

19 January 2017

Resource Assessments, Planning Services
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Michelle Kirkman

Dear Michelle,

WALLARAH 2 COAL PROJECT – RESPONSE TO DPI – WATER QUERIES

1. INTRODUCTION

This letter responds to a request from Department of the Environment (DP&E) on 18 January 2017 to address two issues raised in a letter from Department of Primary Industries (DPI) – Water dated 17 January 2017. These issues are responded to below.

1.1 ISSUE 1

The letter from DPI – Water states:

I refer to your email dated 6 December 2016 in relation to the Planning Assessment Commission's (PAC's) review on the Wallarah 2 Coal Project. As part of the PAC's review on the Wallarah 2 Coal Project, it made the following recommendations.

“Before submission of the project for determination the consent authority be provided with revised estimates by year for:

- (a) increased storage in the alluvium as a result of subsidence;*
- (b) losses to the alluvium from near-surface cracking of bedrock and movement of water into fracture zones;*
- (c) losses to the alluvium from leakage through the constrained zone to the zone of depressurisation;*
- (d) losses to baseflow from any changes to catchment flows (ie loss of catchment area) for streams potentially supplying the CCWS; and*

- (e) any other potential sources of loss of water from subsidence-induced changes to either the streams or the alluvial aquifers.

These estimates must indicate whether the losses are expected to be temporary or extend beyond the life of the mine. The estimates should also have been reviewed by NOW (now DPI Water)."

In response to the above, the Proponent has provided a table with estimated losses by year. However, it is not clear how these figures have been derived. The Proponent should provide detailed responses to each of the PAC recommendations outlined above from (a) through (e). Any modelling and data used in the determination of any figures presented should be provided for review.

1.2 RESPONSE TO ISSUE 1

Background

A brief history of consultation with the Planning Assessment Commission (PAC) and DPI – Water in relation to this issue is provided below to provide relevant background.

DP&E's Assessment Report (February 2014) describes meetings between NSW Office of Water (NOW) (now DPI – Water) and Wyong Areas Coal Joint Venture (WACJV) on 11 October 2013 and states that:

"NOW has accepted the additional information that WACJV provided in the Residual Matters Report, in relation to a 'minimal impacts' assessment under the Aquifer Interference Policy. It is satisfied that there is a low risk of vertical hydraulic connectivity and there is likely to be only minimal impacts to aquifers. Nonetheless, NOW has recommended conditions of consent requiring the development of a monitoring, response and mitigation strategy in the event that vertical leakage is greater than predicted. The Department has incorporated these recommendations into its recommended conditions of consent."

The PAC's review report (June 2014) required revised estimates for items a) to e), which were replicated in DPI – Water's letter of 17 January 2017. The issues in items a) to e) were discussed in two meetings involving the PAC, WACJV, Hansen Bailey and Dr Colin Mackie (groundwater expert) on 29 April 2014 and 30 May 2014. The outcomes of these discussions were reported in Section 2.2.1 of the *Wallarrah 2 Coal Project: Response to Planning Assessment Commission Review Report (Hansen Bailey, 2014)* (Response to PAC Report).

The Response to PAC Report included year by year estimates of the potential impacts on the Central Coast Water Supply Scheme (CCWSS) reproduced in **Appendix A**. These estimates were based on the results of the groundwater modelling and calculations undertaken for the *Wallarrah 2 Coal Project Groundwater Impact Assessment* (Mackie Environmental Research, 2013).

The Groundwater Impact Assessment was included as Appendix I of the Environmental Impact Statement (EIS). The EIS was placed on public exhibition from 26 April 2013 to 21 June 2013.

NOW reviewed the EIS, including the Groundwater Impact Assessment, and provided a submission on 8 July 2013 which included draft consent conditions.

On 8 December 2016, DP&E requested confirmation that the information in the Response to PAC Report has “addressed the PAC’s recommendation in its entirety”. DP&E acknowledged that WACJV understood the intent of the PAC’s issues. An email in reply (dated 8 December 2016) was provided to DP&E which clearly indicated where each issue was addressed in the Response to PAC Report (see **Appendix B**).

In response to DPI – Water’s letter of 17 January 2017, the following section outlines the information used as the basis for the statements in the Response to PAC Report at Section 2.2.1. Please note that all this information was contained in the documentation which was subject to stakeholder consultation (as described in the ‘Background’ section).

Potential Impacts to Water Supply Scheme

- a) The increased water storage in the alluvium was assessed using a shallow zone generic groundwater model. This model was used to assess the recovery of the water table within alluvial materials in subsided areas. The design and results of the shallow zone generic groundwater model were discussed in Appendix F of the Groundwater Impact Assessment.
- b) The predicted losses due to movement of water into shallow fracture zones were assessed by calculating the additional storage volume created by fracturing in the shallow hardrock. The size the cracking was calculated using the predicted maximum tensile strains. Mackie Environment Research (2013) determined that cracking would yield additional storage of approximately 0.9 kL per metre of longwall panel length. The assumptions used in these calculations are presented in Section 5.1 of the Groundwater Impact Assessment.
- c) The predicted losses due to leakage to the zone of depressurisation were assessed using a regional groundwater model. The design and results of the regional groundwater model were discussed in Appendix E of the Groundwater Impact Assessment.
- d) The predicted losses due to reduction in catchment areas were assessed in the Wallarah 2 Coal Project Surface Water Impact Assessment (WRM, 2013). The Surface Water Impact Assessment was provided as Appendix J of the EIS. Section 4.3 of the Surface Water Impact Assessment estimated the reduction in the catchment area of Buttonderry Creek due to construction of the Buttonderry Site. The corresponding reduction in runoff to Buttonderry Creek was calculated using runoff coefficients for that catchment. The reduction in runoff to Wallarah Creek was also determined. However, Wallarah Creek is not a stream that supplies water to the CCWSS.

In addition, WRM (2017) conducted an assessment to determine the potential impact of these losses on stream flow regimes during dry and very dry conditions. This assessment was provided as Appendix A of the *Amendment to DA SSD-4974 Response to DP&E* (Hansen Bailey, 2017) and reproduced as **Appendix C** to this letter.

1.3 ISSUE 2

The letter from DPI – Water states:

The Department of Primary Industries Water (DPI Water) is also concerned regarding the Proponent's proposed approach to fluvial geomorphological monitoring. It is not adequate to use visual observations alone to assess potential impacts of the mine on the geomorphology of the stream.

Surveyed cross-sections will need to be established at key locations prior to commencement of mining operations. Both the geomorphological and water quality monitoring programs will be subject to review and endorsement by DPI Water.

1.4 RESPONSE TO ISSUE 2

In relation to geomorphological monitoring, WACJV has committed to a stream stability monitoring and management program. This program includes baseline surveys of creek cross-sections.

Further details on the monitoring program are provided in Section 6.4.3 of the Surface Water Impact Assessment.

Schedule 3 Condition 5 of the draft conditions also states:

"The Applicant shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Director-General. Each extraction plan must:...

- (h) include a Water Management Plan, which has been prepared in consultation with EPA and NOW, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including: ...*
 - a program to monitor and report on stream morphology and stream flows, assess any changes resulting from subsidence impacts, including potential impacts on town water extraction availability under various climatic scenarios and remediate stream stability;"*

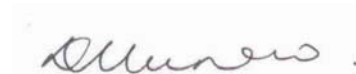
Should you have any queries in relation to this letter, please contact the undersigned on 02 6575 2000.

Yours faithfully

HANSEN BAILEY



Andrew Wu
Environmental Engineer



Dianne Munro
Principal

Appendix A
*Year by Year Estimates of the
Potential Impacts on the CCWS*

Table 1
Estimated Groundwater Impacts by Project Year

Project Year	Vertical leakage (ML)	Loss to crack storage (ML)	Shallow alluvial transfers (ML)
1 – Construction	0.00	0.00	0
2 – Construction	0.00	0.00	0
3 – Construction	0.00	0.00	0
4 – (Year 1 of Mining)	0.00	0.00	0
5	0.00	0.00	0
6	0.00	0.00	0
7	0.00	0.00	0
8	0.37	0.52	35
9	0.66	0.63	68
10	1.06	1.00	110
11	1.61	2.15	157
12	2.19	2.40	180
13	2.92	2.45	169
14	3.65	1.72	110
15	4.45	1.85	113
16	4.96	1.13	75
17	5.18	0.50	41
18	5.26	0.19	20
19	5.33	0.18	17
20	5.40	0.00	8
21	5.48	0.00	5
22	5.58	0.00	5
23	5.66	0.00	5
24	5.77	0.00	8
25	5.95	0.20	20
26	6.39	1.76	117
27	6.79	1.60	102
28	7.12	1.04	63

Appendix B

Email to DP&E 8 December 2016

From: Dianne Munro

Sent: Thursday, December 08, 2016 3:13 PM

To: 'Jessie.Evans@planning.nsw.gov.au' <Jessie.Evans@planning.nsw.gov.au>

Cc: 'Barry, Kenny' <KBarry@wallarah.com.au>; James Bailey <JBailey@hansenbailey.com.au>; Andrew Wu <AWu@hansenbailey.com.au>

Subject: RE: Wallarah 2 PAC recommendations - revised estimates

Hi Jessie,

Thanks for your email.

A meeting was held with the PAC and Col Mackie on 29 April 2014 and 30 May 2014. The Response to PAC Report was prepared in response. All issues are addressed in Section 2.2.1 of that document as follows:

(a) increased storage in the alluvium as a result of subsidence;

Fourth column of Table 1.

(b) losses to the alluvium from near-surface cracking of bedrock and movement of water into fracture zones;

Third column of Table 1.

(c) losses to the alluvium from leakage through the constrained zone to the zone of depressurisation;

Second column of Table 1.

(d) losses to baseflow from any changes to catchment flows (ie loss of catchment area) for streams potentially supplying the CCWS; and

The loss of catchment area due to construction of the Buttonderry Site is addressed in the text in Section 2.2.1. The Tooheys Road Site will reduce the catchment area of Wallarah Creek. However, this impact has not been included in the discussion because Wallarah Creek does not supply water to the Central Coast water supply scheme.

(e) any other potential sources of loss of water from subsidence-induced changes to either the streams or the alluvial aquifers.

Further, there are no other impacts mechanisms that may affect volumes of water within the Central Coast water supply scheme.

Regards,
Dianne.

Appendix C
WRM Report

Memorandum

Date	16 January 2017	Pages	4
Attention	Dianne Munro		
Company	Hansen Bailey		
Job No.	0844-03-B3		
Subject	Wallarrah 2 Coal Project - Impact of low flow losses		

Dear Dianne,

As requested, we have undertaken further analysis to illustrate the impact of potential “worst case” water loss on both surface runoff and baseflow in the Wyong River catchment. Details of the methodology and results of the assessment are provided below.

Methodology

An AWBM rainfall-runoff model, which was calibrated to recorded streamflow data for Jilliby Jilliby Creek, was used to estimate the relative components of surface runoff and baseflow for the catchments draining to the Central Coast Water Supply System (CCWSS). Details of the model calibration are provided in Section 4.6.1 of the Surface Water Impact Assessment (WRM, 2013).

The model was used to simulate the runoff and baseflow components of the catchment drainage to the Lower Wyong River Weir (355 km²) for two scenarios:

- Existing conditions;
- Existing conditions with an assumed total annual water loss of 300 ML/a due to impacts of the Project.

The catchment to the Lower Wyong River Weir represents about half of the total catchment of the CCWSS.

The analysis was undertaken for two historical years; a dry year and a very dry year. 2009 was selected as being representative of a dry year. Rainfall for 2009 (obtained from SILO Data Drill) was 834 mm, which is close to the 10th percentile annual rainfall (90% of years will have higher rainfall). 1944, which was the driest year on record, was selected as the very dry year (annual rainfall of 597 mm). Mean annual rainfall in the region is approximately 1,180 mm.

The loss was subtracted from the total flow at a uniform rate each day. Taking into account the number of no-flow days, a daily loss of 1 ML corresponded to a total annual flow loss of 300 ML for 2009. For 1944, which had more no-flow days, a daily loss of 1.5 ML was subtracted.

Memorandum

Results - Dry year

Figure 1 shows the simulated time series of daily total flow volume at Lower Wyong River Weir for the two modelled scenarios for 2009.

For existing conditions:

- Surface runoff = 8,848 ML (77%);
- Baseflow = 2,588 ML (23%);
- Total flow (surface runoff plus baseflow) = 11,436 ML;
- Volumetric runoff coefficient = 4% (compared to average of 17% for Wyong River and 24% for Jilliby Jilliby Creek).

Including the daily flow loss, the total flow volume reduces to 11,134 ML; a reduction of 2.6%.

The impact on flows is negligible during periods of surface runoff.

The impact of flow loss during dry periods (eg. January, March, May and July-September in 2009) is apparent, but does not change the general character of flow which typically persists for an extended period after surface runoff, with some no-flow periods after extended dry weather. Within the resolution of the model, the impact on the number of no-flow days is negligible. In practical terms, it is unlikely that this flow volume loss could be detected.

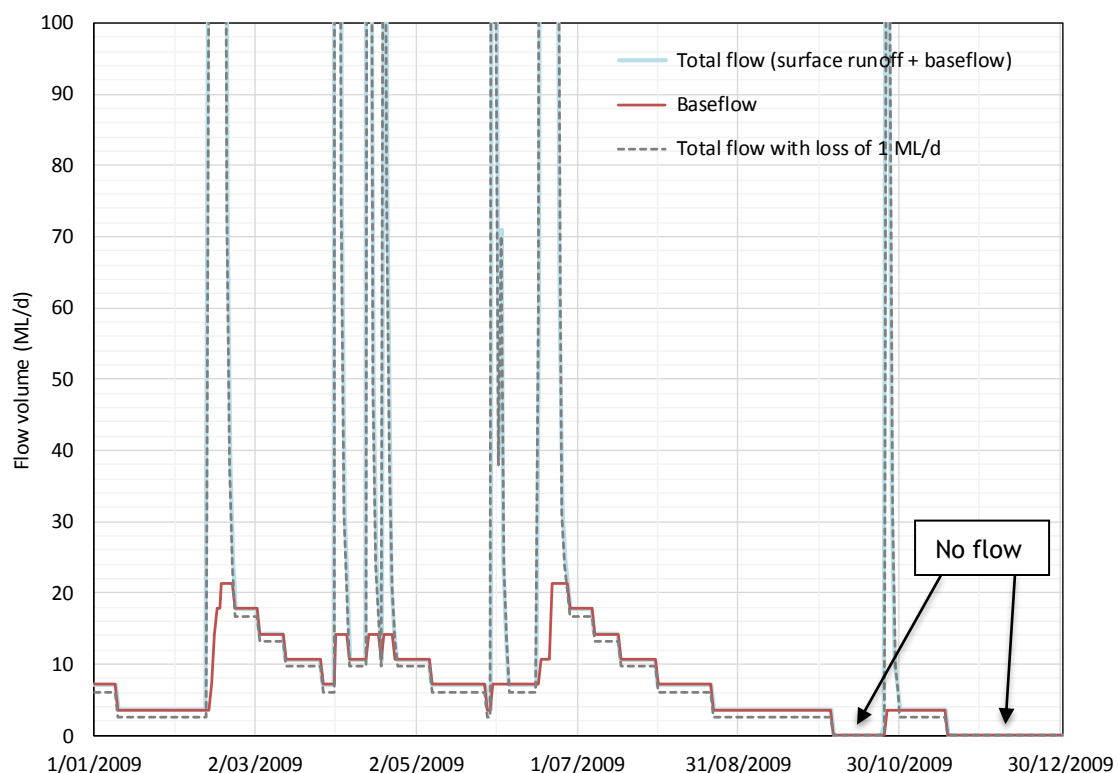


Figure 1 - Time series of simulated flow at Lower Wyong River Weir for 2009

Memorandum

Results - Very dry year

Figure 2 shows the results for 1944. For existing conditions:

- Surface runoff = 2,474 ML (66%);
- Baseflow = 1,260 ML (34%);
- Total flow (surface runoff plus baseflow) = 3,735 ML;
- Volumetric runoff coefficient = 2% (compared to average of 17% for Wyong River and 24% for Jilliby Jilliby Creek);
- There are two extended periods of no flow.

Including the daily flow loss, the total flow volume reduces to 3,433 ML; a reduction of 8%. Again, based on the model resolution, the impact on the number of no-flow days is negligible. In practical terms, it is unlikely that this flow volume loss (which represents an upper limit of potential impacts) could be detected.

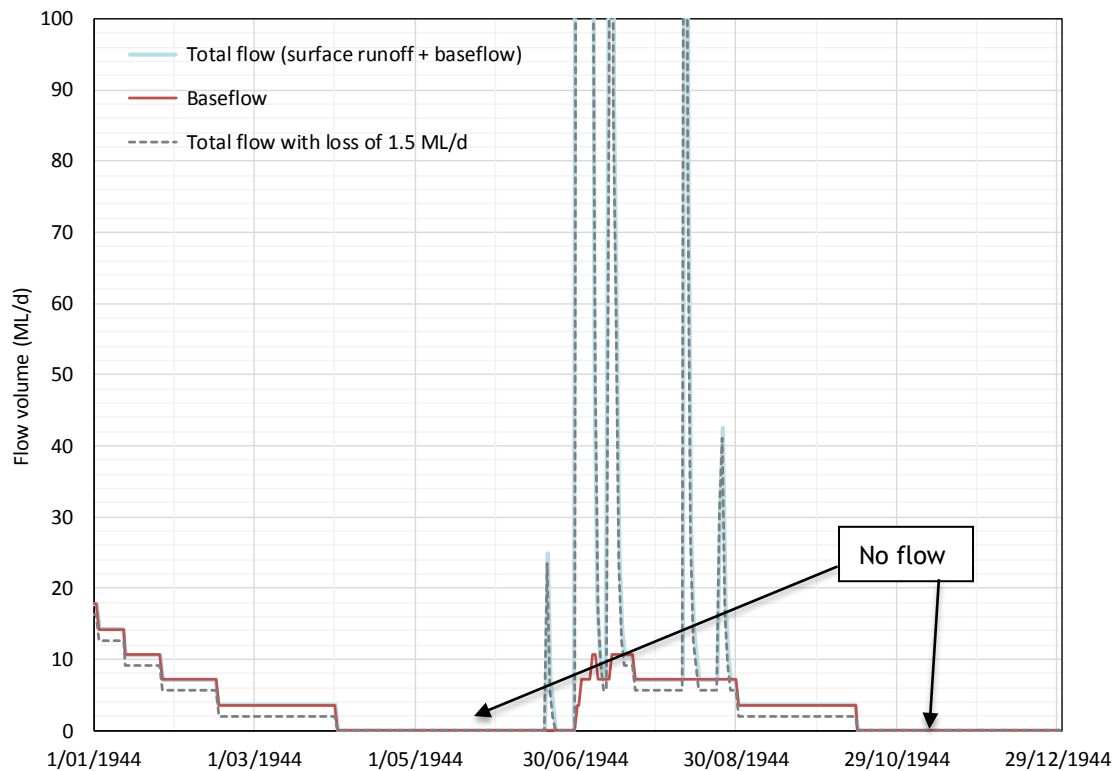


Figure 2 - Time series of simulated flow at Lower Wyong River Weir for 1944

Please do not hesitate to contact me if you require further information.

For and on behalf of

WRM Water & Environment Pty Ltd

David Newton

Director



Memorandum

References:

WRM, 2013 *'Wallarrah 2 Coal Project Surface Water Impact Assessment'*
Report prepared by WRM Water & Environment Pty Ltd, Ref.
0844-01-K, March 2013.