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Illawarra Residents for Responsible Mining

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7 December 2015

Illawarra Residents for Responsible Mining,

As requested by EDO NSW, I have reviewed the additional information on surface water and groundwater provided to the PAC since my initial advice on this project in January 2015.

My two main concerns, raised in previous reviews to various extents, remain:

1) **The need to use geochemical tracers** to validate the conceptual basis of the numerical model, and especially (I view this as critical) to constrain sensitive flow paths, such as those where connectivity is debated. I can currently only find very limited electrical conductivity (EC) and pH information in the available reports, and these are not from locations that enable such flow paths to be tested. The use of isotope tracers (such as δ^2H and $\delta^{18}O$), and a suite of major ions and physical parameters is simple and effective at constraining the relevant flow paths, and should be utilised for this purpose as a minimum requirement in the impact assessment.

In my opinion, a valid understanding of the ground and surface water connections, as well as efforts to reduce uncertainty surrounding aquifer connectivity, cannot be achieved until this water quality and tracer information is collected and analysed. This is especially important for the case under consideration, where all parties bear the responsibility to minimise risk, and thus the value of complementary (and largely independent) evidence on flow paths and aquifer connections from geochemistry cannot be overstated.

2) The evaluation of the **hydraulic connections and potential impacts regarding the upland swamps**. I note that considerable attention has been paid to this by the Commonwealth Independent Expert Scientific Committee on Coal Seam Gas and Large Mining Development (IESC), and also within the PAC Review Report, which has helped clarify the knowledge gaps considerably. From my perspective, there is still no quantitative assessment of the upland swamp hydraulic relationships and water balance. Moreover, there is limited capacity to achieve this without installation of a piezometer network that could accurately identify these linkages. I note that the IESC has also called for a comprehensive upland swamp water balance, and for hydraulically connected swamps to be considered within the numerical model (PAC Review Report 2/4/2015, Appendix 6). One limitation noted by Wollongong Coal in achieving this, is the limited availability of suitable data (as described in the Underground Expansion Project Response to Public Hearing and Response to PAC Review Reports Part 1 and Part 2). This reinforces the need for a dynamic water balance to be constructed. Importantly, a recommendation from the PAC is for the installation of a piezometer network which would be a critical component in providing such a water balance (pg IV of PAC Review Report 2/4/2015) – provided this is appropriately constructed to test the main conceptual models. My recommendation is that the design of this network receive expert feedback to minimise the risk that the wrong information is collected.

In my opinion, the absence of quantitative upland swamp water balances, and the inability to include connected swamps within the numerical model, prevents an accurate assessment (i.e. one that does not rely on poorly constrained assumptions) of the hydrological risks and potential impacts of the proposed development. The establishment of a suitable monitoring network is the beginning of such a process, and would ideally require multiple years of true baseline monitoring to provide such an assessment. The inability of both government agencies and the

relevant industry to provide and pre-empt the minimum information necessary to make judgments on the hydrological processes of interest is a collective failure, especially given the long history of recognised hydrological concerns in this area.

Yours Sincerely,

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Dr Joshua Larsen