Muswellbrook Coal Continuation Project

Economic Assessment

Prepared for

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EXECUTIVE SUMMARY

This Economic Assessment for the Muswellbrook Coal Continuation Project (the modification) has been prepared as part of a Statement of Environmental Effects (SEE).

This Economic Assessment provides the following analyses of the modification:

- 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 addresses the public interest;

- A local effects analysis (LEA) to assess the impacts of the modification 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 to assess the direct and indirect economic activity project footprint in relation to output, value-added, income and employment.

Cost Benefit Analysis

A CBA of the modification indicated that it would have minimum net production benefits (royalties) of $18 M to NSW. In addition, there would be unquantified company tax benefits to NSW and potentially market and nonmarket benefits of employment of in the order of $16 M.

The estimated minimum net production benefits of $18 M can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the modification, after mitigation, compensation and offset, may be assessed. For the modification to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the modification, to NSW, after mitigation, offset and compensation, would need to be valued by the NSW community at greater than $18 M.

In this respect, no material impacts are considered likely in relation to ecology, transport and traffic, public infrastructure, and indigenous and non-Indigenous heritage. Noise impacts, air quality, surface water impacts and groundwater impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the modification. These costs would have no impact on the estimated minimum threshold value of the modification. Only impacts from greenhouse gas emissions and prolonged visual impacts would remain unmitigated and would need to be balanced against the minimum threshold value. Greenhouse gas impacts are estimated at in the order of between $1,900 and $6,700, present value, which is considerably less than the estimated minimum net production benefits to NSW. Visual impacts remain unquantified but are not considered likely to be material from a CBA perspective.

Consequently, the modification is estimated to have net social benefits to NSW of a minimum of $18 M and hence is desirable and justified from an economic efficiency perspective. Any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $18 M for the modification to be questionable from a NSW economic perspective.

Local Effects Analysis

As summary of local area effects is provided in Table ES1.

Table ES1 - Summary of Local Effects

	Project Direct	Project Direct: Local	Net Local Effect	Total Net Local Effect Including Flow-ons
Employment related				
Assuming otherwise employed				
Employment (FTE)	113	93	65	178
Disposable income ($M per annum)	$10.9	$9.0	$6.3	$11.2
Assuming otherwise unemployed				
Employment (FTE)	113	93	79	216
Disposable income ($M per annum)	$10.9	$9.0	$7.7	$13.6
Other non-labour expenditure ($M)	$18.9			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	Not applicable			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**		
Greenhouse gas impacts	Local and NSW households	No material impacts		
Agricultural impacts	MCC	No material impacts - LSC Class 6 land impacted		
Noise impacts	Adjoining landholders	Six landholders moderately impacted - management measures implemented to minimise impacts		
Blasting	Adjoining landholders	No properties impacted by exceedances		
Air quality impacts	Adjoining landholders	Two landholder impacted cumulatively on two to three days - additional monitors installed to manage impacts		
Surface water	MCC	WALs already in MCC ownership and would be held for a longer period of time		
Groundwater	MCC	WALs already in MCC ownership and would be held for a longer period of time		
Ecology	Local and NSW households who value the revegetation	Impacts on biodiversity values unlikely to be significant		
Road transport impacts	Local residents	No impacts identified		
Indigenous and non-Indigenous heritage	Aboriginal people and other local and NSW households who value heritage	No impacts identified		
Visual impacts	Adjoining landholders and people travelling through	Unlikely to be significant		
Net public infrastructure costs	NSW Government and NSW households	No material impacts		
Loss of surplus to other industries	Local industries adversely impacted by the modification	No material impacts		

Supplementary Local Effects Analysis using Input-Output Analysis

Economic activity analysis, using IO analysis, estimated that the modification would make up to the following annual incremental contribution to the regional economy[1] for approximately three years:

- $155M in annual direct and indirect regional output or business turnover;
- $57M in annual direct and indirect regional value added;
- $16M in annual direct and indirect household income; and
- 204 direct and indirect jobs.

[1] The Local Government Areas of Singleton, Muswellbrook and Upper Hunter.

1 INTRODUCTION

1.1 Introduction

Gillespie Economics has been engaged by EMM Consulting Pty Ltd (EMM) on behalf of Muswellbrook Coal Company Limited (MCC) to complete an Economic Assessment for the Muswellbrook Coal Continuation Project (the modification). The purpose of the Economic Assessment is to form part of a Statement of Environmental Effects (SEE) being prepared by EMM to support an application for modification to the development consent (DA 205/2002) under section 96(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Muswellbrook Coal Mine (MCM).

1.2 Legislative Context and Guidelines

This Economic Assessment has been carried out in accordance with:

- Clause 7(1)(f) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* which requires environmental assessments to provide "the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations…" Note to Clause 7 (1) (f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."

- Section 79C of the EP&A Act which requires the following two matters to be taken into consideration by the consent authority in determining a development application:

    - the public interest (taken as the collective public interest of households in NSW); and
    - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.

- the following standards, guidelines and policies:

    - NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*; and
    - NSW Treasury (2007) *NSW Government Guidelines for Economic Appraisal*.[2]

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

- 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 addresses the public interest;

- a local effects analysis (LEA) to assess the impacts of the modification 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.[3]

Economic analysis tools of 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, often conflicting, government goals and objectives.

[2] Refer to Attachment 1 for the legislative context for economic methods in Environmental Impact Assessment (EIA) in NSW.
[3] Refer to Attachment 2 for an introduction to economic methods.

1.3 Report Outline

Section 2 outlines the scope of the modification. Section 3 provides an overview of the CBA and LEA approach used in this study. Section 4 and 5 document the CBA and LEA of the modification, respectively. Section 6 provides a supplementary LEA using input-output (IO) analysis. Conclusions are provided in Section 7.

2 PROJECT DESCRIPTION

The MCM is located on Muscle Creek Road, 3 kilometres (km) north-east of the township of Muswellbrook, in the Muswellbrook local government area (LGA) in New South Wales (NSW).

MCC has a long history of mining in the Muswellbrook area, with underground operations commencing at MCM in 1907. Underground operations ceased in the late 1990s; however open cut mining continues. MCC has approval from Muswellbrook Shire Council (MSC) to mine within the No. 1 Open Cut Extension Area (Open Cut 1) (DA 205/2002, as modified), with operations approved to be complete by 2020.

Additional coal resources have been identified within a previously rehabilitated area adjacent to Open Cut 1. While this area is within the development consent boundary, a modification to the existing development consent is required to modify the conceptual mine plan to allow mining of these additional resources, as well as extending the approved mine life and modifying the conceptual final landform (the modification).

The modification would maximise the recovery of coal resources within ML 1562, ML 1304 and CCL 713 and would enable the recovery of approximately 4.2 million tonnes (Mt) of additional coal resources.

In summary the modification involves:

- extension of open cut mining operations in Open Cut 1;
- extension of the mine life, with operations to cease by the end of 2025;
- changes to the conceptual final landform within the modification area; and
- overburden emplacement in both Open Cut 1 and Open Cut 2, so as to achieve the conceptual final landform.

As the modification involves mining of a previously disturbed area that was used as an overburden dump, there would be no direct impact to previously undisturbed land.

No changes are proposed to the currently approved maximum production rate of 2 Mtpa, mining methods, coal processing, blasting methods, water management, waste management and handling, coal transport, access to site, employee numbers, hazardous substances and dangerous goods management and environmental management.

3 ECONOMIC ASSESSMENT METHODS

3.1 Introduction

The economic methods used to assess the modification and its impacts (as summarised in the SEE) are outlined below.

3.2 Cost Benefit Analysis

3.2.1 Background

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

CBA has its theoretical underpinnings in neoclassical welfare economics. CBA applications in NSW are guided by these theoretical foundations as well as NSW Treasury (2007). CBA applications within the NSW Environmental Impact Assessment (EIA) framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals*.

CBA is concerned with a single objective of the EP&A Act and governments, i.e. economic efficiency. It provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These benefits and costs are defined and valued based on the microeconomic underpinnings of CBA. In particular, 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), a project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

3.2.2 Definition of Society

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

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

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

With respect to the application of CBA in relation to coal mining and coal seam gas proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW.

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

3.2.3 Definition of the Project Scope

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

Coal is an intermediate goods i.e. are inputs to other production processes such as electricity generation. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects (NSW Treasury, 2007). The scope of the modification assessed in this report is summarised in Section 2.

3.2.4 Net Production Benefits

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

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

Net production benefits can be estimated based on market data on the projected financial[4] value of the resource less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of the proponent. This is normally based on commercial-in-confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

3.2.5 Environmental, Social and Cultural Impacts

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

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

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

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

Impacts in the first and second category can potentially be valued in monetary terms using benefit transfer or, subject to available resources, primary non-market valuation methods. Benefit transfer

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

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

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

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

The principle of proportionality also applies to CBA, and so the scope of Economic Assessment will need to be tailored to reflect the scale of a project. In this case, the modification is of a minor scale and hence the Economic Assessment reflects this.

3.2.6 Consideration of Net Social Benefits

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

Even when no quantitative valuation is undertaken of the environmental, social and cultural impacts of a project, the threshold value approach can be utilised to inform the decision-maker of the economic efficiency trade-offs. The estimated net production benefits of a project provides the threshold value that the non-quantified environmental, social and cultural impacts of a project (based on the assessments in the SEE), 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[5] can also be considered using the threshold value approach. The costs of these unquantified environmental, cultural and social impacts would need to be valued by society at greater than the quantified net social benefit of a project to make it questionable from an economic efficiency perspective.

3.2.7 Consideration of the Distribution of Costs and Benefits

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

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

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

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

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

3.2.8 Consideration of other Objectives of Government

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

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

3.2.9 Key steps in Cost Benefit Analysis

The key steps in CBA are summarised in Box 1.

Box 1: Key steps in a CBA
Step 1: Establish the base case against which to assess the potential economic, social and environmental impacts of changes due to the project.
Step 2: Define the project including all significant inputs required to achieve the project's objectives.
Step 3: Quantify the changes from the base case resulting from the project. This will focus on the incremental changes to a range of factors (for example, environmental, economic, social) resulting from the project.
Step 4: Estimate the monetary value of these changes and aggregate these values in a consistent manner to assess the outcomes. Where market prices exist, they are a starting point for valuations of both outputs and of inputs used for production. For non-market goods, as for many environmental impacts and some social impacts, the aim is to value them as they would be valued in money terms by the individuals who experience them.
Step 5: Estimate the Net Present Value (NPV) of the project's future net benefits, using an appropriate discount rate.
Step 6: Undertake sensitivity analysis on the key range of variables, particularly given the uncertainties related to specific benefits and costs.
Step 7: Assess the distribution of costs and benefits across different groups.
Step 8: Report CBA results, including all major unquantified impacts so the appraisal addresses and incorporates all material relevant to the decision maker**.**

Source: NSW Government (2015)

Section 4 reports on the CBA of the modification based on the financial, technical and environmental advice provided by MCC and its' specialist consultants.

3.3 Local Effects Analysis

3.3.1 Introduction

LEA aims to address the consequences of the proposal in its "locality" as required by Section 79C of the EP&A Act. It is intended to complement CBA by translating effects at the NSW level to impacts on the communities located near the project site. It also provides additional information to describe changes that are anticipated within a locality, such as employment changes. LEA is intended to inform the scale of change rather than being representative of costs and benefits to the local community.

For the purpose of a LEA the locality is defined as the Statistical Area Level 3[6] (SA3) that contains the proposed project. The relevant population group is defined as those people ordinarily resident in the locality at the time of the proposal.

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

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

3.3.2 Direct Effects Relating to Local Employment

The *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government 2015) identifies that only employment of people ordinarily resident in the region at the time of the proposal be included in the initial estimation of direct local employment increases.[7]

[6] In this case the Singleton, Muswellbrook and Upper Hunter LGAs have been chosen to represent the locality.

The guidelines assume that these people would otherwise be employed in the region and so the increased disposable wages for the region as a result of a project is the difference between the average net income of these people in the mining industry and the average net income in other industries.[8]

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

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

- existing local residents employed by a project are already employed in the region i.e. they are not unemployed or coming from new participants in the labour force;
- jobs vacancies in the region created by those filling the positions in a project remain unfilled for the duration of the project i.e. it essentially assumes that the regional economy and the wider Australian economy is at full employment. Refer to Attachment 3 for a discussion of the trickle-down effect and a comparison to input-output (IO) analysis.

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

3.3.3 Estimating Effects Related to Non-labour Project Expenditure

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

3.3.4 Second Round/Flow-on Effects

The Guidelines (NSW Government 2015) identify that flow-on effects can also be extremely important for local communities and should therefore also be considered either qualitatively or using techniques such as IO analysis and for larger projects computable general equilibrium (CGE) modelling, provided the assumptions and limitations of the methods are identified. A comparison of IO analysis and CGE modelling is provided in Attachment 4. These methods use a different approach for estimating the direct employment and income effects of a project compared to the approach in the NSW Government (2015) Guidelines.

3.3.5 Effects on Other Local Industries

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

- displacement of other land uses, where the project uses land that would otherwise be used for other purposes;
- where the project affects choices of external parties, particularly tourism and business travel; and

[7] Employment filled by those migrating into a region to live are excluded as are jobs filled by those who reside outside the region.
[8] Wages paid to those migrating into a region to live are excluded as a wages benefit to the region.

- where the project creates temporary effects on other industries that cause short run market adjustments in the cost of living for local residents, particularly food and housing markets.

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

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

3.3.7 Input-output Analysis

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

IO analysis essentially involves two steps:

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

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

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

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

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

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

Gross regional output is a measure of total revenue or turnover. All costs of production would need to be subtracted from total turnover to make it approximate the measure of producer surplus. Value-

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

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

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

4 COST BENEFIT ANALYSIS OF THE MODIFICATION

4.1 Introduction

This section reports on a CBA of the modification based on financial, technical and environmental advice provided by MCC and its specialist consultants.

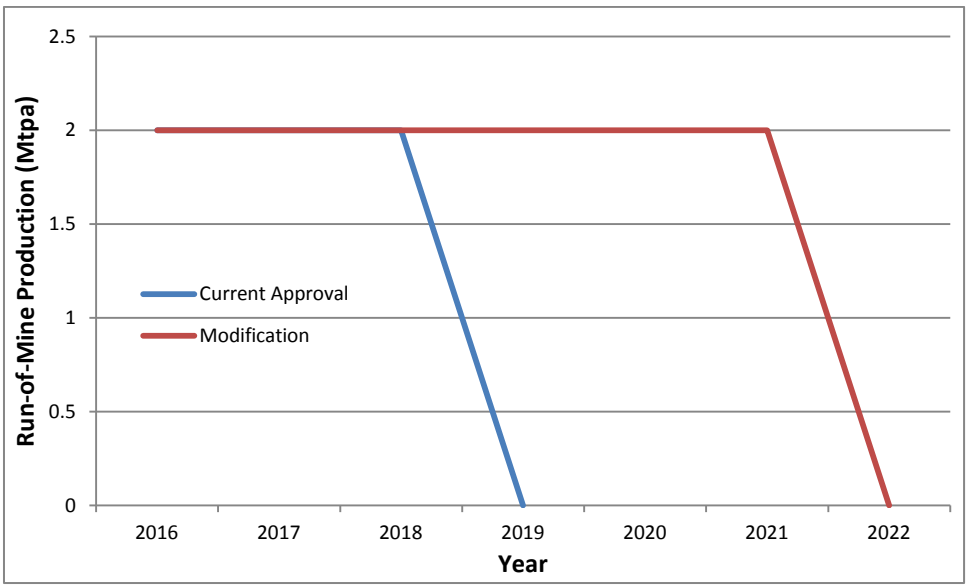
4.2 Identification of the Base Case and the Project

Identification of the “base case” or “without” modification scenario is required in order to facilitate the identification and estimation of the incremental economic benefits and costs of the modification.

Under its current approval (the base case), MCC would mine up to 2 Mtpa of Run-of-Mine (ROM) coal until the end of 2018, with subsequent decommissioning and rehabilitation of the infrastructure area until 2020. With the modification, mining of up to 2 Mtpa of ROM would continue until the end of 2022 with completion of rehabilitation activities by 2025.

An indicative comparison of the maximum production profile "with" and "without" the modification is provided in Figure 4.1[9].

Figure 4.1 - Indicative Maximum Production Schedule With and Without the Modification



[9] For the purpose of the Economic Assessment, 2022 has been nominated as the year for cessation of coal extraction based on the optimal conceptual mine plan. However, the exact timing of mining activities will be dependent on operational requirements as the mine progresses. As such approval is sought to 2025 to allow sufficient time for mining activities to be completed as well as the required rehabilitation works.

4.3 Identification of Benefits and Costs

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

Table 4.1 – Potential Incremental Economic Benefits and Costs of the Modification

Category	Costs	Benefits
Net production benefits	Opportunity costs of capital equipment Opportunity cost of land[1] Development costs including labour, capital equipment and acquisition costs for impacted properties and biodiversity offsets[1] Operating costs of mining including labour and mitigation, offsetting and compensation measures Decommissioning and rehabilitation costs	Avoided decommissioning and rehabilitation costs Value of coal Residual value of capital and land
Potential environmental, social and cultural impacts of extraction, processing and transport to customers after mitigation, offsetting and compensation	Agricultural production Noise impacts Blasting impacts Air quality impacts Greenhouse gas impacts Surface water impacts Groundwater impacts Ecological impacts Road transport impacts Aboriginal heritage impacts Historic heritage impacts Visual impacts Net public infrastructure costs Loss of surplus to other industries	Wage benefits to employment Non-market benefits of employment Economic benefits to existing landholders Economic benefits to suppliers

[1] The value of foregone agricultural production is included in the value of land.

Framed in another but equivalent way the potential incremental costs and benefits of the modification are as follows.

Table 4.2 – Alternative Frame of Potential Economic Benefits and Costs of the Modification

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

It should be noted that the potential environmental, social and impacts listed in Table 4.1 and 4.2 are only economic costs to the extent that they affect individual and community well-being through direct use of resources by individuals or non-use. If the potential impacts do not occur or are mitigated, compensated or offset to the extent where community wellbeing is insignificantly affected (i.e. costs are borne by the proponent), then no environmental, social or cultural economic costs should be included in the modification CBA apart from the mitigation, compensation or offsetting costs.

4.4 Quantification/Valuation of Benefits and Costs

Consistent with NSW Government (2015) and NSW Treasury (2007) the analysis was undertaken in 2016 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%.

The analysis period is ten years (2016 to 2025), coinciding with the time till the end of the modification life (including post mining rehabilitation). 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.

An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[10] and incorporate them into an estimate of the net social benefit of the modification. This estimated net social benefit of the modification provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the modification questionable from an economic efficiency perspective.

4.4.1 Benefits[11]

Net Production Benefits

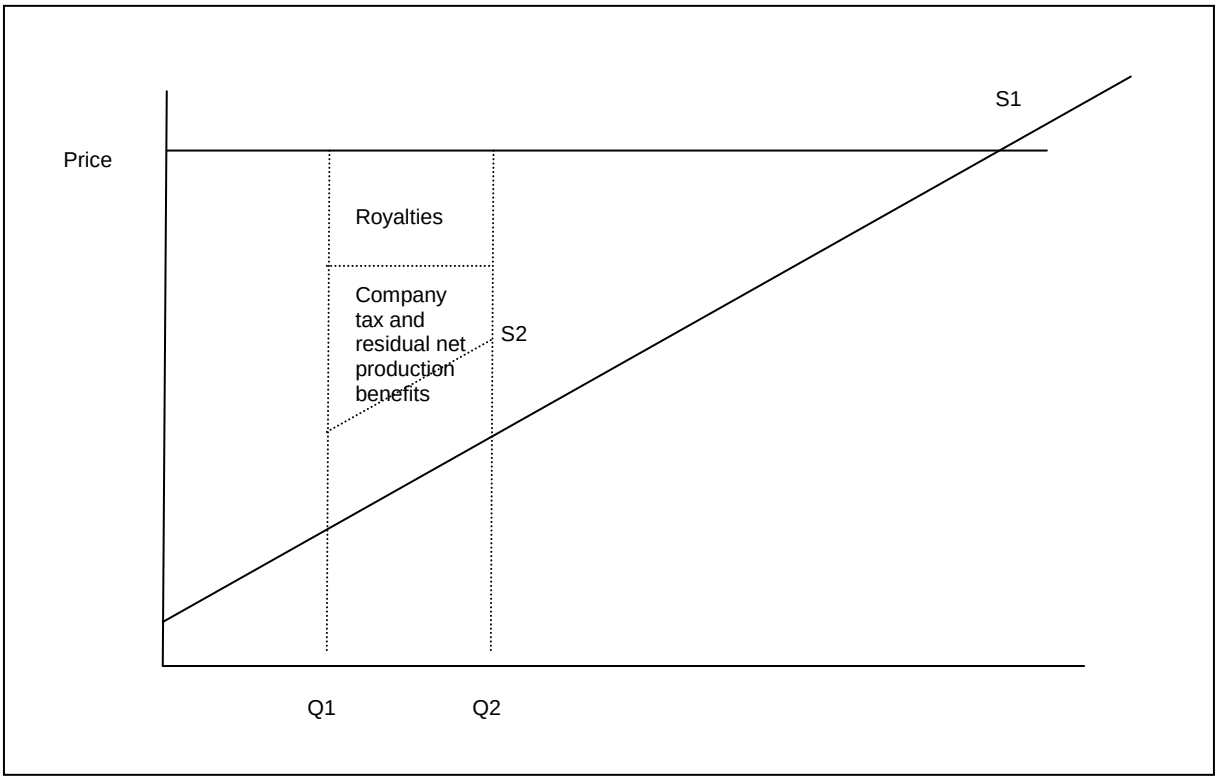
By combining resources in ways that increase their value to society, mining projects create a net production benefit (a producer surplus). This net production benefit can be estimated based on market data on the projected financial[12] value of the resource less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies.

Net production benefits can be generally thought of as comprising royalties, company tax and net profits. Where a project is foreign owned it is the royalties and company tax that accrue to Australia that comprise the net production benefits of the project. From a NSW perspective, the main net production benefit is the royalties generated. Increases in the capital and operating costs of a project to mitigate, compensate or offset environmental, social and cultural impacts will reduce the company tax component (and net profit component) of the net production benefits of a project but have no impact on the royalties component, since royalties are levied on revenue rather than profit.

Refer to Figure 4.1 for a stylised representation of net production benefits of a project producing Q1 to Q2 in coal where supply costs increase from S1 to S2.

[10] Benefit transfer refers to borrowing economic values that have been determined for other study sites.
[11] All values reported in this section are undiscounted Australian dollars unless otherwise specified.
[12] In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the resource.

Figure 4.2 - Net Production Benefits of a Project Under Increasing Costs



The modification will result in incremental ROM coal and product coal production in the order of 4.2 million tonnes (mt) and 3.9 mt, respectively. Based on a consensus price of between AUD80/t and AUD83/t in the years 2019 to 2021 and an effective royalty rate (after consideration of beneficiation and other deductions) of 7.83% of gross revenue, the modification will generate total royalties of $25M. Using a 7% discount rate the present value of royalties from the modification are estimated at $18M. This is a minimum estimate of the net production benefits of the modification to NSW[13] and provides a minimum threshold value against which the environmental, social and cultural costs of the modification, after mitigation, offsetting and compensation, can be compared.

Market Benefits to Workers

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project.

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

Some indication of the potential magnitude of these benefits can be gained by making a number of assumptions. Following the approach of Streeting and Hamilton (1991), if it were assumed that 50% of

[13] It is a minimum estimate since net production benefits to NSW also includes a proportion of company tax that accrues to Australia. No estimate of company tax was made.

the direct and contractor workforce of the modification[14] (which currently comprises 75 FTE and 38 contractors totalling 113 jobs) would otherwise be unemployed for three years and that the reservation wage for these people was $52,440[15] compared to a mine wage of $135,000 then the market employment benefit in terms of income would be $10 M present value, at a 7% discount rate. Values at alternate discount rates and percentages of unemployed are provided in the following table.

Table 4.3 - Potential Economic Benefits to Workers Under Alternative Assumptions

	Discount Rate		
% UE for 3 years	**4%**	**7%**	**10%**
50%	$11.5	$10.0	$8.7
25%	$5.7	$5.0	$4.3
75%	$17.2	$15.0	$13.0
Wage premium benefit	$28.7	$25.0	$21.8

If alternatively the economic benefit to workers is taken as the difference between the median wage in the region[16] $31,741 (ABS 2016) and the wage in the modification i.e. $135,000 pa, over the life of the modification, then the potential economic benefit to workers would be $25 M, present value at 7% discount rate. These calculations exclude any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

The likelihood of wage benefits from the modification are enhanced by the closure of a number of mines in the Hunter Region and hence the reduced likelihood of current labour at the MCM obtaining alternative mining employment without the modification. The unemployment rate for the locality has escalated from 3% in September 2012 to 9% in December 2015 (Department of Employment 2015) with unemployment in the mining sector even higher (The Minerals Institute 2015).

Non-market Value of Employment

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

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

[14] All sourced from NSW.
[15] As estimated by the unemployment benefits plus income tax payable on a mine wage, following the reservation wage rate approach used by Streeting and Hamilton (1991).
[16] ABS does not publish data on average wages by industry sector and therefore it is not possible to estimate the average wage of those not in the mining industry.

The modification will provide employment for the approximately 113 employees and contractors for a period of three years. Using benefit transfer from the more conservative Bulli Seam Operation study and applying the employment value to the estimated incremental direct employees of the modification[17] gives an estimated $6M for the non-market employment benefits of the modification to NSW households.

In the context of a fully employed economy there may be some contention about the inclusion of this value. While the economy could not be considered to be at full employment, conservatively the results are reported "with" and "without" employment benefits.

Economic Benefits to Existing Landholders

Land required for the modification is already owned by the proponent and has been for some time. Therefore there is no economic benefit to existing landholders from payments for the purchase of land that exceed the opportunity cost of the land.

Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. This is because in a competitive market, all resources are assumed to be fully employed, and so increases in the production of goods and services required as inputs to the project will withdraw labour and raw materials from other industries. The net benefits (surpluses) to suppliers to the modification will be offset by decreases in net benefits in other industries and so there is no net secondary benefit to the economy as a whole.

For CBA undertaken at a sub-national perspective some secondary benefits to suppliers may accrue if net benefits that accrue to firms within say NSW are offset by a reduction in economic activity outside NSW. However, no economic benefits to suppliers are included in this analysis.

4.4.2 Environmental, Social and Cultural Costs

Introduction

The consideration of environmental, social and cultural impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts. The environmental impact assessment process results in (nonmonetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts. When environmental, social and cultural impacts are mitigated, offset or compensated to the extent where community wellbeing is insignificantly affected (i.e. costs are borne by the proponent), then no environmental, social or cultural economic costs should be included in the modification CBA apart from the mitigation, compensation or offset costs.

Greenhouse Gas

The maximum estimated annual average greenhouse emissions for the modification is 0.015 Mt CO2-e (Scope 1 and 2).[18]

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. Three shadow prices were used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US EPA Social Cost of Carbon. Under these shadow prices the present value of greenhouse gas emission cost is between $0.6M and $2.1M

[17] This is consistent with the non-market valuation studies which focused on direct employees.
[18] Other Scope 3 emissions associated with the shipping and use of coal are beyond the scope of a CBA of a mining project.

dollars, present value. This is a global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the Guidelines (NSW Government 2015), the focus of this CBA of mining projects is on costs and benefits to the population of NSW. In the absence of any studies that have focused on the social damage cost of carbon emissions to NSW residents, some means of apportioning global damage costs borne by Australians is required. For the purpose of the economic assessment this has been undertaken using Australia's share of global GDP (around 1%) and NSWs share of the Australian population (32%).

On this basis the present value of the cost of greenhouse gas emissions from the modification is estimated at between $1,900 and $6,700 dollars, present value. This is not offset, mitigated or compensated for and needs to be compared to the estimated net production benefits of the modification.

Noise Impacts

Noise emissions are predicted to be substantially the same at assessment locations for which noise limits currently apply under Development Consent No. DA 205/2002. Noise levels are predicted to only marginally exceed the current development consent limit by 1 dB at R13 and R16 and 2 dB at assessment locations R7 and R15. Exceedances by 1dB are imperceptible.

A moderate noise impact (3-5 dB above the PSNLs) is predicted at six assessment locations. The modification therefore gives rise to management liabilities in accordance with the Voluntary Land Acquisition and Mitigation Policy (NSW Government 2014). These noise management liabilities would form part of the capital and operating costs of the modification. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable (part of which would accrue to NSW) and the net producer surplus accruing to the proponent.

Air quality

Air quality impacts have been assessed using conservative dust emission estimation and dispersion modelling for a representative conceptual mine plan year (Year 1).

The modification is predicted to result in exceedances of the 24-hour average PM_{10} criterion at a single assessment location (R25) to the north of MCM. The contemporaneous assessment of cumulative impacts has predicted impacts at two assessment locations, R24 and R25, on two to three additional days which correspond to days where background levels are already elevated.

Existing blast fume management practices are expected to be adequate for continued operations under the modification.

A comprehensive air quality management system, including an extensive monitoring network, is currently in place at MCM which incorporates best practices for the control of dust emissions from coal mines. Relocation of an existing monitor to the north of MCM (near R25) and installation of a new monitor to the south-southeast of MCM are proposed to supplement the existing air quality monitoring network.

Any air quality management costs would form part of the capital and operating costs of the modification. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable (part of which would accrue to NSW) and the net producer surplus accruing to the proponent.

Surface water

No changes to the currently approved water management system are proposed with the exception of minor alterations to the catchment areas of Open Cut 1, Open Cut 2 and Dams 1 and 2.

No additional disturbance is proposed beyond the current approved disturbance boundary and all other activities would continue to be undertaken in accordance with the existing approvals.

Mining would continue to be undertaken in accordance with the relevant management plans. No changes are proposed to the surface water monitoring program currently implemented. With the environmental management, mitigation and monitoring programs identified in the monitoring and management plans, no impact to local surface water resources is anticipated as part of the modification.

Nevertheless, from an economic perspective any existing WALs would need to be held for an additional three years. This is an opportunity cost to MCC that would form part of the capital and operating costs of the modification. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable (part of which would accrue to NSW) and the net producer surplus accruing to the proponent.

Groundwater

The modification would result in changes to the catchment areas of Open Cut 1, Open Cut Pit and Dams 1 and 2.

Groundwater inflows to MCM under the modification are expected to be in the range of previous predictions for approved operations. At the completion of mining and rehabilitation, final voids are expected to remain as evaporative sinks. Therefore, no adverse impacts to the groundwater quality are expected. Final void water levels would be higher than the approved final void water levels as a result of additional overburden emplacement in the Open Cut 1 and 2 voids. However, adequate freeboard would remain in the voids to prevent spills from the voids.

No significant changes would occur to the existing water management system on the site as a result of the modification. The SWMP would continue to be utilised and maintained throughout the continuation of mining.

Nevertheless, from an economic perspective current groundwater WALs would need to be held for an additional three years. This is an opportunity cost to MCC that would form part of the capital and operating costs of the modification. In the minimum threshold value framework adopted in this analysis, these costs would not be subtracted from the estimate of royalties but would reduce the unquantified level of company tax payable (part of which would accrue to NSW) and the net producer surplus accruing to the proponent.

Ecology

The modification is located within a rehabilitated area of MCM. The modification would remove a maximum of 45.2 ha of low condition, rehabilitated woodland and exotic pasture. This vegetation is in poor condition with a sparse, stunted canopy of non-endemic species or species not characteristic of adjacent remnant vegetation. There is a negligible shrub layer within the study area and groundcover of woodland and pasture areas. Fauna habitat is limited in the study area, and no significant habitat features are present.

While the modification would disturb an area of partially completed rehabilitation, the modification area would be progressively rehabilitated following mining in accordance with the MOP.

The ecological assessment concludes that the modification is unlikely to significantly impact biodiversity values. Provided the modification does not significantly impact biodiversity values then there are unlikely to be any material economic costs for inclusion in the threshold value framework.

Traffic and Transport

The modification would not result in changes to the approved volumes of coal produced or transported from MCM. The traffic and transport assessment has not identified any material economic effects for inclusion in the CBA.

Indigenous and non-Indigenous heritage

The modification involves the extension of mining in Open Cut 1 into a partially rehabilitated area formerly used an overburden emplacement area. This area has been extensively disturbed as part of historical mining operations. Accordingly, no impacts to Indigenous or non-Indigenous heritage are predicted and there are no material impacts for inclusion in the CBA.

Visual Impacts

The modification would have a negligible incremental visual impact on people living in, and travelling through, the area around MCM over and above currently approved operations, with existing views from receptor locations remaining substantially the same. This is primarily due to the following:

- existing vegetation and topography shield the view from receptors to the north and east, and many to the south and west in the township of Muswellbrook;
- the modification involves progression of Open Cut 1 into a previously mined area. Parts of Open Cut 1 are currently visible from the south of MCM, along the New England Highway to the north-west, and from areas to the west of Muswellbrook. The modification would prolong these views by up to five years;
- views of MCM that are possible from receptor locations are distant (generally greater than 3 km away). This distance also means that views are likely to be influenced by atmospheric conditions which may further reduce visibility; and
- no change is proposed to the maximum height of the final landform to that currently approved.

Any prolonging of visual impact on people living in, and travelling through, the area may have some economic costs. These remain unquantified in the analysis and in threshold value framework would need to be subtracted from the estimate of royalties.

Agricultural Impacts

Rehabilitated land classed as LSC Class 6 would be temporarily removed during the term of mining in the modification area. This would not result in long term impacts as the land would be rehabilitated to the same LSC class following completion of mining. This land has very limited agricultural capability.

Net Infrastructure

No net infrastructure impacts have been identified for inclusion in the CBA.

4.5 Net Social Benefits of the Project to NSW

The modification is estimated to have minimum net production benefits (royalties) of $18 M to NSW. In addition, there may be unquantified company tax benefits to NSW and potentially wage benefits of employment of $10 M and nonmarket benefits of employment of in the order of $6 M.

Conservatively, the estimated minimum net production benefits of $18 M (i.e. ignoring the potential employment benefits) can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the modification, after mitigation, may be assessed. This threshold value is the opportunity cost to NSW of not proceeding with the modification. The threshold value indicates the price that the NSW community must value any residual environmental impacts of the modification (be willing to pay) to justify in economic efficiency terms the no development option.

For the modification to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the modification, to NSW[19], after mitigation, offset and compensation, would need to be valued by the NSW community at greater than the estimate of the minimum net production benefits (i.e. greater than $18 M).

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to quantitatively consider the potential residual impacts of the modification that are not already mitigated, compensated or offset. No material impacts are considered likely in relation to ecology, transport and traffic, public infrastructure, and indigenous and non-Indigenous heritage. Noise impacts, air quality, surface water impacts and groundwater impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the modification. These costs would have no impact on the estimated minimum threshold value of the modification. Only impacts from greenhouse gas emissions and prolonged visual impacts would remain unmitigated and would need to be balanced against the minimum threshold value. Greenhouse gas impacts are estimated at in the order of between $1,900 and $6,700, present value, which is considerably less than the estimated minimum net production benefits to NSW. Visual impacts remain unquantified but are not considered likely to be material from an CBA perspective.

Consequently, the modification is estimated to have net social benefits to NSW of a minimum of $18 M and hence is desirable and justified from an economic efficiency perspective.

Any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $18 M for the modification to be questionable from an NSW economic perspective.

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

4.6 Distribution of Costs and Benefits

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

The minimum net production benefit of the modification (royalties) accrue to the NSW Government and are subsequently used to fund provision of government infrastructure and services across the State, including the local and regional area.

As identified above, no material impacts are considered likely in relation to relation to ecology, transport and traffic, public infrastructure, and indigenous and non-Indigenous heritage. Surface water and groundwater impacts will occur at the local level but will be internalised into the production costs of MCC through the holding of WALs for a longer period of time. Noise impacts and air quality impacts would initially accrue to members of the local community who own or rent residences that are adversely impacted but would be mitigated by management actions of the proponent.

Prolonging of visual impacts from the mine would impact adjoining residences and those travelling along roads with views of the modification area.

Greenhouse gas impacts from the modification will occur at the local, NSW, national and global level.

Wage benefits of the project accrue at the local level to employees and contractors whose employment is prolonged. Nonmarket benefits associated with employment provided would accrue to households of NSW[20] to who value knowing that the employment of others is secure.

4.7 Sensitivity Analysis

The minimum threshold value approach used in this analysis is based on annual production of 1.5 mt, 1.0 mt and 1.4 mt in the years 2019 to 2021, respectively, and thermal coal prices in these years of AUD79.9/t, AUD83.2/t and AUD82.0/t.

There is uncertainty around production levels and coal prices during the life of the modification. 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 net present value.

In this analysis, as shown in **Table 4.3** the estimated minimum threshold value of the modification was tested for changes to the following variables at a 4%, 7% and 10% discount rate for:

- a 30% decrease in annual product coal production;
- an increase to maximum coal production; and
- a 30% increase or decrease in coal price.

[20] It should be noted that the study from which the employment values were transferred, surveyed NSW households only.

Table 4.4 - Minimum Threshold Value Sensitivity Testing (Net Present Value $M)

Parameter	4%	7%	10%
Core Result	$20	$18	$16
Decrease 30% production	$14	$12	$11
Max production	$21	$18	$16
30% price decrease	$14	$12	$11
30% price increase	$27	$23	$20

What this analysis indicates is that the minimum threshold value is sensitive to a change in production levels or price. A 30% decrease in production or price would reduce the minimum threshold value to $12 M. An increase in coal prices by 30% would increase the modification minimum threshold value to $23 M.

5 LOCAL EFFECTS ANALYSIS

5.1 Introduction

The CBA in Section 3 is concerned with whether the incremental benefits of the modification exceed the incremental costs and therefore whether the NSW community would, in aggregate, be better off 'with' the modification compared to 'without' it. This section and Section 6 examines local effects using two different methods.

The Local Area is defined as the LGAs of Singleton, Muswellbrook and Upper Hunter, within which the modification is located and most employees and contractors reside.

5.2 Direct Effects Related to Employment

The modification will provide continuing employment for approximately 113 people, 75 direct employees and 38 contractors. 88% of employees and 71% of contractors are expected to reside in the region, with the remainder residing elsewhere in NSW.

Assuming that those residing in the region would otherwise be employed in other industries in the region, the incremental disposable wages accruing to the region is $6.3M per annum. This is equivalent to 65 FTE jobs in the coal mining sector.

If these people would otherwise be unemployed, the incremental disposable wages in the region is $7.7M per annum. This is equivalent to 79 FTE jobs in the coal mining sector.

Table 5.1 - Analysis of Net Income Increase and FTE Job Increase

	Otherwise Employed	Otherwise Unemployed
	Ordinarily reside in the locality	**Ordinarily reside in the locality**
a) Direct employment during operations phase	93	93
b) Average net income in mining sectors	$96,994	$96,994
c) Average net income in other industries*	$29,168	$14,607
d) Average increase in net income per job (b-c)	$67,825	$82,387
e) Increase in net income per year due to direct employment	$6,306,414	$7,660,343
f) FTE (e/b)	65	79

*This information is not available from the ABS and hence average income across all sectors is used.

5.3 Direct Effects Related to Non-labour Expenditure

The total annual non-labour expenditure (after subtraction of wages to employees and contractors) during the modification is estimated at in the order of $72M, per annum.

However, not all of this expenditure will accrue to the local area. From the location quotient analysis and allocation of margins and taxes undertaken for Section 6, $19M of non-labour expenditure is estimated to accrue to the local area.

5.4 Second Round and Flow-on Effects

The incremental expenditure by employees and non-labour expenditure that is captured by the local area provides flow-on economic activity to the local economy, which can be estimated in terms of economic activity indicators of output, value-added, income and employment. Section 6 provides a full assessment of flow-on effects arising from both labour expenditure and non-labour expenditure. From this analysis the Type 11A employment and income multiplier for incremental impacts is 2.73 and 1.77, respectively. Applying these multipliers to the direct net employment and net income effects calculated above in accordance with the Guidelines (NSW Government 2015) results in the

modification contributing between $11M and $14M per annum in total local income and between 178 and 216 local jobs.

While net non-labour expenditure would also provide flow-on effects there is no "expenditure multiplier". Its effects, on employment and income are identified above. Its effects in terms of output and value-added would need to be estimated using IO analysis or similar - refer to Section 6.

Table 5.2 - Annual Flow-on Effects Associated with Net Direct Employment and Income

	Direct	Flow-on	Total
Otherwise employed			
Employment	65	112	178
Net income (M)	$6.31	$4.86	$11.16
Otherwise unemployed			
Employment	79	137	216
Net income (M)	$7.66	$5.90	$13.56
Net non-labour expenditure (M)	**$18.9**		

5.5 Effects on Other Industries

5.5.1 Regional Economic Impacts of Displaced Agriculture

The modification will temporarily utilise rehabilitated land classed as LSC Class 6. This land has very limited agricultural capability irrespective of the modification. The approved and proposed final land use would both have an LSC class of 6. Consequently, agricultural impacts of the modification are expected to be negligible.

5.5.2 Wage Impacts

In the short-run, increased regional demand for labour for approximately three years as a result of the modification project (relative to the situation of no modification) could potentially result in some increases pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the region and the availability and mobility of labour from outside the region. The incremental direct employment and income impacts of the modification, as estimated in Section 6 (contractors included in flow-ons), will contribute in the order of 0.3% and 0.5% of direct regional employment and direct regional wages, respectively. The contribution is similar using the approach above in the LEA. The main employment sectors in the regional economy have on average 28% of their labour residing outside the region, reflecting the mobility of labour. Unemployment in the region was at 2,607 people or 9% in September 2015 (Department of Employment, 2015) with unemployment in the mining sector even higher (The Minerals Institute 2015). Wage impacts are therefore 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 attract skilled labour to the region leading to downward pressure on wages.

5.5.3 Housing Impacts

The modification is a continuation of an existing mine. Existing employees and contractors will not result in any additional demand for housing or community infrastructure.

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

The main externalities that potentially accrue to the local area are summarised in Table 5.3.

Table 5.3 - Environmental and Social Impacts on the Local Community

Environmental, social and cultural costs	Incidence of Impacts	Magnitude of Impact
Greenhouse gas impacts	Local and NSW households	No material impacts
Agricultural impacts	MCC	No material impacts - LSC Class 6 land impacted
Noise impacts	Adjoining landholders	Six landholders moderately impacted - management measures implemented to minimise impacts
Blasting	Adjoining landholders	No properties impacted by exceedances
Air quality impacts	Adjoining landholders	Two landholder impacted cumulatively on two to three days - additional monitors installed to manage impacts
Surface water	MCC	WALs already in MCC ownership and would be held for a longer period of time
Groundwater	MCC	WALs already in MCC ownership and would be held for a longer period of time
Ecology	Local and NSW households who value the revegetation	Impacts on biodiversity values unlikely to be significant
Road transport impacts	Local residents	No impacts identified
Indigenous and non-Indigenous heritage	Aboriginal people and other local and NSW households who value heritage	No impacts identified
Visual impacts	Adjoining landholders and people travelling through	Unlikely to be significant
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the modification	No material impacts

5.7 Summary of Local Effects

A summary of local effects of the modification is provided in Table 5.4.

Table 5.4 - Summary of Local Effects

	Project Direct	Project Direct: Local	Net Effect	Total Net Effect
Employment related				
Assuming otherwise employed				
Employment (FTE)	113	93	65	178
Disposable income ($M per annum)	$10.9	$9.0	$6.3	$11.2
Assuming otherwise unemployed				
Employment (FTE)	113	93	79	216
Disposable income ($M per annum)	$10.9	$9.0	$7.7	$13.6
Other non-labour expenditure ($M)	$18.9			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	Not applicable			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**		
Greenhouse gas impacts	Local and NSW households	No material impacts		
Agricultural impacts	MCC	No material impacts - LSC Class 6 land impacted		
Noise impacts	Adjoining landholders	Six landholders moderately impacted - management measures implemented to minimise impacts		
Blasting	Adjoining landholders	No properties impacted by exceedances		
Air quality impacts	Adjoining landholders	Two landholder impacted cumulatively on two to three days - additional monitors installed to manage impacts		
Surface water	MCC	WALs already in MCC ownership and would be held for a longer period of time		
Groundwater	MCC	WALs already in MCC ownership and would be held for a longer period of time		
Ecology	Local and NSW households who value the revegetation	Impacts on biodiversity values unlikely to be significant		
Road transport impacts	Local residents	No impacts identified		
Indigenous and non-Indigenous heritage	Aboriginal people and other local and NSW households who value heritage	No impacts identified		
Visual impacts	Adjoining landholders and people travelling through	Unlikely to be significant		
Net public infrastructure costs	NSW Government and NSW households	No material impacts		
Loss of surplus to other industries	Local industries adversely impacted by the modification	No material impacts		

6 SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 Introduction

This section uses IO analysis to identify the gross economic activity footprint associated with the modification on the local economy.

6.2 Economic Impact Assessment

The modification will directly provide annual output of in the order of $120M, annual value-added of $41M, annual income (wages) of approximately $9M and employment (employees) of 75.

Flow-on economic activity will also arise from:

- Production expenditure in the course of the operation of mine (production-induced effects); and
- Expenditure of employees (consumption-induced effects).

The level of this flow-on effect will depend on:

- The expenditure pattern of the modification and the ability of a region to manufacture and provide the goods and services required by the modification; and
- The residential location of workers. As identified above, 88% of employees and 71% of contractors reside in the local area.

For the analysis of the local impact of the modification, a new modification sector was inserted into a 2011 regional IO table reflecting annual production levels and expenditure. The average annual revenue, operating costs and gross profit for the new sector was obtained from financial information provided by MCC. For this new sector:

- the estimated gross annual revenue from the region was allocated to the *Output* row;
- the estimated wage bill of employees residing in the region was allocated to the *household wages* row (88% live in the region) with the remainder allocated to a secondary household wages row that does not get incorporated into flow-on effects;
- non-wage expenditure was initially allocated across the relevant *intermediate sectors* in the economy, *imports* and *other value-added* based on expenditure information from MCC;
- allocation adjustment was then made between *intermediate sectors* in the regional economy and *imports* based on regional location quotients;
- purchase prices for expenditure in the each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the National Input-Output Tables;
- gross profit and depreciation were allocated to the *other value-added* row*;*
- direct employment by the modification was allocated to the *employment* row.

6.4.2 Economic Activity Impacts

The total and disaggregated annual impacts of the modification on the local economy (in 2016 dollars) are shown in Table 6.1.

Table 6.1 - Economic Impacts of the Modification on the Local Economy ($2016)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	119,686	26,422	9,241	35,663	155,349
Type 11A Ratio	1.00	0.22	0.08	0.30	1.30
VALUE ADDED ($'000)	41,049	11,068	5,104	16,172	57,222
Type 11A Ratio	1.00	0.27	0.12	0.39	1.39
INCOME ($'000)	8,899	5,093	1,777	6,870	15,769
Type 11A Ratio	1.00	0.57	0.20	0.77	1.77
EMPL. (No.)	75	92	37	129	204
Type 11A Ratio	1.00	1.23	0.50	1.73	2.73

*Contractors are included in production-induced flow-ons.

The modification would make up to the following annual incremental contribution to the regional economy for up to three years:

- $155M in annual direct and indirect regional output or business turnover;
- $57M in annual direct and indirect regional value added;
- $16M in annual direct and indirect household income; and
- 204 direct and indirect jobs.

Type 11A ratio multipliers used in the analysis range from 1.30 for output to 2.73 for employment. The high ratio multiplier for employment and income reflect the relatively capital intensive nature of mining projects. Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment and income while at the same time only having a lower level of direct employment and income. This tends to lead to high ratio multipliers for indicators that are related to employment (employment and income).

At the Muswellbrook LGA level flow-on impacts would be less than reported in **Table 6.2** as higher levels of expenditure would leak out the area.

The economic impacts of the modification on the NSW and Australian economy would be larger than they are on regional economies because larger economies are able to capture more of the incremental expenditure and have greater intersectoral linkages.

Economic activity impacts discussed above represent the gross or positive economic activity associated with the modification. Where employed and unemployed labour resources in the region are limited and the mobility of in-migrating or commuting labour from outside the region is restricted there may be competition for regional labour resources that drives up regional wages. In these situations, there may be some 'crowding out' of economic activity in other sectors of the regional economy.

'Crowding out' would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is not at full employment (unemployment is at 9%) and it has access to external labour resources. Consequently, little 'crowding out' of economic activity in other sectors in the region would be expected as a result of the Project. Crowding out would be expected to be greater at the NSW and national levels.

However, even where there is some 'crowding out' of other economic activities this does not indicate losses of jobs but the shifting of labour resources to higher valued economic activities. This reflects the

operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore considered a positive outcome for the economy not a negative.

7 CONCLUSION

The modification is estimated to have minimum net production benefits (royalties) of $18 M to NSW. In addition, there would be unquantified company tax benefits to NSW and potentially market and nonmarket benefits of employment of in the order of $16 M.

The estimated minimum net production benefits of $18 M can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the modification, after mitigation, compensation and offset, may be assessed. For the modification to be questionable from an economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the modification, to NSW, after mitigation, offset and compensation, would need to be valued by the community at greater than $18 M.

In this respect, no material impacts are considered likely in relation to ecology, transport and traffic, public infrastructure, and indigenous and non-Indigenous heritage. Noise impacts, air quality, surface water impacts and groundwater impacts will be mitigated, compensated for or offset, with these costs forming part of the costs of the capital or operating costs of the modification. These costs would have no impact on the estimated minimum threshold value of the modification. Only impacts from greenhouse gas emissions and prolonged visual impacts would remain unmitigated and would need to be balanced against the minimum threshold value. Greenhouse gas impacts are estimated at between $1,900 and $6,700, present value, which is considerably less than the estimated minimum net production benefits to NSW. Visual impacts remain unquantified but are not considered likely to be material from an CBA perspective.

Consequently, the modification is estimated to have net social benefits to NSW of a minimum of $18 M and hence is desirable and justified from an economic efficiency perspective.

Any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $18 M for the modification to be questionable from a NSW economic perspective.

The modification would also provide direct and indirect economic activity to the local, regional, State and National economies for approximately three years. Flow-on economic activity would arise from production expenditure in the course of the operation of the MCM and expenditure of employees who mainly reside within the region.

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ATTACHMENT 1 – LEGISLATIVE CONTEXT FOR ECONOMIC ANALYSIS IN EIA

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

- The basis for economic analysis under the *Environmental Planning and Assessment* (EP&A) *Act 1979* emanates from:
  - the definition of the term "environment" in the EP&A Act which is broad and includes the social and **economic** environment, as well as the biophysical environment;
  - the "objects" of the EP&A Act which includes *"promoting the social and **economic welfare** of the community"*; and
  - Clause 7(1)(f) of Schedule 2 of the EP&A Regulations which requires environmental assessment to provide "*the reasons **justifying** the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, **economic** and social considerations…"*
  - *Section 79C of the EP&A Act requires the following two matters to be taken into consideration by the consent authority in determining a development application:*
    - the public interest (taken as the collective public interest of households in NSW); and
    - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- Objects of promoting economic welfare and requirements to justify a project having regard to economic considerations are consistent with the use of CBA. A Note to Clause 7 (1) (f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- A cost benefit analysis is consistent with the consideration of the public interest, although the limitation of public interest to NSW households requires consideration of the costs and benefits to NSW households, whereas CBA would normally be undertaken at the National level.
- Elements of CBA can provide information on the economic impacts in the locality, although CBA should not be undertaken at the local level. This can be supplemented by other forms of analysis to examine economic impacts in the locality such as the consideration of:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.

Economic Assessment Guidelines

- In 2015 the NSW Government prepared *Guidelines for the economic assessment of mining and coal seam gas proposals*. This provides an outline of how to undertake a CBA and local effects analysis of mining and coal seam gas proposals.
- NSW Treasury (2007) *NSW Government Guideline for Economic Appraisal*, provides guidance for Government agencies on how to undertake CBA of significant spending proposals, including

proposed capital works, projects and new programs across all public sector agencies. However, many of the principles have broader application.

ATTACHMENT 2 – INTRODUCTION TO ECONOMIC METHODS

Cost Benefit Analysis

- Cost Benefit Analysis (CBA) is the primary way that economists evaluate projects and policies.

- CBA evaluates whether the well-being (**economic welfare**) of the community is in aggregate improved by a project. It does this by comparing the costs and benefits of a project to the community.

- The community whose welfare is included is broadly defined as anyone who bears significant costs and benefits of a project. However, in practice most CBA is undertaken at a national level. CBA at a sub-national level is not recommended however if undertaken at this level should provide decision-makers with estimates of all significant effects, including those to non-residents of the sub-national region.

- It is not possible to justify a project on economic grounds without doing a CBA.

Economic Activity Analysis

- Economists also often provide information to decision-makers on the **economic activity** that a project will provide to the regional, state or national economy. This is particularly relevant at the regional level since many regions and towns are experiencing long term decline as a result of structural change in the economy. Additional economic activity can help the prosperity of these regions.

- **Direct** economic activity provided by a project can be estimated from financial and labour estimates for a project. Methods that can be used to estimate **direct** and **indirect** economic activity include IO analysis and CGE modelling. Refer to Attachment 4 for a comparison of these methods and their assumptions.

- While economic activity measures from IO analysis and CGE modelling e.g. direct and indirect output, value-added and income, are generally not measures of benefits and costs relevant to a CBA this information can be of interest to decision-makers[21].

Economic Analysis and Decision-Making

- CBA and local effects analysis (including IO/CGE analysis) are not mechanised decision-making tools, but rather means of analysis that provide useful information to decision-makers.

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

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

ATTACHMENT 3 – 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. However, in IO analysis only the income of employees living in the region are counted as direct income effects since it is only wages expenditure of those living in the region that flows through the regional economy. In IO analysis, if 40% of a projects 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 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 "trickle down" or "job chain" effects are considered.

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

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

The guideline ignores workers who migrate into the region to work - a common outcome in mining regions. 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 to take jobs in a project and who already reside in the region. The entire wage of those migrating into the region is additive to regional income in comparison to wage increments for those already residing in the region.

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

Table 1 - Incremental Income when Immigrating Workforce is Included

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

Even for those already living in the region who are already employed, the incremental income estimated using the guideline 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

"trickle down" effect or "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) or if jobs remain unfilled. In periods of higher unemployment rates, jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new jobs.

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

The guideline does not take account of the "trickle down" 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 "trickle down" 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 Trickle Down 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**

ATTACHMENT 4 – INPUT-OUTPUT ANALYSIS AND COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[22] and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a CBA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.

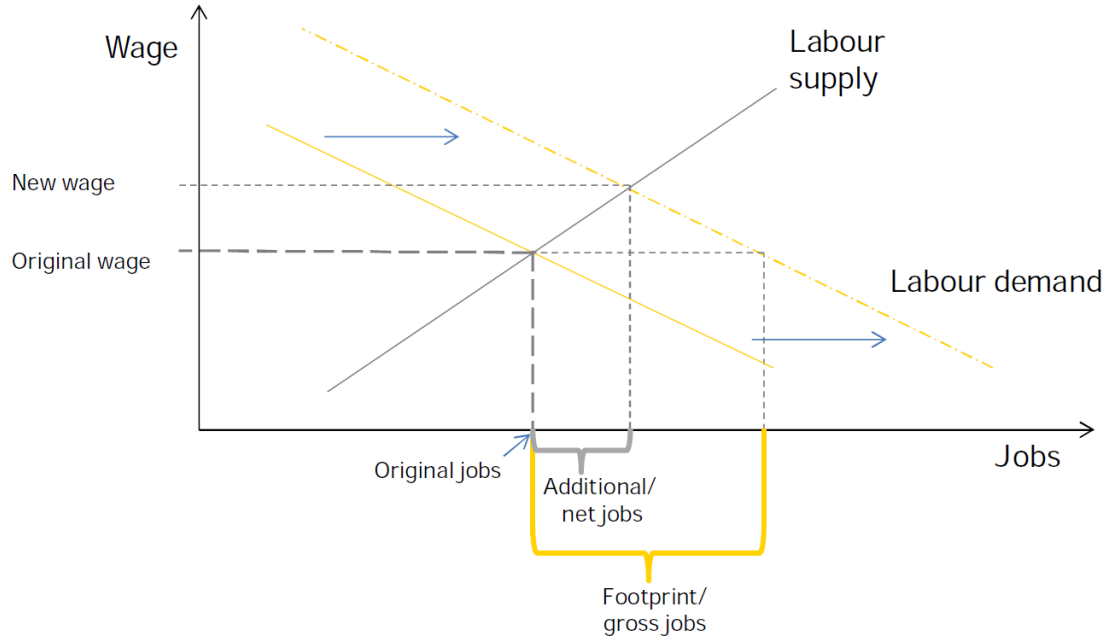
[22] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

- CGE modelling can be dynamic or comparative static[23] and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a CBA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a CBA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

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

Comparison of IO Analysis and CGE Modelling

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



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

- Figure A4.1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity[24]. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and "crowding out" across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I's *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.
- Other guidelines to recognise the role of IO analysis include:
  - US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*;

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

- Australian Bureau of Rural Science (2005) *Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia*.

- NSW Treasury (2007) identify that IO analysis is commonly used to assess the regional impacts of a project. However, IO analysis is concerned with measuring economic activity, and is not a tool for the evaluation of projects (in the way that CBA is).
- NSW Treasury (2009) *Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government*, identifies IO analysis as an appropriate method for estimating the number of jobs that may be supported by the actions, programs and policies of the NSW Government.
- World Bank economist Mustafa Dinc (2015) *Introduction to Regional Economic Development: Major Theories and Basic Analytical Tools*, Edward Elgar, UK, identifies IO analysis as one of the most widely used models around the world for undertaking regional economic impact analysis and a solid framework to analyse the interdependence of industries in an economy.

Government Applications of IO Analysis

- Applications of IO analysis commissioned by Government agencies include:
  - Department of Sustainability, Environment, Water, Population and Communities (2011) *Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale*
  - NSW Natural Resources Commission (2009) *River Red Gum Assessment: Socio-economic impact assessment*;
  - Victorian Environmental Assessment Council (2007) *River Red Gum Forests Investigation – Socio-Economic Assessment.*
  - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy.
  - Reserve Bank of Australia (2012) *Industry Dimensions of the Resource Boom: An Input-Output Analysis.*
  - DECCW (2009) Economic benefits of national parks and other reserves in New South Wales - Summary report, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.
  - DECCW (2006) *Socio Economic Assessment of the Batemans Bay Marine National Park*
  - DECCW (2006) *Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park*
  - National Parks Service, US Department of the Interior (2014) *2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation*.

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO analysisis its use as a substitute for CBA, not its use for estimating direct and indirect regional economic activity impacts.

  - NSW Treasury (2009) "*Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (CBA)".*

  - The main "abuse" reported by the Productivity Commission is using IO analysis to *"make the case for government intervention"* when CBA is the appropriate method for doing this.

- ABS's concerns with IO being "*biased*" refer to it being a "*biased estimator of the benefits or costs of a project"*. IO does not estimate benefits and costs but economic activity.

- Concerns of the Warkworth Judgement with IO analysis being "deficient" related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point)), but more fundamentally for not *"assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors".* This is an inappropriate criticism of the IO method, since it does not pretend to do this.

- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested in the Warkworth Judgement. It allows for labour to come from within or outside the region.

Latest Use of IO Analysis

- BAEconomics (2014) in its Economic Impact Assessment for Warkworth Continuation 2014 and Mt Thorley Operations 2014 justifies the use of IO analysis to estimate economic activity associated with the Project.

- Dr Brian Fisher, the Managing Director of BAEconomics is a highly respected resource economist who previously held the positions of Executive Director of the Australian Bureau of Agricultural and Resource Economics (ABARE) and Associate Commissioner of the Productivity Commission. He received an Order of Australia in the Queen's Birthday Honours List in 2007.

ATTACHMENT 5 – UNDERLYING ASSUMPTIONS AND INTERPRETATIONS OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS

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

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

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

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

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

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

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

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

Components of the conventional output multiplier are as follows:

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

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

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

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

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

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

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

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

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

A description of the different ratio multipliers is given below.

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

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

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

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

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

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Australian Bureau of Statistics (1995) *Information Paper Australian National Accounts Introduction to Input-Output Multipliers*. Cat. No. 5246.0.

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

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

ATTACHMENT 6 – CBA AND ASSESSMENT OF EXTERNALITIES

Consideration of Externalities in the Economic Assessment

Introduction

- The "perfect" CBA is an ideal. Different situations call for different styles and depths of analysis.
- Valuation of all environmental impacts is neither practical nor necessary.
- In attempting to value impacts, there is the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government 2012). The guideline gives an example of impacts of less than $1M being immaterial for a project with an estimated net present value of $20M.
- There is also the principle of proportionality. Essentially, an analysis should itself be subject its own internal BCA. Additional time and resources expended towards gathering data, building more complex models, or disaggregating effects increase analysis costs. Thus, the cost of acquiring such information should at least be equaled by the expected decision-making benefit provided by the informational gain.
- The CBA of the modification took three approaches to the consideration of environmental costs:
  - Threshold value analysis;
  - Qualitative consideration of impacts and valuation of the main impacts based on market data and benefit transfer; and
  - Additional threshold value analysis to recognise that some impacts may not have been fully valued and incorporated into the analysis.

Threshold Value Analysis

- The first approach used to consider the environmental impacts of the modification was the threshold value method.
- Threshold value analysis is a recognised approach to CBA where it is not possible or pragmatic to attempt to value potential external impacts.
- Threshold value analysis was developed by Krutilla and Fisher (1975)[25]. It is specifically referred to as an appropriate approach in the DP&I's (2002) *Draft Guideline for Economic Effects and Evaluation in EIA,* and is a widely recognised approach.
- Threshold value analysis avoids the sometimes contentious matter of physically quantifying environmental impacts and then placing dollar values on them.
- Threshold value analysis leaves the trade-off between quantified economic benefits and unquantified environmental costs for the decision-maker.
- In the Economic Assessment of the modification, the estimated royalties provides a minimum threshold value or reference value against which the relative value of the residual environmental, social and cultural impacts of the modification, after mitigation, offset and compensation, may be assessed. The threshold value indicates the price that the community must value any residual

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

environmental impacts of the modification (be willing to pay) to justify in economic efficiency terms the 'no development' option.

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

- The second approach used was to qualitatively consider, and where possible value, the main environmental, cultural and social impacts of the modification for the well-being of people.

- Qualitative consideration of potential impacts and any subsequent valuation of impacts relied on the assessment of biophysical impacts provided in the modification SEE by technical specialists.

- The approach to valuing environmental impacts in the Economic Assessment of the modification is summarised in Table A6.1.

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

Impact	Potential Valuation Method	Comment
Greenhouse gas emissions	Damage cost method	Estimate of global social damage cost of carbon from literature and govt policy, adjusted to NSW damage cost.
Agricultural impacts	Property valuation method	No material impacts for valuation
Noise impacts		
Significant	Property valuation method	Not applicable
Moderate and low	Defensive expenditure	Noise mitigation costs included in capital costs of project. But would reduce the unquantified net producer surplus and company tax components of modification rather than royalties.
Blasting		Vibration and air blast limits for human comfort and structural damage are met, minimal impact is likely to occur to humans or structures.
Significant air quality impacts	Property valuation method	Cost of acquiring properties encompasses property value impacts due to air quality impacts. But would reduce the unquantified net producer surplus and company tax components of modification rather than royalties.
Use of surface water	Market value of water	Cost of Water Access Licences reflects marginal value product of water. But would reduce the unquantified net producer surplus and company tax components of modification rather than royalties.
Use of groundwater	Market value of water	Cost of Water Access Licences reflects marginal value product of water. But would reduce the unquantified net producer surplus and company tax components of modification rather than royalties.
Groundwater drawdown	Defensive expenditure	No material impacts on private bores predicted.
Water discharges		Regulated under the Protection of Environment Operations Act 1997.
Flora and fauna	Replacement cost	No material impacts
Road transport impacts	Defensive expenditure	No material impacts
Aboriginal heritage	Defensive expenditure	No material impacts
Historic heritage	Defensive expenditure Benefit transfer of CM data	No material impacts
Visual	Defensive expenditure	Unvalued but no material impacts likely.

Additional Threshold Value Analysis

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

ATTACHMENT 7 – NON-MARKET BENEFITS OF EMPLOYMENT

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

- Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005[26]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project. The analysis included consideration of the magnitude of these additional benefits under a number of scenarios but conservatively excludes them from the core analysis. Ceteris paribus these estimates are conservative since they ignore any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

- These treatments of employment in CBA relate to the market value or opportunity cost of labour resources.

- The above treatment of employment in CBA relate to the impacts on the unemployed individuals themselves. However, there may also be spillover effects and externalities to third parties. These are public good values. Spill-over effects referred to in the literature relate to empathy based losses to family or friends (close associates) of impacted workers because of the workers being unemployed and increased crime and community dislocation (Haveman and Weimer 2015: Streeting and Hamilton 1991). Empathy based impacts may also spill over more broadly into the existence values of others in the community who feel sympathy for the unemployed.

- These are non-market values i.e. the values that individuals in a community hold for things even though they are not traded in markets. For example, people have been shown to value environmental resources even though they may never use the resource. These are referred to as existence values and are underpinned by the view in neoclassical welfare economics that individuals are the best judge of what has value to them.

- As identified by Portney (1994[27]), the concept of existence values should be interpreted more broadly than just relating to environmental resources.

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

- The utility (welfare) of individuals may therefore be affected by changes in their own well-being as well as changes in the well-being of others (Rolfe and Bennett 2004[28]). This is consistent with the observed behaviour of altruism (Freeman III 2003[29]).

[26] Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-benefit analysis: concepts and practice*, Prentice Hall, New Jersey.
[27] Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.
[28] Rolfe and Bennett (2004) *Assessing Social Values for Water Allocation with the Contingent Valuation Method,* Valuing Floodplain Development in the Fitzroy Basin Research Reports, Research Report No. 11, Central Queensland University, Emerald.
[29] Freeman III, A. Myrick. (2003) *Economic Valuation: What and Why*. In A Primer on Non-market Valuation, Eds Champ, P., Boyle, K. and Brown, T. Kluwer Academic Publishers, London.

- Whether people have existence values for the employment of others, as hypothesised by Portney, is an empirical issue. A number of non-market valuation studies have found evidence that people hold existence values for the employment of others:

  - Johnson, F. and Desvouges, W. (1997) Estimating Stated Preferences with Rated-Pair Data: Environmental, Health and Employment Effects of Energy Programs. Journal of Environmental Economics and Management, 34, 75-99, estimated the non-market value of employment effects of energy programs.
  - Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. (1998) Stated Preference Approaches to Measuring Passive Use Values: Choice Experiments Versus Contingent Valuation, American Journal of Agricultural and Economics, 80, 64-75, in a study on the protection of old growth forests included an attribute for forest industry employment losses.
  - Morrison, M., Bennett, J. and Blamey, R. (1999) Valuing improved wetland quality using choice modelling, Water Resources Research (Vol. 35, No. 9, pp. 2805-2814) valued irrigation related employment losses as a result of wetland protection.
  - Blamey, R., Rolfe, J., Bennett, J., and Morrison, M., (2000) Valuing remnant vegetation in Central Queensland using choice modelling, The Australian Journal of Agricultural and Resource Economics(44(3): 439-56) in a study of broadscale tree clearing in the Desert Uplands of Queensland, Australia included an attribute for jobs lost to the region.
  - Do, T.N. and Bennett, J. (2007) Estimating Wetland Biodiversity Values: A Choice Modeling Application in Vietnam's Mekong River Delta, Australian National University, Economics and Environmental Network Working Paper estimated values for the number of farmers affected by a change in wetland management of Tram Chim.
  - Othman, J., Bennett, J., Blamey, R. (2004) Environmental values and resource management options: a choice modelling experience in Malaysia, Environ. Dev. Econ. 9, 803–824, valued local employment losses from different conservation management strategies for the Matang Mangrove Wetlands in Perak State, Malaysia.
  - Marsh, D. (2010) Water Resource Management in New Zealand: Jobs or Algal Blooms? Presented at the Conference of the New Zealand Association of Economists Auckland 2 July 2010, valued employment losses as a result of improvements in water quality in a dairy catchment in Waikato region of New Zealand the catchment.
  - Longo A, Markandya A, Petrucci M (2008) The Internalization of Externalities in the Production of Electricity: Willingness to Pay for the Attributes of a Policy for Renewable Energy, Ecological Economics 67:140-152, in the context of renewable energy projects valued additional electricity sector jobs.
  - Colombo, S., Hanley, N., and Requena, J.C. (2005) Designing Policy for Reducing the Off-farm Effects of Soil Erosion Using Choice Experiments, Journal of Agricultural Economics, 56(1), 81-96, valued local employment generated from watershed policies to reduce soil erosion.
  - Caparrós A, Oviedo JL, Campos P (2008) Would you choose your preferred option? Comparing choice and recoded ranking experiments. Am J Agricult Econ 90(3):843–855, valued increases in local employment from a NP reforestation program.
  - Windle, J. and Rolfe, J. (2014) Assessing the trade-offs of increased mining activity in the Surat Basin, Queensland: preferences of Brisbane residents using non-market valuation techniques, Australian Journal of Agricultural and Resource Economics, 58, pp. 111-129, valued jobs generated by mining developments in the Surat Basin, as well as social impacts of mining developments such as increased housing prices and increase wages in non-mining sectors.

- Three non-market valuation studies have found evidence that people in NSW hold existence values for the employment of others in coal mining projects:

    - Gillespie, R. (2009) Bulli Seam Operations Socio-Economic Assessment, prepared for Illawarra Coal Holdings Pty Ltd.
    - Gillespie, R. and Kragt, M. (2012) Accounting for non-market impacts in a benefit-cost analysis of underground coal mining in New South Wales, Australia, Journal of Benefit Cost Analysis, 3(2): article 4.
    - Gillespie, R. and Bennett, J. (2012) Valuing the Environmental, Cultural and Social Impacts of Open Cut Coal Mining in the Hunter Valley of NSW, Australia, Journal of Environmental Economics and Policy, Volume 1, Issue 3, 1-13.

- The values from these studies are summarised in Table A7.1.

Table A7.1 – Existence Values for Mine Employment

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

*Implicit prices are aggregated to 50% of NSW households.

- These values are public good values i.e. they are the sum of values held by individual households in NSW. Comparison of public good values to private good values such as wages are meaningless.

- The motivation behind people's willingness to pay for the employment of others is unknown. Split sample analysis undertaken by Gillespie (2009) providing different information to survey respondents on the re-employment prospects of impacted workers did not impact household willingness to pay for the employment provided by the mine. It is possible that respondents were not concerned so much with the prospects of re-employment elsewhere in the economy or net employment impacts but with the 'forced' change to other people's employment. However, further investigation is required to unpack respondent motivations in relation to attributes representing employment.

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

ATTACHMENT 8 – THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

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

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

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

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

Table A8.1
The GRIT Method

Phase	Step	Action
PHASE I		ADJUSTMENTS TO NATIONAL TABLE
	1	Selection of national input-output table (106-sector table with direct allocation of all imports, in basic values).
	2	Adjustment of national table for updating.
	3	Adjustment for international trade.
PHASE II		ADJUSTMENTS FOR REGIONAL IMPORTS
		(*Steps 4-14 apply to each region for which input-output tables are required*)
	4	Calculation of 'non-existent' sectors.
	5	Calculation of remaining imports.
PHASE III		DEFINITION OF REGIONAL SECTORS
	6	Insertion of disaggregated superior data.
	7	Aggregation of sectors.
	8	Insertion of aggregated superior data.
PHASE IV		DERIVATION OF PROTOTYPE TRANSACTIONS TABLES
	9	Derivation of transactions values.
	10	Adjustments to complete the prototype tables.
	11	Derivation of inverses and multipliers for prototype tables.
PHASE V		DERIVATION OF FINAL TRANSACTIONS TABLES
	12	Final superior data insertions and other adjustments.
	13	Derivation of final transactions tables.
	14	Derivation of inverses and multipliers for final tables.

Source: Bayne and West (1988).

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ATTACHMENT 9 – STUDIES ON THE FLOW-EMPLOYMENT OF THE MINING INDUSTRY

Mining projects provide direct employment opportunities in regional economies. In addition, expenditure on inputs to production and by employees can provide flow-on employment in other sectors of the economy.

All other things being equal, the flow-on employment arising from a project will depend on:

- the expenditure profile associated with a project;
- the size of the regional economy and the ability of local businesses to supply inputs to production demanded by mine proponents;
- the residential location of employees and whether they migrate into the region or already live there and were previously employed or unemployed.

Estimated flow-on employment will also vary based on the modelling approach used i.e. whether primary IO analysis has been undertaken or whether multipliers have been obtained from other studies, and which type of multiplier has been used e.g. Type 1A, Type 1B, Type 11A or Type 11B.

A number of studies have examined the flow-on impacts of mining projects on regional economies and the NSW economy. The results are summarised in Table A9.1.

These studies indicate that:

- for every direct job in mine construction total regional employment impacts range from 1.5 to 1.89; and
- for every operational job total regional impacts range from 1.70 to 4.79.

Table A9.1 – Flow-on Employment of Mining Projects

Construction or operation	Full-time equivalents or Full-time/part time	IIA Multiplier	Method	Region	Project	Reference
Construction	Unspecified	2.73	Borrowed	NSW	Angus Place	Aegis Group (2014)
Construction	Unspecified	4.71	Borrowed	NSW	Bulga Optimisation	Economic Consulting Services (2012)
Construction	Unspecified	1.59	Borrowed	Broke/Bulga	Bulga Optimisation	Economic Consulting Services (2012)
Construction	Unspecified	1.89	Borrowed	Newcastle, Maitland, Cessnock, Singleton, Muswellbrook	Bulga Optimisation	Economic Consulting Services (2012)
Construction	FTE	1.50	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Construction	FTE	1.62	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	6.05	IO	NSW	Warkworth and Mount Thorley	BAE (2014)
Operation	Unspecified	3.50	Borrowed	NSW	Bulga Optimisation	Economic Consulting Services (2012)
Operation	Unspecified	3.98	Borrowed	NSW	Angus Place	Aegis Group (2014)
Operation	FTE	4.79	IO	Upper and Mid Hunter	Warkworth and Mount Thorley	BAE (2014)
Operation	FTE	2.37	IO	Singleton LGA	Warkworth and Mount Thorley	BAE (2014)
Operation	Unspecified	1.49	Borrowed	Broke/Bulga	Bulga Optimisation	Economic Consulting Services (2012)
Operation	Unspecified	1.70	Borrowed	Newcastle, Maitland, Cessnock, Singleton, Muswellbrook	Bulga Optimisation	Economic Consulting Services (2012)
Operation	FTE	4.27	Borrowed	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	3.94	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	2.94	IO	Hunter Region	Bloomfield Collieries	Hunter Valley Research Foundation (2008)

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