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Review of Bulli Seam Operations – Groundwater Assessment and Modelling

Dr N Merrick – Heritage Computing
Reviewed by Dr Frans Kalf

Background

I previously reviewed (20 July 2009) a draft report dated 5 July 2009 prepared by Heritage Computing and made a number of comments, suggestions and recommendations that have now been incorporated in an updated report dated 28 July 2009, designated as Revision E.

The Report Contents

The Merrick report comprises 117 pages together with numerous figures. The main section topics include: Introduction, Hydrogeological Setting; Conceptual Model; Groundwater simulation model; Scenario analysis; Subsidence impacts on the groundwater resource; Climate change and groundwater; Management and mitigation measures; Model limitations; Conclusions and References.

I have examined only the report provided. The report is detailed and it is evident that considerable effort has gone into researching and preparing the data input, modelling and interpreting the model results for the region. This is so given the number of existing mines and piezometer data available for analysis. The report has been completed and presented in professional manner in my opinion.

Conclusion

Based on the evidence presented and the modelling conducted I concur with the report conclusions and management and mitigation measures presented.

F Kalf B.Sc, M. App. Sc, Ph.D.

13 August 2009

T.A. (Tom) McMahon FTSE
Professor Emeritus



Mr Gary Brassington
BHP Billiton Illawarra Coal
Old Port Road
PORT KEMBLA NSW 2526

Dear Mr Brassington

I have now completed my assessment of the Report prepared for the Illawarra Coal Holdings Pty Ltd by Gilbert & Associates Pty Ltd titled *Bulli Seam Operations Surface Water Assessment* August 2009 and my comments follow below. The review process consisted of an initial meeting with Josh Hunt (Resource Strategies) and Lindsay Gilbert (Gilbert & Associates) on 30 April 2009, a two day field visit to the project area with Lindsay Gilbert and Tony Marszalek of Gilbert & Associates accompanied by staff from Illawarra Coal Holdings (19 – 21 August 2009), and reading draft versions of the Report (received on 12 June 2009 and 7 August 2009).

During the field exercise we visited eight locations including the site layout of the West Cliff Pit Top and Brennans Creek Dam, Upper Georges and Georges Rivers to inspect impacted and remediated river reaches, and at Lizard and Wallandoola Creeks we viewed the impact of past upstream longwall mining. Other sites visited included unimpacted areas at the Wedderburn stream gauging station on O'Hares Creek and an extended visit to Green Swamp. Finally, we viewed Maldon Weir on the Nepean River and the Racecourse Creek and Navigation Creek catchments.

In an early draft of the Report, I recommended a number of changes and I can confirm that all these were adequately addressed. I have perused the final draft Report (received 7 August 2009) and I am confident that the hydrology/water balance methodologies are appropriate and, within the limits of the available data, are scientifically defensible. It must be pointed out that the analysis was limited by the hydrological data sets available. Two examples follow.

- The validation of the West Cliff Pit Top Water Balance (Section 4.4) was limited to the recorded water levels in Brennans Creek Dam. This required the adoption of a volume-water level rating curve and, hence, the approach is a crude instrument to validate a water balance model.
- The analysis examining the range of hydrological responses to the effects of subsidence associated with in-stream pools is generic in that a calibrated model has not been built for individual streams/pools. It is recognised that this is because hydrological measurements for each in-stream pool across the Project area have not been made. This results in the simulation of potential pool hydrological behaviour being indicative only as it is not calibrated. However, it is noted that the used underflow rates for pools have been based on measurements at an actual affected pool reported at the Metropolitan Colliery.

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Nevertheless, in these two examples and other hydrologic analysis reported on, I am of the opinion that in each case a credible approach was adopted and full use was made of any available data. In making this comment, there remains, however, one data issue that has yet to be resolved to my satisfaction. This relates to the location and site conditions of the rain gauge at West Cliff Pit Top, as rainfall is a major input to the West Cliff Pit Top Water Balance. If this measuring device is poorly sited it has the potential to introduce error. I therefore recommend that this rainfall gauge be audited against the relevant Australian Standard and upgraded if necessary.

The Report consists of nine chapters, the first two being of an introductory nature to the Project and related area. Chapter 3 covers the baseline hydrology with major sections dealing with the significant catchments within the Project area. These provide hydrologic background to a review of the geomorphology and specifically to the water quality data. Although water quality analysis is not my expertise, I believe that the interpretation of the results is logical and observations are appropriate.

The chapter on Project Water Management (Chapter 4) covers the site water balance, AWBM modelling and several time-series of predicted outcomes. Although these predictions are dependent on the adequacy of the rainfall input and the added moisture of the coal wash material, the relative differences between the current and future development should not be significantly affected by any change to the rainfall or the moisture in the coal wash. This assumption could be tested by sensitivity analysis if necessary.

I am unable to comment on sections 5.1 to 5.3 but note that material is based on previous reports. I endorse the approach adopted in section 5.4 in which a water balance approach is developed for a hypothetical in-stream pool. I note that a key variable, the underflow rate, is based on values reported elsewhere in the Illawarra Region. I am unable to comment on Chapter 6 which deals with valley closure and assessment of potential effects on surface water and the following chapter which deals with stream remediation.

The conclusions reached in Chapter 8, which briefly reviews the effects of climate change on predicted surface water impacts, are appropriate and are not inconsistent with the broad observations noted by others dealing with the impact of climate change on future hydrology. Chapter 9 offers comments on monitoring of baseline surface water, operational surface water and site water balance which I fully endorse.

In summary, I conclude that overall the study detailed in the Report *Bulli Seam Operations Surface Water Assessment* was completed in a professional and detailed manner, and the conclusions in the Report were appropriately supplemented by the field and modelling studies carried out by the authors.



T.A. McMahon
23 August 2009



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24th August 2009

Illawarra Coal Holding Pty Ltd
Old Port Road, Port Kembla
NSW 2505

Attention: Gary Brassington

Re: Bulli Seam Operations Project Aquatic and Terrestrial Ecology
Assessments

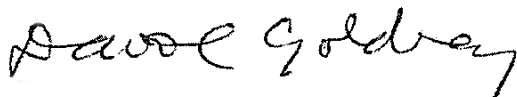
Dear Mr Brassington,

As requested, I have reviewed the following studies which have been prepared as technical appendices to the Bulli Seam Operations Project (the Project) Environmental Assessment:

- *Bulli Seam Operations Project - Terrestrial Flora Assessment*, prepared by FloraSearch.
- *Bulli Seam Operations - Terrestrial Fauna Assessment*, prepared by Biosphere Environmental Consultants.
- *Bulli Seam Operations - Aquatic Ecology Assessment*, prepared by Bio-Analysis Pty Ltd.

I consider the surveys and assessments presented in the above mentioned studies to be adequate and concur with the findings of the studies.

Yours faithfully,



David Goldney

BSc Dip Ed PhD DSc (honoris causa) MEIA
Principal Consulting Ecologist Cenwest Environmental Services
Adjunct Professor, Charles Sturt University
Adjunct Professor, University of Sydney

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3 June 2009

Gary Brassington
Project Manager – Bulli Seam Operations Approvals
Illawarra Coal Holdings Pty Ltd

Report Review
Bulli Seam Operations Aboriginal Cultural Heritage Assessment
by Biosis Research Pty Ltd

As requested by Illawarra Coal Holdings Pty Ltd, I have conducted a review of the Bulli Seam Operations Aboriginal Cultural Heritage Assessment (ACHA) prepared by Biosis Research Pty Ltd as a technical appendix to the Bulli Seam Operations Environmental Assessment.

The comments arising from my review of the Bulli Seam Operations ACHA were provided in April and May 2009. The key issues identified during my review included the following:

- Two of the objectives of the ACHA were not clearly addressed by the report, namely:
 - *Record and assess all sites identified or relocated during the survey in compliance with the guidelines issued by the Department of Environment and Climate Change.* This objective was addressed for a select sample of sites only.
 - *Describe the potential impacts to all identified Aboriginal cultural heritage sites within the study area.* This objective was addressed generally but impacts were not listed for each individual site.
- I provided numerous comments in relation to specific statements/sections contained within the ACHA. These review comments posed queries and/or provided suggestions in order to clarify or correct these statements.
- The basis for determining archaeological significance needed to be more clearly explained rather than just stating that it had been undertaken.
- The terminology and definitions used in the ACHA needed to be corrected and/or made consistent throughout.
- The description of how many sites and which particular sites were chosen for inspection needed to be more clearly articulated.
- Generally, the structure of the ACHA needed to be corrected in order to make the report more concise and its conclusions more pertinent.

The issues I raised were subsequently addressed by Biosis Research Pty Ltd in a revised version of the report. I confirm that all the issues raised during my review have been addressed to my satisfaction in the revised version of the report. I therefore consider that the Bulli Seam Operations ACHA provides an adequate and reasonable assessment and consider the recommendations contained in the report to be appropriate and acceptable.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'R. Gunn'.

R. G. Gunn
Cultural Heritage Advisor
MAACAI

R & Z Consulting

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Rockyview, QLD 4701*

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17th of July, 2009

To whom it may concern

I was engaged by Resource Strategies Pty Ltd to undertake a peer review of the report prepared by Gillespie Economics titled Bulli Seam Operations Project: Socio-Economic Assessment.

This report details the performance of a very professionally conducted socio-economic study to assess and evaluate the potential impacts of continued coal mining operations on regional and state communities. Key components of the study include a benefit cost analysis, a regional economic impact assessment, and an assessment of potential impacts on employment, population and community infrastructure.

The benefit cost analysis is thorough and appropriate. As normal with these types of applications, the focus is on the most significant impacts, with additional sensitivity testing to check whether there are particular treatments of the data that would lead changed findings. The report is extremely thorough in terms of (a) the attention to identifying and analysing the different impacts that might be involved, (b) the use of the choice modelling technique to assess values for key environmental and social impacts and (c) the use of sensitivity analysis to demonstrate that results are robust to a variety of different treatments and underlying assumptions.

The regional economic impact assessment is based on an application of input-output models, which, while not as accurate as general equilibrium models, are suitable for these types of project assessments and form the dominant input into economic impact assessments. The conduct of the input-output modelling is appropriate, and the multipliers that are generated for the regional and state economies are broadly consistent with other similar exercises.

The assessment of the potential impacts on employment, population and community infrastructure is appropriate. Based on the available information, the conclusion that the potential in-migration impacts of the project workforce are unlikely to have major implications on infrastructure and service needs is considered to be appropriate.

I provided a number of comments on the draft Socio-Economic Assessment study (Attachment 1). These have subsequently been addressed to my satisfaction in the final report.

Yours sincerely

A handwritten signature in black ink, appearing to read 'J Rolfe', written in a cursive style.

Dr John Rolfe

R&Z Consulting

Attachment 1

Major comments

1. Cost benefit analysis section. It is unclear sometimes whether or how values have been discounted. For example, on page 19, there is statement that the social value of employment has been estimated at an average value of \$31M per year. It is not clear though whether this is after discounting has taken place, because it appears that the value included in the cost benefit analysis is a simple multiple of the average value by the number of years involved.
2. Section on potential impacts on employment, population and community infrastructure. There is no real discussion of potential risks from cumulative impacts. These can occur when a project in isolation does not generate significant impacts, but where several projects being developed simultaneously can generate cumulative impacts. It may be worth identifying from an EIS register within the NSW government or local regional development bodies whether there are many other major developments likely to proceed in the same region in the same approximate time frame.

Minor comments

1. Page ES3, first dot point, 3rd sentence. This is not a full sentence.
2. Page 3, second paragraph. Add 'discounting to account for temporal differences' as an additional dot point in the steps for BCA,
3. Page 6, first full paragraph, fourth line. Change 'a' to 'at'. As well, it is not quite clear if the market value that is referred to is \$3.1M in current values or values at the time of decommissioning.
4. Page 8, 8th paragraph, third line. Add 'equipment' after 'The residual value of capital...'
5. Page 19, second paragraph, last line. Delete 'etc'.
6. Page 23, last paragraph, last sentence. Replace 'OWSW' with 'OSWS'
7. Page 39, second paragraph, first line. Consider replacing 'Supporting..' with 'Offsetting ...'

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17th of July, 2009

To whom it may concern

I was engaged by Resource Strategies Pty Ltd to undertake a peer review of the report prepared by Gillespie Economics titled Bulli Seam Operations: Choice Modelling Study of Environmental and Social Impacts.

This report details the performance of a very professionally conducted choice modelling study to assess the values of state and regional populations for the potential impacts of continued coal mining operations. The survey performance shows careful attention to design and conduct, and is in line with the standard operation of choice modelling studies that are currently being performed in Australia and internationally. The analysis of results is appropriate and of high quality, and the conclusions that have been drawn are in line with the outcomes of the results. The results appear appropriate for use in subsequent benefit cost analysis.

I provided a number of comments on the draft Choice Modelling Study (Attachment 1) that have subsequently been addressed to my satisfaction in the final report.

Yours sincerely



Dr John Rolfe

R&Z Consulting

Attachment 1

Major comments

1. Page 4, last paragraph. There appears to be a slight inconsistency in the treatment of jobs compared to other attributes, with the full number of 1,170 jobs included as an attribute rather than simply the increase in the number of jobs (1,170 – 875). Additional explanation to justify why the full number of jobs was used would be useful.
2. Page 6, Table 4. Following on from the comment above, it is not quite clear why the lowest level of the non-price attributes is not zero. Essentially the non-zero bases for the non-cost attributes suggest there will still be significant impacts, even if the mine does not go ahead. The low base for the period of time attribute (1 year) suggests that the mine could stop production completely in 1 year (if government approval is not forthcoming), but that there would be a minimum of 40 kilometres of stream affected, 240 hectares of clearing and 20 cultural heritage sites lost. Some additional explanation to justify the setting of the base would be useful.
3. Page 7, last paragraph in section 3.2. Identify if the experimental design used was orthogonal or if an efficient design was employed.
4. Page 8, third dot point. The selection of the payment vehicle is often tricky in CM studies. Your current format of the payment vehicle is a good choice of the available options, but there is not much discussion about this issue. Is there any extra feedback from questions asked in the survey to identify if there were protest votes or other information that can be added to show that there were no problems with the payment vehicle that was used?
5. Page 19, second paragraph and Table 17. In this section a test is reported where the Log form of the Years attribute is added to the choice model. I note that this is added in addition to the linear form of the Years variable, whereas later in the analysis only the log form of the variable is used. For consistency, it is probably better to only have the Log form of the Years variable in the model for Table 17.

Minor comments

1. Executive summary, second paragraph, sixth line. Reword ‘... people change’ to ‘...people choose’

2. Executive summary, first dot point in the last paragraph. The technical terminology would make this hard to understand to the lay person. Perhaps it would be better to simply say that a test has been conducted to identify if there were significant value differences for larger amounts of the impacts.
3. Page 8, dot point 5 – the wording is a touch complex and could be simplified
4. Page 8, first paragraph after the dot points, second line. Replace the first ‘that’ with ‘the’
5. Page 21. Last line of second paragraph. Replace ‘expresses’ with ‘expressed’
6. Page 22, middle of the page. Add ‘between’ after ‘....between V1a and V1b and ...’
7. Page 23, last paragraph before section 5.3. Split the sentence into two separate ones.
8. Page 25, second paragraph, last sentence. Add ‘the’ before ‘Yrs attribute for the Illawarra’
9. Page 25, Table 22, last column. The part-worth for the YrsLn variable seems to be confused?
10. Page 27, last two paragraphs. Just remind the reader which population base is being used for the extrapolation – the regional or the state one.
11. Page 30, second last paragraph, last sentence. This is not a proper sentence, and needs adjusting.
12. Page 30, last paragraph, first sentence. The comparison of models with the LnYrs variable is not quite fair, because it was added to the CL model as well as the linear Yrs variable. If the adjustment is made on page 19 regarding Point 5 above then this is fine.