ENVIRONMENTAL ASSESSMENT

Duralie Extension Project

APPENDIX G
SOCIO-ECONOMIC ASSESSMENT

GLOUCESTER COAL

ResourceStrategies

Appendix G

Duralie Extension Project
Socio-Economic Assessment

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November 2009

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EXECUTIVE SUMMARY

The Duralie Extension Project (the Project) is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley in New South Wales (NSW). The Project would involve the continuation of open pit coal mining at the Duralie Coal Mine (DCM) for nine years, including the production of up to 3 million tonnes per annum of run-of-mine coal for transport to Stratford Coal Mine (SCM).

The Project requires the preparation of an Environmental Assessment (EA) in accordance with the requirements of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). A socio-economic assessment is required as part of the EA.

From a socio-economic perspective there are three important aspects of the Project that can be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of the Project);
- its regional economic impacts (i.e. the economic stimulus that the Project would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations) often considered in terms of the impacts on employment, population and community infrastructure.

A benefit cost analysis of the Project indicated that it would have a net production benefit in the order of $247 million (M). The net production benefit is distributed amongst a range of stakeholders including:

- Duralie Coal Pty Ltd (DCPL) and Gloucester Coal Ltd (GCL) shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of company tax.

The NSW Government receives additional benefits in the form of payroll tax and local councils would also benefit through community infrastructure contributions required under the EP&A Act (if applicable).

The Project also has a range of external economic costs and benefits. External costs associated with noise and dust emissions have been included in the estimate of net production benefits through the acquisition costs for affected properties. The environmental cost of greenhouse gas emissions are estimated at $28M. These costs would ultimately be internalised into the Project through the purchase of emission credits under any emissions trading scheme introduced by the Commonwealth Government and higher prices paid for electricity, diesel and rail transport. There would also be external costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by DCPL. The external benefits associated with employment provided by the Project have been estimated at $117M.

Overall the Project is estimated to have net benefits to society of $336M and hence is desirable and justified from an economic efficiency perspective.

An economic impact analysis, using input-output analysis, estimated that the Project would contribute the following to the regional economy (Gloucester and Great Lakes):

- $208M in annual direct and indirect regional output or business turnover;
- $84M in annual direct and indirect regional value-added;
- $10M in annual household income; and
- 166 direct and indirect jobs.

At the State level it is estimated that the Project would make the following contribution to the economy:

- $413M in annual direct and indirect output or business turnover;
- $196M in annual direct and indirect value-added;
- $75M in annual household income; and
- 1,004 direct and indirect jobs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes, for example, housing, health and education facilities.

The additional direct workforce from the Project is estimated at 15 employees above the existing DCM workforce. Conservatively assuming that all of this workforce migrates into the broader region, has the same residential distribution as current employees (46 percent [%] residing in the Gloucester region and 16% residing in the Great Lakes region) and the same household occupancy as NSW, the additional population impacts would be 35 in the Gloucester region and 12 in the Great Lakes region.

This potential influx in population is small in the context of existing populations of the two regions and is considered likely to have negligible impacts on housing, schools, health or community infrastructure. For the Gloucester region, which has experienced fluctuating population levels since 1996, any population growth from the Project would help avoid decline.

Cessation of the Project after nine years of operation may lead to a reduction in economic activity. The significance of Project cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Project cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given these uncertainties 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 from the stimulation to regional economic activity and skills and expertise that the Project brings to the region, to strengthen and broaden the region's economic base.

G1 INTRODUCTION

Duralie Coal Pty Ltd (DCPL), a wholly owned subsidiary of Gloucester Coal Ltd, owns and operates the Duralie Coal Mine (DCM) which is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley in New South Wales (NSW). The DCM commenced operation in 2003 and produces up to 1.8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coking and thermal coal. ROM coal produced at DCM is transported by rail to Stratford Coal Mine (SCM) where it is processed in the SCM Coal Handling and Preparation Plant. Blended product coal produced at the SCM is transported off-site by rail, primarily to the Port of Newcastle for export.

The Duralie Extension Project (the Project) would involve the continuation of open pit coal mining at the DCM for nine years, including the production of up to 3 Mtpa of ROM coal for transport to SCM. DCPL is preparing an Environmental Assessment (EA) for the Project in accordance with the requirements of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Director-General's Environmental Assessment Requirements (EARs) for the Project indicate that social and economic assessment is required as part of the EA including:

- *an assessment of the demand the project may generate for the provision of local infrastructure and services; and*
- *an assessment of the costs and benefits of the project, and whether the project would pass the net benefit test.*

In this respect, consideration was given to the relevant aspects of the Planning NSW's (James and Gillespie, 2002) draft *Guideline for Economic Effects and Evaluation in EIA* and the Office of Social Policy's (1995) *Techniques for Effective Social Impact Assessment: A Practical Guide*.

From a socio-economic perspective there are three important aspects of the Project that can be considered:

- the economic efficiency of the Project (i.e. consideration of economic costs and benefits);
- the regional economic impacts of the Project (i.e. the economic stimulus that the Project would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

Planning NSW (James and Gillespie, 2002) draft *Guideline for Economic Effects and Evaluation in EIA* identified economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The draft guidelines identified BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

The above draft guideline indicates that regional economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic stimulus to the local economy can be estimated using input-output modelling of the regional economy (regional economic impact assessment).

The draft guidelines also identify the need to consider the distribution of benefits and costs in terms of:

- intra-generational equity effects – the incidence of benefits and costs within the present generation; and
- inter-generational equity effects – the distribution of benefits and cost between present and future generations.

These social impacts are often considered in terms of the impacts on employment, population and community infrastructure. This study relates to the preparation of each of the following types of analyses:

- a BCA of the Project;
- a regional economic impact assessment of the Project; and
- an Employment, Population and Community Infrastructure Assessment (EPCIA).

A consultation programme for the EA was undertaken by DCPL and is described in Section 3 in the Main Report of the EA.

G2 BENEFIT COST ANALYSIS

G2.1 INTRODUCTION

For the Project to be economically desirable from a 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, 2002). For mining projects, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental costs. The main technique that is used to weigh up these benefits and costs is BCA.

A BCA involves the following key steps:

- identification of the base case;
- identification of the Project and its implications;
- identification and valuation of the incremental benefits and costs;
- consolidation of value estimates using discounting to account for temporal differences;
- sensitivity testing;
- application of decision criteria; and
- consideration of non-quantified benefits and costs.

What follows is a BCA of the Project based on financial, technical and environmental advice provided by DCPL and its specialist consultants.

G2.2 IDENTIFICATION OF THE BASE CASE AND PROJECT

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

In this study, the base case or "without" Project scenario involves:

- cessation of mining activity at the DCM in 2012 with associated decommissioning and rehabilitation;
- sale of capital equipment in 2012;
- surplus land allocated to its next best use in 2012; and
- cessation of processing activity at the SCM, which requires a consent for continued operations past March 2012.

In contrast to the "base case", the main activities associated with the development of the Project would include:

- continued development of open pit mining operations at the DCM to facilitate a ROM coal production rate of up to approximately 3 Mtpa, including:
  - extension of the existing approved open pit in the Weismantel Seam to the north-west (i.e. Weismantel Extension open pit) within Mining Lease (ML) 1427 and Mining Lease Application (MLA) 1; and
  - open pit mining operations in the Clareval Seam (i.e. Clareval North West open pit) within ML 1427 and MLA 1;
- ongoing exploration activities within existing exploration tenements;

- progressive backfilling of the open pits with waste rock as mining develops, and continued and expanded placement of waste rock in out-of-pit waste rock emplacements;
- increased ROM coal rail transport movements on the North Coast Railway between the DCM and SCM in line with increased ROM coal production;
- continued disposal of excess water through irrigation (including development of new irrigation areas within ML 1427 and MLA 1);
- raising of the existing approved Auxiliary Dam No. 2 from relative level (RL) 81 metres (m) to approximately RL 100 m to provide significant additional on-site storage capacity to manage excess water on-site;
- progressive development of dewatering bores, pumps, dams, irrigation infrastructure and other water management equipment and structures;
- development of new haul roads and internal roads;
- upgrade of existing facilities and supporting infrastructure as required in line with increased ROM coal production;
- continued development of soil stockpiles, laydown areas and gravel/borrow pits;
- establishment of a permanent Coal Shaft Creek alignment adjacent to the existing DCM mining area;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

At the end of the Project it is assumed that the residual value of capital equipment and land would be realised through sale.

Economic analysis of the Project is complicated by the DCM being an integrated operation with the SCM, however, as the two mines are separated geographically, approvals for each of these mines are sought separately. Approval of the Project would only permit mining at the DCM and transportation of ROM coal to the SCM. Separate approvals are required for extension of the life of the SCM and increased SCM receipt and processing of DCM ROM coal.

For the purpose of the analysis, and to be consistent with the Project description, costs and benefits up to the delivery of DCM ROM coal to SCM have been assessed in this analysis. ROM coal has been valued based on the ultimate product coal sale price less costs incurred in processing at SCM, transportation to port and sales/marketing.

DCPL's alternatives for the mining of coal are essentially limited to different scales, designs, technologies, processes, modes of transport, timing, impact mitigation measures, etc. However, these alternatives could be considered to be variants of the preferred proposal rather than distinct alternatives. Consequently, this BCA focuses on DCPL's preferred proposal (the Project) compared to the base case identified above.

G2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or "without" Project scenario of mine cessation, the Project may have the potential incremental economic benefits and costs shown in Table G-2.1.

It should be noted that the potential external costs, listed in Table G-2.1, 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 impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

Table G-2.1
Economic Benefits and Costs of the Project

Category	Costs	Benefits
Production	• Opportunity cost of land • Opportunity cost of capital • Capital costs of establishment and construction including ancillary works and sustaining capital • Operating costs, including administration, mining, coal handling at DCM and transportation to SCM	• Value of ROM coal delivered to SCM • Residual value of capital and land at the cessation of the Project • Delayed decommissioning and rehabilitation costs of DCM facilities in 2012
Externalities	• Greenhouse gas generation • Noise impacts • Transport impacts • Transport noise impacts • Blasting overpressure and vibration • Air quality impacts • Surface water impacts • Groundwater impacts • Flora and fauna impacts • Aquatic ecology impacts • Aboriginal heritage impacts • Non-Aboriginal heritage impacts • Visual impacts	• Economic and social benefits of employment

G2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

In accordance with the NSW *Treasury Guidelines for Economic Appraisal* (NSW Treasury, 2007), where competitive market prices are available, they have generally been used as an indicator of economic values. Externality values have been estimated, where practicable, using market data and benefit transfer.

G2.4.1 Production Costs and Benefits[1]

Economic Costs

Opportunity Cost of Land

There is an opportunity cost associated with using land at DCM for continued mining and nearby land owned by DCPL for ecological offsets, instead of its next best use. An indication of the opportunity cost of the land can be gained from the market value of the DCM land following decommissioning and rehabilitation and the market value of the nearby land owned by DCPL. This is estimated at $20 million (M).

Opportunity Cost of Plant

Where the mining activity would utilise DCM plant and machinery already owned by DCPL, there is an opportunity cost associated with utilising this plant rather than selling it or using it elsewhere. An indication of its opportunity cost can be gained from its current book value (although this is likely to overstate the market value), which is estimated at $86M.

[1] All values reported in this section are undiscounted unless specified.

Capital Cost of the Project

Capital costs of the Project include new and replacement mobile equipment to achieve higher ROM coal production, the raising of Auxiliary Dam No. 2, land acquisitions and sustaining capital. These capital costs over the life of the Project are estimated at $109M. These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Mine

The annual operating costs of the Project include those associated with mining, progressive rehabilitation, environmental management and monitoring, operation of the rotary breaker and rail loading equipment at DCM, administration and ROM coal rail transport to SCM. Average annual operating costs of the mine (excluding royalties) are estimated at $96M.

While royalties are a cost to DCPL they are part of the overall producer surplus benefit of the mining and processing activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project. Nevertheless, it should be noted that the Project would generate total royalties in the order of $17M per annum with total royalties over the life of the Project in the order of $157M.

Decommissioning and Rehabilitation Costs of Facilities

The DCM site facilities would be decommissioned and rehabilitated at the cessation of the Project at an estimated cost of $2M (this cost is included in the annual operating cost above).

Economic Benefits

Sale Value of Coal

The provisional production schedule is provided in Table G-2.2.

Table G-2.2
Indicative Mine Schedule

Project Year	Waste Rock (Mbcm)	ROM Coal (Mtpa)
1[1]	11.6	2.0
2	14.3	2.2
3	14.2	2.4
4	14.3	2.4
5	14.4	3.0
6	14.3	2.2
7	14.0	2.3
8	11.7	2.5
9	5.6	1.5
Total	**114.4**	**20.5**

Source: Section 2 in the Main Report of the EA.

Mbcm = million bank cubic metres.

[1] Assumed Project commencement date is 1 July 2010.
Approximately 1.5 million tonnes (Mt) ROM coal is associated with the continuation of the existing/approved extent of the Weismantel open pit (as modified by the Minister for Planning on 28 October 2009).

At the SCM, ROM coal produced by the DCM would be processed to produce approximately equal proportions of coking coal and thermal coal for export, with the price received for these products being influenced by both world supply and demand.

However, for the purpose of the analysis, and to be consistent with the Project description, ROM coal delivered to the SCM has been valued based on DCPL's expected ultimate sales price, less costs incurred in processing at SCM, transportation to port and sales/marketing. This is the value of ROM coal delivered to the SCM.

There is obviously considerable uncertainty around future coal prices and hence the value of the DCM ROM coal delivered to the SCM has been subjected to sensitivity analysis (Section G2.6).

Residual Value at End of the Evaluation Period

At the end of the Project, purchased capital equipment and land may have some residual value that could be realised by sale. For this analysis, capital equipment is assumed to have no residual value and rehabilitated land is assumed to have a residual value of $30.5M.

Delayed Decommissioning and Rehabilitation Costs of Facilities

Under the base case, the DCM mine facilities would be decommissioned and rehabilitated in 2012 at a cost in the order of $2M. With the Project, this decommissioning cost would not occur until approximately 2019. The cost of decommissioning in 2012 under the "without" Project scenario is therefore avoided and hence is a benefit of the Project.

G2.4.2 External Costs and Benefits

Greenhouse Gases

The Project is predicted to generate in the order of 1.3 Mt of direct greenhouse gas emissions associated with mining (Scope 1 emissions) over the lifetime of the Project (Heggies Pty Ltd, 2009a) (Appendix D of the EA). Approximately 0.02 Mt of indirect (Scope 2) emissions associated with on-site electricity consumption and 0.04 Mt of indirect (Scope 3) emissions associated with the transport of ROM coal to SCM and on-site diesel and electricity use over the lifetime of the Project have also been conservatively included in the economic analysis. To place an economic value on carbon dioxide equivalent (CO_2-e) emissions, a shadow price of CO_2-e is required that reflects its social costs. The social cost of CO_2-e is the present value of additional economic damages now and in the future caused by an additional tonne of CO_2-e emissions. There is great uncertainty around the social cost of CO_2-e with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the damage costs of CO_2-e is to examine the price of CO_2-e credits. Again, however, there is a wide range of permit prices. For this analysis, a shadow price of Australian Dollars (AUD) $30 per tonne (/t) CO_2-e was used, with sensitivity testing from AUD$8/t CO_2-e to AUD $40/t CO_2-e (refer to Attachment GA).

Operational Noise

As described in the Noise and Blasting Impact Assessment (Heggies Pty Ltd, 2009b) (Appendix C of the EA), the DCM contributes to the existing noise environment at nearby private rural residences. Due to the extension of mining operations to the north and west, and the increased mobile fleet, the Project has the potential to result in additional noise emissions at nearby residences.

Seventeen properties have been identified in Appendix C of the EA as being in the Project noise management zone, where marginal to moderate exceedances of applicable noise criteria are predicted. However, it is assumed that these impacts are likely to have a negligible effect on amenity and hence property values.

Fifteen properties have been identified in Appendix C of the EA as being in the noise affectation zone. It is expected that the owners of properties located within the Project noise affection zone would be granted the opportunity to be acquired by DCPL via conditions of the Project Approval. Therefore the full costs of such land acquisition have been incorporated into the analysis.

Road Transport

The potential impacts of increased DCM road traffic that would arise due to the Project on local traffic conditions and road safety have been considered in the *Road Transport Assessment* (Halcrow MWT, 2009) (Appendix H of the EA). It was concluded that no significant additional road capacity or road safety issues would arise as a result of the Project. Hence, no economic effects have been identified in the BCA with respect to the predicted increased road transport movements associated with the Project.

Road Transport Noise

The potential impacts of increased Project road traffic on noise levels was also assessed. It was concluded that any potential increases in traffic noise on local roads would be acceptable (Appendix C of the EA), and therefore would not warrant inclusion in the BCA.

Rail Transport Noise

As ROM coal production increases, it is expected that the number of train movements would increase from approximately three movements per day to approximately four movements per day when averaged over an annual period (Appendix C of the EA). In order to facilitate improved access to the network train paths, and accommodate the additional train movements, the loading of train wagons and train departures would also be extended.

Appendix C of the EA concluded that these increased DCM ROM coal rail movements were unlikely to change daytime/evening rail noise levels and would only marginally increase night-time rail noise levels. Consideration of the above indicates that no significant economic effects would arise with respect to Project rail noise that would warrant inclusion in the BCA.

Blasting Vibration

Blasting at the Project has the potential to cause structural damage or human discomfort at properties surrounding the Project. The potential impacts of blast vibration were assessed in Appendix C of the EA. The assessment concluded that with a Maximum Instantaneous Charge (MIC) of 400 kilograms (kg) all private receivers would be below the building damage criteria and six private receivers would be above the human comfort criteria.

Blast management measures would be implemented as required to meet structural damage criteria. The receivers where Project blasts are predicted to exceed the applicable human comfort criteria even with the implementation of blast management measures, are also partly located within the operational noise affectation zone. Allowance for acquisition of these properties has been incorporated in the BCA.

Air Quality

Potential air quality impacts may occur at nearby residences as a result of dust generation at the Project from activities such as ore handling, emissions from stockpiles and haul roads, and blasting.

The Air Quality Assessment for the Project (Appendix D of the EA) indicates that one nearby private receiver would be impacted by air quality emissions above relevant criteria. This affected property is also in the noise affectation zone and hence has been included in the potential land acquisitions described above.

Surface Water

The potential impacts of the Project on local and regional surface water resources include changes to flows in local creeks and streams, due the extension of the DCM operational area and the subsequent capture and use of drainage from associated catchments. Potential water quality impacts could also arise as a result of runoff from mine disturbance and irrigation areas.

Existing water management measures would be maintained and/or augmented as a result of the Project. The Surface Water Assessment indicates that water quality issues would be effectively managed on-site such that there would be no unlicensed water quality impacts occurring off-site (Gilbert & Associates, 2009) (Appendix A of the EA). Changes in flows in the Mammy Johnsons River and Karuah River as a result of the Project are expected to be insignificant (Appendix A of the EA).

Overall there are considered to be no surface water impacts as a result of the Project that are sufficiently significant that they would warrant inclusion in the BCA.

Groundwater

The aquifer system at the DCM is continuous through the three major geological formations (i.e. Mammy Johnsons, Weismantels and Durallie Road) due mainly to the extent of faulting/ fracturing/fissures in the Project area (Heritage Computing, 2009) (Appendix B of the EA).

As a result of mine dewatering in the Weismantel and Clareval North West open pits, groundwater would flow towards the open pits as mining progresses. Localised drawdown would occur within the coal seam aquifers as a result of the Project. Following mining, there would be a slow but complete recovery of the groundwater system over many decades and the final voids, once filled with water, would act as flow-through lake systems (Appendix B of the EA).

Dewatering of the deeper groundwater system is not expected to affect the shallow alluvial groundwater systems and there would be negligible loss of groundwater yield to surface stream systems (Appendix B of the EA).

There are three registered production bores located on privately owned land to the north of the Project. Negligible Project drawdown in the water level in these bores is expected (Appendix B of the EA).

As there is expected to be negligible impact on shallow groundwater systems, surface stream systems and production bores, there is considered to be no groundwater impact as a result of the Project that are sufficiently significant that they would warrant inclusion in the BCA.

Terrestrial Flora and Fauna

The additional surface disturbance associated with the Project would involve the clearance of approximately 87 hectares (ha) of native vegetation communities, approximately 109 ha of secondary grasslands and approximately 11 ha of cropping land (i.e. disturbance of approximately 206 ha of land in total).

Some threatened flora and fauna species and endangered ecological communities were identified in the Project area and surrounds as described in Cenwest Environmental Services and Resource Strategies (2009a) (Appendix E of the EA). Assessment of the impacts of the Project indicated that none of the populations, threatened species or endangered ecological communities would be significantly impacted by the Project.

The Project incorporates an ecological offset comprising enhancement and management of some 214 ha of existing native vegetation and 230 ha where re-establishment of woodland would be undertaken in derived grasslands (Appendix E of the EA). The conservation of the proposed offset areas would be secured in perpetuity through a voluntary conservation agreement with the NSW Minister for the Environment.

With the implementation of the above ecological offset proposal and the progressive rehabilitation of Project disturbance areas and mine landforms, it is considered that the potential impacts of the Project on terrestrial fauna and flora would largely be offset and hence no significant economic cost would arise that would warrant inclusion in the BCA. Land opportunity costs and operational expenditure associated with the offset areas have been included in the BCA.

Aquatic Ecology

As the Surface Water Assessment (Appendix A of the EA) found no significant impacts on downstream surface water quality or quantity would occur as a result of the Project, no significant impacts on aquatic ecology would arise (Cenwest Environmental Services and Resource Strategies, 2009b) (Appendix F of the EA).

Aboriginal Heritage

The Project has the potential to impact Aboriginal heritage sites in Project land disturbance areas. Of the nine known Aboriginal heritage sites located within the study area, four may be potentially subject to direct disturbance (Kayandel Archaeological Services, 2009) (Appendix J of the EA). The potential non-use values of these sites have not been estimated in this analysis, but are assumed to be minor.

Non-Aboriginal Heritage

The only building within the vicinity of the Project area on any heritage register or inventory is the Former Weismantels Inn, located approximately 600 m from the nearest boundary of the Clareval North West open pit (Heritage Management Consultants, 2009) (Appendix K of the EA). Potential indirect impacts to the Former Weismantels Inn from blasting vibration and airblast emissions were considered in the Noise and Blasting Impact Assessment for the Project, and with the implementation of suitable blast management measures, compliance with applicable building damage criteria would be achieved (Appendix C of the EA). Therefore no significant economic effects would arise with respect to non-Aboriginal heritage that would warrant inclusion in the BCA.

Visual Impacts

Locations with potential views of the Project landforms primarily include those that already have views of the DCM mine landforms such as the waste rock emplacement. Potential views of the Project landforms would be available from the following locations (Resource Strategies, 2009) (Appendix O of the EA):

- a limited number of privately owned rural residences to the east, north-east and north of the Project;
- sections of Johnsons Creek Road located to the east of the Project and Mammy Johnsons River;
- a portion of The Bucketts Way (i.e. between the intersections of Martins Crossing and Durallie Road) with views to the south towards the Project; and
- sections of the North Coast Railway looking west towards the Project.

Visual impacts of the Project would include new and/or increased views of the waste rock emplacements and open pits from local viewpoints. Continuation and extension of night-lighting would also be associated with the mining operation. Visual impacts associated with mine landforms would decrease over time due to progressive rehabilitation. The use of night-lighting would cease at mine closure.

Visual intrusion can potentially impact the consumer surplus of affected households (can be estimated using the property valuation method) and visitors to surrounding areas (which can be measured via the contingent valuation method). Visual impacts would be most appreciable at the nearest privately owned dwellings with views of the Project open pit mining areas and waste rock emplacement. These nearest dwellings are within the noise affectation zone as outlined above and hence the cost for acquisition of these properties by DCPL has already been incorporated in the BCA.

There are considered to be no other visual impacts that are sufficiently significant that they would warrant inclusion in the BCA.

Social and Economic Value of Employment

The Project would generate an on-site workforce of 135 for a period of nine years. Historically employment benefits of projects has tended to be omitted from BCA on the implicit assumption that labour resources used in a Project would otherwise be employed elsewhere. Where this is not the case and labour resources would otherwise be unemployed for some period of time, Streeting and Hamilton (1991) and Bennett (1996) outline that otherwise unemployed labour resources utilised in a project should be valued in a BCA at their opportunity cost (wages less social security payments and income tax) rather than the wage rate which has the effect of increasing the net production benefits of the Project. In addition, there may be social costs of unemployment that require the estimation of people's willingness to pay to avoid the trauma created by unemployment. These are non-market values.

It has also been recognised that the broader community may hold non-environmental, non-market values (Portney, 1994) for social outcomes such as employment (Johnson and Desvouges, 1997) and the viability of rural communities (Bennett *et al*., 2004).

Gillespie Economics (2008) estimated the value the NSW community hold for each year that the Metropolitan Colliery provides 320 jobs, at $33M (present value) per year of mine life. A simple extrapolation of this result to the Project, which would provide an additional 135 jobs for approximately nine years, suggests a resulting community value of the Project in the order of $125M.

G2.5 CONSOLIDATION OF VALUE ESTIMATES

The present value of costs and benefits, using a 7 percent (%) discount rate, is provided in Table G-2.3.

Table G-2.3
Benefit Cost Analysis Results of the Project (Present Values)

	COSTS	$M*	BENEFITS	$M*
Production[1]	Opportunity cost of land	16	Value of coal delivered to SCM	993
	Opportunity cost of capital	70	Residual value of capital and land at the cessation of the Project	10
	Capital costs of establishment and construction including ancillary works, land acquisition and sustaining capital	92	Delayed decommissioning and rehabilitation costs of DCM facilities in 2012	2
	Operating costs, including administration, mining, coal handling, transportation, rehabilitation and decommissioning	579	-	-
	Production Sub-total	***758***	-	***1,005***
	Net Production Benefits	-	-	***247***
Externalities	Greenhouse gas emissions	28	Economic and social benefits of employment	117
	Operational noise	Included in capital costs above	-	-
	Transport	Negligible		
	Transport noise	Negligible	-	-
	Blast vibration	Included in capital costs above	-	-
	Air quality	Included in capital costs above	-	-
	Surface water	Negligible	-	-
	Groundwater	Negligible	-	-
	Flora and fauna	Negligible with the Project offset proposal	-	-
	Aboriginal heritage	Negligible	-	-
	Non-Aboriginal heritage	Negligible	-	-
	Visual impacts	Negligible	-	-
	Externalities sub-total	***28***	-	***117***
	Net externalities with employment benefits	-	-	***89***
	Net externalities without employment benefits	***28***	-	-
NET BENEFITS (including employment benefits)				**336**
NET BENEFITS (excluding employment benefits)				**219**

[1] Production costs and benefits in accordance with data provided by DCPL.

* Totals may have minor discrepancies due to rounding.

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

Table G-2.3 indicates that the Project would have net production benefits of $247M. The net production benefit is distributed amongst a range of stakeholders including:

- DCPL and GCL shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of Company tax.

The NSW Government receives additional benefits in the form of payroll tax and local councils may also benefit through community infrastructure contributions required under the EP&A Act (if applicable).

The main external costs from the Project relate to greenhouse gas generation, noise, air quality and blasting. Noise, air quality and blasting costs have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Greenhouse gas costs have been estimated at $28M. There would also be externality costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by DCPL. External benefits associated with employment provided by the Project have been estimated at $117M.

Overall the Project is estimated to have net benefits of $336M and hence is desirable and justified from an economic efficiency perspective.

The external environmental impacts of the Project would initially be borne by affected residents but the majority of these would ultimately be met by DCPL through land acquisition costs. External greenhouse costs would also be internalised through the purchase of emission credits under any emissions trading scheme introduced by the Commonwealth Government and higher prices paid for electricity, diesel and rail transport.

Project external employment benefits would accrue to the broader community who value the employment provided by the Project.

G2.6 SENSITIVITY ANALYSIS

The NPV presented in Table G-2.3 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV.

In this analysis, the BCA result was tested for changes to the following variables:

- opportunity cost of land;
- opportunity cost of capital;
- capital costs;
- operating costs;
- value of ROM coal;
- residual value of land;

- greenhouse gas impacts; and
- social value of employment.

This analysis indicated (Attachment GB) that the results of the BCA are not sensitive to reasonable changes in assumptions regarding any of these variables. In particular, significant increases in the values used for external impact such as greenhouse gas costs, or environmental impacts had little impact on the overall economic desirability of the Project.

The results were most sensitive to decreases in the value of ROM coal, although substantial (34%) and sustained reductions in assumed coal prices would be required to make the Project undesirable from an economic efficiency perspective.

G3 REGIONAL ECONOMIC IMPACT ASSESSMENT

G3.1 INPUT-OUTPUT TABLE AND ECONOMIC STRUCTURE OF THE REGION

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 gross regional output, value-added, income and employment.

These indicators can be defined as follows:

- ***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.
- ***Income*** – the wages paid to employees including imputed wages for self employed and business owners.
- ***Employment*** – 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 annual ROM coal production of up to 3 Mtpa at the DCM.

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 and employment associated with the Project but not making the economy so large that the impact of the proposal becomes trivial (Powell and Chalmers, 1995). Data on the residential location of current employees at DCM indicates that approximately 62% live in the Gloucester and Great Lakes Statistical Local Areas (SLAs). The remainder are spread across a range of regions including Taree, Clarence, Hastings, Maitland, Newcastle, Gosford and Sydney. The impacts of the Project have therefore been estimated on the Gloucester and Great Lakes SLAs.

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 input-output analysis.

Input-output analysis essentially involves two steps:

- development 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/or 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).

A 2005-06 input-output table of the regional economy (Gloucester and Great Lakes SLAs) was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment GC) using a 2005-06 NSW input-output table (developed by Monash University) as the parent table. The 109 sector input-output table of the regional economy was aggregated to 30 sectors and six sectors for the purpose of describing the economy.

A highly aggregated 2005-06 input-output table for the regional economy is provided in Table G-3.1. 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 employed in each industry is also indicated in the final row.

Table G-3.1
Aggregated Transactions Table: Regional Economy 2005-06 ($'000)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Services	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	1,975	6	6,800	2	100	2,285	**11,168**	2,734	55,624	61,497	**131,023**
Mining	2	1,356	1,376	2,863	531	213	**6,342**	53	-312	31,786	**37,869**
Manuf.	4,255	485	18,445	463	22,987	28,494	**75,127**	22,382	14,984	117,943	**230,437**
Utilities	1,123	163	1,819	15,526	1,197	9,742	**29,571**	6,941	2,794	23,379	**62,685**
Building	860	336	536	1,068	67,794	12,549	**83,144**	0	191,054	-834	**273,363**
Services	11,587	2,013	24,849	2,164	26,319	214,825	**281,759**	203,073	307,237	502,849	**1,294,919**
TOTAL	**19,803**	**4,359**	**53,824**	**22,087**	**118,929**	**268,108**	**487,110**	**235,183**	**571,383**	**736,620**	**2,030,296**
Household Income	32,614	4,896	37,014	5,446	55,332	381,622	**516,923**	0	0	0	**516,923**
OVA	27,291	22,613	42,317	16,657	37,003	291,308	**437,189**	33,241	20,203	1,324	**491,958**
Imports	51,314	6,001	97,282	18,495	62,100	353,880	**589,074**	334,035	108,547	52,222	**1,083,877**
TOTAL	**131,023**	**37,869**	**230,437**	**62,685**	**273,363**	**1,294,919**	**2,030,296**	**602,459**	**700,133**	**790,166**	**4,123,054**
Employment	837	85	695	114	946	8,088	**10,766**	-	-	-	-

Note: Totals may have minor discrepancies due to rounding.

Gross regional product (GRP) for the regional economy is estimated at approximately $1,009M, comprising approximately $517M to households as wages and salaries (including payments to self employed persons and employers) and approximately $492M in OVA (Table G-3.1).

The number of employees working in the region in 2006 was 10,766 people.

The economic structure of the regional economy can be compared with that of NSW through a comparison of results from the input-output model (Figures G-3.1 and G-3.2). This indicates that in the regional economy, the agriculture, forest and fishing sectors, mining sector (GRP only), and building sectors are of greater relative importance than they are in the NSW economy, while the manufacturing sectors and services sectors are of less relative importance than they are to the NSW economy.

Figures G-3.3 to G-3.5 provide a more expansive sectoral distribution of gross regional output, gross value-added, gross regional income, gross regional employment, regional imports and exports, and can be used to provide some more detail in the description of the economic structure of the economy.

In terms of gross regional output, gross value-added and income, the business services sectors, retail trade sectors and building/construction sectors are the most significant sectors of the regional economy (Figures G-3.3 and G-3.4). The retail trade sector is the most significant sector for regional employment (Figure G-3.4). The retail trade sectors, business services sectors and building/construction sectors and are the most significant sectors of the regional economy for imports while the retail trade sectors, business services sectors and ownership of dwellings sectors are the most significant sectors for exports (Figure G-3.5).

Figure G-3.1
Summary of Aggregated Sectors: Regional Economy (2005-06)

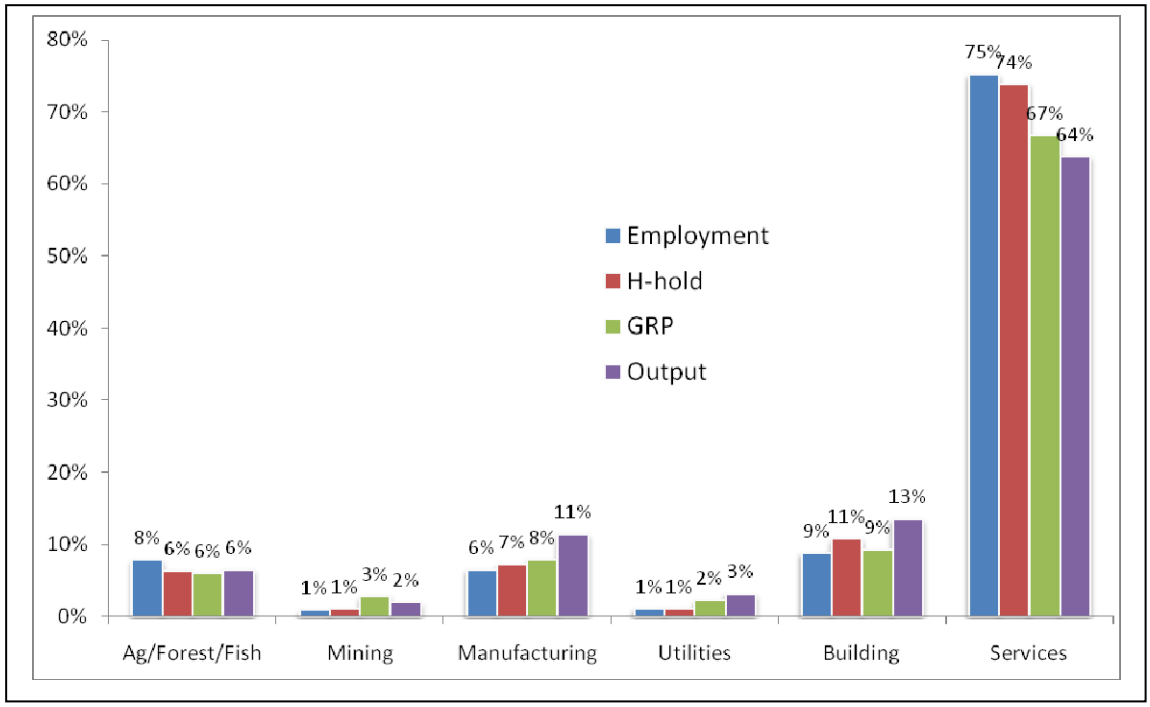


Figure G-3.2
Summary of Aggregated Sectors: NSW Economy (2005-06)

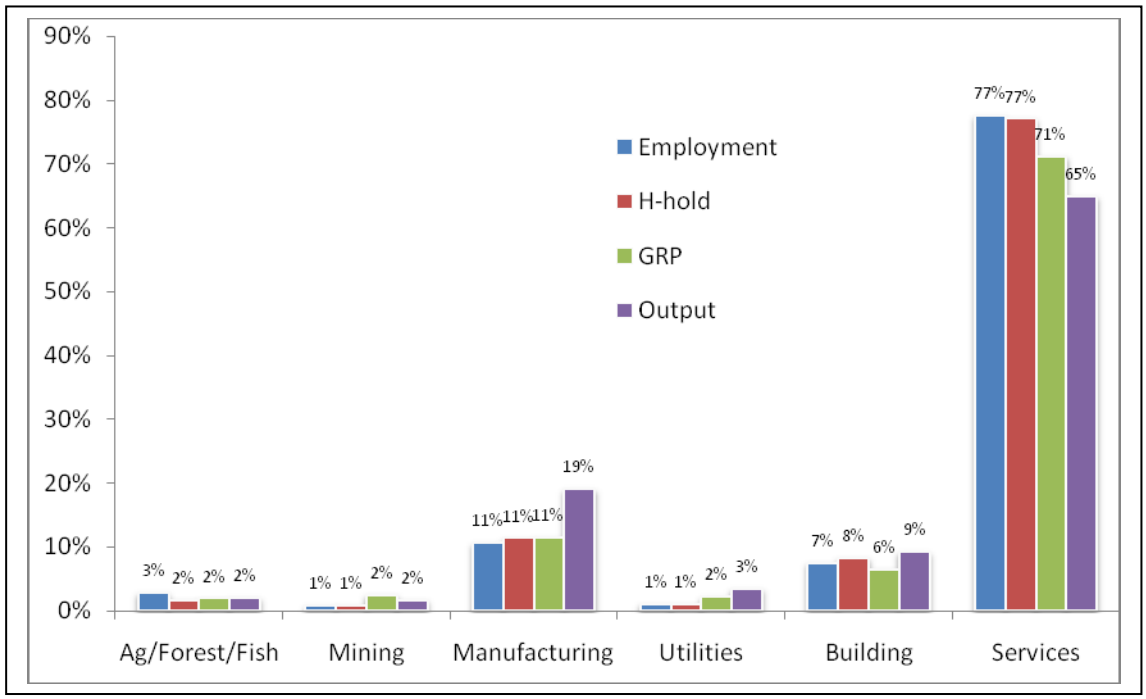


Figure G-3.3 Sectoral Distribution of Gross Regional Output and Value-Added ($'000)

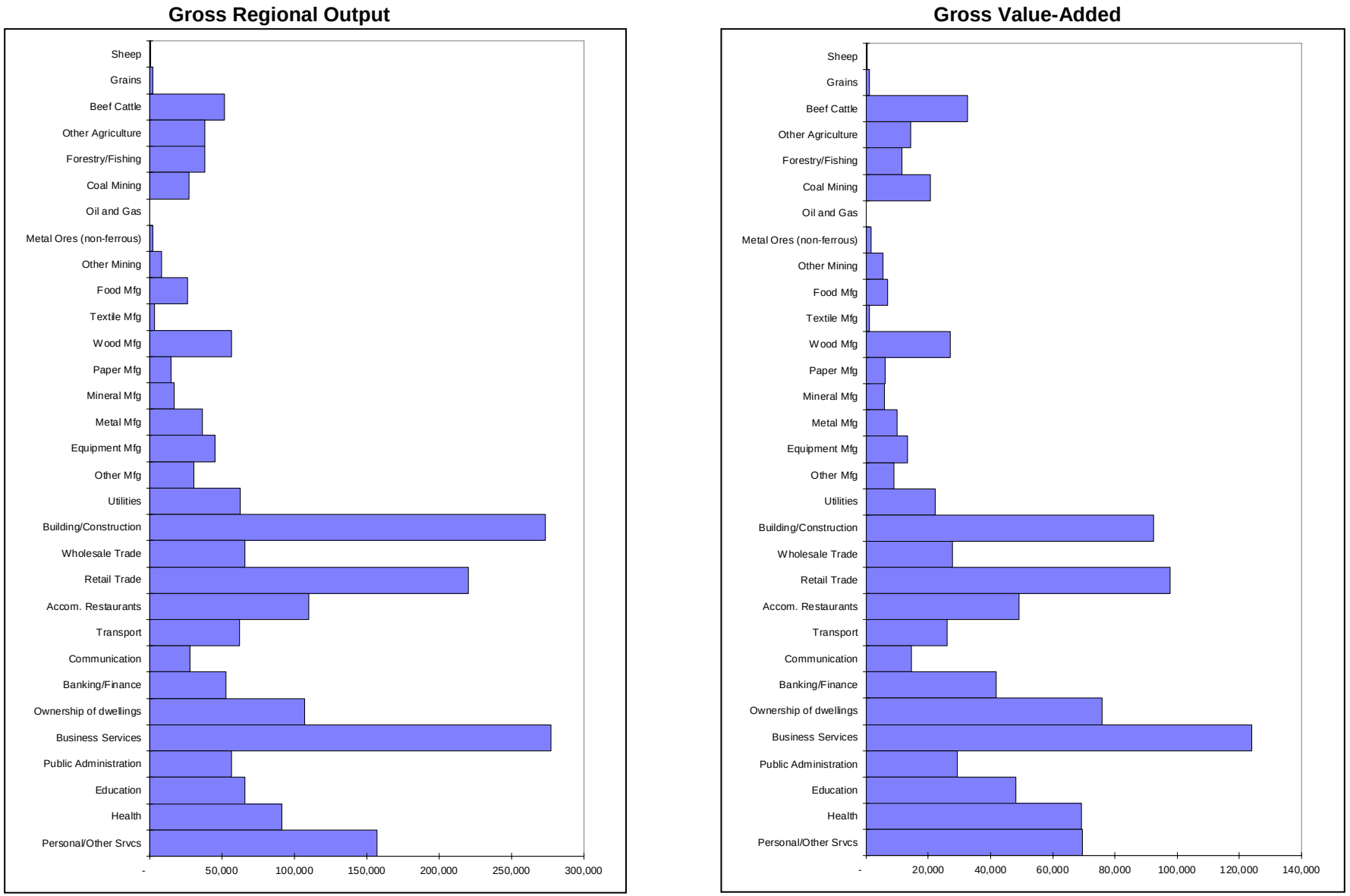
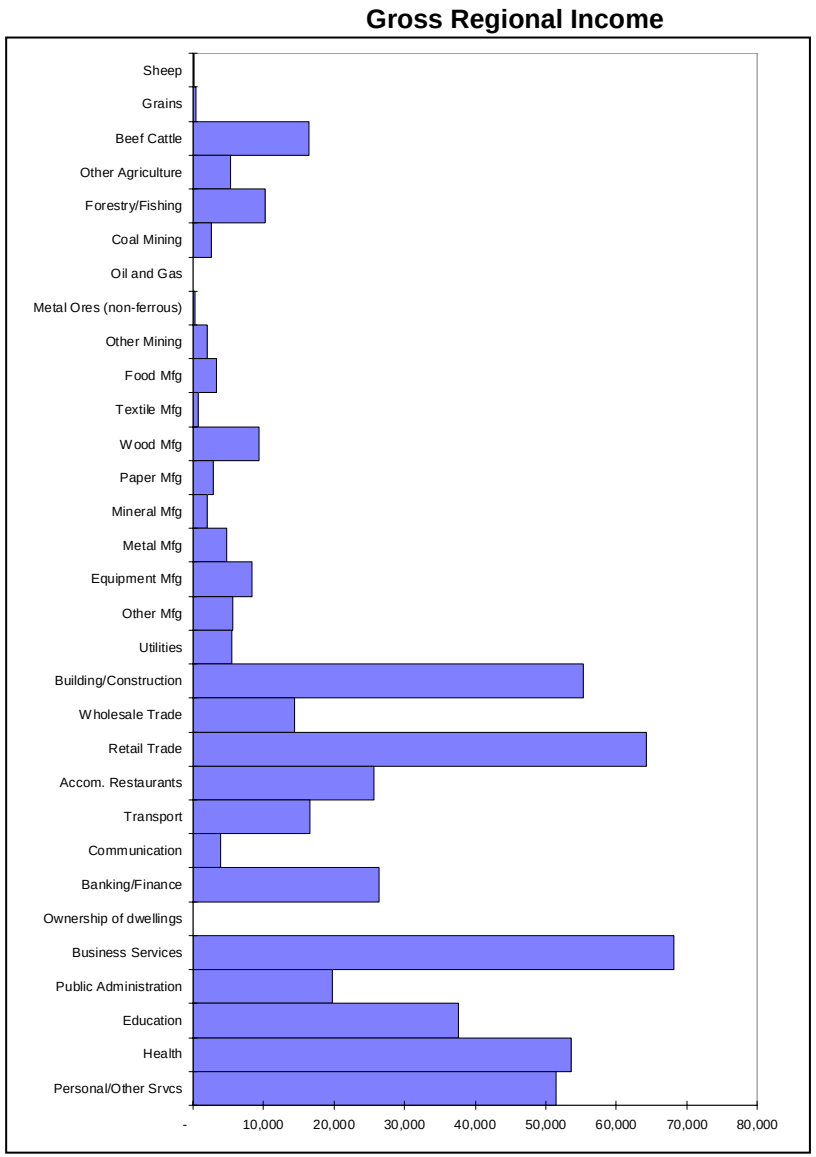


Figure G-3.4 Sectoral Distribution of Gross Regional Income ($'000) and Employment (No.)



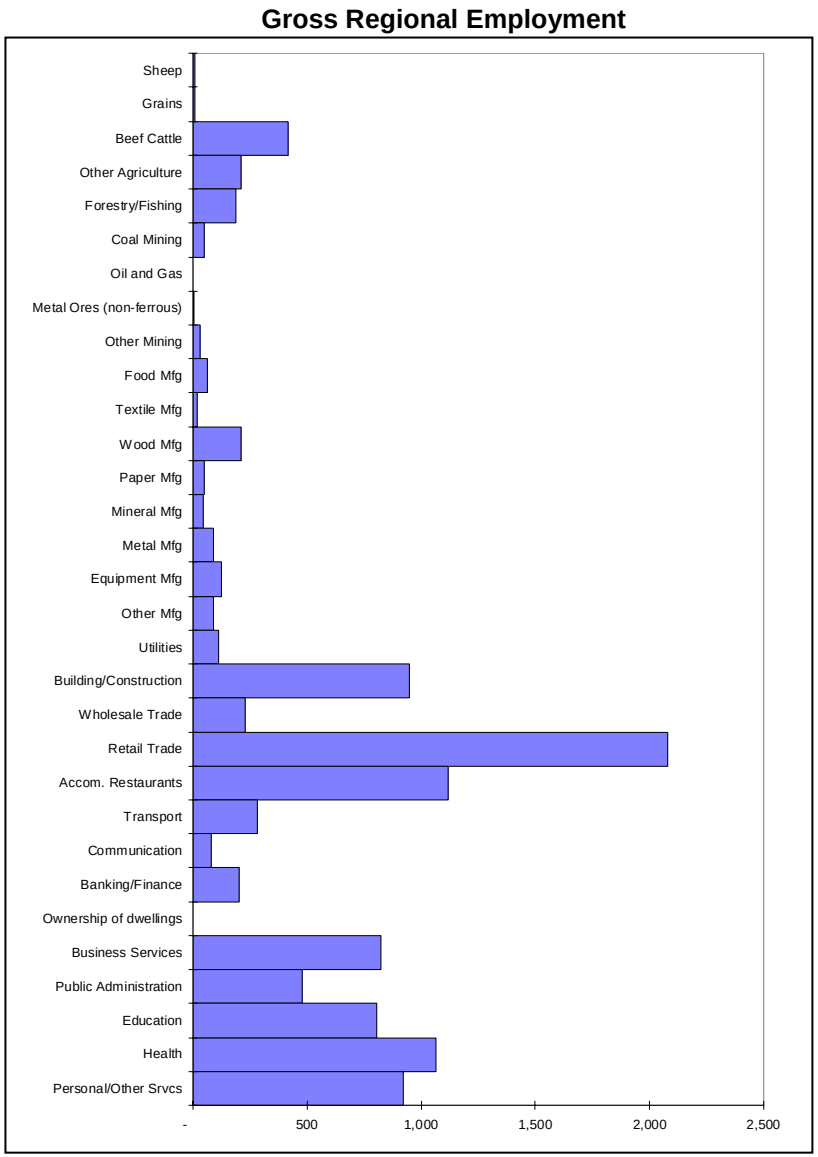
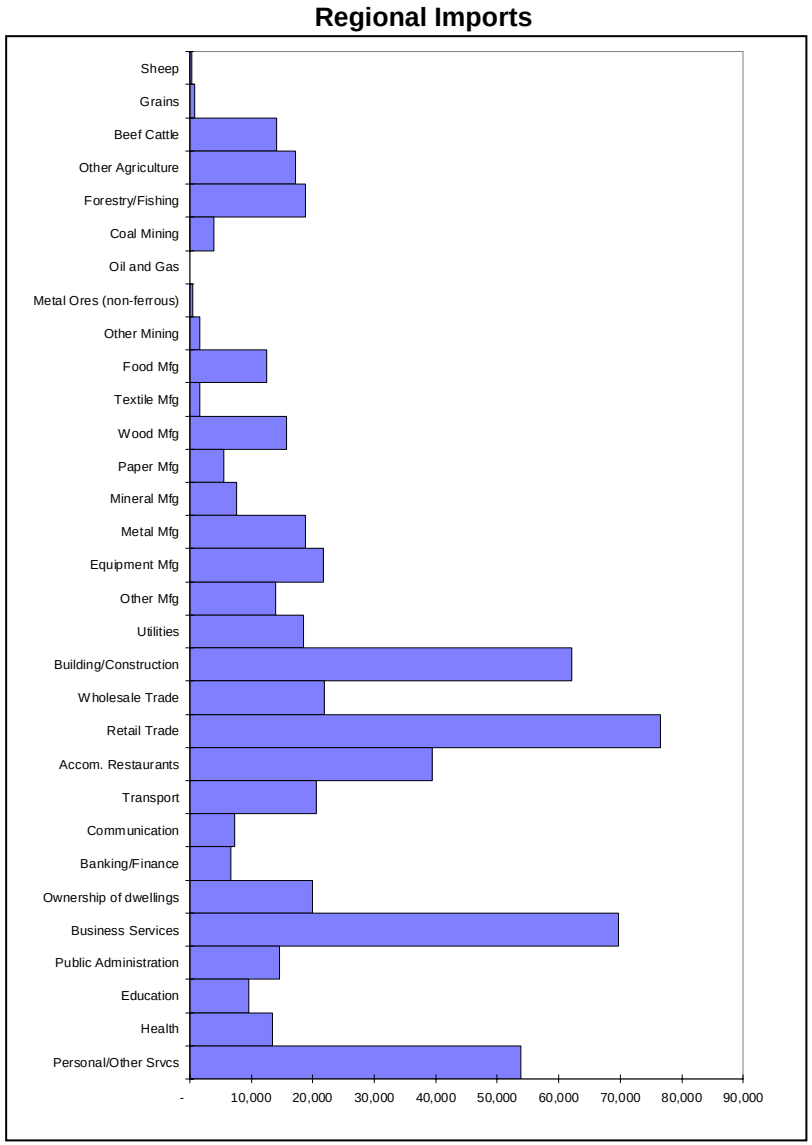
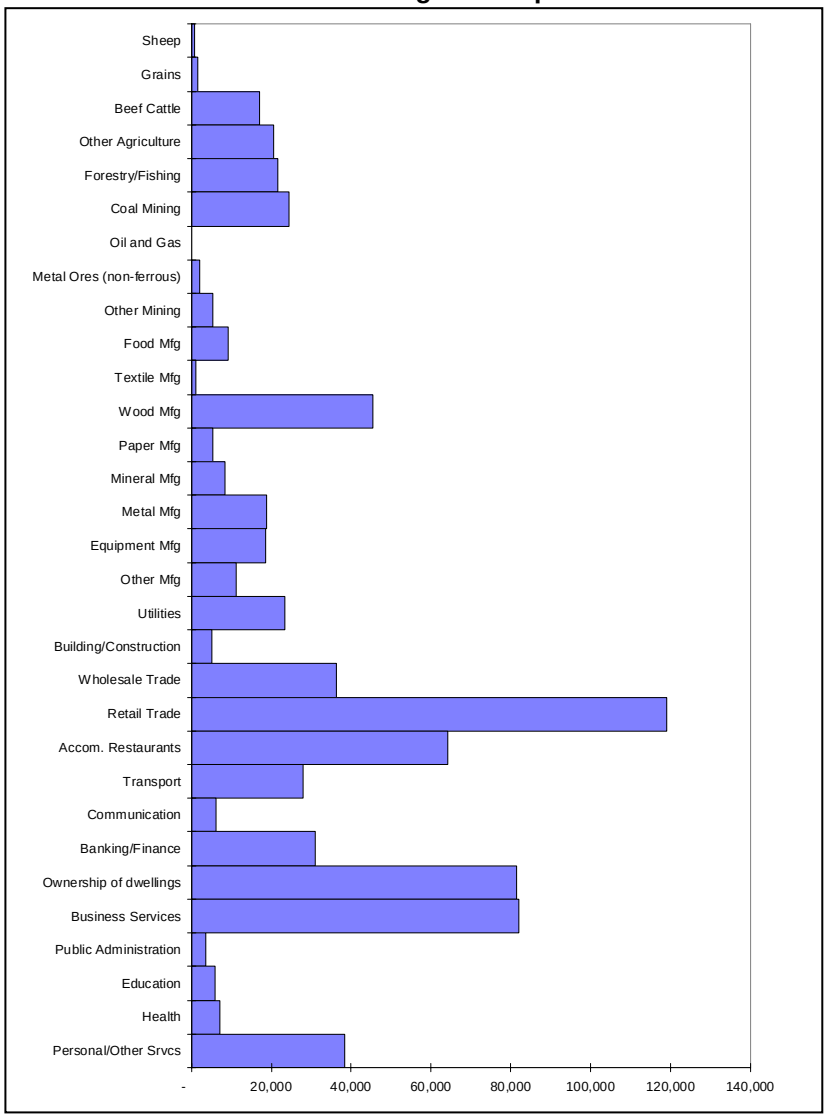


Figure G-3.5 Sectoral Distribution of Imports and Exports ($'000)





G3.2 REGIONAL ECONOMIC IMPACT OF THE PROJECT

G3.2.1 Introduction

The main regional economic impact of the Project is associated with the continued operation of the DCM, albeit at higher than historical production levels. For the analysis of the Project, a DCM sector was inserted into the input-output table. For this sector:

- the average annual gross value of ROM coal delivered to SCM was estimated from data provided by DCPL and allocated to the *Output* row;
- the estimated average annual expenditure over the life of the Project was estimated from data provided by DCPL;
- a detailed expenditure break down (contractor and other costs) for one typical historical year was provided by DCPL, and this was pro-rated to the estimated average annual contractor and non-labour expenditure of the Project;
- expenditure was allocated to appropriate *intermediate sectors*, and the o*ther value-added* row;
- expenditure on primary and secondary goods were allocated between local expenditure and *imports* based on the location quotient for each relevant sector;
- expenditure on contractors in the region was adjusted to reflect the level of contractor employment estimated to be living and working in the region (i.e. 84);
- purchase prices for each sector were adjusted to basic values and margins and taxes allocated to appropriate sectors using relationships in the latest (2001-02) National Input-Output Tables; and
- the difference between total revenue and total costs was allocated to the *other value-added* row.

G3.2.2 Impacts of the Project

The total and disaggregated annual impacts of the average operation of the Project on the regional economy in terms of output, value-added, income and employment (in 2009 dollars) are shown in Table G-3.2. Direct contractor employment living and working in the region and the associated income and value-added have been relocated from production induced flow-on impacts to direct effects.

Table G-3.2
Annual Regional Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	168,056	34,782	5,126	39,908	207,964
Type 11A Ratio	*1.00*	*0.21*	*0.03*	*0.24*	*1.24*
VALUE-ADDED ($'000)	65,384	16,167	2,479	18,646	84,030
Type 11A Ratio	*1.00*	*0.25*	*0.04*	*0.29*	*1.29*
INCOME ($'000)	5,903	2,939	1,581	4,520	10,423
Type 11A Ratio	*1.00*	*0.50*	*0.27*	*0.77*	*1.77*
EMPLOYMENT (No.)	84[1]	46	36	82	166
Type 11A Ratio	*1.00*	*0.55*	*0.43*	*0.98*	*1.98*

[1] While the Project would provide 135 direct jobs, only 84 are assumed to reside inside the region (i.e. Gloucester and Great Lakes SLAs).

In total, the Project is estimated to make the following contribution to the regional economy (Table G-3.2):

- $208M in annual direct and indirect regional output or business turnover;
- $84M in annual direct and indirect regional value-added;
- $10M in annual household income; and
- 166 direct and indirect jobs.

G3.2.3 Multipliers

The Type 11A ratio multipliers for the Project range from 1.24 for output up to 1.98 for employment.

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

G3.2.4 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:

- services to mining sector;
- scientific research, technical and computer services sector;
- electricity supply sector;
- retail trade sector;
- accommodation, cafes and restaurants sector; and
- education sector.

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

G3.3 STATE ECONOMIC IMPACTS OF THE PROJECT

G3.3.1 *Introduction*

The State economic impacts of the Project operation were assessed in the same manner as for estimation of the regional impacts. A new DCM sector was inserted into a 2009 NSW input-output table in the same manner described in Section G3.2.1. The primary difference from the DCM sector identified for the regional economy was that all contractor expenditure was assumed to occur in NSW and a greater level of expenditure would therefore be captured by the NSW economy compared to the regional economy.

G3.3.2 Impacts of the Project on NSW

The total and disaggregated average annual impacts of the Project on the NSW economy in terms of output, value-added, income and employment (in 2009 dollars) are shown in Table G-3.3. Direct contractor employment living and working in the State and the associated income and value-added have been relocated from production induced flow-on impacts to direct effects.

Table G-3.3
Annual State Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	168,056	157,515	87,368	244,883	412,939
Type 11A Ratio	*1.00*	*0.94*	*0.52*	*1.46*	*2.46*
VALUE-ADDED ($'000)	71,859	79,557	44,501	124,058	195,917
Type 11A Ratio	*1.00*	*1.11*	*0.62*	*1.73*	*2.73*
INCOME ($'000)	12,411	37,453	25,467	62,920	75,331
Type 11A Ratio	*1.00*	*3.02*	*2.05*	*5.07*	*6.07*
EMPLOYMENT (No.)	135	474	395	869	1,004
Type 11A Ratio	*1.00*	*3.51*	*2.93*	*6.44*	*7.44*

In total, the Project is estimated to make the following contribution to the NSW economy (Table G-3.3):

- $413M in annual direct and indirect output or business turnover;
- $196M in annual direct and indirect value-added;
- $75M in annual household income; and
- 1,004 direct and indirect jobs.

The estimated Project impacts on the NSW economy are substantially greater than for the regional economy, as the NSW economy is able to capture more mine and household expenditure, and there is a greater level of intersectoral linkages in the larger NSW economy.

G3.4 PROJECT CESSATION

The establishment and operation of the Project would stimulate demand in the regional and NSW economy leading to increased business turnover in a range of sectors and increased employment opportunities. Conversely, cessation of the mining operations would result in a contraction in regional economic activity.

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

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

Ignoring all other influences, the impact of Project cessation would depend on whether the workers and their families affected would leave the region. If it is assumed that some or all of the workers remain in the region, then the impacts of Project cessation would not be as severe compared to a greater proportion of employees leaving the region. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption the regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table G-3.2. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table G-3.2.

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).

To the extent that alternative development opportunities arise in the regional economy, the regional economic impacts associated with Project 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 of a region is a region's capacity to expand its factors of productions by attracting investment and labour from outside the region (Bureau of Industry Economics, 1994). This in turn can depend on a region's natural endowments.

If new mining resource developments occur in the future this would help broaden the region's economic base and buffer against impacts of the cessation of individual activities. The Gloucester Basin is a prospective location with a range of coal and coal-bed methane resources (e.g. AGL's proposed Gloucester Coal Seam Gas Project).

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

Nevertheless, given the uncertainty about the future complementary mining activity in the region 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 from the stimulation to regional economic activity and skills and expertise that the Project would maintain in the region.

G4 EMPLOYMENT, POPULATION AND COMMUNITY INFRASTRUCTURE ASSESSMENT

G4.1 INTRODUCTION

Changes in the workforce and populations of a region may well have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. This may include the number of services that are available to be used and the accessibility of these services.

The objective of this EPCIA is to examine the potential impacts of the Project on the existing community infrastructure as a result of employment and population change associated with the Project.

The basic methodology for carrying out the EPCIA was to:

- analyse the existing socio-economic environment of the region potentially impacted by the Project;
- analyse the likely incremental magnitude of the additional Project work force and associated population growth including estimated flow-on employment effects;
- consider the impacts of estimated employment and population change on community infrastructure based on Australian Bureau of Statistics (ABS) data; and
- recommend impact mitigation or management measures for any substantive impacts that are identified.

The geographic scope of the EPCIA was determined by the location of Project and the region that would potentially service the Project and its employees. The Project is located approximately 20 km south of Stratford in the Gloucester Valley. Approximately 62% of current employees live in the Gloucester SLA and Great Lakes SLA. While these SLAs were combined for the purpose of the regional economic impact assessment for the EPCIA they are described separately below.

The assessment draws on a range of publications and reports as well as data provided by DCPL, the ABS Census (ABS, 2007), and information from Section G3 on the potential regional economic impacts of the Project. While the Project would also be expected to have population and workforce effects at a NSW state level and in other nearby regions such as Taree, Clarence, Hastings, Maitland, Gosford and Sydney, these effects would not be of sufficient magnitude to warrant consideration of potential adverse effects.

G4.2 REGIONAL PROFILE

Population

In 2006, Gloucester SLA had a population of 4,800 and Great Lakes SLA had a population of 32,764, representing approximately 0.1% and 0.5% of the NSW population, respectively (Table G-4.1).

Table G-4.1
Gloucester, Great Lakes and NSW Population and Growth Rates 1991 to 2006

	Year	1996	2001	2006
Gloucester SLA	Population	4,886	4,654	4,800
	Annual Population Growth Rate	-	-0.95%	0.63%
Great Lakes SLA	Population	28,086	30,863	32,764
	Annual Population Growth Rate	-	1.98%	1.23%
NSW	Population	6,006,206	6,270,781	6,549,179
	Annual Population Growth Rate	-	0.88%	0.89%

Source: ABS Census Time Series Profile (place of residence).

The population of Great Lakes has been increasing at a greater rate than for NSW while the population of Gloucester declined between 1996 and 2001 and then increased between 2001 and 2006, albeit it at a lower rate than the NSW growth rate (Table G-4.1).

Consistent with the trend for NSW, the proportion of the Gloucester and Great Lakes populations under the age of 44 has been declining over time while the proportion of the population over the age of 44 has been increasing (Table G-4.2). Both Gloucester and Great Lakes have a greater proportion of the population aged over 44 compared to NSW (Table G-4.2).

Table G-4.2
Distribution of the Gloucester, Great Lakes and NSW Population by Age Group

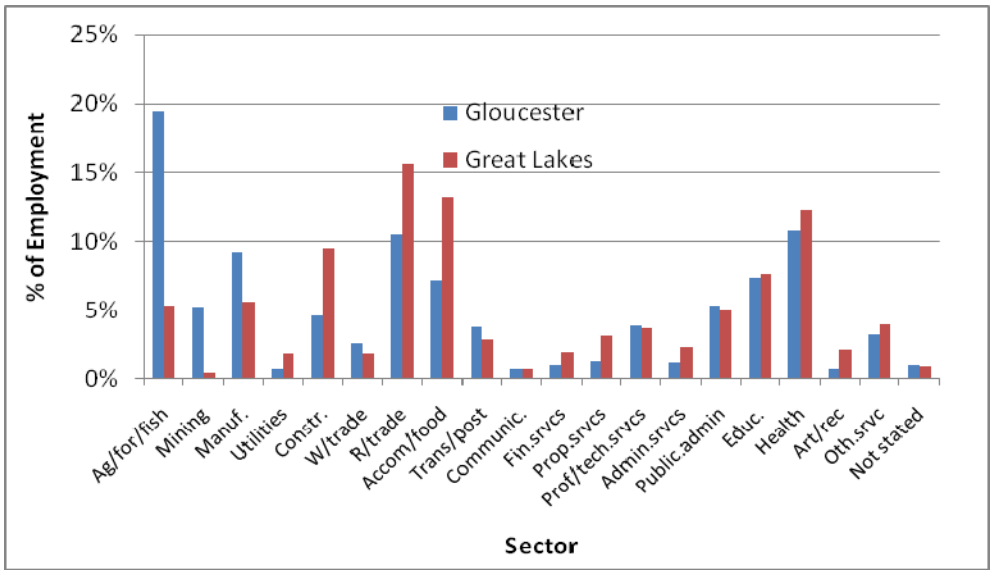
Proportion of Total Population	Gloucester SLA			Great Lakes SLA			NSW		
	1996	2001	2006	1996	2001	2006	1996	2001	2006
Aged 14 years and younger	22.8%	21.0%	18.2%	19.6%	17.8%	16.1%	21.4%	20.9%	19.8%
Aged 15 years to 44 years	35.5%	32.5%	28.8%	31.3%	29.2%	27.1%	44.7%	43.1%	41.5%
Aged 45 years to 64 years	24.8%	26.7%	30.8%	24.9%	27.9%	29.0%	21.1%	22.9%	24.8%
Aged 65 years and over	17.0%	19.8%	22.2%	24.1%	25.1%	27.8%	12.7%	13.1%	13.8%

Source: ABS Census Time Series Profile (place of residence).
Note: Percentages may not add to 100% due to rounding.

Employment

Employment by industry data is presented on Figure G-4.1. This figure shows the greater relative importance of agriculture/forestry/fishing, mining and manufacturing in the Gloucester SLA and the greater relative importance of construction, retail trade and accommodation/food sectors in the Great Lakes SLA.

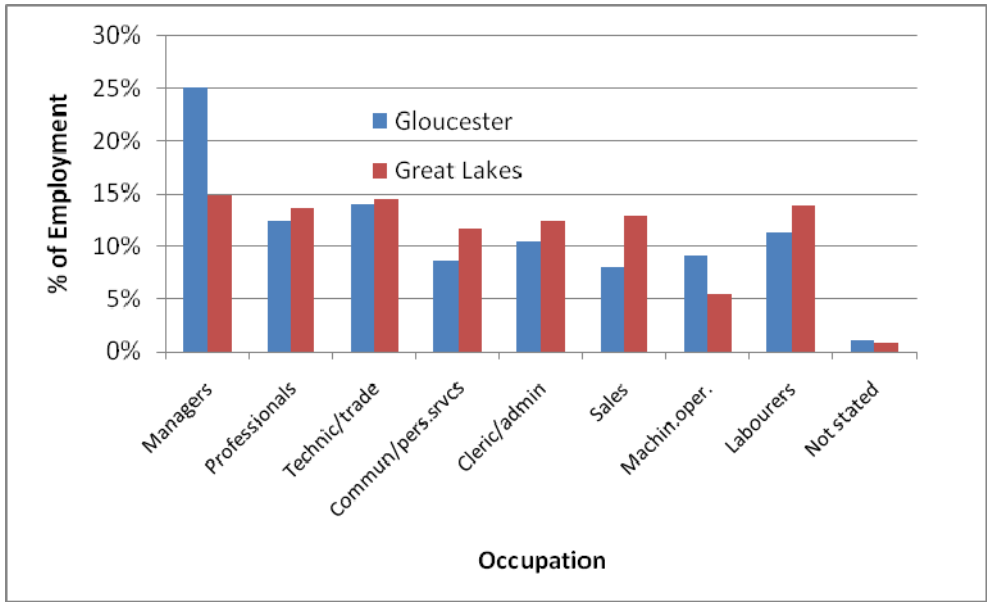
Figure G-4.1
Employment by Industry in the Gloucester and Great Lakes SLAs



Source: ABS Census Place of Employment Profile.

Reflecting the employment by industry data, Gloucester SLA has a higher relative proportion of managers (mainly rural) and machinery operators (Figure G-4.2). Great Lakes SLA has a higher relative proportion of other occupations (Figure G-4.2).

Figure G-4.2
Occupations in the Gloucester and Great Lakes SLAs



Source: ABS Census Place of Employment Profile.

The unemployment rate in the Gloucester SLA and Great Lakes SLA has been declining between censuses (Tables G-4.3 and G-4.4). However, the unemployment rate for both SLAs has been consistently higher than that for NSW (Tables G-4.3 and G-4.4). Since the 2006 census, the global financial crisis has resulted in a trend of rising unemployment levels, albeit from lower unemployment levels than those reported at the 2006 census. The level of unemployment in the December 2008 quarter is reported as 133 people (5.5%) for Gloucester SLA and 1,254 (9.5%) for Great Lakes SLA (Commonwealth Department of Education, Employment and Workplace Relations, 2009).

Table G-4.3
Unemployment in the Gloucester SLA

	1996	**2001**	**2006**
Total No. in Labour Force	2,015	1,966	2,002
As % of People over 15 Years	41.24%	42.24%	41.71%
Total Employment	1,818	1,819	1,881
Total Unemployment	197	147	121
Unemployment Rate	9.78%	7.48%	6.04%
NSW Unemployment Rate	**8.8%**	**7.2%**	**5.90%**

Source: ABS Census Time Series Profile.

Table G-4.4
Unemployment in the Great Lakes SLA

	1996	**2001**	**2006**
Total No. in Labour Force	9,808	10,726	11,731
As % of People over 15 Years	34.92%	34.75%	35.80%
Total Employment	8,306	9,472	10,633
Total Unemployment	1,502	1,254	1,098
Unemployment Rate	15.31%	11.69%	9.36%
NSW Unemployment Rate	**8.8%**	**7.2%**	**5.90%**

Source: ABS Census Time Series Profile.

Average individual taxable income in 2005 in the Gloucester SLA and Great Lakes SLA was $37,247 and $37,275, respectively, compared to $49,728 for NSW (ABS, 2009a).

Housing

In 2006 there were approximately 1,927 private occupied dwellings in the Gloucester SLA and 13,420 in the Great Lakes SLA, about 0.1% and 0.5% of the State total, respectively (Table G-4.5). The Gloucester and Great Lakes SLAs had a higher proportion of separate houses than the State (approximately 93% and 77% respectively, compared with approximately 70% for NSW) and a lower proportion of townhouses/units/flats/apartments (approximately 5% and 20% respectively, compared with 29% in NSW) (Table G-4.5).

Table G-4.5
Housing Stock in Gloucester, Great Lakes and NSW
(Occupied Dwellings Only)

Housing Stock	Gloucester SLA			Great Lakes SLA			NSW
	1996	2001	2006	1996	2001	2006	2006
Total Private Dwellings	1,793	1,825	1,927	11,037	12,513	13,420	2,470,452
Separate Houses	91.0%	92.4%	92.7%	75.1%	74.8%	76.5%	69.7%
Townhouse, Flat, Unit, Apartment	4.9%	5.2%	5.1%	18.7%	20.2%	20.0%	28.8%
Other	3.1%	2.5%	2.2%	5.1%	4.3%	3.5%	1.4%
Not Stated	1.1%	0.0%	0.0%	1.1%	0.7%	0.0%	0.08%

Source: ABS Census Time Series Profile.

At the 2006 Census, there were 392 unoccupied dwellings in the Gloucester SLA and 5,831 unoccupied dwellings in the Great Lakes SLA (Table G-4.6).

Table G-4.6
Housing Stock in the Gloucester and Great Lakes SLAs (All Dwellings)

Housing Stock	Gloucester SLA (2006)			Great Lakes SLA (2006)		
	Occupied Dwelling	Unoccupied dwelling	Total Dwelling	Occupied Dwelling	Unoccupied dwelling	Total Dwelling
Separate house	1,833	348	2,181	10,672	3,515	14,187
Semi-detached, row or terrace house, townhouse	20	6	26	1,637	808	2,445
Flat, unit or apartment	89	24	113	1,380	1,433	2,813
Other dwelling	62	14	76	665	75	740
Dwelling structure not stated	0	0	0	3	0	3
Total	**2,004**	**392**	**2,396**	**14,357**	**5,831**	**20,188**

Source: ABS Census Time Series Profile.

There is considerable short stay tourism accommodation available in the Great Lakes SLA with 34 establishments providing 718 rooms and 2,288 beds (Table G-4.7). Short stay tourism accommodation in Gloucester is more limited (Table G-4.7).

Table G-4.7
Gloucester and Great Lakes - Hotels, Motels
and Serviced Apartments with Five or More Rooms (June Quarter 2009)

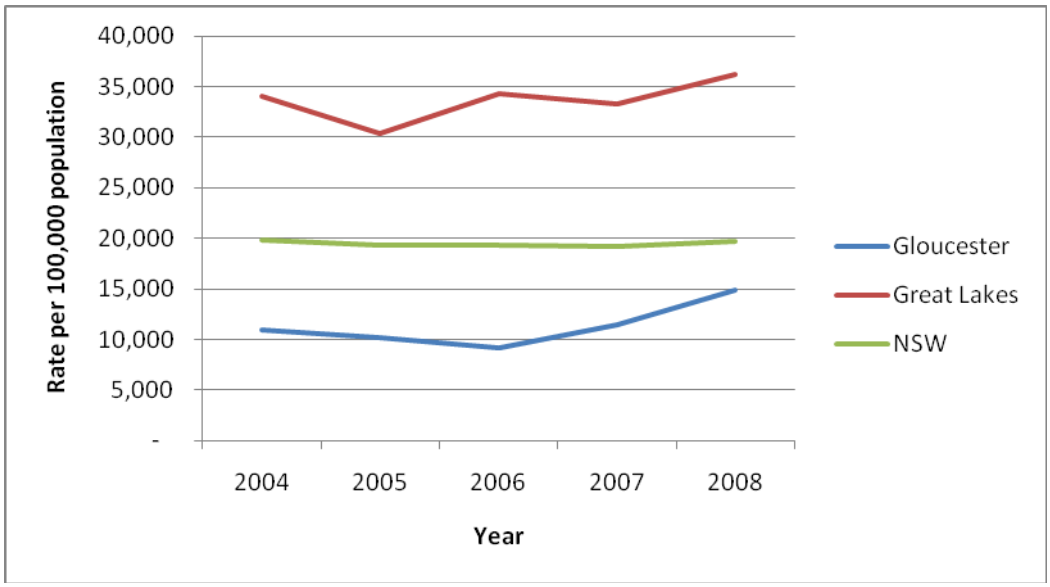
Short Stay Tourism Accommodation	Gloucester SLA	Great Lakes SLA
Establishments	3	34
Rooms	NA	718
Beds	NA	2,288
Guest Nights	NA	51,082
Room Occupancy Rates	NA	38.1%
Bed Occupancy Rate	NA	24.5%
Accommodation Gross Takings ($)	NA	2,571,804

Source: ABS 8635.1.55.001 - Tourist Accommodation, Small Area Data, NSW, December 2008.
NA = Not Applicable.

Crime and Safety

NSW Bureau of Crime Statistics and Research indicates that the incidence of crime in the Gloucester and Great Lakes SLAs per 100,000 head of population is following a general increasing trend (Figure G-4.3).

Figure G-4.3
Gloucester SLA, Great Lakes SLA and NSW Incidence of Crime per 100,000 Head of Population Over Time



Source: NSW Bureau of Crime Statistics and Research (2009).

While the overall incidence of crime per capita was lower in the Gloucester SLA and higher in the Great Lakes SLA than for NSW, the per capita incidence of different crimes varied between SLAs (Table G-4.8).

Table G-4.8
Gloucester SLA, Great Lakes SLA and NSW Incidence of Crime per 100,000 Head of Population, 2008

	Gloucester SLA	Great Lakes SLA	NSW
Homicide	40	6	4
Assault	1,127	1,386	1,046
Sexual offences	221	201	137
Abduction and kidnapping	-	6	6
Robbery	60	58	100
Blackmail and extortion	-	-	1
Harassment, threatening behaviour and private nuisance	463	553	361
Other offences against the person	20	23	22
Theft	1,629	4,601	4,132
Arson	40	146	105
Malicious damage to property	845	1,796	1,589
Drug offences	181	530	419
Prohibited and regulated weapons offences	121	242	125
Disorderly conduct	624	786	379
Betting and gaming offences	-	9	5
Liquor offences	262	428	260

Table G-4.8 (Continued)
Gloucester SLA, Great Lakes SLA and NSW Incidence of Crime per 100,000 Head of Population, 2008

	Gloucester SLA	Great Lakes SLA	NSW
Pornography offences	-	-	2
Prostitution offences	-	-	3
Against justice procedures	141	1,013	649
Driving offences	8,831	24,084	9,500
Transport regulatory offences	81	6	573
Other offences	161	381	226
Total*	14,846	36,253	19,643

Source: NSW Bureau of Crime Statistics and Research (2009).
* Totals may have minor discrepancies due to rounding.

It is difficult to specify reasons for the higher overall incidence of crime in Great Lakes and a higher incidence of some categories of crime in the Great Lakes SLA than in the State since causal factors that lead to criminal activity are complex and include many and varied social and economic circumstances and conditions. However, socio-economic characteristics of the Great Lakes SLA that may be relevant include relatively lower income levels and higher unemployment rates.

Community Infrastructure

Education

The NSW Department of Education and Training is the main provider of primary and secondary education in the Gloucester and Great Lakes SLAs, accounting for 83% and 85% of primary school enrolments and 95% and 82% of secondary school enrolments in 2006, respectively (Table G-4.9).

Table G-4.9
Education in the Gloucester and Great Lakes SLAs

	Gloucester SLA			Great Lakes SLA		
	1996	**2001**	**2006**	**1996**	**2001**	**2006**
Preschool	71	56	80	465	433	500
Infants/Primary	503	499	388	2,630	2,626	2,301
Public	*87%*	*84%*	*83%*	*87%*	*87%*	*85%*
Private	*13%*	*16%*	*17%*	*13%*	*13%*	*15%*
Secondary	377	353	324	1,663	1,934	2,136
Public	*99%*	*96%*	*95%*	*89%*	*90%*	*82%*
Private	*1%*	*4%*	*5%*	*11%*	*10%*	*18%*
TAFE	53	61	77	475	779	666
University	35	33	24	182	202	250
Other	22	17	23	77	158	110
Not Stated	226	136	313	1,384	1,135	2,531
Total	1,287	1,155	1,229	6,876	7,267	8,494

Source: ABS Time Series Profile.

In both SLAs there has been declining total enrolments at infants/primary schools with an increasing proportion of enrolments being in private schools (Table G-4.9). There is therefore likely to be some spare capacity in both the public and private infants/primary school infrastructure.

Secondary school enrolments in the Gloucester SLA have declined over time (Table G-4.9). There is therefore likely to be some spare capacity in the secondary school infrastructure in Gloucester. Secondary school enrolments in the Great Lakes SLA have increased over time with the proportion accommodated by private schools also increasing over time.

Health, Arts and Recreation

According to the 2006 population census there were 187 people employed in the health care and social assistance industries in the Gloucester SLA and 1,113 employed in these industries in the Great Lakes SLA (Table G-4.10). The proportion of employment in these health care and social assistance sectors in the Great Lakes SLA was higher than in NSW (Table G-4.10).

Table G-4.10
Employment in Health, Arts and Recreation Services

	Gloucester SLA		Great Lakes SLA*		NSW*	
	Number	**Proportion**	**Number**	**Proportion**	**Number**	**Proportion**
Health care and social assistance						
Health care and social assistance	0	0.0%	30	0.3%	9,400	0.3%
Hospitals	98	5.6%	189	2.1%	94,187	3.4%
Medical and other health care services	55	3.2%	311	3.4%	85,108	3.1%
Residential care services	10	0.6%	362	4.0%	44,648	1.6%
Social assistance services	24	1.4%	221	2.4%	59,618	2.2%
Total	***187***	**10.8%**	***1,113***	**12.2%**	***292,961***	***10.7%***
Arts and recreation services						
Arts and recreation services	0	0.0%	9	0.1%	1,740	0.1%
Heritage activities	5	0.3%	27	0.3%	4,424	0.2%
Creative and performing arts activities	0	0.0%	4	0.0%	8,122	0.3%
Sports and recreation activities	6	0.3%	147	1.6%	18,873	0.7%
Gambling activities	0	0.0%	4	0.0%	4,799	0.2%
Total	***11***	***0.6%***	***191***	***2.1%***	***37,958***	***1.4%***
TOTAL	**198**	**11.4%**	**1,304**	**14.3%**	**330,919**	**12.0%**
TOTAL EMPLOYMENT	**1,737**	**100.0%**	**9,093**	**100.0%**	**2,748,394**	**100.0%**

Source: ABS (2009b).

* Totals may have minor discrepancies due to rounding.

The proportion of employment in Gloucester in arts and recreation services was lower than for NSW while the proportion of employment in Great Lakes in these sectors was greater than for NSW (Table G-4.10).

The main health facility in Gloucester SLA is Gloucester Soldiers Memorial Hospital which offers services in (Gloucester Shire Council, 2007):

- physiotherapy;
- radiographer;
- catering officer;
- program of aids for the disabled;
- specialist and general nurses;
- paediatric; and
- palliative care.

The Great Lakes SLA is serviced by Forster Private Hospital and Bulahdelah Public Hospital.

While it is outside of the Gloucester and Great Lakes local government areas (LGAs) the Manning Base Hospital located in Taree also services the wider region.

G4.3 PROJECT WORKFORCE AND POPULATION CHANGE

The main drivers for impacts on community infrastructure are changes in employment and population and the spatial location of these changes in employment and population. Employment that is directly generated by the Project may be sourced from:

- the local region either from:
  - the unemployment pool; and/or
  - workers from other industries;
- in-migration; or
- commuters.

Sourcing labour from the local region has minimal direct impact on local community infrastructure and services since it results in no changes to the regional population and hence demand for services. It may, however, have an indirect impact on some local community infrastructure and services where changes in employment status or income result in changes in demand for some particular services (e.g. health services).

Whether local labour is sourced from the unemployment pool or from other industries, it can reduce unemployment levels - directly in the case of employing unemployed people and indirectly via the filter effect[2] where labour is sourced from other industries.

The impact of commuter workers would depend on the extent to which they integrate into the regional communities, however, for the purpose of this analysis it is assumed that the impact of commuter workers is likely to be modest.

In-migration resulting in population change is likely to have the greatest potential impact on demand for community services and infrastructure with this impact dependent on the new residential location of the migrating workforce and their families.

As well as direct employment and population changes, mining projects may also generate indirect labour demand through expenditure by employees in the local region and mine operation expenditure in the local region on other inputs to production. This induced demand for labour may also have consequences for population change and demand for community infrastructure and services.

To facilitate consideration of potential community infrastructure impacts, this section explores the likely direct and indirect employment and population effects of the Project.

[2] The filter effect refers to the situation where labour is sourced from other industries in the region making jobs available in those industries which are subsequently filled by people either from the unemployment pool or other industries with the latter making jobs available in that industry, etc.

G4.3.1 Operation Workforce and Population Change

The Project relates to the continuation of an existing activity, albeit at increased rates of ROM coal production. Currently, the total direct workforce at the DCM is approximately 120 people, with approximately 74 residing within the Gloucester and Great Lakes SLAs. The operational workforce associated with the Project is estimated at 135, hence, the additional direct workforce from the Project is estimated at 15. Conservatively assuming that all this workforce migrates into the broader region and has the same residential distribution as current employees (46% residing in the Gloucester SLA and 16% residing in the Great Lakes SLA) and the same household occupancy as NSW, the additional population in the region would be 35 in the Gloucester SLA and 12 in the Great Lakes SLA (Table G-4.11).

Table G-4.11
Employment and Population Change in the Region

SLA	Current DCM Worrkforce Residential Location	New Employment Living in the Region			Assumed Household Size	New Population to the Region
		Direct	Flow-on	Total		
Gloucester	46%	7	7	14	2.6	35
Great Lakes	16%	2	2	5	2.6	12

Note: Totals may have minor discrepancies due to rounding.

G4.4 COMMUNITY INFRASTRUCTURE IMPACT ASSESSMENT

A population influx to the Gloucester SLA of up to 35 and to the Great Lakes SLA of up to 12 (Table G-4.11) represents in the order of 15 months average population growth between 2001 and 2006 for the Gloucester SLA and less than 1 months average population growth between 2001 and 2006 for the Great Lakes SLA (Table G-4.1).

In Gloucester, the demand this population influx would create for housing represents 1% of total occupied housing stock in 2006 or 4% of unoccupied residential properties in 2006. In Great Lakes it represents 0.03% of total occupied housing stock in 2006 or 0.09% of unoccupied residential properties in 2006 (Table G-4.12).

Table G-4.12
Predicted Project-Related Demand for Additional Accommodation

SLA	Demand for Housing	Housing Stock	
	New Employment Living in the Region	Total Occupied Housing Stock 2006	Unoccupied Residential Properties 2006
Gloucester	14	2,004	392
Great Lakes	5	14,357	5,831

During the operation of the Project, any incoming workers would be expected to exhibit average family structures and hence would be associated with some children, creating some increased demand for education facilities within the region. Assuming that the incoming population exhibits the same characteristics as the NSW working age population, Table G-4.13 summarises the likely demand for pre-school, infants/primary and high school places.

Table G-4.13
Predicted Project-Related Demand for Children's Schooling

Type	Demand	2006 Enrolment (No.)	School Change in Enrolment 2001-2006
Gloucester SLA			
Pre-school	3	80	24
Infants/Primary	3	388	-111
High school	4	324	-29
Great Lakes SLA			
Pre-school	1	500	67
Infants/Primary	1	2,301	-325
High school	1	2,136	202

These demands can be compared to the total enrolments in 2006 and growth/decline in school enrolments between 2001 and 2006 (see Table G-4.9). In this context, it is evident that the increased demand for schooling associated with incremental Project employment effects could be considered to be insignificant.

There is potential for the Project to increase the demand for public health facilities in the region such as for Hospitals, General Practitioners Medical Services, Dental, Physiotherapy, Chiropractors, Optometrists, etc. via the potential increase in population as a result of increased direct and indirect flow-on employment associated with the Project. However, the potential population increase from the Project is very small compared to the total population and both SLAs seem to be reasonably well served by health care services (Table G-4.10).

The Project also has the potential to indirectly positively impact on public health through the provision of employment opportunities and the reduction in unemployment. Prolonged unemployment can generate a range of personal and social problems including increased drug and alcohol dependency and increased demand for health services (University of NSW, 2006). Providing opportunities to reduce unemployment can therefore be beneficial.

Demand for additional investment in community services such as child care, aged care and community care services, by Local, State and Commonwealth Governments can arise from increases in the population. However, as identified above the expected increases in population would be very small in the context of the existing population. No requirement for additional investment in community services and facilities infrastructure is therefore anticipated to result from the Project.

G5 CONCLUSION

A BCA of the Project indicated that it would have a net production benefit in the order of $247M. The net production benefit is distributed amongst a range of stakeholders including:

- DCPL shareholders;
- the NSW Government via royalties; and
- the Commonwealth Government in the form of company tax.

The NSW Government receives additional benefits in the form of payroll tax and local councils would also benefit through community infrastructure contributions required under the EP&A Act (if applicable).

The Project also has a range of external economic costs and benefits. External costs associated with noise and dust emissions have been included in the estimate of net production benefits through the acquisition costs for affected properties. The environmental cost of greenhouse gas emissions are estimated at $28M. These costs would ultimately be internalised into the Project through the purchase of emission credits under any emissions trading scheme introduced by the Commonwealth Government and higher prices paid for electricity, diesel and rail transport. There would also be external costs associated with the clearing of native vegetation. However, these would be counterbalanced by the offset actions proposed by DCPL. The external benefits associated with employment provided by the Project have been estimated at $117M.

Overall the Project is estimated to have net benefits to society of $336M and hence is desirable and justified from an economic efficiency perspective.

An economic impact analysis, using input-output analysis, estimated that the Project would contribute the following to the Gloucester and Great Lakes economy:

- $208M in annual direct and indirect regional output or business turnover;
- $84M in annual direct and indirect regional value-added;
- $10M in annual household income; and
- 166 direct and indirect jobs.

At the State level the Project would make the following contribution to the economy:

- $413M in annual direct and indirect output or business turnover;
- $196M in annual direct and indirect value-added;
- $75M in annual household income; and
- 1,004 direct and indirect jobs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities.

The additional direct workforce from the Project is estimated at 15 employees. Conservatively assuming that all this workforce migrates into the broader region, has the same residential distribution as current employees (46% residing in the Gloucester SLA and 16% residing in the Great Lakes SLA) and the same household occupancy as NSW, the additional population impacts would be 35 in the Gloucester SLA and 12 in the Great Lakes SLA.

This potential influx in population is small in the context of existing populations of the two SLAs and is considered likely to have negligible impacts on housing, schools, health or community infrastructure. For the Gloucester SLA, which has experienced fluctuating population levels since 1996, any population growth from the Project may help avoid decline.

Cessation of the Project after nine years of operation may lead to a reduction in economic activity. The significance of these Project cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Project cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given these uncertainties 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 from the stimulation to regional economic activity and skills and expertise that the Project brings to the region, to strengthen and broaden the region's economic base.

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ATTACHMENT GA – VALUING GREENHOUSE GAS EMISSIONS

To place an economic value on carbon dioxide equivalent (CO_2-e) emissions a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions.

A prerequisite to valuing this environmental damage is scientific dose-response functions identifying how incremental emissions of CO_2-e would impact climate change and subsequently impact human activities, health and the environment on a spatial basis. Only once these physical linkages are identified is it possible to begin to place economic values on the physical changes using a range of market and non market valuation methods. Neither the identification of the physical impacts of additional greenhouse gas nor valuation of these impacts is an easy task, although various attempts have been made using different climate and economic modelling tools. The result is a great range in the estimated damage costs of greenhouse gas.

The *Stern Review: Economics of Climate Change* (Stern, 2006) acknowledged that the academic literature provides a wide range of estimates of the social cost of carbon. It adopted an estimate of United States (US) $85 per tonne (/t) of carbon dioxide (CO_2) for the "business as usual" case, i.e. an environment in which there is an annually increasing concentration of greenhouse gas in the atmosphere.

Tol (2006) highlights some significant concerns with Stern's damage cost estimates including:

- that in estimating the damage of climate change Stern has consistently selected the most pessimistic study in the literature in relation to impacts;
- Stern's estimate of the social cost of carbon is based on a single integrated assessment model, PAGE2002, which assumes all climate change impacts are necessarily negative and that vulnerability to climate change is independent of development; and
- Stern uses a near zero discount rate which contravenes economic theory and the approach recommended by Treasury's around the world.

All these have the effect of magnifying the social cost of carbon estimate, providing what Tol (2006) considers to be an outlier in the marginal damage cost literature.

Tol (2005) in a review of 103 estimates of the social cost of carbon from 28 published studies found that the range of estimates was right-skewed: the mode was US$0.55/t CO_2 (in 1995 US$), the median was US$3.82/t CO_2, the mean US$25.34/t CO_2 and the 95th percentile US$95.37/t CO_2. He also found that studies that used a lower discount rate and those that used equity weighting across regions with different average incomes per head, generated higher estimates and larger uncertainties. The studies did not use a standard reference scenario, but in general considered 'business as usual' trajectories.

Tol (2005) concluded that "it is unlikely that the marginal damage costs of carbon dioxide emissions exceed US$14/t CO_2 and are likely to be substantially smaller than that". Nordhaus's (2008) modelling using the DICE-2007 Model suggests a social cost of carbon with no emissions limitations of US$30 per tonne of carbon (US$8/t CO_2).

An alternative method to trying to estimate the damage costs of carbon dioxide is to examine the price of carbon credits. This is relevant because emitters can essentially emit CO_2 resulting in climate change damage costs or may purchase credits that offset their CO_2 impacts, internalising the cost of the externality at the price of the carbon credit. The price of carbon credits therefore provides an alternative estimate of the economic cost of greenhouse gas. However, the price is ultimately a function of the characteristics of the scheme and the scarcity of permits, etc. and hence may or may not reflect the actual social cost of carbon.

In 2008, the price of carbon credits under the European Union Emissions Trading Scheme were around Pounds (£) 24/t CO_2, the equivalent of about US$38/t CO_2 while spot prices in the Chicago Climate Exchange were in the order of US$3.95/t CO_2.

As of July 2008 the spot price under the New South Wales (NSW) Government Greenhouse Gas Reduction Scheme was Australian Dollars (AUD) $7.25/t CO_2. Prices under the Commonwealth Governments Greenhouse Friendly Voluntary Scheme were AUD$8.30/t CO_2 and Australian Emissions Trading Unit (in advance of the Australian Governments Emissions Trading Scheme) was priced at AUD$21/t CO_2-e (Next Generation Energy Solutions, pers. comm., 24 July 2008).

A National Emissions Trading Scheme is foreshadowed in Australia by 2010. While the ultimate design and hence liabilities under the scheme are still a work in progress, the National Emissions Trading Taskforce cited a carbon permit price of around AUD$35/t CO_2.

The *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future* (Commonwealth of Australia, 2008) cited a carbon permit price of AUD$23/t CO_2-e in 2010 and AUD$35/t CO_2-e in 2020 (in 2005) dollars for a 5% reduction in carbon pollution below 2000 levels by 2020.

Given the above information and the great uncertainty around damage cost estimates, a range for the social cost of greenhouse gas emissions from AUD$8/t CO_2-e to AUD$40/t CO_2-e was used in the sensitivity analysis described in Section G2.6 of the Socio-Economic Assessment, with a conservatively high central value of AUD$30/t CO_2-e.

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ATTACHMENT GB – BCA SENSITIVITY TESTING

Table GB-1
Benefit Cost Analysis Sensitivity Testing Project NPV ($Millions)
Including Employment Benefits

INCREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	408	335	278
Opportunity cost of capital	394	322	267
Capital costs	389	318	263
Operating costs	272	220	181
Revenue	645	535	448
Delayed decommissioning costs	409	337	280
Residual value of land	412	338	281
Employment benefits	433	360	303
GREENHOUSE GAS COSTS @ $40/TONNE (T)	398	327	272

DECREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	410	338	281
Opportunity cost of capital	424	350	293
Capital costs	429	355	297
Operating costs	546	452	379
Revenue	173	138	111
Delayed decommissioning costs	409	336	279
Residual value of land	406	334	278
Employment benefits	385	313	257
GREENHOUSE GAS COSTS @ $8/T	433	357	297

Table GB-2
Benefit Cost Analysis Sensitivity Testing Project NPV ($Millions)
Excluding Employment Benefits

INCREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	288	218	164
Opportunity cost of capital	273	205	153
Capital costs	269	201	149
Operating costs	152	103	67
Revenue	525	418	334
Delayed decommissioning costs	289	220	166
Residual value of land	291	221	167
GREENHOUSE GAS COSTS @ $40/TONNE (T)	278	210	158

DECREASE 20%	4% Discount Rate	7% Discount Rate	10% Discount Rate
Opportunity cost of land	289	220	167
Opportunity cost of capital	304	233	179
Capital costs	308	238	183
Operating costs	425	335	265
Revenue	52	21	-2
Delayed decommissioning costs	288	219	166
Residual value of land	286	217	164
GREENHOUSE GAS COSTS @ $8/T	312	240	183

ATTACHMENT GC – 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 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 GC-1 (Powell and Chalmers, 1995).

Table GC-1
The GRIT Method

Phase	Step	Action
PHASE 1		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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