Appendix U

Economics Assessment

Boggabri Coal Mine
Modification 8
Economic Assessment

Prepared for

Boggabri Coal Operations Pty Limited

By

Gillespie Economics
Tel: 0419 448 238
Email: gillecon@bigpond.net.au

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TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

EXECUTIVE SUMMARY

Introduction

Boggabri Coal Operations Pty Limited (BCOPL) is seeking a Modification to its existing State Significant Development (SSD) Approval 09_0182 for the Boggabri Coal Mine (BCM), to increase the depth of approved mining operations and to facilitate the construction of a fauna movement crossing of the existing haul road (MOD 8).

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 8 must be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of MOD 8) 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.

Cost Benefit Analysis

A CBA of MOD 8 indicates that it would have net production benefits to Australia and NSW of $294M and $241M, respectively. Provided the residual environmental, social and cultural impacts of MOD 8 that accrue to Australia and NSW are considered to be valued at less than the level of net production benefits, MOD 8 can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

The environmental, cultural and social impacts were then valued using market data and benefit transfer[1], and incorporated into an estimate of the net social benefit of MOD 8. Most impacts were considered to be immaterial from an aggregate economic efficiency perspective. The main quantifiable environmental impacts of MOD 8, 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 scope 1 and scope 2 greenhouse gas (GHG) emissions. The opportunity cost of WALs is estimated at $0.6M. Scope 1 and Scope 2 GHG impacts to Australia and NSW are estimated at $0.3M and $0.1M, respectively. These economic costs are considerably less than the estimated net production benefits of MOD 8.

Overall, MOD 8 is estimated to have net social benefits to both Australia and NSW of $293M and $240M, respectively.

While the major environmental, cultural and social impacts have been quantified and included in the MOD 8 CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $293M and $240M for Australia and NSW, respectively, for MOD 8 to be questionable from an economic efficiency perspective.

Local Effects Analysis

The local area comprises Narrabri and Gunnedah Local Government Areas. MOD 8 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 8 is provided in Table ES1.

[1] Benefit transfer refers to transferring economic values that have been determined for other study sites.

MOD 8 will provide for the continuation of employment at BCM for an estimated average annual 620 full-time equivalent (FTE) direct jobs (2022 to 2039).

The LEA method specified by NSW Government (2015) adjusts the incremental employment (i.e. difference between the base case and MOD 8 case) downwards by only considering those that already live in the region – 57% based on current 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 ($94,233) and average after tax (net) wage in the region ($47,991)) 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 MOD 8 to local residents as a result of the annual average 620 direct FTE jobs, is $16M in net income and 173 FTE jobs; and
- the incremental net income and incremental net employment to local residents from MOD 8 relative to the base case, ramps up from 2028 to a peak of $17M and 178 jobs, respectively, and averages $8M in net income and 80 net FTE jobs between 2022 and 2039.

The average annual non-labour operating expenditure associated with MOD 8 is $485M between 2022 and 2039 with $225M per annum estimated to accrue to the local area. Annual incremental non-labour expenditure from MOD 8 relative to the base case ramps up from 2028 to a peak of $197M in 2034 and averages $91M between 2022 and 2039.

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, MOD 8 is estimated to provide the following total annual direct and indirect annual effects to the local economy between 2022 and 2039:

- $1,259M in output;
- $585M in value-added;
- $153M in gross wages; and
- 1,789 jobs.

This average annual regional economic effect of MOD 8 is also representative of the incremental economic impact of MOD 8 from 2034 to 2036. The incremental economic impact provided by MOD 8 ramps up to this level from 2027 when production under the existing approval would have begun to decline and then ramps down from 2036 as production under MOD 8 begins to decline.

Table ES1 - Summary of Effects on the Local Community

Local Effects (Local Effects Analysis)	Direct Total	Direct Already Resident in the Local Area	Net
Average Annual Total FTE of MOD 8 (2022-2039)	620	353[1]	173
Average Annual Total Income of MOD 8 ($M) (2022-2039)	58		16
Average Annual Total Non-labour expenditure of MOD 8 in the Local Area (2022-2039)	225		
Incremental Annual FTE of MOD 8 Relative to the Base Case (2022-2039)	Range of -57 to 638 (ave 286)	Range of -32 to 364 (ave 163)	Range of -16 to 178 (ave 80)
Incremental Annual Income of MOD 8 Relative to the Base Case ($M) (2022-2039)	Range of -5 to 60 (ave 27)		Range of -2 to 17 (ave 8)
Incremental Annual Non-labour expenditure in the Local Area of MOD 8 Relative to the Base Case ($M) (2022-2039)	Range of -9 to 197 (ave 91)		
Total Local Impacts MOD 8 (Input-Output Analysis)	**Direct**	**Flow-on**	**Total**
Output ($M)	863	396	1,259
Value-added ($M)	378	207	585
Income ($M)	46	107	153
Employment	620	1,169	1,789

Other Local Economic Impacts	
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*
Local Environmental Impacts	
Greenhouse gas emissions (Scope 1 and 2)	$0.0003M[2]
Operational noise	Modelled 1 dBA exceedance of criteria specified within SSD 09_0182 at three residences during the night only – exceedances of 0-2dBA are indiscernible
Air quality	Modelled cumulative 24-hour PM_{10} criteria exceeded one day per year at three private residences
Visual	Continued moderate to low visual impacts to the south east, with no material additional impacts on any private receptor

[1] This is based on the proportion (57%) of BCM workers that reside in the Local Area.
[2] The Narrabri and Gunnedah population is 0.3% of the NSW population. NSW GHG impact have been apportioned accordingly.
* 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 is imperfect.

1 INTRODUCTION

Boggabri Coal Operations Pty Limited (BCOPL) is seeking a Modification to State Significant Development (SSD) Approval 09_0182 under Section 4.55 of the *Environmental Planning & Assessment Act 1979* (EP&A Act) to increase the depth of approved mining operations and to facilitate the construction of a fauna movement crossing over the existing haul road at the Boggabri Coal Mine (BCM) (MOD 8).

A conceptual layout of MOD 8 is shown on Figure 1.1 and generally comprises the following:

- Increasing the approved maximum depth of mining down to the Templemore Coal Seam to recover an additional 61.6 Million tonnes (Mt) of Run of Mine (ROM) coal within the currently approved Mine Disturbance Boundary. It is expected that the additional ROM coal will be suitable for producing a lower ash, higher energy thermal, semi-soft coking and pulverised coal injection (PCI) quality products for sale to the export market. This will result in the extension of the mine life by six (6) years; and
- Construction of a specifically designed fauna movement crossing over the existing haul road between the overburden emplacement area (OEA) and the western side of the regional biodiversity corridor. The establishment of the fauna movement crossing is proposed to improve the movement of fauna from the Leard State Forest through the Southern Rehabilitation Area (SRA).

The proposed changes to mining operations will remain within the currently approved Mine Disturbance Boundary. Some very minor substitution of disturbance (less than 1.21 ha) will be required to facilitate the construction of the fauna movement crossing. However, this will be immediately rehabilitated as part of the crossing construction program and overall, there will be a net decrease in disturbance area of the project of approximately 2.06 ha. This proposed substitution will result in no additional offset requirements due to an existing surplus of biodiversity offsets for the BCM.

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 8 are required:

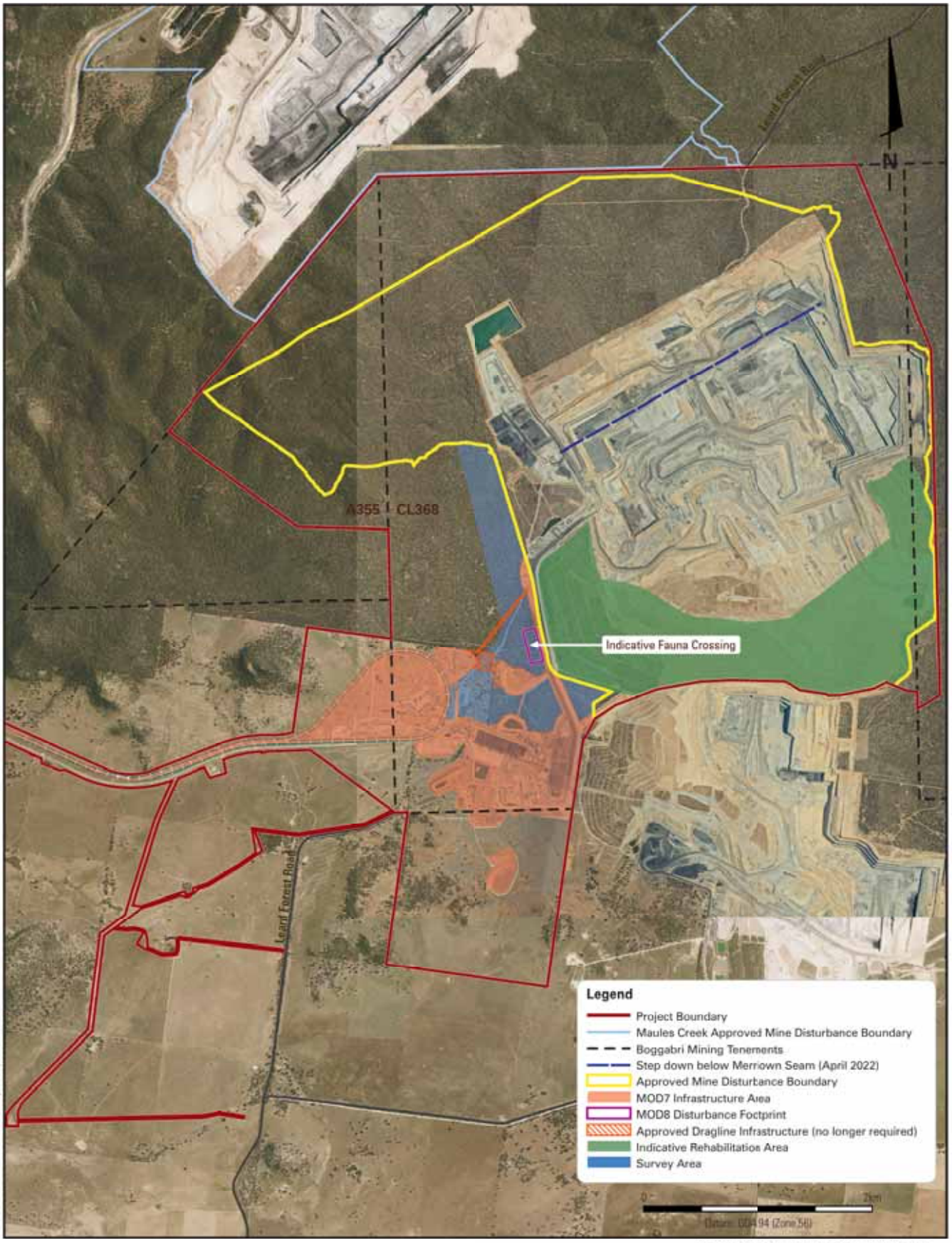
- a cost benefit analysis (CBA) which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest; and

- a local effects analysis (LEA) to assess the impacts of MOD 8 in the locality, specifically:

    - effects relating to local employment;
    - effects relating to non-labour project expenditure; and
    - environmental and social impacts on the local community.

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

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.



H8 BOGGABRI 1624 F2 MOD8 Project Layout 24 02 2021

BOGGABRI COAL MINE

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

IDEMITSU
BOGGABRI COAL

MOD 8 Conceptual Project Layout

FIGURE1.1

2 COST BENEFIT ANALYSIS

2.1 Introduction

CBA of MOD 8 involves the following key steps:

- identification of the "with" and "without" Modification scenario;
- 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; and
- consideration of the distribution of costs and benefits.

What follows is a CBA of MOD 8 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 8 scenario, or base case, for the BCM, including the land impacted by MOD 8. This becomes the base case against which to assess the potential incremental changes of any economic, social and environmental impacts due to MOD 8.

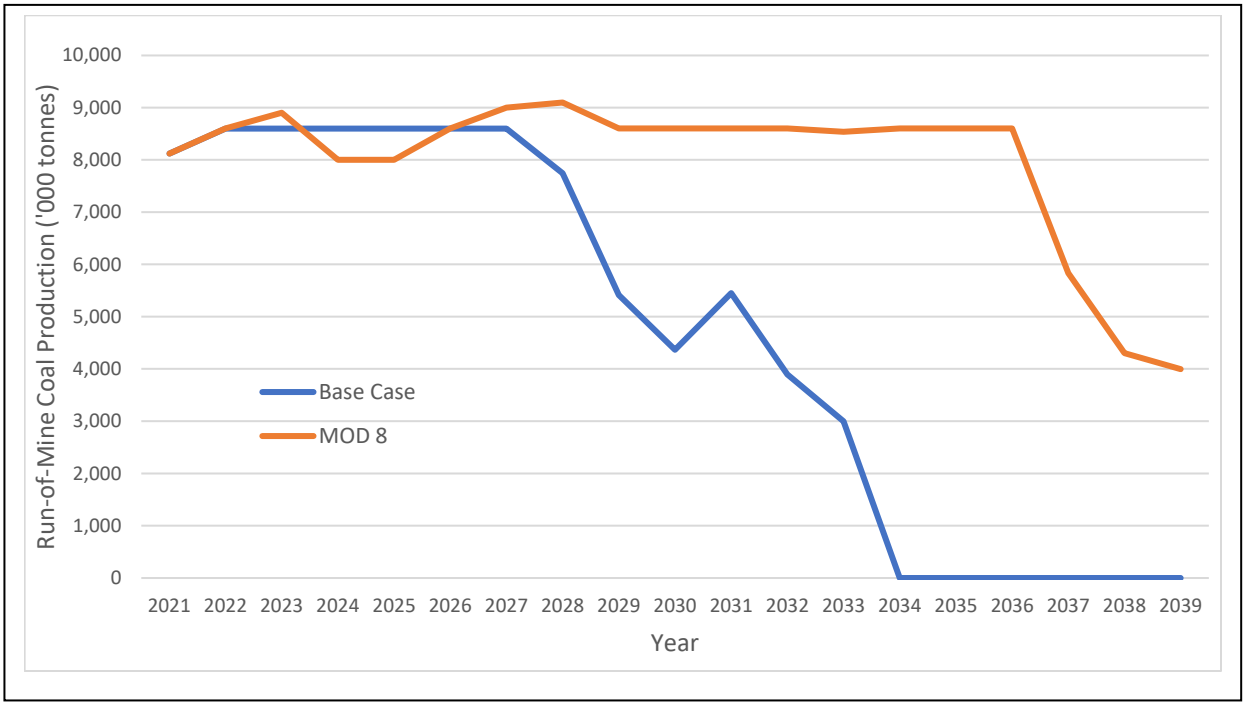
The existing state significant development consent (SSD 09_182) allows for mining of up to 8.6 Mtpa ROM coal until December 2033. At this time, the mine would be rehabilitated and the processing plant and associated mine infrastructure decommissioned. BCM is part of the BTM complex with Tarrawonga Coal Mine and Maules Creek Coal Mine being operational mines in close proximity.

2.3 Identification of the "With" MOD 8 Scenario

"With" the proposed MOD 8, additional coal seams below the Merriown coal seam would be targeted, increasing the depth of open cut mining from 180 m to approximately 380 m. Peak ROM production would increase to 9.1 Mtpa of ROM and the mine life would increase by six years until December 2039.

Figure 2.1 illustrates the incremental production of MOD 8 relative to the base case.

Figure 2.1 – Incremental Production from MOD 8 Relative to the "Without" MOD 8 Scenario



2.4 Identification of Benefits and Costs

Relative to the base case, MOD 8 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.

Table 2.1 - Potential Incremental Economic Benefits and Costs of MOD 8

Category	Costs	Benefits
Production	• Opportunity cost of land after final rehabilitation commencing in 2034 • Opportunity cost of capital (2034) • Development costs • Operating costs, including administration, mining, processing, transportation, mitigation measures and offsets (but excluding royalties) • Decommissioning and rehabilitation costs at cessation of MOD 8	• Avoided decommissioning and rehabilitation costs starting in 2034 • Sale value of coal • Residual value of capital and land at the cessation of MOD 8
Indirect Impacts	• Greenhouse gas generation • Operational noise impacts • Road transport impacts • Air quality impacts • Groundwater impacts • Surface water impacts • Biodiversity impacts • Aboriginal heritage impacts • Historic heritage impacts • Visual impacts • Net public infrastructure costs • Loss of surplus to other industries	• Wage benefits to employment • Economic benefits to existing landholders • Economic benefits to suppliers

Framed in another, but equivalent way, the potential incremental costs and benefits of MOD 8 are as per Table 2.2.

Table 2.2 - Alternative Frame of Potential Economic Benefits and Costs of MOD 8

Costs	Benefits
Direct costs	***Direct benefits***
Nil	Net production benefits • *Royalties* • *Company tax* • *Net producer surplus*
Indirect costs	***Indirect benefits***
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 2021 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 22 years, coinciding with the proposed life of MOD 8 (i.e. 2022 to 2039) plus one year pre-approval and three years for rehabilitation and closure. 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.[2]

The environmental, cultural and social impacts were then valued using market data and benefit transfer[3], and incorporated into an estimate of the net social benefit of MOD 8. This estimated net social benefit of MOD 8 provides another threshold value that any residual or non-quantified economic costs would need to exceed to make MOD 8 questionable from an economic efficiency perspective. In terms of cumulative environmental 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 the Project.

2.5.1 Production Costs and Benefits[4]

Economic Costs

Opportunity Cost of Land and Capital

Under the base case, the mining would cease at the end of 2033 and residual land and capital value would be realised.

With MOD 8, the BCM life would be extended to 2039 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 $2M for privately owned land[5] 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.

Capital Cost of MOD 8

Compared to the economic base case, MOD 8 would require additional capital expenditure primarily associated with:

- the purchase of additional capital equipment;
- sustaining capital; and
- the fauna crossing construction.

This incremental cost is estimated at $661M over the MOD 8 life.

Annual Operating Costs of MOD 8

Compared to the base case, operating costs of MOD 8 are associated with marginally higher annual levels of ROM mining and overburden handling and six additional years of mining.

Incremental operating costs are associated with:

- Pit top costs;

[2]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.
[3] Benefit transfer refers to transferring economic values that have been determined for other study sites.
[4] All values reported in this section are undiscounted unless specified.
[5] 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; and
- Decommissioning and rehabilitation costs.

The incremental operating costs of MOD 8 (excluding royalties) over the MOD 8 life are estimated at $4.4B. 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 8.

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 8, decommissioning and rehabilitation of the surface infrastructure would occur from 2040. These costs are included in the operating costs above.

Economic Benefits

Avoided Decommissioning and Rehabilitation Costs

Without MOD 8, the existing consent (SSD 09_0182) will expire at the end of 2033 and the BCM would be decommissioned and rehabilitated. With MOD 8, these costs from 2033 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 8 will result in additional revenues resulting from sale of additional coal to be mined. Incremental revenues are associated with three coal products from MOD 8:

- Semi-soft coking coal (SSCC);
- Pulverised coal injection (PCI); and
- Thermal Coal.

Revenues were estimated based on a coal price derived from a KPMG consensus forecast as follows:

- saleable tonne yield of 92%;
- USD95.4/t for SSCC (KPMG, 2020);
- USD98.7/t for PCI coal (KPMG, 2020);
- USD69.2/t for Newcastle benchmark thermal coal (KPMG, 2020), with adjustments for different ash levels; and
- AUD: USD exchange rate of 0.74 (KPMG, 2020).

There is obviously considerable uncertainty around future coal prices in USD and the AUD/USD exchange rate and 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 8, the land and capital equipment required for MOD 8 would have some residual value that could be realised by sale or alternative uses. This is estimated at $2M 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 8 for which approval is sought i.e. emissions from additional equipment to allow deeper mining and transport of product coal to the port of Newcastle for sale to the export market, are relevant to a CBA of MOD 8.

NSW Government (2018) *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* 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 8 have been estimated at 6.18 Million tonnes of CO_2 equivalent (Mt CO_2-e) and 0.45 Mt CO_2-e, relative to the base case.

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. An average of three shadow prices was used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US Environmental Protection Agency (EPA) Social Cost of Carbon. However, these represent the global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the Economic Guidelines (NSW Government 2015), the focus of this CBA of a mining projects is on costs and benefits to the population of NSW. Accordingly, the Technical Notes (NSW Government, 2018) identify that the global social damage cost estimates of Scope 1 and 2 GHG emissions of MOD 8 therefore need to be apportioned to **NSW only**.

In the absence of any studies that have focused on the social damage cost of carbon emissions to Australian and then NSW residents, some means of apportioning global damage costs is required. For the purpose of the Economic Assessment, apportionment has been undertaken using Australia's share of the global population (around 0.3%) and NSW's share of the Australian population (32%).

On this basis, the present value (at 7% discount rate) of the cost of MOD 8 GHG emissions to Australia and NSW is estimated at $0.31M and $0.1M respectively, relative to the base case.

Scope 3 emissions are associated with the overseas burning of coal from MOD 8 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 Economic Assessment.

Operational Noise

Noise modelling was undertaken to assess the potential acoustic impacts of all operational activities proposed by MOD 8.

The modelling predicts that MOD 8 will comply with the relevant noise criteria under SSD 09_0182 at all privately owned residences, except for three residences. Two residences are predicted to experience noise levels up to 1 dBA greater than the relevant noise criteria under SSD 09_0182 during the night period only. The NSW Government 2018 *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) states that exceedances of 0-2 dBA above the intrusive noise criteria are not discernible to the average listener, and therefore do not give rise to any acquisition or mitigation requirements. A further third residence is also predicted to experience noise levels 1 dBA greater than the maximum predicted noise levels specified within SSD 09_0182 during the night period, however this property is already subject to acquisition upon request with BCM.

MOD 8 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

The construction of the fauna movement crossing for MOD 8 will require approximately 25 construction personnel (it is assumed the actual construction personnel will be more likely around 10 -15) during the short-term construction phase (approximately 6 months). Traffic movements associated with the construction workforce will be negligible compared to background traffic volumes.

The operational workforce for MOD 8 is an average of 620 full-time-equivalent (FTE) from 2022 to 2039, with a peak number of 770 FTE. SSD 09_0182 original approval supported by the *Continuation of Boggabri Coal Mine Environmental Assessment* (Hansen Bailey, 2010) describes that the operations at BCM will be supported by up to 500 employees (indicative) at the peak production of 7 Mtpa of product coal. It should be noted that the Boggabri EA estimate of 500 FTE did not account for contractors employed for short term or shutdowns or persons accessing site for very short periods of time, which are now captured by contemporary industry reporting through the use of the FTE value recording system.

The traffic assessment for MOD 8 assessed an increase in employees from 500 FTEs to 770 FTEs, an increase of 270 FTE personnel. However, the current Social Impact Management Plan (SIMP) which has been submitted to the Department of Planning, Industry and Environment (DPIE) for approval (October 2020), identifies at June 2020 a workforce of approximately 750 personnel (including employees and contract workers) supported the BCM. Therefore, the traffic assessment is conservative with very little changes to traffic conditions expected beyond those currently experienced.

The traffic assessment has identified that the project-generated traffic would have a negligible impact on the operation of the road network and that there are no specific safety concerns with the existing road transport environment that would be exacerbated by the project-generated traffic. The worst-case scenario (Year 2025, with a peak of 770 FTE employees) and cumulative impacts of other projects demonstrates that the road network will continue to operate within acceptable levels.

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 all operational activities proposed by MOD 8. MOD8 is predicted to comply with all air quality criteria for the "project only" and cumulative scenario. This includes assessments for PM_{10}, $PM_{2.5}$, Total Suspended Particulates (TSP) and deposited dust.

When the background air quality levels are approaching the criteria, the modelling indicates the potential for BCM (including the changes sought by MOD 8) to cause an exceedance of EPA criteria (specifically 24-hour average PM_{10}) at three private residences. Under these conditions, the modelling indicated that the contribution from BCM (including the changes sought by MOD 8) would be a very small proportion and that this risk can be managed through the ongoing implementation of air quality management measures currently in place at BCM. Most locations around Boggabri, and in fact NSW, have historically recorded one or more days each year when the 24-hour average PM_{10} concentration exceeded 50 $\mu g/m^3$. This illustrates that MOD 8 would have a negligible impact on air quality.

Post blast fume emissions are not expected to result in any adverse air quality impacts, based on modelling which showed compliance with the relevant air quality criteria.

Emissions from diesel exhausts associated with off-road vehicles and mining equipment 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

The peak groundwater inflows to BCM for MOD 8 are modelled to occur in 2027 with a total of 712 Megalitres per year (ML/year) compared to a maximum of 537 ML/year (to occur 2021) for the currently approved operations at BCM. BCOPL hold sufficient Water Access Licences (WALs) to account for all predicted takes. However, there is an opportunity cost with having to hold an additional 175 ML of WALs as these could potentially have been sold as being excess to requirements. This opportunity cost is assumed to be in the order of $2,900 per ML[6]. It is important to note that large changes in the assumed price will not have material impacts on the outcome of the economic analysis.

Cumulative drawdown to the neighbouring alluvial aquifers is predicted to be generally less than 2 m for both the approved BCM and MOD 8. The only exception is a small portion of the alluvial tongue, located directly southwest of the approved BCM on BCOPL owned land, where a maximum drawdown of 3 m is predicted. MOD 8 results in an incremental drawdown in this area of around 0.4 m.

MOD 8 is predicted to result in the most significant drawdown of the Merriown Seam and the Nagero Seam within the mined footprint, with respective maximums of approximately 110 m and 300 m. This drawdown generally corresponds with the depth of the coal seams to be mined and is not anticipated to result in any adverse impacts to surrounding water users.

Predictions show that cumulative impacts associated with MOD 8 generally meet the *Aquifer Interference Policy, 2012* (AIP's) Level 1 minimal impact considerations.

At the end of mining, the water table drawdown beneath several high priority Groundwater Dependent Ecosystems (GDEs) is predicted to exceed the 10% cumulative drawdown threshold. However previous works have demonstrated that these potential GDEs are either unlikely to be present or have already

[6] The same as trades in Lower Namoi General Security Water – see below discussion of surface water.

been taken into consideration as part of environmental assessments for surrounding mining operations. Further, these impacts are not specific to MOD8 and are also predicted to occur as part of approved mining.

The groundwater impact assessment has demonstrated that MOD 8 is not likely to result in a significant impact on groundwater resources. An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral has been lodged with the Commonwealth Department of Agriculture Water and Energy (DAWE) and at time of release of this report, the assessment level decision was still to be received.

Surface Water

MOD 8 proposes no significant changes to the approved water management system (WMS), except those associated with the extended mine life (to 2039). The existing WMS would continue to be used to manage runoff with all pit water and mine surface runoff directed to the WMS. The existing approved clean water diversions will continue to divert runoff as required around the WMS. Given that the proposed changes to mining operations will remain entirely within the approved Mine Disturbance Boundary, there are no new diversions proposed or required as part of MOD 8.

The water balance modelling indicates total water inventory on site is primarily driven by groundwater inflows into the pit, and water supplies from external sources, including extractions from the Namoi River and groundwater extractions via the approved borefield. During periods of low groundwater inflows, when site water inventories drop below about 1,000 ML, additional external water supplies may be required if coupled with below average rainfall. However, this is consistent with the current water management procedures at BCM.

The water balance modelling indicates that, for average conditions, MOD 8 will not result in the need to purchase any additional WALs for extraction of water from the Lower Namoi River Water Source. However, 326.1ML of surface water licence from the Lower Namoi Regulated River Water Source would need to be held for an additional six years as a result of MOD 8. There is an opportunity cost associated with holding these WALs for extra time. This opportunity cost is assumed to be $2,900/ML (Key Water, 2021). However, it is important to note that large changes in the assumed price will not have material impacts on the outcome of the economic analysis.

The 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 as a result of the rehabilitation of the catchment area, and subsequent release of surface runoff to the downstream environment.

Biodiversity

The proposed changes to mining operations will remain within the currently approved Mine Disturbance Boundary. However, there would be some additional clearing associated with the construction of the fauna movement crossing. This clearing is within an area of Plant Community Type (PCT) 88 Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion; which is not listed under either the *Biodiversity Conservation Act 2016* (BC Act) or the EPBC Act.

BCOPL is proposing to surrender the proposed disturbance area associated with the Dragline Erection pad and walk road, which was approved under SSD 09_0182 and compensated for under BCM's Revised Biodiversity Offset Strategy. Using the disturbance area of 1.21 ha associated with MOD 8, surrendering the Dragline Erection pad and walk road would result in a net decrease of approximately 2.06 ha of impact associated with MOD 8 and thus, a net gain in biodiversity values.

Overall there will be a reduction in the area and significance of vegetation cleared as a result of MOD 8. This means that some offsets already provided as a result SSD 09_0182 could potentially be relinquished or sold. However, conservatively this benefit remains unquantified in the analysis.

Aboriginal Heritage

There are no Aboriginal sites located within the MOD8 Disturbance Footprint. Therefore, the construction of surface infrastructure relating to the fauna movement crossing will not result in any impacts to Aboriginal sites.

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

Historical Heritage

There are no historic sites located within the MOD8 Disturbance Footprint. Therefore, the construction of surface infrastructure relating to the fauna movement crossing will not result in any impacts to historic sites.

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 8, due to screening from the Willow Tree Range.

The South East Sector (VP3 and VP4) is anticipated to continue to experience moderate to low impacts with the approval of MOD 8.

The MOD 8 Conceptual Final Landform will result in an increase in maximum height of the Overburden Emplacement Area (OEA) by 5 m to incorporate macro-relief elements to the surface of the final landform design, thus improving both its appearance and sustainability.

As MOD 8 will not result in any additional impact on the surrounding visual landscape at any private receiver, no additional mitigation or management measures beyond that outlined in the current approvals are proposed.

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

Net Public Infrastructure Impacts

No additional public infrastructure is required for MOD 8. Potential impacts of MOD 8 on existing infrastructure include the ongoing use of utilities for at least six years. This will be paid for by user fees which are included in MOD 8 operating costs. Heavy vehicle impact 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 8.

Loss of Surplus to Other Industries

No loss of surplus to other industries will occur as a result of MOD 8.

Market Benefits to Workers

MOD 8 will provide additional 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 8 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 8.

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 2.3.

MOD 8 is estimated to have global net production benefits of $521M (present value at 7% discount rate), relative to the base case.

BCOPL is 100% foreign owned. Consequently, the net production benefits that accrue to Australia are government royalties i.e. 8.2% of the ex-mine value of coal[7](NSW Department of Mining, Exploration and Geoscience, 2021), 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 8 that accrue to Australia are estimated at $294M (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 8 that accrue to NSW are estimated at $241M (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 8, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with MOD 8. It is a minimum threshold value as it does not include potential wage benefits and benefits to suppliers.

[7] 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.

Provided the value of the residual environmental impacts of MOD 8, to Australian and NSW households, after mitigation, do not exceed the respective net production threshold values, then MOD 8 will have net benefits to the Australian and NSW communities.

Table 2.3 - Net Production Benefits of MOD 8 ($M Present Values at 7% Discount Rate)

	$M
Costs	
Opportunity cost of land	$1
Opportunity cost of capital equipment	$0
Capital costs	$314
Operating cost (ex royalties), including rehabilitation and decommissioning	$1,753
Sub-total	***$2,067***
Benefits	
Revenue	$2,580
Residual value of land	$0
Residual value of capital equipment	$0
Sub-total	***$2,580***
Global Net Production Benefits	**$513**
Royalties to NSW Govt	$216
Company Tax	$78
Residual Net Production Benefits	$219
Global Net Production Benefits	**$513**
Royalties to NSW Govt	$216
Company Tax	$78
Residual Net Production Benefits	$0
Australian Net Production Benefits	**$294**
Royalties to NSW Govt	$216
Company Tax	$25
Residual Net Production Benefits	$0
NSW Net Production Benefits	**$241**

2.6.2 Indirect Impacts

The CBA qualitatively considered and where possible quantified the main environmental, cultural and social impacts of MOD 8 to Australia and NSW. Table 2.4 summarises the results of the consideration of indirect impacts in Section 2.5.2.

Table 2.4 – Indirect Impacts of MOD 8 ($M Present Values at 7% Discount Rate)

	Economic Base Case	
Benefits	**Australia**	**NSW**
Wage benefits to employment[1]	Unquantified	Unquantified
Economic benefits to existing landholders	$0	$0
Economic benefits to suppliers[1]	Unquantified	Unquantified
Sub-total	**$0**	**$0**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.3	$0.1
Operational noise	No material impact*	
Road transport and traffic	No material impact*	
Air quality	No material impact*	
Groundwater	$0.5	
Surface water	$0.1	
Biodiversity	No material impact* - reduction in impact	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	

[1] 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 is imperfect.

From Section 2.5.2, it is evident that the main potential impacts of MOD 8 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 8 are associated with opportunity cost of WALs and scope 1 and scope 2 GHG costs. Although from Table 2.4, it is evident that these impacts to Australia and NSW are small or immaterial.

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 2.3 and Table 2.4 are combined in Table 2.5 to estimate the net social benefits of MOD 8 to Australia and NSW, relative to the base case.

Table 2.5 – Net Social Benefits of MOD 8 ($M Present Value @ 7% Discount Rate)

Benefits	Australia	NSW
Net Production Benefits		
Royalties to Government	$216	$216
Company Tax	$78	$25
Residual Net Production Benefits	$0	$0
Sub-total	**$294**	**$241**
Other Benefits		
Wage benefits to employment[1]	Unquantified	Unquantified
Economic benefits to existing landholders	$0	$0
Economic benefits to suppliers[1]	Unquantified	Unquantified
Sub-total	**$0**	**$0**
Total Benefits	**$294**	**$241**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.3	$0.1
Operational noise	No material impact*	
Road transport	No material impact*	
Air quality	No material impact*	
Groundwater	$0.5	
Surface water	$0.1	
Biodiversity	No material impact* - reduction in impact	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
Sub-total	***$0.9***	***$0.7***
Net Social Benefits	**$293**	**$240**

[1] 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 is imperfect.

Overall, MOD 8 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 major environmental, cultural and social impacts have been quantified and included in MOD 8 CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $293M and $240M for MOD 8 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 8 to NSW are potentially distributed among a range of stakeholders as identified in Table 2.6.

Table 2.6 - Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	($M Present Value @ 7% Discount Rate)
Share of Net Production Benefits		
Royalties	NSW Government and NSW households	$216
Company tax	NSW Government and NSW households	$25
Additional benefits		
Wage benefits to employment[1]	Some of the local and NSW labour force	Unquantified[1]
Economic benefits to existing landholders	Local landholders who sell land required for MOD 8 including buffer land	$0
Economic benefits to suppliers[1]	Regional and State suppliers of inputs to production	Unquantified[1]
Environmental, social and cultural costs*		
Greenhouse gas emissions (Scope 1 and 2)	Local and NSW households	$0.1
Operational noise	Adjoining landholders	No material impact*
Road transport	Local residents	No material impact*
Air quality	Adjoining landholders	No material impact*
Groundwater	BCOPL via WAL purchases	$0.5
Surface water	BCOPL via WAL purchases	$0.1
Biodiversity	Local and NSW households	No material impact* - reduction in impact
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 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*

[1] 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 is 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; and
- other environmental, social and cultural impact estimations and required mitigation measures.

The NSW DPIE has previously identified that the financial viability of projects is a risk assumed by the project owners. Nevertheless, it should be noted that it is highly unlikely that BCOPL would invest in MOD 8 if it were not financially viable. However, any risk that MOD 8 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 NSW Department of Regional NSW – Resources Regulator (DRNSW-RR) as the holder of a mining authority under the *Mining Act 1992*. This security deposit is held by DRNSW-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 DRNSW-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 DRNSW-RR to meet the relevant requirements.

The provision of biodiversity offsets can be associated with a number risks. However, no additional biodiversity values will be impacted by MOD 8 and hence no risks with regard to biodiversity and offsets arise.

In relation to the estimation of environmental, social and cultural impacts of MOD 8, 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 net present value of MOD 8 to NSW (presented in Table 2.5) 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[8].

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; and
- surface water costs.

[8] 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 2.7. 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 and net producer surplus. Changes in revenue also impact company tax estimates and residual net production benefits, only a component of which accrues to NSW. Changes in operating costs do not impact royalties but do impact the estimates of company tax and residual net production benefits.

The sensitivity analysis indicated that the CBA results are not sensitive to changes in capital costs, or environmental costs that have not already been internalised into production costs, such as GHG, groundwater and surface water costs. Since mitigation, offset and compensation costs are a small component of the capital and operating costs of MOD 8, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Under all scenarios examined, MOD 8, has net social benefits to NSW.

Table 2.7 - NSW CBA Sensitivity Testing ($M Present Value @ Various Discount Rates)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$363	$240	$162
INCREASE – 20%			
Opportunity cost of land	$363	$240	$162
Operating costs	$335	$223	$151
Capital costs	$356	$237	$161
Revenue	$461	$309	$210
Residual value of land	$363	$240	$162
Greenhouse gas costs	$363	$240	$162
Groundwater costs	$363	$240	$162
Surface water costs	$363	$240	$162

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE – 20%			
Opportunity cost of land	$363	$240	$162
Operating costs	$385	$257	$175
Capital costs	$364	$243	$165
Revenue	$259	$172	$116
Residual value of land	$363	$240	$162
Greenhouse gas costs	$363	$240	$162
Groundwater costs	$363	$240	$162
Surface water costs	$363	$240	$162

3 LOCAL EFFECTS ANALYSIS

3.1 Introduction

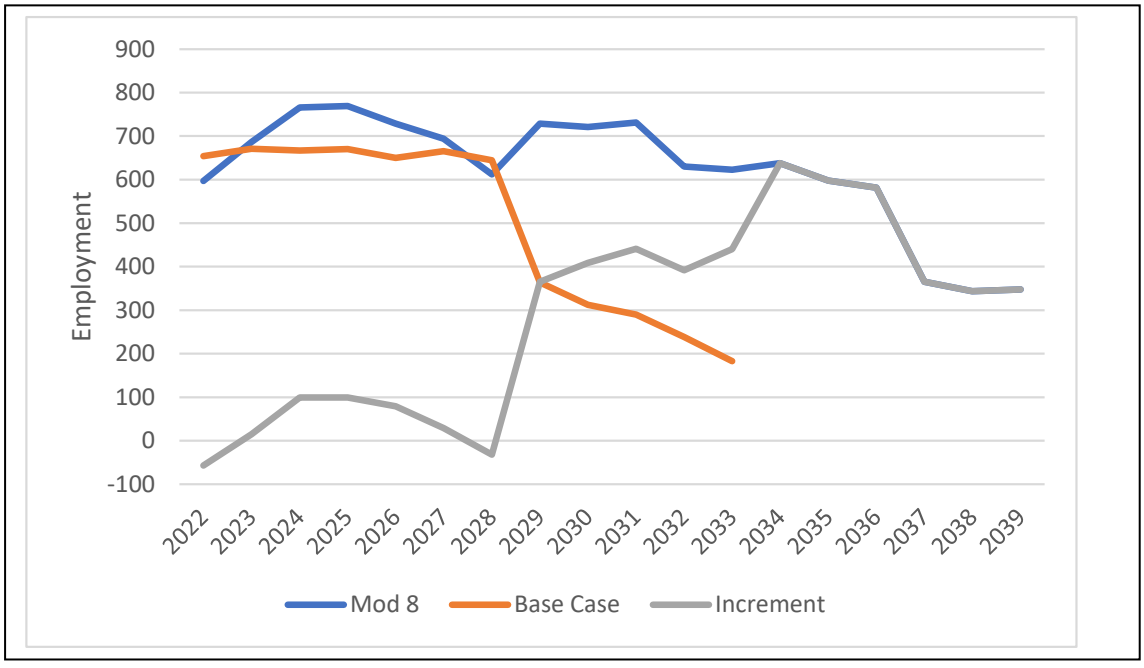
The CBA in Section 2 is concerned with whether the incremental benefits of MOD 8 exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' MOD 8 compared to 'without' it. This section examines local effects. It focuses on the operational phase of MOD 8.

The local area is defined as the Local Government Areas (LGAs) of Narrabri and Gunnedah, within which MOD 8 is located and is the region considered likely to be main source of labour and non-labour inputs for MOD 8.

3.2 Direct Effects Related to Employment of Existing Residents Only

MOD 8 will provide continuation of employment at BCM for an estimated average annual 620 FTE direct jobs (2022 to 2039). The incremental production employment provided by MOD 8 (i.e. between 2022 to 2039) compared to the base case (between 2022 and 2033) is provided in Figure 3.1. The incremental production employment ramps up from 2028 to a peak of 638 in 2034.

Figure 3.1 – Incremental Production 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 – 57% based on current 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 ($94,233) and the average after tax (net) wage in the region ($47,991)) and calculating the net FTE jobs by dividing this incremental net income by the average net mining wage. On this basis, the average annual impact of MOD 8 from 620 average annual FTE jobs (between 2022 and 2039) is $16M in net income and 173 FTE jobs.

The annual incremental net income to local residents and the incremental net FTE jobs to local residents from MOD 8 relative to the base case is represented in Figure 3.2. Incremental net income and

incremental net employment to local residents ramps up from 2028 to a peak of $17M and 178 jobs, respectively, and averages $8M in net income and 80 net FTE jobs between 2022 and 2039. This estimated incremental net income and 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

3.3 Direct Effects Related to Non-Labour Expenditure

Stimulus to the local area from MOD 8 comes from both income expenditure and non-labour expenditure (operating costs of MOD 8 after subtraction of wages). Average annual non-labour operating expenditure associated with MOD 8 is $485M between 2022 and 2039. However, not all of this expenditure will accrue to the local area. From a 2016 input-output table of the local area economy developed by Gillespie Economics for this analysis, approximately 46% (i.e. $225M pa of non-labour expenditure) is estimated to accrue to the local area.

Annual incremental non-labour expenditure from MOD 8 relative to the base case ramps up from 2028 to a peak of $197M in 2034 and averages $91M between 2022 and 2039.

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.

A recent study by Lawrence Consulting (2020) for the NSW Minerals Council confirms the existence of substantial flow-on effects from mining operations in the Hunter region, but does not report multipliers.

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 8 is estimated to provide the following average annual direct and indirect annual effects to the local economy between 2022 and 2039:

- $1,259M in output;
- $585M in value-added;
- $153M in gross wages; and
- 1,789 jobs.

Table 3.1 – Gross Annual Direct and Indirect Regional Economic Impacts of MOD 8

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output ($M)	863	298	98	396	1,259
Type IIA Multiplier	*1.00*	*0.35*	*0.11*	*0.46*	*1.46*
Value Added ($M)	378	148	59	207	585
Type IIA Multiplier	*1.00*	*0.39*	*0.16*	*0.55*	*1.55*
Income ($M)	46	80	27	107	153
Type IIA Multiplier	*1.00*	*1.76*	*0.59*	*2.35*	*3.35*
Employment (No.)	620	768	400	1,169	1,789
Type IIA Multiplier	*1.00*	*1.24*	*0.65*	*1.88*	*2.88*

This average annual regional economic of MOD 8 is also representative of the incremental economic impact of MOD 8 from 2034 to 2036. The incremental economic impact provided by MOD 8 ramps up to this level from 2028 when production under the existing approval would have begun to decline and then ramps down from 2036 as production under MOD 8 begins to decline.

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 8 (relative to the "without MOD 8" scenario) 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 8 will largely result in an extension of time that the BCM provides employment. It will therefore not result in any change in the in-migration of workers and their families and consequently the impact on housing prices is expected to be negligible.

3.6.3 Price Impacts on Food and Other Services

MOD 8 will result in higher regional demand for food and other retail goods and services (relative to the "without" MOD 8 scenario) due 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

MOD 8 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 agriculture and forestry. These are lower value land uses compared to mining.

3.6.5 Tourism

MOD 8 is not estimated to have any material impacts on tourism infrastructure, tourism destinations or amenity in the local area.

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

The distribution of costs and benefits of MOD 8 are summarised in Table 2.11. The main potential effects on the local community are indiscernible night time noise criteria exceedances at three residences, one day where the cumulative 24hr average PM_{10} criterion of 50 µg/m^3 is exceeded at three residences, continued moderate to low visual impacts to the south east (with no material additional impacts on any private receptor) and minor GHG emission impacts to the local community.

3.8 Summary of Local Effects

A summary of local effects of MOD 8 is provided in Table 3.2.

Table 3.2 - Summary of Effects on the Local Community

Local Effects (Local Effects Analysis)	Direct Total	Direct Already Resident in the Local Area	Net
Average Annual Total FTE of MOD 8 (2022-2039)	620	353[1]	173
Average Annual Total Income of MOD 8 ($M) (2022-2039)	58		16
Average Annual Total Non-labour expenditure of MOD 8 in the Local Area (2022-2039)	225		
Incremental Annual FTE of MOD 8 Relative to the Base Case (2022-2039)	Range of -57 to 638 (ave 286)	Range of -32 to 364 (ave 163)	Range of -16 to 178 (ave 80)
Incremental Annual Income of MOD 8 Relative to the Base Case ($M) (2022-2039)	Range of -5 to 60 (ave 27)		Range of -2 to 17 (ave 8)
Incremental Annual Non-labour expenditure in the Local Area of MOD 8 Relative to the Base Case ($M) (2022-2039)	Range of -9 to 197 (ave 91)		
Total Local Impacts MOD 8 (Input-Output Analysis)	**Direct**	**Flow-on**	**Total**
Output ($M)	863	396	1,259
Value-added ($M)	378	207	585
Income ($M)	46	107	153
Employment	620	1,169	1,789
Other Local Economic Impacts			
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*		
Local Environmental Impacts			
Greenhouse gas emissions (Scope 1 and 2)	$0.0003M[2]		
Operational noise	Modelled 1 dBA exceedance of criteria specified within SSD 09_0182 at three residences during the night only – exceedances of 0-2dBA are indiscernible		
Air quality	Modelled cumulative 24-hour PM_{10} criteria exceeded one day per year at three private residences		
Visual	Continued moderate to low visual impacts to the south east, with no material additional impacts on any private receptor		

[1] This is based on the proportion (57%) of BCM workers that reside in the Local Area.
[2] The Narrabri and Gunnedah population is 0.3% of the NSW population. NSW GHG impact have been apportioned accordingly.
* 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 is imperfect.

4 CONCLUSION

A CBA of MOD 8 has determined that MOD 8 would have net production benefits to Australia and NSW of $294M and $241M, respectively. Provided the residual environmental, social and cultural impacts of MOD 8 that accrue to Australia and NSW are considered to be valued at less than the level of net production benefits, MOD 8 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 8. Most impacts were considered to be immaterial from an aggregate economic efficiency perspective. The main quantifiable environmental impacts of MOD 8, 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 $0.6M. GHG impacts to Australia and NSW are estimated at $0.3M and $0.1M, respectively. These economic costs are considerably less than the estimated net production benefits of MOD 8.

Overall, MOD 8 is estimated to have net social benefits to both Australia and NSW of $293M and $240M, respectively.

While the major environmental, cultural and social impacts have been quantified and included in MOD 8 CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $293M and $240M for Australia and NSW, respectively, for MOD 8 to be questionable from an economic efficiency perspective.

MOD 8 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[9] 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:

[9] 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 benefits of a project provides the threshold value that the non-quantified environmental, social and cultural impacts of a project (based on the assessments in the 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[10] can also be considered using the threshold value approach. The costs of these unquantified environmental,

[10] 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.

REFERENCES

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

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
Total Direct Empl	**100**	**6,500,000**	**10,000,000**	**3,500,000**	**5,400,000**

Even for those already living in the region who are already employed, the incremental income estimated using the guideline 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	
Total		**$3,455,664**