REPORT

Springvale Colliery Mine Extension Project

Review of Economic Impact Assessment

Prepared for
NSW Department of Planning and Environment

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THE CENTRE FOR INTERNATIONAL ECONOMICS
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CANBERRA

Centre for International Economics
Ground Floor, 11 Lancaster Place
Canberra Airport ACT 2609

GPO Box 2203
Canberra ACT Australia 2601

Telephone +61 2 6245 7800
Facsimile +61 2 6245 7888
Email cie@TheCIE.com.au

Website www.TheCIE.com.au

SYDNEY

Centre for International Economics
Suite 1, Level 16, 1 York Street
Sydney NSW 2000

GPO Box 397
Sydney NSW Australia 2001

Telephone +61 2 9250 0800
Facsimile +61 2 9250 0888
Email ciesyd@TheCIE.com.au

Website www.TheCIE.com.au

Contents

BOXES, CHARTS AND TABLES

Summary

The CIE has been engaged by the NSW Department of Planning and the Environment (the Department) to peer review the revised economic assessment produced by Aigis Group for the Springvale Colliery Mine Extension Project (the Project). The CIE has previously provided comment on the earlier assessment by Aigis (dated March 2014). A revised assessment (dated March 2015) is now available and is the subject of this report.

The revised assessment includes a revised Cost Benefit Analysis (CBA) and regional impact assessment. The focus of our report is on the CBA which is the central decision tool for judging the merits of the Project to the NSW community.

Overview of Aigis Group's revised analysis

Table 1 provides a summary of the findings of the CBA of the Project. The Cost Benefit Ratio (CBR) is intended to provide a summary of the overall value for money of the Project. The revised CBR for the Project is estimated by Aigis to be 7.2 indicating that the economic, environmental and social benefits are over 7 times greater than the costs. This compares to the original assessment where the benefits were estimated to be over 11 times greater than the costs.

The revised analysis includes a number of changes to the original assessment:

- removing mitigation provisions as a benefit
- amending the way in which employment benefits are calculated. It now assumes that there are:
  - no construction-stage wage premiums associated with the Project,
  - wage benefits to the Centennial Coal workforce, estimated by assuming the differential between the average Centennial salary and a reservation wage, adjusted for unemployment effects.
- revisions to some estimates of the economic costs.

1 Magnitude of the costs and benefits quantified

Parameter	Original Assessment March 2014	Revised Assessment March 2015
	NPV ($ million)	NPV ($ million)
Economic benefits		
Employment wages	648	170
Coal royalties	201	201
Government taxes	22	18

Parameter	Original Assessment March 2014	Revised Assessment March 2015
	NPV ($ million)	NPV ($ million)
Mitigation provisions	30	-
Total benefits	***901***	***389***
Economic costs		
Noise	1.5	1.5
Subsidence	16.4	18.0
Soil and land capability	16.4	18.0
Surface water & groundwater	16.4	18.0
Air	0.3	0.37
GHG emissions	6.4	6.1
Heritage	16.5	18.7 [a]
Biodiversity	3.5	3.7
Visual amenity	0.2	0.22
Avoidance, management, mitigation provisions		- 30.0
Costs	***77.6***	***54.5***
Cost benefit ratio	**11.6**	**7.2**

[a] This includes $18m associated with natural heritage and $0.7m for archaeological heritage.

Sources: Aigis Group, Springvale Colliery Mine Extension Project, Economic Impact Assessment, March 2014 and March 2015.

CIE's findings

Compared to the original assessment, the revised CBA more closely aligns with well-established principles of undertaking CBAs and the NSW Government's November 2012 Guideline for the use of CBA in mining and coal seam gas proposals. However, there remain a number of aspects where adjustments are required and where we have updated values based on more recent information. Nevertheless, once these adjustments are made the Project is still expected to deliver net benefits to the community.

While there is some uncertainty regarding the quantum of the impact, *at a minimum*, it reasonable to expect that the Project would deliver net benefits associated with royalties. The Division of Resources and Energy within NSW Trade and Investment have estimated the royalties from the Project to be around $180 million in present value terms. Even if the export price of thermal coal remained at current levels of around AUD$80 per tonne the royalties stream is expected to deliver around $160 million in present value terms.

We have adjusted the estimated economic costs to account for revised estimates for air quality impacts and potential impacts associated with greenhouse gas emissions. We have also removed the deduction of the costs associated with 'avoidance, management and mitigation provisions' from the environmental and social costs, consistent with the guidelines. Updated value of biodiversity impacts have also been included. Based on

these changes the social/environmental costs, *at an upper bound*, is estimated to be around $116 million in present value terms.

Based on our revised estimates, assuming thermal coal export prices remain at $80 per tonne the Project would still deliver net benefits to the community is conservatively estimated to be $44 million in present value terms. If the additional benefits to employees and government taxes are also included the net benefits are expected to be over $200 million in present value terms.

While our analysis suggests that the Project is likely to deliver net benefits to the NSW community, this relies on the findings of the Environmental Impact Assessment (EIA) for the Project. We note that there have been concerns raised by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) about the potential impacts on water quality. To the extent that these issues are considered material and have not been adequately addressed in the EIA, then CBA should be updated to incorporate this information.

In regards to the estimates of the social/environmental costs we have raised a number of points of clarification. While these points should be addressed from the perspective of completeness, it is unlikely to change broad conclusion of the CBA regarding the positive net benefits to community from the Project.

2 *Economic benefits*

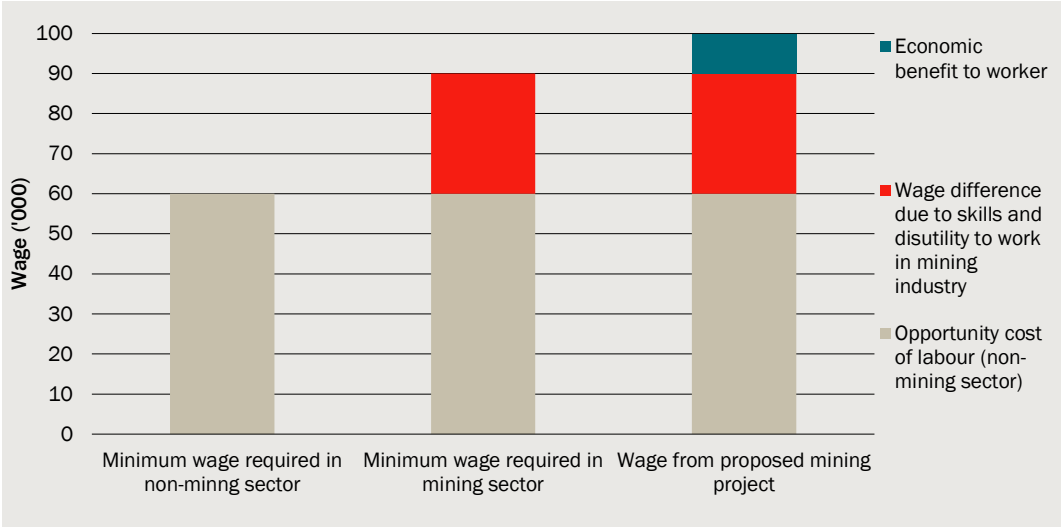
This section considers the estimated benefits to employees and to Government (in the form of royalties and taxes). We have provided revised estimates of the value of royalty payments. There is limited data currently available on which to test Aigis's estimates of the benefits to employees as well as that associated with additional tax revenue. Nevertheless, the royalty stream can be considered to be the *minimum benefits* that can be expected from the Project.

Benefits to employees

Workers in the mining project who would otherwise by unemployed, working part-time, working in other non-mining sectors or working in a different mine at a lower wage may gain higher wages than they would without the Project (a labour/wage premium).

The economic benefit to workers is the difference between the wage that he or she is paid in the mining project and the minimum (reservation)[1] wage that they would accept for working elsewhere in the mining sector (chart 2.1). The minimum wage reflects the employment opportunity costs, skill level required and the relative disutility of an employment position. In practice, minimum (reservation) wages are not transparent.

2.1 Identifying the economic benefit to workers



Data source: CIE.

1 The reservation wage is the minimum wage a worker has to be paid to work in a particular industry. In view of the hours of work and working conditions, there is a reasonable possibility that workers' reservation wages in mining are higher than in other industries.

Aigis estimated the average wage premium (economic benefit) to the Project's employees as $50 015 per employee. This is based on an alternative average wage of $102 766 (which accounts for 5.9 per cent unemployment) and the average wage at the Project of $152 781.2

It is very difficult to estimate the total value of the wage premium to NSW workers from a mining project because the reservation wages and the proportion of employees who migrate to NSW to work in the mine are not easily identifiable.

Aigis's approach to estimate the wage premium as the difference between the actual wage and the alternative mining wage is broadly consistent with economic theory. However, the assumption that the ABS median wage for the mining sector is the alternative mining wage in the case of the Project may not account for the following:

- the relative disutility of working in an underground mine (if applicable)
- differences between the NSW and Australian median wages for the mining sector.

The estimated present value of the wage premium ($170 million) will only be 100 per cent attributable to NSW if all employees currently reside in NSW. Aigis has not identified whether all employees are currently based in NSW.

Furthermore, Aigis's estimated value of the wage premium hinges on the stated average wage at Springvale Mine of $152 781. There is no information available on which to independently test this proposition.

- **Aigis's approach is broadly consistent with economic theory, however, there is limited information on which to test the estimates. Therefore, for the purposes of the CBA this should be considered to be an upper bound estimate of the economic benefit to workers in NSW.**

Royalties payable

A key benefit is the royalties estimated to be generated from the Project. Aigis has estimated the value of the royalty stream to be $201 million in present value terms. This is based on the assumption of 4.5 million tonnes per annum (Mtpa) from the mine over the period 2016-2041(assuming a 7 per cent real discount rate). It assumes a royalty rate of 7.2 per cent for underground coal less than 400 metres deep.

The Division of Resources and Energy within NSW Trade and Investment has provided advice on the significance of the resource and estimated that royalty stream that can be expected from the Project.

> The Division considers that the Project area contains an in-situ coal resource of greater than 70 million tonnes (Mt) of export and domestic quality thermal coal. Of this, it is estimated that the mineable coal reserve totals more than 50 Mt, which is generally extracted from the lower section of the Lithgow Seam. This compares closely with the estimated mine life of 13 years,

2 Median wage for the mining sector (2013) as determined by ABS (2014)

> producing up to 4.5 Mtpa of ROM coal. The Division considers these estimates are reasonable.[3]

The Division, however, estimated that

> if the Project is approved, around 4.0 Mtpa of product coal would be able to be economically mine from the Project area from 2016 to 2028.

The Division also notes that the average ash value of the ROM coal over the life of the mine (22 per cent) is similar to other operating mines in the region. Washing of the export product will be required prior to transporting the product to Port Kembla.

The Springvale mine is expected to sell 50 per cent of its coal on the domestic thermal market (currently the Mount Piper power station) and the other 50 per cent to the export market via the Port Kembla terminal.

The Division has confirmed that the majority of the coal will be mined at depths less than 400 metres which implies a royalty rate of 7.2 per cent. A deduction for coal beneficiation applies. As half the coal from Project will be subjected to washing and half subjected to crushing, the Division has estimated a deduction rate of $2.00 per tonne should apply. In addition, a deduction of $1.00 per tonne is estimated to also apply.

The Aigis report does not provide information on its future coal price estimates. The Division has estimated an average price for domestic thermal coal of $60 per tonne over the Project life. In regards to export thermal coal prices, for its royalty calculations

> The Division uses the current low short term coal prices and medium to long term export thermal prices in the range of $A97 to $117 per tonne.

- **Based on the assumptions noted above, the Division estimates a royalty stream of $180 million in present value terms (using a 7 per cent real discount rate) over the life of the Project.**

The key uncertainty in the royalty calculation is likely to be the world coal export price. Independent data from the Australian Government's Department of Industry provides a point of comparison. In regards to thermal coal, it indicates that

> Benchmark prices for the Japanese Fiscal Year 2015 (JFY, April 2015 to March 2016) are forecast to settle 14 per cent lower at around US$70 a tonne.[4]

Based on the current exchange rate (as at 13 April 2015) of AUD 0.76 per US dollar, forecast prices in 2015/16 would be around A$92 per tonne for thermal coal. If these prices persisted over the next 15 years, this would generate royalties of $175 million in present value terms.

If the export price of thermal coal was around A$80 per tonne this would equate to around $160 million in royalty payments in present value terms over the life of the Project.

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3 NSW Trade and Investment, Letter to Department of Planning and Environment, dated 10 March 2015.

4 Australian Department of Industry, (2014) *Resources and Energy Quarterly*, December 2014, p.26.

- **While there is some uncertainty regarding the future prices, particular for exported thermal coal, it is reasonable to assume that royalties generated from the Project would be between $160 to $180 million in present value terms.**

Taxes payable

In regards to other taxes, Aigis estimates these would generate approximately $18 million in additional revenue to government. In order to test Aigis estimates, further information is required in order to determine the profitability of the Project and the estimated tax on the profit generated. This information has not been provided in Aigis' report but further information could be sought on a confidential basis.

- **However, given the relatively small size of the tax revenue, it is unlikely to materially change the conclusion as to whether the Project will deliver positive net benefits to the community. Therefore, for the purposes of the CBA the estimate of $18 million in present value terms should be considered to be an upper bound estimate.**

3 Environmental impacts

The Proponent and its consultant should be commended for attempting to quantify and value the environmental impacts in a CBA, given the challenges which are commonly faced in undertaking this task. Nevertheless, we have raised some issues and recommended a number of changes which would result in the estimated costs increasing from $54 million to $116 million (as an upper bound).

It is important to recognise that Aigis' analysis is based on the findings of the EIA. To the extent that these findings do not accurately represent the potential impact of the Project it could also change the estimated social/environmental costs.

Cost of environmental mitigation and management measures

Economic value of unmitigated environmental impacts

The economic impact assessment should estimate the economic value of *unmitigated* environmental impacts (i.e. those impacts that will occur despite management and mitigation measures put in place by the proponent). It is unclear from detail provided by Aigis whether the economic value of environmental impacts has been estimated:

- pre-mitigation – all environmental impacts have been valued assuming no mitigation measures will be implemented
- post-mitigation – those residual environmental impacts that could not be mitigated (unmitigated environmental impacts) have been valued.

- **Further clarity is required as to whether AIGIS has estimated the economic value of pre-mitigation environmental impacts or unmitigated environmental impacts.**

Treatment of management and mitigation costs in CBA

Rehabilitation, decommission and environmental management costs are a private cost. Table 4 (page 24) in AIGIS's revised economic impact assessment deducts the cost (present value of $30 million) of environmental avoidance, management and mitigation provisions. This includes the cost of rehabilitating and decommissioning the site at the end of the mine life (page 48).

- **These private costs should not be deducted from the environmental and social cost. Instead the private costs of rehabilitation, decommission and environmental management should be included in the proponent's capital and operating costs.**

Assessment of approach to valuing environmental/social impacts

Air pollution

The valuation measure used by Aigis for impacts to air quality of $281-$1 311 per capita per annum is from *DEC NSW (2005), Health costs of air pollution in the Greater Sydney Metropolitan Region.* This study is almost ten years old and the air pollution costs per capita are based on estimated annual health costs of mean ambient pollution levels across the greater metropolitan region. Therefore, these costs are not related to the quantity of emissions made by the Springvale Mine Expansion Project.

In 2013, PAEHolmes completed a study for NSW EPA outlining a methodology for valuing the health impacts of changes in particle emissions.[5] In the study, PAEHolmes recommended appraisal of air quality impacts from projects be based on the change in pollutant emissions and prepared unit damage costs per tonne of $PM_{2.5}$ emissions by significant urban area (SUA) across NSW.[6] The unit damage cost per tonne of $PM_{2.5}$ for the significant urban area of Lithgow is $29 000 per tonne of $PM_{2.5}$ (in 2011 dollars), equivalent to $31 000 in 2014 dollars.[7]

SLR Consulting Australia estimated emissions from the Project of total suspended particulate (TSP), and particulate matter with an aerodynamic diameter of 10 microns (PM_{10}), 2.5 microns ($PM_{2.5}$) (table 3.1).

3.1 Emission Inventory for the Springvale Mine Extension Project

Phase of project	TSP	PM_{10}	$PM_{2.5}$
	kg/annum	kg/annum	kg/annum
Construction	109 842	26 332	4 670
Operation	188 912	48 345	4 897
Rehabilitation	82 383	16 197	8 106

Source: SLR Consulting Australia, 2014, Springvale Mine Extension Project: Air Quality and Greenhouse Gas Assessment Report Number 630.10123.01020-R1.

Applying the unit damage cost of $PM_{2.5}$ of $31 000 to the emissions of $PM_{2.5}$ estimated by SLR Consulting Australia, an approximate cost of air pollution from the Project is $1.6 million in present value terms.[8]

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5 PAEHolmes, 2013, *Methodology for valuing the health impacts of changes in particle emissions - final report*. Prepared for NSW Environment Protection Authority (EPA).

6 These unit damage costs were transferred from a UK study[6]and adjusted to account for population density to estimate unit damage costs weighted for population exposure for each Significant Urban Area (SUA).

7 PAEHolmes, 2013, *Methodology for valuing the health impacts of changes in particle emissions – final report*. For NSW Environment Protection Agency (EPA).

8 This assumes that the mine operates from year 1 to year 13. In year 1, in addition to emissions from operations, there is also the emissions from construction. The emissions associated with the rehabilitation work is assumed to occur in year 14 consistent with SLR Consulting.

- **Based on more recent data, the impacts of air pollution from the Project are around $1.6 million in present value terms.**

Greenhouse gas emissions

Which source of GHG emissions should be included?

The GHG Protocol categories greenhouse gas emissions into three broad scopes:

- Scope 1: All direct GHG emissions
- Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam
- Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport- related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc. [9]

SLR Consulting Australia estimated the three sources of greenhouse gas emissions from the Project (table 3.2). Aigis reported Scope 1 emissions of 22 697 tonnes CO_2-e per annum in its economic impact assessment. Aigis' Scope 1 emission matches the estimate in the Air Quality and Greenhouse Gas Assessment Report.

3.2 Summary of Scope 1, 2 and 3 GHG emissions from the Project

Source	Reported by Aigis in EIA	Estimated by SLR
	tonnes CO_2-e per annum	tonnes CO_2-e per annum
Proposed operations		
Scope 1	22 697	22 697
Scope 2	not reported	78 560
Scope 3	not reported	1 075 485

Source: SLR Consulting Australia, 2014, Springvale Mine Extension Project: Air Quality and Greenhouse Gas Assessment Report Number 630.10123.01020-R1.

Clearly, the impact of direct emissions (Scope 1) should be assessed in a CBA. Aigis reports and values the impact of Scope 1 emissions in the economic impact assessment.

Currently there are no hard and fast rules about whether Scope 2 emissions should be assessed in cost benefit analysis. Although Scope 2 emissions are indirect emissions caused by the Project's use of electricity (and indirect impacts are not always covered in a cost benefit analysis), it can be argued that the activities of the Project directly determine its electricity consumption and if need be could be altered to minimise electricity consumption.

In the case of the Project, the total Scope 1 and Scope 2 greenhouse gas emissions is 101 257 tonnes CO_2-e per annum.

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9 For more information, please see: http://www.ghgprotocol.org/calculation-tools/faq

Carbon price

Aigis values the cost of greenhouse gas emission using a constant price of A$25 per tonne of carbon dioxide equivalent (CO_2-e).[10] This appears to be based on the starting price (2012-13) used for the previous Commonwealth Government's carbon pricing mechanism. Although the carbon price has now been repealed, the estimated carbon price profile is likely to be a reasonable estimate of the cost of greenhouse gas emissions over time, with the value being updated to 2016 dollars. Furthermore, the cost of carbon emissions under the carbon pricing mechanism was expected to increase significantly in real terms over time.

Given the uncertainty regarding the social cost of carbon, a CBA should estimate the economic cost of greenhouse gas emissions using multiple carbon prices. Two possible carbon prices, which both account for increases in real terms over time, include:

- the projected carbon price estimated by Australian Treasury modelling [11]
- US EPA Social Cost of Carbon (table 3.3).

3.3 US EPA Social Cost of Carbon (per tonne)

Year	Low 5 per cent discount rate	Medium 3 per cent discount rate	High 2.5 per cent discount rate	95th Percentile 3 per cent discount rate	Low 5 per cent discount rate
	$US 2011 dollars	$US 2011 dollars	$US 2011 dollars	$US 2011 dollars	AUS $ 2014[a]
2015	12	39	61	116	17
2020	13	46	68	137	18
2025	15	50	74	153	21
2030	17	55	80	170	24

Source: US EPA Social Cost of Carbon, http://www.epa.gov/climatechange/EPAactivities/economics/scc.html

The annual cost of Scope 1 emissions estimated by Aigis is $567 425 which is based on $25 per tonne CO_2-e and an annual emission estimate of 22 697 tonnes. The present value of greenhouse gas emissions estimated by Aigis is $6.1 million in 2016 dollars.[12]

Using different carbon prices the economic value of greenhouse gas emissions from the Project ranges as follows (in present value terms at 7 per cent) based on emission estimates in the Air Quality and Greenhouse Gas Assessment Report:

- ***Scope 1 emissions*** - $4.9 million to $8.1 million
- ***Scope 1 and 2 emissions*** - $21.8 million to $36.1 million (table 3.4).

10 Aigis report, p.22.

11 Australian Treasury, 2011, *Strong growth, low pollution: modelling a carbon price*. http://cache.treasury.gov.au/treasury/carbonpricemodelling/content/report/downloads/Modelling_Report_Consolidated.pdf Accessed 13 April 2015.

12 Based on our calculations we estimate the value to be $4.9 million in present value terms.

3.4 Economic value of GHG emissions (present value of 7 per cent)

Carbon price	Scope 1 emissions	Scope 1 and 2 emissions
	2016$m	2016$m
Constant price of $25/tonne (current approach by Aigis)	6.1	22.4
Australian Treasury's projected carbon price (core scenario)	8.1	36.1
USEPA Social Cost of Cost (medium scenario)[a]	3.7	16.5

[a] The 5 per cent social cost of carbon has been applied.

Source: CIE based on various sources detailed above.

- **There is uncertainty regarding the value of the impacts from greenhouse gas emissions. Based on a range of assumptions the value is expected to range between $3.7 million to $36.1 million in present value terms.**

Noise

Aigis estimated the noise impact of the Project based on the valuation measure unit of $97-$205/dBA applied to noise exceedances of up to 4dBA at affected receptors. These noise exceedances were modelled in the Noise Impact Assessment[13] as noise impacts that would occur without noise mitigation measures.

As noted above, an economic assessment should estimate the economic value of unmitigated environmental impacts, i.e. those impacts that will occur despite management and mitigation measures put in place by the proponent. The Noise Impact Assessment assessed:

> …that with the recommended noise control measures in place, it is feasible to reduce noise emissions from the existing Springvale pit top to be compliant with the project specific intrusive and amenity noise levels at the nearest affected receivers. [14]

The cost of noise control measures are a private cost and should be included in the proponent's relevant capital and operating costs. No further valuation of noise impacts is required given noise impacts were assessed to be managed through implementation of noise control measures.

Assessment of heritage

In both 2014 and 2015 Aigis reports, the source of valuing the impact on heritage remained the same:

- Allen Consulting Group (2005), "Valuing the Priceless: The Value of Heritage Protection in Australia" – choice modelling/WTP and

13 SLR Global Environmental Solutions, 2014, *Springvale Mine Extension Project: Noise Impact Assessment.* Report Number 630.10123.01010-R1, January 2014.

14 SLR Global Environmental Solutions, 2014, *Springvale Mine Extension Project: Noise Impact Assessment.* Report Number 630.10123.01010-R1, January 2014.

- Streever WJ, Callaghan-Perry M, Searles A, Stevens T & Svoboda P (1998), "Public Attitudes and Values for Wetland Conservation in NSW Australia" – simulated market price/WTP.

In their assessment of the costs associated with impact on heritage, Aigis previously used a valuation measure of $7 per capita per annum for each 1 000 places protected. This was revised up to $7.65 per capita per annum, taking into account inflation. However, the size of the population used in calculations remained the same, at the 2011 level as reflected in the Census data. The assumption of constant population is likely to marginally underestimate the results.

In line with the previous CIE comments, the Aigis Group updated the source of their figures around the number of Aboriginal heritage sites impacted in their March 2015 report to reflect the more recent and pertinent Cultural Heritage Impact Assessment by RPS (2014, p. 2) in relation specifically to the Springvale Mine Extension Project which showed that,[15]

> Overall, 34 Aboriginal sites have been identified in the Project Application Area or within 50m of its boundary. Of these, 30 were previously registered with AHIMS and four have been identified as a result RPS surveys and visual inspections.

Assessment of biodiversity

In addition to the previous source of valuation of biodiversity impact in the 2014 report, Aigis included a further source in their 2015 report by Jakobsson and Dragun (2001).[16] This reflects the use of willingness-to-pay in valuing the impact on biodiversity, in line with NSW Government's Guidelines as suggested in the previous CIE report.

However, the number of species affected by the Project reflected in the Aigis report remains inconsistent with the relevant Springvale Flora and Fauna Assessment Report.[17] The discrepancies in the numbers are reflected in the table 3.5 below:

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15 RPS Australia East Pty Ltd (2014), 'Cultural Heritage Impact Statement – Springvale Mine Extension Project' prepared for *Springvale Coal Pty Limited*

16 Jakobsson K. and Dragun A. (2001), 'The worth of a possum: Valuing species with the contingent valuation method', *Environmental and Resource Economics,* vol. 19, pp. 211-227

17 RPS Australia East Pty Ltd (2014), 'Flora and Fauna Assessment Report – Springvale Mine Extension Project' prepared for *Springvale Coal Pty Limited*

3.5 Differences in the number of species impacted by mine extension project

	Aigs Group(2015)	Springvale Flora and Fauna Assessment Report (2014)
Endangered Ecological Communities (EECs)	▪ 4 EECs impacted	▪ 4 EECs impacted
Threatened flora	▪ 3 species of threatened flora	▪ 3 identified during flora surveys and 10 identified through desktop assessments as being potentially affected
Threatened fauna	▪ 17 species of threatened fauna	▪ 22 species of threatened fauna

Source: Aigis Group (2015) and RPS (2014)

The report referred to by Aigis as a source for their numbers is an older Flora and Fauna Assessment report completed in 2013 by RPS.

It is important to note that the valuation measure used seems to be updated from the previous Aigis report in 2014. Although this takes into account inflation, the source of the number remains pertinent to Victoria and the Aigis Group has not provided any further information on the transferability of the results to the Lithgow region. Nevertheless, we are unaware of other more relevant studies that could be used.

- **Using updated data would increase the overall number of species impacted by an additional 15 species and increase the cost from $3.7 million to $6.0 million in present value terms.**

Assessment of visual amenity

In assessing the impact on visual amenity, Aigis continued to refer to the study by Curtis (2004)[18] which evaluated the impact on the wet tropics of Queensland world heritage area. The transferability of results remains questionable as no substantial reasoning was provided behind the use of this source.

The assumptions underpinning the detailed calculations are based on 11.44 hectares of vegetation being removed as a result of the Project. This is consistent with the current Flora and Fauna Assessment report.

Assessment of subsidence and soil

The Aigis group continued to use the report by Streever et al. (1998)[19] as their source of valuation measure and updated the figure to account for inflation. The unit valuation measure for Subsidence, Soil and Water is $173 per household per annum. This value has been used to separately estimate the environmental impacts of subsidence, air,

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[18] Curtis I.A. (2004), 'Valuing Ecosystem Goods and Services: A New Approach Using a Surrogate Market and the Combination of Multiple Criteria Analysis and A Delphi Panel to Assign Weights to Attributes'

[19] Streever W.J., Callaghan-Perry M., Searles A., Stevens T. & Svoboda P. (1998), 'Public Attitudes and Values for Wetland Conservation in New South Wales, Australia'

surface and groundwater and heritage, implying the value is additive, that households are willingness to pay $173 per annum four times for each of the four environmental impacts.

Neither is it clear whether this estimate of WTP can be used in an additive manner, or whether households would be only willing to pay once for an improvement in environmental conservation (more specifically wetland conservation).

The number of households in the Lithgow LGA are assumed to remain the same as in 2011, which may be unlikely. The costs remain potentially understated because of this and also taking into account that the willingness to pay value may be applicable to households outside the Lithgow LGA as the subsidence impacts may extend to a National Park.

Furthermore, there is a possibility that the willingness to pay value will apply to households outside the Lithgow area as subsidence, water and heritage impacts may affect a broader community outside Lithgow. However, in their analysis the Aigis Group has only applied the willingness to pay value to households in Lithgow. Consequently, these costs may be understated.

The CIE noted in its previous review that it was unclear how an estimate of the willingness to pay of NSW households for wetland conservation was appropriate to use in valuing the impact of the Projects on subsidence, soil, water and heritage impacts. Nevertheless, we are unaware of other studies that would be more appropriate to apply in this circumstance.

Surface and groundwater

As noted above, there are a number of issues noted above in regards to the approach to valuing the impact on water resources.

However, a further and, potentially, more material issue relates to the accuracy of the EIS documentation in describing the potential impact on water resources. The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) was requested by the Australian Government Department of the Environment and the New South Wales Department of Planning and Environment to provide advice on the Springvale Mine Extension Project. Key conclusions from IESC's assessment were:

- Potential impacts to the Temperate Highland Peat Swamps on Sandstone (THPSS) are not accurately predicted by the water modelling. The modelling did not include data on existing surface water, groundwater and ecological conditions for the majority of the THPSS within the proposed project area and the scale of the groundwater model was inappropriate to predict finer scale interactions between surface water and groundwater in THPSS. The IESC noted 'Finer scaled, site specific models, informed by a conceptualisation of the hydrology and hydrogeology, would be needed to have confidence in the predictions of groundwater impacts to individual swamps'.
- Water quality impact estimates for the Coxs River assumed water demand from the Wallerawang Power Station. IESC noted the Wallerawang Power Station has been placed into care and maintenance. ISEC noted 'The proponent needs to assess the

impacts of the potential closure of Wallerawang Power Station on Coxs River water quality'.

- **It is not clear how IESC's findings have been incorporated into the Economic Impact Assessment. If these issues have not been adequately been considered in the EIA then further revision to the CBA would be required to ensure that these impacts do not materially change the results of the program.**

Adjusting values into base prices

AIGIS notes that all values (including unit valuation measures) have been adjusted by 3 per cent per annum to allow for inflation. Table 3.6 summarises changes in AIGIS's 2014 and 2015 economic impact assessment relating to *Table 3: Valuation Methods – socioeconomic and biophysical impacts*.

In some cases it does not appear that the unit valuation measures have been adjusted by only 3 per cent to adjust values from 2014 dollars to 2015/16 dollars. For example, the value for biodiversity was $149 per household per annum (preservation of 700 species) in AIGIS's 2014 report which increased to $213 per household per annum (preservation of 700 species) in AIGIS's 2015 report. The change does not reflect a 3 per cent adjustment for inflation. Similarly the lower and upper bound estimates for noise impacts have not been adjusted equivalently since the 2014 report.

3.6 Comparison of economic values presented in AIGIS's 2014 and 2015 economic impact assessment reports

Description	Source of Valuation (2014 report)	Source of Valuation (2015 report)	Valuation measure (2014 report)	Valuation measure (2015 report)
Noise	▪ Day B, Batemand I & Lake I (2010), "Estimating the Demand for Peace and Quiet Using Property Market Data" – Hedonic pricing (impact on dwelling values)	▪ Same as 2014	▪ $77-202/dBA per annum (upper bound assumed for estimation)	▪ $97-$205/dBA per annum (upper bound assumed for estimation)
Subsidence, soil and water	▪ Streever WJ, Callaghan-Perry M, Searles, A, Stevens T & Svoboda P, (1998), "Public Attitudes and Valies for Wetland Conservation in NSW Australia" – simulated market price/WTP	▪ Same as 2014	▪ $154/household per annum	▪ $173/household per annum
Air	▪ DEC NSW (2005): "Health Costs of Air Pollution in the Greater Sydney Metropolitan Region" – cost of injury/replacement: wtp	▪ Same as 2014	▪ $243-$1 131 per capita per annum(upper bound assumed for estimation)	▪ $281-$1 311 per capita per annum(upper bound assumed for estimation)

Description	Source of Valuation (2014 report)	Source of Valuation (2015 report)	Valuation measure (2014 report)	Valuation measure (2015 report)
Greenhouse gas	▪ Australian Government, Clean Energy Future	▪ The Garnaut Review (2011)	▪ $23 per tonne of carbon dioxide emission	▪ $25 per tonne of carbon dioxide emission
Heritage	▪ Allen Consulting Group (2005): "Valuing the Priceless: The Value of Heritage Protection in Australia" – choice modelling/WTP ▪ Streever WJ, Callaghan-Perry M, Searles, A, Stevens T & Svoboda P, (1998), "Public Attitudes and Valies for Wetland Conservation in NSW Australia" – simulated market price/WTP	▪ Same as 2014	▪ $7.00 per capita per annum for each 1 000 places protected	▪ 7.65 per capita per annum for each 1 000 places protected
Biodiversity	▪ Land & Water Australia (2005): "Making Economic Valuation Work for Diversity Conservation", Australian Government Dept of Environment and Heritage – simulated market price/WTP	▪ Same as 2014 and additionally: ▪ Jakobsson K & Dragun A (2001) "The worth of a possum: valuing species with the contingent valuation method" – *Environmental and Resource Economics,* 19, 211-227 – simulated market price/WTP	▪ $149 per household per annum (preservation of 700 species – flora and fauna – VIC)	▪ $213 per household per annum (preservation of 700 species flora and fauna – VIC)
Visual	▪ Curtis I.A (2004): "Valuing Ecosystem Goods and Services: A New Approach Using a Surrogate Market and the Combination of Multiple Criteria Analysis and a Delphi Panel to Assign Weights to Attributes – actual market pricing"	▪ Same as 2014	▪ $1 044 to $1 331 per hectare per annum (upper bound assumed for estimation)	▪ $1 142 to $1 453 per hectare per annum (upper bound assumed for estimation)

Source: CIE based on information in AIGIS's 2014 and 2015 Economic Impact Assessments of the Springvale Mine Extension Project.

- **For completeness, Aigis should review its scaling, although this is unlikely to materially impact the estimated costs.**

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