sup> While the Economic Guidelines recognise both these potential benefits, there is no agreed method of estimation and inclusion in previous Economic Assessments has proved controversial. Conservatively, they therefore remain unquantified in this Economic Assessment.

\* NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures mitigate, offset or compensate then no material residual impacts occur, and all impacts are borne by the proponent.

From Section 2.5.2, it is evident that the main potential impacts of MOD 10 are internalised into the production costs through mitigation measures, infrastructure user charges and ownership of water allocations. Other costs not already included in the production costs of MOD 10 are associated with opportunity cost of WALs and Scope 1 and Scope 2 GHG costs. Although from Table 2.5, it is evident that these impacts to Australia and NSW are small or immaterial from a CBA perspective.

### **2.6.3 Net Social Benefits to Australia and NSW**

The main decision criterion for assessing the economic desirability of a project to society is its net present value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the project, because the community as a whole would obtain net benefits from the project.

The results from Table 2.4 and Table 2.5 are combined in Table 2.6 to estimate the net social benefits of MOD 10 to Australia and NSW, relative to the base case.

**Table 2.6 – Net Social Benefits of MOD 10 (\$M Present Values @ 7% Discount Rate)**

<b>Benefits</b>	<b>Australia</b>	<b>NSW</b>
<b>Net Production Benefits</b>		
Royalties to Government	\$213	\$213
Company Tax	\$208	\$66
Residual net production benefits	\$0	\$0
<b>Sub-total</b>	<b>\$421</b>	<b>\$279</b>
<b>Other Benefits</b>		
Wage benefits to employment <sup>1</sup>	Unquantified	Unquantified
Economic benefits to existing landholders	\$0	\$0
Economic benefits to suppliers	Unquantified	Unquantified
<b>Sub-total</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Benefits</b>	<b>\$421</b>	<b>\$279</b>
<b>Costs</b>		
Greenhouse gas emissions (Scope 1 and 2)	\$0.2	\$0.1
Operational noise	No material impact*	
Road transport	No material impact*	
Air quality	No material impact*	
Groundwater	\$2	
Surface water	\$1	
Biodiversity	Impact offset – cost included in capital costs	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
<b>Sub-total</b>	<b>\$3.1</b>	<b>\$3.0</b>
<b>Net Social Benefits</b>	<b>\$418</b>	<b>\$276</b>

<sup>1</sup> While the Economic Guidelines recognise both these potential benefits, there is no agreed method of estimation and inclusion in previous Economic Assessments has proved controversial. Conservatively, they therefore remain unquantified in this Economic Assessment.

\* NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures mitigate, offset or compensate then no material residual impacts occur and all impacts are borne by the proponent.

Overall, MOD 10 is estimated to have net social benefits to both Australia and NSW relative to the base case and hence is desirable and justified from an economic efficiency perspective.

While the typical environmental, cultural, and social impacts have been quantified and included in the MOD 10 CBA, any other residual environmental, cultural, or social impacts that remain unquantified would need to be valued at greater than \$418M and \$276M for MOD 10 to be questionable from an Australian and NSW economic efficiency perspective, respectively.

## 2.7 Distribution of NSW Costs and Benefits

CBA is primarily 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 MOD 10 to NSW are potentially distributed among a range of stakeholders as identified in Table 2.7.

**Table 2.7 - Incidence of NSW Costs and Benefits**

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	(\$M Present Value @ 7% Discount Rate)
<b>Share of net production benefits</b>		
Royalties	NSW Government and NSW households	\$213
Company tax	NSW Government and NSW households	\$66
<b>Additional benefits</b>		
Wage benefits to employment <sup>1</sup>	Some of the local and NSW labour force	Unquantified <sup>1</sup>
Economic benefits to existing landholders	Local landholders who sell land required for MOD 10 including buffer land	\$0
Economic benefits to suppliers <sup>1</sup>	Regional and State suppliers of inputs to production	Unquantified
<b>Environmental, social and cultural costs*</b>		
Greenhouse gas emissions (Scope 1 and 2)	Local and NSW households	\$0.1
Operational noise	Adjoining landholders	No material impact*
Road transport	Local residents and road users	No material impact*
Air quality	Adjoining landholders	No material impact*
Groundwater	BCOPL via opportunity cost of holding WALs	\$2
Surface water	BCOPL via opportunity cost of holding WALs	\$1
Biodiversity	Local and NSW households	Impact offset - cost included in capital costs
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impact*
Historic heritage	Local and NSW households	No material impact*
Visual amenity	Adjoining landholders and passing motorists	No material impact*
Net public infrastructure costs	NSW Government and NSW households	No material impact*
Loss of surplus to other industries	Not applicable	No material impact*

<sup>1</sup> While the Economic Guidelines recognise both these potential benefits, there is no agreed method of estimation and inclusion in previous Economic Assessments has proved controversial. Conservatively, they therefore remain unquantified in this Economic Assessment.

\* NSW regulations require many impacts to be borne by the proponent 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 proponent. This table identifies who bears residual impacts where mitigation, offset and compensation are imperfect.

## 2.8 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 coal prices and any consequent environmental impacts from premature cessation of operations.
- ecological risk associated with whether the biodiversity offsets will adequately compensate for the direct ecological impacts.
- other environmental, social, and cultural impact estimations and required mitigation measures.

The NSW Department of Planning, Housing and Infrastructure has previously identified that the financial viability of projects is a risk assumed by the project owners. Any risk that MOD 10 may commence and then cease operation for financial reasons leaving unmet rehabilitation liabilities is mitigated by the fact that BCOPL is required to pay a rehabilitation security deposit to the Department of Primary Industries and Regional Development (DPIRD) – Resources NSW – Resources Regulator NSW (DPIRD-RR) as the holder of a mining authority under the *Mining Act 1992*. This security deposit is held by DPIRD-RR to ensure that the legal obligations in relation to rehabilitation and safety of the site can be met following mine closure and is regularly reviewed and updated in accordance with DPIRD-RR rehabilitation cost estimate requirements. If rehabilitation obligations are not met to the satisfaction of the Minister, then the security funds would be used by DPIRD-RR to meet the relevant requirements.

The provision of biodiversity offsets can be associated with several 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 are mitigated through offset ratio requirements in the provision of/payment for offsets and commitment to the offset actions/payments prior to the impacts occurring.

In relation to the estimation of environmental, social, and cultural impacts of MOD 10, these impacts have generally been assessed based on the maximum annual levels of production and hence are likely to be overstated and very conservative. The relevant technical studies have not identified any material environmental, social, or cultural impacts.

The NPV of MOD 10 to NSW (presented in Table 2.6) 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<sup>6</sup>.

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 cost of land.
- operating costs.
- capital costs.
- revenue.
- residual value of land.
- GHG costs.
- groundwater costs.
- surface water costs.

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<sup>6</sup> Quantitative risk analysis could also potentially be undertaken. However, this requires information on the probability distributions for input variables in the analysis. This information is not available and so the sensitivity testing is limited to uncertainty analysis.

Results are reported in Tables 2.8. What this analysis indicates is that CBA is most sensitive to changes in revenue (reflecting production levels, the value of coal in USD and the USD/ AUD exchange rate) and to a lesser extent, operating costs. This is because changes in revenue directly impact royalties which is the main component of net production benefits to NSW. Changes in revenue also impact company tax estimates, only a component of which accrues to NSW. Changes in operating costs do not impact royalties but do impact the estimates of company tax.

The sensitivity analysis indicated that the CBA results are not sensitive to changes in capital costs, or indirect costs that have not already been internalised into production costs, such as GHG, groundwater and surface water opportunity costs. Since mitigation, offset and compensation costs are a small component of the capital and operating costs of MOD 10, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Under all scenarios examined, MOD 10 has net social benefits to NSW.

**Table 2.8 - NSW CBA Sensitivity Testing (\$M Present Value @ Various Discount Rates)**

	<b>4% Discount Rate</b>	<b>7% Discount Rate</b>	<b>10% Discount Rate</b>
<b>CENTRAL ANALYSIS</b>	\$390	\$276	\$198
<b>INCREASE – 20%</b>			
Opportunity cost of land	\$390	\$276	\$198
Operating costs	\$363	\$257	\$184
Capital costs	\$388	\$275	\$197
Revenue	\$501	\$354	\$254
Residual value of land	\$390	\$276	\$198
Greenhouse gas costs	\$390	\$276	\$198
Groundwater opportunity costs	\$390	\$276	\$198
Surface water opportunity costs	\$390	\$276	\$198

	<b>4% Discount Rate</b>	<b>7% Discount Rate</b>	<b>10% Discount Rate</b>
<b>GLOBAL GREENHOUSE GAS COSTS</b>	\$314	\$225	\$164

	<b>4% Discount Rate</b>	<b>7% Discount Rate</b>	<b>10% Discount Rate</b>
<b>DECREASE – 20%</b>			
Opportunity cost of land	\$390	\$276	\$198
Operating costs	\$418	\$296	\$212
Capital costs	\$393	\$278	\$199
Revenue	\$280	\$198	\$142
Residual value of land	\$390	\$276	\$198
Greenhouse gas costs	\$390	\$276	\$198
Groundwater opportunity costs	\$390	\$276	\$198
Surface water opportunity costs	\$390	\$276	\$198

### 3 LOCAL EFFECTS ANALYSIS

#### 3.1 Introduction

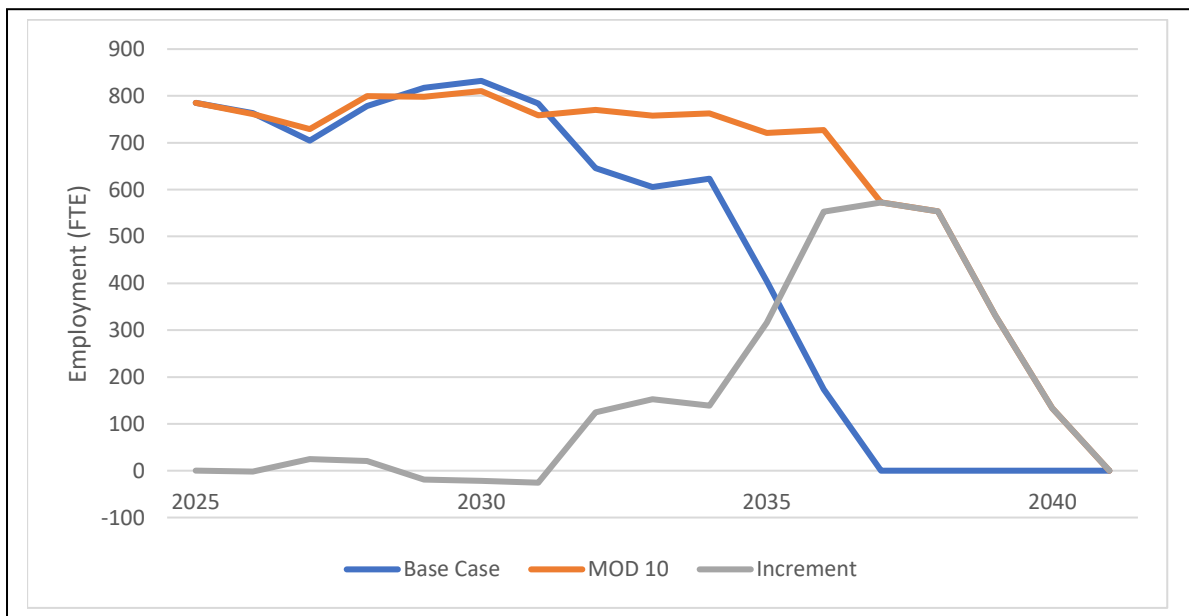
The CBA in Section 2 is concerned with whether the incremental benefits of MOD 10 exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' MOD 10 compared to 'without' it. This section examines local effects. It focuses on the operational phase of MOD 10.

The local area is defined as the Local Government Areas (LGAs) of Narrabri and Gunnedah, within which MOD 10 is located and is the region considered likely to be main source of labour and non-labour inputs for MOD 10.

#### 3.2 Direct Effects Related to Employment of Existing Residents Only

MOD 10 will provide continuation of employment at BCM for an estimated average annual 673 FTE direct jobs and \$90M per year in total after tax mining wage income (2025 to 2040). The incremental production employment provided by MOD 10 (i.e. between 2025 to 2040) compared to the base case (between 2025 and 2036) is provided in Figure 3.1. The incremental production employment ramps up from 2031 to a peak of 573 in 2037.

**Figure 3.1 – Incremental Employment**

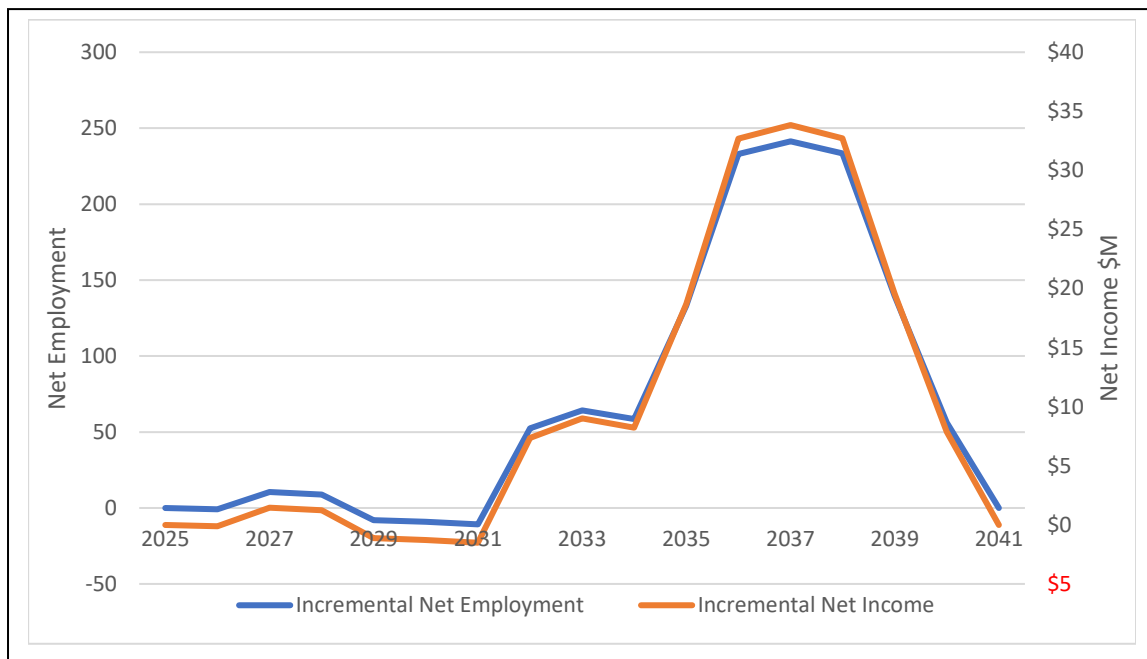


The LEA method as specified in NSW Government (2015) adjusts the incremental employment downwards by only considering those that already live in the region – 70% based on ABS four-digit ANZSIC employment data. It then further adjusts incremental employment downwards by calculating the incremental net income for those already living in the region (i.e. the difference between after tax (net) mining wage (\$140,000) and the average after tax (net) wage in the region (\$56,000)) and calculating the net FTE jobs by dividing this incremental net income by the average net mining wage. On this basis, the average annual gross impact of MOD 10 from 673 average annual FTE jobs (between 2025 and 2040) is \$40M in net income and 284 FTE jobs.

The annual incremental net income to local residents and the incremental net FTE jobs to local residents from MOD 10 relative to the base case is represented in Figure 3.2. Incremental net income and

incremental net employment to local residents ramps up from 2031 to a peak of \$34M and 241 jobs, respectively, in 2037. This estimated incremental net income and incremental net FTE jobs is a minimum estimate, as it assumes full employment in the region and hence the jobs from which people come to fill the mining jobs remain vacant.

**Figure 3.2 – Incremental Net Income and Net FTE Jobs to Local Residents**



During the life of MOD 10 from 2037 to 2040, the average annual total employment of MOD 10 is 398 (278 to local residents), which is associated with average annual after-tax income of \$56M. Incremental net employment to local residents is 168 jobs with incremental net income to local residents of \$24M.

### 3.3 Direct Effects Related to Non-Labour Expenditure

Stimulus to the local area from MOD 10 comes from both income expenditure and non-labour expenditure (operating costs of MOD 10 after subtraction of wages). Average annual non-labour operating expenditure associated with MOD 10 is \$400M between 2025 and 2040. However, not all of this expenditure will accrue to the local area. From a 2021 input-output table of the local area economy developed by Gillespie Economics for this analysis, approximately 44% (i.e. \$176M pa of non-labour expenditure) is estimated to accrue to the local area.

Annual incremental non-labour expenditure from MOD 10 relative to the base case ramps up from 2031 to a peak of \$336M in 2037 and averages \$116M between 2025 and 2040. The proportion accruing to the local area peaks at \$161M in 2037 and average \$51M between 2025 and 2040.

During the life of MOD 10 from 2037 to 2040, the average annual non-labour expenditure from MOD 10 is \$277M with \$122M accruing to the local area.

### 3.4 Second Round and Flow-On Effects

The expenditure by employees, who reside in the region, and non-labour expenditure that is captured by the local area, provides flow-on economic activity to the local economy.

Recognised methods for assessing second round and flow-on effects such as input-output (IO) analysis (but also computable general equilibrium analysis), do not utilise direct effects of employment and income effects as calculated above in accordance with the Economic Guidelines (NSW Government, 2015). Instead, they use the total employment working in the region, with total wages (rather than net additional wages to existing employed people) divided between those who live in the region and those who reside outside the region. Multiplier effects arising from labour and non-labour expenditure are evaluated in terms of how this expenditure contribute to the local area economy in terms of direct and indirect output, value-added, income and employment. This type of assessment is reported in the following section.

### 3.5 Local Economic Impact Assessment

Standard regional economic impact assessment using IO analysis, is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. The presence of job chain effects in a region, means that to the extent that jobs from which people come, to fill the mining jobs, are themselves filled and their jobs are also filled until the lowest paid jobs are filled by people from unemployment, new labour force participants, then new wages in the region will approximate the total incremental wages associated with the mining project. Refer to Attachment 2.

In this framework, MOD 10 is estimated to provide the following gross average annual direct and indirect annual effects to the local economy between 2025 and 2040:

- \$1,484M in output.
- \$913M in value-added.
- \$191M in gross wages.
- 1,882 jobs.

**Table 3.1 – Gross Average Annual Direct and Indirect Regional Economic Impacts of MOD 10 (2025-2040)**

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output (\$M)	1,124	234	126	360	1,484
<i>Type IIA Multiplier</i>	1.00	0.21	0.11	0.32	1.32
Value Added (\$M)	725	114	74	188	913
<i>Type IIA Multiplier</i>	1.00	0.16	0.10	0.26	1.26
Income (\$M)	99	59	33	93	191
<i>Type IIA Multiplier</i>	1.00	0.60	0.34	0.94	1.94
Employment (No.)	673	690	519	1,209	1,882
<i>Type IIA Multiplier</i>	1.00	1.02	0.77	1.80	2.80

The average annual direct and indirect economic impact of MOD 10 to the local economy from 2037 to 2040 is:

- \$794M in output.
- \$467M in value-added.

- \$112M in gross wages.
- 1,095 jobs.

**Table 3.2 – Gross Average Annual Direct and Indirect Regional Economic Impacts of MOD 10 (2037-2040)**

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output (\$M)	586	134	73	207	794
<i>Type IIA Multiplier</i>	1.00	0.23	0.13	0.35	1.35
Value Added (\$M)	358	65	43	109	467
<i>Type IIA Multiplier</i>	1.00	0.18	0.12	0.30	1.30
Income (\$M)	58	34	20	53	112
<i>Type IIA Multiplier</i>	1.00	0.58	0.33	0.91	1.91
Employment (No.)	398	394	303	697	1,095
<i>Type IIA Multiplier</i>	1.00	0.99	0.76	1.75	2.75

### 3.6 Effects on Other Industries

#### 3.6.1 Other Wage Impacts

In the short run, increased regional demand for labour as a result of MOD 10 (relative to “without” MOD 10) could potentially result in some increased pressure on wages in other sectors of the economy, particularly during the extension of the BCM life. However, given the availability of labour inside and outside the region e.g. nearby Tamworth LGA, wage impacts are not likely to be significant. Where upward pressure on regional wages occurs, it represents an economic transfer between employers and owners of skills and would in turn attract skilled labour to the region leading to future downward pressure on wages.

#### 3.6.2 Housing Impacts

MOD 10 will result in an extension of time that the BCM provides employment to its employees and these employees provide demand for housing in the region. However, the impact on housing prices as a result of this ongoing demand for four years is expected to be negligible.

#### 3.6.3 Price Impacts on Food and Other Services

MOD 10 will result in higher regional demand for food and other retail goods and services (relative to “without” MOD 10) due to the extension of time that the BCM provides employment and wages. However, this increased demand is modest in the context of overall demand and is anticipated to be met through adjustments in supply.

#### 3.6.4 Displacement of Other Land Use

The additional mining operations proposed by MOD 10 will occur within the existing BCM Project Boundary. Accordingly, MOD 10 is consistent with the current approved use of the land. It will not displace any alternative uses however it will delay the return of the land to alternative land uses of biodiversity and forestry. These are lower value land uses compared to mining.

### 3.6.5 Tourism

MOD 10 is not estimated to have any material impacts on tourism infrastructure, tourism destinations or amenity in the local area.

### 3.7 Environmental, Cultural and Social Impacts on the Local Community (Externalities)

The distribution of costs and benefits of MOD 10 are summarised in Table 2.7. There are no material residual environmental, cultural or social impacts that accrue to the local community.

### 3.8 Summary of Local Effects

A summary of local effects of MOD 10 is provided in Table 3.3.

**Table 3.3 - Summary of Effects on the Local Community**

<b>Local Effects (Local Effects Analysis) 2025 to 2040</b>	<b>Direct Total</b>	<b>Direct Already Resident in the Local Area</b>	<b>Net</b>
Average Annual Total FTE of MOD 10	673	473 <sup>1</sup>	284
Average Annual Total After Tax Income of MOD 10 (\$M)	90		40
Average Annual Total Non-labour expenditure of MOD 10 in the Local Area	176		
<b>Local Effects (Local Effects Analysis) 2037 to 2040</b>			
Average Annual Total FTE of MOD 10	398	278	168
Average Annual Total After Tax Income of MOD 10 (\$M)	56		24
Average Annual Total Non-labour expenditure of MOD 10 in the Local Area	122		
<b>Average Total Annual Local Impacts of MOD 10 (Input-Output Analysis) 2025 to 2040</b>			
	<b>Direct</b>	<b>Flow-on</b>	<b>Total</b>
Output (\$M)	1,124	360	1,484
Value-added (\$M)	725	188	913
Income (\$M)	99	93	191
Employment	673	1,209	1,882
<b>Average Total Annual Local Impacts of MOD 10 (Input-Output Analysis) 2037 to 2040</b>			
	<b>Direct</b>	<b>Flow-on</b>	<b>Total</b>
Output (\$M)	586	207	794
Value-added (\$M)	358	109	467
Income (\$M)	58	53	112
Employment	398	697	1,095
<b>Other Local Economic Impacts</b>			
Contraction in other sectors e.g. tourism	No material impact*		
Displaced activities e.g. agriculture and forestry	No material impact*		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Price impacts on food and other services	No material impact*		
<b>Local Environmental, Cultural and Social Impacts</b>	No material impacts*		

<sup>1</sup> This is based on the proportion (70%) of coal mine workers that reside in the Local Area (ABS Census of Population and Housing).

\* NSW regulations require many impacts to be borne by the proponent 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 proponent.

## 4 CONCLUSION

A CBA of MOD 10 has determined that MOD 10 would have net production benefits to Australia and NSW of \$421M and \$279M, respectively. Provided the residual environmental, social, and cultural impacts of MOD 10 that accrue to Australia and NSW are considered to be valued at less than the level of net production benefits, MOD 10 can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

The environmental, cultural, and social impacts were valued using market data and benefit transfer and incorporated into an estimate of the net social benefit of MOD 10. Most impacts were immaterial from an aggregate economic efficiency perspective. The main quantifiable environmental impacts of MOD 10, which have not already been incorporated into the estimate of net production benefits, relate to the opportunity cost of WALs and the impacts of GHG emissions. The opportunity cost of WALs were estimated at \$3M. GHG impacts to Australia and NSW are estimated at \$0.2M and \$0.1M, respectively. These economic costs are considerably less than the estimated net production benefits of MOD 10.

Combining the estimate of net production benefit with the residual environmental costs, MOD 10 is estimated to have net social benefits to both Australia and NSW of \$418M and \$276M, respectively.

While the major environmental, cultural, and social impacts have been quantified and included in the MOD 10 CBA, any other residual environmental, cultural, or social impacts that remain unquantified would need to be valued at greater than \$418M and \$276M for Australia and NSW, respectively, for MOD 10 to be questionable from an economic efficiency perspective.

MOD 10 will provide direct economic activity, including jobs, to the local economy, and indirect economic activity to the local area via both wage and non-wage expenditure, while having no material adverse impacts.

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## **ATTACHMENT 1 - COST BENEFIT ANALYSIS**

### **Introduction to CBA**

Cost Benefit Analysis (CBA) has its theoretical underpinnings in neoclassical welfare economics. Applications in New South Wales (NSW) are guided by these theoretical foundations as well as the NSW Treasury (2017). CBA applications within the NSW environmental assessment framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas projects* and the 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 *Environmental Planning & Assessment Act, 1979* (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 costs and benefits are defined and valued based on the microeconomic underpinnings of CBA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

While CBA 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 equity are subjective and are therefore left to decision-makers.

Similarly, 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 governments.

### **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.

As a tool of investment appraisal for the public sector, CBA can potentially be applied across different definitions of society such as a local area, state, nation, or the world. However, most applications of CBA are performed at the national level. This national focus extends the analysis beyond that which is strictly relevant to a NSW government planning authority. However, the interconnected nature of the Australian economy and society creates significant spill-overs between States. These include transfers between States associated with the tax system and the movement of resources over state boundaries.

Nevertheless, "where major impacts spill over national borders, then CBA should be undertaken from the global as well as the national perspective" (Boardman *et al.*, 2001). For mining projects, impacts that spill over national borders include greenhouse gas costs and producer surplus benefits to foreign owners.

With respect to the application of CBA in relation to coal mining and coal seam gas proposals, NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals*, define the public interest, and hence society, as the households of NSW. Similarly, NSW Treasury (2017) *NSW*

*Government Guide to Cost-Benefit Analysis*, makes it clear that in terms of geographic scope, a CBA should focus on impacts (costs and benefits) to the NSW community (households, businesses, workers and/or governments).

CBAs of mining projects are therefore often 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. A consideration of the distribution of costs and benefits can then be undertaken to identify the benefits and costs that accrue to NSW.

### **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 coal mining projects, typically only the costs and benefits from mining the coal and delivering it to Port or domestic users, are relevant.

Coal is an intermediate good i.e. it is an input to other production processes such as production of electricity and steel making. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects.

### **Net Production Benefits**

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

- the net production (producer surplus) benefits of a project; and
- the environmental, social and cultural impacts (most of which are costs of mining but some of which may be benefits).

Net production benefits can be estimated based on market data on the projected financial<sup>7</sup> value of coal less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies. This is normally commercial in confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

### **Environmental, Social and Cultural Impacts**

The consideration of non-market impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts. The environmental impact assessment 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 relevant assessment document), 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.

These environmental, social, and cultural impacts generally fall into three categories, those which:

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<sup>7</sup> In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the coal.

- 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 value (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 changes in property value.

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).

Where benefits and costs cannot be quantified these items should be included in the analysis in a qualitative manner (NSW Treasury, 2007).

### **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, it should be noted that the estimates 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, the costs of providing ecological offsets and the cost of purchasing groundwater and surface water entitlements in the water market etc. Including these costs effectively internalises the respective and otherwise, non-monetary environmental, social, and cultural costs. 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 benefit 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 relevant assessment document), after mitigation, offset and compensation by the proponent, 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<sup>8</sup> can also be considered using the threshold value approach. The costs of these unquantified environmental,

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<sup>8</sup> Including potential impacts that were unknown at the time of the preparation of the relevant assessment document or arise during the Environmental Impact Assessment process due to differences in technical opinions.

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.

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## ATTACHMENT 2 – COMPARISON OF INPUT-OUTPUT ANALYSIS AND THE LEA METHOD

Input-Output (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. All income paid to employment is also included, as it is generated in the economy and IO tables are based on place of work. However, in assessment of the impacts of a project on the regional economy, 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 will accrue to people living in the region even though they are new residents. In impact assessments using IO analysis, the income of those residing outside the region is excluded as most of their income will 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 "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 in the NSW (2015) Guideline.

The guideline splits labour into those who ordinarily reside in the region and those who do not ordinarily reside in the locality. For those who ordinarily reside 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 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
<b>Total Direct Empl</b>	<b>100</b>	<b>6,500,000</b>	<b>10,000,000</b>	<b>3,500,000</b>	<b>5,400,000</b>

Even for those already living in the region who are already employed, the incremental income estimated using the guideline will substantially understate 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 "job chain" - 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), if jobs remain unfilled or if jobs are filled by a commuter workforce. The latter is less likely for lower paying jobs down the job chain. 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 job chain 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 will 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	
<b>Total</b>		<b>\$3,455,664</b>