# Springvale Extension Project SSD 12_5594, April 2014

# Submission by Dr Ann Young 26th May 2014

**I object to this proposal and ask that it be referred to a public Planning Assessment Commission Inquiry, with the associated Angus Place Mine Extension Project SSD 12_5602.** My comments are focused on the Springvale application because my principal expertise is in respect of the upland swamps, which are mainly but not exclusively in the Springvale Project Area. Also the Angus Place reports contain identical material about swamp impacts.

## *Regional significance*

Together these projects will undermine much of the non-conserved Newnes Plateau that has not already been affected. It needs to be emphasised that the Newnes Plateau is a unique part of the Blue Mountains Plateau complex. The thickness of the Burralow Formation mapped for this project is probably the reason for the smooth topography visible on satellite imagery over the Springvale/ Angus Place leases and also to the northeast in part of Wollemi National Park. This terrain is in stark contrast to the highly dissected nature of most of the Blue Mountains / Wollemi region, especially the adjacent Wollangambe terrain. Unfortunately the only available regional map, the 1992 south Western Coalfields 1:100,000, does not differentiate the Burralow Formation from other Narrabeen Group formations.

As the EIS notes, the upland swamps are closely associated with the Burralow Formation. Hence the protection of the integrity of the Burralow Formation is critical to the protection of the Newnes Plateau and to the conservation of the value of this regionally highly significant landform assemblage of broad ridges, swamps and fringing pagoda areas.

## *The aquifers of the Burralow Formation and swamp distribution*

The Burralow Formation is described (p 51 Main Report pt1) as 'essential to the formation and persistence of both hanging and shrub swamps'.. Table 2.5 comments that 'without the Burralow Formation and the aquitard layers within it, swamp communities would not exist. [and] The thicker and more extensive the Burralow Formation, the larger and more laterally extensive the swamp'.

Its perched aquifers are described as discontinuous, surficial and independent of regional groundwater. However the mapping such as in Fig. 2.8 shows the brown isopachs of the aquitards (denoted as YS or SP semi-permeable layers in the discussions) as laterally continuous. Hence they are of regional and not local importance.

Specifically Table 2.5 identifies
AQ6 as a perched unconfined aquifer overlying the YS1 claystone. The aquitards 'direct groundwater laterally into adjacent gullies'.
AQ5 at some greater depth, below SP4 (= claystone YS4 and sandstone/siltstone, described on p 27 of Appendix E pt 1) and overlying YS6 claystone. Fig 2 of Aurecon's hydrogeological assessment Appendix 7 to the 2011 Angus Place Modification shows AQ5 at about 45m depth.

Unfortunately Fig 2.12 has a barely readable legend and no clearer version is given in Appendix E, it lacks a vertical scale and its location is not given on the preceding map Fig

2.11. Nor is AQ6 identified on the ispoach maps of the Burralow Formation such as Figs 2.8. In Appendix E pt1, p 80, it is identified with the upper 3 isopachs (YS 1-3), so presumably the lowest isopach represents YS6 at the boundary of the Banks Wall Sandstone. Initial water levels in AQ6 are 1060-1100 m asl.

So in summary, the reports strongly assert that the AQ6 aquifer in the Burralow Formation is critical to the existence of the upland swamps. It also states that vertical permeability of the semi-permeable claystone aquitards, is not affected by mine subsidence. However Fig 39 of RPS's Groundwater analysis in Appendix E pt 2 shows drawdown of AQ6 of 0.5 - 5m in 2015 and 0.5 - 10m drawdown by 2020. Fig 50 shows 0.5 - 10m drawdown by end of mining and I can see virtually no blue 'recovery' lines amongst the swirls of re 'drawdown'. **The evidence shows that the protection of the Burralow Formation aquitard AQ6 is critical to swamp protection but that AQ6 will drop well below root depth and by up to 10m, if mining is permitted.**

## *Impacts on swamps*

**1. Changes to baseflow**

Appendix E pt 1 p. 81 ff discusses impacts of potential baseflows on swamps, for example, Carne West swamp. There may be no direct cracking to goaf in this environment, with two very thick sandstones and a thick continuous claystone above the goaf. Surface fracturing may reach only 10 - 15m below the surface, but obviously the thin aquitards of the Burralow Formation will be disrupted by the near-surface subsidence. Indeed, and to my knowledge innovatively, it is argued that these disruptions will be beneficial:

> As the swamp is undermined by the Springvale longwall panels, the associated increase in horizontal conductivity in the shallow aquifer due to bed separation results in increased groundwater flow to the swamp driven by the higher heads in the surrounding aquifer than are present in the swamp. If groundwater levels were below the level of the swamp then the opposite response would be observed, with the increased hydraulic conductivity resulting in increased leakage from the swamp... Overall the predicted impact at Carne West Swamp is a positive increase in baseflow. Post mining the baseflows are predicted to stabilise at around 0.0409 ML/day, around double the predicted baseline value of 0.02 ML/day.

Perhaps this flushing effect explains the rise in groundwater levels in Sunnyside Swamp shown in Fig 2.17 of the Main Report. However no such claim is made; rather that Report simply neglects the obvious change in average levels and the inconsistency with cumulative rainfall deviation, and comments that there has 'been no impact due to mining within the angle of draw' (p 63). More probably, rather than a beneficial impact of mining, the rise is merely due to more rainfall after a long drought. And if mining were good (or even neutral) for valley swamps, it might have been expected that Kangaroo, Wolgan West, Narrow and Wolgan East swamps also would have shown higher water levels post- than pre-mining.

One obvious further question is whether if there were indeed any increase due to higher permeability, it would continue, as Appendix E asserts; or whether stored groundwater would be flushed soon after mining and thereafter flow through the Burralow Formation would be faster than under pre-mining conditions, perhaps supplying the same volume to valley floor swamps like Carne West but under a more flashy regime.

Flow patterns at Narrow Swamp provide a good example of the recycled analysis that is common in the EIS. I quote from the hydrogeological report for the Angus Place Modification 2011:'

> measurements to date have indicated that there appears to be no adverse impact on the flow patterns in the Narrow Swamp due to the longwalls that have already been extracted

> beneath it (920, 940 and 950) (Aurecon, 2009). Flow monitoring carried out in this swamp prior to the extraction of longwall 950, and during discharge events from LDP005, has shown that approximately 91% of the discharge from LDP005 reached a weir (NSW1) in the centre of the Narrow Swamp (Figure 8). The deficit in flow volume is apparently taken up in the peat deposits in the swamp (which is normally periodically waterlogged), since this part of the swamp had not been undermined at the time that the flow measurements were taken. The percentage of discharge from NSW1, which reached a weir at the northern end of the swamp (NSW2), was also 91%. Two longwall panels have undermined the Narrow Swamp in the section of the watercourse between NSW1 and NSW2, and so the flow monitoring indicates conclusively that the mining to date has not resulted in any significant changes to the total flow from the swamp. This is demonstrated in Figure 8, which shows the measured discharge at the LDP005 weir as well as the flows at the two weirs further downstream.

Exactly the same wording appears on p 228 of the Main Report vol 2 ie there has been no update of previous conclusion and data which went only up to March 2009. Are no further data available? As Fig 8.5 shows, flow dropped to near zero after LW 950 was mined in early 2009. Did they recover as they had in June and August 2008? Flow was obviously dominated by the discharge from LDP 5 of over 8 ML/day; and I have suggested elsewhere that loss of water from swamps is most critical in low flow conditions, not when high flows fill the near-surface cracks. What has been the flow pattern since discharge from LDP 05 ceased? And given the spread of point data in Fig 8.4, is a simple percentage really a sufficient parameter to declare that a result 'conclusively'?

**2. Piezometric traces**

These have been impossible to interpret. The multiple traces on Fig 2.14 and 2.15 make them unreadable. Colour differentiation is indistinct, the traces overlap and the data is unclear. The depths of sediment are not given, nor are the times when the swamps were undermined or the longwalls involved.

Kangaroo Creek Swamp is a 'periodically waterlogged' swamp. From the photographs Photo 2.11- 13 it is mainly on a steep valleyside and so normally free-draining. Nevertheless, as the Report notes (p 82 and Fig 2.27), KC1 hydrograph dropped after mining nearby at Angus Place in 2008 and has not recovered. As it is a small swamp, the impacts may not be dramatic, but it shows clearly that undermining does lead to long-term loss of water from the swamp sediments. This is in line with results from swamps in the Southern Coalfield, and entirely predictable given the 6 mm/m tensile and 26 mm/m compressive strains experienced. Nor is the assurance that flora monitoring shows 'no trend of decreasing condition' consoling. We expect such changes to be decadal rather than taking only a few years to show. Also for most of the time, the drought broke in 2010 so the vegetation has been supported by increasing rainfall.

Narrow Swamp

The traces from Narrow Swamp are complicated by the discharges of mine water shown on Fig 8.5. Again the longwalls affecting them are not shown; again it is very hard to separate the individual traces. However the pattern is quite clear. Until the latter half of 2006, NS1 and NS2 showed a recession curve compatible with slow drainage from saturated sediments. Since then, both have responded only with brief spikes to high rainfall (between April 2008 and January 2009, the traces are indecipherable). It may be that the water levels were artificially supported by minewater discharge but the swamps have been damaged by the undermining. The water level at NS1 and NS2 is now some 2m below the pre-mining position! Narrow Swamp is called a 'periodically waterlogged swamp' - and this is now the case. However it probably was not so before the mining damage.

East Wolgan Swamp

East Wolgan Swamp is also listed as 'periodically waterlogged'. I do not intend to rehearse all the arguments about cause and effect but wish to make several points:

- the minewater discharges into East Wolgan Swamp caused scalding in a narrow line down the valley axis. It did not support the vegetation over most of the swamp but killed it along the line of maximum discharge, encouraging erosion.
- the depth of peat in East Wolgan Swamp is completely incompatible with a periodically waterlogged swamp with a high water table only after high rainfall. Deep accumulations of organic material require thousands of years of sustained high water tables.
- the topographic location of East Wolgan Swamp, and the considerable area of Burralow Formation ridge above it suggest it was naturally permanently waterlogged. Fig 2.10 shows Sunnyside 'permanent' swamp as a wider valley incised about half the depth of the Burralow Formation (to YS4) and fed by the AQ6 aquifer. East Wolgan is incised into the Banks Wall Sandstone and may well have a steeper thalweg, but is fed by both AQ6 and AQ5.

**It is misleading and inaccurate to argue that mining has not caused a drop in the water tables of the undermined swamps above the Springvale and Angus Place mines.**

**3. Hanging swamps**

These are the forgotten swamps in this document. p iv declares that

> The predicted depressurisation of aquifers in strata overlying the coal seam will have minimal impact on the shrub and hanging swamps on Newnes Plateau and the surface drainage network of the water supply catchments

Their dependence on flow via aquitards in the Burralow Formation is emphasised. 26 have been undermined (p 85) and there are 75 in the Project Area (p 94). Section 2.8.3.5 deals with impacts of past undermining - all examples are of valley floor swamps, although Kangaroo Creek could perhaps be described as a hanging swamp. In short, while recognising the importance of the hanging swamps, the Report does not address the impacts of mining on them. Yet they are clearly at least as vulnerable to diversion of water via bedrock cracking as valley floor swamps. While not affected by valley closure impacts, their sediments are shallow and the source of flow to them is localised. Disruption to the YS 1-3 aquitards is very likely to divert flow from the swamps on the valleysides. It could perhaps move it into the valley floor shrub swamps, but this would not compensate for the loss from hanging swamps. In principle this can be seen in the cross-section in Fig 2.10 (Attachment 1). It is predicted by the map of drawdown in Fig 50, from which I have taken Attachment 2. (Note also the likely impact on MU 52).

**Severe impacts on the hanging swamps are likely and this has not been considered in the EIS.**

## *On establishing acceptability criteria for mine subsidence impacts on the natural environment*

I attach a copy of the paper of this title by Pells, Turner and Young, given at the recent 9th Triennial Conference of the Mine Subsidence Technological Society (Attachment 3). I draw your attention to several points made in the paper:

- at present there are no criteria that balance environmental considerations against the economic value of coal

- there exists no feasible remediation strategy for remediation of damaged swamps. Restoration of eroded areas is feasible via the 'Save our Swamps' and similar technologies, but there is no available technique for repairing damaged bedrock or aquitards. Damage must be avoided if it will be unacceptable.
- our community already recognises abiotic features as being of special significance (eg in World Heritage listing of landscapes) in a way analogous to recognising threatened biota as being worthy of special conservation consideration.

While I have concentrated on the swamps, the Newnes Plateau is not just a group of swamps and a group of pagodas and a groups of streams and a group of vegetation communities, as if all these groups were discrete and to be taken separately and the few best bits of each kept. It is in fact a landform and biotic assemblage. Nor are these groups simply of scientific interest or aesthetic value. The Plateau is vital headwater catchment for the Nepean/ Hawkesbury system and the landform/plant assemblages are integral to its effectiveness for this.

**The challenge in considering these two proposed projects is to weigh up the competing short term economic benefit against the long term value of the natural features of the Newnes Plateau.**