Economic Impact Assessment

Appendix 17

ANVIL HILL PROJECT

ECONOMIC ASSESSMENT

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EXECUTIVE SUMMARY

Centennial Hunter Pty Limited (Centennial), a wholly owned subsidiary of Centennial Coal Company Limited, proposes to establish an open cut coal operation, including a Coal Preparation Plant (CPP) and rail loop in the Wybong area, 20 kilometres west of Muswellbrook and approximately 10 kilometres north of the township of Denman.

The proposal, known as the Anvil Hill Coal Project (the Project), is based on a large, undeveloped coal reserve of some 150 million tonnes (Mt) that has the potential to provide thermal coal to both domestic and export markets. The proposal is to mine up to 10.5 million tonnes per annum (Mtpa) using truck and shovel methods over a 21 year project life.

The Project is considered in this report within two economic frameworks:

- benefit cost analysis (threshold value analysis) which examines the economic efficiency or net community welfare impacts of the proposal; and
- regional economic impact analysis which examines the impact of the construction and operation phases of the Project on the regional economy (comprising the local government areas of Muswellbrook, Singleton and Scone) and on the state of NSW.

A benefit cost analysis, identified a range of incremental economic costs and benefits of the Project and placed indicative values on the production costs and benefits. External economic costs and benefits of the proposal were identified and discussed. The analysis indicated that the incremental net production benefits of the Project (after full incorporation of greenhouse gas effects, air quality impacts, noise and blast vibration, agricultural impacts, traffic impacts, and partial internalisation of visual impacts, flora and fauna impacts, Aboriginal heritage impacts and historic heritage impacts) would be in the order of $480M. This net benefit is distributed amongst a range of stakeholders including:

- Company shareholders;
- the NSW Government via royalties and payroll tax;
- the Commonwealth Government in the form of Company tax;
- the local community via Centennial's Community Enhancement Plan which includes:
  - an upfront contribution to community infrastructure in Denman and Wybong of $500,000;
  - an education and training contribution of $200,000 per annum for 3 years;
  - a contribution to environmental management in the local catchment of $100,000 per annum for 5 years.
- the local community via Centennial's proposed conservation and heritage offsets.

The estimated net production benefit of the Project represents the opportunity cost to society of not proceeding with the Project. Put another way, any environmental costs of the Project, after mitigation by Centennial, would need to be costed at greater than $480M to make the Project questionable from an economic efficiency (net community welfare) perspective.

The revenue, expenditure and employment associated with the construction and operation of the Project will stimulate economic activity for the regional economy, as well as for the broader NSW economy. Using input-output analysis, it was estimated that during the construction phase of the Project it would contribute the following to the regional economy and NSW economy, respectively:

Regional Economy – Construction Phase

- $19M to $21M in annual direct and indirect regional output or business turnover;
- $9M to $10M in annual direct and indirect regional value added;

- $5M to $6M in annual direct and indirect household income; and
- 121 to 143 direct and indirect jobs.

These particular impacts on the regional economy are only likely to be felt for a period of in the order of one year, with lesser impacts in other years comprising construction start up and completion phases.

NSW Economy – Construction Phase

- $25M to $35M in annual direct and indirect regional output or business turnover;
- $11M to $16M in annual direct and indirect regional value added;
- $6M to $8M in annual direct and indirect household income; and
- 147 to 201 direct and indirect jobs.

The impacts for NSW are highly conservative as they do not include any expenditure on machinery manufacture and leasing that is likely to occur in NSW.

The main sectors of the regional economy that would be stimulated by the construction phase of the Project are the other construction sector and the wholesale and retail trade, accommodation, cafes, restaurants, road transport, scientific research and fabricated metal products.

Operation of the Project was estimated to have the following impacts on the regional economy and NSW economy, respectively:

Regional Economy – Operational Phase

- $212M to $224M in annual direct and indirect regional output or business turnover;
- $115M to $121M in annual direct and indirect regional value added;
- $25M to $28M in annual household income; and
- 343 to 449 direct and indirect jobs.

NSW Economy – Operational Phase

- $275M to $324M in annual direct and indirect regional output or business turnover;
- $133M to $158M in annual direct and indirect regional value added;
- $33M to $43M in annual household income; and
- 531 to 809 direct and indirect jobs.

The Project operation would directly generate demand for mining employment in the regional economy. Production-induced employment impacts would mainly occur in the services sectors (predominantly community services, legal, accounting and business management sector, other businesses services, other services, other property services, scientific research and banking), wholesale and retail trade, manufacturing (predominantly agriculture, mining and construction machinery manufacturing, fabricated metal products manufacturing, other chemicals manufacturing, other machinery manufacturing and iron and steel manufacturing) and transport sector (predominantly rail and road transport). Consumption-induced employment flow-ons would mainly occur in the wholesale and retail trade sectors, the services sectors (education, health, community services and personal services) and accommodation, cafes and restaurants sector.

1.0 INTRODUCTION

Centennial Hunter Pty Limited (Centennial), a wholly owned subsidiary of Centennial Coal Company Limited, proposes to establish an open cut coal operation, including a Coal Preparation Plant (CPP) and rail loop in the Wybong area, 20 kilometres west of Muswellbrook and approximately 10 kilometres north of the township of Denman.

The proposal, known as the Anvil Hill Coal Project (the Project), is based on a large, undeveloped coal reserve of some 150 million tonnes (Mt) that has the potential to provide thermal coal to both domestic and export markets. The proposal is to mine up to 10.5 million tonnes per annum (Mtpa) using truck and shovel methods over a 21 year project life.

Umwelt (Australia) Pty Limited has been commissioned by Centennial to prepare an Environmental Assessment (EA) for the Project. An economic impact assessment is required as part of the EA.

Economic analysis is primarily concerned with weighing up the potential economic costs and benefits of the Project to the community (ie. consideration of economic efficiency). This includes the costs and benefits to the environment. The main technique that is used to evaluate proposals with respect to economic efficiency is benefit cost analysis. Information on the regional economic impact or economic activity generated by development proposals is also of interest to decision-makers and has direct links to the analysis of potential impacts on community infrastructure and population.

Both these economic aspects of the Project are considered in this report together with contextual information on world supply and demand for thermal coal.

2.0 DEMAND AND SUPPLY

[1]The Hunter Valley produced 98 million tonnes of coal in 2003-04 accounting for 35% of Australian coal production. The majority of this production was thermal coal suitable for electricity generation and some industrial purposes. The remainder is metallurgical coal suitable for steel making. Around 21% of Hunter Valley production is sold to domestic electricity generators with the remainder exported to overseas markets.

Domestic consumption of coal in the Hunter Valley has remained relatively stable over the last 5 or 6 years, with increased production during this time primarily going to export. In 2003-04 total Hunter Valley Coal exports were 77.8 million tonnes with thermal coal accounting for 78%. The major destination for the region's thermal and metallurgical coal exports are Japan, Korea and Chinese Taipei.

Exports from the Hunter Valley account for around 11 per cent of world thermal coal trade and 28% of north east Asian thermal coal imports. In particular, Hunter Valley coal accounted for nearly 36% of Japan's thermal coal imports in 2003.

The outlook for global coal trade is good. Global trade is forecast to increase at an average annual rate of 1.9 percent between 2004 and 2015. Stronger growth is expected in metallurgical coal (2.7 per cent a year), however thermal coal trade is still expected to grow by 1.6 per cent a year. Thermal coal trade will maintain its dominant share of global coal trade accounting for nearly 70 percent of total trade over the period to 2015.

The potential global demand for Australian thermal coal and metallurgical coal exports between 2004 and 2015 is expected to grow by 3.2 per cent per year and 4.0 per cent per year, respectively. This strong growth in Australian exports reflects Australia's relative proximity to expanding Asian markets, relatively low cost coal and perceived reliability as a coal supplier.

In the absence of infrastructure constraints, potential demand for exports from the Hunter valley is projected to increase at an average annual rate of 2.8 per cent a year, with the Hunter Valley's share of global demand for thermal coal exports rising to around 13.3%.

The Anvil Hill Project will contribute supply to meet this increasing global demand for thermal coal as well as supplying domestic power stations. In this respect, subject to the mine gaining relevant Government approvals, Centennial has contracted to supply coal to Macquarie Generation for its Bayswater and Liddell power stations for an initial 12 years commencing in 2008.

[1] This section is based on ABARE (2005).

3.0 BENEFIT COST ANALYSIS

3.1 INTRODUCTION

While there may be expectations of strong demand for coal in the future and therefore an assured market for coal produced from Anvil Hill, from an economic perspective this alone is not sufficient to make the project desirable for the Australian community. For the project to be economically desirable from an Australian community perspective, it must be economically efficient. Technically, a project is economically efficient and desirable on economic grounds if the benefits to society exceed the costs (James and Gillespie 1997). The main technique that is used to evaluate proposals with respect to economic efficiency is benefit cost analysis (BCA).

BCA involves the following key steps:

- Identification of the base case;
- Identification of the project and its implications;
- Identification and valuation of the incremental costs and benefits;
- Consolidation of value estimates;
- Sensitivity testing;
- Application of decision criteria; and
- Consideration of non-quantified costs and benefits.

What follows is a benefit cost analysis of the Project based on technical and environmental advice provided by Centennial and its consultants.

3.2 IDENTIFICATION OF THE BASE CASE AND THE PROJECT

Identification of the “base case” or “without” Project option is required in order to facilitate the identification and measurement of the incremental economic costs and benefits of the Project. In this study, the “without” Project involves:

- continuation of the cattle grazing of open grasslands; and
- continuation of low intensity grazing and conservation of steeper land and areas of native vegetation.

In contrast to the “base case” the Project comprises the development and operation of an open cut coal mine and related infrastructure, including:

- temporary construction facilities and permanent facilities such as offices, maintenance workshops, equipment and supply storage and yards, employee facilities;
- a Coal Preparation Plant (CPP) and mine facilities area and associated services;
- water supply and management infrastructure;
- a wastewater treatment plant;
- a new access road from Wybong Rd to the proposed mine infrastructure area;
- internal heavy vehicle and light vehicle roads;
- a rail loop and loading facility;
- transportation of product coal to market via train;

- development and rehabilitation of final mine landforms and establishment of self sustaining indigenous vegetation consisting of native and naturalised tree, shrub and grass species;
- development of habitat compensation offset areas, community enhancement programmes and other offsets.

This benefit cost analysis focuses on the Project compared to the base case (above).

3.3 IDENTIFICATION AND VALUATION OF COSTS AND BENEFITS

Relative to the base case or "without" Project scenario of continued agricultural use of the land, the Project may have the following potential incremental economic costs and benefits.

Table 3.1
Potential Economic Costs and Benefits of the Project

	Potential Costs	Potential Benefits
Production (Centennial)	• Opportunity cost of land (including loss of Agricultural production). • Mining and infrastructure capital costs. • Mine operating costs including: - Rehabilitation costs; - Monitoring costs; and - Transport costs.	• Residual value of land and capital at cessation of the Project. • Value of export and domestic product coal.
Potential External Impacts	• Air quality affecting neighbouring properties. • Noise and blast vibration disturbing residents of neighbouring properties. • Disturbance of surface and groundwater flows. • Modification of the visual landscape. • Disturbance of flora and fauna. • Disturbance of Aboriginal heritage sites. • Disturbance of non-Aboriginal heritage sites. • Generation of greenhouse gas by the Project • Increased rail movements and road transport	
Conservation offsets	• Cost of offsets	• Environmental and heritage benefits of offsets

It should be noted that the potential external costs, listed in Table 3.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or non-use. If the potential external impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

3.3.1 Production Costs and Benefits

The following cost and revenue estimates are based on the financial information provided by Centennial with adjustments made where necessary to reflect economic values. These adjustments include adjusting nominal values to real values, including capital costs when they occur, ignoring depreciation and including opportunity costs.

Opportunity Cost of Land

It is relevant to include in a benefit cost analysis the opportunity cost of land used in the Project, regardless of whether or not the land has already been purchased by the proponent. This is because

there is generally an opportunity cost of using the subject land for mining or other purposes rather than its next best use permissible under the existing land use regulations. An indication of the opportunity cost of the land can be gained from its market value, which in turn reflects it structural, access and environmental attributes as well as its income producing potential.

Land the subject of the mining Project, including land identified as potentially required for air and noise buffer areas, was identified and valued based on actual acquisition costs and expected acquisition costs for land not yet acquired. It should be noted that this is an overestimate of the opportunity cost of affected land, as some land will only be marginally impacted eg. by noise or air impacts, and hence the whole value of the property will not be lost. Also, acquisition costs generally exceed the normal market value of land.

Part of the estimate of the opportunity cost of land relates to foregone agricultural activity as a result of the area impacted by the open cut mine and associated infrastructure, as well as potential noise and air quality buffers. However, again this is likely to overstate agricultural impacts since the potential noise and air quality buffer area is intended to be well managed for continued existing use as rural/residential and grazing or for inclusion in Wybong Uplands Land Management Strategy which aims to provide positive environmental and land capability outcomes in the long term.

In addition, proposed ecological and Aboriginal heritage offset areas will also have an opportunity cost, part of which relates to foregone agricultural production. This market cost of this land has also been included in the above estimate.

Mining and Infrastructure Capital Costs

The capital costs associated with the Project (excluding land costs) relate to:

- Coal mining plant and equipment;
- Coal handling and preparation facility; and
- Site infrastructure.

These capital costs are estimated to be in the order of $46M in 2007 (assumed to be start of construction) and $111M in 2008 (during completion of construction) with sustaining capital each year over the life of the mine. There were also a number of historical purchases e.g. on motor vehicles, furniture and computers, water rights and mining tenements that were considered to have an opportunity cost and hence included in the analysis in Year 1 at their full purchase price.

Mine and Processing Operating Costs

The annual operating costs of the Project comprise:

- contractor mining cost;
- minesite rehabilitation cost;
- coal handling facility costs;
- rail and port delivery costs; and
- overheads and contingencies.

In total these resource costs are estimated to be in the order of $120M per annum. It should be noted that while royalties are a cost of the Project, they are part of the overall producer surplus benefit of the mining activity that is redistributed by government. Royalties have therefore not been included in the calculation of the resource costs of operating the Project.

Sale Value of Coal

Revenue from the sale of coal is the major economic benefit of the Project. Coal production from the Anvil Hill Project is earmarked for both export and domestic sale. Based on the conceptual mining schedule, average annual revenue is estimated at in the order of $202M.

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land may have some residual value that is a benefit to Centennial. However, for the purpose of this analysis, capital equipment and land the subject of the mine are conservatively assumed to have no residual value.

3.3.2 External Costs and Benefits

The EA main text and specialist appendices provide a detailed consideration of the potential environmental impacts of the Project and the proposed means of mitigation. These main potential environmental impacts are briefly considered below from an economic perspective.

Air Quality - potential air quality impacts relate to dust deposition (dust that settles on the ground) and dust concentration (dust suspended in the air). Computer based dispersion modelling that takes account of proposed air pollution controls and mitigation strategies indicates that up to 19 private residences will be subject to adverse air quality impacts at some stage during the life of the Project. Such impacts are likely to impact the amenity of these properties and can be valued by the change in property value using the property valuation method.

Instead of estimating the likely change in property value that would arise from air quality impacts this analysis has included the full acquisition value of the affected properties, as Centennial has made an offer to each of the affected private landholders to purchase these affected properties or negotiate another appropriate outcome. The analysis therefore has overestimated the economic cost of air quality impacts.

Noise and Blast Vibration – noise and blasting on-site has the potential to impact on sensitive receptors such as nearby residences and buildings. Analysis indicates that under worst case noise predictions, up to 72 private residences will have noise levels 10 dBA above background noise levels (30 dBA). 17 of these properties are also predicted to be affected by dust impacts. A number of these properties will also be adversely impacted by vibration and overpressure

Such impacts are likely to impact the amenity of these properties and can be valued by the change in property value using the property valuation method.

However, again, instead of estimating the likely change in property value that would arise from noise and vibration impacts, this analysis has included the full acquisition value of the affected properties, as Centennial has made an offer to each of the affected private landholders to purchase these affected properties or negotiate another appropriate outcome. The analysis therefore has overestimated the economic cost of noise and vibration impacts.

Surface and Groundwater – Centennial acknowledges the importance of protection of local water resources and has committed to a range of measures to minimise groundwater and surface water impacts from the Project. Detailed assessment of surface and groundwater impacts indicated that the Proposed Disturbance Area will affect less than 3% of the Wybong Creek catchment and 1% of the Sandy Creek catchment at any stage of mining. There are unlikely to be any significant impacts in relation to channel stability or instream habitat, flooding, sediment levels or groundwater of the Wybong catchment but may be some impacts on the smaller feeder catchments.

The economic values affected relate to any use or non used values associated with the surface and groundwater flows in these smaller feeder catchments.

Visual Impacts – residences to the north, south, east and west of the Project may have views of the active mine workings and overburden placement area, with the prominence of these views varying between residences and over the life of the mine. Centennial has committed to a range of landscape management measures to ameliorate impacts and will continue to liaise with relevant stakeholders to determine any further feasible landscape management measures.

However, to the extent that visual impacts remain these are an economic cost of the Project that can potentially impact the consumer surplus[2] of affected households and may be valued via the property valuation method.

Flora and Fauna – the Project will involve the clearing of approximately 1304 ha of treed vegetation communities as well as an area of disturbed grasslands. While the majority of the vegetation that will be cleared has already been cleared at some time since the 1930s the Project is likely to significantly impact:

- two threatened flora species; and
- 13 threatened fauna species;

To some extent impacts on flora and fauna may be internalised by Centennial's proposal to manage adjacent land for conservation as an offset for the ecological impacts of the Project. This adjoining land contains five threatened flora species, 16 threatened fauna species, one endangered ecological community and one endangered population. The costs of purchasing land and managing this offset has been included in the benefit cost analysis.

Any overall impacts on flora and fauna species would likely affect the non use economic values (consumers' surplus) of individuals and could potentially be interpreted in an economic context via surveys to elicit the community's willingness to pay to avoid any potential impacts ie. the contingent valuation method or choice modelling (see further detail at Section 3.6).

Aboriginal Heritage - archaeological surveys have been conducted within the Project disturbance area and adjoining potential offsets area. A total of 173 Aboriginal heritage sites were recorded including 88 artefact scatters, 69 isolated finds and 16 rock shelters. 74 sites will be impacted by the Project, which include 32 isolated finds and 42 artefact scatters. In relation to archaeological values these include 69 sites assessed as having low research potential, three sites with low to moderate research potential, one site with moderate research potential and one site with high research potential.

Mitigation measures proposed by Centennial, and included in the costs of operation, are establishment of an Aboriginal cultural heritage offsets area to conserve and manage 99 sites including the majority of sites of high significance, surface collection of all impacted archaeological sites and sub surface investigation of selected sites, modification of the location of the rail loop to avoid impact on the artefact scatter of moderated research potential and high Aboriginal heritage value.

Any impacts on heritage may impact the consumer surplus of individuals within the indigenous and broader community. These could potentially be measured through the contingent valuation method and choice modelling although such techniques have limited application to indigenous communities.

[2] Consumer surplus is the consumers' willingness to pay for a good less what they actually have to pay. It is a measure of the net value to the consumer.

Historic Heritage – a historic heritage study indicates that the Project would impact on a number of items of local heritage significance. However, no sites of regional, state or national significance were identified. Proposed mitigation measures include documentation of the history of area in consultation with local landholders and full recording of a range of heritage items identified within the proposed disturbance area as well as monitoring of the potential impacts of blasting on heritage structures and refinement of blast design as necessary to reduce impacts. Any residual impacts on historic heritage may impact the consumer surplus of visitors to these items as well as people's non use values. These could potentially be measured through the contingent valuation method or choice modelling.

Greenhouse Gas Generation – the average annual greenhouse emissions for the Project are estimated at 167,574 tonnes CO_2 equivalent, less than the Australian open cut black coal mining industry average. These greenhouse gas emissions are dominated by energy use with diesel at 39% and electricity at 36% of the total. Emissions from methane make up 23% of the total and explosives use at 2% make up the remainder.

There is no single agreed and robust price or cost per unit of CO_2-e emissions, rather there are a variety of approaches that can be taken to deriving a price or cost. These different approaches do not yield a single price/cost, but a range from near zero to $15 per tonne CO_2-e. This range was obtained by accounting for a number of sources of information including:

- the observation that, on a global basis, the vast majority of emissions are not regulated, taxed or included in emissions trading schemes;
- the observed value of early trades in carbon, facilitated by independent brokers or as part of early regulatory schemes;
- the observed value of carbon trades in the NSW Electricity Benchmarks Scheme;
- the implied value of carbon emissions from economic modelling studies of the impact of Australia seeking to achieve particular emissions targets;
- the implied value of optimal carbon changes derived from economic studies that seek to determine the best balance between avoiding the costs of climate change and avoiding the economic slowdown from abatement; and
- the subsidies per tonne of emissions avoided (implicit or explicit) that the Australian Government has been prepared to pay through a number of its schemes including the Mandatory Renewable Energy Target scheme and the Greenhouse Gas Abatement Program.

Using this range, total costs of CO_2-e emissions from the Project would be in the order of between $0M to $2.5M per annum. For the core analysis, a conservative figure of $10 per tonne CO_2-e has been used ie. an average of annual cost of $1.7M.

Transport – a detailed traffic study indicated that with a number road improvements proposed by Centennial traffic generated by the Project will not have an adverse impact on the integrity of the existing road network or on road safety in the local area. The cost of these road improvements has been included in the analysis.

3.4 CONSOLIDATION OF VALUE ESTIMATES

To determine the threshold value, a 7% discount rate was used to consolidate the streams of quantified production costs and benefits over time into a present value. It was found that at a 7% discount rate, the net incremental production benefits of the Project (after full incorporation of greenhouse gas effects, air quality impacts, noise and blast vibration, agricultural impacts, traffic impacts, and partial internalisation of visual impacts, flora and fauna impacts, Aboriginal heritage impacts and historic heritage impacts) would be in the order of $480M net present value (NPV).

This net benefit is distributed amongst a range of stakeholders including:

- Company shareholders;
- the NSW Government via royalties and payroll tax;
- the Commonwealth Government in the form of Company tax;
- the local community via Centennial's Community Enhancement Plan which includes:
  - an upfront contribution to community infrastructure in Denman and Wybong of $500,000;
  - an education and training contribution of $200,000 per annum for 3 years;
  - a contribution to environmental management in the local catchment of $100,000 per annum for 5 years; and
- the local community via Centennial's proposed conservation and heritage offsets.

Centennial Coal Company is a NSW-based coal producer listed on the Australian Stock Exchange. With around 16,000 shareholders it is reasonable to assume that a substantial proportion of the benefit to shareholders is recycled within the NSW economy.

3.5 SENSITIVITY ANALYSIS

This NPV is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a benefit cost analysis can be dealt with through changing the values of critical variables in the analysis (James and Gillespie 1997) to determine the effect on the NPV. In this analysis, the net production benefit (threshold value) was tested for changes to the following variables:

- capital costs (excluding property acquisitions);
- operating costs;
- coal values;
- cost of greenhouse gas emissions;
- property acquisitions.

What this analysis indicated is that the results of the benefit cost analysis are not sensitive to reasonable changes in assumptions regarding any of these variables. While the results are most sensitive to the assumptions regarding operating costs and coal revenues, operating costs would need to increase by 45% to result in a negative NPV. Similarly, domestic value of coal would need to reduce to less than 75% of the assumed value for the NPV to be negative.

3.6 APPLICATION OF DECISION CRITERIA AND THRESHOLD VALUE ANALYSIS

The main decision criterion for assessing the economic desirability of a proposal is usually the NPV. The NPV is the sum of the discounted benefits less the sum of the discounted costs. The economic assessment is different to an internal Company financial assessment of NPV. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the Project, because the community would obtain net benefits from the Project. In this instance, because some potential environmental impacts of the proposal have not been valued, the NPV represents a threshold value.

This threshold value indicates the price that the community must value any negative residual environmental impacts of the development, after mitigation by Centennial, to justify (on economic efficiency grounds) refusing the Project.

However, not all the external impacts of the Project are negative. Provision of a Potential Offset Area for the conservation of ecological values and an Aboriginal Cultural Heritage Offset area would be

valued positively by the community. The direct contribution of funds to community enhancement is also an external impact that would be considered positive. Hence the estimated $480M net production benefits of the Project could be considered a minimum threshold value[3].

From the assessment above, there are four potentially negative residual impacts of the Project. This minimum threshold value must be weighed against these:

- clearing of 1,304 ha of treed vegetation communities and associated impacts on flora and fauna;
- any residual impacts on Aboriginal heritage;
- any residual impacts on historic heritage;
- any residual visual impacts on adjoining properties.

The latter three residual environmental impacts of the Project are considered minor given the mitigation measures proposed by Centennial. Consequently the main focus of the threshold value analysis is the impact of the clearing of some 1,304ha of native vegetation.

There have been two main choice modelling studies of the community willingness to pay for native vegetation protection. A study by Lockwood and Carberry (1998) found a willingness to pay of $3.80 per household for every 10,000 ha of native vegetation conserved with an extra willingness to pay of $1.69 per household for every extra native plant and animal species conserved in the region (note that this is a regional focus so that if the conservation does not add to regional number of species conserved in the region then a zero value is assumed).

A study by Rolfe et al (1997) found a willingness to pay of $3.68 per household for every percentage reduction in the area of unique ecosystem, with additional willingness to pay of $11.39 per household per endangered species preserved and an additional willingness to pay of $1.69 per percentage increase in population size of non threatened species.

Based on these studies, the following values are relevant for conservation of remnant vegetation and associated biodiversity:

- $3.80 per NSW household per 10,000 ha of native vegetation conserved (i.e. $760 per ha);

- $1.69 per household for every extra native plant and animal species conserved in the region (i.e. $3.4M for every extra native plant and animal species conserved in the region[4]);

- $1.69 per NSW household per percentage increase in population size of non-threatened species (i.e. $3.4M per percentage increase in population size of non-threatened species);

- $11.39 per household per endangered species protected (ie. $22.8M per endangered species protected). It should be noted that the valuation per endangered species protected relates to fauna species moving from “endangered” to a less threatened status of “vulnerable”. In applying this valuation it is therefore necessary to make some judgement of the contribution of the action being taken to protect endangered species.

[3] Van Bueren, M. and J. Bennett (2000) in a choice modelling study commissioned by the National Land and Water Resources Audit examined community values for land restored or protected from degradation. The study revealed a community willingness to pay of $0.07 per household per year for 20 years per 10,000 ha of land restored or protected from degradation (i.e. $0.74 once off payment per household or aggregated across NSW households $148 per ha) and an additional $0.68 per household per year for 20 years per endangered species protected (i.e. $7.20 once off payment per household or aggregated across NSW households $14M per species).

[4] These per household values were applied to all households in NSW.

Hence the loss of 1,304 ha of native vegetation (at $760/ha) would equate to an initial economic cost of in the order of $1M. The Project will also impact in the order of 15 threatened species (none of which are endangered). However, given the metric of the economic values estimates (i.e. per endangered species protected and percentage increase in population of size of non-threatened species etc), it is difficult to apply them in any meaningful way. However, even applying the highest value figure of $22.8M for each threatened species impacted (which is incorrect and likely to greatly overestimate the economic cost of ecological impacts) is not sufficient to make the environmental impacts outweigh the net production impacts of the Project. This assessment has also not considered the value of the ecological offset proposal.

3.7 BENEFIT COST ANALYSIS CONCLUSION

The Project is estimated to result in incremental net production benefits of in the order of $480M. This figure represents the opportunity cost to society of not proceeding with the proposal. Interpreted another way, any environmental impacts from the proposal, after mitigation by Centennial, would need to be valued at greater than $480M to make the Project questionable from an economic efficiency perspective.

This is equivalent to each household in the Muswellbrook LGA having a willingness to pay of $85,000 to avoid any of the residual environmental impacts of the Project, after mitigation by Centennial. The equivalent figure for the Muswellbrook, Singleton and Scone region is $27,000 and the figure for NSW households is $190.

4.0 REGIONAL ECONOMIC IMPACTS

4.1 INTRODUCTION

Regional economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of a number of specific indicators, such as employment, income, gross regional product and gross regional output.

These indicators can be defined as follows:

- ***Gross regional output*** - is the gross value of business turnover;
- ***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;
- ***Income*** – is the wages paid to employees including imputed wages for self employed and business owners; and
- ***Employment*** – is the number of people employed (including full-time and part-time).

An impacting agent may be an existing activity within an economy or may be a change to a local economy (Powell *et al.,* 1985; Jensen and West, 1986). This assessment is concerned with:

- the impact of the construction of the Project; and
- the impact of the operation of the Project.

The economy on which the impact is measured can range from a township to the entire nation (Powell *et al.,* 1985). In selecting the appropriate economy regard needs to be had to capturing the local expenditure associated with the Project but not making the economy so large that the impact of the proposal becomes trivial (Powell and Chalmers, 1995).

For this study, the impacts of the Project have been estimated for two regions:

- NSW; and
- the region comprising the Local Government Areas of Muswellbrook, Singleton and Scone.

A range of methods that can be used to examine the regional economic impacts of an activity on an economy including economic base theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models (Powell *et al.,* 1985). This study uses regional input-output analysis.

Input-output analysis essentially involves two steps:

- construction of an appropriate input-output 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 operation) in a form that is compatible with the input-output equations so that the input-output multipliers and flow-on effects can then be estimated (West 1993, p 2-1).

4.2 INPUT OUTPUT TABLE AND ECONOMIC STRUCTURE OF THE REGION

For this study, two input output tables were used:

- a 2000-01 input-output table of the NSW economy developed by the Centre for Agricultural and Regional Economics (CARE) using the Generation of Regional Input-output Tables (GRIT) procedure; and
- a 2000-01 input-output table of the regional economy, developed by Gillespie Economics from the NSW table using the GRIT procedure.

A 106 sector input-output table of the NSW economy and regional economy was aggregated to 30 sectors and 6 sectors for the purpose of describing the economies.

Highly aggregated 2001 input-output tables for NSW economy and the regional economy are provided in Table 4.1 and Table 4.2. The rows of the table indicate how the gross regional output of an industry is allocated as sales to other industries, to households, to exports and other final demands (OFD - which includes stock changes, capital expenditure and government expenditure). The corresponding column shows the sources of inputs to produce that gross regional output. These include purchases of intermediate inputs from other industries, the use of labour (household income), the returns to capital or Other Value Added (OVA - which includes gross operating surplus and depreciation and net indirect taxes and subsidies) and goods and services imported from outside the region. The number of people (from the region) employed in each industry is also indicated in the final row.

Table 4.1
Aggregated Transactions Table: NSW Economy 2000-01 $'000

	Ag/Forest/ Fish	Mining	Manufact-uring	Utilities	Building	Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	837,023	2,439	3,121,709	463	10,066	306,839	**4,278,539**	822,126	636,626	4,125,589	**9,862,880**
Mining	5,652	212,186	2,432,110	271,315	90,610	127,306	**3,139,179**	26,585	-50,440	4,328,971	**7,444,294**
Manufacturing	1,270,348	738,871	25,149,154	609,260	5,078,821	17,615,714	**50,462,167**	21,910,219	10,266,636	42,420,940	**125,059,963**
Utilities	69,799	100,205	1,466,256	792,155	34,026	2,334,402	**4,796,843**	4,767,459	204,846	17,348	**9,786,495**
Building	28,667	22,626	11,186	6,429	12,744	909,975	**991,627**	0	17,134,126	24,527	**18,150,280**
Services	1,626,674	1,005,985	17,524,606	1,417,175	3,429,349	74,234,660	**99,238,449**	89,172,065	43,542,228	30,352,294	**262,305,037**
TOTAL	**3,838,163**	**2,082,311**	**49,705,021**	**3,096,798**	**8,655,616**	**95,528,896**	**162,906,804**	**116,698,453**	**71,734,023**	**81,269,669**	**432,608,949**
H-hold Income	2,991,412	1,105,865	11,831,244	1,122,199	6,329,488	70,585,278	**93,965,486**	0	0		**93,965,486**
O.V.A.	2,093,100	2,641,217	16,720,602	4,357,212	2,112,604	79,161,739	**107,086,475**	20,925,131	3,174,230		**131,185,836**
Imports	940,204	1,614,901	46,803,096	1,210,287	1,052,571	17,029,123	**68,650,183**	19,657,219	13,591,792		**101,899,195**
TOTAL	**9,862,880**	**7,444,294**	**125,059,963**	**9,786,495**	**18,150,280**	**262,305,037**	**432,608,949**	**157,280,803**	**88,500,045**	**81,269,669**	**759,659,466**
Employment	96,130	15,095	322,393	20,835	194,118	2,092,051	**2,740,622**				

Table 4.2
Aggregated Transactions Table: Regional Economy 2000-01 $'000

	Ag/Forest/ Fish	Mining	Manufact-uring	Utilities	Building	Services	TOTAL	H-hold Exp	O.F.D	Exports	Total
Ag/Forest/Fish	13,820	123	41,302	5	71	1,065	56,387	3,858	46,896	90,913	198,054
Mining	106	25,925	7,907	14,870	806	756	50,370	179	12,779	1,950,575	2,013,903
Manufacturing	4,738	94,842	83,517	5,699	15,547	35,045	239,388	36,014	99,344	460,675	835,421
Utilities	1,736	22,357	7,220	27,375	236	10,372	69,295	27,389	229,879	40,143	366,706
Building	832	1,837	44	256	79	5,375	8,423	0	117,853	203	126,479
Services	20,866	140,951	82,815	24,357	15,612	200,413	485,014	292,827	438,201	148,449	1,364,491
TOTAL	42,099	286,035	222,805	72,562	32,351	253,026	908,877	360,267	944,952	2,690,958	4,905,054
H-hold Income	60,703	331,476	67,239	42,717	42,682	368,025	912,842	0	0		912,842
O.V.A.	39,515	740,764	123,129	159,436	18,368	402,775	1,483,987	140,709	41,814		1,666,510
Imports	55,738	655,628	422,248	91,991	33,078	340,666	1,599,349	556,644	179,045		2,335,038
TOTAL	198,054	2,013,903	835,421	366,706	126,479	1,364,491	4,905,054	1,057,621	1,165,811	2,690,958	9,819,444
Employment	2,156	4,007	1,743	746	1,205	11,747	21,604				

From the above tables, it can be seen that the value of the gross regional output for the NSW economy and the regional economy in 2001 is estimated by the model at $759,659M and $9,819M, respectively. However, it is generally considered that gross regional product (value-added) is a better measure of economic activity, as it avoids double counting associated with purchases of intermediate products.

Gross regional product for the NSW economy is estimated at $225,151M comprising $93,965M to households as wages and salaries (including payments to self employed persons and employers) and $131,185M in Other Value Added. Gross regional product for the regional economy is estimated at $2,579, comprising $912M to households as wages and salaries (including payments to self employed persons and employers) and $1,666M in Other Value Added.

The employment totals were 2,740,622 and 21,604 for the NSW and regional economy, respectively.

The economic structure of the regional economy may be compared with that for NSW through a comparison of Figure 4.1 and Figure 4.2. This reveals that the agriculture, forestry and fishing sector, mining sector and the utilities sector in the regional economy are of greater relative importance than they are to the NSW economy. While the manufacturing sector, building sector and, in particular, the services sectors are of less relative importance than they are to the NSW economy.

The destination of imports into the respective regions from all sources (overseas, inter regional and interstate) are shown in aggregate in Figures 4.3 and 4.4.

For NSW, the intermediate sector of manufacturing has the greatest reliance on imports while for the regional economy most intermediate sectors, apart from building and utilities, rely significantly on imports. This reflects the small size of the economy and hence its inability to supply all the inputs demanded by industries.

Figure 4.1
Summary of Aggregated Sectors: Regional Economy (2000-01)

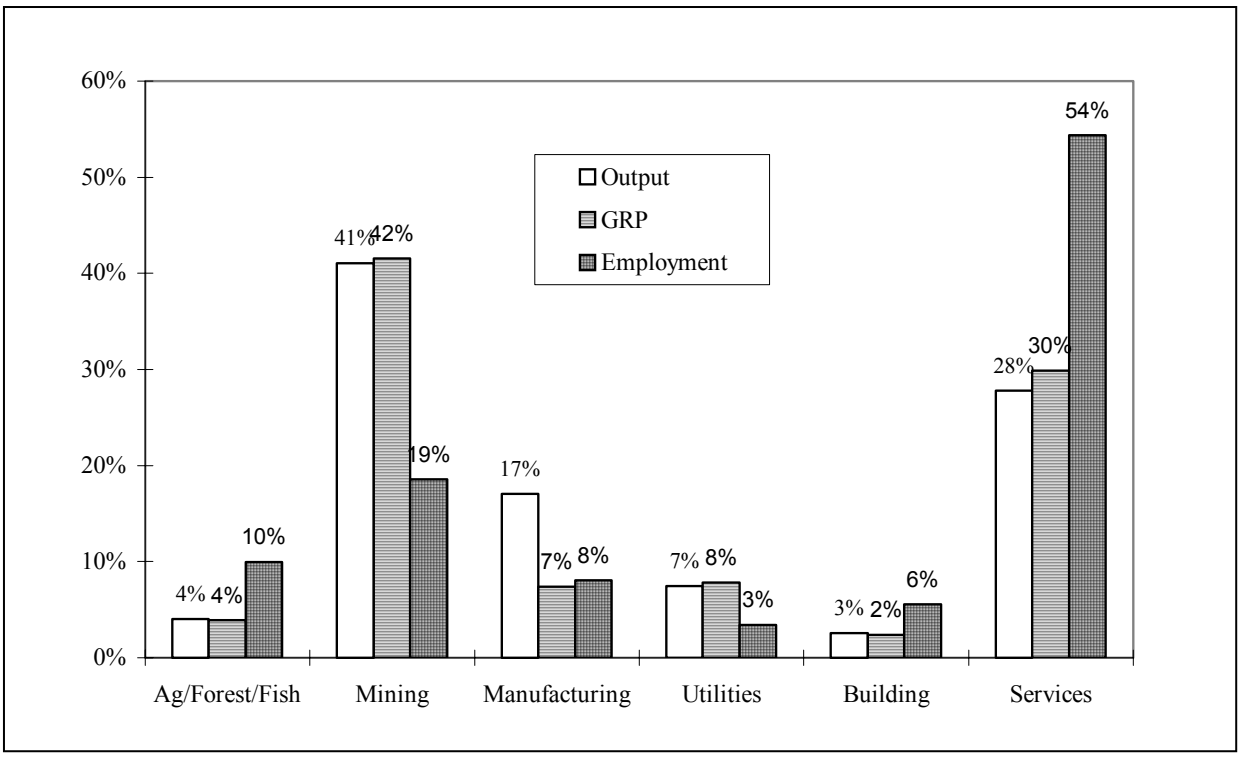


Figure 4.2
Summary of Aggregated Sectors: NSW Economy (2000-01)

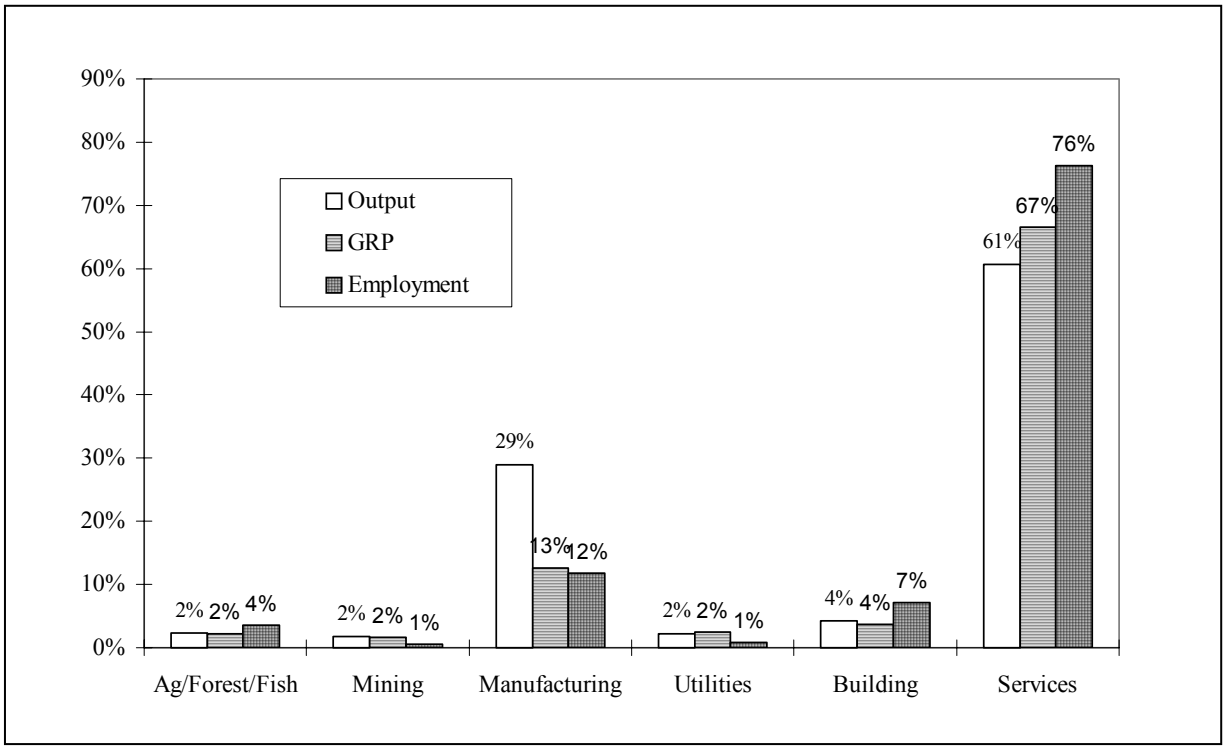
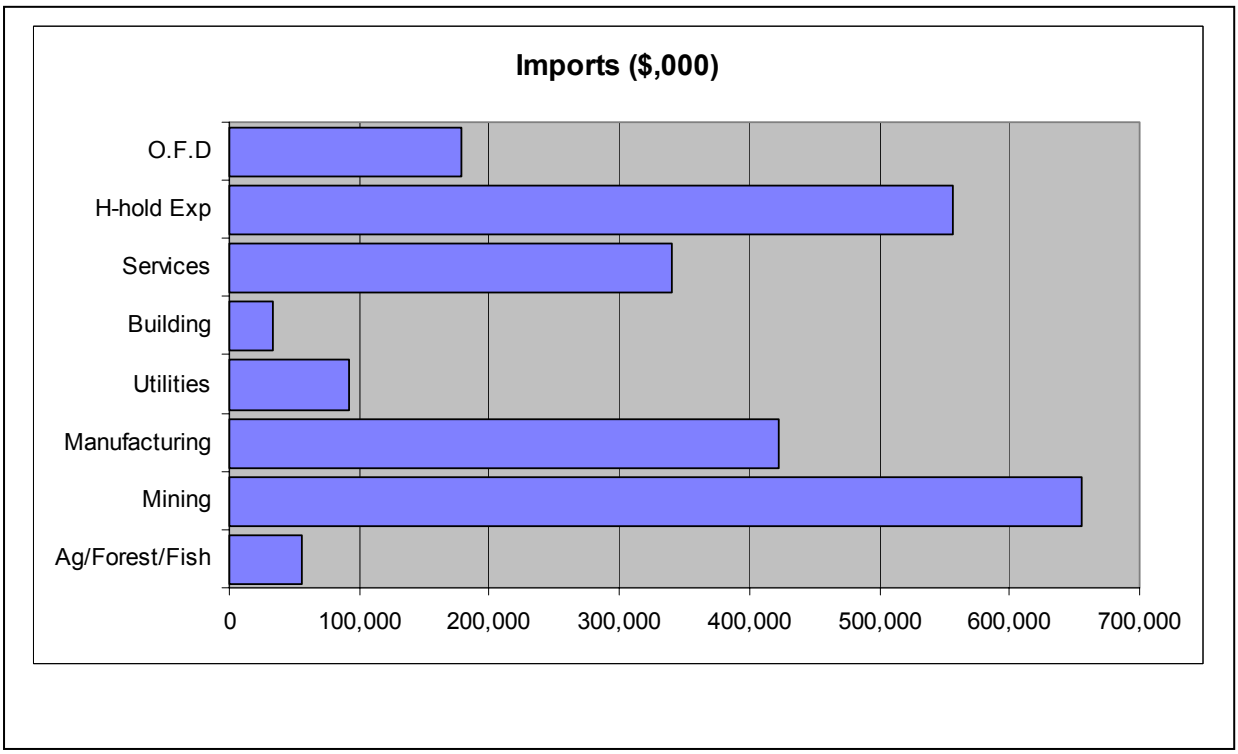
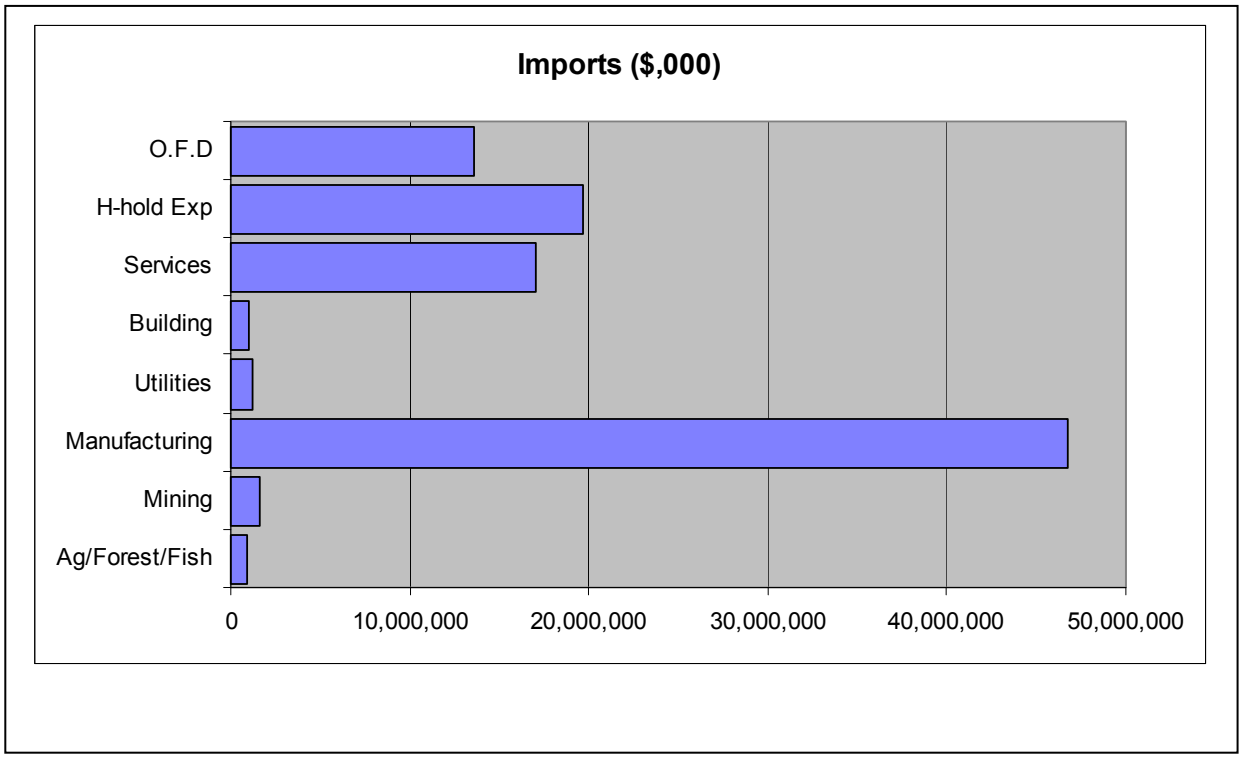


Figure 4.3
Regional Economy - Distribution of Imports by Destination Sector



Note: OFD is other final demand and includes Government final consumption expenditure, private gross fixed capital expenditure, public enterprise and general government gross fixed capital expenditure and increases in stocks.

Figure 4.4
NSW Economy - Distribution of Imports by Destination Sector



Figures 4.5 to 4.10 provide a more expansive sectoral distribution of gross regional output, employment, household income, gross regional product, exports and imports, and can be used to provide some more detail in the description of the economic structure of the economy.

In terms of all the regional economic indicators, gross regional output, value added, employment, income, imports and exports, the coal mining sector is by far the most significant sector of the regional economy.

With respect to regional output and value-added, food manufacturing (wine), utilities (electricity) and other agriculture (grapes) are the next most significant sectors of the economy. However, in terms of employment and wages some other more labour intensive sectors are also notable including, the trade sectors, building and construction and services sectors. The coal mining sector dominates exports and imports.

The coal mining sector is the most productive sector of the economy (as measured through Gross Regional Product per employee) and has the highest average wage of all the economy sectors.

4.3 MULTIPLIERS

The multipliers for each sector of the economy can also be derived from the input-output tables for the NSW economy and the regional economy.

The calculation of multipliers from the input-output tables is based on the following underlying assumptions:

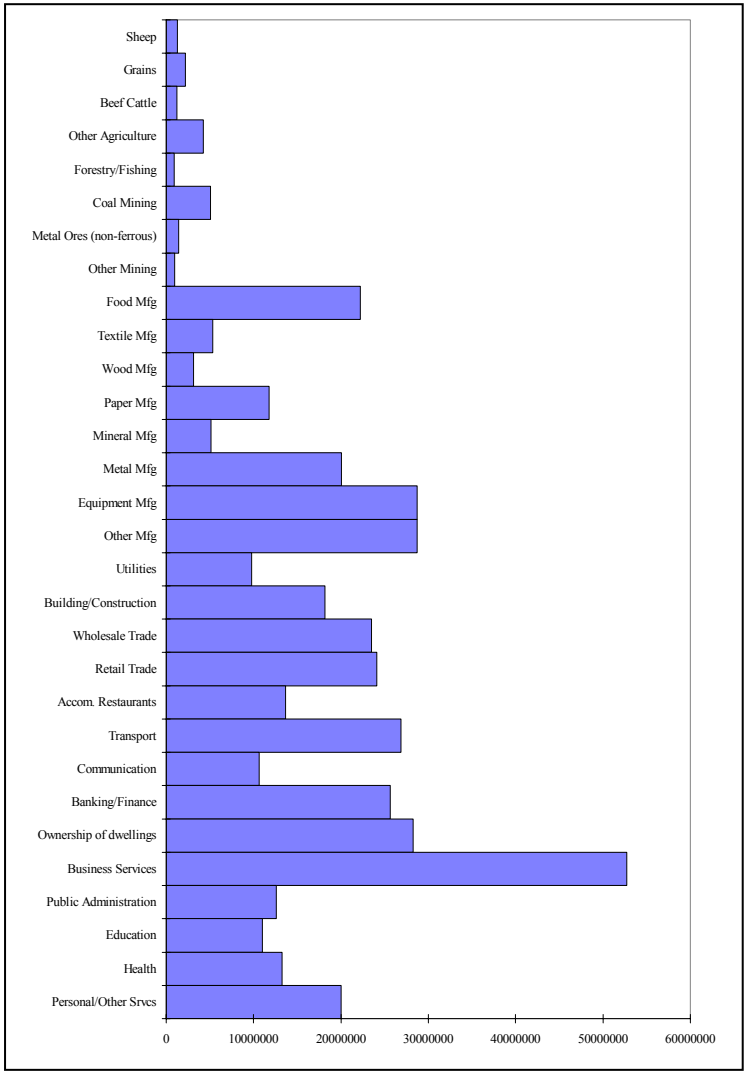
- “there is a fixed input structure in each industry, described by fixed technological coefficients;
- all products of an industry are identical or are made in fixed proportions to each other;
- each industry exhibits constant returns to scale in production;
- unlimited labour and capital are available at fixed prices; 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.” (ABS 1995, p 24).

Multipliers therefore do not take account of economies of scale, unused capacity or technological change since they describe average effects rather than marginal effects (ABS 1995).

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 gross regional output, employment, gross regional product and income multipliers show the gross regional output, employment, gross regional product and income responses to an initial gross regional output stimulus (Jensen and West, 1986).

Figure 4.5 Sectoral Distribution of Gross Regional Output ($,000)

NSW Economy



Regional Economy

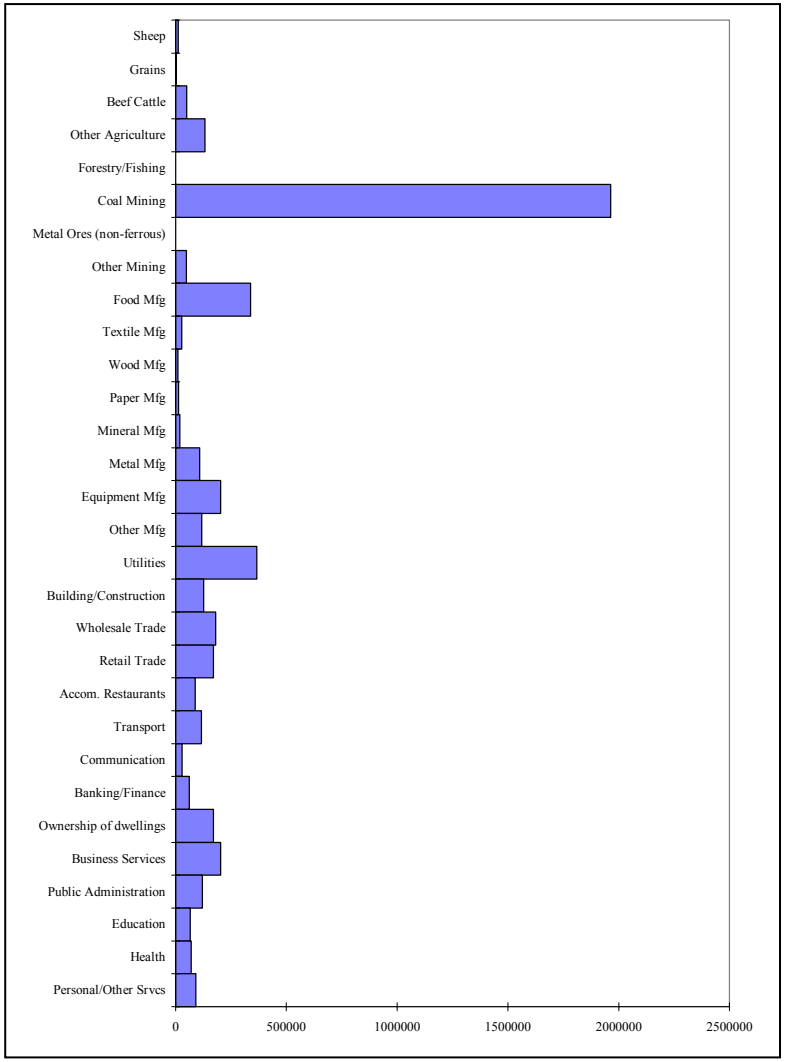
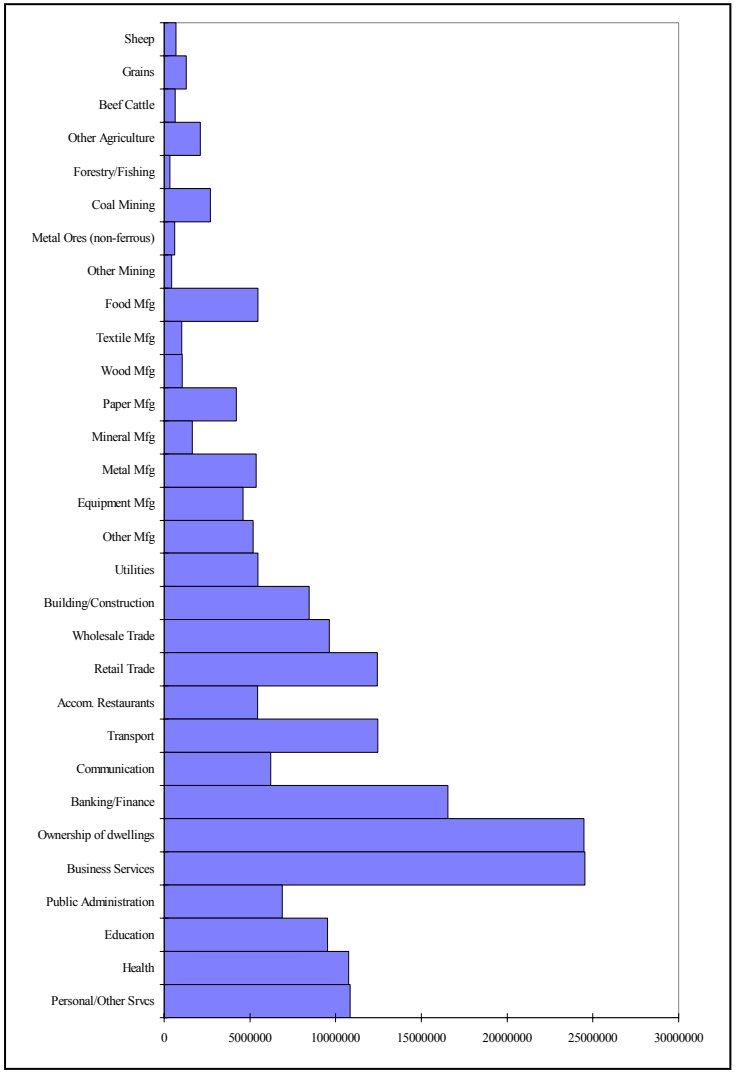


Figure 4.6 Sectoral Distribution of Gross Regional Product ($,000)

NSW Economy



Regional Economy

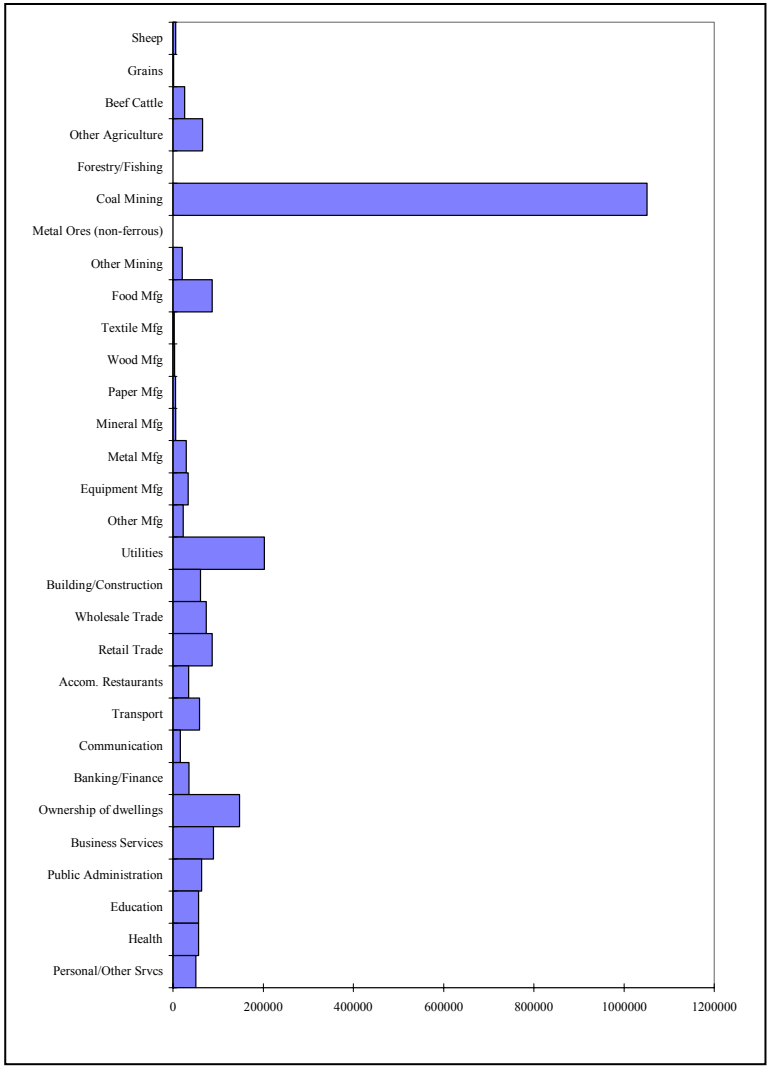
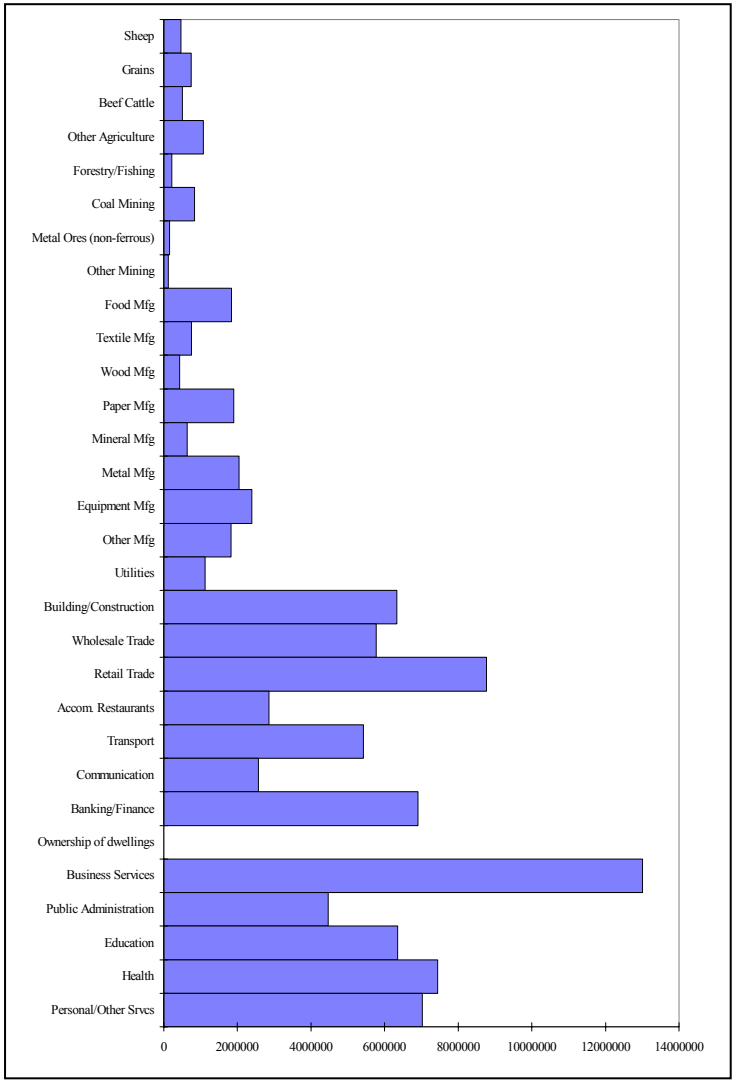


Figure 4.7 Sectoral Distribution of Gross Regional Income ($,000)

NSW Economy



Regional Economy

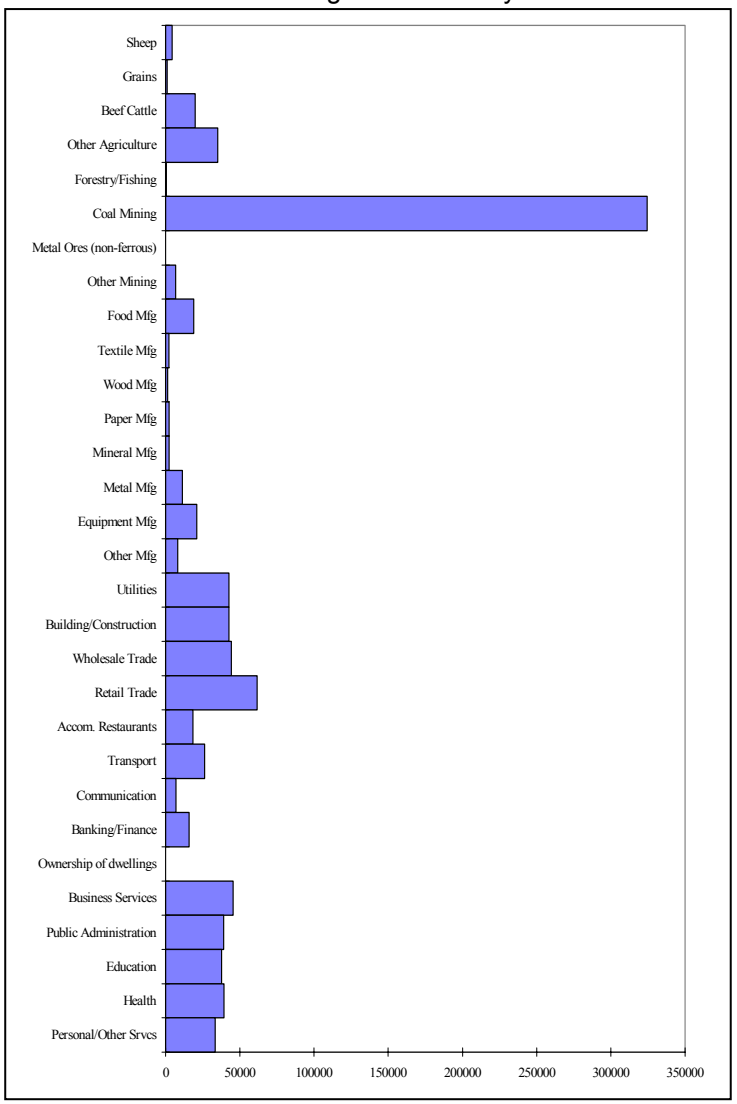
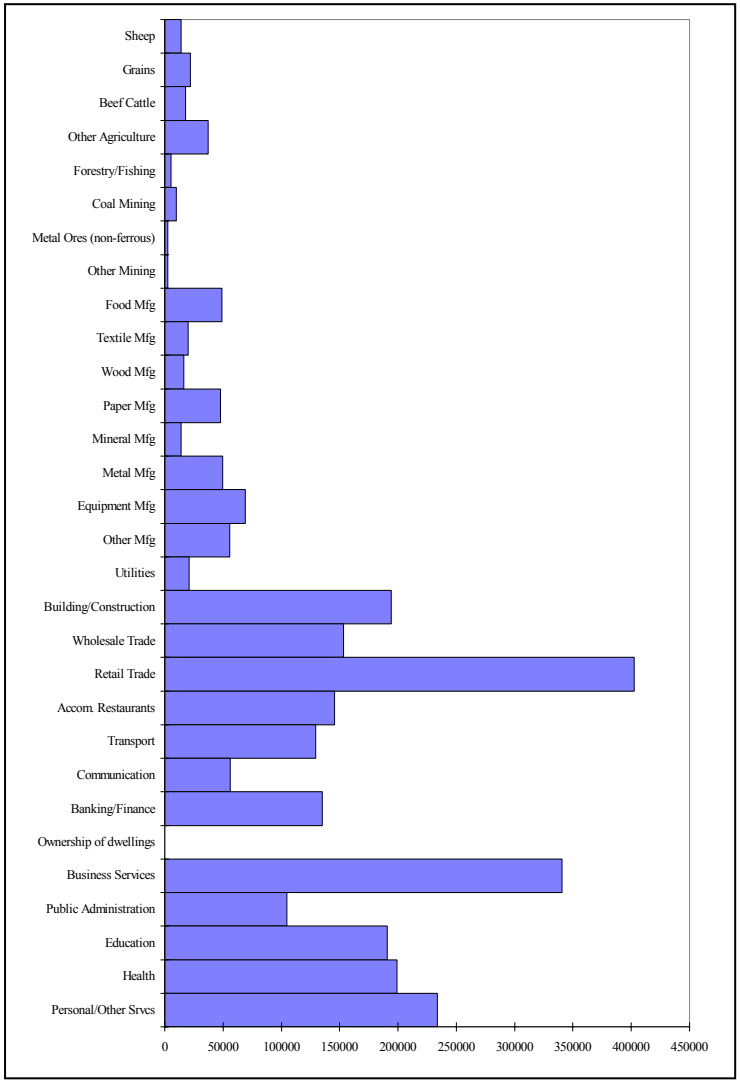


Figure 4.8 Sectoral Distribution of Regional Employment (No.)

NSW Economy



Regional Economy

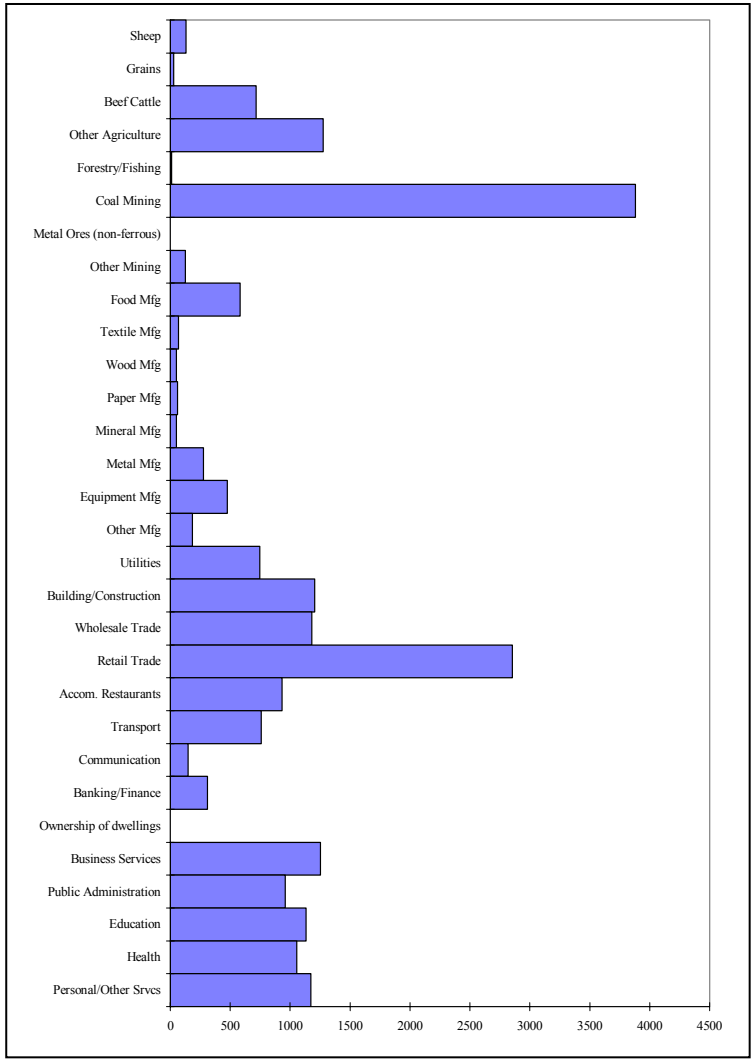
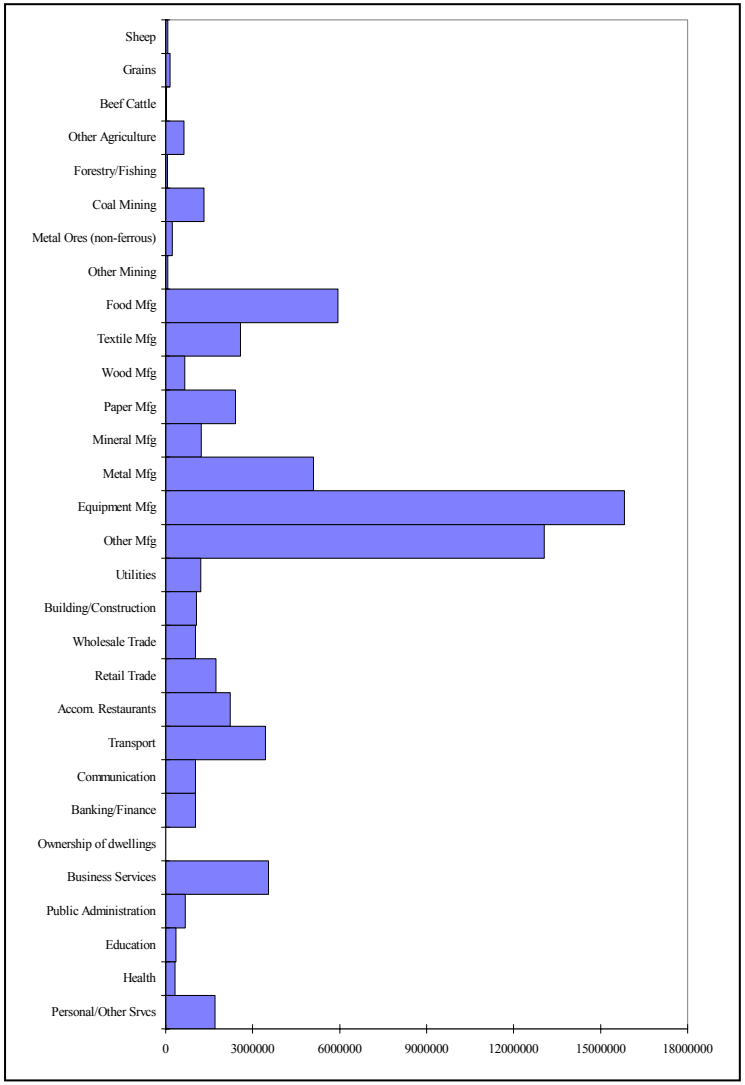


Figure 4.9 Sectoral Distribution of Imports ($,000)

NSW Economy



Regional Economy

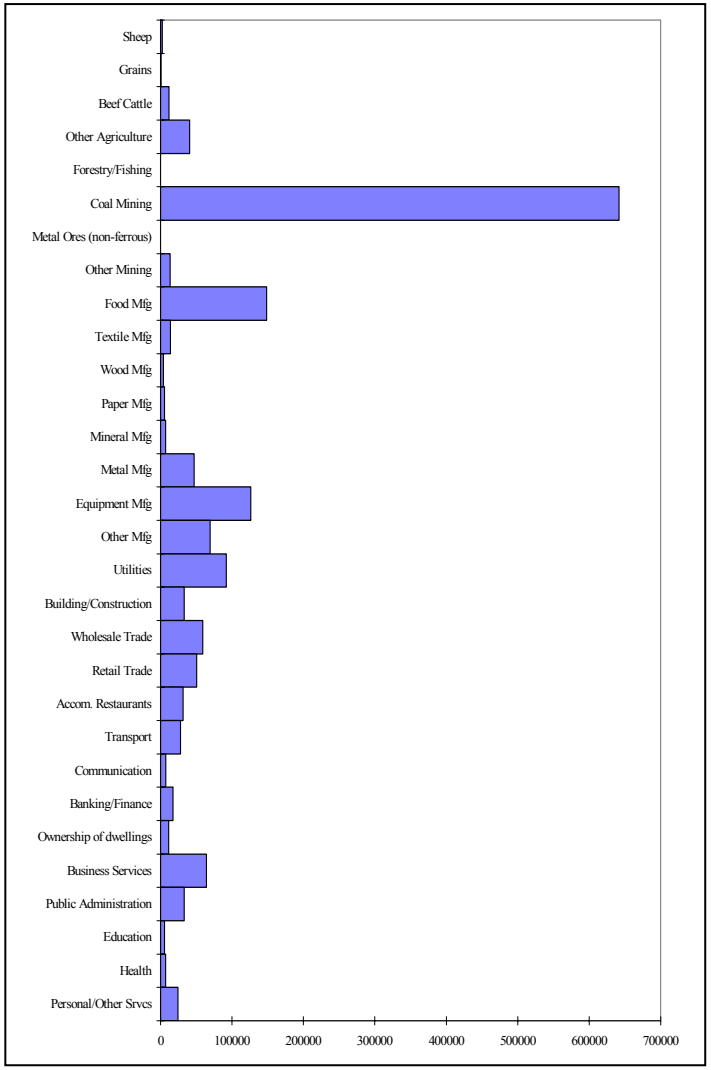
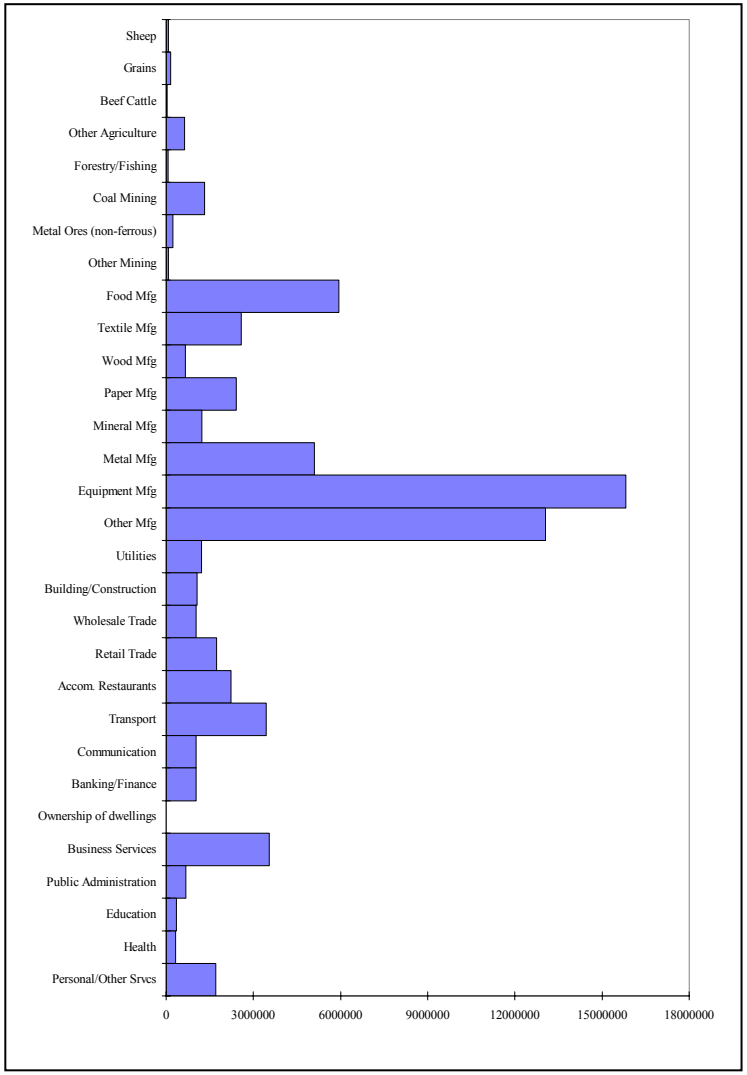
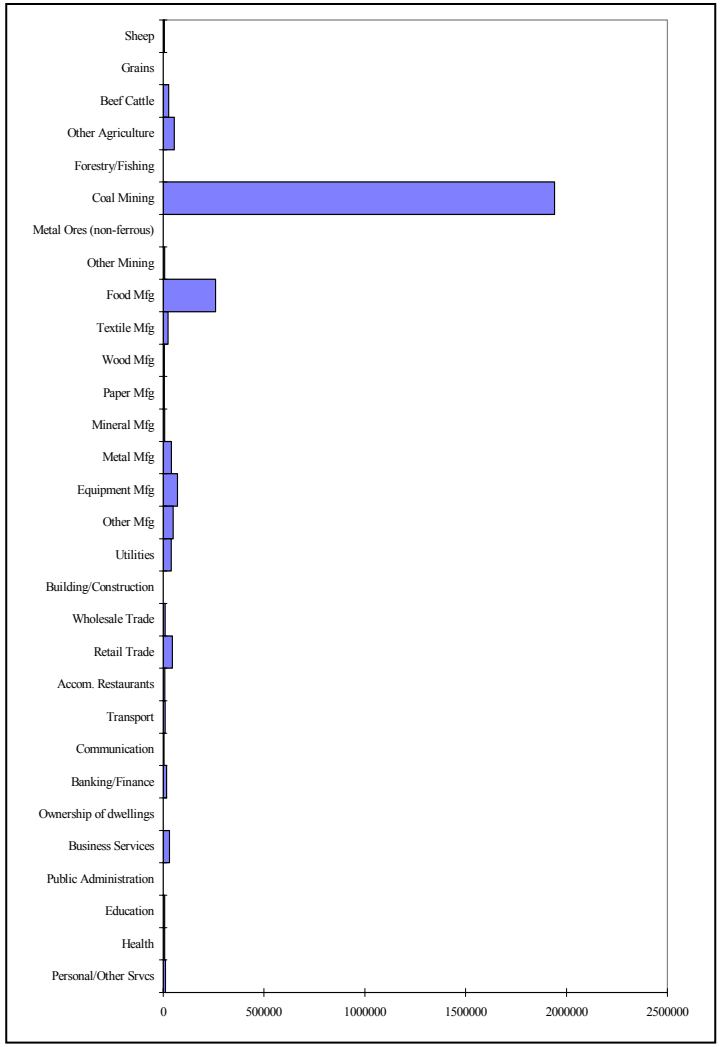


Figure 4.10 Sectoral Distribution of Gross Regional Exports ($,000)

NSW Economy



Regional Economy



Components of the conventional gross regional 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 ie. 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, gross regional product and income multipliers have similar components to the gross regional output multiplier, however, through conversion using the respective coefficients show the employment, gross regional product and income responses to an initial gross regional output stimulus (Jensen and West 1986).

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

A description of the different ratio multipliers is given below.

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

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

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

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

(Centre for Farm Planning and Land Management 1989, p.207)

Type 11A ratio multipliers are used in Section 4.4 to estimate the total regional economic impact of the Project.

4.4 ECONOMIC IMPACT OF THE PROJECT

The revenue, expenditure and employment associated with the construction and operation of the Project will stimulate economic activity for the regional economy, as well as for the broader NSW economy.

The regional impacts of both these stimuli are estimated for the indicators of output, value-added, income and employment.

4.4.1 Construction Phase

Economic activity associated with the Anvil Hill construction phase is estimated to mainly directly occur within three sectors of the economy:

- the *other construction sector* which includes those involved in the preparation of mine sites as well as the construction of plant and facilities, such as Coal Handling and Preparation Plants;
- *other property services sector* which is involved in the leasing of industrial machinery, plant or equipment; and
- *agriculture, mining and construction machinery manufacturing sector* which is involved in manufacturing construction, earthmoving and mining machinery.

4.4.1.1 Impact on Regional Economy

Given the largely specialist nature of capital equipment and the relatively small size of the economy, for the purpose of this analysis it is assumed that all such purchases and the leasing of machinery are made outside the regional economy. Thus regional economic activity from the mine establishment phase primarily relates to the *other construction sector*.

It is estimated that the monthly construction workforce will be range from 10 to 200 people over a period of approximately one year. On average over this time period a workforce of in the order of 100 is predicted.

A starting point for consideration of the indicative magnitude of economic impacts on the regional economy associated with this construction activity can be obtained by assuming that:

- that the *other construction sector* associated with the Project construction will have the same input output coefficients and hence regional linkages as the existing *other construction sector* in the region; and
- the 100 average direct workforce will have the same pattern of regional expenditure as a normal workforce within the region.

Under these assumptions, in the order of $14M of capital costs would need to be spent in the *other construction sector* within the region to result in a direct workforce of 100 people. The direct and indirect regional economic impacts of this level of expenditure in the Muswellbrook, Scone and Singleton region during the construction phase of the Project is provided below.

Impacts

Table 4.3
Regional Economic Impacts of the Construction Phase of the Project on the Regional Economy

	Direct Effect	Production Induced	Direct + Production Induced	Consumpt. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	13,837	4,757	18,594	2,622	7,379	21,216
Type 11A Ratio	*1.00*	*0.34*	*1.34*	*0.19*	*0.53*	*1.53*
INCOME ($'000)	4,481	846	5,327	708	1,554	6,035
Type 11A Ratio	*1.00*	*0.19*	*1.19*	*0.16*	*0.35*	*1.35*
VALUE ADDED ($'000)	6,973	1,843	8,816	1,238	3,081	10,054
Type 11A Ratio	*1.00*	*0.26*	*1.26*	*0.18*	*0.44*	*1.44*
EMPL. (No.)	100	21	121	23	44	143
Type 11A Ratio	*1.00*	*0.21*	*1.21*	*0.23*	*0.44*	*1.44*

The total regional impacts referred to above, separate out the flow-on effects that are associated with firms buying goods and services from each other (production-induced effects) and the flow-on effects that are associated with employing people who subsequently buy goods and services as households (consumption-induced effects). It is important to separate these two effects as they operate in different ways and have different spatial impacts.

Production-induced effects occur in a near-proportional way, whereas the consumption-induced flow-on effects will only occur in a proportional way if workers and their families enter the region. The implicit assumption in the impact summary provided in Table 4.3, is that all employment generated by the construction phase is sourced from workers outside the region who subsequently migrate into the region. Where this is not the case the consumption-induced impacts will be less. Total impacts will therefore lie between the direct plus production-induced effects and total effects provided in Table 4.3.

From Tables 4.3 it is estimated that construction of the Project will contribute in the order of:

- $19M to $21M in annual direct and indirect regional output or business turnover;
- $9M to $10M in annual direct and indirect regional value added;
- $5M to $6M in annual direct and indirect household income; and
- 121 to 143 direct and indirect jobs.

These particular impacts on the regional economy are only likely to be felt for a period of in the order of one year, with lesser impacts in other partial years of construction related activities.

Multipliers

The adjusted Type 11A ratio multipliers for the construction phase of the mining proposal range from 1.35 for income up to 1.53 for output.

Main Sectors Affected

Flow-on impacts from the construction phase of the Project are likely to affect a number of different sectors of the regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be *wholesale and retail trade*, *accommodation, cafes, restaurants, road transport, scientific research* and *fabricated metal products*.

Examination of the estimated direct and flow-on employment impacts gives an indication of which sectors employment opportunities would be generated in. This provides important information to the community infrastructure assessment to facilitate consideration of whether this increased demand can be met from the unemployed within the region or from people migrating from outside the region and hence implications for housing demand and demand for community infrastructure.

Table 4.4
Distribution of Average Direct and Flow-on Employment by Industry Sector of the Construction Phase for the Regional Economy

Sector	Average Direct Effects	Production Induced	Adjusted Consumption-induced	Total
Primary	0	0	1	1
Mining	0	0	0	0
Manufacturing	0	5	1	6
Utilities	0	0	0	1
Wholesale/Retail	0	4	10	14
Mechanical and other repairs	0	2	1	2
Accommodation,cafes, restaurants	0	1	3	3
Building/Construction	100	0	0	100
Transport	0	3	1	3
Services	0	6	7	13
Total	100	21	23	143

Note: Totals may have minor discrepancies due to rounding.

Direct employment impacts would generate demand for *other construction* employment. Production-induced employment impacts would mainly generate demand for employment in the:

- *services sectors* (predominantly *other property services, legal, accounting and business management sector, scientific research, technical and computer services and other business services*);
- *wholesale and retail trade*;
- *manufacturing* (predominantly *cement lime and concrete slurry manufacturing, structural metal products manufacturing and fabricated metal products manufacturing*); and
- *transport sector* (predominantly *road transport*).

Consumption-induced employment flow-ons would mainly generate demand in the:

- *wholesale and retail trade sectors;*
- *services sectors (education, health, community services and personal services); and the*
- *accommodation, cafes and restaurants sector.*

4.4.1.2 Impact on the NSW Economy

The impacts of mine construction on the NSW economy are likely to be greater than that estimated for the regional economy as a result of:

- the NSW economy also capturing some of the expenditure of Centennial on mine equipment manufacturing and leasing;
- the larger intersectoral linkages and hence multipliers of the NSW economy.

In the absence of financial projections on mine equipment purchases and leasing within NSW the analysis is limited to examining the larger intersectoral linkages of the NSW economy by applying NSW output, income, value-added and employment ratio multipliers for the *Other construction sector* to the direct impacts from Table 4.3. The results are reported below.

Impacts

Table 4.5
Regional Economic Impacts of the Construction Phase of the Project on the NSW Economy

	Direct Effect	Production Induced	Direct + Production Induced	Consumpt. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	13,837	11,263	25,100	9,755	21,018	34,855
Type 11A Ratio	*1*	*0.81*	*1.81*	*0.71*	*1.52*	*2.52*
INCOME ($'000)	4,481	1,976	6,457	1,918	3,894	8,375
Type 11A Ratio	*1*	*0.44*	*1.44*	*0.43*	*0.87*	*1.87*
VALUE ADDED ($'000)	6,973	4,295	11,268	4,937	9,232	16,205
Type 11A Ratio	*1*	*0.62*	*1.62*	*0.71*	*1.32*	*2.32*
EMPL. (No.)	100	47	147	54	101	201
Type 11A Ratio	*1*	*0.47*	*1.47*	*0.55*	*1.02*	*2.02*

Again, the estimated consumption-induced flow-on effects will only occur to this degree if all workers and their families enter the region. The implicit assumption in the impact summary provided in Table 3.6, is that all employment generated by the expenditure in NSW is sourced from workers outside of NSW who subsequently migrate into the region. Where this is not the case the consumption-induced impacts will be less. Total impacts will therefore lie between the direct plus production-induced effects and total effects provided in Table 4.5.

From Tables 4.5 it is estimated that construction impacts of the Project on the NSW economy would be in the order of:

- $25M to $35M in annual direct and indirect regional output or business turnover;
- $11M to $16M in annual direct and indirect regional value added;
- $6M to $8M in annual direct and indirect household income; and
- 147 to 201 direct and indirect jobs.

Multipliers

The Type 11A ratio multipliers for the construction phase of the mining proposal range from 1.87 for income up to 2.52 for output in the NSW economy.

4.4.2 Operation Phase

For the analysis of the operation phase of the Project, a new Anvil Hill sector was inserted into the regional input-output table and the NSW input-output table, indexed to 2006. To generate this new sector, cost and revenue data generated for the benefit cost analysis was further refined, as follows, to be in the form required for regional economic impact assessment:

- Average annual revenue (based on the market value of the coal) exclusive of GST was allocated to the *total output* row of the new sector. For the smaller region of Muswellbrook, Scone and Singleton, revenue and costs were also adjusted to exclude coal transport costs since these would essentially occur outside the region.
- The estimated wages for Centennial Coal employees and direct mining contractor employment was allocated to the *income* row.
- The difference between average annual gross revenue and average annual operating costs was allocated to the *other value-added* row.
- Average annual operating costs (net of *income* paid to employment and contractors) was allocated between total *intermediate* sector usage and *imports* in the same ratios as for the Coal sector in Muswellbrook, Scone and Singleton input-output table and the NSW input-output table.
- Estimated total intermediate sector usage was then allocated across 106 sectors in the same ratios as for the Coal sector in Muswellbrook, Scone and Singleton input-output table and the NSW input-output table.

The major difference between the sectors generated for the regional input-output table and the NSW input-output table was the greater revenue and input costs (intermediate plus imports) for NSW, reflecting the inclusion of transport costs and that NSW is able to provide a greater proportion of the inputs to production whereas the smaller region has greater reliance on imports.

Table 4.6
Project Sector for the Regional Economy and NSW Economy (2006 Dollars)

	Region ($000)	NSW ($000)
TOTAL INTERMEDIATE	$23,384	**$43,394**
Wages and Salaries	$19,234	$19,234
Other Value Added	$84,047	$84,047
Imports	$55,262	$55,427
OUTPUT	**$181,928**	**202,102**
Employment	**208**	**208**

On this basis the estimated regional economic impacts of the operation phase of the Project were determined for the regional economy and for the NSW economy.

4.4.2.1 Impacts

The total and disaggregated annual impacts of the operational phase of the Project on the regional economy and the NSW economy in terms of output, value added, income and employment (in 2006 dollars) are shown in Table 4.7 and Table 4.8.

Table 4.7
Annual Regional Economic Impacts of the Operation Phase of the Project on the Regional Economy

	Direct Effect	Production Induced	Direct + Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	181,928	30,406	212,334	12,213	42,619	224,547
Type 11A Ratio	*1.00*	*0.17*	*1.17*	*0.07*	*0.23*	*1.23*
INCOME ($'000)	19,236	5,582	24,818	3,298	8,881	28,117
Type 11A Ratio	*1.00*	*0.29*	*1.29*	*0.17*	*0.46*	*1.46*
VALUE ADDED ($'000)	103,293	11,977	115,270	5,766	17,742	121,035
Type 11A Ratio	*1.00*	*0.12*	*1.12*	*0.06*	*0.17*	*1.17*
EMPL. (No.)	208	135	343	107	241	449
Type 11A Ratio	*1.00*	*0.65*	*1.65*	*0.51*	*1.16*	*2.16*

Table 4.8
Annual Regional Economic Impacts of the Operation Phase of the Project on the NSW Economy

	Direct Effect	Production Induced	Direct + Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	202,102	72,923	275,025	49,886	122,809	324,911
Type 11A Ratio	*1.00*	*0.36*	*1.36*	*0.25*	*0.61*	*1.61*
INCOME ($'000)	19,234	13,763	32,997	9,800	23,563	42,797
Type 11A Ratio	*1.00*	*0.72*	*1.72*	*0.51*	*1.23*	*2.23*
VALUE ADDED ($'000)	103,279	29,614	132,893	25,234	54,848	158,127
Type 11A Ratio	*1.00*	*0.29*	*1.29*	*0.24*	*0.53*	*1.53*
EMPL. (No.)	208	323	531	278	601	809
Type 11A Ratio	*1.00*	*1.55*	*2.55*	*1.34*	*2.89*	*3.89*

Again, the implicit assumption in the impact summary provided in Tables 4.7 and 4.8 is that all employment generated by the proposal is sourced from workers outside the regions who subsequently migrate into the regions. In reality, this is unlikely to be the case and hence the consumption-induced impacts will be less. Total impacts will therefore lie between the direct plus production-induced effects and total effects provided in Table 4.7 and Table 4.8.

In total, the operation of the Project is estimated to make the following contribution to the regional economy:

- between $212M and $224M in annual direct and indirect regional output or business turnover;
- between $115M and $121M in annual direct and indirect regional value added;
- between $25M and $28M in annual household income; and
- between 343 and 449 direct and indirect jobs.

For the NSW economy, the operation of the Project is estimated to contribute:

- between $275M and $324M in annual direct and indirect regional output or business turnover;
- between $133M and $158M in annual direct and indirect regional value added;
- between $33M and $43M in annual household income; and

- between 531 and 809 direct and indirect jobs.

4.4.2.2 Multipliers

The multipliers for any particular sector of a regional economy reflect primarily:

- the magnitude of, and relationship between, the direct effects eg. labour, income and gross profit to output levels;
- the level of direct intermediate sector expenditures that would be captured within the region; and
- the ability of other sectors in the region to supply production and consumption induced goods and services that are demanded.

The type 11A ratio multipliers for the operational phase of the Project are also provided in Tables 4.7 to 4.8.

For the regional economy, the Type 11A ratio multipliers for the operational phase of the mining proposal range from 1.17 for value-added up to 2.16 for employment. While for the larger NSW region they range from 1.53 for value added up to 3.89 for employment.

The higher ratio multipliers for employment and income reflect the capital-intensive nature of operation of the Project. Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to high ratio multipliers for employment. The lesser ratio multiplier for income (compared to employment) probably largely reflects comparatively higher wage levels in the mining and ore processing sectors compared to incomes in the sectors that will experience flow-on effects from the Project. The low ratio multipliers for output and value-added largely reflect the high direct output and value-added generated by the Project compared to the sectors that experience flow-on effects from the Project.

4.4.2.3 Main Sectors Affected

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

- *retail trade sector* which consists of business engaged in retail trade;
- *wholesale trade sector* which consists of businesses engaged in wholesale trade;
- *rail and road transport sectors* which consists of businesses engaged in operating railways for the transportation of freight or passengers and businesses engaged in, among other things, the transportation of freight by road;
- *accommodation, cafes and restaurants* which consists of businesses engaged in providing hospitality services in the form of accommodation, meals and drinks;
- *agricultural and mining machinery manufacturing sector* which consists of businesses engaged in, manufacturing construction, earthmoving and mining machinery;
- *electricity supply sector* which consists of businesses engaged in the generation, transmission or distribution of electricity;
- *other property services sector* which includes business involved in renting and leasing assets including machinery, equipment, motor vehicles, real estate, airplanes, etc;

- *community services* which includes businesses engaged in, among other things, child care services;

For NSW similar sectors are likely to be the most impacted, however, other sectors also become more significant such as the *communication sector, banking sector, petroleum sector, legal, accounting, marketing and business management services and ownership of dwellings sector*.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities would be generated. This provides important information to the community infrastructure assessment to facilitate consideration of whether this increased demand can be met from the unemployed within the region or from people migrating from outside the region and hence implications for housing demand and demand for community infrastructure.

Table 4.9
Distribution of Average Direct and Flow-on Employment by Industry Sector for the Regional Economy

Sector	Average Direct Effects	Production Induced	Adjusted Consumption-induced	Total
Primary	0	0	2	211
Mining	208	5	0	5
Manufacturing	0	19	3	23
Utilities	0	4	2	6
Wholesale/Retail	0	25	48	73
Mechanical and other repairs	0	3	4	7
Accommodation,cafes, restaurants	0	6	13	19
Building/Construction	0	1	0	1
Transport	0	21	3	24
Services	0	50	31	81
Total	**208**	**135**	**107**	**449**

Note: Totals may have minor discrepancies due to rounding.

Table 4.9 indicates that direct, production-induced and consumption-induced incremental employment impacts of the Project on the regional economy are likely to have different distributions across sectors.

The Project operation would directly generate demand for mining employment. Production-induced employment impacts would mainly occur in the services sectors (predominantly community services, legal, accounting and business management sector, other businesses services, other services, other property services, scientific research and banking), wholesale and retail trade, manufacturing (predominantly agriculture, mining and construction machinery manufacturing, fabricated metal products manufacturing, other chemicals manufacturing, other machinery manufacturing and iron and steel manufacturing) and transport sector (predominantly rail and road transport). Consumption-induced employment flow-ons would mainly occur in the wholesale and retail trade sectors, the services sectors (education, health, community services and personal services) and accommodation, cafes and restaurants sector.

4.5 IMPACT OF CESSATION OF THE PROJECT ON THE REGIONAL ECONOMY

The magnitude of the regional economic impacts of cessation of the Project would largely depend on whether the workers and their families affected by Project cessation would leave the region. Where displaced workers remain in the region the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants 1989). Under this assumption the regional economic impacts on the regional

economy of mine closure would approximate the direct effects and production-induced effects identified in Table 4.7. However, if displaced workers and their families leave the region then impacts may begin to approximate the total impacts identified in Table 4.7.

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

There is some evidence to suggest that on closure of major employment activities in regional economies, such as abattoirs etc. that many displaced workers and their families remain in the area. The greater number of families that remain in the region the less would be the economic impact of Project cessation.

The regional economic impetus of the Project may also stimulate a 'virtuous cycle' of growth. This theory of regional economic growth suggests that places that are able to attract population immigration (eg. associated with mining proposals) create increased demand for goods and services and thus more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen 1990).

Ultimately, the significance of the economic impacts of cessation of the Project would depend on the relative significance of the Project to the regional economy and the economic structure and trends in the regional economy at the time. For example, if the impacts of Project cessation take place in a declining economy the impacts might be significant. Alternatively, if Project cessation takes place in a growing diversified economy, where there are other development opportunities, the ultimate cessation of the Project may not be a cause for concern.

To the extent that alternative development opportunities arise in the regional economy, the regional economic impacts associated with mining closure that arise through reduced production and employment expenditure can be substantially ameliorated and absorbed by the growth of the region. One key factor in the growth potential, is a region's capacity to expand its factors of production by attracting investment and labour from outside the region (BIE, 1994). This in turn can depend on a region's natural endowments. The Muswellbrook, Scone, Singleton region and the broader Hunter region is highly prospective with coal mining being a major industry in the region. It is therefore highly likely that over time new mining developments would occur, offering potential to strengthen the economic base and hence buffer against impacts of the cessation of individual coal mining activities.

Nevertheless, given the long term nature of the Project it is not possible to foresee the likely circumstances within which Project cessation would occur. It is therefore important for regional authorities and leaders to take every advantage of the stimulation to regional economic activity and skills and expertise that the Project would bring to the region.

5.0 CONCLUSIONS

A benefit cost analysis, identified a range of incremental economic costs and benefits of the Project and placed indicative values on the production costs and benefits. External economic costs and benefits of the proposal were identified and discussed. The analysis indicated that the incremental net production benefits of the Project (after full incorporation of greenhouse gas effects, air quality impacts, noise and blast vibration, agricultural impacts, traffic impacts, and partial internalisation of visual impacts, flora and fauna impacts, Aboriginal heritage impacts and historic heritage impacts) would be in the order of $480M. This net benefit is distributed amongst a range of stakeholders including:

- Company shareholders;
- the NSW Government via royalties and payroll tax;
- the Commonwealth Government in the form of Company tax;
- the local community via Centennial's Community Enhancement Plan which includes:
  - an upfront contribution to community infrastructure in Denman and Wybong of $500,000;
  - an education and training contribution of $200,000 per annum for 3 years;
  - a contribution to environmental management in the local catchment of $100,000 per annum for 5 years.
- the local community via Centennial's proposed conservation and heritage offsets.

The estimated net production benefit of the Project represents the opportunity cost to society of not proceeding with the Project. Put another way, any environmental costs of the Project, after mitigation by Centennial, would need to be costed at greater than $480M to make the Project questionable from an economic efficiency (net community welfare) perspective.

The Project will also stimulate economic activity in the immediate region and NSW. Using input-output analysis, it was estimated that during the construction phase of the Project it would contribute the following to the regional economy and NSW economy, respectively:

Regional Economy – Construction Phase

- $19M to $21M in annual direct and indirect regional output or business turnover;
- $9M to $10M in annual direct and indirect regional value added;
- $5M to $6M in annual direct and indirect household income; and
- 121 to 143 direct and indirect jobs.

These particular impacts on the regional economy are only likely to be felt for a period of in the order of one year , with lesser impacts in other partial years of construction activity.

NSW Economy – Construction Phase

- $25M to $35M in annual direct and indirect regional output or business turnover;
- $11M to $16M in annual direct and indirect regional value added;
- $6M to $8M in annual direct and indirect household income; and
- 147 to 1201 direct and indirect jobs.

Operation of the Project was estimated to have the following impacts on the regional economy and NSW economy, respectively:

Regional Economy – Operational Phase

- $212M to $224M in annual direct and indirect regional output or business turnover;
- $115M to $121M in annual direct and indirect regional value added;
- $25M to $28M in annual household income; and
- 343 to 449 direct and indirect jobs.

NSW Economy – Operational Phase

- $275M to $324M in annual direct and indirect regional output or business turnover;
- $133M to $158M in annual direct and indirect regional value added;
- $33M to $43M in annual household income; and
- 531 to 809 direct and indirect jobs.

The main sectors of the regional economy that would be stimulated by the construction phase of the Project are the *other construction sector* and the *wholesale and retail trade, accommodation, cafes, restaurants, road transport, scientific research and fabricated metal products*.

The Project operation would directly generate demand for mining employment in the regional economy. Production-induced employment impacts would mainly occur in the *services sectors (predominantly community services, legal, accounting and business management sector, other businesses services, other services, other property services, scientific research and banking), wholesale and retail trade, manufacturing (predominantly agriculture, mining and construction machinery manufacturing, fabricated metal products manufacturing, other chemicals manufacturing, other machinery manufacturing and iron and steel manufacturing) and transport sector (predominantly rail and road transport).* Consumption-induced employment flow-ons would mainly occur in the *wholesale and retail trade sectors, the services sectors (education, health, community services and personal services) and accommodation, cafes and restaurants sector*.

6.0 REFERENCES

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ATTACHMENT A

THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

ATTACHMENT A
THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

"The 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 non-ferrous metals and building and construction sectors. 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. It also means that the method should be used by an analyst who is familiar with the economy being modelled, or at least someone with that familiarity should be consulted.

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). That 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 IA-1" (Powell and Chalmers 1995, p13-14).

Table IA-1
The GRIT Method

Phase	Step	Action
PHASE I		ADJUSTMENTS TO NATIONAL TABLE
	1	Selection of national input-output table. (109-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: Table 2 in Bayne and West (1988)

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