NSW GOVERNMENT Trade & Investment

Response to the Report on mining impacts in the catchment

Ann Young <annbob@nsw.chariot.net.au> 2 September 2014 09:17
To: nswchiefscientist@chiefscientist.nsw.gov.au

Dear Professor O'Kane

I attach my response to your Report, as sent to the relevant Ministers.

I would like to add that I found the Report informative and I congratulate you and your staff for the range of material you brought together on the issues.

I would be happy to discuss my concerns with you.

Yours sincerely
Ann Young

A Young to Ministers re Chief Scientist Report 9-14.pdf
175K

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cc Prof. M. O'Kane
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1st September 2014

Dear Ministers

Response to the NSW Chief Scientist and Engineer's Report on long-term impacts of underground coal extraction in the Southern Coalfield / Sydney Metropolitan Catchment Area

I write in response to the final report of the NSW Chief Scientist and Engineer (May 2014) and its associated expert studies.

As well as the Chief Scientist and Engineer's Report, several other important documents relevant to the Sydney water catchment that have overlapping sources in and/or relevance to your areas of responsibility have been released recently. These are:

- The declaration under the Commonwealth's EPBC Act of Coastal Upland Swamps as EECs (July 2014)
- The IESC Knowledge Reports on Temperate Highland Peat Swamps on Sandstone by the Commonwealth Department of Environment (August 2014)

Also I have recently appreciated opportunities to discuss these issues with advisors to the Chief Scientist and to Minister Humphries, and with SCA scientific staff. I mention also the Review of Surface Water Modelling done for the Dendrobium CCC by Prof. Tom McMahon and sent to your departments in June 2014; correspondence from the Sydney Catchment Authority (D2014/48501) and the Department of Planning and Environment (14/0373 and 14/08397); and the papers by Galvin and by Pells et al. to the May 2014 Mine Subsidence Technical Society Workshop. The governmental reports collate an impressive body of scientific data on the impacts of mining on the environment of the catchment. While all reports rightly identify gaps and inadequacies in data, they consistently point to a range of likely long-term detrimental impacts on ecology, water quality and catchment yield. I draw mainly on those of the Chief Scientist and wish to comment on some of the recommendations of that Report. In summary, I argue:

1. **The Woronora/Metropolitan catchments are the most reliable and highest rainfall areas administered by the Sydney Catchment Authority and of great importance to Sydney's water supply, yet they are being extensively undermined and significantly affected by longwall coal extraction.**
2. **The major recommendations by the CS for whole-of-catchment modelling including 3D visualisation are unrealistic. The data available for these**

catchments are not adequate, nor will monitoring provide good data before such large areas are undermined that the exercise is almost irrelevant. Site-specific detailed investigations that could be extrapolated to the wider area would seem a better way forward.

3. **While we lack sufficient data and modelling even to answer the basic questions such as whether water lost in the headwaters reports downstream, the observed impacts on swamp piezometers, stream flow and hydraulic conductivity of strata are sufficient to guide decisions to give much stronger protection to the catchment environment than has been given in the past.**
4. **The current policies are not appropriate. They are reactive, lag behind mine planning, and are not risk-based. They achieve the adaptive monitoring mentioned in the CS Report only in a few localised cases. The TARP mechanism is useful for monitoring but not for impact management.**
5. **The conclusions that water quality issues can be managed at the treatment works and that current mining should continue because major impacts have not been demonstrated are out of tune with community expectations. The community is increasingly concerned about water security and aware of the long-term impacts of mining, as the *Our Land, Our Water, Our Future* campaign clearly demonstrates. Nor have the real costs of dealing with impacts been considered.**

1. The Woronora / Metropolitan (Upper Nepean) catchments' importance

These are the catchments underlain by valuable metallurgical coal reserves, and although they occupy only 0.5% and 5.7% of the area administered by the Sydney Catchment Authority, are the parts of Sydney's catchment with the highest and most reliable rainfall. The Final Report of the Chief Scientist notes:

- that SCA modelling of climatic change predicts a heavier reliance on these catchments in the future than now (Section 1.1.2)
- while only 8% of the Special Areas of the total area of SCA catchments have as yet been undermined (Section 1.2), 25% of the Special Areas in the Woronora/ Metropolitan catchments are being currently undermined, with major expansions planned in the future (Appendix p14). The SCA expects 91% to be undermined by 2030.

It had been assumed that mining and catchment integrity could continue to co-exist without difficulty, but information collected - largely by coal companies under development consent conditions - over the past decade or so makes it clear that this is not the case. **The range of documented impacts indicates that it is not possible to protect the important water catchment unless there are significant constraints on coal extraction.**

2. How much do we know and how can we predict current and future impacts?

This is the critical question addressed by the Chief Scientist. In essence, do we know enough to argue that damage is occurring and is that damage serious enough to warrant restrictions on mining? There is much valid concern about the summary form of data presented to government by companies, the poor understanding of the groundwater hydrology relative to somewhat better data on surface water flows, the short records for data on water quality in streams as opposed to water storages etc. Yet the Report concludes that technologies and data are available or soon-to-be-available to allow whole-of-catchment monitoring, modelling and even 3D visualisation, recommending that these be the ways forward. I disagree very strongly with those recommendations for several reasons:

- The data is neither available nor likely to be so soon - unless 'soon' is some decades away, by which time far more undermining and impacts will have occurred.

- Whole-of-catchment impacts can only be modelled when the component sub-catchment processes are understood. The surface water review done for the Dendrobium CCC showed that even for the best-monitored small sub-catchments in the Southern Coalfield - Wongawilli and Sandy Creeks - the monitoring could not determine whether water lost high in the catchment did return further downstream and thus flow to storage. Even for the oldest Special Area in the system (declared in 1880), in almost the smallest sub-catchment administered by the SCA, in an area where mining has been carried out since 1888 and the water reservoir was completed in 1941, we still do not have a hydrological balance for Waratah Rivulet, the major tributary supplying 30-50% of flow to the reservoir.
- Few gauges were installed in the Metropolitan catchments simply because they were so reliable hydrologically. While the SCA may have copious data on its catchments *in toto*, the data on those in contention here are sparse.
- Data historically has been collected by different methods and at differing frequencies, analysed using a range of methods and interpreted differently, even from the same data set. It is no small task to try to achieve a body of compatible data about any parameter that might be used in a catchment-wide model.
- Data over long time frames are sparse. As the report by Ward and Kelly (2013) for the CS Interim Report notes, it may take decades for depressurisation at depth to impact on near-surface water levels. There seems to be widespread acceptance that such impacts on near-surface aquifers will occur, yet the mines responsible may have ceased operation before they do. And the current data do not allow us to model these future water losses.

One important question is whether flow lost in small headwater streams and swamps re-emerges downstream to maintain catchment yield. But not even at the best-gauged subcatchments - Waratah Rivulet (above Metropolitan mine), Sandy Creek and Wongawilli Creek (above Dendrobium mine) - can we answer the question of return flow.

- Even if Metropolitan colliery installs a new gauge just above water storage level, there will only be a very short pre-mining period to compare with post-mining data and discern whether or not flow re-emerges above the reservoir. Whatever that result, the water balance techniques are not suitable to decide whether flow emerges in the reservoir itself.
- Above Dendrobium, in smaller catchments, error in discharge measurements and natural flow variability mean that it would be hard to conclude with reasonable statistical confidence that water did report downstream unless mining impacts were severe. In other words, the losses are hard to quantify on small streams.

Yet it is clear that the entire flow of small streams is lost to subsurface in non-flood periods and it is reasonable to assume that at least some of this is then lost to evapotranspiration. It would be interesting to see a sensitivity analysis using what data is available for flow rates in headwater streams and estimating the potential losses from 1st to 3rd order streams across the catchments during drought conditions.

The studies needed to illumine us about impacts are not the overarching general models collating diverse sets of existing data, but studies helping us to understand further the inter-relationships between mining and catchment environment. Much time and money could be spent on catchment-wide models without significant advances in our understanding of actual and cumulative impacts. Site-specific detailed investigations that could be extrapolated to the wider area would seem a better way forward.

3. Are the data and understanding we already have useful in shaping decisions?

Nevertheless, I would argue that we have plenty of data and studies available to guide our decisions about the impacts of existing and proposed mining activities. The IESC reports summarise these impacts:

- Water is lost from swamps which then show no sign of recovery after several years, even during high rainfall periods.
- Opening of joints and bedding planes increases the hydraulic conductivity of valley side slopes and watersheds, so water may be lost to evapotranspiration by deep-rooted vegetation.
- Cracking of the bedrock increases hydraulic conductivity so that flow moves subsurface in a fractured zone 20-40m wide and 5-10m deep, absorbing any flows during low rainfall periods. Small streams thus dry out and only flow in flood times. Only when streams become gaining systems further downstream can flow re-emerge at the surface. By then it is usually polluted by iron and other contaminants.
- Subsidence increases the hydraulic conductivity of the rock below the ground surface so that the normal decrease in conductivity to about 200m below the surface no longer occurs. Especially when panel widths are similar to the depth of overburden above the seam, water lost from the surface may move to deep groundwater or even into the collapse zone, and never re-emerge to storage.
- The collapse zone above the goaf is likely to reach high enough above wide panels to cause drainage from aquifers in the Hawkesbury Sandstone, and the Bald Hill Claystone is not an effective aquaclude.
- Subsidence does not simply accelerate the rate at which natural processes (such as rock falls from cliffs) operate but introduces new stresses and rock movements (dilatancy and valley closure).
- The report of the Southern Coalfield Inquiry and subsequent Planning Assessment Commission reports describe the detrimental water quality of impacts iron spring activity initiated by mining activity. Once pristine streams and rivers may become so contaminated that metal concentrations in inflows to reservoirs exceed Australian Drinking Water Guidelines.

Our current monitoring systems do not allow certainty about whether flow re-emerges to water storage after being lost down subsidence cracks and opened natural partings in the bedrock. Yet observed changes to swamp piezometers and loss of flow from swamps suggest that they are significant, especially during low rainfall periods and potentially very significant cumulatively across the catchment. There are enough strong pointers to cumulative and long-term impacts to guide decisions towards a much more rigorous control of the damage caused by longwall mining.

4. Are current policies appropriate?

The Chief Scientist comments that 'adaptive management approaches have been successful in the Catchment when used to ensure highly significant features are protected', citing the example of Sandy Creek waterfall above Dendrobium mine (Section 2.3.1). This was achieved by close monitoring of ground movements and stopping a longwall short of the planned end. In short, it was done by the smallest possible change in longwall layout and at very considerable expense and after some years of planning. The probable need for stopping short had been known before the longwalls had been developed. (I note in passing that the company was not required to guarantee maintenance of yield from Sandy Creek catchment, just integrity of the rock structure of the waterfall and nearby channel.) Longwalls above Russell Vale mine (formerly Gujarat NRE1) were relocated to avoid undermining some

swamps, recognising that avoidance is the only useful strategy to protect significant features from subsidence-induced damage. Again this came at considerable cost of sterilised coal. This is the reality: adaptive mining cannot be a short-term change in mining operations in response to measured subsidence because layouts are planned decades in advance. Yet consent to mine and mine layout approval usually comes within a period of a few months, after the mine has already got very close to the end of a previous area, and can thus argue that it is imperative that its plan is approved promptly to maintain employment and production. **There is a strong dichotomy between the coal companies' planning framework and the current approval process that greatly disadvantages protection of the integrity of the catchment (as we saw with Dendrobium Area 3B).**

Management of subsidence impacts is reactive and not risk-based. Professor Galvin, in his keynote address to the Mine Subsidence Technical Society workshop in May, drew a parallel between subsidence management and mine safety management. He noted the dramatic improvement in coal mine safety in NSW after legislation was introduced in the mid 1980s requiring companies to minimise risk to their employees. He argued that subsidence damage should also be placed on a risk management basis. At the same workshop, Pells, Turner and I argued that it is feasible to specify quantitative criteria for significance of natural features. At present however, regulation of impacts relies on TARPs. These lead to monitoring and discussions between stakeholders (exclusive of those from the community) but not to effective action for three reasons.

- Firstly TARPS may identify damage but there are few effective proven methods to repair it. The best-known method - grouting of stream beds - is slow, lags behind the extension of damage downstream, replaces naturally pervious nickpoints with a very low permeability 'curtain', cannot be applied if the bed is obscured by boulders or sediment, is unproven over decadal use, and creates its own environmental impacts. If the bedrock base is disrupted, there is no proven method to repair upland swamps. And of course cliffs damaged by rockfalls can hardly be rebuilt.
- Secondly the TARPs do not trigger adaptive mining. The longwall panel layout is approved for an area and unless there is drastic damage (eg sufficient inflow to cause obvious loss of water from storage - and presumably also major safety problems underground), no change to mining operations of which I am aware has followed triggering of TARPs.
- Thirdly the ecological and hydrological damage is often hard to quantify for some years after impacts happen. For example, changes to vegetation in swamps do not happen over a few weeks although the water loss occurs over this short time. Changes to both ecology of swamps and water yield of their exit streams are not easy to separate from natural variations due to climate, fire etc so setting unambiguous TARP criteria can be difficult.

TARPs are useful in monitoring impacts but of very little practical benefit in managing them.

I do not consider the current policies appropriate.

- **They are reactive to company plans that are largely finalised before being brought to government.**
- **They fail to take long-term post-mining catchment dehydration into account in assessing impacts.**
- **They are not risk-based, and rely on the inadequate TARP system to regulate damage.**
- **They do not provide for adaptive management except in a very few localised situations.**

5. Is the current level of concern by government compatible with community expectations?

The Chief Scientist concluded that water quality issues can be managed by treatment works, and that current mining activities are not causing disastrous cumulative impacts or major water loss; and so current activities should proceed. The recent change to the mining SEPP which gave primacy to economic benefit supports this view.

However this view ignores several important facts:

- The community values the catchments more strongly as water security becomes a matter of increasing concern. Conservation groups focussing on water security have grown rapidly and gained widespread support from both regional and metropolitan communities. The *Protect Sydney's Water Alliance* brings together many concerned organisations and the concerns in Sydney's catchment are echoed state-wide by the *Our Land, Our Water, Our Future* campaign.
- That concern comes from the information now available on the impacts of mining on the catchment areas. For example, a decade ago, the upland swamps, which continue to be my main concern, were barely considered in decisions about mining. Now their ecological and hydrological value are recognised in NSW and Commonwealth listing as EECs and their value to catchment yield is widely acknowledged. As more information becomes available and longer-term impacts are documented, the community has greater, not lesser, reason for concern.
- The issue of water affordability and our dependence on reservoir capacity are emphasised in the Arup *Future of Urban Water* study for Sydney Water study released yesterday. Unfortunately catchment damage and mitigation/remediation strategies or costs are not considered in the environmental section which merely notes 'degradation and depletion", and all case studies are of engineering solutions. As a risk management strategy, catchment protection should be considered as a priority.
- The costs of treating water of poor quality and potentially of supplying water via desalination or raising dam wall heights if catchment yield drops are not factored into the current planning decisions. No cost-benefit analysis has been suggested to weigh these increased economic costs against the value of the royalties, employment etc of the coal operations. Nor have the environmental consequences of these 'solutions' (especially to supply problems) been investigated and weighed against the benefits of better catchment protection.
- And economic value is not the only value that the community places on the catchments. The perceived higher value of fresh v recycled water and the conservation value of the catchments ecologically need also to be taken into account.
- Mining has already been approved under stored waters in the Woronora catchment, even though major longwalls under reservoirs are untested in the catchment. If the impacts on water balance in the reservoir due to the subsidence damage upstream cannot be clearly defined and are considered possibly enhanced by unrecognised geological defects (unmapped even in a mined area!), how is the impact of mining below storage to be measured? And should there be a major loss of water, there is no feasible way of repairing the damage.

I believe that current policy greatly underestimates community concerns and expectations for the protection of Sydney's water catchments.

Yours faithfully
Ann Young