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APPENDIX 1
TERMS OF REFERENCE

Request to the Planning Assessment Commission: Russell Vale Colliery Underground Expansion Project

Section 23D of the *Environmental Planning and Assessment Act 1979*

Clauses 268R and 268V of the *Environmental Planning and Assessment Regulation 2000*

I, the Minister for Planning, request the Planning Assessment Commission to:

1. Carry out a review of the Russell Vale Colliery Underground Expansion Project, and:
 - a) consider the EA for the project, the issues raised in submissions, the formal response to submissions, the Preferred Project Report, the Residual Matters Report, the Department of Planning & Environment's preliminary assessment report of the project, and any other relevant information provided on the project to the Commission during the course of the review;
 - b) assess the merits of the project as a whole, paying particular attention to the potential impacts to:
 - upland swamps and water resources (especially Cataract Creek and the stored waters of Cataract Reservoir) resulting from mine subsidence; and
 - residents in the vicinity of the Russell Vale pit top resulting from noise and air emissions and the trucking of product coal;
 - c) apply all relevant NSW Government policies in that consideration and assessment; and
 - d) provide recommendations on any reasonable and feasible measures that could be implemented to avoid, reduce and/or offset the potential impacts of the project.
2. Conduct public hearings on the project no later than 30 January 2015.
3. Complete the review by 20 March 2015, unless the Secretary of the Department of Planning and Environment agrees otherwise.

**The Hon. Pru Goward MP
Minister for Planning**



Sydney

9

December 2014

APPENDIX 2

LIST OF SPEAKERS AT THE PUBLIC HEARING

Date & Time: Tuesday 3 February 2015, 9am

Place: WIN Entertainment Centre; corner Harbour and Crown Streets, Wollongong

1. Nature Conservation Council, Kate Smolski, CEO
2. Wollongong Transport Coalition, Irene Tognetti
3. Illawarra Branch of the National Parks Association, Peter Turner
4. Tom Hunt
5. Rod Plant
6. Dr Ann Young
7. Miguel Heatwole
8. Susan Fawaz
9. National Parks Association Macarthur Branch, Julie Sheppard
10. Peter Turner
11. Protect Sydney's Water Alliance, Isabel Mctosh
12. Rivers SOS, Caroline Graham
13. Illawarra Greens, Elena Martinez
14. Illawarra Business Chamber, Debra Murphy
15. Georges River Environmental Alliance, Sharyn Cullis
16. Garry Caynes
17. Western Sydney Environmental Network, Michael Streatfield
18. Illawarra Residents for Responsible Mining, Kaye Osborn
19. Public Health Association of Australia, Anna Bethmont & Doctors for the Environment Australia, Dr Melissa Haswell
20. Southern Sydney Branch National Parks Association, Murray Scott
21. Kristen Lee
22. Parramatta Climate Action Network, Michael Rynn
23. Oatley Flora & Fauna Society, Melina Amerasinghe
24. Ann Brown
25. Gavin Workman
26. Susan Benham
27. Shirley Gladding
28. Kaye Osborn
29. Kim Wagstaff
30. Romana Lesnjakovic
31. Scott Jones
32. Nick Karakolevski
33. Dominic Tier
34. Richard Knappett
35. Maureen Mage
36. David Bitz
37. Dr Alison Edwards & Dr Graham Heath
38. Bruce Rowles
39. Jeff Brown
40. Martin Denny
41. Deidre Stuart
42. Anne O'Brien
43. Dr Keith Tognetti
44. Wollongong Climate Action Group, Rowan Huxtable
45. Natasha Watson

SUBMISSIONS AND PRESENTATIONS MADE AT THE PUBLIC HEARING

Objecting to the Proposal

Upland Swamps

- Swamps are protected under both NSW and Commonwealth legislation, and are Endangered Ecological Communities, and are listed on the IUCN red list (international list of threatened species and communities).
- Swamps provide habitat for threatened species, such as the Giant Dragonfly.
- Swamps provide ecosystem functions, to the catchment. Loss of this function could have water quality impacts within the catchment. The swamps are critical to water in the catchment, and water holding bodies such as these swamps need to be enhanced rather than damaged.
- Damage to the swamps is irreversible. Limited evidence regarding remediation of these swamps, the remediation could cause more damage.
- Debate as to how many swamps are going to be impacted from this application: 9, 12 or 14? The impacts to the swamps will not be seen, as it is locked up behind closed doors, within the catchment.
- Swamps are small and threatened by mining practices, and are susceptible to climate change and changing weather and fire regimes, once they have been impacted by mining, through the loss of their perched water tables.
- Swamps above Longwalls 4 & 5, have been impacted by longwall mining, and these swamps are now rain responsive swamps, they do not retain water for long periods of time.
- The vegetation within the swamps is changing, vegetation that is tolerant to drier conditions is moving in. Vegetation is being damaged to allow for the installation of infrastructure to monitor the impacts.

Water resources – groundwater, surface water & drinking water catchment

- Poor understanding of near surface hydrology, the connectivity between the swamps, surface cracking and the cracking zone above the goaf. Where does the water from the swamps go, once the rock bed has cracked? Does this water reappear further downstream? The evidence does not support the theory that the water reappears downstream.
- The Special Areas of the catchment are critical for drinking water supply and should be protected from mining and CSG development. The Cataract Reservoir catchment along with all of Sydney's drinking water catchments supplies clean drinking water for 4.5 million people.
- 3 billion litres of water lost each year to the current mining activities within the catchment.
- The Special Areas within the catchment are restricted to the public, though mining companies seem to have an open door policy.
- Mining should not occur within the catchment.
- Water NSW has been holding out against CSG in the Special Areas, and longwall mining the Dam Notification Areas, due to concerns regarding the potential impacts to water quality and quantity.
- Drinking water supplies should be safe secure and sufficient to meet the needs of the population. Public infrastructure is being put at risk from mining.
- Why gamble a clean drinking water supply for 5 years of coal mining, it's not ours to gamble, and it is not worth the risk and it certainly is not the time to take risks. There is the risk of having a permanently degraded catchment.
- The water loss predicted from the catchment is based on models, and these estimates maybe exceeded. Unacceptable level of risk to the groundwater.

Offsets

- Swamps cannot be offset, as the majority of the upland swamps are within the catchment, and the catchment is largely covered by exploration licences. The areas that are provided as offsets should be surrendered from the mining lease to provide protection in perpetuity.
- Swamps may be able to be offset ecologically, but not hydrologically. Where is the lost water going to come from? Additional water sources, e.g. desalination plant?
- Any offsets should be 'like for like', and not something else. Financial contribution to offset fund, does not protect the habitat, it is the developers way of 'buying their way out of offsets'.
- Offset policy is based on biodiversity, and is based on the total clearance of habitat, of if 50% is cleared, then need to offset this amount. This does not work for swamps or in this case, where little clearing is occurring, but damage is being done.
- How is the impact to the swamps measured? The indicator that the swamp has been impacted is a change in the near surface hydrology. The ecological indicators have a time lag, and may only be evidence after a catastrophic event, such as a bushfire.
- Bank guarantee of \$600,000 will not cover the environmental impacts or offsets required. Who will pay for the offsets, both ecological and hydrological? Tax payers will pay through higher costs for drinking water.

Independent Expert Scientific Committee & NSW Chief Scientist & Engineer's reports

- This mine is considered to be a 'current activity' within the NSW Chief Scientist's report, though it is not, it should be considered as a 'new mine'.
- ISEC has a number of residual concerns regarding the project that need to be resolved were noted including:
 - That this mining may reactivate the voids created by previous mining has not been addressed; and
 - The timing of impacts diminishes the ability of adaptive management.

Planning & approval processes

- Piecemeal approach by the company to planning and approvals, October PAC public meeting for MOD 2 and the community have limited faith that their concerns are considered during the process.
- No more modification applications should be accepted and no longwalls in the Wonga West area (as these have been removed from this application). Any new mining should be assessed under Part 4 of the EP&A Act, and not Part 3A.
- The Precautionary Principle and the principles of Ecologically Sustainable Development should prevail over the 'significance' of the coal resource. The mining SEPP does not apply to this Part 3A application, so the significance of the coal resource should not outweigh the environmental impacts.
- Dams Safety Committee, Water NSW and Independent Expert Scientific Committee concerns have not been addressed. PAC should be influenced by the other government agencies who have residual concerns and object to the application.
- Mining companies can get away with damaging environmental features.
- PAC has the opportunity to stop mines from causing damage to the catchment.
- Mines cannot be assessed in isolation; the cumulative impacts from all mines need to be assessed. Not acceptable to assess the project in isolation, needs to be assess in totality of the industry, including an upfront independent cost-benefit analysis, reasons behind the reduction in greenhouse gases, and standards that apply to other industries.
- The case should be made that mining is required, not the case against mining.
- Why is the maximum extraction rate of 3Mtpa being applied for, when the total extraction is for only 4.7Mt? Department of Planning & Environment state that it is just a hangover from the earlier Environmental Assessment, which included the Wonga West longwalls. The

maximum extraction limit should be 1Mtpa, as the 3Mtpa could be the bases for further modifications.

- Wonga East (what is being applied for) is being mined to raise the capital to fund the extraction of the Wonga West area – that was outlined in the MOD 2 application, though not mentioned in this application. The whole area should be assessed as one unit, including the Wonga West area.
- Wongawilli seam is not a great coking coal seam of 52% of the RoM coal is coking coal, so extraction is really only 2.7Mt not 4.7Mt
- Project is neither neutral nor beneficial under s32B of the EP&A Act.
- Conditions mean nothing without enforcement.
- Since the mine was closed during 1996-2004, then the mine should meet the modern environmental standards, and not the old standards that this mine has.
- Lack of scrutiny and bias towards the proponent within the Department's assessment report.

Noise – traffic and pit top

- The increased in yearly production, will increase the number of trucks on the roads, in particular Bellambi Lane, Memorial Drive and the roads to Port Kembla.
- Trucks are lined up along Bellambi Lane, prior to the 7am loading curfew, the trucks leave their engines on while waiting to enter the Wollongong Coal site to load.
- The proponent should have to fully fund road maintenance, though DPE state that proponent should only have to fund the additional maintenance costs.
- Past practices, by the former owner, have left a negative perception in the community that this company will be any better.
- Bellambi Lane is marked as an industrial road, as the land to the south of Bellambi Lane is zoned light industrial. The northern side of Bellambi Lane is zone residential. Southern side of Bellambi Lane as no noise criteria, as it is 'industrial' and the 30 properties and 100 residents effected are deemed to be 'isolated residents'. Bellambi Lane is not included in the Noise Management Plan. There is no real time noise monitoring of Bellambi Lane.
- 1979 approval capped road capacity at 2Mtpa.
- Noise criteria are higher levels than within the 2011 approval? Why? The noise limit is to be increased to 56dB, when the current approval is for 53dB.
- Noise modelling was changed to include previous activities (including the washery).
- The mine was closed from 1996 to 2004, residents had an expectation that the mine would not reopen, and therefore the noise levels experienced between these years should continue. During this time the washery and processing plants were not operating.
- The expected noise increase on Bellambi Lane is 2dB, however the vibration levels from all the additional trucks is still unknown.
- Night time noise from trucks until 10pm, some residents have requested a reduction in hours to 8pm.
- EPA quoted as stating that the noise study is poor.

Air quality

- Local residents are already impacted by coal dust from the pit top, and are concerned that the increase production will increase the coal dust produced and the risk to human health that this will have.
- Past practices, by the former owner, have left a negative perception in the community that this company will be any better. No confidence that the mitigation and management measures will reduce the coal dust emissions.
- Two new coal stockpiles are to be established, increasing the amount of coal stored on site.
- Health impact assessment needs to be undertaken as part of the application.

- No safe level of exposure to fine particulate matter (PM_{2.5}), leads to longer term health impacts as the fine particulate matter can enter the blood stream.
- Diesel emissions from the increased truck movements along Bellambi Lane.
- A resident has an air quality monitor install on their property for some 6 years, though it is not registered with any agency.
- Concerns over the large reduction in the amount of fugitive gas (methane) being released from the mine – from over 2Mt in the original Environmental Assessment to approximately 200,000t.

Water – water use, pit top & Bellambi Gully

- Bellambi Gully is used as a drain; it has been dammed and runs black with coal during storms. Bellambi Gully as not be re-aligned as was a condition of any earlier approval.
- Water that flows from the emplacement areas needs to be directed away from residents, as it is polluted with coal dust.

Socio-economic

- There has been no independent cost/benefit analysis, as was committed to by the Minister for Planning (June 2014).
- The benefits of the project have been overestimated, and the multipliers that have been used are high, and overestimate the benefits. The financial benefits are going offshore, as the company is foreign owned.
- The costs of the project have been underestimated. The cost of the externalities has not attempted, as it is difficult to put a price on these, particularly swamps. The community is more aware of the value of the swamps within the catchment.
- Short term economic benefits versus long term ecological costs.
- The price of coal is decreasing.
- Employment figures are overestimated; mine employees make up about 1% of the total Illawarra working population. Coal industry no longer brings in the indirect jobs.
- The mine was closed between 1996 and 2004, residents were told that the mine was closed down and would not be reopening.
- The mine is too close to residential areas for any expansion.
- No social benefit too many members of the community.
- Decision needs to consider inter-generational equality.

Uncertainties

- Differences in the predicted impacts from single seam mining, and triple seam mining. Triple seam mining adds a whole new level of complexity and uncertainty to the predications. How will the older previously mined seam react to being undermined? The subsidence impacts may be greater than predicted. Potential for localised anomalies in subsidence to occur.
- There is not adequate pre-mining information on the swamps or other environmental features, so any impacts due to previous mining are not known, they are only estimated.
- There are still gaps in knowledge, these knowledge gaps should be addressed before further mining goes ahead.
- The location and extent of the Corrimall Fault. Will the third seam mining reactivate the fault, and will there be any hydraulic connection between the mine workings and the stored waters of the reservoir if the fault is reactivated by mining?
- Why aren't the uncertainties being considered in the assessment?

Company's practices

- Piecemeal approach by the company to planning and approvals, October PAC public meeting for MOD 2 and the community have limited faith that their concerns are considered during the process.
- Community has little faith that this company will be any better than the previous owners.
- Company picks and chooses which aspects of the conditions it adheres to.

Flora & Fauna

- Vegetation generally can look after itself, if the population is restricted from entering the area.
- Fauna is important, and fauna movement (mobility) is important. The big factor in fauna mobility is access to water. Fauna mobility within the catchment is restricted to between the road infrastructure (the Hume Highway and the Princes Highway). Fauna required a north-south-east-west area of mobility, due to changes in climate and other factors for survival.
- The impact assessment is inadequate due to limited survey methods; no trapping was undertaken and no remote cameras were used. The approach of survey was less rigorous than it should have been, and it did not meet the methodology set out in the guidelines (OEH have 2 guidelines for surveying threatened species and the Commonwealth Department of Environment have 5 guidelines).
- Several species were not look at adequately, and the habitat preference of some threatened species is limited due to the inadequate surveys.

Aboriginal Cultural Heritage

- Living spirits on Country.
- Cross-cultural relationship regarding land management.
- Need to continue the dialogue with Aboriginal people.

Supporting the Proposal

Socio- economic

- The Illawarra region has a long history of mining, dating back to the 1880s.
- Mining is one of the highest 'value added' industries for the economy.
- There are 611 businesses that directly service the mining industry of the Illawarra region.
- Mining direct spend in the region is \$1.5 billion, and the flow on effect is \$3 billion.
- Direct and indirect flow on economic benefits of mining. The company supports over 350 local businesses; if the mine was to close then thousands of jobs would be lost.
- The community benefits from large projects like this one.
- The company supports the Autism School; the company has provided the land for the school (land owned by the company), built a car park for the school, and regularly undertakes maintenance of the grounds of the school.
- The mine and the company are part of the community.

Environmental Monitoring & Planning

- Focus is on subsidence monitoring (including surface water impacts)
- Company is working with Wollongong University and ecology and hydrology consultants on research projects
- Working to develop best practice monitoring techniques

APPENDIX 3

SUMMARY OF MEETINGS

MEETING NOTE

Briefing from Department of Planning and Environment		
Meeting note taken by Naomi Cleaves	Date: Wednesday, 28 January 2015	Time: 2:40pm
Project: Russell Vale Colliery Underground Expansion Project		
Meeting place: PAC Office		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves & Megan Webb Department of Planning and Environment: Howard Reed & Sara Wilson		
The purpose of the meeting is to have a briefing from the Department		
<p>Summary of the key topics discussed are provided below.</p> <p>The Department provided an introduction on the history of the application and the site, noting the different mining precincts associated with the mine, namely:</p> <ul style="list-style-type: none"> ○ Wonga East (the subject of this application) and the mains to Wonga West ○ Wonga West ○ Wongawilli – which has an existing approval but is in care and maintenance mode and is now referred to as Wonga South <p>The Department explained that the Wonga West area was originally included in this application, but in its Preferred Project Report the Proponent had decided to remove this part of the mine plan from application. The Department confirmed it expected the Proponent would submit another application for that area, at a later date. In relation to this application, the Department noted:</p> <ul style="list-style-type: none"> • The assessment of this project is easier without the Wonga West component • It is a relatively small mine, 4.7Mt of coal, extraction rate of 1 – 1.5 Mtpa with a 5 year life (maximum extraction rate is up to 3Mtpa, which was part of the original EA, this hasn't changed as part of the reduction in the size of the project) <p>The Department noted the Proponent's amended application (Preferred Project Report) was sent out to the Government agencies in late 2013 – the amendments included the removal of the Wonga West area from the application. In summarising the Agency feedback it had received the Department noted:</p> <ul style="list-style-type: none"> • Dam Safety Committee did not comment on the Preferred Project Report – however it is noted that the Dam Safety Committee can impose conditions on mining, where the mining occurs within the dam notification area (this area is designed to provide protection to the structure of the dam, and the stored waters of the reservoir) • Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Developments (a Commonwealth committee) request for advice was on 12 August 2014, very late in the process. The Committee's comments are on the Preferred Project Report and not the original Environmental Assessment, and the Committee highlighted a number of uncertainties surrounding the project • The Independent Expert Scientific Committee commented that it 'can't rely on adaptive management' when the life of the mine in this proposal is only for 5 years – the environmental impacts may not yet be visible 		

- The Independent Expert Scientific Committee's comments are based on first principles assessment, therefore a number of their concerns have already been addressed
- The project requires approval under the Environmental Protection Biodiversity Conservation Act 1999, as a Controlled Action (two separate Controlled Actions, one from MOD 2 (the longwall mining of part of Longwall 6) and the second for this project)
- Due to the late referral to the Commonwealth as a Controlled Action, the Department of Environment will undertake a separate assessment of the project under Commonwealth legislation, and within the statutory timeframes associated with the Commonwealth legislation.
- The Department of Planning & Environment believes that it has enough information and sufficient understanding of the risk profiles to recommend approval for the project

Sydney catchment – water

- The Department noted there is a new water authority (Water NSW), and a relatively new Board of the Sydney Catchment Authority, which has not reconsidered SCA's policy position on longwall mining within the catchment
- The Department noted that the Chief Scientist had been asked to review the risk of impacts associated with longwall mining in the catchment – and found that existing longwall mining shouldn't be prohibited in the catchment, though monitoring and adaptive management are critical to ensuring impacts are minimised

Upland swamps

The Department noted that the Office of Environment and Heritage has indicated

- It does not want to see any more than negligible impacts to swamps, if the mine is approved
- Any impacts above negligible should be offset
 - Principles of the new offset policy have been extended to swamps – however there are still uncertainties as to how the policy will work, given the impact may not be evident for a significant period of time
 - There is still some uncertainty about how to offset a swamp and OEHL and the Department are working through some potential options.

The Department has agreed that any impact greater than negligible environmental consequence will be offset, and have structured the conditions such that:

- Actual impact is less than predicted then there will be remittance
- Actual impact is greater than predicted then within 6 months additional offsets will be required

Economic Assessment

The Commission sought clarification on the economic assessment, the Department advised that:

- The multiplier used by the Proponent to assess indirect jobs, is the one provided by DRE
- There is some suggestion that higher salaries lead to higher flow on effects

Noise

The Commission noted that the proposed noise limit are higher than in the 2011 approval, and sought clarification on the reasons for this, noting that previous audits showed that the company met the 2011 conditions. The Department undertook to provide some further information on this.

Documents to be provided: Explanation behind the raising of the noise limits from the 2011 approval limits

Meeting closed at 4:15pm

MEETING NOTE

Meeting with Wollongong Council		
Meeting note taken by Naomi Cleaves	Date: Monday, 2 February 2015	Time: 11:30am
Project: Russell Vale Colliery Underground Expansion Project		
Meeting place: Wollongong Council Offices		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves & Megan Webb Wollongong Council: Ron Zwicker (Special Projects Manager) & Mark Riordan (Manager Development Assessment & Certification)		
The purpose of the meeting is discuss Wollongong Council's residual concerns with the project		
Summary of the key topics discussed are provided below. <u>Subsidence</u> <ul style="list-style-type: none"> Concern regarding the subsidence predictions, noting the seams above have already been mined and suggesting there is insufficient information available on the layout of previous mine workings undertaken historically and the extent of subsidence particularly in relation to the previously mined Bulli seam (very limited information given the time the mining was occurring) Have seen impacts from mining the Wongawilli seam – longwalls 4 and 5 <u>Special significance swamps</u> <ul style="list-style-type: none"> Swamps of special significance need to be protected – Council preferred to see longwall 6 commence mining from the mains end, and stop short of CCUS4 Council concerned that there is still limited monitoring to justify mining longwall 6, and Council still want this swamp protected <u>Flood mitigation works</u> <ul style="list-style-type: none"> Version 6 of the Bellambi Gully Flood Study (Cardno) has been provided to Council – which includes the correct blockage assessments outlined by Council previously (100% blockage of all pipes smaller than 6000mm) Council & proponent has reached agreement on the flood mitigation options/recommendations within the Cardno report, and Council would like these to become conditions of approval 12 month time frame for these mitigation works to be undertaken should also be part of the conditions, and are reasonable and feasible <u>Noise & traffic</u> <ul style="list-style-type: none"> Residents are still concerned about noise and traffic impacts Noise levels have been reduced with the construction of the noise bund and noise attenuation of mine equipment Noise wall, was due to be constructed (has since been taken out due to the construction of the noise bund and the other noise attenuation measures) Noise limits proposed are higher during the day and evening periods (than in the 2011 approval); does Council have a view on this? Council has not formed a view on this at this stage <p>The Commission sought clarification on whether the elected Council had a view on the project, the elected Council's view that is generally supportive of existing mines, and is focused on managing the impacts within the catchment. The elected Council has a different view on new industries; these should not be within the catchment.</p>		

Other issues

The main concerns that have been raised at the CCC meetings, are:

- Noise
- Air quality
- Dust emissions

Noise is still the major issue raised at CCC meetings, though not as much as earlier on. Dust emissions and air quality issues have also decreased since the change in mine owner and the environmental performance/compliance with conditions has improved.

Documents tabled at meeting: Summary sheet of Council's residual concerns and the Bellambi Gully Flood Study (Ver 6)

Meeting closed at 12:00pm

MEETING NOTE

Briefing from Proponent – including pit top inspection, and underground inspection		
Meeting note taken by Naomi Cleaves	Date: Monday, 2 February 2015	Time: 1:30pm
Project: Russell Vale Colliery Underground Expansion Project		
Meeting place: Russell Vale Colliery		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves & Megan Webb Wollongong Coal: David Stone, David Clarkson, Rhys Brett, Jasbir Singh Proponent's consultants: Hansen Bailey: Diane Munroe; SCT: Ken Mills; and Biosis: Nathan Garvey		
The purpose of the meeting is to be briefed on the project and see the pit top areas and mine workings		
Summary of the key topics noted by the Proponent is provided below. <u>Mine planning</u> <ul style="list-style-type: none"> New company took over in November 2013, and are developing a 30 year plan for the mine, which includes this application, a modification for LW12 and development of the western mining area (Wonga West) Retained the maximum extraction rate from the original EA (3Mtpa) which is likely to be reached in year 3 of this project, by that time they hope to have approval for mining in the Wonga West area, and this will lead to continuity of mining and ongoing employment The Proponent has undertaken significant redesign of the mine proposal over the years to reduce the impacts to environmental features, and this has resulted in the permanent sterilisation of 1.8Mt of coal – this coal will not be mined as part of future applications <u>Subsidence</u> <ul style="list-style-type: none"> Cataract Reservoir infrastructure (the dam wall) is over 11km away from longwall 11 (the longwall nearest the dam) and is unlikely to be impacted by the mining Longwalls have been redesigned to be setback from the dam consistent with DSC advice, and have been redesigned to avoid 3rd and 4th order streams Monitoring of subsidence from longwalls 4 and 5 show that the subsidence is largely confined to above the panels and isn't spreading out from the panels, and the subsidence is less than predicted <u>Ecology and swamps</u> <ul style="list-style-type: none"> 33 of the 39 swamps (in the investigation area) have been undermined previously and are still functioning as swamps, what impact has occurred to the swamps is not known as there isn't any obvious signs on the surface of impacts from mining Detailed monitoring plan are being developed with multiple trigger points, including: <ul style="list-style-type: none"> subsidence trigger/actions, hydrological trigger/actions and ecological trigger/actions While subsidence has occurred under the swamps, there is no 'noticeable' impact to the swamps, however there is still the risk of negative environmental consequences from mining There were said to be two types of swamps in the region, those that rely on a perched watertable (wetter, humic swamps, characterised with Cyperoid Heath and Tea-tree Thicket vegetation) and those that do not rely on a perched watertable (drier swamps characterised with Banksia Thicket, Sedgeland and Restioid Heath vegetation) 		

CCUS4

- CCUS4 is the wettest of the swamps in the investigation area, and has a perched watertable, and a small yet measureable outflow
- CCUS4 has a small section that is wet and has a water holding period of 2 – 6 days
- CCUS4 has already been subsided, from previous mining, in the range of 1.2 – 1.4m, however there is the potential for further impacts, especially if there was cracking of the rock bar; there is a potential risk of draining the swamp and/or a shorter water holding period
- Ecological impact of this is unknown – the swamp may still function as a swamp, it may transition to a drier type swamp
- Monitoring of CCUS4 will provide data on the impact to humic swamps from longwall mining (which is limited in the southern coalfields) – though evidence of any ecological impacts may take a significant period of time
- Longwall 6 becomes uneconomical if mining under CCUS4 is prohibited through mining discontinuity and the relocation of mining equipment

Surface & groundwater

- The surface groundwater (perched watertables) are not connected to the deeper groundwater systems, so water from the perched watertables is not going to drain into the mine system
- Potential cracking at the base of the Cataract Creek isn't likely to be great, and the impact wouldn't be as great as the impact seen in the Hawkesbury Sandstone as the base of the Cataract Creek is within the Bulgo Sandstone strata.

Flooding – Bellambi Gully

- Council has been supplied with the updated modelling for Bellambi Gully, after several iterations and discussions
- The Proponent is waiting for Council's response on the report

Amenity – Noise & Air

- Past operating practices have left the community with a negative view of the mine
- Air quality modelling indicates that the mine is unlikely to be in breach of the depositional dust ($4\text{g}/\text{m}^2/\text{month}$) and PM_{10} ($30\mu\text{g}/\text{m}^3$) criteria
- Modelling shows 1 day (worst case scenario – including a bush fire and other background factors) that the PM_{10} level would be $50\mu\text{g}/\text{m}^3$
- Monitoring shows the PM_{10} level are around $2.8\mu\text{g}/\text{m}^3$

Transport

- Mine traffic use of Bellambi Lane is approximately 10%
- Bellambi Lane is an industrial road

The Commission was also escorted around the pit top (including to Bellambi Gully, the sedimentation/storage ponds, the emplacement and stockpile areas and noted the noise bunds and proximity to neighbouring residential properties. The Commission was also taken underground, to the longwall machine waiting at the start of longwall 6, the longwall machine was not operating; and to the current activities at the mains.

Documents tabled at meeting: Summary package including the powerpoint presentation and factsheets (which are publicly available)

Meeting closed at 3:30pm

MEETING NOTE

Meeting with Water NSW – Russell Vale UEP		
Meeting note taken by Naomi Cleaves	Date: Tuesday, 10 February 2015	Time: 10:40am
Project: Russell Vale Colliery – Underground Expansion Project		
Meeting place: PAC office		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves & Megan Webb Water NSW: David Harris – Chief Executive Officer; Fiona Smith – Executive Manager Water Quality, Catchment Protection & People & Culture; Graham Begg – Manager Catchments Apologies: Terry Charlton – Chairman Water NSW Board		
The purpose of the meeting is to discuss Water NSW's policy position regarding mining within the drinking water catchment, and to discuss the residual issues that Water NSW have regarding the project.		
A summary of the key topics discussed are provided below. <u>Assessment process</u> <ul style="list-style-type: none"> Two stages in the process – the review stage and the determination stage – currently in the review stage E/Prof Jim Galvin (who is a casual PAC member) will be providing the PAC with technical assistance with the subsidence issues, including a desktop review. <u>Residual concerns</u> <ul style="list-style-type: none"> There are a number of uncertainties associated with this project, and additional work may not resolve all of these uncertainties – including triple-seam mining, closeness to the stored waters of the reservoir, potential connectivity between the reservoir and the mine – potential for connectivity through the triple seam mining re-activating the shallower two goafs It becomes a question regarding the threshold – as the modelling has been undertaken and peer reviewed Monitoring and adaptive management in this situation are pointless, when the performance criteria are loose and the impact signals are hard to trace or define – due to time lags The mining company is unlikely to be held accountable due to the uncertainties; the difficulties in defining impacts and to untangle different signals and influences on any observed change -such as those associated with natural variability and/or climate change Performance criteria need to be meaningful, measurable and enforceable, and these need to be defined prior to any determination and not left to be defined in the management plans after any determination is made Swamps can potentially be offset biologically, but cannot be offset hydrologically, and this is a major concern for Water NSW Water NSW is responsible for water quality and quantity, and they are concerned about cumulative impacts within the catchment from multiple mines and other industries If swamps start to dry out due to impacts of mining, this tends to lead to further negative environmental impacts, as the swamps are more susceptible to fire damage, which in turn can lead to water quality issues (if the vegetation cover of the swamp is lost), such as turbidity spikes in the stored waters – this is hard to manage through the treatment plants, and unsatisfactorily treated water can increase risk to human health Water NSW has had an example where a swamp's vegetation community was impacted by mining 		

activities in the catchment (in this case a pollution incident), a subsequent fire event burnt through the swamp and major water quality impacts were identified during the next storm event (and traced back to the swamp).

- Require verification of the location of the Corrimal Fault, where does it end, does it extend through longwall 6, or does it reappear anywhere? – This is another uncertainty which could have potential impact to the Cataract Dam

Dam Safety Committee's Notification Area

- The Notification Area was discussed including the parameters used to define the area.
- Water NSW confirmed the notification area is gazetted
- Water NSW objects to longwall mining within the DSC Notification area – this is the Board's policy position. Water NSW noted that it is not objecting to mining in the drinking water catchment, nor to mining in the Special Areas; the objection only relates to longwall mining in the Dam Safety Committee's Notification Areas
- Water NSW noted it is sometimes asked to provide 'evidence' for this policy position, however given the risks and uncertainties its position is that the precautionary principle should apply
- The Commission sought clarification on whether, the Dam Safety Committee's view (should it find mining could proceed in the notification area) would alter Water NSW's position. Water NSW noted that the Dam Safety Committee only considered impacts within the notification area, whereas Water NSW needed to consider the broader cumulative impacts to water supply and quality across the entire catchment.
 - Some other mines within the catchment have identified in the monitoring, the point where noticeable impacts have occurred, and the longwalls have had to be pulled up short and these are (perhaps coincidentally or perhaps for logical reasons) at the Notification area

Other topics

The Commission noted that at the public hearing, speakers indicated that Australia is the only country that allows longwall mining within the drinking water catchments. Water NSW confirmed that there is nothing to compare with the size of the population that these catchments supply however there are strict controls in place to protect the water quality and quantity of the drinking water.

Documents to be provided: A response to some questions that were raised during the meeting.

Meeting closed at 12:10pm

MEETING NOTE

Meeting with Wollondilly Council – Russell Vale Colliery Underground Expansion Project		
Meeting note taken by Naomi Cleaves	Date: Thursday, 19 February 2015	Time: 1:30pm
Project: Russell Vale Colliery – Underground Expansion Project		
Meeting place: Teleconference		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves Wollondilly Council: Luke Johnson – General Manager, Brad Staggs – Manager Environmental Services, & David Henry – Environmental Assessment Planner		
The purpose of the meeting is to discuss Council's key concerns surrounding the project.		
A summary of the key topics discussed are provided below. <u>Environmental concerns</u> <ul style="list-style-type: none"> • Council is concerned about the impact that longwall mining will have on the upland swamps and the groundwater • Concern as to the re-emergence of surface water downstream, if the beds of the creeks are cracked and water can drain out • CCUS4, there is an assumption that damage will be caused to this swamp, so an offset will be required • Offsets for swamps are difficult, and obtaining 'like-for-like' offsets is challenging, as the numbers of swamps that are already in conservation mode, is there a net gain in using these for offsets <u>Scientific adequacy concerns</u> <ul style="list-style-type: none"> • The Independent Expert Scientific Committee's advice is not address in-depth in the Department's assessment report • Council is concerned that the offset policy does not cover the upland swamp adequately, as these are difficult to offset • Council is further concerned about the adequacy of any TRAPs associated with management of the swamps, due to the time lag between mining and appearance of impacts/damage • Council considers that the precautionary principle should be considered when scientific rigour is lacking <u>Other concerns/issues</u> <ul style="list-style-type: none"> • Council's position is for no new mines and coal seam gas development within the drinking water catchments, since this mine is an existing mine, it should be allowed to continue, subject to environmental restrictions and conditions • The mine provides very little socio-economic benefit to the Wollondilly LGA, as only a small area of the exploration licence area is within the Wollondilly LGA, the majority is within the Wollongong LGA • Council would like to see further research/work in the following areas: <ul style="list-style-type: none"> ○ Groundwater and the associated impacts on receiving water-courses from: <ul style="list-style-type: none"> ▪ Groundwater and surface water interactions ▪ Aquifer interference – currently scientific uncertainty around these impacts 		
Documents tabled at meeting: NIL		
Meeting closed at 2:00pm		

MEETING NOTE

Meeting with EPA – Russell Vale Colliery Underground Expansion Project		
Meeting note taken by Naomi Cleaves	Date: Thursday, 19 February 2015	Time: 3:15pm
Project: Russell Vale Colliery Underground Expansion Project		
Meeting place: PAC Office		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves EPA: Peter Bloem – Manager Southern Region, Anthony Savage – Air quality technical specialist, William Dove – Regulatory Section, & Larry Clark – Noise policy		
The purpose of the meeting is discuss pit top issues particularly the noise and air quality issues and recommended draft conditions.		
<p>A summary of the key topics discussed in provided below.</p> <p><u>Noise criteria</u></p> <p>The PAC raised the questions to the EPA, that the 2011 conditions for noise, set an interim set of noise levels at sensitive receivers, which were to be replaced by a tighter set of long term noise criteria (which were tighter than the Project Specific Noise Limits) and best endeavours to meet the tighter criteria, so why are the criteria proposed now less strict? Even though the audits showed that the company was meeting these tighter criteria? PAC raised that the noise attenuation measures that were conditions of previous approvals (2011 decision) have been removed from this application</p> <ul style="list-style-type: none"> EPA notes that the noise levels exceed the intrusive noise criteria, however they do not exceed the amenity criteria, and given that this is the only large industry within the area, it is not expected to exceed the amenity criteria EPA would rather that the intrusive noise criteria not be exceeded, however it was close to the threshold for the decision making process, and the decision was deferred to Planning as a decision of socio-economic benefit vs community impacts (the EPA provided a copy of its latest advice to DPE on this issue) The greatest noise complaints that the EPA receive regarding this mine is trucks along Bellambi Lane, and noise associated with the conveyor (rock landing on rock) <p><u>Bellambi Lane</u></p> <ul style="list-style-type: none"> The southern side of Bellambi Lane is zoned light industrial – under this zoning there is no recognition of the residential properties along this side – the residential noise limits do not apply here The northern side of Bellambi Lane is zone residential – so the noise limits apply here The road has been used as a major road for a number years Recognition that empty trucks are noisier than loaded trucks (as they tend to bounce more when empty) – these would be travelling along the southern side of the road The residents raised concerns that the trucks were queueing up in the morning, waiting to enter the mine to load - outside the haulage hours If the traffic noise is able the criteria, then all reasonable and feasible measures are to be undertaken to reduce the noise – it could be possible to ask for a noise barrier along part of the northern side of Bellambi Lane At peak times more trucks will be allowed on the road, which will increase noise limits but also air quality issue from diesel fumes (which was raised by a number of speakers at the public hearing) 		

Air quality

- The large emplacement area (which is not covered by this application, but covered by a Council approval) is used mainly for reject rock placement, and there is little traffic on it for dust generation
- The stockpiles are an issue for the EPA
- Complaints regarding dust have come from the southern side of Bellambi Lane and are largely due to dust coming from the trucks
- Complaints about lime dust from lining the mine, dust was exiting out the portal
- EPA has been auditing loading and unloading activities across the state – automated loading has air quality benefits, as there is less spillage of material and therefore less carry over (dust getting on the truck and then being dropped onto roads) – this also has noise level benefits particularly if it is enclosed
- The company has a very good air quality management network, with both proactive and reactive procedures

Bellambi Gully realignment

- EPA do not have a role with this – it is an OEH issue
- EPA did provide comments on the water treatment controls – one of the runoff dams was built as a 'leaky dam' though the EPA are unsure as to why it was constructed as such – options for the runoff water and the dam are being considered including reusing the water on site
- EPA does get complaints about black water in Bellambi Gully, though the EPA are happy with the measure in place to manage surface water

Documents to be provided: Further comments on the 2011 noise conditions and additional information that the EPA thinks needs to be further addressed prior to determination

Meeting closed at 4:30pm

MEETING NOTE

Meeting with the Dams Safety Committee – Russell Vale Colliery Underground Expansion Project		
Meeting notes taken by Naomi Cleaves	Date: Friday, 20 February 2015	Time: 9:00am
Project: Russell Vale Colliery – Underground Expansion Project		
Meeting place: PAC Office		
Attendees: PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM PAC Secretariat: Naomi Cleaves Dams Safety Committee: Steve Knight – Executive Engineer; Bill Ziegler – Manager Mining Projects		
The purpose of the meeting is to discuss the dam Notification Areas in general and with regard to the Russell Vale project		
A summary of the key topics discussed is provided below: <u>Dam Notification Areas</u> <ul style="list-style-type: none"> These Notification Areas, while noted the Water NSW policy position of no longwall mining within the Dam Notification Areas, are not ‘no-go’ zones for mining It is a line that triggers the Dams Safety Committee (DSC) involvement, and these areas generally require careful consideration of the potential impacts to the structure integrity of the dam wall, but also the stored waters of the reservoir Mining can safely occur within close proximity of the dam storages. There just needs to be safeguards in place, due care and diligence is required, and mining is assessed on a case by case basis, which depends largely on the geology of the underlying material and the depth of mining It is important to have good geological information regarding each longwall before deciding on whether the mining within the Notification Area is suitable or not. This information is largely sourced by in-seam drilling and the formation of gate roads. The Dams Safety Committee’s powers under the Mining Act 1992 allow the Dams Safety Committee to insert conditions into the relevant Mining Leases, which regulate mining within Notification Areas. Under the Mining Act the Dams Safety Committee has the authority to have an iterative approval method, which allows for the approval of mining development over a number of stages – the Committee can impose and strengthen conditions on individual longwalls as they are being developed Various mining restrictions, before the Dams Safety Committee came into existence, included for example: <ul style="list-style-type: none"> 35° Angle of Draw from the full supply level – this was the restriction zone 35° Angle of Draw from the fully supply level + ½ the depth of cover to the mining operations – this was the marginal zone Other angles and defined zones, as also indicated in the Reynolds Enquiry document. The use of dam Notification Areas is defined under the Mining Act 1992 and not the Dams Safety Act 1978. <u>Residual Concerns</u> <ul style="list-style-type: none"> The Dams Safety Committee has concerns surrounding the unknowns that are associated with triple seam mining, in particular relating to the impact on the stored waters, as they have responsibility for no ‘uncontrolled loss of water’ from the storages. The updated groundwater model is an improvement on the original model, however it is only a model The Dams Safety Committee has ongoing concerns regarding the location of and the impact that the Corrimall Fault may have on the longwall mining, in particular in Longwall 7, as it is one of the closest 		

longwalls to the reservoir

- The driving of the gate roads for Longwall 7 will provide evidence as to whether or not the Corrimal Fault has dissipated as predicted by the proponent
 - The presence of the Corrimal Fault could potentially be an option to trigger certain remediation works or to define the end of the longwall, or trigger further risk assessment and monitoring of impacts
- The Dams Safety Committee has concerns regarding the unusual groundwater results from a borehole in the vicinity of Longwalls 9, 10 and 11,
 - This requires further investigation as one nearby borehole appears to show a connection to the reservoir
 - More bores are required in this area to better understand the groundwater movements in the area
 - The Dams Safety Committee accepts that there will be water flowing into the voids from the reservoir; however there are concerns about the volume. The Dams Safety Committee defines negligible impact as being 1 ML/d inflow of Reservoir water.
- The Dams Safety Committee is concerned that if large volumes of water do enter the mine, the mine will not be able to be sealed, and water will continually leak from the mine. The Dams Safety Committee has requested the proponent to provide it with an alternative water management plan. The Mine has proposed that water entering the mine be treated by Reverse Osmosis to a drinking water standard and then either returned to the Reservoir or connected to the water supply network.

Review of legislation

- The Dams Safety Act is currently under review, and it has been for some time.
- A draft bill has been written, and this may become law in the second half of 2015. There will be an interim period the updated regulations (i.e. standards and requirements) will be determined. During this interim period, likely to extend into 2016, the current Dams Safety Committee will continue in existence and working under its current requirements.
- There will be a new body eventually under this revised Act – Dams Safety NSW.

Documents later provided: Dams Safety Committee paper (1989) – Coal mining beneath reservoirs; Dams Safety Committee submission to the 2013 audit of the Sydney Drinking Water Catchment by GHD; a Dams Safety Committee Guidance Sheet DSC4B Mining near Prescribed Dams – Mining Applications (2010); and the Reynolds Enquiry 1997

Meeting closed at 10:15am

MEETING NOTE

Briefing with OEH & DP&E to discuss the draft framework for upland swamp offsets		
Meeting note taken by Naomi Cleaves	Date: Friday, 20 February 2015	Time: 10:30am
Project: Russell Vale Colliery – Underground Expansion Project		
Meeting place: PAC Office		
<p>Attendees:</p> <p>PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM</p> <p>PAC Secretariat: Naomi Cleaves</p> <p>OEH: Derek Rutherford – Director, South Branch, & James Dawson – Senior Team Leader, Ecosystems & Threatened Species</p> <p>DP&E: David Kitto – A/Executive Director, Resource Assessments & Howard Reed – Manager, Mining Projects</p>		
<p>The purpose of the briefing is to be updated with the development of the draft <i>Policy Framework for Biodiversity Offsets for Threatened Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence</i></p>		
<p>A summary of the key topics discussed are provided below:</p> <p><u>Draft Policy Framework</u></p> <ul style="list-style-type: none"> • Draft policy framework will sit within the Biodiversity Offsets Policy for Major Projects • Under the new Biodiversity Offset Policy a ‘red flag’ does not stop the project – triggers offsets • Recognition that swamps are not different from any other threatened species or community • Subsidence related impacts are hard to define – as there is generally no clearing of vegetation (as there is with other development, which is used in part to determine the offset required) • The policy has been discussed with the Commonwealth Department of the Environment, they are broadly comfortable with the policy framework • The framework is a 2 part strategy that 1) provides upfront offsets for predicted impacts and 2) provides flexibility of offsets (actual impacts versus predicted impacts) • Policy is moving away from negligible consequences when uncertainty surrounds the impacts/predictions to performance criteria that are measureable and enforceable • It will become a framework for all projects that are impacted by subsidence (subsidence impacts will be included in the offset’s calculator) <p><u>Russell Vale specifically</u></p> <ul style="list-style-type: none"> • Need to know what the groundwater regime is that is supporting the swamps, for without this it would not be possible to determine the impacts of subsidence • Need to have baseline data • What do the predictions mean in a biological and hydrological sense – are there options for avoiding and mitigating the impacts before offsetting options are considered • Uncertainty in the predictions for each swamp, this is due to the size of the swamps and the regional scale required for the groundwater modelling (different scale), which makes it difficult to accurately predict the tilts and strains at each individual swamp • Upland swamps are not deep sediment swamps, they are drier than other swamps • Agreement that CCUS4 has a high risk of being impacted by longwall mining • CCUS4 has shallower and drier sediment areas, and an area that has deeper sediments which are wetter • In the shallower and drier sediment areas they wouldn’t be a great deal of difference in pre and post mining monitoring (these areas are rain responsive currently) 		

- In the deeper and wetter sediment areas, there is likely to be a noticeable hydrological and ecological change within the swamp due to mining impacts (however there is a time lag for the ecological change)
- Upfront offsets and time dependent offset
 - Based on predictions of impacts
 - Monitoring of swamps/impacts
 - Offsets provided when realisation of impacts (predicted impacts vs actual impacts)

Documents tabled at meeting: A copy of the draft *Policy Framework for Biodiversity Offsets for Threatened Upland Swamps and Associated Threatened Species Impacted by Longwall Mining Subsidence* was provided

Meeting closed at 11:30am

MEETING NOTE

Proponent Meeting regarding timeframe for Review		
Meeting note taken by Megan Webb	Date: Monday, 23 March 2015	Time: 3:05pm
Project: Russell Vale Colliery Underground Expansion Project		
Meeting place: Planning Assessment Commission Offices, Level 13 301 George St Sydney		
Attendees: PAC Members: Nil PAC Secretariat: Megan Webb Wollongong Coal: David Stone and Rhys Brett		
The purpose of the meeting is to seek written clarification on process and timeframe for finalising the Review		
<p>Meeting details</p> <p>Secretariat advised that it was unusual to meet the Proponent without the Commission Members present and clarified that the Commission would still need to make a record of the meeting, report on this meeting.</p> <p>The Proponent acknowledged this and advised it needed written clarification on the finalisation of the PAC's Review Report, which was to have been completed on Friday 20 March 2015.</p> <p>The Secretariat noted that the Dam Safety Committee's advice had been requested by the Department of Planning and Environment, to inform the Commission's review, so it is waiting for that advice, expected in early April.</p> <p>The Proponent sought clarification on whether there was any other information the Commission was waiting on and how long it would take to finalise once the information was received. The Proponent also expressed concern about the future of the company.</p> <p>The Secretariat advised that it wasn't possible to speak for the Commissioners, but that the DSC advice was understood to be the key piece of information it was waiting for. The Commission's timeframe for finalising its review would then depend on the advice and whether it was consistent with the issues raised previously.</p> <p>The Secretariat confirmed the Proponent is seeking written clarification on the process and timeframe for the extension and agreed to advise the Commissioners of this request.</p>		
Documents tabled at meeting/to be provided: Nil		
Action: Letter from Deputy Secretary extending the timeframe to 10 April 2015, was made publicly available on the PAC webpage for the project at 1 pm on 24 March 2015.		
Meeting closed at 3:20 pm		

SUMMARY OF CATCHMENT INSPECTION MEETING NOTE

Site inspection within the Cataract Reservoir catchment with officers of Water NSW, OEH and Biosis		
Meeting note taken by Naomi Cleaves	Date: Wednesday, 4 February 2015	Time: 9:30am
Project: Russell Vale Colliery – Underground Expansion Project		
Meeting place: Cataract Reservoir catchment		
<p>Attendees:</p> <p>PAC Members: Mr Paul Forward, Mr Brian Gilligan, & Mr Joe Woodward PSM</p> <p>PAC Secretariat: Naomi Cleaves & Megan Webb</p> <p>Water NSW: Graham Begg; Malcolm Hughes; Ravi Sundaram; Kel Lambkin; Fiona Smith</p> <p>Office of Environment & Heritage: James Dawson; Calvin Houlison; Lachlan Wilmott</p> <p>Biosis: Nathan Garvey</p>		
<p>The purpose of the visit is to inspect the swamps and Cataract Creek that are potentially going to be undermined by the Underground Expansion Project</p>		
<p>A summary of the sites visited and key topics discussed are provided below.</p> <p>The sites inspected:</p> <ul style="list-style-type: none"> • <u>Longwall 6, CCUS4 and part of CRUS1</u> – these two swamps will be impacted by mining of Longwall 6, and where inspected by the Commission as part of the assessment of the Modification 2 application. • <u>Cataract Creek</u> – downstream of Mt Ousley Road – near the panel end of Longwall 5 • <u>Waratah Rivulet</u> – to see the impacts, the current state of the waterway and the remediation works there – from longwall mining • <u>CCUS1</u> – a swamp on the eastern side of Mt Ousley Road, on Wollongong Coal owned land that could potentially be used as an offset swamp for biological impacts <p>Subsidence impacts were observed on the walk to swamp CCUS4, including cracking and upsidence, these are understood to be around the centre line of the longwall panels.</p> <p>Discussions held:</p> <p>The discussions held during the course of the day covered the following topics:</p> <ul style="list-style-type: none"> • <u>Impacts to swamps</u> – predicted by the proponent and the difference of opinion between the proponent and government agencies as to the level of impacts predicted, and what levels are likely to cause irreversible damage. Discussion regarding the level of impact/damage that has already occurred and how much more can the swamps take, where is the tipping point? • <u>Swamp offsets</u> - What should the limit of impact be that triggers offsets, and will these offsets be ecological/biological offsets, what about hydrological offsets? Hydrological impacts cannot be offset. What could be a suitable swamp offset, ecologically? Could the upland swamps that are on privately owned land (owned by the proponent) be a suitable offset, as part of any biodiversity offset strategy? These swamps are currently degraded, and accessed illegally by the public for unsuitable activities (trail bike riding etc) and are within the Sydney Catchment Special Areas • <u>Water quality and quantity</u> – Water NSW outlined their concerns regarding potential impacts to water quality and quantity from longwall mining. It is difficult to accurately monitor and calculate the water quantity flowing out of the swamps, as these swamps tend to have multiple outflow points. The outflows are small at each point, but the cumulative outflow could be greater than predicted. Water 		

NSW and OEH are concerned that the cumulative impacts from multiple mines, impacting multiple catchments will lead to significant decrease in inflows into the storages, and the inflows will have higher turbidity levels and higher levels of TSS and pollutants such as iron oxide.

- Remediation works – while at Waratah Rivulet, the discussions turned to remediation works that have been and are being undertaken by mining companies that have caused significant negative impacts to streams and swamps within the catchment, and how successful of otherwise the remediation works have been. To date the swamps have not been successfully remediated; neither have the streams that have suffered from stream bed cracking, up-subsidence and loss of flow. These impacts have led to hydrological impacts, the extent of which is very difficult to monitor and calculate. It was noted that the impacts on the Waratah Rivulet occurred with just a single layer of longwall mining, whereas the project under consideration is for a third layer of mining at Russell Vale (the different location and depth of mining was acknowledged).

Documents tabled at meeting/to be provided: NIL

Meeting closed at 4:00pm

APPENDIX 4
AGENCY SUBMISSIONS

MAJOR PROJECT No. 2009/13 - RUSSELL VALE COLLIERY UNDERGROUND EXPANSION PROJECT

ISSUES

1. Subsidence related Impacts

- Two previous mined seams (Bulli seam and Balgownie seam) above the Wongawilli seam – Insufficient information available about the previous mine layout and the extent of subsidence particularly in relation to the previously mined Bulli seam.
- The current predicted subsidence level is a best guestimate only and hence, the subsidence impacts as a result of mining the three (3) coal seams may be far greater than estimated.
- The proposed mining of the Wongawilli seam will create additional subsidence impacts.

2. Impact upon 'Special Significance' Swamps

- The precise level of impact upon swamps cannot be accurately predicted given the lack of understanding of the impacts associated with the proposed triple-seam mining, beneath swamps.
- Subsidence has the potential to crack the 'special significance' swamps especially swamp CCUS4 (over LW6) - which is at high risk of cracking of the sandstone bedrock base and changes in the swamp hydrology, including water holding capacity.
- As per PAC determination report for the Preliminary Works project Modification 2, the PAC recognises that there is uncertainty as to the potential impacts to CCUS4 and the risks associated with those impacts from triple seam mining beneath this swamp.
- Previous mining impacts upon the CCUS4 swamp's integrity are relatively unknown and as a result the risk of reaching the swamp's tipping point (ie the point where the swamp can no longer function effectively as a swamp) is relatively high.
- As per PAC determination report for the Preliminary Works project Modification 2, the PAC considered a cautious approach should be adopted and limited extraction of LW6 to the western edge of CCUS4 (ie LW6 remain restricted to the current 365 metre approval length) to allow monitoring and data collection of any changes in the swamp. The PAC recommended the monitoring include hydrological changes and that the monitoring results would provide empirical information for the assessment and prediction of the extent of changes to CCUS4.
- The PAC determination for Preliminary Works project Modification 2 was only on 19 November 2014 – Therefore, it is considered that there has been insufficient time to properly monitor any changes to CCUS4 and its hydrological regime.
- Therefore, the retention of the current 365 metre approval length for LW6 is recommended to be maintained (ie stopping short of the waterfall outflow of CCUS4). The finishing point at the end of the 365 metre length of LW6 will ensure that it aligns with No. 10 cut-through in Maingate 6, which would allow the retrieval of the longwall miner. The 365 metre length limit for LW6 would protect CCUS4 from bedrock cracking and any associated adverse hydrological changes / impacts.
- However, the formulation of an adaptive management plan is required if the PAC decides mining is to proceed, including if mining is to occur through the whole of LW6.
- Additionally, any impact upon 'special significance' swamps including CCUS4, above 'negligible', should be offset in line with the Government's Biodiversity Offset Policy. The

proponent should be required to acquire alternate swamps as part of the offset strategy, in case any swamp (including CCUS4) is damaged, during mining operations.

3. Flood mitigation works

- Wollongong Coal (formerly Gujarat NRE) previously committed to flood mitigation works including the realignment of Bellambi Gully as proposed in the Statement of Commitments included in the first Preliminary Works Project approval in 2011. The realignment and flood mitigation works were required to be completed by 31 December 2013.
- The NSW Department of Planning & Environment issued a draft order on 6 May 2014 to Wollongong Coal given the company's failure to complete the required realignment works.
- Wollongong Coal has subsequently worked with NSW Department of Planning & Environment and Wollongong City Council, in order to try to resolve this issue.
- In mid- January 2015, Wollongong City Council received a revised Bellambi Gully Flood Study dated January 2015 from Cardno (NSW/ACT) Pty Ltd acting on behalf of Wollongong Coal. The January 2015 flood study has recommended a range of flood mitigation measures to reduce clean run-off entering the stockpile area, while conveying all site run-off in a controlled way to Bellambi Gully and ultimately to Bellambi Creek; in order to prevent flooding of Bellambi Lane and downstream residential properties.
- It is recommended that if the project is ultimately approved, the project be subject to the completion of all proposed flood mitigation measures as outlined in the Cardno (NSW / ACT) Pty Ltd Bellambi Gully Flood Study report dated January 2015. The proposed flood mitigation measures will redress previous flooding impacts upon Bellambi Lane and surrounding downstream properties.
- The proposed flood mitigation measures are recommended to be completed within 12 months from the date of the project approval.

Our Ref: D2015/32200

10 March 2015

Naomi Cleaves
Planning Assessment Commission
GPO Box 3415
SYDNEY, NSW 2001

Dear Ms Cleaves

**WOLLONGONG COAL RUSSELL VALE COLLIERY
PREFERRED UNDERGROUND EXPANSION PROJECT NO. MP 09_0013**

I refer to the discussion between the Planning Assessment Commission (PAC) and WaterNSW on 10 February 2014 regarding the above proposal. I thank the PAC for providing Water NSW with an opportunity to provide further comments on the proposal.

WaterNSW continues to object to the proposal as it currently stands, particularly with regard to the incursion of longwalls into the Dam Safety Notification Area surrounding Cataract Reservoir. WaterNSW therefore recommends that the PAC advises the Minister for Planning that the project is not suitable for determination in its current form. WaterNSW's key concerns on which our objection is based are:

- There remains a significant risk that surface water resource quantities will be appreciably degraded, particularly if a zone of hydraulic connectivity arises below Cataract Reservoir. WaterNSW is not satisfied that the proposed setbacks are sufficient to adequately ensure the protection of surface water resources, and particularly Cataract Reservoir which is an essential part of Sydney's drinking water supply system.
- Uncertainties arising from incomplete knowledge of key geological structures in the area proposed to be mined.
- Uncertainties with subsidence predictions due to the complex mining environment. In our opinion these uncertainties have the potential for impacts to be more profound than those predicted in the environmental assessment.
- The likely impact on the environment of Cataract Creek and associated tributaries, swamps and dependent ecosystems. These include the loss of stream flow, reduction in base flows, increased acidification and deposition of precipitates reducing water quality, and the reduction in shallow water tables affecting swamp vegetation, particularly upland swamps of "*Special Significance*".
- The fact that a number of our recommended performance measures have not been adopted, and importantly that the assessment report does not contain any indication of what performance indicators might be realistically monitored and used to trigger management measures. Unless detailed indicators, triggers and responses are finalised prior to the project approval, the severity of impacts would remain open to interpretation and the TARP cannot be effectively implemented or enforced.

As a result of the uncertainties identified above, in our opinion there is a significant risk that the magnitude of impacts will be greater than predicted. Importantly many of these impacts are difficult to measure and even more difficult, if not impossible, to rectify. Further, the impacts may not become apparent for some time, which significantly limits the applicability of adaptive management responses and the effectiveness of any rectification works.

WaterNSW has reviewed the Department Planning & Environment's (DP&E) Assessment Report and Conditions of Approval (dated 10 December 2014). We are concerned that the DP&E has accepted the predictions and associated environmental consequences in the Proponent's Environmental Assessment (and associated documents) as reasonable, despite a range of uncertainties, deficiencies and the potential risks to water quantity, quality and swamps overlying or adjoining the proposed mining area.

WaterNSW notes that the Minister for Planning has requested the PAC to review the application prior to it being considered for approval.

WaterNSW also notes the recent advice from the Independent Expert Scientific Committee on the proposal (dated 11 September 2014) which raises significant issues and supports the findings of previous WaterNSW's submissions. WaterNSW requests the PAC to carefully consider the Committee's advice.

WaterNSW is concerned that some of its proposed performance measures have not been adopted by the DP&E.

WaterNSW requests that its remaining concerns be addressed prior to the project progressing towards determination. These include modifying the mine layout, undertaking further geological investigations, undertaking a legitimate assessment of the economic viability of further modifying the mine layout to avoid unacceptable impacts on swamps and water resources, developing a TARP and associated monitoring plan.

Should the project proceed, appropriate Conditions should be applied including:

1. The proposed mining layout is modified to exclude any mining from the Dam Safety Notification Area for Cataract Dam.
2. The consent should only permit mining up to a point where valley closure is predicted to be 200 mm or less, consistent with the Trigger Action Response Plans for LWs 5 and 6.
3. WaterNSW's performance criteria developed for the proposed mining area (see Table 1 of the attached submission) be adopted including those for Cataract Reservoir, swamps, biodiversity and cliffs, including modification of the mine layout if necessary to ensure negligible impact on all swamps of special significance.
4. Detailed Trigger Action Response Plans, incorporating appropriate and measurable performance measures, monitorable performance indicators and management response triggers be developed and agreed by relevant agencies prior to Determination.
5. Monitoring Plans including details of how the agreed performance measure triggers will be monitored should also be agreed with Water NSW and other relevant agencies and approved prior to approval of the expansion project.
6. WaterNSW's other concerns related to DP&E's draft Conditions of Approval specifically Schedule 2, Condition 15 and Schedule 3, Conditions 1, 2b, 4, 27 be addressed. Water NSW requests that, if the project is approved the amended conditions laid out in the attached submission be adopted.
7. Adequate financial provisions are included in any approval granted to mine within the Cataract Dam Safety Notification Area to compensate WaterNSW for any water losses from Cataract Reservoir or its catchment should the measures in the Contingency Plan fail.
8. Contingency planning referred to in draft Conditions of Approval specifically Schedule 3 Condition 8(o) resulting in a plan which can be implemented effectively over the short, medium and long term to maintain impacts within acceptable limits.

A detailed submission expanding on WaterNSW's concerns and recommendations is attached for the PAC's consideration. Also detailed in the submission are an outline of WaterNSW's legislative obligations, our Mining Principles, the Board's specific position on Longwall Mining and the basis for that position, and suggestions for consideration when further defining performance measures and developing triggers and responses.

Further queries about our submission can be directed to Graham Begg, Manager Catchments, who can be contacted on 4724 2402 or via e-mail graham.begg@sca.nsw.gov.au.

Yours sincerely

A handwritten signature in blue ink, consisting of a large, stylized 'D' followed by a series of loops and a long horizontal stroke extending to the right.

DAVID HARRIS
Chief Executive Officer

WATER NSW SUBMISSION
to
PLANNING ASSESSMENT COMMISSION
PREFERRED UNDERGROUND EXPANSION PROJECT
WOLLONGONG COAL Ltd RUSSELL VALE COLLIERY
MARCH 2015

1. LOCATION OF MINING AREA AND RELATIONSHIPS TO WATER NSW
AREAS OF INTEREST

The areas of interest to WaterNSW and the main reasons for our interest are summarised below:

- The entire proposed mining area is located under a declared catchment area and under land managed as Schedule 1 Special Area (noting that the primary purpose of these areas is to protect the quality and quantity of water in our catchments and that a primary objective is to maintain their ecological integrity).
- Longwalls 6, 7, 9 to 11 are located under land owned by WaterNSW.
- Western portions of Longwalls 6, 7, 9 to 11 are located within the Dams Safety Committee's (DSC) Cataract Notification Area. Mining of these longwalls has the potential to induce leakage from the reservoir with the possible significant loss of stored water.

2. WATER NSW'S PRIMARY OBJECTIVES and FUNCTIONS

Section 6(1) (c) of the *Water NSW Act 2014* states that a principal objective of Water NSW is 'to ensure that declared catchment areas and water management works in such areas are managed and protected so as to promote water quality, the protection of public health and public safety, and the protection of the environment'.

Section 7 (1)(g) of the *Water NSW Act 2014* states that a function of Water NSW is to protect and enhance the quality and quantity of water in declared catchment areas. The proposal has the potential to impact both the quality and quantity of water.

3. WATER NSW'S PRINCIPLES FOR MANAGING MINING AND COAL SEAM
GAS IMPACTS

Water NSW has a set of principles that underpin its decision making in relation to mining and coal seam activities in the Special Areas. These principles establish the outcomes Water NSW considers as essential to protect the drinking water supplies to the four and half million people of Sydney and the surrounding region.

- 1. *Protection of water quantity***
Mining and coal seam gas activities must not result in a reduction in the quantity of surface and groundwater inflows to storages or loss of water from storages or their catchments.
- 2. *Protection of water quality***
Mining and coal seam gas activities must not result in a reduction in the quality of surface and groundwater inflows to storages.
- 3. *Protection of human health***

Mining and coal seam gas activities must not pose increased risks to human health as a result of using water from the drinking water catchments.

4. Protection of water supply infrastructure

The integrity of Water NSW's water supply infrastructure must not be compromised.

5. Protection of ecological integrity

The ecological integrity of the Special Areas must be maintained and protected.

6. Sound and robust evidence regarding environmental impacts

Information provided by proponents, including environmental impact assessments for proposed mining and coal seam gas activities must be detailed, thorough, scientifically robust and holistic. The potential cumulative impacts must be comprehensively addressed.

4. WATER NSW POSITION ON LONGWALL MINING

Water NSW's position on longwall mining is that it opposes any longwall mining:

- within the Dams Safety Committee notification areas applying to prescribed dams managed by Water NSW, or
- that is predicted to damage water supply infrastructure.

Water NSW is obliged by section 6(2)(d) of the *Water NSW Act 2014* to conduct its operations in compliance with the principles of ecologically sustainable development contained in section 6 (2) of the *Protection of the Environment Administration Act 1991*. Water NSW also notes that an objective of the *Environmental Planning and Assessment Act 1979* is to encourage ecologically sustainable development. One of the principles of ecologically sustainable development is the precautionary principle which provides that:

if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

Water NSW's opposition to this longwall mining proposal is based on the fact that there is insufficient scientific certainty of the potential short to long term impacts of the proposal on potential for loss of water from the reservoir, a reduction in catchment yield and impacts on upland swamps. This position has been reaffirmed by the current Board of Water NSW.

5. PERFORMANCE MEASURES

Water NSW has adopted a risk management approach to assess this proposal and to identify specific performance measures for key subsidence impacts that can be monitored and managed (where adaptive management is feasible) through the Trigger Action Response Plan. The recommended performance measures are presented in Table 1.

These performance measures are generally consistent with those included in consents for other longwall mining projects issued over the last few years for mining within the Special Areas.

On this basis, Water NSW recommends that the proponent should ensure to the satisfaction of the Secretary of the Department of Planning & Environment (DP&E) that the project does not cause any exceedance of the performance measures and conceptual triggers identified in Table 1.

Water NSW recommends that the performance measures, triggers and associated monitoring measures should be tailored to each significant feature which may be impacted, and thus the triggers and monitoring measures listed in

Table 1 are merely initial suggestions. These matters should be finalised in consultation with relevant government agencies.

Although we have included these suggestions to assist in the PAC's deliberations it must be noted that for some impacts (such as ecosystem biodiversity), there may be no effective measure which can give an early indication of change. Therefore the precautionary principle should be adopted and the mine layout modified accordingly

Table 1: Recommended subsidence impact performance measures and corresponding monitorable triggers

Water resources	Performance Measures	Indicative/Conceptual Monitoring Triggers
Cataract Reservoir	<p>Negligible environmental consequences including:</p> <ul style="list-style-type: none"> • negligible reduction in the quantity or quality of surface water inflows to the reservoir, • negligible reduction in the quantity or quality of groundwater inflows to the reservoir, • negligible increase in the quantity of water entering the groundwater system from the reservoir, and • negligible leakage from the reservoir to underground mine workings. 	<p>Performance triggers may be set using the following approaches:</p> <ul style="list-style-type: none"> • Changes in the quality of water entering Cataract reservoir are not significantly different post-mining compared to pre-mining (based on analysis of stream and shallow groundwater samples) • Changes in groundwater inflow rates to reservoir (relative to calculated/estimated groundwater inflow rates using groundwater model) • Changes in the interactions between lake and groundwater based on groundwater monitoring in nested piezometers installed at several locations along the section of reservoir between existing and proposed mine workings • Mine inflow rates exceed groundwater model predictions or occurrence of high inflow events based on mine water make monitoring and fingerprinting of mine water source
Cataract Creek, Cataract River and tributaries	<p>Negligible environmental consequences including:</p> <ul style="list-style-type: none"> • negligible diversion of flows or changes in the natural drainage behaviour of pools, • negligible gas releases and iron staining, • negligible increase in water cloudiness, • negligible increase in bank erosion, and • negligible increase in sediment load. 	<p>Performance triggers may be set using the following approaches:</p> <ul style="list-style-type: none"> • Changes in stream flow continuity (e.g. by visual observation/mapping of surface cracking, stream sections with no flow, and differential stream flow gauging). • Changes in water quality parameters (e.g. turbidity, suspended solids, total iron), significantly different post mining compared to pre-mining. • Changes in the extent of stream iron staining (possibly by mapping of visual observations of stream sections with iron precipitates). • Changes in natural pools drainage behaviour (e.g. by visual observation/mapping of rock bar cracking, monitoring of pool water levels).

Groundwater	No measurable increase in the level of hydraulic connectivity between the floor of the reservoir or between watercourses, swamps and the land surface and the mine workings (including associated goaf zones).	<p>Performance triggers may be set using the following approaches:</p> <ul style="list-style-type: none"> • Changes in vertical hydraulic gradients in the shallow groundwater around reservoir, along streams and in swamps (groundwater level monitoring in nested piezometers around the reservoir, along streams and in swamps). • Mine inflow rates exceed groundwater model predictions, occurrence of high inflow events (mine water make, fingerprinting to determine mine water source). • Water ingress in old workings above currently mined seam. • Changes in bulk hydraulic permeability measurements before and after mining (e.g. by means of packer or pump testing).
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Swamps	Performance Measures	Indicative/Conceptual Monitoring Triggers
CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 and BCUS11	<p>Negligible environmental consequences including:</p> <ul style="list-style-type: none"> • negligible change in the size of swamps • negligible erosion of the surface of swamps • negligible change in the ecological functioning of swamps • negligible change to the composition or distribution of species within swamps, • negligible change to the structural integrity of any controlling rockbar; and • negligible drainage of water from swamps, or redistribution of water within swamps. 	<p>Performance triggers may be set using the following approaches:</p> <ul style="list-style-type: none"> • Changes in groundwater connections (detected by monitoring of groundwater levels in swamp substrate and bedrock using nested piezometers in combination with monitoring of subsidence effects) • Changes in swamp outflow rates (measured by swamp outflow gauges) • Changes in abundance of flora and fauna species (e.g. by surveys of threatened or vulnerable species, invasive species) • Changes in swamp conditions (e.g. by survey/mapping of swamp extent, peat thickness and/or cracking and vegetation conditions and proportion of bare land) • Measured changes in suitable piezometer water levels • Measured changes in flow dynamics into, out of or within swamps at key locations • Measured changes in topography likely to result in changes in hydrology • Measured changes in extent, distribution, diversity and functional elements of key ecological groups/species.
All other swamps mapped in the PPR	No significant environmental consequences beyond predictions in the EA.	<p>Performance triggers may be set using the following approaches:</p> <ul style="list-style-type: none"> • Changes in groundwater connections (monitoring of groundwater levels in swamp substrate and bedrock using nested piezometers, monitoring of subsidence effects) • Changes in swamp outflow rates (gauging swamp outflows) • Changes in abundance of flora and fauna species (threatened or vulnerable species, invasive species) • Changes in swamp conditions (survey/mapping of swamp extent, peat cracking and vegetation conditions and proportion of bare land) • Measured changes in suitable piezometer water levels

		<ul style="list-style-type: none"> • Measured changes in flow dynamics into, out of or within swamps at key locations • Measured changes in topography, including tilting and differential subsidence, likely to result in changes in hydrology • Measured changes in extent, distribution, diversity and functional elements of key ecological groups/species.
Biodiversity		
Threatened species, threatened populations, or endangered ecological communities	Negligible environmental consequences, including negligible reduction in biodiversity.	Performance triggers may be set using the following approaches: <ul style="list-style-type: none"> • Changes in diversity and abundance of swamp fauna (e.g. by periodic surveys of threatened species)
Cliffs and Steep Slopes	Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face of such cliffs within any longwall mining	Performance triggers may be set using the following approaches: <ul style="list-style-type: none"> • Survey and visual observation/mapping of rock falls and surface cracks

6. Neutral or Beneficial Effect (NorBE) Assessment

DP&E's Assessment Report acknowledges that SEPP 28 (Sydney Drinking Water Catchment) 2011 limits a consent authority from granting consent to proposed development under Part 4 of the Environmental Planning and Assessment Act unless it would have a neutral or beneficial effect (NorBE) on water quality. However this requirement does not specifically apply to an application under Part 3A of the EP&A Act. As a consequence, Water NSW has no concurrence role with respect to this project.

The Report further states that based on the detailed assessment of the impacts of the development on surface and groundwater together with a consideration of submissions received from relevant agencies and relevant reports in the EA, the Department is satisfied that the project:

- would have a neutral impact on water quality within the catchment, and
- is generally consistent with the aims and objectives of SEPP (Sydney Drinking Water Catchment) 2011.

Water NSW nevertheless remains concerned that there remain significant risks the proposed development will result in adverse impacts on water quantity and quality of Sydney's drinking water catchments.

7. WATER NSW's ASSESSMENT

Water NSW has reviewed the DP&E's Assessment Report and draft Conditions of Approval (dated December 2014). Water NSW has also considered the following reports in preparing this response to the Planning Assessment Commission (PAC):

- Independent Expert Scientific Committee (IESC) advice to the Commonwealth Government Department of Environment and the DP&E in relation to Wollongong Coal Ltd (WCL) Wonga east Preferred Project Report and Residual Matters Report (dated 11 September 2014), and
- WCL response to IESC advice (dated 24 November 2014).

Water NSW's major issues of concern related to the Preferred UEP application and the Department's response in the Assessment Report are discussed below.

Water NSW Concern 1: There remain unacceptable levels of uncertainty associated with the subsidence predictions and thus the predicted impacts of the proposal.

The proposed mining in Wonga east is predicted to result in high tilts ranging from 24 to 51 mm/m, tensile and compressive strains from 7 to 24 mm/m and valley closure values from 150 to 700 mm. As stated in the IESC literature reviews and other reports, tensile and compressive strains of 1-2 and 2-3 mm/m respectively are considered as the threshold below which no environmental consequences would be expected. The predicted tilts, strains and closure values are expected to cause bed cracking, loss of stream flows and is likely to cause significant impacts on swamps above the proposed longwalls.

Further, there remains a high level of uncertainty associated with these predictions. In particular, these uncertainties are caused by:

- the nature of the overlying Bulli Seam bord-and-pillar workings is not known
- subsidence predictions are based on very limited datasets from LWs 4 and 5
- data-gaps related to geological and structural features in the vicinity of the proposed longwalls, and the potential for these features to become conduits for higher than predicted groundwater flow volumes.

Water NSW remains concerned that if the subsidence impacts are greater or more complex than predicted, there will be more profound environmental consequences than those predicted in the EA.

The DP&E Assessment Report refers to a subsidence report (prepared by SCT for the proponent) and subsidence monitoring data in LWs 4 and 5 and suggests:

- Although the vertical subsidence associated with multi-seam mining is significantly greater than for single-seam mining, the lateral extent of vertical subsidence is expected to be similar to single seam mining and will not extend greatly over the adjoining pillars.
- Subsidence is thus expected to be expressed on the ground surface as relatively narrow subsidence troughs which are deep, steep sided and predominantly constrained to the limits of the surface expression of the longwall panel.
- The associated tilt, strains and valley closure values would be significantly less than the predicted maxima, and significant valley closure effects along Cataract Creek are unlikely to occur.
- Subsidence patterns beyond the goaf edge are predicted to be similar to the subsidence observed during mining of LWs 4 and 5. Vertical movements are predicted to be limited to a height of 0.7 times the overburden depth from the nearest goaf and this result in a subsidence profile falls predominantly within the footprint of the panel being mined.

DP&E has accepted that these subsidence predictions are reasonable and acceptable. However, DP&E notes in its assessment report that the predictions are made from a relatively small database of observed data and that there is scope for localised anomalies due to the multi-seam environment, geological structures and other effects in natural systems which may lead to unexpected subsidence behaviour. DP&E accepts these uncertainties, but suggests that the Extraction Plan for the preferred UEP would include detailed monitoring and validation of subsidence predictions (without including performance measure conditions that might make such adaptive management enforceable).

The IESC response on the Preferred UEP (dated 11 September 2014) states that the subsidence assessment does not provide a reasonable estimation of the risk of impacts to overlying swamps as it does not take into account potential increased subsidence implications of multiple goaf strata settling after longwall extraction.

Water NSW reiterates its previous advice that there remain unacceptable uncertainties associated with the subsidence predictions, related in particular to the extent and nature of the overlying Bulli Seam workings, the implications of structural and geological features which may connect surface waters with existing and/or proposed workings, and the very limited datasets on which the subsidence predictions are based.

If the Commission decides to recommend the mining proposal for approval, Water NSW recommends that Trigger Action Response Plans (TARP) for a range of performance measures described in Table 1 be developed and agreed by relevant agencies prior to approval by the Minister for Planning. Further, these TARPs should include details of the monitoring that will support the identification of performance criteria and triggers for specific responses, preferably within an integrated Monitoring Plan for the project which should also be developed and agreed by relevant agencies prior to approval by the Minister for Planning.

Water NSW Concern 2: It is critical that the nature and full extent of the Corrimal Fault and the hydraulic implications of dyke D8 are fully understood before the proposed mining is further considered.

The Water NSW's reasons for this concern include:

- the Corrimal Fault has been intersected by the LW6 gateroads and the fault does not appear to be petering out (as claimed by Wollongong Coal)
- a dyke (D8) is present in the LW6 gateroad workings and is exposed in the sides of the reservoir, and
- the zone where the Corrimal Fault is associated with small sub parallel faults has caused significant roof deterioration of the LW6 gateroad.

The Assessment Report states that Wollongong Coal and SCT consider that:

- dyke D8 has been mined through in LW5 and there is no evidence of high water ingress associated with the dyke at this location;
- no surface expression of the Corrimal Fault was found during the ground-truthing traverses to the northwest of the existing fault alignment (including on the banks of the reservoir);
- no water make was observed from the fault plane in the overlying Bulli and Balgownie seam workings, and no water make has been observed in the Wongawilli Seam workings to date; and
- reactivation along the fault plane as a result of subsidence and goaf formation is considered unlikely, given that the recent extraction of LWs 4 and 5, at least 140 m away from the inferred fault plane, has not resulted in evidence of reactivation of the fault.

The Assessment Report states that the Department has accepted that the existing information provides a high level of confidence that the Corrimal Fault peters out in the vicinity of the proposed LW7, and that a hydraulic connection between the fault and Cataract Reservoir is unlikely. The Report also states that more information about the north-western extent of the fault would be available when the maingates for LW7 are driven. This suggestion contradicts the above statement therefore does not provide Water NSW with any confidence in its accuracy.

The Assessment Report refers to WCL and SCT explanation and states that no water make was observed from the fault plane in the overlying Bulli and Balgownie Seam workings, and no water make has been observed in the Wongawilli Seam workings to date. Based on the data provided to Water NSW, we believe it unlikely that the historical Bulli and/or Balgownie workings or Wongawilli workings have previously intersected the inferred Corrimal Fault Plane in this area. Therefore this justification appears invalid and the potential for hydraulic connection between historical and proposed workings remains a great concern to Water NSW.

The Assessment Report further states that the Department has accepted subsidence predictions based on subsidence monitoring data available from LWs 4 and 5. This statement suggests that the Department is not aware or is ignoring the fact that the extraction of LWs 4 and 5 provides no real precedent as they did not intersect the Corrimal Fault. It appears that LWs 6 and 7 may intersect this fault, but the exact nature and extent of the fault in the proposed extraction area is unknown.

Water NSW does not accept that there is sufficient evidence to infer that the Corrimal Fault is petering out in the proposed extension area as claimed by WCL. If the fault does exist in this area, the geological weaknesses could lead to abnormal subsidence profiles and/or shear zones of increased hydraulic connectivity in response to the proposed mining, with potentially high hydraulic and environmental consequences.

Water NSW Concern 3: It has not been demonstrated that the proposal would result in negligible leakage from the reservoir to mine workings nor that there would be no connective cracking between the reservoir and the mine.

Water NSW is not satisfied that it is feasible to stop leakage from the reservoir to the mine workings should it arise.

Water NSW is not satisfied that the proposed setback of mining from Cataract Reservoir can provide an effective primary control for protecting the stored waters of Cataract Reservoir in this complex mining environment.

Water NSW's reasons for above concerns are:

- The groundwater model does not consider the presence of potential pathways for loss of reservoir waters or the impact of mining to potentially increase hydraulic connectivity, e.g. by reactivation of shear zones or dilation of intrusive formations.
- The height of the zone of depressurisation above the Wongawilli Seam longwall where the Bulli Seam has been extracted is estimated to be 222 metres. It is thus likely that connective fracturing will extend to the Bulgo Sandstone in the zone above the proposed workings. The base of the reservoir to the west of LWs 6 and 7 may lie in the Bulgo Sandstone. If a highly permeable layer or a shear zone develops in the Bulgo Sandstone, then an enhanced connection from the reservoir to the mine would be formed.
- Remobilised shear planes are considered to provide the pathways by which a piezometer, installed above the Bulli Seam workings located 540 metres from the reservoir, responds to changes in the level of the reservoir. This observation provides evidence of a potentially significant risk of leakage from the reservoir as a direct result of extraction of LWs 6 and 7.
- There is a likelihood that at least one regionally significant dyke (Dyke D8) intercepts the confluence of Cataract River and Cataract Creek. If present, this dyke(s) may well provide an enhanced hydraulic pathway to workings below, particularly if dilation occurs due to mining-induced fracturing (Ziegler and Middleton, 2014 – paper presented to the 9th Triennial Conference on Mine Subsidence: risk management in action). In addition, the close proximity of the western end of LWs 6 and 7 to the Full Supply Level (FSL) of Cataract Reservoir and the shallow depth of cover do not provide Water NSW with a high level of confidence that hydraulic connections will not be formed between the workings and the stored surface waters.

The Assessment Report states that WCL has designed the preferred UEP longwall layout to avoid any coal extraction inside the 35° angle of draw (AOD) (0.7 times the depth of the coal Seam) from the Reservoir's full storage level (FSL). Water NSW notes that a small area of LW6 and the western portions of LWs 7, 9, 10 and 11 fall within the DSC Notification Area.

The Assessment Report further refers to the SCT explanation and conclusion that:

- although the presence of Bulli Seam goaf areas may reduce the effectiveness of this 0.7 times depth barrier for mining of LW7, the pathway for seepage from the reservoir to the mine is likely to be predominantly along horizontal shear planes at or just below the level of the valley
- the height of depressurization for Bulli Seam pillar extraction panel is well below the level of any horizontal shear planes capable of interaction with the reservoir
- there is no potential for these existing Bulli Seam goaf areas to significantly reduce the effectiveness of the 0.7 times depth barrier for LW7.

Water NSW further notes that the Department has required installation of a groundwater monitoring bore between LW6 and the Reservoir (Condition 37A of Approval for Preliminary Works Project Modification 2), as recommended by the DSC. The Assessment Report also states that WCL has confirmed that it has approval from Water NSW to establish additional bores in the Preferred UEP area, including a bore located between LW6 and the reservoir, and that the bore locations were negotiated and agreed with Water NSW and the DSC.

Water NSW supports the installation of a groundwater monitoring bore between LW6 and the Reservoir, and the monitoring requirements recommended by the DSC (Ref 10.123.167; dated 14 May 2014).

Given that the detailed nature and extent of the fault in the northwest is unknown and the possibility of reactivation of fault and pre-mined goaf areas and/or connection with Cataract Reservoir, the suggestion that the height of full depressurisation may approach the surface is of great concern, as are the uncertainties associated with this prediction. The current information does not provide confidence that 0.7 times depth stand-off from the FSL, particularly for LW7, can be used as an effective primary control for protecting the stored waters of Cataract Reservoir in this complex mining environment.

It is noted that the draft Conditions of Approval do not include Water NSW-recommended performance measures for Cataract Reservoir. We are particularly concerned that the recommended condition that “no connective cracking (or, alternatively, measurable increase in permeability) between the reservoir floor and the mine” has not been adopted in the draft Conditions.

Water NSW is greatly concerned that if a connection between mine workings and stored water occurs, there would be a high likelihood that substantial stored water volumes would be lost to the mine. Water NSW considers that it is not feasible to stop leakage from the reservoir to the mine workings should it arise.

If the Commission decides to recommend the mining proposal for approval, Water NSW recommends the following measures:

- The proposed mining layout is modified to exclude any mining from the Dams Safety Notification Area for Cataract Dam.
- Water NSW-recommended performance measures for Cataract Reservoir be adopted. Water NSW strongly recommends that a robust set of performance measures and effective monitoring procedures be adopted to protect Cataract Reservoir (note that this type of performance measure is contained in the consents for the Metropolitan Coal Project issued on the 22.06.09 and the Nebo Area Project issued on the 2.11.11).
- Adequate financial provisions are included in any approval granted to mine within the Cataract Dam Notification Area to compensate Water NSW for any water losses from Cataract Reservoir or its associated catchments, and to manage potentially polluted groundwaters should the measures in the Contingency Plan fail.

Water NSW Concern 4: Reduction in water quantity and quality in Cataract Reservoir, Cataract River, Cataract Creek and tributaries due to reduction in base flows and surface flows.

As stated above, one of Water NSW’s key concerns with the proposed mining is that it will result in a substantial and probably permanent reduction in the quality and quantity of the surface waters of the catchment, which are collected in the Cataract Reservoir. The bases for our concerns are discussed below under various sub-headings.

Groundwater Modelling and Assessment

Water NSW's concerns in relation to the groundwater modelling predictions and associated assessments include:

- The water balance presented for the calibration period (Table 11 of the groundwater assessment) suggests that groundwater recharge (leakage) from streams and storages (22.6 ML/day) is about three times higher than estimated baseflow discharge to streams (6.2 ML/day). This evidence suggests that surface waters (leakage from streams and storages) are "lost" to deeper aquifers in the catchment overall.
- Differentiating natural losses from mining-induced losses would present great challenges given the low levels of certainty in baseline surface flow volumes discussed elsewhere in this submission. For these reasons, Water NSW recommends that a Monitoring Plan setting out how monitoring will be undertaken would need to be agreed with Water NSW and relevant government agencies prior to Approval.
- The end of mining in Wonga East does not correspond to the time when maximum changes to the groundwater systems are likely to occur. Therefore, predictions of reduction in baseflow discharge or estimated leakage from Cataract Reservoir presented in the report for end of mining on Wonga east do not appear likely to capture the full extent of impacts.

Water NSW is greatly concerned about the potential for permanent mining-induced losses of surface water from streams and storages to deeper aquifers. It is recognised that in many cases surface water that is intercepted by zones of mining-induced higher permeability will tend to move both vertically and laterally. Such water may not reach deeper aquifers, but may reappear further down the catchment with generally poorer water quality. Diversion of natural surface flows resulting in water quality changes and losses to deep aquifers are a principal concern to Water NSW.

Water NSW is satisfied that draft conditions of approval have adopted its recommended performance measures for Cataract Creek and Cataract River. However, we remain concerned that the recommended performance measures for Cataract Reservoir have not been adopted. Water NSW recommends that the proposal must meet appropriate performance criteria, including that of negligible environmental consequences on features of special significance including Cataract Reservoir, and that this performance criteria should be adopted in approval conditions if issued.

Risks to Groundwater Resources

The Assessment Report refers to GeoTerra's assessment and states that the Preferred UEP may result in some localised iron hydroxide precipitation and some lowering of pH if the groundwater is exposed to freshly-fractured rock surfaces through dissolution of unweathered iron sulphide or carbonate minerals. However, it also states that groundwater quality in the region has not been adversely affected by previous mining and that many aquifers in the Southern Coalfield already have significant iron levels.

The Assessment Report states that OEH and DSC raised concerns (which were also raised in Water NSW's previous submissions D2014/70021) that the height of full groundwater depressurisation above the UEP longwalls may extend into the basal shear planes and shallow aquifers of the Bulgo Sandstone where previous mining has taken place. The Assessment Report refers to GeoTerra's

(groundwater assessment consultant) assessment and draws the following conclusions:

- Where mining of all three Seams has occurred, there is a potential for interaction between surface water features and the top of the depressurised groundwater zone recharged from rainfall and adjacent creeks. This potential may be enhanced if there is interaction between the hill-slope basal shear plane that may have been reactivated by subsidence and the top of the zone of depressurisation above each longwall panel.
- This is possible for mining in shallower areas such as the northern ends of LWs 2 and 3, as well as the northern end of LW7. However, GeoTerra notes that the shifting of LW7 to the south to avoid the previously mined seams limits the potential for interaction between the surface water features and the top of the depressurised groundwater zone in this area.
- Given the depth of cover associated with the remaining longwalls (255 – 385 m), interaction between the surface water features and the top of the depressurised groundwater zone is considered unlikely.

The Assessment Report further states that the Department is satisfied that the groundwater assessment provides a sound basis for assessing the potential groundwater impacts of the project. It is also satisfied that the proposed mining within the Preferred UEP area can be managed such that it would not result in any significant impacts on groundwater resources.

Water NSW does not agree that groundwater issues are adequately dealt with in the Proposal's supporting documentation. If the Proposal is ultimately approved, it is very important that adequate performance measures, backed up by effective monitoring of TARP trigger points, be developed and agreed with Water NSW and relevant agencies prior to Approval being granted.

Surface Water Modelling and Assessment

As highlighted in Water NSW's original submission to the Department, surface water modelling has been prepared for the Loddon River and Bellambi Creek, which do not overlie the mining area and are not impacted by the proposed mining proposal. This is explained by the proponent as being due to the absence of actual stream flow data for creeks which will be impacted by the mining. Water NSW in its subsequent submission to the Department noted that the revised surface water modelling and assessment reiterates that insufficient data is available to derive long-term stream flow records for the potentially affected streams, and it states that it is not possible with the data available to directly predict the magnitude of stream flow losses or the lengths of streams likely to be impacted based on the available subsidence assessments. This suggests that the limitations and uncertainties with the surface water modelling and assessment still remain, and thus remain of concern to Water NSW.

With respect to these uncertainties, DP&E's assessment report (p33) states that 'even if the losses were to increase by several orders of magnitude from the predicted 7 ML/year, they would still be considered acceptable'. To suggest that a baseflow loss of 700 ML per year from a single mine proposal (let alone considering the cumulative impact of mining) within this catchment is acceptable suggests either a fundamental misunderstanding of the issue or a disturbing attitude to the importance of the water supply system of which Cataract Reservoir forms a vital component.

Risks to Surface Water Resources

Water NSW is likewise concerned about the magnitude of predicted reductions in baseflow to streams and Cataract Reservoir, including predictions of reductions in the frequency of low flows up to 90% and maximum durations for the cessation of flow for over 100 days. The reduction in low flows in Cataract Creek and tributaries would clearly exert a greater impact during drought periods when surface runoff is substantially reduced. Water NSW notes baseflows can contribute up to one third of average annual inflow to Cataract Reservoir.

Issues with the Trigger Action Response Plan approach

Water NSW notes the UEP's commitment to develop a Trigger Action Response Plan (TARP) to enable adaptive management of the project.

However, we do not support the adoption of an adaptive management for issues that cannot effectively be mitigated once impacts are realised (discussed further under Adaptive Management heading below). Water NSW reiterates its previous position that it does not support the adaptive management approach proposed for some aspects of the proposal as it currently stands, given the lag time for mining-related impacts to manifest and changes required to be implemented.

If the proposal is approved and an adaptive management approach is adopted despite our objections, the success of this approach will depend on the identification of suitable performance measures, triggers for implementing responses and an effective monitoring program aimed at identifying when the agreed triggers are being approached or have been passed. Specific advice on the above matters and the importance of agreeing on them with Water NSW and other relevant agencies are included elsewhere in this submission.

Water NSW therefore recommends that, if approval is contemplated, the TARP should be carefully developed and agreed by relevant agencies prior to approval by the Minister of Planning. We further recommend that the monitoring which will be undertaken to enable any impacts or effects on the agreed Performance Measures also be agreed prior to approval.

Subsidence Impact Risks

It appears from the DP&E's Assessment Report and draft Conditions that the proponent's predictions and proposed TARP triggers for valley closure values of 300 mm to 700 mm for Cataract Creek and its tributaries near LWs 1 to 3, 6 and 7 may be considered acceptable to DP&E. Water NSW disagrees and endorses the IESC's best-practice recommendations that valley closure values should be maintained at less than 200 mm to avoid unacceptable losses of surface flows and keep water quality to within manageable levels. This limit is consistent with the proposed TARP for LWs 5 and 6.

Water NSW further supports inclusion of negligible environmental consequences on Cataract Creek and Cataract River in draft conditions of approval (refer to Table 1 above). DP&E's Assessment Report suggests that while Cataract Creek has previously been partially undermined by longwall mining in the Balgownie Seam and bord-and-pillar and pillar extraction mining in the Bulli Seam, little evidence has been found to date of stream bed cracking, and that there is no apparent evidence of flow loss or adverse effects on pool levels. Detailed observations by WCL and its consultants reveal no evidence that extraction of the Wongawilli Seam associated with LWs 4 and 5 has caused visible subsidence impacts on the creek.

DP&E's Assessment Report refers to SCT's assessment and concludes that:

- valley closure (or horizontal movement in a downslope direction) appears to be concentrated on a horizon at the bottom of the overlying Hawkesbury Sandstone, which in this case, is above the level of the creek channel. The Department accepts that this is the most likely explanation of the limited subsidence impacts on Cataract Creek, and
- valley closures near LWs 1 to 3 would cause perceptible cracking and surface flow diversion, particularly in the upper reaches of the southern branch of Cataract Creek where it flows across Hawkesbury Sandstone outcrop above LW1. Some loss of surface water and iron staining is predicted in this area as a result. Significant iron staining and flow diversion is not predicted in the other reaches of Cataract Creek due to the presence of the Bald Hill Claystone creek bed.

The Assessment Report further states that consultant Paul Tammetta has advised DP&E that:

- there is the potential for connective cracking at the northern corner of LW7 and risks to the capacity of the channel of Cataract Creek to transmit surface water
- the level of this risk is difficult to quantify in multi-seam situations but it warrants consideration.

The Report also states that as a result of this concern WCL committed to shifting the LW7 panel further to the south to avoid any part of the adjacent Bulli bord-and-pillar panel in order to minimise risks of connective cracking along Cataract Creek. However, Mr Tammetta indicates that: "Despite the absence of existing full extraction workings over a small strip of about 50 m width, there may still be a risk to the capacity of the channel of Cataract Creek to transmit surface water. There may also still be a risk of direct hydraulic connection between the creek channel and goaf, through the collapsed zone, where the channel comes close to the panel edge."

The Report refers to the SCT assessment which indicates that connective cracking and flow diversions along this section of Cataract Creek are not expected to be significant for the reasons outlined above. Both SCT and Mr Tammetta agree that a program of prediction updates, closely with monitoring and response processes (potentially limiting the length of the longwall panel) is the most effective method of managing this uncertainty.

Water NSW agrees with Mr Tammetta's conclusions.

If the Commission decides to recommend the mining proposal for approval, Water NSW recommends that:

- the proposed mine layout be modified to exclude any mining in the Dams Safety Notification Area for Cataract Dam to minimise uncertainties associated with the risk of direct hydraulic connection between the creek channel and goaf through the collapsed zone; and
- the consent should only permit mining up to a point where the closure is predicted to be less than 200 mm, consistent with the TARP for LWs 5 and 6. TARPs and their associated monitoring plans should be prepared in consultation with agencies including Water NSW and prior to approval being granted.

Water NSW Concern 5: Significant impacts on upland swamps of Special Significance are considered unacceptable.

Water NSW is concerned that the environmental assessment predicts tensile and compressive strains that will cause cracking and fracturing to the base of many “Special Significance” upland swamps. This is likely to result in significant impacts to the hydrological regime of the swamp including a reduction in baseflow to Cataract Creek and reduce supporting the endangered ecological community and populations of threatened species. Water NSW recommends that layout of longwalls should be modified to avoid significant impacts to swamps because the remediation of impacted swamps has not been demonstrated in the Southern Coalfields and there is doubt that remediation would be successful given the difficulty of locating and accessing cracks beneath swamps.

The Assessment Report states that the Department is satisfied that WCL has made major changes to its original UEP to avoid a significant number of upland swamps, and accepts that the company has done everything reasonable and feasible to avoid and/or minimise the impacts of the project on swamps. The Report states that WCL “could not do more without seriously compromising the viability of the Preferred UEP”. However, an independent assessment of the economics of the project submitted to the PAC (Perry, 2015) indicates that DP&E’s satisfaction is misplaced and that the economic justification for the proposal has not been adequately performed. Water NSW recommends that the true environmental costs, including water and ecosystem losses, needs to be quantified and legitimately assessed prior to further consideration of the project.

DP&E’s Assessment Report describes potential subsidence impacts on upland swamps in the Preferred UEP mining area (as determined by Biosis):

- a high risk of subsidence impact to swamp CCUS4 (located over the western extent of LW6)
- a moderate risk of impact to swamp BCUS4 (located partially over LW 10), and
- a low risk of impacts to the remaining swamps.

The Report notes that the above conclusion was supported by Evans & Peck engaged by the Department to undertake an independent expert review of the surface water issues associated with the Preferred UEP, including a detailed review of Biosis’s original swamp impact assessment.

The Report also presents consultant’s (Biosis and SCT) assessments that previous mining in the area has not impacted the upland swamps. The Report states that there is no evidence cited of large-scale loss of or impacts on upland swamps undermined by the relatively narrow longwalls at either Russell Vale or Wongawilli Collieries. The consultants advise in their reports however that their assessments are necessarily based on incomplete swamp monitoring data.

The Report refers to the OEH submission and notes that:

- longwall mining beneath upland swamps on the Woronora Plateau should meet performance measures of ‘nil’ to ‘negligible’ environmental consequences
- this performance measure is unlikely to be achieved for the majority of upland swamps in the UEP area (with the exception of swamp CCUS1), and
- consequently, unless the Proposal is refused, WCL should prepare an offset strategy in the expectation that this performance measure would not be met.

The Report states that the Department agrees with OEH assessment that WCL may not achieve a performance measure of 'nil' or 'negligible' in relation to the registered swamps in the Preferred UEP area, other than CCUS1. Further the Report states that, given the existing multi-seam mining, and the uncertainty associated with impacts, the precise level of impact to the swamps cannot be accurately predicted. Thus the Department considers performance measures may not be the best way to manage impacts which may be construed as 'likely to occur but uncertain in expected extent and significance'. We thus have a situation where all parties agree that these swamps have special significance. Impacts on the swamps should therefore be negligible, and the mine layout modified to achieve this, rather than accepting that impacts are likely to exceed these levels and resorting to offsets (which should be an absolute last resort).

The Report states that the Department considers that the approval should contain a trigger (rather than a performance measure) which requires a proportional offset for impacts on swamps, where those impacts are greater than 'negligible' environmental consequences and remediation is not possible or is not effective. The trigger is proposed to be defined as:

- greater than negligible erosion of the surface of the swamp
- greater than negligible changes in the size of the swamp
- greater than negligible changes in the ecosystem functionality of the swamp
- greater than negligible change to the composition or distribution of species within the swamp, and
- greater than negligible change to the structural integrity of controlling rockbar/s for the swamp.

Water NSW understands that the Department has accepted OEH swamp risk assessment and any biodiversity offset will be required for impacts greater than 'negligible environmental consequences'. Water NSW notes that the Department is working closely with OEH to establish appropriate offsets which may change draft recommended conditions, and we request that we be kept informed of any proposed offsets.

However, Water NSW is concerned that draft Schedule 3, Condition 1, and Table 1 – Performance Measures for swamps do not list eight swamps which have been assessed to have moderate to high risk. Water NSW recommends that these swamps be listed in the Table 1. It is further noted that the Water NSW recommended performance measure "negligible drainage of water from swamps, or redistribution of water within swamps" has not been included in the list of Recommended Performance measures nor considered in the potential offset triggers listed above.

If the Commission decides to recommend the mining proposal for approval, Water NSW recommends that:

- the mine layout is modified to ensure negligible impacts on all upland swamps assessed by OEH to have moderate to high risk and specific inclusion of all these swamps in Schedule 3, Table 1, and
- Water NSW's recommended performance measure "negligible drainage of water from swamps, or redistribution of water within swamps" should be inserted in Table 1 (Recommended Performance Measures). If performance measures are not ultimately used to derive triggers for swamp offset programs, we request that a suitable trigger covering greater than negligible changes to the hydrology of a swamp be included.

Water NSW Concern 6: Significant impacts on cliff and steep slopes are considered unacceptable.

Minor rock falls are expected on up to 5% of the length of sandstone cliff formations that are undermined in the Preferred UEP.

The Assessment Report further states that the Department is satisfied that mining would not impact the most significant cliffs in the region and that the total length of the other cliff formations potentially impacted is small and is therefore acceptable. Consequently, the Department believes that subsidence impacts on cliffs and steep slopes can be managed via the standard Extraction Plan process, and has recommended conditions to ensure this occurs. The draft condition listed in Schedule 3, Table 1 (performance measure for cliffs) includes “No greater subsidence impacts or environmental consequences than predicted in the EA.”

This is not acceptable to Water NSW, as it does not provide adequate precision to enable the Performance Measure to be implemented in a TARP. Water NSW recommends that the performance measure should be worded as “Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face of such cliffs within any longwall mining)”.

Other Water NSW concerns:

1. Cumulative impacts

In assessing this proposal consideration should be given to cumulative impacts, i.e. the accumulation of effects arising from past, present and reasonably foreseeable activities. In this situation there have been past impacts from mining in the locality and clearly the proponent has plans for mining beyond that sought by the current application such as mining envisaged in the Wonga west area.

Water NSW notes that the Director-General's requirements for the Underground Expansion Project (issued on 9 August 2009) required the proponent to assess cumulative impacts, yet these have not been satisfactorily assessed or quantified.

Water NSW is very concerned about the cumulative impacts of longwall mining in the area surrounding Cataract Reservoir. The key cumulative impacts of concern to the Water NSW are the potential for impacts on the reservoir, impacts on catchment yield and impacts on upland swamps.

Water NSW notes that the IESC has raised similar, well-justified concerns about cumulative impacts.

It is recommended that a detailed analysis of the likelihood and magnitude of cumulative impacts be undertaken to enable the regional risks to be quantified and suitable performance measures to be developed. Such analysis should be completed prior to Approval to ensure that suitable monitoring is in place prior to commencement.

2. Adaptive Management

Water NSW considers that the adaptive management approach has limitations for this proposal and that these limitations must be recognised in making a decision on the proposal and in the drafting of conditions. There are two primary aspects where limitations exist – when mining commences adjacent to a sensitive feature (e.g. a reservoir) and moves away from that feature and the other is with respect to mining under upland swamps. The former situation has limitations because the impact is immediate and at its most severe – diminishing as the longwall moves away from the feature. The latter has limitations because once impacted a swamp cannot be remediated. In both cases the impacts may not be identifiable until an extended period has past – potentially many years.

Water NSW therefore recommends the PAC recognise these limitations in the capacity of the proponent to realistically adapt their mining and exercise due caution in your recommendations to the Minister. Where adaptive measures cannot realistically be applied, the Precautionary Principle should be adopted, e.g. by modifying the proposed layout of the longwalls to provide effective protection.

3. Trigger Action Response Plans

Water NSW is concerned that the Trigger Action Response Plans that have been prepared for mining projects in the Southern Coalfields have an insufficient emphasis on practical mitigation measures. Proponents should be required to prepare a suite of mitigation measures to address those impacts which are very likely or likely to occur.

Water NSW is also concerned that in many cases the monitoring which is undertaken to confirm that impacts are not occurring is inadequate for the purpose, hence our strong recommendation that an integrated Monitoring Plan be agreed prior to approval.

4. Draft Conditions of Approval

Water NSW has reviewed the draft Conditions of Approval prepared by DP&E, and submits the following comments and requests for modification of these Conditions if approval is ultimately granted.

Schedule 2

Condition 15 – Updating and Staging of Strategies, Plans or Programs states that 'With the agreement of the Secretary, the Proponent may prepare any revised plan, strategy or program 'without undertaking consultation' with all parties applicable condition in the approval'. Water NSW interprets this statement that the consultation with agencies, nominated in the conditions, is not required. If that is the case, this is of a great concern to Water NSW. This wording in Condition 11 contradicts many conditions requiring agencies consultation including Conditions 8(h) and 9 which requires consultation with Water NSW in the preparation of Water Management Plan and Upland Swamp Monitoring Program.

Water NSW recommends removing this wording.

Schedule 3

- Condition 1, Table 1 – Water NSW recommended performance measures for Cataract Reservoir have not been adopted.

Water NSW recommends that its performance measure for Cataract Reservoir be adopted.

- Condition 1, Table 1 – Names of swamps have not been included.

Water NSW recommends inserting names of swamps (CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 and BCUS11) that have been assessed to have moderate to high risk.

- Condition 1, Table 1 and Condition 4 - Performance measures for swamps does not include:

“Negligible erosion of the surface of swamps”

Water NSW recommends inserting above performance measure for swamps.

- Condition 1, Table 1 - Performance measures for Biodiversity - Water NSW recommends deletion within brackets (except CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, CCUS12, BCUS4 and BCUS11)
- Condition 2(b) – Water NSW recommends including a timeline submission for reports related to exceedance or performance measures. The recommended condition should also include:

There should be a timeframe for submission of the report required by Schedule 3 – Condition 2(b). It is recommended that the report(s) be submitted within 3 months of the date the performance measure has been exceeded or otherwise as directed by the Secretary. This would provide flexibility for those circumstances where a serious situation occurs which requires a shorter timeframe.

- Condition 27(a) – Water NSW should be consulted in the preparation of a Rehabilitation Plan.

CONCLUSION

Water NSW has significant concerns that the mining proposal has the potential to impact on water quantity of Cataract Reservoir and the ecological integrity of the Special Areas under our stewardship. Considering Water NSW's statutory objectives and functions, our mining and coal seam gas principles and our policy on longwall mining, Water NSW objects to the proposal in its current form.

In light of the above matters, Water NSW requests that its remaining concerns be addressed prior to the project progressing towards determination. These include modifying the mine layout, undertaking further geological investigations, undertaking a legitimate assessment of the economic viability of further modifying the mine layout to avoid unacceptable impacts on swamps and water resources, developing a TARP and associated monitoring plan. Should the project proceed appropriate Conditions should be applied including:

1. The proposed mining layout is modified to exclude any mining from the Dam Safety Notification Area for Cataract Dam.
2. The consent should only permit mining up to a point where valley closure is predicted to be 200 mm or less, consistent with the Trigger Action Response Plans for LWs 5 and 6.
3. Water NSW's performance criteria developed for the proposed mining area (see Table 1 of the attached submission) be adopted including those for Cataract Reservoir, swamps, biodiversity and cliffs, including modification of the mine layout if necessary to ensure negligible impact on all swamps of special significance
4. Detailed Trigger Action Response Plans, incorporating appropriate and measurable performance measures, monitorable performance indicators and

management response triggers be developed and agreed by relevant agencies prior to Determination.

5. Monitoring Plans including details of how the agreed performance measure triggers will be monitored should also be agreed with Water NSW and other relevant agencies and approved prior to approval.
6. Water NSW's other concerns related to DP&E's draft Conditions of Approval specifically Schedule 2, Condition 15 and Schedule 3, Conditions 1, 2b, 4, 27 be addressed. Water NSW requests that, if the project is approved the amended conditions laid out in the attached submission be adopted.
7. Adequate financial provisions are included in any approval granted to mine within the Cataract Dam Notification Area to compensate Water NSW for any water losses from Cataract Reservoir or its catchment should the measures in the Contingency Plan fail.
8. Contingency planning referred to in draft Conditions of Approval specifically Schedule 3 Condition 8(o) resulting in a plan which can be implemented effectively over the short, medium and long term to maintain impacts within acceptable limits.

DH:DH:1148-1#489

N Cleaves
Administration Officer
NSW Planning Assessment Commission
GPO Box 3415
SYDNEY NSW 2001

30 January 2015

Dear Ms Cleaves

RUSSELL VALE COLLIERY PROJECT EXPANSION

Council has taken a strong position in regard to potential impacts of mining operations on the environment, the community, local infrastructure as well as Water Catchment Areas within the Wollondilly Local Government Area (LGA). Council has also taken a strong position in advocating the expressed concerns by the local community regarding these potential impacts.

The establishment of the Planning Assessment Commission to review the Russell Vale Colliery Project Expansion (Project Application) is consequently welcomed. Please be advised that Council will not be providing a presentation at the public hearing however Council Officers will be in attendance.

It is requested to be noted that the timeframe for lodgement of submissions prevented the consideration of the review of the Russell Vale Colliery Project Expansion (Project Application) by Council. The attached submission consequently provides a range of requested issues for investigation by the Commission based on previous Council submissions on other longwall mining projects within the Wollondilly LGA. The submission also suggests the holding of a meeting with members of the Commission to discuss the concerns of Council and the local community in more detail as part of the review process.

Should you have any enquiries regarding aspects of Council's submission, please contact Council's Environment Assessment Planner, David Henry, on (02) 4677 8287 or via e-mail david.henry@wollondilly.nsw.gov.au.

Yours faithfully



Brad Staggs
Manager Environmental Services
ENVIRONMENTAL SERVICES]

SUBMISSION ON THE RUSSELL VALE COLLIERY EXPANSION

The Russell Vale Colliery Expansion (Project Application) has relevance to Council and the community it represents given the location of part of the Project Area in the Wollondilly Local Government Area (LGA). This submission welcomes the review of the Project Application by the Commission as a means of reducing potential environmental and social impacts associated with the Project in its current form.

Council has not lodged a previous submission in regard to the Project Application and the timeframe for receipt of submissions to the Planning Assessment Commission has prevented consideration and endorsement of this submission at a meeting of Council. The concerns of Council and the local community outlined in this submission are consequently based on comments expressed in previous submissions on other mining projects within the Wollondilly LGA that are viewed as being transferrable to the Project Application. The submission however also provides a range of requested issues for investigation by the (the Commission) based on a brief review by Council Officers that are consistent with these concerns based on the Terms of Reference (ToR) for the Inquiry.

The major requested issues to be investigated by the Commission as part of the review are:

- The Commission investigate the adequacy of the Response to Submission Report in considering and evaluating all issues raised in submissions in accordance with the Objects of the *Environmental Planning and Assessment Act 1979*.
- The Commission investigate the adequacy of the scientific basis of the Preferred Response Report and draft Instrument of Approval.
- The Commission develop scientifically rigorous recommendations to reduce potential environmental, social and cultural impacts associated with the Project Application as alternatives to the recommended use of Offsets and Trigger Response Plans by the Department of Planning and Environment.
- The Commission provide comments as well as recommendations involving project refusal, deferral or further amendments to avoid or reduce potential social and environmental impacts of the Project and to enhance its scientific basis where warranted.

1) Overview of Council's position regarding the Project and mining operations in general

Council recognises the contribution that the mining industry provides to the local and state economy. However, Council also considers that longwall mining should be managed so as not to result in environmental, cultural and social impacts as well as drinking water catchment values of the local region. Council's submission on the Bulli Seam Project stated in this regard that *"feedback from the local community and anecdotal evidence available to Council suggests that local residents are more concerned with the long-term damage to natural assets resulting from mining than the temporary economic and social issues arising from changes in employment and economic conditions"*.

Council has not adopted a formal position in regard to the Russell Vale Colliery Underground Project. However, the position of Council and related expressed community concerns in regard to other mining projects are viewed as being transferable to the Russell Vale Project given the similarities in operations and associated environment and socio-economic impacts.

Council therefore requests that the Commission consider the general position of Council and the community in regard to mining operations as part of its review of the

Project Application. Council would also appreciate a meeting with members of the PAC as part of the consultation process associated with the review to discuss these concerns in more detail.

2) Submission regarding the Russell Vale Colliery Underground Project

The following comments on the Terms of Reference are consistent with Council's adopted position on the coal mining industry in general and other mining projects within the Wollondilly LGA.

Terms of Reference 1: Consider the EA for the project as well as related documents prepared by the proponent and the Department of Planning and Environment

Comments are not provided on the Environmental Assessment (EA) as a result of Council not providing a submission on this document. The NSW Department of Planning and Environment (DP&E) is noted however to have required the Commission consider "*any other relevant information provided on the project to the Commission during the course of the review*". The following comments on other documents associated with the Project based on the concerns of Council and the local community regarding mining operations within the Wollondilly LGA are provided within this context

(i) Preferred Response Report

The expressed view by the PRR that the likely level of potential environmental and social impacts as a consequence of the amendments to the original proposal is supported in-principle. However, it is noted that the amended projected area retains nine upland swamps that are recognised as being of extreme conservation significance by a wide range of scientific documents such as the Report produced by the Commission that investigated the Bulli Seam Project.

In relation to this matter, the PRR is noted to contain a number of statements that indicate a level of scientific uncertainty over the level and likely hood of potential impacts on the retained upland swamps within the Project Area. Council is therefore of the view that the Precautionary Principle should be invoked and project approval be deferred until greater certainty regarding this matter has been achieved.

It is consequently requested that the Commission examine the adequacy of the PPR in regard to:

- **The stated level of potential impacts associated with the revised proposal on the natural, cultural and built environment as well as the stated economic benefit.**
- **The scientific basis of the monitoring regimes, baseline data, assessment and remediation measures outlined in the document.**
- **The response by the PRR to all issues raised in submissions from residents and agency submissions.**

(ii) Response to Submission Report and Residual Matters Report

The public availability of issues raised in submissions on the EA and PRR as well as response to these submissions by the proponent is acknowledged as a suitable means of informing the local community on the progress of the Project Application. A brief review of the Residual Matters Report however has identified that the proponent has in general not provided a detailed response to issues specifically raised in a number of submissions on both the EA and

the PRR. There is also considered an absence of discussion within the document regarding the merits of issues raised in submissions in enhancing the Project Application.

It is therefore requested that the Commission investigate whether both the Response to Submission and Residual Matters Report have adequately:

- **Given careful consideration and evaluation to all issues raised in received submissions in accordance with the Objects of the *Environmental Planning and Assessment Act 1979*.**
- **Considered all current research regarding key complex issues associated with the Project Application such as subsidence related potential impacts on the condition of all potentially affected watercourses and upland swamps.**

(iii) Major Project Assessment Report

The Major Project Assessment Report is acknowledged to have outlined the viewpoint of the Department of Planning and Environment on key issues associated with the Project Application. Council Officers however have doubts over the adequacy of the scientific basis of the document on the following grounds:

- There is a considered absence of reference within the Report to research carried out by organisations (such as the Independent Expert Scientific Committee) (IESC) and third parties in the description of the recommended regulatory approach by the DP&E.
- There is a considered absence of any discussion within the Report on the key conclusions of the Advice provided by the IESC in regard to the Project Application listed in Table 2 of the document.
- There is a considered absence of reference to any peer review of the recommended regulatory approach by the DP&E outlined in the Report.

Council has adopted the position that the community deserves to be assured and shown that the level of independent scrutiny and decision-making should be similar for both 'State Significant Developments and Development Applications lodged under Part 4 of the *Environmental Planning and Assessment Act 1979*. Council's submission on the Bulli Seam Project EA expressed the expectation of Council in this regard that the PRR (for this Project) contain information that would demonstrate:

- That every relevant issue raised in submissions has been: researched by the DP&E (or other assessment persons acting in a public capacity) using independent, reliable, expert sources.
- That a judgement has been made by the Director-General in relation to each relevant issue that it either meets the Objects of the *Environmental Planning and Assessment Act 1979*.

The Commission is consequently requested to investigate the adequacy of the scientific basis of the Preferred Response Report within the context of the above Council position regarding such documents.

(iv) Draft project approval

It is noted with concern that the Commission has not been specifically requested to carry out a review of the adequacy of the draft Instrument of Approval available on the DP&E's website. The review of this Instrument is however viewed as being in accordance with the section of the

ToR that requires the Commission to review *“any other information provided on the project to the Commission during the course of the review”*.

In relation to this matter, Officers are of the view that the recommended DP&E regulatory approach for the Project Application detailed in the draft Instrument of Approval should be referred to appropriate research organisations such as the IESC for an adequacy review if possible. The Commission is therefore requested to note Council's viewpoint that the deferral of project approval in accordance with the Precautionary Principle is warranted to allow for the review of the scientific basis of the recommended DP&E regulatory response that is noted to inform the draft Instrument of Approval.

Terms of Reference 2: *Assess the merits of the project as a whole paying particular attention to the potential impacts to upland swamps and noise and air emissions to Russell Vale residents*

(i) *Upland swamps and water resources (especially Cataract Creek and the stored waters of Cataract Reservoir) resulting from mine subsidence*

(a) Council position

The protection of upland swamps, waterways and water catchments from impacts associated with longwall mining operations are a key concern of Council and the local community. The tight timeframe for the lodgement of submissions has prevented a detail review of the addressing of this complex issue by the documents subject of the Inquiry. The comments contained in Council's submission on the Bulli Seam EA are consequently listed below for the information and consideration by the Commission during its review of the Russell Vale Project:

- *“More evidence is needed before any assessment can be made regarding the impacts of the project on shallow and deeper groundwater in regard to baseflow, recharge of watercourses as well as supporting ecosystems within a catchment context.*
- *It is critically important that the matter of surface water loss through stream bed fractures attributable to mining operations and ‘re-emergence’ be examined by a suitably qualified and experienced authority independent of any mining related interest.*
- *All potentially impacted watercourses should be subject to the same ‘Stream Impact Minimisation Criteria’ as the Nepean River.*
- *The EA has not evaluated the significance of the upland swamp network and the importance of each swamp within this network”.*

(b) Comments on the addressing of the issue by the Major Project Assessment

Scientific basis of the recommended regulatory response

It has been assumed that detailed feedback will be sought from the Sydney Catchment Authority and Government Agencies such as the NOW regarding the adequacy of the PPR and associated recommended regulator approach. However, the preceding section of this submission has expressed the view that any consideration of project approval should be deferred due to questions over the adequacy of the scientific basis of the PPR and associated draft Instrument of Approval.

In this regard, the IESC is noted to have released Research Papers titled **“Temperate Highland Peat Swamps on Sandstone: evaluation of mitigation and remediation techniques range of statements”** and **“Background review: Subsidence from coal mining activities”**. The NSW Office of the Chief Scientist is also noted to have prepared a Research Paper titled **“Measuring the cumulative impacts of activities which impact**

ground and surface water in the Sydney Water Catchment” as part of the **Independent Review of Coal Seam Gas Activities in NSW**. Officers are of the view that the PPR and Instrument of Approval should be consistent with these Papers (at a minimum) given the significant expertise of the authors.

Recommended use of Offsets and Trigger Responses

The relevance of the NSW Office of Environment and Heritage's (OEH) **Biodiversity Offsets Policy for Major Projects** to the Project Application is acknowledged. However, Council Officers view this Policy as having the effect of fragmenting biodiversity and result in net loss biodiversity outcomes. This viewpoint is considered by Officers to be consistent with a statement in a recent public letter from a former OEH Conservation Officer that *“The Department of Planning and the Office of Environment and Heritage are developing policies which will guarantee further losses of biodiversity”*. Officers are consequently strongly in opposition to the proposed utilisation of the Offset Policy by the DP&E to protect and manage upland swamps potentially impacted by the Project Application based on the above considerations.

The PRR is noted to state on Page 33 in relation to this matter that the *“Department considers that the approval should contain a trigger (rather than a performance measure) which requires a proportional offset for impacts on swamps, where those impacts are greater than ‘negligible’ environmental consequences and remediation is not possible or is not effective”*. The IESC Remediation Techniques Research Paper is noted however to state that *“Trigger Action Response Plans (TARP) as a method of protecting swamps is not considered overly useful because many of the impacts are likely to be long term and difficult to detect without extended monitoring”*. This and a number of other similar statements within the Research Paper are viewed as raising questions over the scientific basis of the DP&E recommended regulatory response.

The following actions by the Committee are consequently requested in regard to this Terms of Reference:

- **Consider the issues and concerns previously raised by Council in regard to the Bulli Seam Project during the review and development of recommendations.**
 - **Note Council's concerns regarding the apparent inconsistency of the DP&E recommended regulatory approach with Research Papers produced by the IESC and the NSW Office of Chief Scientist and its preference that the PRR be supplied to the IESC (if viable) for an adequacy review.**
 - **Develop scientifically rigorous recommendations to reduce potential environmental, social and cultural impacts associated with the Project Application as alternatives to the recommended use of Offsets and Trigger Response Plans by the Department of Planning and Environment.**
- (ii) *Residents in the vicinity of the Russell Vale pit top resulting from noise and air emissions and the trucking of product coal*

It has been assumed that Wollongong City Council will provide comments regarding potential impacts from noise and air emissions to residents within the immediate vicinity of the Russell Vale pit top. There is however considered potential for dust emissions generated by the Project to extend a considerable distance and impact on residents in the eastern section of the Wollondilly LGA depending on prevailing wind conditions. **The Commission is therefore requested to examine the adequacy of the PRR and RtS in assessing all environmental,**

health and social impacts resulting from noise and air emissions associated with the Project in a localised and regional context.

(iii) Other concerns of Council regarding the Project Application

The potential impacts on water resources and residents in the vicinity of Russell Vale are acknowledged as being key issues associated with the Project Application. However, it is considered appropriate that the Commission investigate the adequacy of all documents subject of the Inquiry in regard to the following concerns of Council and the local community regarding other potential impacts:

- Potential impacts on terrestrial, riparian and aquatic biodiversity (both threatened and non-threatened) resulting from mine subsidence, vegetation clearance and indirect impacts such as stormwater flow.
- Potential environmental and health impacts associated with any goaf gas drainage activities. The Commission is requested to note in this regard that Council resolved at its meeting of 11 December 2014 *"to request the NSW Government include the impacts on communities and infrastructure from coal mine gas drainage be included in the criteria for Local Government assistance through the Resources to Regions Program"*.
- Potential impacts to Aboriginal Heritage in terms of artefacts, Potential Archaeological Deposits as well as the cultural landscape.
- The methodology and outcomes of the Benefit Cost Analysis in determining the short and long-term social and economic benefits of the Project Application.

Terms of Reference 3: Apply all relevant NSW Government policies in that consideration and assessment

The following comments relate to Council's and associated concerns of the local community regarding the current legislative and policy framework for mining projects.

(i) Legislative framework

Council and the local community have a general absence of confidence in the State Significant Development Process for reasons that include the detachment of local government and community from the process as well as adverse positive environmental and social outcomes. This lack of confidence in the legislative framework is considered to be verified by the significant deficiencies in the Project Application identified in the Scientific Advice provided by the IESC. The Commission is requested to note in this regard that Council resolved at its Ordinary Meeting of 19 October 2013 that *"Council write to the Minister and Shadow Minister for Planning calling for third party appeals to be permitted for Part 3A determinations or alternatively that Part 3A be removed from the **Environmental Planning and Assessment Act 1979**"*.

(ii) Policy framework

Council has acknowledged aspects of the Government's Strategic Regional Land Use Policy (SRLUP) and associated documents such as the Aquifer Interference Policy (AIP) as being positive in the assessment and regulation of mining activities. However, Council has also raised a number of concerns and deficiencies regarding aspects of the SRLUP including the full requirements of the Policy not applying to all State Significant Developments.

Council has previously expressed the view that the loss of water through streambed fractures should be classed as an aquifer interference activity. In relation to this matter, the AIP is noted

to list 'underground mine workings' as high risk aquifer interference activities. However, there is an apparent absence of discussion within the PRR regarding the implications of the AIP to the Project Application.

It is consequently considered appropriate that the Committee provide the following comments in regard to both the Legislative and Policy Framework as part of its review of the Project Application:

- **The adequacy of the existing legislative framework in achieving positive environmental and social outcomes and any impediment the framework provides in the obtainment of these outcomes.**
- **The consistency of the Project Application with the requirements of the NSW Aquifer Interference Policy.**

It is also considered appropriate that the Commission provide recommendations to address deficiencies in the legislative framework that include measures to address that (the considered) disconnection of local government and communities and allow for third party appeals.

Terms of Reference 4: *Provide recommendations on any reasonable and feasible measures that could be implemented to avoid, reduce and/offset the potential impacts of the project*

The provision of any recommendations that would reduce potential environmental and social impacts of the Project Application would be supported (at least) in principle. However, it is considered imperative that such recommendations (at a minimum) be consistent with the first underlying Principle of the **Biodiversity Offsets Policy for Major Projects** that "*offsets should only be pursued if impacts cannot be adequately avoided or mitigated*". The Commission is requested to note the experience of Council Officers in this regard that proponents of large proposals within the Wollondilly LGA have almost universally pursued an Offset Strategy at the early stages of the application process.

In relation to this matter, the basis of statements within the PRR to the effect that offsets and defined trigger values are beneficial in addressing unavoidable impacts associated with mine subsidence are acknowledged. However, a previous section of this submission has referred to deficiencies in this process identified by the IESC. In addition the Precautionary Behaviour component of the definition for Ecological Sustainable Development (Environs 1999) is noted to state in relation to this matter that "*where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as reason for postponing measures to prevent environmental degradation*".

It is consequently viewed as appropriate that the Commission provide comments as well as recommendations involving project refusal, deferral or further amendments to avoid or reduce potential social and environmental impacts of the Project and to enhance its scientific basis where warranted.

3) Concluding statement

This submission welcomes the review of the Project Application by the Commission as a means of reducing potential environmental and social impacts associated with the Project in its current form. However this submission provides a range of requested issues for investigation by the Commission to address identified shortcomings in the Application based on the concerns of Council and the community it represents in regard to mining operations within the Wollondilly LGA. This submission also expresses the view that a recommendation of no or deferral of approval is warranted due to identified questions over the adequacy of the scientific basis of aspects of the Preferred Response Report and draft Instrument of Approval.



Our reference: EF13/3016:DOC15/59812:WD
Contact: William Dove (02) 4224 4100

The Planning Assessment Commission
(Attention: Joe Woodward)
GPO Box 3415
SYDNEY NSW 2000

Dear Sir

**ENVIRONMENT PROTECTION AUTHORITY/PLANNING ASSESSMENT COMMISSION MEETING
RUSSELL VALE COLLIERY – UNDERGROUND EXPANSION PROJECT MP 09 0013**

I refer to the meeting held on Thursday, 19 February 2015 between the Environment Protection Authority (EPA) and the Planning Assessment Commission (PAC) to discuss matters relating to the Russell Vale Colliery 'Underground Expansion Project MP 09_0013'.

At this meeting, the PAC requested the EPA provide additional information on a number of matters in relation to the premises; including: site noise and dust, transport noise and dust, emplacement activities and water quality.

The EPA response to this request is provided in Attachment A to assist the PAC in its assessment of the proposal.

If you have questions regarding the above please phone William Dove on (02) 4224 4100.

Yours sincerely

A handwritten signature in black ink, appearing to be 'P. Bloem', with the date '13/3/15' written next to it.

PETER BLOEM
Manager Illawarra
Environment Protection Authority

Attachment A

ATTACHMENT A

1. Development Approval Process

The Russell Vale Colliery development application was first lodged with NSW Department of Planning and Environment (DPE) in 2009. To date the overall expansion project has not yet been determined. Instead there has been a trend for approval modifications to allow short term works to continue. This has made the integrated and strategic environmental assessment of the overall mine project complex. This is in contrast to other mines in the southern coalfields which have assessed and obtained development approvals for major projects spanning up to 20 to 30 years. For example, in 2013 the EPA commented to DPE on the Underground Expansion Project, based on an 18 year mine life. Following a change in the scope of the project, recent EPA comments are based around a mine life of only five years and 3 MTPA. This project proposal appears however to be time limited to 2019, meaning another application may potentially be lodged in the near future.

2. EPA Regulation

The EPA regulates only surface pit top activities and vent shafts at the Russell Vale mine under Environment Protection Licence (EPL) No 12040. The EPA does not regulate activities associated with the operation of Bellambi Lane. A copy of the mine's EPL No 12040 and summary of compliance history can be viewed on the EPA Public Register at: www.epa.nsw.gov.au The EPA has previously issued Penalty Notices, new licence conditions and Pollution Reduction Programs (PRP) in response to licence non-compliances that have occurred.

3. Mine Production

The following table (Table 1) lists six southern coalfield mines, being Dendrobium, West Cliff Bulli Seam Operations (BSO), Tahmoor, Metropolitan, Wollongong Coal (Russell Vale) and Wongawilli Colliery. The table includes approved production rates, and actual production rates taken from Annual Environmental Management Reports and information provided by the mines. Also included is how product coal is transported from the mine, and how the coal is loaded, whether from bins or by Front End Loader (FEL).

	Dendrobium	West Cliff	Tahmoor	Metropolitan	Wollongong Coal	Wongawilli
EPL	3241	2504	1389	767	12040	1087
Loading	Bins	Bins	Bins	FEL	FEL	FEL
Transport	Train	Truck	Train	Train	Truck	Train
Approved (Mtpa)	5.2	10.5	3.0	3.2	1.0	2.0
Produced (Mtpa)						
07	2.5	2.9	Data not available	Data not available	Data not available	Data not available
08	3.5	4.5	1.4	1.22	0.550	0.040
09	3.0	5.25	Data not available	Data not available	Data not available	Data not available
10	3.25	5.25	Data not available	1.8	Data not available	Data not available
11	3.6	5.5	1.6	1.9	Data not available	Data not available
12	4.25	6.5	2.3	1.9	0.439	Data not available
13	4.5	6.0	2.5	1.6	0.784	Data not available
14	3.75	6.1	2.8	2.7	0.286	Data not available

Table 1: Coal Production Southern Coalfields Underground Mines

Wollongong Coal has produced 0.439, 0.784 and 0.286 MTPA over the years 2012, 2013, and 2014. Other southern mines appear able to produce reliably at >2MTPA.

The Recommended Instrument of Approval prepared by DPE limits production to 3 million tonnes of ROM coal in any calendar year. It is unclear if it is physically possible to mine and transport this amount of coal from Russell Vale Colliery in a calendar year, with current and proposed infrastructure, especially when compared with other mines in the southern coalfields. The colliery appears to have several constraints to coal production. These include the distance of current and future coal reserves to the Pit Top which will become greater over time, capacity of longwall, limited size of pit top for stockpiling, all truck loading carried out by FEL and not loading via bins, and coal transport restrictions from the mine to Port Kembla Coal Terminal (PKCT).

4. Site Noise

The Preliminary Works Approval (No 10_0046) was issued to Gujarat NRE Coking Coal Limited on 13 October 2011. It included Noise Criteria under condition 10, 11 and 12 for a period up to 31 December 2013, and amended Noise Criteria for the period post 1 January 2014.

The DPE 'Recommended Instrument of Approval 09_0013 Underground Expansion Project' Noise Conditions are at condition 1 on page 12. Condition 2 on page 12 spells out specific operating requirements aimed at regulating site noise. The noise limits in this document are significantly different to those in Approval 10_0046.

The EPA wrote to DPE on 11 December 2014 providing a critical assessment of the proposed noise limits and advised DPE the following:

...“proposed limits exceed what the EPA would consider licensing to”...and ...“noise from the premises will be clearly audible and likely to be considered as intrusive by some members of the surrounding community”....

A copy of this letter was provided to the PAC on 19 February 2015 and the EPA refers the PAC to this letter for more information.

The Russell Vale mine is a very old existing mine located in a residential suburb. Neighbouring land uses in the area have changed considerably over the years. There has been a stop/start nature of production at the colliery. Production has not occurred or been at very low levels for extended periods and a return to constant and elevated production levels will be a new experience for some local residents. DPE has advised that night-time and evening noise could achieve amenity criteria if handling and transport operations are curtailed. They have also indicated that any such curtailing of operations would either exacerbate day-time noise levels or be economically unviable.

The EPA recommends that the PAC request additional information on reasonable and feasible measures that may be installed to reduce site noise levels. Condition 2 on page 12 of the 'Recommended Instrument of Approval' includes some specific requirements, however there may be other measures. This could include conveyor runner bearing design, replacement of metal clips used to join conveyors with vulcanised joints, use of noise barriers on site boundaries and noise barriers around identified noisy equipment on the site, maintaining a volume of coal in bins so that coal is not dumped into an empty bin, minimising dump height from mobile plant, noise dampening material in coal bins/deflection plates, noise cladding on conveyor winder houses and conveyor rope rollers, enclosed motor rooms, etc.

Modified coal handling/transport, could also reduce site noise. The EPA recommends the PAC seek information on noise reductions with different load out operations, in particular longwall to conveyor to bin to truck, compared to longwall to conveyor to stockpile to FEL to truck. Some coal loading from stockpiles will be required to deal with longwall changeouts or underground production problems, however an assessment of different stockpile/bin loading ratios, between 100 per cent bin load out to 100 per cent stockpile load out could be useful. If bin use is found to reduce site noise, the PAC could consider requiring progressive implementation of bins, and/or regulating load out from stockpiles during times when it would provide lesser impact to residents. Load out is currently restricted to day and evening only, with no night-time load out.

DPE advised the EPA that Wollongong Coal are about to complete installation of an underground reclaimer, which will reduce the need for FEL/stockpile loading of trucks and allow some loading of trucks from a bin, however we do not have information on system capacity or timing for commissioning.

DPE has advised the EPA that Wollongong Coal commissioned an acoustical consultant from Hatch to undertake an assessment of noise emissions from the conveyor system and other pit-top plant and equipment. DPE attended workshops and provided input to the report's recommendations. The information contained in this report may help the PAC in their assessment of this proposal.

The EPA is aware of investigations carried out by a number of mines in the southern coalfields to manage noise, for example the Noise Management Plan prepared by BHP Billiton for BSO under the terms of the BSO consent. The EPA can seek a copy of this report if required.

5. Emplacement Area

The use of the emplacement area adjacent to Russell Vale Golf Course has been limited. The colliery has advised EPA that currently approximately 20,000 tonne/rock/annum is emplaced, and it is also used as a mine equipment staging area. It does not appear to be used by high vehicle numbers. Given these observations the emplacement does not appear to cause a significant impact on local air quality or contribute to noise impacts at this time. The EPA recommends that the PAC should seek further advice from the proponent on the future use of this area. Notwithstanding this, the EPA also recommends that the PAC consider requesting the colliery prepare and commit to a progressive rehabilitation plan. The EPA notes that rehabilitation plans may already be described through the *'Mining Operations Plan'* regulated by NSW Department of Trade and Investment, Regional Infrastructure and Services (NSW Trade & Investment) through the Mining lease. The PAC may wish to discuss this further with NSW Trade & Investment.

6. Air Quality

The EPA considers there is value in getting the colliery to investigate *'Best Practice Coal Loading from Stockpile to Truck'* and *'Best Practice Coal Loading'*. Currently all coal is loaded from stockpiles by FEL into trucks. Conveyors to coal bins may reduce site and transport dust emissions, while also reducing noise and air emissions from mobile plant.

In response to a PRP the EPA has required the mine to complete a site specific Best Management Practice determination to assess existing dust controls and make recommendations on any improvements. This was completed in 2012. The EPA can provide a copy of this report on request.

7. Water Quality

There are four Licensed Discharge Points (LDP) on EPL No 12040:

- LDP 1 Underground drainage from coal stockpile emplacement (Russell Vale Golf Course)
- LDP 2 Discharge of treated stormwater and minewater
- LDP 3 Discharge from stormwater dam – *'leaky dam'*
- LDP 4 Overflow spillway at stormwater control dam.

The EPL has a range of limit, operating, monitoring and reporting requirements associated with these discharge points. The EPA has also had a program of PRPs in place at Russell Vale Colliery to deal with environmental issues strategically and also as they arise.

The EPA provides the following advice in relation to water management from site and to reduce impacts from site discharges to Bellambi Creek.

- a) Main Stormwater Control Dam *'leaky dam'* (LDP 3 and 4). Discharges from the *'leaky dam'* impact on Bellambi Creek, and have long been a source of irritation for local residents. Currently Russell Vale Colliery is investigating options to manage this dam. The EPA considers this process can be adequately managed via PRP(s) or other mechanisms on EPL No 12040.

- b) Water Discharges to Bellambi Creek Gully (LDP 2). Water make from Russell Vale Colliery has been variable over the last few years. Discharges from the colliery can be a significant source of flow to Bellambi Creek. Bellambi Creek downstream of Russell Vale Colliery is engineered and degraded, and flows for a relatively short distance before discharging into the ocean via a small intermittently closed and open coastal lakes and lagoons (ICOLLS).
- c) *The State of the Environment Catchment Report* (DECCW 2010) identified sediment input to Bellambi Gully Creek as being very high. While *The Estuary Management Plan for Several Wollongong Creeks and Lagoons Wollongong Council* (WCC 2007) also identified sediment in Bellambi Gully Creek to be a significant issue with water quality generally characterised by elevated pH, conductivity, BOD, COD, ammonia, suspended solids, nutrients, copper and zinc. The report also states that the waterway receives runoff and discharges from Russell Vale Colliery operations and urban development and is generally in poor condition. The EPA commented to DPE on the Underground Expansion Project in a letter dated 17 April 2013 on water discharges to Bellambi Gully Creek. The EPA recommends that the PAC consider the comments in this letter, in particular the requirement to collect baseline data and complete a characterisation of the discharge waters taking account of any variability in flow and volume.
- d) Water Discharges under the emplacement (LDP 1). A new 'PRP Clean Water Repair and Upgrade Russell Vale Emplacement' with a completion date of 30 March 2015 was added to EPL No 12040 in December 2014. The EPA considers water quality issues surrounding the emplacement can be managed by licence condition.

8. Truck noise and dust

Given the haul route down Bellambi Lane from the mine and close proximity of residential areas, noise and dust are key environmental issues. Impacts from current production rates of <0.5 MTPA have generated complaints to the EPA from community members living on Bellambi Lane.

Transport noise impacts appear greatest at either end of Bellambi Lane, where trucks are braking and accelerating from traffic lights. Once up to 'cruising' speed, and if not using compression brakes, noise impacts from transport appear less. Community members have also reported to EPA the different road camber where Bellambi Lane meets the Princes Highway causes empty trucks and trailers to bounce and bang. The community also reports to EPA that coal trucks on Bellambi Lane do not comply with speed restrictions, aimed at reducing truck noise and dust.

EPA visual inspections have found the greatest dust impact from coal trucks appears to be to the east of the truck wash and out onto Bellambi Lane. Russell Vale Colliery operates a truck wash at the exit to the colliery and all loaded trucks are required to be covered. Trucks at the colliery are loaded from stockpiles. FEL to truck is less precise than truck loading from bins, and can result in coal being 'hung up' on chassis, body and draw bar structures. Trucks travelling on unsealed stockpile areas carry more coal/sediments onto exit roads in their tyre treads. Unless carefully managed, this can provide an additional solids load on the truck wash which may reduce its effectiveness and create additional dust loads on Bellambi Lane.

Investigations carried out by some mines in the southern coalfields have identified that truck washes can cause elevated dust impacts on adjacent roads, depending on whether or not the trucks are accessing unsealed bare coal areas or coal stockpile areas for loading.

To help manage transport related noise and dust impacts, the following could be considered further:

- a transport curfew to provide residents respite from coal transport.
- best practice acoustically treated trucks and trailers.
- Sealing of proposed haul road.
- fitting of diesel exhaust treatment devices, especially for older vehicles.
- investigation into pavement modifications at Princess Highway/Bellambi Lane intersection to reduce truck/trailer banging.
- investigation of impacts on noise and dust from coal transport fleets made up of different classes of vehicles. For example, would all coal transported in fewer A-Doubles (85 tonnes) B-doubles (65 tonnes)

or other larger vehicles, have less impacts than a fleet made up of smaller semi-trailers (30-35 tonnes)/truck and dog arrangements? The EPA notes there are constraints on vehicle size on different roads and the use of A-Doubles on the haulage route from West Cliff Mine to PKCT is by special arrangement.

- installation of a sound barriers along Bellambi Lane. A sound barrier on the north side of Bellambi Lane may propagate transport noise towards the residents on the south side of Bellambi Lane within the Industrial Zone.
- Investigation and implementation of Truck Wash Improvements.
- Completion of a best practice bulk coal transport assessment and review. The review should investigate a range of alternate coal transport options. For example, use of conveyors to rail load out bins, or alternate locations for the haulage of coal from the mine such as a remote location (for example, existing or new vent shaft) on top of the escarpment.
- Negotiated agreements between the company and affected residents.

11/12/14



Our reference: EF13/3016:DOC14/108053:05:PW
Contact: Paul Wearne (02) 4224 4100

Department of Planning and Environment
(Attention: Jeff Parnell)
GPO Box 39
SYDNEY NSW 2001

Dear Sir

**RUSSELL VALE COLLIERY (FORMERLY NRE NO 1)
UNDERGROUND EXPANSION PROJECT
REVISED NOISE IMPACT ASSESSMENT**

I am writing in reply to your request for comments regarding the revised Noise Impact Assessment (NIA) and proposed draft noise conditions for Wollongong Coal Limited's expansion project. These were provided to the Environment Protection Authority (EPA) at a meeting with the Department of Planning and Environment (DPE) on 27 November 2014.

The EPA has reviewed the proposed operational noise limits and components of the revised Noise Impact Assessment (NIA) relating to these draft limits and has provided comments (**Attachment A**) for DPE's consideration.

In relation to current EPA noise policy for environment protection licensing, the EPA usually specifies limits not more than Project Specific Noise Levels (PSNL) plus 5 dB(A) when satisfied that all feasible and reasonable noise mitigation measures have been applied. However, a review of the proposed noise limits in the draft conditions reveals that they exceed this criterion based on mitigation measures already applied, but not yet quantified to the tripper achieving a SWL of 100 dB(A).

The proposed limits significantly exceed what the EPA would consider licensing to. Exceedances of this criterion occur at the majority of the receivers assessed. These exceedances range between 2-12dB(A) – daytime; 2-14dB(A) – evening and 0-7dB(A) – night time. DPE has advised that during night time and evenings and on public holidays this EPA criteria could be achieved if operations are curtailed by conditions associated with the handling and transport of material from the site to PKCT.

On the basis of the noise levels in the revised NIA, the noise from the premises will be clearly audible and likely to be considered as intrusive by some members of the surrounding community. However, predicted premises based noise levels typically show a minor noise reduction (1-2dB(A)) between the existing and all other proposed scenarios. Also, the proposed noise limits do not exceed the "acceptable" suburban industrial interface noise levels proposed by the INP (and application notes). These acceptable noise levels apply to total industrial noise in an area in order to address cumulative impact. While the EPA does not normally licence amenity based levels, it is important that the amenity of adjoining sensitive land uses is carefully considered and protected.

The EPA requests that DPE consider this information as part of its determination of this major project application.

If you have questions regarding the above please phone the contact officer on (02) 4224 4100.

Yours sincerely

A handwritten signature in black ink, appearing to be 'PB' with a large loop and a diagonal stroke.

11/12/14

PETER BLOEM
Manager Illawarra
Environment Protection Authority

Att

ATTACHMENT A

- The Department of Planning and Environment (DPE) has supplied a revised Noise Impact Assessment (NIA) and draft operational noise limits (premises based activities) and have requested the Environment Protection Authority (EPA) comment: *Russell Vale Colliery – Noise Impact Assessment: Report No. 1414, Version C, September 2014, Wilkinson Murray* (hereafter referred to as revised NIA).
- The stated purpose of the revised NIA: *"This assessment replaces in full the previous noise impact assessment for the UEP, It has been revised for updated assumptions (including meteorological data) and mitigation commitments"* (revised NIA, Page 1); and *"With the revision of the project as presented in the PPR, WCL engaged Wilkinson Murray to revise this (ERM) assessment"* (Revised NIA, Page 36).
- The revised NIA has adopted fourteen (14) receiver locations for assessment purposes identified as R1-R14.
- Premises based operational noise criteria: The revised NIA presents the results of an additional background noise survey. The results of the survey are marginally different to that presented in the exhibited NIA. On a conservative basis the lower levels should be adopted for purposes of deriving intrusive criteria. The revised background noise levels and intrusive criteria are shown on pages 8 and 9 of the revised NIA.
- The assessment adopts the suburban industrial interface receiver category under the INP (and application notes thereunder). The INP indicates that this category applies within a zone around the premises defined by a 5 dB(A) reduction of noise from the premises boundary. This zone has not been quantified in the NIA however it is likely to apply to the nearby receivers identified in the revised NIA. The Project Specific Noise Level is the intrusive criteria, being the more stringent of the intrusive and the amenity criteria.
- The revised NIA presents predicted noise levels considerably higher (up to 14dB under calm conditions and 16 dB under adverse meteorological conditions) than those identified in the exhibited EA (see revised NIA Section 7.2).
- The revised NIA presents predicted noise levels for the following scenarios: Existing, Existing Mitigated, Year 2 and Year 4.
- Section 6.4 and 10.4 of the revised NIA present/discuss the feasible and reasonable mitigation measures adopted in the modelling.
- Predicted premises based noise levels typically show a minor noise reduction (1-2dB(A)) between the existing and all other proposed scenarios.
- The proposed limits reflect the predicted noise levels in *"Table 10-1 Predicted worst case combined LAeq,15minutes noise levels from project"* (NOTE: the levels for receivers R7 and R8 appear anomalous in that a reduction in the order of 10 dB(A) is evident between the existing and proposed scenarios. This is not experienced at any other locations and there does not appear to be a reason for it.
- The proposed limits significantly exceed what EPA would normally consider licensing to. When satisfied that all feasible and reasonable noise mitigation measures have been applied the EPA will consider licensing to PSNL plus 5 dB(A). Exceedances of this criterion occur at almost essentially all of the receivers. These exceedances range between 2-12dB(A) – daytime; 2-14dB(A) – evening and 0-7dB(A) – night time. This is based on mitigation measures already applied, but not yet quantified, to the tripper achieving a SWL of 100 dB(A). DPE has advised that during night time and evenings and on public holidays this EPA criteria could be achieved if operations are curtailed by conditions associated with the handling and transport of material from the site to PKCT.
- The proposed limits, when adjusted by -3 dB(A) to account for the typical difference between an $L_{Aeq,15minute}$ and $L_{Aeq,period}$ descriptor, are at or below the suburban industrial interface acceptable noise levels under the INP.
- On the basis of the noise levels in the revised NIA, the noise from the premises will be clearly audible and likely to be considered as intrusive by some members of the surrounding community. However the proposed noise limits do not however exceed the "acceptable" suburban industrial interface noise levels proposed by the INP (and application notes). These acceptable noise levels apply to total industrial noise in an area.

26 March, 2015

Major Projects Assessment
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Our ref: 10.123.183.

Your ref: MP 09_0013

**Attention: Howard Reed
Manager Mining Projects**

Dear Howard,

Russell Vale Colliery –
Underground Expansion Project (MP 09_0013)

Reference is made to the letter from your Department of 27 March 2015 regarding the above subject. The Dams Safety Committee (DSC) has reviewed the available documents pertaining to Russell Vale Colliery Underground Expansion Project (UEP) Longwalls 6-11. These longwalls lie partly within the Cataract Notification Area (NA).

Cataract Dam is a major water supply dam which is prescribed by the Dams Safety Committee. It is a 56m, mass gravity dam that forms a significant part of Sydney's water supply. The Dam is owned by Water NSW (formerly SCA) and forms a significant part of the integrated asset base, supplying Sydney with water via the Upper Canal and Prospect Reservoir.

The DSC is currently regulating mining within the Cataract NA which surrounds the Cataract Dam, using its powers under the Dams Safety Act (1978) and the Mining Act (1992). The proposed mining within the NA requires an application to the DSC to mine within the NA.

It should be understood that the interests of the DSC are specific to the safety of the Dam and its stored waters (the reservoir). The DSC's views on the proposed Russell Vale Colliery UEP include the following initial main points:

- The DSC has no concerns with the extraction of LW6 within the Notification Area.
- The DSC has no concerns with the development of first workings in MG7.
- Given the uncertainty that still exists concerning the presence of the Corrimall Fault beyond LW6, the DSC is not in a position to recommend that the extraction of LW7

DSC Submission_Russell Vale UEP_March 2015.docx

be approved. The presence or absence of the Corrimal Fault will be proved by the development of MG7 first workings. If the Fault is intercepted then the DSC will not recommend approval of the western end of LW7 and will request that the longwall be set back from the Fault, leaving a hydraulic barrier of solid coal against the fault for protection against ingress.

- If the Corrimal Fault is absent from LW7, the DSC has no concerns with the extraction of LW7 regarding this fault.

The DSC notes that there is a potential, although considered likely to be of a very low probability, for loss of a significant volume of the stored water from the reservoir if there were a connection between the storage and the mine (beyond LW6) and depending on the nature of any such connection. Due to the potential major consequences of such an event, it is important that all reasonable efforts are taken to properly assess the risk of such an event and to ensure appropriate and effective measures are put in place to mitigate and control such risks. The DSC agrees with the view expressed by Prof. Galvin in his March 2015 letter report to the Planning Assessment Commission (PAC) that the project has not had to date an appropriate level of risk assessment to allow a proper assessment of this issue to be undertaken.

The DSC's views on the on the proposed Russell Vale Colliery UEP also include the following additional points:

- The DSC is not yet in a position to recommend that the extraction of LWs 9-11 be approved. It awaits the results from ongoing groundwater monitoring and roadway development (i.e. first workings) north of dyke D8 to demonstrate the absence of major geological structures connecting the mine workings to the reservoir.
- Similar to the condition for the Corrimal Fault, a hydraulic barrier of solid coal should be left against dyke D8.
- The DSC awaits effective Contingency and Closure Plans before recommending approval of LW7 extraction.
- The DSC notes issues concerning the possible consequences of ineffective Closure Plans. In other cases previously, the DSC has required that a Closure Plan be developed that involves the placement underground of plugs to seal pathways for water to exit a mine. It is understood in the case of Russell Vale Colliery for the longwalls under consideration that it likely would not be possible to instigate such measures in order to seal the mine against an inrush for the long term. As mentioned in the detailed attachment, whilst the DSC considers it to be a low risk (based on the extensive Bulli Seam workings down dip of Wonga East), there has been no quantitative assessment of this risk for the long time frame that the reservoir will be in existence. It is considered that such an assessment is important in ensuring that appropriate and effective Contingency and Closure Plans are in place.

Some explanatory outlining pertaining to the DSC's reviews of the various documents and associated views can be found in the detailed attachment to this letter.

Yours sincerely,



Steve Knight
Executive Engineer
Dams Safety Committee

CC: Marcus Ray, Deputy Secretary Planning Services, Dept of Planning & Environment
Paul Forward, Chair of the UEP Panel, Planning Assessment Commission
Mark Paterson, Secretary, NSW Trade & Investment

A. BACKGROUND

The previous submission (2013) by the DSC concerning the proposed mining within the Cataract NA listed 15 issues requiring further investigation. The Mine's responses to the original submission are summarised in Annexure 1. The Wonga West development is no longer part of the current mine under consideration. With the removal of Wonga West from the proposed Underground Expansion Project, DSC's concerns regarding potential impacts of mining on the integrity of the Dam have been eliminated. Remaining issues for the DSC focus on possible pathways for the Reservoir water to connect to the mine workings (i.e. loss of storage). For example the development of a connection from the Reservoir to the underground workings in Wonga East, at the confluence of the Cataract Creek and Cataract River, could result in a significant loss of the available storage capacity of the Reservoir.

From the DSC's understanding and perspective, 'intolerable' losses from the Reservoir have been denoted previously as losses of $\geq 1\text{ML/day}$ from the Reservoir to the mine. In the ongoing development of methods of risk analysis (both qualitative and quantitative) for dams and their storages undertaken by the DSC, e.g. Reid (2007) and Hilyard et al (2012), interception of structure is one of the most difficult risks to predict. Indeed the potential impact of intercepting geological structures such as dykes and faults beneath the full supply level (FSL) of a major water supply reservoir has been identified by the DSC as being one of the most major sources of risk to the storage and the most difficult of which to be certain.

To ensure that structures are not inadvertently intercepted, even when mines are only conducting development workings under or near to a water storage, the DSC requires mines to conduct within seam drilling a minimum of 30m ahead (and frequently hundreds of metres ahead) of their first workings. This ensures that the mines are aware of the presence of more major structures months in advance of mining within the area delineated for extraction. By the time secondary extraction of a longwall is recommended for approval by the DSC, the first workings have already been conducted and mapped for structures. The consequences of using this approach is that mines establish an excellent understanding of the actual (rather than statistically likely) structure present prior to extraction of a longwall. If anything significant is in doubt the Mine is required to get an independent review of the situation undertaken by a consultant and if doubt still remains the mining does not proceed. The DSC uses the precautionary principle when recommending applications for mining within Notification Areas around Water NSW storages to be approved. So that if there is any doubt at all the Mine must either change its mine plan appropriately or develop effective contingency measures ahead of mining.

B. UNCERTAINTIES

B1. BULLI SEAM MINE PLANS

It should be understood that old plans of existing workings are often inaccurate and some of DSCs remaining concerns result from this uncertainty. The inaccuracies potentially present in old mine plans are mentioned also by SCT in its June 2014 update of Subsidence Assessment for Wollongong Coal PPR (WCRV4263) where it states (pg ix) "the mine records for the period of mining may be incomplete or inaccurate due to the survey and drafting standards of that time."

i. CORRIMAL FAULT

In direct contradiction to the earlier reports by the Mine stating that the Corrimal Fault was not predicted to be present in MG6 based on old mine plans of the overlying Bulli Seam workings, the Corrimal Fault has been intersected in both the maingate and tailgate of longwall 6 (LW6). An inspection of the existing old plans showing Bulli Seam workings around the junction of Cataract Creek and Cataract River in the adjoining Corrimal Colliery, indicates that workings are absent between the projections of the dyke (D8) and Corrimal Fault in the neighbouring Corrimal Colliery. The absence of workings in this area is actually supportive of there being more than a reasonable probability that the Corrimal Fault exists in the area. That is, the evidence regarding absence or presence of the Fault (i.e. old plans for Bulli Seam workings) is contradictory. The Mine's claim that 'as seam workings have not intersected the Fault' is insufficient justification to claim that the Fault is not present. That is, the absence of evidence of a fault in old workings is not the same as evidence of absence of the fault; as has been clearly demonstrated in the intersection of the Corrimal Fault in MG6. A simple projection of the fault further would indicate there is a high probability of the Fault being present within LW7 as well, but just not expressed on the existing Bulli Seam mine plans.

ii. PRESENCE OF BULLI SEAM PILLARS ABOVE LW7

Another possible inaccuracy in the Bulli Seam mine plan (SCT WCRV4263 fig.6) may be indicated in the first workings shown at the south western end of LW7 (commencement end). With the exception of the first workings shown in the marginal zone around Cataract Reservoir, the rest of the Bulli Seam workings in this area are shown as extracted (hatched areas) as would be anticipated. Consequently there is no obvious reason for this area at the start of LW7 being left un-extracted, and it is likely that the extraction has already occurred.

B2. HEIGHT OF DEPRESSURISATION ABOVE BULLI SEAM EXTRACTION

The height of depressurisation for single seam Bulli extraction is estimated to be 60m (SCT-WCRV4209). SCT in Response to Submissions (WCRV4263) adjusted this height of depressurisation for a 180m wide Bulli Seam goaf area and 2.4m mining height to 160m. This discrepancy for the height of depressurisation has created some uncertainty and needs to be clarified.

B3. PRESENCE OF HORIZONTAL SHEAR PLANES AT RESERVOIR FLOOR LEVEL

The current Groundwater model uses two boreholes that appear to be connected hydraulically to the Reservoir. SCT (WCRV4209) postulates that horizontal shear planes at the level of the base of the Reservoir connect borehole NRE-D to the Reservoir. NRE-D is located 540m from the Reservoir.

B4. IMPERMEABLE NATURE OF DYKE D8

NRE-D is located just to the north of LW11. Longwalls 9, 10 & 11 are on the northern side of dyke D8 which separates these longwalls from the Cataract Creek arm of the Reservoir. Wollongong Coal has stated that intersections of D8 underground are dry and therefore it does not act as a conduit for water to flow from the surface to the mine. Given its impermeable nature, it would be anticipated that D8 would also act to separate the groundwater to the north and south of its location. So the lateral connectivity shown between the Reservoir and NRE-D may not be the case to the south of D8.

B5. PRESENCE OF WORKINGS IN 3 SEAMS ALONG ESCARPMENT

The presence of three seams being mined and their interconnection via goaves, along the escarpment results in the presence of numerous portals to seal on the escarpment. Possible vertical cracks in the strata close to the escarpment require that the sites for plug installation be set in competent ground away from the escarpment. This results in the requirement to involve old and waste workings which are largely inaccessible, and make seals an expensive and probably unviable solution to containing an inflow.

C. PROPOSED EXTRACTION WITHIN CATARACT NOTIFICATION AREA

C1. LW6

In direct contradiction to the Mine's structural predictions that Corrimal Fault would not be intercepted in LW6 (on the basis of the existing Bulli Seam record tracings-Section B1i), the Mine did indeed intercept the Corrimal Fault in MG6. Now fully cognisant of the fact that the Corrimal Fault is indeed cross-cutting LW6, Russell Vale Colliery proposes to conduct full extraction through the Corrimal Fault in the first 365m of LW6. On the basis of old workings coupled with a failure to identify the fault at surface the Mine's position is that the fault peters out past LW6 and does not continue towards the Reservoir. The Mine is basing its decision once again on the existing Bulli Seam record tracings which they are confident indicate that the Corrimal Fault is not present in LW7.

However, the DSC uses the precautionary principle when assessing applications to mine within Notification Areas, and as a consequence with the information available at this time makes the assumption that in spite of the Mine's confidence that the Corrimal Fault peters out, that instead the Corrimal Fault continues to the Reservoir and forms a connection. Assuming that this occurs then water from the Reservoir has to travel 700m horizontally along the plane of the fault and 300m vertically along the fault plane. However, given the typical high horizontal compressive stresses in the Southern Coalfield acting to close fault planes, and the overlying stress, the quantities of water that could flow from the Reservoir to the mine via this route are likely to be negligible.

At the time of mining the Bulli Seam from this area (commencement end of LW6) a marginal zone around the FSL of the Reservoir, which was approximately 80m wide, was delineated within which the extraction of pillars was not allowed. The closest LW6 comes to the

Reservoir to the southwest, is 360m horizontally and 280m vertically. Between LW6 and the Reservoir is a 40m wide Colliery boundary. This barrier between Collieries has the effect of reducing the size of Bulli Seam goaf areas and hence the height of depressurisation (height of connective cracking). Given the depth and distance of the Reservoir from the commencement end of LW6, direct connective cracking from the mine to the Reservoir is deemed to have a very low probability of occurring. Hence, it is considered highly unlikely that quantities of water greater than 1ML/day could flow from the Reservoir to the mine via this route.

The Bulgo Sandstone lies just below the Reservoir in the area of the confluence of Cataract Creek and Cataract River. There is the potential for a seepage path to develop along the Bulgo Sandstone to the top of the fracture zone, a distance of 360m for LW6 and then down to the mine. Height of depressurisation where Bulli and Wongawilli Seams have been extracted is estimated to be 222m (SCT WCRV4209).

The Geology Report for Wonga East (Figure 12) shows the interburden from the Bulli Seam to the top of the Bulgo Sandstone to be approximately 230m and from Wongawilli Seam to top of Bulgo Sandstone to be approximately 260m. At the base of the Bulgo Sandstone is the Stanwell Park Claystone (SPC) approximately 100m above the Bulli Seam. So the height of depressurisation, for the combined seams (at 222m) would be above the Stanwell Park Claystone (an aquitard). While the height of depressurisation above the Bulli Seam extraction only (at 60m, SCT WCRV4209), could be below the Stanwell Park Claystone.

The DSC has been monitoring water make in a mine in the Southern Coalfield in a setting similar to that of Wonga East for over 10 years. The mine extracted two longwalls that were 240m wide within the Wongawilli Seam, which were partly overlain by Bulli Seam workings close to the escarpment. The Bulli Seam workings extended below the Reservoir. In both Mines the longwalls lie between two arms of a Reservoir below a ridge line. The longwalls were separated from the reservoir by a distance equal to an angle of draw of 35° plus ½ depth of cover. In the case of this other Mine the Reservoir floor was in the Stanwell Park Claystone (SPC) and the Scarborough Sandstone where the SPC was eroded. Inflows to these longwalls reached a maximum of 1.5ML/day during mining and have averaged 0.35ML/day over the last 3 years. To date there have been no indications of Reservoir water entering the mine. These numbers compare favourably with the Groundwater Model (App. C GeoTerra) which predicted a maximum inflow to the mine following extraction of LWs 2 & 3 of 1.7ML/day.

According to Wollongong Coal, predictions for total water make from the entire mine (including Wonga West pump out), only 0.6ML/day is added to predictions for Wonga East water make. The assumption then is that only small amounts of water are entering the remaining Bulli Seam workings. This includes the extracted Bulli Seam workings to the southwest of LW6. Therefore the height of depressurisation above the Bulli Seam appears to be below the Stanwell Park Claystone (i.e. less than 100m, as water make is minimal).

Any flow from the Reservoir would be controlled by the in-situ permeability of the Bulgo Sandstone. The Mine's groundwater model included a sensitivity study by increasing horizontal permeability in strata above the Bulli Seam (including the Bulgo Sandstone), the modelling results of which did not exceed 0.06ML/day of surface water reporting to the mine. Consequently loss of storage to the mine in excess of the DSC's limit of tolerability of 1ML/day is considered highly unlikely by this seepage path in the Bulgo Sandstone.

The DSC has no concerns with the extraction of all of LW6 within the Notification Area and has indeed already recommended the extraction of the first 365m of LW6 be approved within the Notification Area

C2. LW7

Russell Vale Colliery proposes to mine LW7 through the projected line of the Corrimal Fault in the assumption that it is absent. If indeed the Corrimal Fault is absent from LW7, the DSC has no concerns with the extraction of LW7 regarding this fault. If however the Corrimal Fault is intercepted during the development of the maingate in LW7 then it has been demonstrated that the Fault exists and it should be assumed that it continues under the Reservoir unless some evidence to the contrary is produced. Assuming the Corrimal Fault is intersected in MG7, which seems probable, then a hydraulic barrier of solid coal should be left against the fault for protection against ingress. The Dams Safety Committee has previously used a maximum hydraulic gradient of 5 for design of long term stable hydraulic barriers. The maximum depth of cover of 315m at LW7 equates to a $\geq 63\text{m}$ pillar of solid coal being left in place, offset from the structure.

The DSC notes comments by SCT (WCRV4263) and Galvin and Associates (letter, 3/3/15) concerning instability of pillars between LW7 and the Reservoir. SCT discusses the likelihood of Bulli Seam extraction in this area reducing the effectiveness of the horizontal barrier to control leakage from the Reservoir. SCT's view is that the effectiveness of the barrier will not be reduced. Prof. Galvin acknowledges the discourse by Dr. Mills in the SCT report about the possible instability of the pillars and SCT's associated view that this does not appear to be a serious concern. However, Prof. Galvin suggests that the possibility of pillar instability in this area warrants more assessment.

Given the depth of cover to the Bulli Seam below FSL (280m) and the low level of subsidence possible if Bulli Seam pillars failed, it is highly unlikely that connective cracking would result and therefore a hydraulic pathway between the mine workings and the Reservoir has a very low likelihood of occurring. However, it is noted that a definitive study/assessment has not been undertaken.

The horizontal distance from the Reservoir to LW7 is approximately 200m. Assuming the longwall is overlain by Bulli Seam extraction, then the height of depressurisation above the Wongawilli Seam is 222m (SCT Assessment of Groundwater Data for Russell Vale Colliery, WCRV4209). This means that connective cracking above the longwall goaf extends into the Bulgo Sandstone.

In a similar situation to LW6, water from the Reservoir would need to travel through intact Bulgo Sandstone from below the FSL to reach the depressurised zone above the Wongawilli goaf. Wollongong Coal has installed 3 boreholes, between the Reservoir and the end of LW7 to monitor changes in Bulgo and Hawkesbury Sandstones groundwater. Wollongong Coal is in the process of installing other monitored boreholes to increase the understanding of the groundwater behaviour in this area. The data from these boreholes should be used to update the groundwater model on a regular basis and check the predictive reliability of the model.

The Mine's groundwater model included a sensitivity study by increasing horizontal permeability in strata above the Bulli Seam (includes Bulgo Sandstone), the modelling results of which did not exceed 0.06ML/day of surface water reporting to the mine. Consequently loss of storage to the mine in excess of the DSC's limit of tolerability of 1ML/day is considered highly unlikely if the Corrimal Fault is not present in LW7.

Given the uncertainty that still exists concerning the presence of the Corrimal Fault beyond LW6, the DSC is not yet in a position to recommend that the full extraction of LW7 be approved. The presence or absence of the Corrimal Fault will be proved by the development of MG7 first workings. If the Fault is intercepted then the DSC will not recommend approval of the western end of LW7 and will request that the longwall be set back from the Fault.

C3. LW9-11

SCT (WCRV4209) postulates that horizontal shear planes at the level of the base of the Reservoir connect borehole NRE-D to the Reservoir. NRE-D is located 540m from the Reservoir.

NRE-D is located just to the north of LW11. Longwalls 9, 10 & 11 are on the northern side of dyke D8 which separates these longwalls from the Cataract Creek arm of the Reservoir. Wollongong Coal has stated that intersections of D8 underground are dry and therefore it does not act as a conduit for water to flow from the surface to the mine. Given its impermeable nature, it would be anticipated that D8 would also act to separate the groundwater to the north and south of its location. So the lateral connectivity shown between the Reservoir and NRE-D may not be the case to the south of D8.

Boreholes to monitor the groundwater above and below the level of the floor of the Reservoir should be established between LWs 9-11 and the Reservoir. These boreholes should be used to investigate the permeability of the strata below the floor of the Reservoir to determine the potential for flow along this plan.

From Figures 8 & 10 of the Geology report, (Appendix K) the interburden from Bulli Seam to Wongawilli Seam in the area of LWs 9-11 is 32m to 33m and the depth of cover to the Bulli Seam below the Reservoir is 285m. Consequently depth of the Wongawilli Seam below the

Reservoir is 317m. Given the prediction for height of depressurisation above Wongawilli Seam longwalls overlain by Bulli Seam extraction is 222m, then a vertical distance of 95m of Bulgo Sandstone separates the height of depressurisation from the shear plane at the base of the Reservoir. Minimum distances of LWs from the FSL are: LW9 @ 200m; LW10 @ 500m and LW11 @ 400m.

LW9 abuts dyke D8 which separates it from the Cataract Creek arm of the Reservoir. Similar to the recommendation for the Corrimal Fault, a hydraulic barrier of solid coal should be left against the dyke. For a hydraulic gradient of 5, at a maximum depth of cover of 317m, this equates to a barrier of solid coal against the dyke of $\geq 63\text{m}$.

The DSC is not in a position to yet recommend that the extraction of LWs 9-11 be approved. It awaits the results from ongoing groundwater monitoring and roadway development north of dyke D8.

D. CONTINGENCY AND CLOSURE PLANS

Given the severity of the consequences of the mine workings connecting to the Reservoir, Closure and Contingency Plans need to be developed before longwall mining commences. Multiple seam operations complicate development of Contingency and Closure Plans considerably for worst case scenarios, in which Reservoir water enters the mine. The presence of three seams being mined and their interconnection via goaves, along the escarpment results in the presence of numerous portals to seal on the escarpment. Possible vertical cracks in the strata close to the escarpment require that the sites for plug installation be set in competent ground away from the escarpment. This results in the requirement to involve old and waste workings which are largely inaccessible, and make seals an expensive and probably unviable solution to containing an inflow.

Wollongong Coal has developed a Contingency Plan that is based on containing the loss from the Reservoir, while the site of the connection is identified and sealed with grout. It is proposed that the mine water is treated to a standard that would allow for its introduction to the Reservoir or to the water supply network in the Illawarra; and thus reducing the net loss from the Reservoir. This treatment option involves a Reverse Osmosis Plant, which has the potential to produce a higher quality product than that currently produced by Sydney Water. This is viewed as a temporary measure while long term grouting solutions are determined.

A plan showing floor contours of the Bulli Seam (figure 2) in Appendix 'D' 'Hydrogeology Specialist Report' depicts the extensive workings in the Bulli Seam to the northwest of the Wonga East area. From this plan it appears that there is a 70m difference in RL between the Bulli Seam outcrop and the area above LWs 6 & 7. Given an interburden between the Bulli and Wongawilli Seams of 30m, this means that water entering the mine and flowing down to the Wongawilli seam will re-emerge in the Bulli Seam before reaching the mine entries and then flow back down dip into the northwest Bulli Seam workings.

The DSC notes issues concerning the possible consequences of ineffective Closure Plans. In other cases previously, the DSC has required that a Closure Plan be developed that involves the placement underground of plugs to seal pathways for water to exit a mine. It is understood in the case of Russell Vale Colliery for the longwalls under consideration that it likely would not be possible to instigate such measures in order to seal the mine against an inrush for the long term. As mentioned above, whilst the DSC considers it to be a low risk (based on the extensive Bulli Seam workings down dip of Wonga East), there has been no quantitative assessment of this risk for the long time frame that the reservoir will be in existence. It is considered that such an assessment is important in ensuring that appropriate and effective Contingency and Closure Plans are in place.

Although the use of Reverse Osmosis Plants is increasingly common at mines located in remote areas, this option for treating mine water has not been undertaken in the Illawarra. For this reason any approval of this mining should require Wollongong Coal to undertake a full feasibility study into this option of a Reverse Osmosis Plant. This should also involve obtaining undertakings from a bulk water supplier or user that they would take the product. Establishing a pilot plant to prove that mine water can be cleaned to a saleable standard would also be important.

The DSC awaits a demonstration that Contingency and Closure Plans would be effective.

E. APPROVAL CONDITIONS

- A program to collect and analyse data and report on the water chemistry of the overlying strata, the water entering the mine and the Reservoir waters.
 - At a minimum, water should be sampled on a monthly basis and analysed for algae, trace element analyses and Tritium isotopes.
 - Sampling borehole sites between the mine workings and the Reservoir should be established, and as much background data as possible be obtained prior to extraction.
 - A means of analysing and assessing the implications of the results from the monitoring needs to be established. This would involve a review team with the authority to commission further studies if needed and to approve changes to the mine plan if it were thought necessary.
- A geological risk assessment as quantitative as possible should be undertaken with emphasis on identifying possible conduits for loss of Reservoir water to the mine or to catchments outside that of the Reservoir's.
 - Hydraulic barriers need to be established against identified structures
- Contingency and Closure Plans need to be in place before LW7 extraction commences and satisfactorily demonstrated that they are effective in mitigating the assessed risks associated with loss of stored waters from the reservoir in both the short and long term.
- A full feasibility of the Contingency Plan concerning the establishment of a Reverse Osmosis Plant needs to be conducted.

- The establishment of boreholes between the Reservoir and LW7, also LWs9 to 11, to monitor groundwater pressure in the Bulgo Sandstone below the level of the thalweg of the Reservoir.
 - Results from the monitoring should be compared to those predicted by the Groundwater Model and the model updated as required
 - The results should be assessed by an independent team whose purpose it is to ensure that the approved mining is occurring as predicted.

References

Hilyard, D., Ziegler, W. and Middleton, H. (2012), "Risk Assessment for Managing Impacts of Mining on Dams. In: Management of Subsidence: State of the Art.", *Proceedings 8th Triennial Conference Management of Subsidence Technological Society*, pp. 185-200.

Reid, P. (2007), "Risk assessment of applications to mine near dams and stored waters. In: Management of Subsidence. A Community Issue.", *Proceedings 7th Triennial Conference Management of Subsidence Technological Society*, University of Wollongong, NSW, pp 165-176.

ANNEXURE 1

The previous submission (2013) by the DSC concerning the proposed mining within the Cataract NA listed 15 issues requiring further investigation. The Mine's responses to the original submission are summarised below (note the Groundwater Model Appendix C GeoTerra, is now available):

SUMMARY of Answers to DSC Concerns

No.		Wollongong Coal (previously NRE) Response
1	The presence of structure in Wonga East Area	A detailed review of the geological structures in the Wonga East Study Area through comparison and analysis of coincident structures on mine plans between the Bulli, Balgownie and Wongawilli Seams has been completed. The surface geology has been reviewed using ground truthing, Lidar topographic data and aerial photography.
2	Absence of Regional Aquitard - Wonga East	Groundwater Potential impacts will be determined based on the outcomes of current ground and surface water remodelling. Outcomes will vary due to the modification of the Wonga East layout and removal of Wonga West from this application.
3	Absence of contingency planning - Wonga East	Contingency and Closure Plans are being developed
4	Location of prominent lineament over northern end of Wonga West longwalls	no longer in project
5	Potential connection between the Reservoir and Lizard Creek	no longer in project

6	the potential for Wonga main roads to intercept structures and intrusions	no longer in project
7	lack of knowledge about distribution and thickness of Bald Hill Claystone - Wonga West	no longer in project
8	the working section height appears variable and no information is provided on the maximum working height of the NRE#1 longwall	detailed geology report is available
9	ongoing subsidence is underestimated and at times ignored	refers to Wonga West area - no longer in project area
10	the potential for reactivating the already extensive local and more distant goaves	This is referring to mining in Wonga West which no longer is a part of the project
11	the potential for loss of reservoir waters via structure	detailed geology report is available and a revised groundwater model is in progress
12	the potential for loss of reservoir waters via change in water pressure	await new groundwater model
13	the hydraulic conductivity used in the model underestimates actual values	await new groundwater model
14	calibration of groundwater model with real results has not be undertaken	await new groundwater model
15	there are constant errors between reports, suggesting that insufficient attention has been paid to detail	is less of an issue with the Preferred Project Report



Office of Environment & Heritage

Date: 28 January 2014
Your reference: MP 09_0013
Our reference: DOC15/12812
Contact: Calvin Houlison
4224 4179

Naomi Cleaves
Planning Assessment Commission Secretariat
GPO Box 3415
SYDNEY NSW 2001
E-mail: pac@pac.nsw.gov.au

Dear Naomi

RE: Russell Vale Colliery Underground Expansion Project (MP 09_0013)

Thank you for notifying the Office of Environment and Heritage (OEH) of the Planning Assessment Commission (PAC) public hearing date and providing the opportunity for further comment on the abovementioned proposal. OEH has reviewed the Department of Planning & Environment's (DPE) major project Assessment Report and draft consolidated consent conditions. Detailed comments on the content of the assessment are provided at Attachment 1.

OEH's previous submissions have stated that the proposed modification should adhere to the "avoid, mitigate, offset" hierarchy for offsetting a project's impact upon biodiversity values. In particular, any required offset strategy should have regard to the six principles established under the NSW Government Biodiversity Offsets Policy for Major Projects (the offset policy), which commenced on 1 October 2014.

In light of the above, we have reviewed the Major Project Assessment and draft Project Approval conditions and raise the following issues:

- The proposed mine plan for the Russell Vale Underground Expansion Project will undermine all or part of nine threatened coastal upland swamps, three of which support populations of the threatened giant dragonfly, as well as impacting on creeks and aquifers in the Metropolitan Special Area. It is likely that that this layout will have significant impacts on seven upland swamps, including two with giant dragonfly populations, and may result in connective fracturing between the surface and the mine, resulting in water loss from the drinking water catchment.
- OEH recommends that the mine plan be further modified to avoid or reduce impacts to threatened ecological communities, threatened species and water resources. If the proposed mine layout is approved, OEH considers that the company should identify and secure appropriate offsets for impacts that are predicted to result in the loss of the shallow groundwater aquifers that support these water dependent species and communities.
- It is unclear whether adequate consideration has been given to floodplain management issues. Particular concerns are associated with the assessment of flood events greater than the 1% Annual Exceedance Probability, water quality impacts and the ability to manage downstream adverse flood impacts to public and private development.

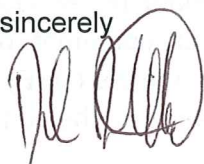
I note that initial advice from the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) indicates that insufficient consideration has been given to subsidence impacts on surface water systems and coastal upland swamps. DPE's Assessment Report also acknowledges that subsidence monitoring during extraction of coal for Longwalls 4/5 forms a limited data set and is not a reliable indicator for predicting subsidence impacts associated with the current proposal.

OEH supports that offsets should be provided for 'greater than negligible' subsidence impacts upon coastal upland swamps, as outlined in the draft conditions. However, the draft conditions do not contain a mechanism for offsets to be committed to or secured. It is important the PAC ensures that consent conditions dealing with offsetting subsidence impacts are enduring, enforceable and auditable.

Noting the timeframe for the PAC's consideration of this proposal, it is suggested that OEH and DPE meet jointly with the PAC soon after the public hearings in early February to discuss how a draft offset framework for coastal upland swamps currently being developed by DPE and OEH may be used in the context of this proposal.

I trust that this advice will assist the PAC in considering the proposed underground expansion project. Please do not hesitate to contact Calvin Houlison, Conservation Planning Officer on (02) 4224 4179 or via e-mail calvin.houlison@environment.nsw.gov.au should you require any further information.

Yours sincerely



28/1/15

DEREK RUTHERFORD
Director, South Branch
Regional Operations

Enclosure – Attachment 1: OEH Detailed Comments on Major Project Assessment, Underground Expansion Project

ATTACHMENT 1 – OEH DETAILED COMMENTS ON MAJOR PROJECT ASSESSMENT – RUSSELL VALE COLLIERY UNDERGROUND EXPANSION PROJECT (MP 09_0013)

A. ECOSYSTEMS AND THREATENED SPECIES

1. Application of the NSW Biodiversity Offset Policy for Major Projects

As noted in the Assessment Report, the NSW Government has recently adopted the *NSW Biodiversity Offset Policy for Major Projects* (the offset policy). The first principle underpinning the offset policy is that before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures.

Avoid

OEH does not consider that removal of the Wonga West domain from the Underground Expansion Project constitutes avoidance of impacts to upland swamps in the longer term. Upland swamps in the Wonga West domain are not protected from future mining applications and are likely to be the subject of a future proposal.

It is acknowledged that Wollongong Coal has made modifications to the project, via re-orientation of longwalls in the Wonga East domain, with the intent of avoiding some impacts to populations of threatened species, upland swamps, creeks and streams. However, despite the modifications, significant impacts are likely to occur as a consequence of the proposed mine plan.

OEH considers that the proposal is likely to cause the loss of seven threatened coastal upland swamps, two of which contain habitat for threatened species. Three of these swamps are identified by Biosis as being of “special significance” (CCUS4, CCUS5, CCUS10). Where large, complex swamps with populations of threatened species are known to exist, the argument to avoid impacts is strong and any proposal that may permanently damage them should be rigorously examined.

Mitigate

Based on experience in Australia and internationally, mitigation via remediation of significant subsidence-related impacts to upland swamps and populations of water-dependent threatened species is not feasible.

Offset

Where all feasible measures have been taken to avoid and minimise impacts, offsets should be used to compensate for remaining impacts. The offset policy aims to provide transparent and certain guidance for proponents and stakeholders through determining biodiversity requirements upfront.

The offset policy applies to major projects, but currently does not provide guidance on impacts of subsidence associated with mining developments. The Assessment Report identifies that DPE and OEH are working to develop an appropriate policy framework for offsetting subsidence impacts to upland swamps and their threatened species. OEH considers that offsets for impacts greater than negligible should be calculated using the Framework for Biodiversity Assessment (FBA) based on predicted impacts and secured (or committed to) under an enforceable and perpetual mechanism prior to the activity commencing.

OEH does not support leaving this step to a post-approval monitoring and management plan, as this will significantly compromise the likelihood of a suitable offset being achieved.

2. Upland Swamps- Potential impacts to swamps

OEH does not agree with the risk assessment for swamps undertaken by Biosis. As stated in our response to the Residual Matter Report, OEH has undertaken its own risk assessment for each swamp based on predicted subsidence levels, Planning Assessment Commission threshold levels for negative environmental consequence (Bulli Seam PAC Report 2010) and previous experience in the Southern Coalfields. For the remaining longwalls to be extracted as part of the current PPP, three swamps (CCUS1, CCUS14 & CRUS1) are assessed to have a low or low to moderate risk of fracturing the bedrock base of the swamp and draining of any perched aquifer. One swamp (CCUS12) is assessed as having a moderate to high risk of such an impact. Seven swamps (CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, BCUS4 and BCUS11) are assessed as having a high risk of impact, which will likely lead to long-term ecological change and loss of the threatened upland swamp vegetation community and the habitat for the Giant Dragonfly.

3. Performance Measures and Offsets

OEH considers that the approval authority should set performance measures for features of significance and triggers for the securing of offsets at the approval stage and does not support this being deferred to a post approval management plan.

DPE states that the need to identify performance measures and/or triggers that lead to offset requirements is a critical outstanding issue for this proposal. Meaningful, measurable and auditable triggers are also required to address the recommendations of the NSW Chief Scientist and Engineer's independent review for 'providing clearly agreed impact definitions at the point of approvals'.

OEH is concerned that the proposed performance measures/triggers for upland swamps have been unsatisfactory in managing subsidence impacts to upland swamps for other mining projects to date. Specifically:

- Erosion of the surface of the swamp. Without baseline mapping or an agreed method, this measure is of little use as a trigger. It is a secondary impact that occurs following the primary impact, which is bedrock fracturing and tilts that result in loss and/or redistribution of shallow groundwater aquifers and destabilisation of swamp sediments.
- Changes in the size of the swamp. A change in the size of a swamp is difficult to detect and may take many years to express itself to a measureable extent. This too is a secondary impact that follows the primary impact, which is loss of shallow groundwater aquifer.
- Changes in the ecosystem functionality of the swamp. This term is not defined in this context and is therefore unmeasurable. OEH would support this measure if it were defined with reference to the key ecosystem process that underpins the function of these water-dependent ecosystems – the presence of a perched shallow groundwater aquifer.
- Change in the composition or distribution of species within the swamp. This ecological impact may take considerable time and robust monitoring to detect and quantify. It is also a secondary impact that follows the primary impact, which is loss of shallow groundwater aquifer.
- Change to the structural integrity of controlling rockbar/s for the swamp. A measurable and potentially remediable measure that should be retained.

OEH considers that these largely undefined and unmeasurable criteria, coupled with either loosely or undefined levels of impact (negligible, significant, minor), will not allow a consent authority to understand whether mining is being undertaken in accordance with the consent and are therefore unlikely to result in

corrective management action being implemented where upland swamps are impacted. OEH considers that the existing TARP for longwall 5 is not suitable in its current form for adoption in the UEP.

Giant Dragonfly

The Giant Dragonfly *Petalura gigantea* (listed as endangered under the Threatened Species Conservation Act 1995) has been recorded in three swamps, all of which are to be undermined and two that are considered to be at high risk of impact. OEH disagrees with Biosis' argument that there is a high risk of changes in water availability impacting the species habitat in the swamps, but that the impact is unlikely to significantly impact the local population. Giant Dragonflies are reliant on waterlogged sediment for their long larval stage and even small changes are likely to render habitat unsuitable. Given that all known sites in the mining area will be undermined and the sensitivity of the species to groundwater changes, OEH considers that a significant impact on the local population is likely and recommend that measures to avoid and minimise the level of impact are undertaken. Any remaining impact on the species should be offset in accordance with the offset policy. A monitoring program should be required in order to assess the impact to the species/population.

4. Surface Water Resources

In the Assessment Report, it is recommended that "*all other watercourses and tributaries are subject to performance measures of no greater impact or environmental consequence than predicted in the EA*". OEH considers that this is not a practical performance measure. Conditions and performance measures should be clearly stated in the consent and reference to other documents such as the EA to determine if impacts are within the approval should not be required.

The aims of the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* focus on water quality rather than quantity. OEH and other agencies and groups have been expressing concerns for several years about the potential for surface to seam connections occurring as a result of longwall mining in the Woronora Plateau that may already be resulting in loss of water quantity from the drinking water catchments to deep storage.

There is published evidence on the potential and actual loss of water from the catchment to mine workings and deep storage within the Southern Coalfields, which points to a loss of surface water in the catchment, some of which is unlikely to return to the reservoir:

- Ziegler and Middleton 2011 – algae in mine and reservoir water
- Heritage Computing 2012 – correlation between rainfall and lagged inflows
- Coffey Geotechnics 2012 – potential complete drainage of aquifers above longwalls.

OEH is concerned that significant cumulative impacts on aquatic habitat and Sydney's drinking water resources may occur before the threat is adequately assessed. The Dams Safety Committee has previously recommended that monitoring to identify connections between the reservoir and mine, including algae and tritium isotopes, be included in mining consents. OEH supports the inclusion of such a condition to contribute to a deeper and more reliable understanding of this issue.

5. Draft Instrument of Approval

Schedule 2, Condition 15 – Updating & Staging Strategies, Plans or Programs

OEH notes that there is a requirement for some plans and programs to be developed in consultation with OEH and other Government agencies with subject matter expertise. However, Condition 15 would permit

the proponent to review or update these documents at any time without consultation or notification with these other agencies. OEH considers that this condition should be removed from the approval.

Schedule 4, Condition 12 - Water Management Plan

The draft consent does not require OEH to be consulted in the development of the Water Management Plan. Given the potential for impacts to the habitat of threatened species, OEH should be consulted.

B. FLOODPLAIN RISK MANAGEMENT

As the Russell Vale Colliery is affected by flooding and has the potential to cause adverse flood impacts downstream, the proposal should be considered in accordance with the NSW Government's Flood Prone Land Policy (Policy) and Floodplain Development Manual, 2005. The PAC should consider and be satisfied that the following matters have been adequately addressed with relation to floodplain management:

- the impact of flooding on the potential development (including overland flow breakouts); and
- the impact of the potential development on flood behaviour (particularly debris and flow impacts) including any management measures to mitigate adverse flood impacts; and
- the impact of flooding on the safety of people (onsite and downstream), including flood hazard on access routes and access requirements in times of flood; and
- the full range of flood events, up to and including the PMF; and
- the environmental risks particularly for floods exceeding the design event on water quality; and
- the implications of climate change (particularly increased rainfall intensity).

From the information available to OEH, it is unclear whether adequate consideration has been given to these issues. Particular concerns are associated with the assessment of flood events greater than the 1% AEP, water quality impacts and the ability to manage downstream adverse flood impacts to public and private development.

As identified in the Combined Catchments of Whartons, Collins and Farrahars Creeks, Bellambi Gully and Bellambi Lake Flood Risk Management Study and Plan (2014), the site may increase already significant downstream flood risk. It is unclear the extent to which the proposed management options would alleviate these risks (primarily raising the stockpile access road, installing a new culvert and connecting flows to the existing swale). Debris control structures and structure maintenance while having the potential to reduce blockage, do not alleviate risks associated with blockage. This is reflected in Wollongong City Councils (WCC) Conduit Blockage Policy (2003), which requires all stormwater pipes less than 6m to be modelled as 100% blocked.

Water quality risks associated with floods exceeding the design event (reported as the 10% AEP) have also not been considered. It is suggested that, given the location and geomorphic nature of the site, any works be consistent with the riparian corridor objectives outlined in WCC Riparian Land Management DCP Chapter E23. This includes accommodating the planting of appropriate endemic riparian species to rehabilitate the natural function of the watercourse, and minimise sedimentation and nutrient transfer to the Tarrahars Lagoon receiving waters.

Given the location of the site, opportunity exists for the proponent to consider options which can reduce downstream flood risk. The Combined Catchments of Whartons, Collins and Farrahars Creeks, Bellambi Gully and Bellambi Lake Flood Risk Management Study and Plan (2014) identifies that upgrading the stormwater control dam into a dual purpose water quality pond/flood retarding basin and including an additional basin to the north has the potential to improve water quality and prevent floodwater from discharging through 22 residential properties, and prevent above-floor inundation from being experienced in

11 residential and 4 commercial properties, during a 100 year ARI flood event. It is suggested that the PAC consult with Wollongong City Council on potential floodplain management options and consistency with Councils floodplain management policy.

Given the above, the PAC may wish to seek additional advice including a risk based flood study considering the full range of floods up to and including the PMF for both blocked and unblocked conduit scenarios to assist informed decision making. This assessment should also include Farrahars Creek Tributary 2 if the watercourse is intended to be diverted under the road (mitigation measure 6) and/or if the northern coal emplacement area is utilised.

APPENDIX 5

GROUNDWATER REVIEW REPORT – DR COLIN MACKIE



NSW Planning and Environment
Planning Assessment Commission
GPO Box 3415
Sydney NSW 2001

22/03/2015

Att. P. Forward, J. Woodward PSM and B. Gilligan

Re: Proposed longwall panels at Russell Vale coal mine – Groundwater Impact Assessment

Further to instructions, I have conducted a review of the reported groundwater impacts associated with the Russell Vale underground mine in the Southern Coalfield. The proponent Wollongong Coal (WC) has prepared a number of assessment documents of which my focus has been on the Preferred Project – Residual Matters Report¹ (PPR-RM). This document provides information relating to the proposed mining operations, design and development of a regional groundwater flow model, simulation of mining operations and quantification of groundwater related impacts. Since the model is the platform from which all impacts have been assessed, I have essentially overviewed the translation from a conceptual groundwater flow model to the numerical model, and undertaken an appraisal of the numerical model. This has included a check of model computer files.

1. Background to groundwater flow modelling

There are essentially two groundwater domains in the Southern Coalfield and in the area of interest:

- ***the surficial (and shallow) systems*** associated with the unconsolidated regolith and swamp lands. These systems tend to act as water stores and sources of surface runoff during periods of high rainfall;
- ***the underlying rock strata*** comprising interbeds of sandstone, siltstone and claystone within the Hawkesbury Sandstone, the underlying Narrabeen Group and the deeper Permian coal measures. These strata can exhibit low to moderate groundwater storage depending upon location and facies.

The Hawkesbury Sandstone is the uppermost unit and hosts the steeply incised valleys common throughout much of the Southern Coalfield. It also hosts the water table or phreatic (zero pore pressure) surface in many elevated areas. However along parts of Cataract Creek, the Hawkesbury Sandstone is completely eroded leaving exposures of Bald Hill Claystone and Bulgo Sandstone to host the water table.

The Permian coal measures comprise interbeds of sandstone, siltstone, claystone and laminite, together with the main coal seams including the Bulli, Balgownie and Wongawilli seams.

Interburden strata generally exhibit low groundwater storage and transmission characteristics.

The water table within the rock strata typically resides at depths varying from zero adjacent to major drainage channels, to more than 50 m in elevated terrain with a geometry broadly reflecting topography. The water table in the shallow systems is often more variable with perching evident in many areas, particularly in upland swamp systems.

The proposed WC mining operations include eight longwalls as shown on the following Figure 1 - LW1 to LW3, LW6 and LW7, and LW9 to LW11 in the Wongawilli seam (longwalls LW4 and LW5 have already been mined). The longwalls are at depths ranging from 250 to more than 385 m (see Figure 2); Table 1 provides a summary of the depths of cover.

¹ See Hansen Bailey, June 2014.

Table 1: Summary of proposed longwall depths

Longwall Panel	Panel Width (m)	Depths of cover (m)
1	131	255-320
2	125	255-330
3	150	250-340
4	150	300-360
5	150	265-345
6	150	270-345
7	131	270-340
9	150	330-380
10	150	335-390
11	150	350-385

Mining has historically been undertaken in the overlying Balgownie and Bulli seams as shown on Figure 1. The floors of these overlying old workings are approximately 20 m (Balgownie seam) and 30 m (Bulli seam) above the floor of the Wongawilli seam. Undoubtedly there is a high level of hydraulic connection between the Balgownie and Bulli seams which is the product of subsidence above the Balgownie seam extraction areas. There will also be a highly connected cracked regime above the Bulli seam where full extraction has historically occurred. Within this subsidence regime, vertical drainage will have been enhanced and a phreatic surface² will have migrated upwards through parts of the overlying Narrabeen Group and feasibly into the Hawkesbury Sandstone. These workings are reported to be relatively dry with localised ponding in places³.

Proposed mining in the lowermost Wongawilli seam will generate a deeper zone of cracking which is expected to yield a highly transmissive connection to the Balgownie seam. Re-activated movement within the overlying subsidence zone is likely to further enhance drainage of the Narrabeen Group and the Hawkesbury Sandstone. Hence the proposed mining operations could be expected to act as a regional groundwater 'sink' both during and for some considerable time after mining operations cease.

Some indication of water make is provided by the inflow arising from the mining of longwall panels 4 and 5 which is reported to be about 1.05 ML/day distributed as follows:

- 0.3ML/day from pre LW4 mining development headings (in the Wongawilli Seam);
- 0.2ML/day for pre LW4 up dip inflow from up gradient adjacent workings in the Bulli and Balgownie Seams;
- 0.1ML/day additional inflow from mining Longwall 4;
- 0.5ML/day from mining Longwall 5.

Longer term (post mining) recovery of strata pore pressures will be constrained by the ability to isolate workings from the entry adits in each of the three seams. This is because the adit portals are located at elevations well below the regional pre-mining water table.

2. The conceptual flow model

The conceptual model prepared by the Proponent's groundwater consultants Geoterra and Groundwater Exploration Services (GES), is summarised in Figure 3. Fundamentally, rainfall and runoff provide inflows to the groundwater system by recharging the shallow regolith and swamp systems. These water stores promote both shallow localised flow domains and vertical infiltration downwards through the variably unsaturated vadose zone and ultimately to the fully saturated zone where a permanent water table resides.

Where mining has extracted coal (full extraction and longwall operations), overlying strata have been subsided. As part of this process, an enhanced fracture flow regime has evolved with strata bed separations providing horizontal conduits for flow and strain induced sub vertical cracking providing vertical connectivity between bed separations. This complex and tortuous fracture regime promotes downwards drainage of strata with flows reporting to goaves, and upwards migration of a phreatic

² Phreatic surface is defined as the interface where pore pressures rapidly change from -ve to +ve (the water table is at zero pore pressure).

³ See Section 8.4, from PPR-RM Appendix C (GeoTerra – GES)

surface. The enhanced flow regime is often characterised by specific zones including detached roof material at the seam extraction level, an overlying highly connected fracture flow regime, a shallower constrained zone where connectivity is quite low and an elastic zone.

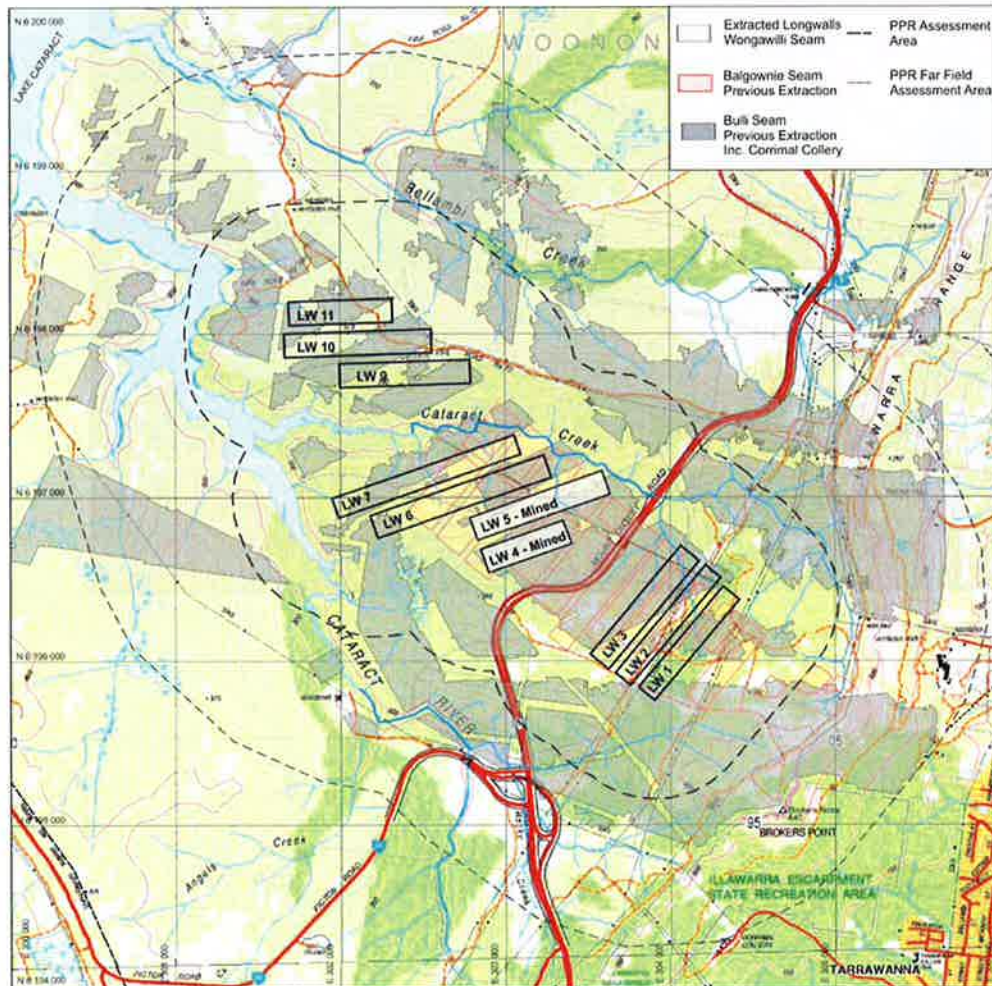


Figure 1: Longwall locations and extent of overlying workings⁴

Prediction of crack occurrence, crack attributes and crack connectivity within the subsidence zone is especially difficult. Empirically based 'rule of thumb methods' are typically based upon longwall width, height and depth of cover while mechanistic methods employ numerical modelling of strata mechanical properties. In the current study, the proponent has utilised an empirical relationship recently published by Tammetta⁵ to predict the maximum height of drainage above the proposed longwall panels.

However this methodology is based on single seam extraction in contrast to the multi seam extraction that will prevail after mining. In order to account for this, the Proponent has modified the thickness of extraction to account for all three seams by simple addition. Application of the Tammetta equation for this increased thickness yields heights of complete drainage that may be close to, or intercept the surface at certain locations.

⁴ Figure from PPR-RM Appendix B (SCT Operations, Figure 11)

⁵ see Tammetta, P., 2012. Ground Water Journal, Vol.

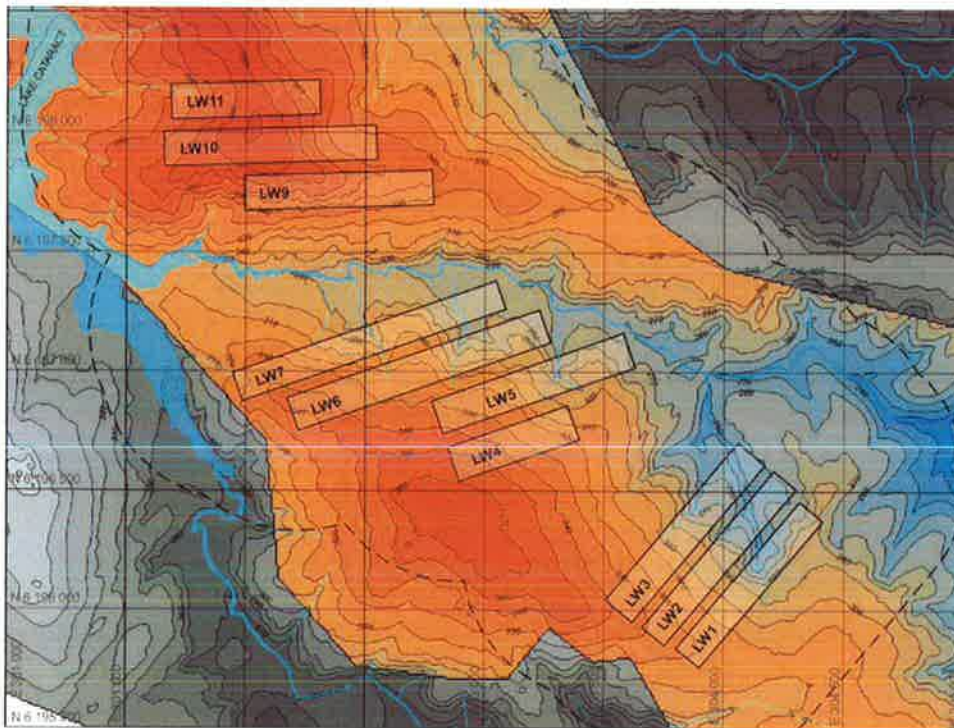


Figure 2: Depth of cover over longwall panels⁶

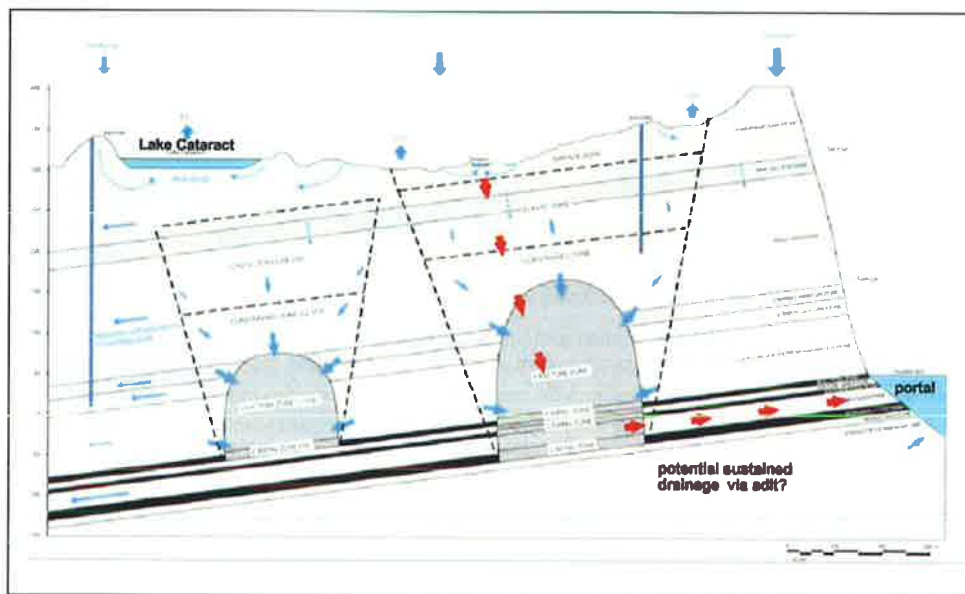


Figure 3: Conceptualisation of surface water and groundwater systems (PPR-RM, Figure 10⁷). Red arrows indicate potential surface to adit leakage pathway.

⁶ Figure from PPR-RM Appendix B (SCT Operations, Figure 10)

⁷ Figure from PPR-RM Appendix C (GeoTerra - GES, Figure 31)

3. Groundwater flow model

There are three stages of numerical modelling that have been undertaken by the Proponent. These include:

1. a pre-mining calibrated model on which the mining process has been imposed;
2. a mining process model representing extraction of the longwall panels;
3. a post mining model that examines the period of pore pressure and water table recovery.

These models do not include the very shallow and surficial systems associated with the regolith, swamps and any perched systems which are acknowledged to be very difficult to characterise (hydraulically) and to represent at an appropriate scale in a groundwater flow model.

3.1 Pre-mining calibrated model

The groundwater model utilises a finite difference based scheme known as Modflow-Surfact and simulates an area of some 392 sq.km. The mesh accommodates 18 layers with cells of differing dimensions across the model. Finer discretisation has been adopted in the horizontal plane in areas around and close to the proposed mining area where 25 x 50 m cell dimensions have been employed. More distant areas host cells with much larger dimension (250 x 250 m). In the vertical plane, the discretisation varies from about 1 m cell thickness where layers pinch out, to more than 300 m thickness in the lowermost layer. Each of the 3 coal seams has been represented by a separate layer.

The model covers a reasonably large area with the extents defined by the coastline in the east, and by surface drainage systems elsewhere.

The Modflow-Surfact code has been employed in the *unsaturated* mode meaning the vadose zone⁸ has been included. This type of simulation presents significant challenges since not only are the standard material properties that govern saturated flow required, but an additional suite of parameters characterising the vadose zone are also required. The standard saturated zone parameters include horizontal and vertical hydraulic conductivity⁹ (Kh, Kv), elastic storage (Ss) and drainable porosity (Sy) while the additional vadose zone parameters include air entry (α), desaturation rate (β), residual saturation (Rs) and an exponent (n) in the defining equations.

The saturated zone hydraulic conductivities have been assessed through local field testing and from reported parameters at other regional coal mines. Tests have included falling/rising head tests, short term pumping tests, packer tests and airlift tests. Laboratory core testing has also been assessed in order to understand the likely lower bound for strata hydraulic conductivities in the absence of fracture enhancement. The overall database for hydraulic conductivities is reasonable.

In contrast to the saturated zone properties, there is no reported reference anywhere in the PPR-RM, to the vadose zone parameters yet they are fundamental to the operation of the model and prediction of the water table elevation. I am not aware of any testing pertaining to the Southern Coalfield that supports the adopted vadose zone parameterisation. Consequently the values are considered to be based entirely on conjecture while the use of the same properties for all strata has no factual basis. In addition the same parameter values (including the drainable porosity) have been assigned to all layers of the model which seems counter-intuitive since there are notable differences in lithologies and in the measured hydraulic properties of different strata under saturated conditions; a sandstone for example, has distinctly different hydraulic properties to a siltstone or claystone.

A pre-mining 'steady state' model has been developed by the proponent and calibrated to piezometric data at five locations. The resulting regional water table predicted by this model has not been provided as a contoured plot in the PPR-RM. This may be related to complexities associated with using the vadose zone option where the water table elevation can only be determined by examining each vertical column of cells throughout the entire model and establishing by interpolation of reported heads at the centroids of each model cell, the elevation of the zero pore pressure surface. Hence accuracy is closely linked to discretisation in the vertical direction.

The only representation of the modelled water table in the PPR-RM is on a number of vertical sections that illustrate pore pressure distributions. Figure 4 shows one such vertical section which illustrates the pre-mining pore pressure distributions. Close inspection suggests unusual water table depressions

⁸ The vadose zone is the variably unsaturated zone above the water table.

⁹ Hydraulic conductivity is sometimes also loosely (and incorrectly) referred to as permeability

(or complete loss of the water table) across parts of the model domain casting significant doubt on the usefulness of the reported model.

The authors of the Modflow-Surfact code attest to the need for high vertical resolution (discretisation) to describe the vertical variation of moisture and to establish the water table elevation for vadose zone modelling. They also attest to the need for very small time steps in order to track the variability of moisture accurately and as such, vadose zone simulations are considered impractical for regional applications like mining assessments. Instead, the use of the 'pseudo soil' option is recommended which negates the need to incorporate the additional four parameters noted above (α , β , R_s , n).

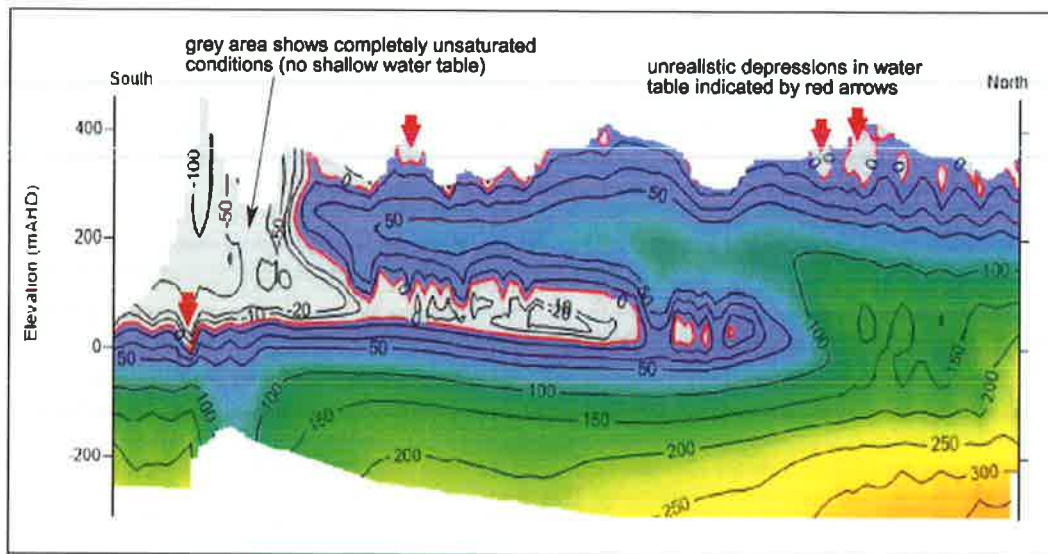


Figure 4: Predicted pre-mining pore pressures on south-north section (E303000)¹⁰

3.2 Mining process transient model

The mining phase model adopts the pre-mining model water table as the starting position. The mining model utilises a so-called 'drain' boundary condition to represent the removal of groundwater from model cells located within the longwall panel areas at a reference elevation which is just above the floor of the Wongawilli seam. Activation times for drain cells representing the panels have been aligned with the planned mining schedule. Simultaneously, the hydraulic conductivities in strata overlying the coal seams, have been enhanced to represent cracked strata associated with the subsidence regime thereby promoting accelerated drainage and depressurisation of overlying strata. This enhancement has been applied from layer 17 up to and including layer 3 of the model.

Mining in the Balgownie and Bulli seams has also utilised drain cells however these cells are activated well before the commencement of mining in the Wongawilli seam and remain activated throughout the period of mining.

Model outputs are provided as a series of drawdown plots and as a number of graphs indicating the predicted groundwater seepage to underground operations.

3.3 Recovery model

The recovery model is an extended transient simulation beyond the end of mining. That is, the model identified in Section 3.2 has been extended for a further 200 years with the drain cells simulating the proposed operations in the Wongawilli seam, removed from the model. Other aspects of the transient simulation like representation of historical mining in the overlying Balgownie and Bulli seams remain the same. Hence drain cells continue to remove groundwater from the model. It is unclear from the information provided, why these cells remain active.

I note that the simulation of recovery as a transient process, while providing an estimate of the rate of recovery, may not provide the best estimate of the 'recovered' water table.

¹⁰Figure from PPR-RM Appendix C (GeoTerra - GES, Figure 37)

Since it is desirable to understand the long term (ultimate) impacts of mining on the regional groundwater systems, a steady state simulation would be useful.

4. Initial questions put to the Proponent

Given the Proponent's adoption of vadose zone simulations and the use of supporting parameters based on conjecture, I prepared a number of preliminary questions seeking clarification on various aspects of the modelling effort from the Proponent (see Attachment 1).

The response to those questions is disconcerting insofar as the modelling reported in the PPR-RM is stated to be 'inappropriate'. Additional simulations have been undertaken by the Proponent using the alternate and more appropriate 'pseudo soil' parameterisation of the groundwater model which negates the need to assign vadose zone parameters. The alternate model output is also more amenable to the assessment of pressure head distributions and drawdowns for impact assessments.

Some impact outcomes have been provided in the response to questions, but there are a number of issues which in my view still need to be addressed. These include:

- Reasoning behind the use of the same value of drainable porosity for all strata in the groundwater model since this parameter significantly influences the evolution of the phreatic surface and mine inflows;
- Discussion of revised model calibrations including presentation of hydrographs showing measured and predicted pressure heads using the 'pseudo soil' option;
- Illustration of model pressure heads (in plan) in the coal seams, Bulgo Sandstone and Hawkesbury Sandstone prior to, during and post mining (50 and 100 years);
- Assessment of the long term steady state groundwater flow systems post mining and identification of shallow and surficial areas that are likely to be dewatered;
- Assessment of potential leakage via the adit and assessment of the role played by the abandoned overlying workings (and their adits) in constraining the recovery of pore pressures;
- Risk assessment associated with potential leakage from Cataract Dam via the proposed panel extractions and adit (see also Galvin & Associates report to the PAC dated 05/03/2015);
- Mitigation measures that might be invoked to minimise impacts.

5. Recommendations

In view of the Proponent's decision to discard the PPR-RM model in favour of an alternate model, I suggest the PPR-RM be amended to include the revised modelling and any additional assessments that might be directed towards resolving the above noted issues.

Yours sincerely

Mackie Environmental Research Pty. Ltd.



C. Mackie

Attachment 1

**QUESTIONS RELATING TO GROUNDWATER IMPACT ASSESSMENTS
RUSSELL VALE PROJECT**

The focus of my review is the groundwater model that underpins all predictions of groundwater related impacts for the project. This type of review necessarily requires checks on the model structure, material properties, boundary conditions and solution convergence error bands.

The modelling process undertaken by the proponent has comprised three stages (1) a pre-mining steady state simulation to generate a pre-mining water table, (2) a simulation of mining, and (3) a post mining transient recovery model.

I have assumed that each of the models supplied to me (as data files) have been assembled in a diligent manner having regard for the layer geometries, material properties distributions, boundary conditions (including operational constraints), iterative solver convergence parameters and volumetric balances.

Questions arising from the review to date are as follows:

Comment 1 - The model data files indicate all simulations have been conducted assuming saturated-unsaturated (vadose zone) flow conditions. Vadose zone modelling normally requires a very high level of discretisation in the model grid with cell dimensions typically being sub metre. Indeed benchmark studies generally have cell dimensions which are sub deci metre (0.1m) in order to determine the water table elevations and associated saturations. The Russell Vale model clearly exceeds these dimensions.

Question 1: What assurance can the proponent give that the model grid is sufficiently discretised to generate estimates of the water table, pressure head distributions and saturations with reasonable accuracy?

Comment 2 - The proponent has directed a considerable effort towards parameterisation of model layers. These parameters include horizontal and vertical hydraulic conductivity (K_h , K_v), elastic storage (S_s) and specific yield (S_y). The model data files indicate all simulations have been conducted using the so called Van Genuchten-Brook Corey parameterisation for the vadose zone which includes a further four parameters - air entry (α), desaturation rate (β), residual saturation (R_s) and Brooks exponent (n). There are no references in the report relating to these parameters yet they are fundamental to model operation and prediction.

Question 2: Can the proponent provide relevant test data in support of the adopted parameterisation for vadose zone flow?

Comment 3 - A check of the model data files indicates the above noted Van Genuchten-Brook parameters are the same value for every model layer ie, $\alpha=0.3$, $\beta=2$, $R_s=0.2$, $n=2$. In addition, the specific yield (S_y) is essentially the same in all layers. This distinctly uniform assignment of properties seems counter intuitive since both the geological conditions and the saturated hydraulic properties (K_v , K_h , S_s) differ from layer to layer.

Question 3: Can the proponent provide an explanation as to why the values are identical across all model layers? Can the proponent also provide an explanation for the adoption of a value of 0.01 for drainable porosity while residual saturation has been assigned a value of 0.2?

Comment 4 - Model layers 1 to 15 have been treated as variably unconfined while model layers 16 through 18 have been installed as strictly confined (the groundwater level remains above the top of the layer). Layer 17 is the Wongawilli seam which is the target seam for extraction.

Question 4: Why is the Wongawilli seam treated as a strictly confined layer when the seam will be dewatered during mining? What are the implications arising from the assignment of strictly confined conditions?

Comment 5 – General head boundary conditions have been employed along the active model perimeter. These conditions support a head/flux relationship that can control depressurisation by introducing or removing groundwater from the model.

Question 5: How were the heads and conductance terms determined for individual cells?

Comment 6 -The fractured zone above goaf was simulated with horizontal hydraulic conductivity enhanced by a factor of two, and vertical conductivity enhanced according to a function which varied the conductivity field within the deformation zone and “weighted” the permeability changes based on layer thickness. Limits for the variability were governed by the predicted fracture height, based on Tammetta (2012) and the pre-determined upper and lower bounds of hydraulic conductivity.

Question 6: Can further explanation be provided in relation to the ‘weighting’ of permeability changes based on layer thickness, and the pre-determined upper and lower bounds of hydraulic conductivity?

Comment 7 – On page 89 of the report it is stated that ‘the adapted Tammetta (2012) method is a conservative assessment of the potential height of depressurisation, and that, although the atmospheric pressure depressurisation zone may extend to surface, that does not mean the vertically connected, enhanced permeability, fractured strata will cause a “full” direct connection of surface waters to the mine workings to the degree where total loss of stream flow or swamp water occurs.’

Question 7: What would be the loss of stream flow or swamp water if not total loss?

Comment 8 – There is no drawing in the report which shows the current (pre mining?) regional water table generated by the groundwater model (in plan).

Question 8: Can the proponent provide such a plot with 10m contour intervals with the regional drainage network also shown? Can the proponent also prepare a water table plot for the end of mining (10m contours) and a difference plot showing impacts on the phreatic surface?

APPENDIX 6
INDEPENDENT EXPERT SCIENTIFIC COMMITTEE ON COAL SEAM GAS AND
LARGE COAL MINING DEVELOPMENT - ADVICE

REQUEST FOR ADVICE

Summary				
Requesting agency/agencies	NSW Planning Assessment Commission			
Project title	Russell Vale Colliery Underground Expansion Project	Proponent	Wollongong Coal Pty Ltd	
Reference no.	EPBC 2014/7268	State	NSW	
Project stage	NSW Department of Planning & Environment has undertaken a preliminary assessment of the project, and it has been provided to the Planning Assessment Commission for a review. The Commission held a Public Hearing (as per the Terms of Reference provided by the Minister for Planning to the Commission) on Tuesday 3 February 2015 in Wollongong. The Commission is considering the issues raised in the submissions to the Commission before finalising the Review Report.			
Timing	The Commission is required under its Terms of Reference for the Review to provide its Review Report to the Department of Planning & Environment, by the 20 March 2015.			
Documentation	Documentation that is included with this request, are: <ul style="list-style-type: none"> • The Commission's Terms of Reference. • The ISEC advice on this project, dated 11 September 2014. • The Proponents response to the ISEC advice, dated 24 November 2014. • Water NSW's (formerly Sydney Catchment Authority) submission to the Department of Planning & Environment dated 28 July 2014. • NSW Dam Safety Committee's submission to the Department of Planning & Environment dated 16 May 2014 (please note that while this submission is regarding the Modification 2 application for part of Longwall 6, the Dam Safety Committee have confirmed that this submission can be considered for the Underground Expansion Project). 			
Description of the proposed project				
Development type	<input type="checkbox"/> Coal Seam Gas	<input type="checkbox"/> Open cut coal mine	<input checked="" type="checkbox"/> Underground coal mine	
	<input type="checkbox"/> Other: (please specify)	Site	<input type="checkbox"/> New	<input checked="" type="checkbox"/> Expansion
Operational life	5 years	Scale	3 Mtpa ROM coal (this is the maximum, most years 1Mtpa ROM coal (proposed total extraction is 4.7Mt)	
Geological basin	Sydney – Southern Coalfields	Coal resource	Wongawilli Coal Seam	
Assessment of impacts to water resources				
Surface water catchment	Cataract Creek and Cataract River	Groundwater basin	Greater Metropolitan Region	
Key water	<ul style="list-style-type: none"> • The coastal upland swamps, creeks and rivers of the catchment area are of 			

related assets	<p>ecological value, as is the Cataract Reservoir, which provides water to the residents of the Illawarra region, and is part of the drinking water supply for greater Sydney.</p> <ul style="list-style-type: none"> • The main water user is the population of greater Sydney. There are a number of underground coal mines within the drinking catchment of greater Sydney who also are considered water users.
Relevant water management policies, regulations or information	<p>Water NSW, the former Sydney Catchment Authority, have a number of concerns regarding the project, including:</p> <ul style="list-style-type: none"> • “Incomplete knowledge of key geological structures known to occur in the area proposed to be mined; • The potential loss of stored waters from Cataract Reservoir to underground mine workings at the upper arm of Cataract Reservoir as a result of mining induced leakage; • The impact on the environment of Cataract Creek and associated tributaries, swamps and dependent ecosystems as a result of the loss of stream flow, reduction in base flows, increased acidification and iron precipitation, and the reduction in shallow water tables affecting swamp vegetation and significant impact to the ‘<i>Special Significance</i>’ upland swamp CCUS4.” <p>Water NSW have a “neutral or beneficial effect on water quality” test for development proposals within the Sydney Drinking Water Catchment, under the State Environmental Planning Policy 2011, and is concerned that this proposal does not have a neutral or beneficial effect on water quality.</p> <p>The NSW Dam Safety Committee which also has a regulatory role with developments within the Cataract Notification Area, are concerned regarding:</p> <ul style="list-style-type: none"> • “The safety of the Dam itself; • Security of the stored waters within the reservoir; • The presence of structure is the Wonga East Area; • Absence of Regional Aquitard; • The working section height appears variable and no information is provided on the maximum working height of the longwall through the faulted zone; • A groundwater model that addresses the possibility of losses from the Reservoir as a result of mining has not been provided; • The potential for loss of Reservoir Waters via Structure.”
Key issues (identified by the requesting agency)	<ul style="list-style-type: none"> • The Planning Assessment Commission’s key concerns are that there is still a number of uncertainties surrounding the surface water and groundwater modelling, and the impact that these uncertainties may have on the catchment, particularly the water quality and quantity, given the Cataract Reservoir is part of the greater Sydney’s water supply. The Commission is seeking advice as to whether some of the uncertainties outlined in the Committee’s advice have been adequately addressed. • The key potential impacts are reduced flows in the creeks and streams flowing into the Cataract Reservoir; possible decrease in water quality within the Cataract Reservoir and loss of water from the coastal upland swamps leading to ecological changes to the upland swamps. • The key potential cumulative impacts related to this project are as above.

Request for Advice

Broadly, do the responses that the proponent has provided to the Committee's advice on questions 7, 8, 9 and 11 (raised by the NSW Department of Planning & Environment and the Commonwealth Department of Environment) provide the Committee with increased confidence in the groundwater and surface water modelling predictions? If not, what additional work would need to be undertaken and demonstrated that would provide the Committee with a satisfactory level of confidence that the modelling predictions are robust and reasonable?



Specifically in relation to Q7. Has the proponent undertaken the sensitivity analysis recommended by the Committee, paragraph 32 d? Has this analysis been undertaken to a suitable standard to provide the Committee with the justification required for the chosen scenario?

Specifically in relation to Q8. Is the Committee satisfied that the concerns raised by the NSW Office of Environment & Heritage regarding the loss of water from the swamps to the Southern Coalfield mines or lower aquifers due to deep connective cracking have been "explicitly assessed by the proponent"? Is the Committee satisfied that the proponent has provided supporting evidence that the re-directed surface flow will re-emerge down gradient within Cataract Creek or directly into Cataract Reservoir?

Specifically in relation to Q9. Has the proponent adequately addressed the Committee's concerns regarding the changes to stream flow highlighted in paragraph 43? If not, what additional information is required to adequately address the Committee's concerns?

Specifically in relation to Q11. Water NSW (formerly the Sydney Catchment Authority) has recommended that mining, within the drinking water catchments, should be setback to be outside the Dam Safety Committee's Dam Notification Area (35° angle of draw from full supply level) with an additional safety margin as shown in the gazetted Dam Notification Area for Cataract Dam.

Given Water NSW's position of no longwall mining within the Dam Notification Area, and the proponent's response to the issues raised in paragraph 61; "the use of 0.7 times depth of cover for the setbacks; the proximity to the multiple overlying historical extraction zones", is the Committee satisfied that the proponent has provided adequate justification for the use of the 0.7 times depth of cover for the setback? Does the Committee have an increased level of confidence that the proposal should not have a significant impact on the stored waters of Cataract Reservoir through connective cracking? Would the Committee still have concerns regarding the connectivity between the stored waters of Cataract Reservoir and the proposed mining, if the Water NSW setback position (i.e. the DSC gazetted dam Notification Area for Contract Dam) was adopted?

Contact information			
Agency contact officer/s	Naomi Cleaves, Senior Planning Officer, Planning Assessment Commission Secretariat, (02) 9383 2105, naomi.cleaves@planning.nsw.gov.au Paula Poon, Director, Planning Assessment Commission Secretariat, (02) 9383 2101, paula.poon@planning.nsw.gov.au		
Approval			
Agency Delegate	Paul Forward, Commission member and Chair of this Commission, Planning Assessment Commission		
Signature		Date	18 February 2015
Agency Delegate	Lynelle Briggs, Commission Chair, Planning Assessment Commission		
Signature		Date	18 February 2015

Advice to decision maker on coal mining project

IESC 2015-065: Russell Vale Colliery Underground Expansion Project

Requesting agency	The New South Wales Planning Assessment Commission
Date of request	18 February 2015
Date request accepted	18 February 2015
Advice stage	Assessment

Context

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) was requested by the New South Wales Planning Assessment Commission to provide advice on the Russell Vale Colliery Underground Expansion Project in New South Wales, proposed by Wollongong Coal Ltd.

The IESC has previously provided advice to the Commonwealth Department of the Environment and the NSW Department of Planning and Environment on the project proposal on 11 September 2014 (see attached), and also to the Commonwealth Department of the Environment on the proposed Russell Vale Longwall 6 Project (23 September 2014). The IESC has been informed that the latter component has been approved by the NSW Planning Assessment Commission and the Commonwealth Department of the Environment.

In response to a request from the NSW Planning Assessment Commission (18 February 2015), this advice considers the proponent's response to the previous IESC advice (11 September 2014). It draws upon relevant aspects of information in the proponent's response to the previous advice, together with the expert deliberations of the IESC. The project documentation and information accessed by the IESC are listed in the source documentation at the end of this advice.

The proposed Russell Vale Colliery Underground Expansion Project (the proposed project) is an extension to the existing Russell Vale Colliery, and is located approximately 8 kilometres north of Wollongong, NSW. The proposed project is located mainly within the catchment of Lake Cataract, a Sydney drinking water reservoir, and also within the Woronora Plateau, a sandstone plateau which is host to Coastal Upland Swamp ecological communities listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposed project will extract a total of up to 4.7 million tonnes of run-of-mine coal over a five year period using longwall mining techniques.

Advice

The IESC's advice, in response to the requesting agency's specific questions, is provided below.

Question 1:

- a) Broadly, do the responses that the proponent has provided to the Committee's advice on questions 7, 8, 9 and 11 (raised by the NSW Department of Planning and Environment and the Commonwealth Department of Environment) provide the Committee with increased confidence in the groundwater and surface water predictions?
- b) If not, what additional work would need to be undertaken and demonstrated that would provide the Committee with a satisfactory level of confidence that the modelling predictions are robust and reasonable?

Response

1. No. As no additional data or analysis has been provided by the proponent the IESC does not have increased confidence in the groundwater and surface water predictions. Broadly, the responses acknowledge that multi-seam mining adds complexity to the system. There is insufficient data in several areas, specifically on extent of fracturing and hydraulic connectivity; it relies on empirical evidence regarding the resilience of swamps and it does not provide sufficient geotechnical and hydrogeological information on high risk areas to address the knowledge deficits identified by the NSW Dam Safety Committee such as faulting and shear planes.
2. Additional geotechnical information and assessment is needed to assess risks, inform modelling and improve confidence in predictions. This may include, but is not limited to: validation of goaf fracturing and depressurisation heights and lateral extent, especially in multi-seam mining areas of the project area; improved conceptualisation of reactivation of fractures associated with previous mining, including of the Bulli Seam; improved delineation of the extent of the Corrimall Fault; improved understanding of extent, re-activation capacity, connectivity and hydraulic properties of bedding shear planes.
3. While noting that current and proposed monitoring activities will improve existing conceptual understanding of groundwater and surface water dynamics, the IESC considers that, in addition to the geotechnical information, the following additional groundwater and surface water work, most of which is identified in the previous advice, would improve confidence that the modelling predictions are robust and reasonable:

Groundwater modelling predictions

- a. Measurement and estimation of surface flows, including baseflow and subsequent inclusion of baseflow measurements as calibration targets in model calibration.
- b. Installation of multiple boreholes to obtain multi-level pressure and hydraulic conductivity estimates, especially in locations directly above and adjacent to longwalls, ideally collecting data prior to, throughout, and post undermining.
- c. Aquifer pumping tests within the upper zone of predicted fracturing to measure hydraulic conductivity and assess connectivity between shallow regional groundwater systems and deeper groundwater systems.
- d. Site-specific studies and hydrological and ecological monitoring, and finer scale models, are needed to characterise the hydrology and ecological requirements of the swamps. This

information could be used to inform ecological conceptualisation and finer scale modelling of swamps using methods such as those described in Commonwealth of Australia (2015).

- e. While acknowledging the difficulties associated with installation of piezometers, the IESC notes that shallow piezometers are commonly installed into bedrock in the vicinity of rivers in the Southern Coalfields (see Merrick 2009). Where installation is feasible, data obtained from shallow multi-level piezometers in the vicinity of Cataract Creek (to ~ 50 m below the level of the creek) would improve understanding of groundwater-surface water interactions and the response of the shallow regional groundwater to mining.
- f. An improved description of the calibration process including: the calibration method/s used; how mine inflows were incorporated as calibration targets and comparison of measured and predicted mine inflows over the calibration period; and representation of calibrated values for host vertical hydraulic conductivity and fracture zone horizontal hydraulic conductivity, which are not displayed in Table 10 (GeoTerra & GES 2014).
- g. Update of the uncertainty analysis considering ranges of vertical hydraulic conductivity and using greater ranges of horizontal hydraulic conductivity representative of the system, not constrained by the calibrated value. This would include an additional description of whether fracture zones were allocated higher hydraulic conductivity values than non-fracture zones in each impacted layer.
- h. A sensitivity analysis of the influence of storage parameters (specific storage and specific yield) on predictions of baseflow and mine inflows, and the model's ability to better match observed amplitude in groundwater pressure fluctuations.

Surface water modelling predictions

- i. Justification for scenarios used to model losses in tributary flow, losses of streamflow in Cataract Creek and losses in catchment yield to Cataract Reservoir is needed. Realistic values from published literature need to be used and models rerun if needed with appropriate sensitivity and uncertainty analysis.
- j. As noted in the previous IESC advice, surface water monitoring data should be collected and provided to support model predictions. This should include:
 - i. Pool height and streamflow from the existing surface water monitoring locations potentially affected by the mining of Longwalls 4 and 5 (LW4 & LW5), particularly the sites overlying LW5 and between Longwalls 5 and 6 (LW6).
 - ii. Provision of data obtained from the recently installed or upgraded monitoring locations at CC3, CC4, CT1, CT1A, CT2, CT3, CT3A, CT4A, and CT4B.
 - iii. Installation of additional monitoring locations in the headwater catchments above Longwalls 1-3 and 9-11. Locations immediately downstream of headwater swamps would be particularly useful.
 - iv. Streamflow data, where possible. The IESC has previously highlighted the need for existing pool height data to be converted to flow. As a minimum the pool storage characteristics and cease to flow height should be determined.
- k. Evidence should be provided to support the proponent's assumption that swamp contribution to streamflow is proportional to its catchment area. Swamps generally have a higher water-holding capacity, and subsequent increased capacity to release water to downstream tributaries over longer periods, than other catchment areas with shallower soils. In doing so,

swamps generally contribute an important component of baseflow during extended dry periods.

Question 2:

- a) Specifically, in relation to Q7. Has the proponent undertaken the sensitivity analysis recommended by the Committee, paragraph 32 d?
- b) Has this analysis been undertaken to a suitable standard to provide the Committee with the justification required for the chosen scenario?

Response

- 4. No, further sensitivity analysis has not been undertaken. Additional justification is still needed as the proponent has not demonstrated the maximum streamflow loss scenario to be applicable to potential surface water losses in Cataract Creek.
- 5. The sensitivity analysis should be informed by a review of existing information relating to streamflow losses caused by subsidence in the Southern Coalfield. This would provide an indication of the potential range of losses in various situations, based on observations, which could then be used to better inform streamflow loss modelling and predictions. The proponent should demonstrate that the scenarios chosen for the sensitivity analysis are applicable to the proposed project through a comparison of:
 - a. Topographic and geomorphic features, including stream order, stream gradient, geomorphology and key assets (e.g. swamps, rock bars, pools). Evidence should also be provided to demonstrate the likelihood of fracturing in the streambed material in Cataract Creek (Bulgo Sandstone / Bald Hill Claystone) compared to the Hawkesbury Sandstone.
 - b. Hydrologic features including catchment area, permanence of flow and significance to catchment yield including downstream water supply.
 - c. Disturbance including existing disturbance / landuse and the relevant subsidence parameters as a result of undermining such as valley closure.
- 6. Streamflow loss scenarios would be further supported by water balances on key features, such as swamps or pools to demonstrate the potential loss of surface flow to groundwater. The most likely mechanisms through which flow will be lost from pools on Cataract Creek are fracturing of rockbars and loss of surface water to groundwater (underflow). The proponent should undertake conceptual and analytical modelling of pools within the proposed project area to determine the potential losses. This assessment should be supported by monitoring data from existing operations at Longwalls 4, 5, & 6. Similar studies have been undertaken by Gilbert & Associates (2009) for generic pool types in the region.

Explanation

- 7. The maximum streamflow loss scenario of 0.5 ML/day is based on the estimated capacity of the induced fracture network in the Hawkesbury Sandstone to transmit underflow from a large pool in Waratah Rivulet (Gilbert & Associates, 2008). Elsewhere, underflow induced by longwall mining in the Southern Coalfield has exceeded 0.5 ML/day. For example Gilbert & Associates (2009) reports that surface flows of 1.23 ML/day were lost along a reach of the Georges River.
- 8. Considerations in the water balance modelling for pools (Gilbert & Associates, 2009), which may be useful for the proponent to consider, include:

- a. The existing hydraulic capacity of the fracture network and its interconnectivity with the stream bed upstream of the pool, the bed of the pool, and its downstream rockbar.
- b. The amount of valley closure and upsidence, the strength of the bedrock, and the orientation characteristics of any pre-existing jointing and bedding planes.
- c. The volume, length, and depth of the pool.
- d. The nature of bed sediment present or moving through the pool reach.
- e. The frequency, regularity, and magnitude of flows entering the pool from the upslope catchment.

Question 3:

- a) Specifically, in relation to Q8. Is the Committee satisfied that the concerns raised by the NSW Office of Environment and Heritage regarding the loss of water from the swamps to the Southern Coalfields mines or lower aquifers due to deep connective cracking have been “explicitly assessed by the proponent”?
- b) Is the Committee satisfied that the proponent has provided supporting evidence that the redirected surface flow will re-emerge down gradient within Cataract Creek or directly into Cataract Reservoir?

Response

9. No. The IESC does not consider that concerns regarding the loss of water from swamps (and streams) to mines or lower aquifers due to deep connective cracking has been explicitly assessed by the proponent. The IESC considers that the loss of any water from swamps due to cracking, regardless of whether it is lost through deep connective cracking to the mine or deeper aquifers, or through shallow cracking and re-emergence downgradient within Cataract Catchment, presents a significant risk to their long term viability.
10. No. The IESC is not satisfied that the proponent has provided supporting evidence that redirected surface flow will re-emerge downgradient within Cataract Creek or directly into Cataract Reservoir.

Explanation

11. In response to Question 8 the proponent in Section 2.37 [Issue 37] (Wollongong Coal Ltd 2014) notes that there is potential for connective cracking though considers that there is no evidence (to date) of connective cracking from the surface to underground mine workings. As evidence the proponent points to low mine water balance and vibrating wire piezometer data at the time of assessment (SCT Operations 2014; GeoTerra & GES 2014) and monitoring data from recently installed bores. The IESC notes that:
 - a. GeoTerra & GES (2014) indicates potential for depressurisation (Figure 34) and fracturing to the surface (Figure 35) where multi-seam extraction occurs beneath swamps and tributaries of Cataract Creek.
 - b. No monitoring piezometers at the time of the assessment were located above longwalls (GW1 is located 190 m east of LW4 and 175 m south of LW5, whilst GW1A is located 280 m east of LW4 and 125 m south east of the LW5 secondary extraction area).
 - c. No monitoring data from recently installed bores has been provided to the IESC for consideration.

- d. The proponent indicates that “improvements to mine inflow monitoring will allow identification of variations in mine inflows (if any) subsequent to significant rain events” suggesting that to date the proponent has not been able to reliably identify variations in mine inflows that may have already occurred.
 - e. Surface water (including overland flow which has yet to reach Cataract Creek or its tributaries) lost to deeper aquifers may still be lost to the Cataract Dam catchment while not connecting directly with the mine. Where cracking occurs from the surface to middle-deeper sections of the groundwater system, but not directly to the mine, it may take years or decades for water to move through the deeper aquifer system, eventually either to the mine or elsewhere in the groundwater system.
12. In response to Question 8, the proponent, in Section 2.39 [Issue 39] (Wollongong Coal Ltd 2014), asserts that there is “no evidence of an increase in the hydraulic gradient overlying Longwalls 4 & 5 following the extraction of Longwall 5...”. The IESC notes that:
- a. GeoTerra & GES (2014, p47) state that: “The relative water levels indicated by each of the piezometers [Note: piezometers in GW1 located 175 m south of LW5] indicates a slight downward gradient, suggesting downward flow into the lower groundwater system and the change in gradient indicates the downwards gradient has increased during the period of mining LW5.” The IESC considers this interpretation of an increased downwards gradient due to mining LW5 is reasonable and likely to extend to and perhaps be further increased, directly above LW5.
13. The proponent provides evidence (Figure 14 GeoTerra & GES 2014) of increased rainfall responses in the shallow regional groundwater system (groundwater pressure measurements in GW1 at 30 m and 45 m depth). This indicates possible increased connectivity to at least this depth which, combined with the increased downwards gradient discussed above (Paragraph 12 a), may result in additional losses of surface water away from Cataract Creek and reservoir to deeper aquifers.

Question 4:

- a) Specifically, in relation to Q9. Has the proponent adequately addressed the Committee’s concerns regarding the changes to stream flow highlighted in paragraph 43?
- b) If not, what additional information is required to adequately address the Committee’s concerns?

Response

14. No. While the IESC better understands the methods used to predict impacts to streamflow in Cataract Creek, the proponent’s response has not adequately addressed the IESC’s concerns regarding the proponent’s prediction of such impacts (highlighted in paragraph 43 of the previous advice). Methods to address these concerns, including a review of existing information to provide observed ranges from the Southern Coalfields and water balance modelling for pools, have been outlined in response to Question 2.
15. On the separation of baseflow and runoff the proponent’s explanation is reasonable. However, the predicted impacts to streamflow from subsidence (WRM, 2014) should be considered in addition to the predicted loss of baseflow from depressurisation (GeoTerra & GES 2014) to determine the total predicted impact to streamflow.

Question 5: Specifically, in relation to Q11. Water NSW (formerly the Sydney Catchment Authority) has recommended that mining, within the drinking water catchments, should be setback to be outside the Dam Safety Committee's Dam Notification Area (35° angle of draw from full supply level) with an additional safety margin as shown in the gazetted Dam Notification Area for the Cataract Dam.

- a) Given Water NSW's position of no longwall mining within the Dam Notification Area, and the proponent's response to the issues raised in paragraph 61; "the use of 0.7 times depth of cover for the setbacks; the proximity to multiple overlying historical extraction zones", is the Committee satisfied that the proponent has provided adequate justification for the use of 0.7 times depth of cover for the setback?
- b) Does the Committee have an increased level of confidence that the proposal should not have a significant impact on the stored waters of Cataract Reservoir through connective cracking?
- c) Would the Committee still have concerns regarding the connectivity between the stored waters of Cataract Reservoir and the proposed mining, if the Water NSW setback position (i.e. the DSC gazetted Dam Notification Area for Cataract Dam) was adopted?

Response

- 16. No. The proponent has not provided adequate justification for the use of 0.7 times depth of cover for the setback.
- 17. No. The IESC does not have increased confidence from the proponent's response that the proposed project would not have a significant impact on the stored waters of Cataract Reservoir through connective cracking.
- 18. Yes. The IESC would still have concerns regarding possible connectivity of the stored waters of Cataract Reservoir and the proposed mining. This concern arises because there are factors other than distance that affect connectivity, for which there is generally limited understanding of their extent and influence. These factors include faults, dykes, topography (i.e. influence of rugged terrain on angle of draw), bedding shear planes and the effects of subsidence and fracturing associated with historical and proposed mining. Additional geotechnical information needed is noted in Paragraph 2.

Explanation

- 19. There is evidence both within the project area and elsewhere in the Southern Coalfields where subsidence impacts have been observed in areas outside the 35° angle of draw (0.7 times the depth of cover).
 - a. SCT (2014, p48) report that cracks extending into the bedrock have occurred on Mt Ousley Road 500 m from the southern end of LW4, where there is an overburden depth of 360 m (equivalent to 54° angle of draw from longwall). STC (2014, p35) indicate that cracking on Mt Ousley Road coincides with goaf edges of previous mining activity in the Bulli and Balgownie Seams and may be the result of reactivating existing subsidence cracks.
 - b. Holla and Barclay (2000) reported that angle of draw in the Southern Coalfields exceeded 35° in approximately 30% of cases, and also noted rugged terrain as an influence on increased angle of draw.
- 20. GeoTerra & GES (2014, pp49-51) indicate that shear planes may extend up to 450 m away from Cataract Creek and the decline in groundwater levels during mining of Longwall 5 was considered to be the result of the reactivation of a possible basal shear plane at or below the level of Cataract Creek. GeoTerra & GES (2014, p68) also indicate a possible hydraulic connection between the

reservoir and the piezometer at location NRE-D (at a distance of 540 m from the reservoir at a depth of 110 m) potentially along a horizontal to sub-horizontal shear plane at a level just below the base of Cataract Reservoir.

21. The potential for impacts outside the 35° angle of draw and for connectivity along shear planes, the lack of measurements of height and lateral extent of fracturing and depressurisation above mined Longwalls 4 and 5, and the uncertainty associated with the extent of Corrimal Fault highlighted by the NSW Dam Safety Committee (2014) and the Sydney Catchment Authority (2014), contribute to a continued level of uncertainty regarding the potential connectivity between the reservoir and the proposed project.

Date of advice	11 March 2015
Source documentation available to the IESC in the formulation of this advice	<p>Gujarat NRE Coking Coal Pty Ltd, 2013. Underground Expansion Project Preferred Project Report including Response to Submissions.</p> <p>NSW Dams Safety Committee, 2014. Environmental Assessment Russell Vale Colliery – Underground Modified Preliminary Project (MP 10_0046 Mod 2). Letter to Major Projects Assessment, Department of Planning and Environment, dated 16 May 2014.</p> <p>Sydney Catchment Authority, 2014. Residual Matters Report Wollongong Coal Russell Vale Colliery, Stage 2 Underground Expansion Project Application No. MP 09-0013. Letter to Manager Mining Projects, Department of Planning and Infrastructure, dated 28 July 2014.</p> <p>Underground Expansion Project Residual Matters Report, June 2014. Hanson Bailey Environmental Consultants.</p> <p>Wollongong Coal Ltd, 2014. Response to advice of the Independent Expert Scientific Committee on the Russell Vale Colliery Underground Expansion Project. Letter to Environmental Assessment and Compliance Division, Department of the Environment, dated 24 November 2014.</p>
References cited within the IESC's advice	<p>Commonwealth of Australia, 2015. Modelling water-related ecological responses to coal seam gas extraction and coal mining, prepared by Auricht Projects and the Commonwealth Scientific and Industrial research Organisation (CSIRO) for the Department of the Environment, Commonwealth of Australia.</p> <p>GeoTerra & GES, 2014. Russell Vale Colliery – Underground Expansion Project, Preferred Project Report, Wonga East Groundwater Assessment. Appendix C, Underground Expansion Project Residual Matters Report, June 2014. Hanson Bailey Environmental Consultants.</p> <p>Gilbert & Associates, 2008. Metropolitan Coal Project – Surface Water Assessment. Report for Helensburgh Coal Pty Ltd. (Appendix C to Metropolitan Coal Project EA)</p> <p>Gilbert & Associates, 2009. Bulli Seam Operations – Surface Water Assessment. Report for Illawarra Coal Holdings Ltd, Milton Qld. (Appendix C to Bulli Seam Operations EA)</p> <p>Holla, L and Barclay, E., 2000. Mine Subsidence in the Southern Coalfield, NSW, Australia. NSW Department of Mineral Resources.</p> <p>Merrick, N., 2009. Bulli Seam Operations Groundwater Assessment. A hydrogeological Assessment in support of the Bulli Seam Operations Environmental Assessment for Illawarra Coal Holdings Pty Ltd. Report HC2009/5, July 2009.</p>

SCT, 2014. Update to Subsidence Assessment of Wollongong Coal Preferred Project Report, Russell Vale No 1 Colliery. Appendix B, Underground Expansion Project Residual Matters Report, June 2014. Hanson Bailey Environmental Consultants.

WRM, 2014. Russell Vale Colliery Wonga East Underground Expansion Project – Surface Water Modelling. Report for Wollongong Coal Limited, Appendix F Underground Expansion Project Residual Matters Report, June 2014. Hanson Bailey Environmental Consultants.

Advice to decision maker on coal mining project

IESC 2014-057: Russell Vale Colliery Underground Expansion Project (MP 09_0013; EPBC 2014/7268)

Requesting agency	The Australian Government Department of the Environment and The New South Wales Department of Planning and Environment
Date of request	12 August 2014
Date request accepted	12 August 2014
Advice stage	Referral (Commonwealth Department of the Environment) Assessment (NSW Department of Planning and Environment)

Context

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) was requested by the Australian Government Department of the Environment and the NSW Department of Planning and Environment to provide advice on the Wollongong Coal Ltd Russell Vale Colliery Underground Expansion Project (the Russell Vale Expansion) in New South Wales.

This advice draws upon information in the Preferred Project Report and Residual Matters Report, together with the expert deliberations of the IESC. The project documentation and information accessed by the IESC are listed in the source documentation at the end of this advice.

The Russell Vale Expansion is proposing to use longwall mining methods to extract up to 4.7 Mt of run-of-mine coal over a five year period, at up to 3 Mtpa. The Russell Vale Expansion is located approximately 8 km north of Wollongong, NSW. The majority of the proposed project area is located within the catchment of Lake Cataract, a Sydney drinking water reservoir and also within a Sydney Catchment Authority Metropolitan Special Area, proclaimed under the NSW *Sydney Water Catchment Management Act 1998*. The proposed project area lies within the Woronora Plateau, a sandstone plateau, which is host to approximately 83% of the estimated 1003 swamps of Coastal Upland Swamp ecological communities listed (17 July 2014) as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Approximately 78% of swamps on the Woronora Plateau are located wholly, or partially, over current mining leases, while approximately 4.7% of swamps on the Woronora Plateau are located within the proposed project area.

On 9 September 2014 the Australian Government Department of the Environment requested separate advice from the IESC in relation to a component of the Russell Vale Expansion Project, being the first 400 metres of Longwall 6, which was referred separately under the EPBC Act (EPBC 2014/7259). As

this is related to the current project but entails further information which needs to be assessed, the IESC's advice on this separate component will be expedited out of session and will be provided as soon as possible.

Key potential impacts

The key potential impacts as a result of the proposed Russell Vale Expansion include:

- Irreversible impacts to the long term viability and ecological integrity of EPBC listed Coastal Upland Swamp (swamp) ecosystems and down gradient ecosystems caused by surface and shallow cracking and subsequent loss of water holding capacity within swamps.
- Impacts to the ecological integrity of instream and riparian ecosystems caused by loss of stream flow and baseflow and increased iron seepages within Cataract Creek.
- Impacts to water storage in Cataract Reservoir caused by loss of stream flow and baseflow in its contributing catchment.
- Impacts to water storage in Cataract Reservoir caused by subsidence induced cracking within a 45 degree angle of influence from the longwall and subsequent potential connectivity and drainage between the Cataract Reservoir and mine workings.

Assessment against information guidelines

The IESC, in line with its Information Guidelines¹, has considered whether the proposed project assessment has used the following:

Relevant data and information: key conclusions

The monitoring of water level, as opposed to flow, in Cataract Creek does not enable the rainfall-runoff model to be calibrated within the subcatchment and reduces confidence in predictions.

There has been reasonable mapping of 39 upland headwater swamps. However, hydrological characterisation of all potentially impacted swamps has not been done and should include field data to inform conceptual understanding of individual swamp hydrology, determination of the distribution of perched water within swamps and all water inputs and outputs.

Application of appropriate methodologies: key conclusions

Methods for predicting subsidence in the assessment by SCT are generally appropriate. However, insufficient consideration has been given to the potential impacts of subsidence on surface water systems and upland swamps. The use of a 0.7 times depth of cover setback as a mitigation measure for protecting water storage within Cataract Reservoir needs to be justified, given the proximity to the multiple overlying extraction zones.

The applicability of the Tammetta model² to the prediction of height of fracturing and depressurisation of multi-seamed mining is not supported by evidence and may underpredict fracturing and increases in hydraulic conductivities. Predictive uncertainty analysis should include consideration of potential effects of increased and variable vertical hydraulic conductivity as a result of mine subsidence. The regional scale groundwater model does not enable prediction of impacts to swamp hydrology at a scale suitable for informing management and mitigation options.

Potential impacts to surface water in Bellambi Gully cannot be assessed as the project assessment documentation does not include an up-to-date water balance or an updated flood study. Also the proposed future mining at Wonga West has the potential to add to the cumulative impacts of mining in this region.

Reasonable values and parameters in calculation: key conclusions

The greatest uncertainties regarding the groundwater model are related to the hydraulic and spatial characteristics of the fracture zone. Calibrated hydraulic conductivity values are only partially reported and those reported for the fracture zones are lower than values measured from other studies within the southern coalfields³ potentially leading to underestimation of drawdown and loss of baseflow. In addition, the value used for evapotranspiration is significantly higher than predicted for the area by the Bureau of Meteorology, leading to potential overestimation of groundwater losses to evapotranspiration from low elevation areas within the model. Scenarios modelled for subsidence-induced surface water losses are not justified and have not been linked to the mechanisms which are likely to cause impacts. As such, there is low confidence in predicted impacts to Cataract Creek and the Reservoir.

Advice

The IESC's advice, in response to the requesting agencies' specific questions is provided below.

The Residual Matters Report for the preferred project has identified a number of risks relating to Coastal Upland Swamps, listed as endangered under the EPBC Act.

Question 1: Do the subsidence, groundwater assessment and surface water assessments, including numerical modelling therein, provide reasonable estimations of the risk (including likelihood, extent and significance) of impacts on overlying and adjacent swamps?

Response

22. The subsidence assessment does not provide a reasonable estimation of the risk of impacts to overlying swamps as it does not take into account potential increased subsidence implications of multiple goaf strata settling after longwall extraction, and possibly underestimates the risks of cracking beneath swamps by using less stringent strain criteria than elsewhere in the Residual Matters Report.
23. The surface water assessment only predicts the area of swamps impacted by subsidence but does not assess the surface water related risks to swamps.
24. The proponent is justified in not including swamps which are known to be disconnected from the regional groundwater system, in the regional scale numerical groundwater model. However, the connectivity of all swamps to the regional groundwater system has not yet been assessed. Swamps whose hydrology is connected to, or influenced by, the regional groundwater system should be included in the regional groundwater model. Where localised perched aquifers are likely to support overlying swamps, finer scale groundwater modelling is necessary to predict the risk of impacts to swamps.

Explanation

Subsidence assessment

25. The proponent's subsidence assessment predicts fracturing of bedrock where tensile and compressive strains are greater than 1-2 mm/m and 2-3 mm/m respectively. The proponent's biodiversity assessment uses the more stringent criteria (>0.5 mm/m and >2 mm/m for tensile and compressive strains) for identification of swamps at risk of negative environmental consequences, such as bedrock cracking, as stated by the NSW Planning Assessment Commission⁴ and referenced in Conservation Advice for Coastal Upland Swamps in the Sydney Basin Bioregion⁵.

Groundwater assessment

26. The regional-scale numerical groundwater model is not constructed to assess the potential risks as a result of subsidence on localised perched aquifers. Where shallow ephemeral perched aquifers within the Hawkesbury Sandstone contribute to the water balance of swamps, there is a risk that surface cracking associated with subsidence will drain perched aquifers and reduce inflows to swamps. All sources of water, including contributions from perched aquifers and potential losses associated with surface cracking need to be considered in the assessment of risk of impacts to swamps. Finer scale models are needed to characterise the hydrology of swamps and quantify likely changes as a result of the proposed project. These models should be informed by detailed site specific studies, and include time series data and predicted changes to runoff within swamp catchments.

Biodiversity assessment

27. The initial risk assessment within the biodiversity assessment used established criteria^{4,5}, which indicated that 14 swamps are likely to experience negative environmental consequences. The final risk assessment potentially underestimates the risks to swamps from cracking by equally weighting risks to perched water and flow accumulation, resulting in the proponent's final ranking of risks as low, where there remains a high likelihood of cracking and tilting. The risks assigned to compressive tilts and strains within the final risk assessment should be considered high where they exceed established criteria^{4,5}.
28. The biodiversity assessment provides reasonable descriptions of swamp locations and ecological characteristics, however, the assessment of perched water within swamps is based on a limited number of piezometers installed in swamps, with only swamp CCUS5 having more than one installed piezometer (two). To better determine ecosystem reliance on perched water, assessment of swamp hydrology should include measurement of the distribution of perched water and soil moisture content using multiple piezometers distributed within each potentially impacted swamp, and within unimpacted control swamps.

Question 2: If not, what is a reasonable assessment of the likelihood, extent and significance of impacts on overlying and adjacent swamps?

Response

29. The likelihood that cracking and tilting will occur to the base of at least 14 swamps within the project area is considered high. While there is limited evidence available on ecological impacts on the Woronora Plateau, research from the Newnes Plateau (NSW) indicates impacts are likely to be severe and irreparable where the ecology is dependent on standing water levels; and where desiccation and induced slope are sufficient to initiate erosion⁶.
30. The hydrological and soil conditions within the swamps provide habitats for an array of threatened flora and fauna communities. Where these threatened species occur, the loss or severe decline of the swamps within the project area would be expected to negatively impact these species⁵.

Explanation

Evidence of previous impacts

31. Impacts to undermined Coastal Upland Swamps in the Sydney Basin are variable and poorly understood. Mining has occurred in the area over many years and impacts to swamps in many

cases are not apparent, however ecological change may occur over decadal timeframes. While a number of studies have assessed impacts to water-holding capacity of swamps, the IESC is not aware of any long term ecological impact studies.

32. Evidence of undermining of Swamp 12 and 15b at the adjacent Dendrobium mine presented in Appendix G of the Residual Matters Report and further evidence at Swamp 1b⁷ indicate loss of perched water and reduction in soil moisture as a result of subsidence. The ecological impacts of these changes are yet to be determined but are likely to lead to ecosystem change over extended time periods.
33. Impacts have been identified in swamp CCUS4 which overlies the proposed longwall 6. These impacts included collapse of the sandstone cliffs and fracturing within sandstone bedrock. Further fracturing has been identified on ridgelines following the extraction of longwalls 4 and 5. Fracturing is predicted to occur within shallow bedrock and may not be visible below surface soil cover within swamps.
34. The Residual Matters Report does not identify any significant impacts to swamp ecology within the project area; however this assessment does not include identification of cracks beneath swamps or a long term assessment of ecosystem change. As noted in the NSW Planning Assessment Commission (2010) report on Bulli Seam Operations “*There are compounding problems in the current lack of ability to detect and quantify all but the most obvious change and the possibility that vegetation compositional changes will take time (possibly decades). However, the bottom line appears to be if mine subsidence has the potential to impact on near surface formations to an extent that could cause changes in the hydrology of a swamp, then the swamp is at risk of serious negative environmental consequences in whole or in part*”⁴.

Subsidence

35. Changes to the slope (through subsidence induced tilt) above the established subsidence criteria^{4,5} are predicted to occur in 14 headwater swamps within the project area. Tilts are predicted to range between 19 and 32 mm/m at various points within these swamps. Tilt is predicted to be most severe where multiple underlying goaves are directly adjacent to multiple underlying chain pillars (for example, between proposed longwalls one to three and between longwall five and proposed longwalls six and seven). In these locations, changes to surface flow regimes are expected to be more severe, and therefore these localities represent a higher risk to headwater swamps.

Perched water

36. Assessment of water level responses within headwater swamps indicates short residence times for perched water within a number of headwater swamps, in some cases possibly indicating impacts due to prior subsidence. The limited number and distribution of piezometers may underestimate reliance of swamp ecosystems on standing water levels and soil moisture levels.
37. Assessment of impacts to a headwater upland swamp at the nearby Dendrobium mine indicates undermining has resulted in impacts to perched aquifer levels, soil moisture levels and flows to the down gradient tributary⁷. A reliable assessment of impacts to perched water levels, soil moisture levels and associated ecological communities needs a robust Before-After Control-Impact study design approach⁸ including assessment of the spatial and temporal distribution of standing water levels and soil moisture within each swamp.

Threatened species

38. The Coastal Upland Swamps provide important habitats for a number of threatened species, including the EPBC listed vulnerable green and gold bell frog (*Litoria aurea*) and giant burrowing

frog (*Heleioporus australiacus*). The red-crowned toadlet (*Pseudophryne australis*), which is listed as vulnerable in NSW, is also known to be present. The ecological community also provides habitat for the NSW listed endangered giant dragonfly (*Petalura gigantea*) which is now uncommon in the coastal regions of NSW⁵. The proponent's biodiversity assessment identified the giant burrowing frog (tadpoles), the red-crowned toadlet, and the giant dragonfly onsite, with suitable habitats for the stuttering frog (*Mixophyes balbus*). Where these threatened species occur, the loss or severe decline of Coastal Upland Swamps within the project area would be expected to negatively impact the reproductive cycle and thus the long term viability of these species.

Question 3: Has the proponent provided strategies to effectively avoid and mitigate, or reduce the likelihood, extent and significance of these impacts?

Response

39. While the proponent has reduced the likelihood of impacts to a number of swamps through a change of the mine plan associated with the Preferred Project Report, the mine plan still proposes to wholly or partially undermine 12 swamps, which the proponent predicts will experience fracturing within shallow bedrock at their base. No other strategies are provided that are likely to effectively avoid or mitigate impacts to swamps.

Explanation

40. The proponent has reduced the likelihood of impacts to a number of swamps through a change of the mine plan associated with the Preferred Project Report that has reduced the number of swamps that will be undermined. The redesign includes moving longwall extraction areas resulting in significantly reduced but still partial undermining of swamps CCUS1, CCUS5 and CCUS10.
41. The Residual Matters Report outlines a Biodiversity Management Plan and associated adaptive management measures. The associated measures involve identifying impacts during and post mining which may provide important information for future mining proposals in this area. However, as they do not include conditions to reduce ground movement and strains below swamps to less than the established criteria^{4,5}, these measures are considered ineffective in avoiding or mitigating impacts to swamps.
42. Triggers outlined in the Trigger Action Response Plan (TARP) for recently mined longwall 5⁹ will not determine swamp reliance on perched water, or mitigate impacts to swamps, because they occur after, not prior, to impacts. Further, the TARP does not require changes to the mine plan or cessation of mining associated with an unacceptable level of impact, therefore limiting its capacity to avoid or mitigate impacts.

Question 4: Are there any strategies available to avoid, mitigate, reduce or remediate the likelihood, extent and significance of these impacts? If so, what are these?

Response

43. The only known strategy to avoid the risk of impacts to swamps is to ensure mining does not cause ground movement and strain in excess of the established criteria^{4,5}. This strategy should also be applied to any ephemeral perched groundwater systems which contribute a significant proportion of a swamp's water balance.
44. The irreversible nature of impacts to swamps in combination with the potential delay before identification of impacts diminishes the likelihood of success of adaptive management measures.

Explanation

45. A recent evaluation of remediation techniques was not able to identify any examples of mitigation or remediation of undermined peat swamps, and in instances where impacts have occurred there have been no signs of self-amelioration in swamps impacted more than 25 years ago⁶.
46. Remediation strategies such as sealing fracture networks of exposed rock in creeks and tributaries have been found to be costly, risky and likely to have a limited lifespan⁶. The successful use of this approach is likely to be limited due to presence of overlying sediments, issues with detection of fracture networks, and potential significant impacts to swamps associated with the remediation process such as clearance of vegetation and swamp substrate to determine extent of cracking.

Question 5: Which, if any, of the strategies does the IESC recommend, and why?

Response

47. Given the variable nature of impacts to swamps and difficulties in their accurate and confident prediction, the most effective strategy to reduce the risk of impact to swamp communities within the proposed project area would be to alter the mine layout such that swamps are not undermined by longwall panels and are not subjected to strains in excess of the established criteria^{4,5}. Further, surface flows that contribute water to swamps should not be disrupted. There is no scientific evidence to demonstrate that remediation activities are able to successfully restore the hydraulic and ecological functions of these ecological communities to pre-impact condition⁶.

Question 6: The Residual Matters Report recognizes the limitations of adaptive management to address potential impacts on individual upland swamps due to the short timeframes to manage longwall retreat. What measures or triggers could be used to minimize impacts and address uncertainty in impact prediction?

Response

48. The only currently known measures to successfully minimise impacts to swamps involve modification of mine layout to prevent stresses greater than established criteria^{4,5}.
49. Adaptive management is not a suitable approach to minimise impacts to swamps due to the irreversible nature of impacts and the potential for long time delays before identification of irreversible ecological impacts.

Explanation

50. Measures to reduce uncertainty in impact prediction include:
 - a. Detailed swamp water balance studies assessing extent and temporal distribution of standing water and soil moisture within swamps, including identification of all water inputs and outputs. Assessment of water sources should consider but not be limited to potential contributions from catchment run-off and seepage from shallow perched groundwater systems.
 - b. The development of long term Before-After Control-Impact studies which enable identification and quantification of cracking and tilting, altered flowpaths and changes to water quality, subsequent erosion and ecological responses of flora and fauna.

Questions 7-12 are in respect to the preferred project's assessment of the impacts of potential groundwater and surface waters and its groundwater and surface water modelling:

Question 7: Are the groundwater and surface water models suitably robust for the quantitative predictions provided?

Response

51. No. The groundwater and surface water models are not suitably robust for the quantitative predictions provided. The key uncertainties regarding the groundwater model are related to the hydraulic and spatial characteristics of the fracture zone and its unsuitability to predict impacts at a scale relevant to swamp hydrology. The key uncertainties with the surface water model include the lack of justification for predicted streamflow loss scenarios, and lack of streamflow data for calibration in Cataract Creek.

Explanation

Groundwater

52. Quantitative predictions made using the regional groundwater model include predictions of drawdown, mine inflow and stream baseflow. There is low confidence in these predictions for the following reasons:
- a. There is a lack of long term calibration data for groundwater pressure, and no calibration data for baseflow and mine inflows resulting in low confidence in the predicted range of baseflow and mine inflow.
 - b. The calibrated hydraulic conductivity values, particularly within the impacted zone, are lower than values measured in other studies within the Southern Coalfields³. Given the low hydraulic conductivity values utilised, the groundwater model potentially underestimates drawdown, including lateral and vertical extent, as well as the quantity of mine inflows induced by the effect of multiple overlying goaves and their associated fracture network.
 - c. The Tammetta Model² used to predict subsidence effects on groundwater pressure and hydraulic conductivity is not supported by evidence from the site. Measurements of groundwater pressure and horizontal and vertical hydraulic conductivity, prior to and post undermining, would improve confidence in model representation of subsidence impacts on groundwater systems.
 - d. The predictive uncertainty analysis is limited in that it does not explore a full range of vertical and horizontal hydraulic conductivities. Confidence in the predictions of this analysis are low due to:
 - i. The limits placed on the range of randomly generated horizontal hydraulic conductivity values whereby values are centred around the calibrated value for each model layer. Uncertainty analysis should enable consideration of the effects of higher horizontal hydraulic conductivity on baseflow and mine inflow.
 - ii. The analysis not including scenarios which consider increased vertical hydraulic conductivity through the profile. Given the high likelihood of increased vertical conductivity above goaves and the potential effect this can have on reducing groundwater pressures and increasing downward flow, uncertainty analysis predictions should consider the potential effect of increased vertical hydraulic conductivity.

Surface water

53. Quantitative predictions made using the surface water model include loss of streamflow to locations along Cataract Creek, complete loss of tributaries to Cataract Creek, and loss of catchment yield to Cataract Reservoir (see paragraphs 82-85). There is low confidence in these predictions as:
- a. The model does not predict the magnitude of actual streamflow losses, or the lengths of streams likely to be impacted by subsidence; rather it assumes a range of streamflow losses, which are not supported by adequate justification.
 - b. There is no link provided between the scenarios and the physical factors influencing streambed fracturing. Predictions of streamflow losses as a result of streambed fracturing should explicitly consider mining-related factors, topographic factors, near-surface geological factors and in-situ stresses.
 - c. Streamflow loss is modelled as a constant value per day up to the total flow. Confidence in predictions would be increased by consideration of the variation of impacts: over time (cracks may develop, then fill with sediment; fracture networks may be flooded, then drain); along the length of the creek (rock bars are more susceptible to cracking, natural pools may drain more rapidly, in other areas subsidence is likely to result in ponding); and under a variety of flow conditions (losses are more likely to be significant in low flows).
 - d. Given the limited justification for the scenarios chosen, a sensitivity analysis is recommended, including: the potential for streamflow losses of greater than 0.5 ML/day to Cataract Creek; more realistic scenarios for loss of tributary flow; and a range of fracturing behaviour, including that the Bald Hill Claystone and Bulgo Sandstone fracture in the same manner as the Hawkesbury Sandstone.
 - e. There is no flow data available for calibration of the model in Cataract Creek (see recommendation in paragraph 67), despite water monitoring in pools along Cataract Creek and Cataract River since September 2009.
 - f. Daily runoff for the Cataract Creek catchment was estimated using Australian Water Balance Model (AWBM) parameters transposed from the Bellambi Creek catchment. There is low confidence in the predictions for Cataract Creek as the Bellambi Creek AWBM rainfall-runoff model:
 - i. Was calibrated with under five years of streamflow data, with significant periods of missing, or questionable data; and
 - ii. Could not replicate a number of cease to flow periods in actual streamflow data for Bellambi Creek (9% of days). The proponent states that this would be consistent with a loss of streamflow to seepage of approximately 0.3 ML/day or due to inaccuracies in the flow data.
 - g. The complete results of verification of the model against available water level data from Cataract Creek were not presented. Presentation of the performance of the model against the full period of measured data at all sites along the creek would improve confidence in predictions.

Question 8: Do the subsidence, groundwater assessment and surface water assessments provide reasonable estimations of likely impacts to water resource, with particular reference to Cataract Creek and the Cataract Reservoir?

Response

54. The subsidence, groundwater assessment and surface water assessment do not provide reasonable estimations of the combined impacts as a result of the Russell Vale Expansion to Cataract Creek and Cataract Reservoir.
- a. The proponent should quantify the potential for impacts to Cataract Creek surface water flow and quality as a result of: impacts to swamps in the headwaters; shallow subsidence effects (see also paragraphs 53, 61 & 64); deep connective cracking; and groundwater drawdown.
 - b. Assessment of impacts to water resources should include potential for impacts to all water related assets and associated ecological communities (see paragraph 66).
 - c. The mitigation measure of a lateral setback of 0.7 times the depth of cover, proposed for protecting Cataract Reservoir, requires further justification (see Question 11 for further explanation). Such a setback might not be adequate to ensure the integrity of Cataract Reservoir.

Explanation

Surface water

Swamps

55. The proponent's surface water assessment compares the relative extent (in hectares) of: swamps likely to be impacted by subsidence; swamps not predicted to be impacted by subsidence; and the remaining catchment areas of Cataract Creek, Cataract River and Bellambi Creek. The assessment has not considered:
- a. The existing contribution of each swamp to streamflow;
 - b. The extent or significance of subsidence impacts to each swamp; or
 - c. The consequential impacts to streamflow, water quality and aquatic ecosystems as a result of subsidence beneath swamps.

Shallow subsidence effects

56. There is a risk to stream flow and connectivity to Cataract Creek and its tributaries as a result of valley closure (up to 650 mm on the third order unnamed tributary above longwalls 1-3). This is likely to result in cracking of the streambed and rock bars and bed delamination, diverting flow beneath the surface and reducing pool capacity.
57. The proponent's assessments disregard the potential for significant changes to the streambed profile. Given the change in stream profile along the length of Cataract Creek, further justification is needed to support the proponent's lack of assessment of bedload transport mechanisms or afflux.

Deep connective cracking

58. The proponent suggests that impacts on surface flow will be minimal, since water lost through surface cracks (up to 15 metres deep) will flow laterally and then re-emerge downstream. The

NSW Office of Environment and Heritage, in its submission on the Preferred Project Report, showed that there is mounting evidence to suggest that water is being lost from upland swamps and streams into Southern Coalfield mines or lower aquifers due to deep connective cracking. Given this evidence and historical mining activity, deep connective cracking and its role in preventing re-emergence of surface flows should be explicitly assessed by the proponent.

Groundwater drawdown

59. The predicted reductions in baseflow to Cataract Creek (0.006-0.03 ML/day) should consider the existing temporal (baseflow is shown to vary substantially between months) and spatial (e.g. groundwater seeps at various locations) variability, which may be masked by presentation of averaged results. In particular, the potential impacts to water related assets as a result of modifying the point that Cataract Creek changes from ephemeral to perennial need to be assessed (see paragraph 66).
60. The proponent assumes that, as a result of groundwater drawdown, redirected surface flow will re-emerge down gradient within Cataract Creek or directly into Cataract Reservoir. This assumption needs to be supported by further evidence (see paragraph 68), as shallow groundwater levels associated with longwalls 4 and 5 indicate an increased downward gradient. If subsurface flows do not re-emerge, actual baseflow losses to Cataract Creek and subsequently Cataract Reservoir may be greater than predicted.

Question 9: The subsidence assessment indicates the likelihood of minor fracturing of creek beds and creek catchments with resultant diversion of stream flow and runoff. Does the Residual Matters Report provide a reasonable estimation of the potential changes in stream flow and runoff volume, and the impacts to water dependent ecosystems? Is there adequate monitoring to enable these impacts to be assessed? What measures or triggers could be used to monitor and minimise impacts into the future?

Response

61. The Residual Matters Report, particularly Appendix F, does not provide a reasonable estimation of impacts to streamflow and runoff volume as a result of subsidence. The resultant impacts on aquatic ecosystems of predicted extended cease to flow periods, or the potential draining of pools, including loss of refugial habitat and stream connectivity, are not assessed.
62. There is inadequate streamflow monitoring to enable future impacts to the flow regime to be assessed. Pool water level data along Cataract Creek and its tributaries has not been converted to flow. Converting to flow would enable characterisation of existing gaining and losing reaches, calibration of the rainfall-runoff model and verification of streamflow impacts due to mining of longwalls 4 and 5.
63. To monitor impacts in future, quantitative flow monitoring should commence and surface water quality monitoring should continue. Visual observations should also include any visible cracking in the vicinity of rock bars as well as signs of erosion or sedimentation where there are changes in stream gradient. To minimise impacts in future, mitigation measures should be applied when triggers are exceeded to avoid, restrict or isolate subsidence impacts on drainage features.

Explanation

Changes to streamflow

64. There is low confidence in the proponent's prediction of impacts to streamflow in Cataract Creek as a result of cracking, streambed fracturing and bed delamination from the Russell Vale Expansion. Predictions include:

- a. No flow in Cataract Creek midstream (monitoring station 5) 21% of the time under the maximum streamflow loss scenario (0.5 ML/day). Whilst the model predicts no cease to flow periods under existing conditions, it predicts the creek at this location could have no flow for up to 78 days per year as a result of the Russell Vale Expansion.
- b. Decrease in median streamflow in Cataract Creek downstream (monitoring station 9) by 0.9 ML/day as a result of the loss of the nine upper tributaries. The largest impact on streamflow is seen with the loss of the third order unnamed tributary 1 overlying longwalls 1-3.
- c. Estimates for impacts to runoff, baseflow and total streamflow. It is unclear how impacts to baseflow and runoff have been separated.

Impacts to ecology

65. Assessment of the likely impacts to water-related assets as a result of changes to flow predicted in Appendix F of the Residual Matters Report has not been undertaken. How the maximum predicted streamflow loss to Cataract Creek may impact on habitat connectivity and the viability of instream and riparian ecosystems is not considered. A decrease or complete loss of flow could remove refugial habitat in pools, would likely further increase iron flocculent in streams and has the potential to isolate fish or reduce ability to feed and distribute eggs as connectivity between pools is lost. The impact on listed frog species has not been considered by the proponent.
66. Further information on water-related assets needs to be provided in the Environmental Management Plan including: pre-mining condition of water related assets; the water regime required to maintain assets; impacts to the assets from Russell Vale Expansion (changes to flow regimes, water quality, habitat, channel morphology and erosion zones with consideration of seasonal variations and extreme events such as floods); monitoring requirements with measurable thresholds and triggers; and options to minimise, mitigate or avoid impacts.

Monitoring

67. Flow monitoring should be undertaken at various locations along Cataract Creek, ideally by developing height-discharge relationships for existing pool monitoring locations. Records of the existing, or subsidence-induced, subsurface or overland diversion of flow along the creek would assist the proponent in providing evidence for the existing behaviour of the stream, so that impacts as a result of the proposed Russell Vale Expansion can be assessed.
68. Installations of additional shallow piezometers along Cataract Creek, as well as the monitoring of streamflow, are needed to provide evidence to support the proponent's assertion that surface flows will re-emerge downstream.

Measures and triggers

69. Stream features particularly prone to subsidence effects should be monitored regularly. The location of all rock bars should be mapped and recorded with photos on a regular basis during mining. Similar attention should be paid to areas where ponding or erosion/sedimentation (indicated by a significant change in stream gradient) are likely.
70. The TARP for longwall 5⁹ does not require changes to mine plan or cessation of undermining associated with an unacceptable level of impact on surface water features, only a requirement to report and undertake remediation works. The effectiveness of remediation measures, such as grouting, has not been proven.
71. Mitigation measures for Cataract Creek are recommended when subsidence, surface water quality or flow triggers are exceeded. Measures should preferentially avoid (stop mining, change

mine layout) or restrict (decrease extraction height, increase pillar width) subsidence impacts on streams.

Question 10: The Residual Matters Report indicates an increase in iron rich seepage in Cataract Creek due to impacts of previous mining subsidence. Does it adequately consider the potential for further increases in iron rich discharges to creeks and the significance of any resulting impacts to water quality and the downstream environment? If not, what is the potential?

Response

72. No, the Residual Matters Report does not adequately consider the potential for further increases in iron rich discharges to creeks or its potential impact to water quality and the downstream environment. Given the high likelihood of further cracking of Cataract Creek and its tributaries and the history of related iron seepages, the potential for increased iron seepages is considered highly likely. This has the potential to impact water quality as well as instream and riparian ecological communities.

Explanation

73. *The Residual Matters Report acknowledges the potential for further increases in iron rich discharges to Cataract Creek and the associated development of large quantities of iron oxidising bacteria to smother eggs of threatened fish*¹⁰. However, the potential for future increases in iron oxides/hydroxides and associated water quality changes in the future has not been quantified, nor has the tolerance of aquatic biota and threatened species to changes in water quality been assessed.

74. Where there is increased subsurface flow and re-emergence resulting from cracking, impacts are likely to include increased salinity, iron, manganese and other metals, cations and anions, combined with depleted oxygen concentrations. Re-emerging water is rapidly oxidised to precipitate iron oxides/hydroxides out of solution and is more concentrated under low flow conditions where baseflow is the major flow component¹¹. Mats of bacteria commonly develop on iron oxides/hydroxides and in doing so can reduce interstitial habitat, available food, oxygen content and can negatively impact macroinvertebrate communities and smother eggs of threatened fish species. These changes have the potential to negatively impact the ecological integrity of instream and riparian systems resulting in loss of plant and animal populations.

75. Threatened fish species present within Cataract Creek include EPBC-listed macquarie perch (*Macquaria australasica*), silver perch (*Bidyanus bidyanus*) and murray cod (*Maccullochella peelii*). An assessment of potential impacts to these species from increased iron seepages and associated mats of bacteria has not been undertaken. Where it is considered possible that threatened fish species will be negatively impacted, monitoring and mitigation measures should be developed.

76. While the EPBC-listed stuttering frog (*Mixophyes balbus*) was not identified in surveys undertaken by the proponent, Cataract Creek is within its range and provides suitable habitat. As this species relies on shallow running water, it is likely to be impacted by the loss of baseflow and increased iron seepages resulting from bedrock fracturing.

Question 11: Is the information provided sufficient to predict any changes to either water quality or water quantity in the Cataract Reservoir which would arise as a result of the mining operations? What are the consequences for stored waters within Cataract Reservoir?

Response

77. The information provided is not sufficient to determine the likelihood of subsidence induced fracturing and potential drainage from Cataract Reservoir outside the proposed mitigation zone of 0.7 times the depth of cover. Considering the significant consequences should potential cracking associated with mining activities occur beneath the reservoir, even low likelihoods of fracturing and drainage equate to considerable overall risks.
78. The information provided is not sufficient to confidently predict changes to water quantity within Cataract Creek and their subsequent impacts on storage within Cataract Reservoir as a result of the proposed mining. Consequences for storage in Cataract Reservoir are presented across a large range, including very significant losses of storage in the upper range, but there is little evidence that predictions are realistic.
79. The information provided is not sufficient to predict changes to water quality in Cataract Reservoir as the proponent has not modelled the likely changes as a result of the proposed project. However based on existing water quality and flow volumes in Cataract Creek the water quality consequences for Cataract Reservoir are not likely to be significant.

Explanation

Water quality

80. Detailed assessment of the effects of potential changes in water quality in Cataract Creek on water quality in Cataract Reservoir has not been undertaken. However, the information provided in the Residual Matters Report indicates the current water quality in Cataract Creek meets Australian drinking water guidelines¹² though occasionally exceeds ANZECC and ARMCANZ¹³ South-east Australia trigger values for total nitrogen and total phosphorus and the trigger values for protection of 95% of aquatic ecosystems for zinc, copper and aluminium.

Water quantity

81. The proponent's primary measure to prevent leakage from the Cataract Reservoir through subsidence induced connective fracturing is through a lateral set back distance between the Cataract Reservoir full supply level and proposed longwalls equal to 0.7 times the depth of cover. This distance is equal to approximately 203 m at the closest point, which correlates to a 35 degree angle of draw. However it is also stated that in several places the presence of overlying historical pillar extraction areas reduces the protection afforded by the set back distance.
82. Further, there is a risk that the 0.7 times depth of cover (35 degree angle of draw) is not an adequate distance to prevent subsidence induced leakage from the Cataract Reservoir where the full supply level extends upwards along Cataract Creek and Cataract River. Evidence from the western coalfield suggests an angle of influence for impact, characterised by deformation of underlying strata, to a maximum of 45 degrees¹⁴. Evidence from the western coalfields aligns closely with observations discussed by Ouyang and Elsworth (1993)¹⁵ who identified a "probable angle of influence" of 42 degrees. In their current proposed layout, a 45 degree angle of influence for impact due to the proposed longwalls would intersect the full supply level of Cataract Reservoir. As a result, there is a risk that subsidence induced fractures will cause connectivity and leakage between the cataract reservoir and mine workings. The use of a 0.7 times depth of cover set back needs to be justified, given its proximity to the multiple overlying historical extraction zones.

83. While the existing mining voids associated with historical underground mining within the proposed project area do not appear to have induced leakage from Cataract Reservoir, the extraction of further underlying coal beneath these historical workings presents a risk of re-mobilisation of the previously collapsed overlying strata. Re-mobilisation and the resulting increased vertical subsidence are potential causes of fracturing which may result in connectivity between the reservoir, historical underground voids and the proposed longwalls. Any fracturing that results in connectivity between the existing Bulli Seam board and pillar voids (shallowest) and the Cataract Reservoir will result in connectivity to the Wongawilli longwalls of the proposed project, as the historical underground voids and the proposed longwalls are hydraulically interconnected through the collapsed goaves.
84. The maximum modelled loss in Cataract Reservoir storage as a result of subsidence impacts from the Russell Vale Expansion ranges from 550 ML (0.5 ML/day loss in yield) to greater than 10 GL (10 ML/day loss in yield). The upper prediction is reported inconsistently in Appendix F of the Residual Matters Report: 10,890 ML in the text (P51); and at least 20,000 ML in Figure 8.2 (P52). However, the reservoir is not modelled to drop below 10% storage under the historical climate record for any scenario.
85. While the range of modelled potential losses of storage in the Cataract Reservoir are significant, there is low confidence in the assumptions made in the modelling and the applicability of model results (see paragraph 53). No justification is provided for the selection of modelled losses in catchment yield. However, given the reported¹⁶ lack of measurable risk to water storage volumes from longwall mining in the Southern Coalfield, these scenarios are likely to be worst-case.

Question 12: Are the questions adequately targeted to the greatest risks of impacts to water resources for the preferred project? If not, what are the greatest foreseeable risks to water resources associated with the project and how could they be mitigated?

Response

86. The greatest immediate risks associated with the project are largely as targeted by the questions:
- a. Impacts to Coastal Upland Swamps and associated communities;
 - b. Impacts to Cataract Creek, its tributaries; and
 - c. Impacts to the integrity of Cataract Reservoir.
87. *However, further risks to water resources are likely to arise from the cumulative impacts of the additional proposed mining at Wonga West, and these should be considered together with the current proposal.*
88. *Further, there are risks associated with mine discharges to Bellambi Gully, due to the increase in mine discharge associated with the proposed project, and a history of flooding at the site.*

Explanation

89. *There is no flood study yet available for the proposed project and the proponent has not evaluated the capacity of the mine water management system to handle revised groundwater inflows or discharge mine-affected water in a manner which enables water quality objectives for the Bellambi Gully to be achieved. A complete assessment of the potential impact of mine-affected discharges on water resources and water related assets as a result of the Russell Vale Expansion is needed. Discharges of water with low pH and elevated concentrations of toxicants including metals are likely to increase risks to aquatic ecosystems and other water related assets.*

90. The Southern Sydney Basin, which includes the Hawkesbury-Nepean subregion, has been identified as a Bioregional Assessment priority region. Data and relevant information from the proposed project should be made accessible to this Bioregional Assessment to assist the knowledge base for regional scale assessments.

Date of advice	11 September 2014
Source documentation available to the IESC in the formulation of this advice	Gujarat NRE Coking Coal Pty Ltd, 2013. Underground Expansion Project Preferred Project Report including Response to Submissions. Underground Expansion Project Residual Matters Report, June 2014. Hanson Bailey Environmental Consultants.
References cited within the IESC's advice	<p>1 Information Guidelines for Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals available at: http://iesc.environment.gov.au/pubs/iesc-information-guidelines.pdf</p> <p>2 Tammetta, P., 2012. Estimation of the Height of Complete Groundwater Drainage Above Mined Longwall Panels. Ground Water. National Groundwater Association</p> <p>3 Reid P. 1996. Effect of mining on permeability of rock strata in the Southern Coalfield. Symposium on Geology in Longwall Mining, 12–13 November, pp 273-280.</p> <p>4 NSW Planning Assessment Commission, 2010. Bulli seam operations. PAC Report. NSW Planning and Assessment Commission, Sydney.</p> <p>5 Threatened Species Scientific Committee, 2014. Environment Protection and Biodiversity Conservation Act 1999 (s266B) Conservation Advice (including listing advice) for Coastal Upland Swamps in the Sydney Basin Bioregion. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=140</p> <p>6 Commonwealth of Australia, 2014a. Temperate Highland Peat Swamps on Sandstone: evaluation of mitigation and remediation techniques, report prepared by the Water Research Laboratory, University of New South Wales, for the Department of the Environment.</p> <p>7 Krogh, M., 2014. Environmental Trust Grant 2011/RD/0028: Hydrology of Upland Swamps on the Woronora Plateau. Progress Report 2. January 2014. Science Division, Office of Environment & Heritage.</p> <p>8 Commonwealth of Australia, 2014b. Temperate Highland Peat Swamps on Sandstone: ecological characteristics, sensitivities to change, and monitoring and reporting techniques, Knowledge report. Prepared by Jacobs SKM, for the Department of the Environment.</p> <p>9 Wollongong Coal Ltd, 2014. Russell Vale Colliery Longwall 5 End of Panel Report, May 2014.</p> <p>10 Jankowski, J., 2007. Impacts of longwall mining on surface water-ground water interaction and changes in chemical composition of creek water. Proceedings of the XXXV IAH Congress: Groundwater and Ecosystems, Lisbon, Portugal, 17-21 September, Ribeiro, Chambel, Condesso de Melo (eds), Published by International Association of Hydrogeologists, ISBN 978-989-95297-3-1</p> <p>11 Jankowski, J., 2007. Changes in Water Quality in a Stream Impacted by Longwall Mining Subsidence. Proceedings of the 7th Triennial Conference on Mine Subsidence, Wollongong, Australia, 26-27 November 2007, Li & Kay (eds) © Published by Mine Subsidence Technological Society, ISBN 978-0-9585779-3-9</p> <p>12 NHMRC and NRMMC, 2011. Australian Drinking Water Guidelines Paper 6 National</p>

Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

13 ANZECC and ARMCANZ, 2000. Australian Guidelines for Water Quality Monitoring and Reporting. National Water Quality Management Strategy (NWQMS). Document 4. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council for Australia and New Zealand, Canberra.

14 Commonwealth of Australia, 2014c. Temperate Highland Peat Swamps on Sandstone: longwall mining engineering design – subsidence prediction, buffer distances and mine design options, report prepared by Coffey Geotechnics for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment.

15 Ouyang, Z., and Elsworth, D. 1993. Evaluation of groundwater flow into mined panels. Int. J.R. Mechs. Min.Sci. & Geomechanics. Abstracts, Volume 30, No.2, p. 71-79.

16 NSW Department of Environment and Climate Change, 2007. Submission on the Strategic Review of the Impacts of Underground Mining in the Southern Coalfield, Department of Environment and Climate Change NSW, 30/07/2007.

APPENDIX 7

SUBSIDENCE REVIEW REPORT – E/PROF JIM GALVIN

Galvin and Associates Pty Ltd

ABN 27 086 258 871

3 March 2015

Ms L Briggs
Chair
Planning Assessment Commission
GPO Box 3415
Sydney NSW 2001

Dear Lynelle

**Subject: Review of Subsidence Aspects Associated with Russell Vale Colliery
Underground Expansion Project**

I refer to your request of 21 January 2015 to provide advice to the Commission on mine subsidence related matters in regard to the above project. As previously advised, I am not in a position to undertake the level of inquiry required to provide comprehensive advice in the given timeframe. In particular, I have not had the opportunity to undertake a full field inspection and to review all relevant documentation in detail.

Nevertheless, after reviewing select documentation provided by the Planning Assessment Commission and meeting on 18 February 2015 with the Commissioners who are reviewing this application, I am able to provide the following overview advice. This advice is premised on the following foundation principles:

- Risk is a combined measure of the likelihood of an event occurring and, should it occur, the consequences that arise.
- There are three aspects to evaluating risk presented by mine subsidence, namely:
 - Effects: The nature of a particular mining-induced ground movements.
 - Impacts: Any physical changes to the fabric of the ground, its surface, or a man-made feature resulting from a subsidence effect.
 - Consequences: Any changes in the amenity, function or risk profile of a natural or man-made feature due to a subsidence impact.

In this matter, a major concern is the potential threat that mine subsidence may present to Sydney's drinking water catchment. This may or may not have merit – I am not yet in a position to offer an opinion, other than that any threat should be able to be managed by selecting an appropriate mine layout once all the risks are fully understood and assessed. This leads to the most important points of my advice, namely, that:

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- The project should be subjected to robust risk assessment in respect of environmental impacts in general, and especially in regard to threats to drinking water.
- The range of impacts that can arise due to mine subsidence and a proper understanding of their consequences requires a multidisciplinary approach to risk assessment.

The material that I have reviewed has a high focus on the *likelihood* that mine subsidence *effects* will fall within a given range. There is a lack of detailed consideration as to the *consequences* should these outcomes be more adverse than predicted.

By way of example, it is predicted that it is very unlikely that water from the Cataract Reservoir will leak into the mine via a geological structure. Putting aside for the moment that the organisations making these types of predictions may not be specialists in the subject matter, there is potential for the consequences of leakage into the Russell Vale Coal Mine workings to be much higher than in the case of other collieries that mine in the vicinity of stored waters. This is because the mine is an adit mine that has its entrance well below the water level of the overlying Cataract Reservoir (and above a residential area). Unlike a shaft entry mine where equilibrium can be restored by allowing the mine to flood to the surface, it is not inconceivable that any major leak could be unstoppable and escalate over time.

Much of the focus on likelihood at this point in time is of a qualitative nature rather than quantitative. There is a considerable reliance on experience and judgements. This may be appropriate for situations where the consequences of an unplanned outcome are not all that serious. However, based on my knowledge and experience, a more quantitative approach is warranted when one is dealing with something as important as Sydney's water supply.

Having said that, it can be difficult to produce meaningful quantitative estimates of likelihood in circumstances such as pertaining to Russell Vale Coal Mine. This makes it all the more important that qualitative assessments are made by those with appropriate knowledge and experience. In my opinion, conclusions relating to critical matters, such as the location and hydraulic properties of geological structures, should involve input from specialist in these areas. Although I have no reason to believe that the predictions in the material I have reviewed are incorrect, I am of the view that the assessment of those matters with high potential consequences warrant more specialist input.

Sound risk assessment provides the platform for identifying hazards in the first instance; devising controls, assessing residual risk; deciding if residual risk levels are acceptable; and, if they are, for developing contingency plans to manage consequences should a threat still materialise. In the case of mine subsidence, the prediction of effects, impacts and consequences requires input and collaboration from a multidisciplinary team.

The Environmental Assessment for the project comprises a number of reports from discipline experts. However, without the benefit of a robust risk assessment, one cannot be sure that mine subsidence impacts and consequences have been fully assessed.

Against this background, I offer the following more specific comments, which should not be regarded as comprehensive:

- There is nothing particularly unusual about multiseam coal mining involving caving of the superincumbent strata. It is practiced extensively throughout the world. Subsidence prediction in multiseam total extraction operations is generally more straight forward and accurate than in single seam operations. There are mines in Australia currently extracting single seams at a mining height up to twice that of the

combined thickness of the three seams in the Russell Vale project area. A higher error in subsidence predictions can be associated with these thicker, single seam operations. The primary limitations to accurate subsidence predictions at Russell Vale Coal Mine are, firstly, the irregular nature of mining conducted up to a century ago in the Bulli Seam and, secondly, the lack of records as to the location and magnitude of the resulting surface subsidence. However, these are not serious limitations because subsidence effects were restricted due to the low mining height in the Bulli Seam.

- Nevertheless, the prediction of subsidence *effects* in the Russell Vale project area is not straightforward. Dr Ken Mills has undertaken this task in a commendable fashion and I am unaware of a better and more accurate approach in the given circumstances.¹
- Professor Hebblewhite's peer review comments have, for the most part, been taken into account in Dr Mills' report.
- The peer review of this type of information before it comes to the PAC represents a step forward and is quite helpful. However, it must be borne in mind that it is primarily a critique of the information provided and is not a rigorous 'gap analysis' to identify what may have been missed in a report.
- Dr Mills' report presents a detailed breakdown of cumulative vertical surface displacements resulting from multiseam mining over a period of around 100 years. However, it does not present cumulative surface strains and tilts. This information would be beneficial for assessing subsidence *impacts* and *consequences*.
- A high reliance has been placed on a 35° angle of draw to the full storage level as a control for preventing Longwall 7 impacting on the security of Cataract Reservoir. This criteria has its origins as a control for limiting vertical surface displacement at a point. That is not the issue in this matter. Rather, the critical issue is the amount of structural disturbance to the rock mass and the potential that this creates for hydraulic connections to the reservoir. These could arise, for example, through horizontal movements which extend beyond the angle of draw. In my opinion, the concept warrants more critical review and assessment as a control.
- An additional concern is that the inbye end of Longwall 7 is located under coal pillars in the Bulli Seam in workings that go right up to the edge of the footprint of the full storage level of Cataract Reservoir. This raises the question of whether extraction of Longwall 7 could initiate a pillar failure that extends beyond the limits of the 35° angle of draw, thus inducing additional ground movement that could extend under the reservoir. This matter is discussed in general terms in Dr Mills' report and, on that basis, does not appear to be a serious concern. However, given that there is potential for impacts to extend up to the edge of the reservoir and under it for a short distance, I consider that it also warrants more detailed discussion and assessment.
- Dr Mills' report does not go into a lot of detail regarding subsidence impacts and consequences. This is understandable and to be expected since specialist knowledge is required in respect of some impacted features, such as groundwater systems, swamps, flora and fauna. This is an important reason for why a multidisciplinary approach is required to assessing risk.
- Based on the material I have reviewed and on the importance of protecting the water catchment, I recommend that the Commission also seek input from a specialist in groundwater when in assessing mine subsidence impacts.

¹ Appendix B of Underground Expansion Project Residual Matters Report. Wollongong Coal Limited. June 2014

- One of a number of reasons for being of this view, is the reliance placed in the EA on a methodology proposed by Tammetta (2013) for calculating the height of groundwater depressurization due to mining induced caving and fracturing. Whilst this methodology may represent an advance in predicting subsidence impacts on groundwater, it is contentious in mine subsidence and groundwater circles. I do not subscribe fully to it. In its submission of 30 July 2014, the (then) Sydney Catchment Authority (SCA) noted that *the uncertainties that the height of depressurization may approach the surface are of great concern*. I have no feel for the extent of concern (consequences) should the height of depressurization reach the surface. However, the information I have reviewed is insufficient to give me confidence that the height of depressurization will not reach the surface. Hence, the importance of considering the consequences in the event that this did occur.
- The SCA also noted in its submission of 30 July 2014 that it was *still of the opinion that there is a likelihood that the Corrimal Fault extends northwest and intersects the confluence of Cataract River and Cataract Creek*. The SCA submission expands on this opinion, noting that *it is concerned that a risk assessment on the potential for hydrologic connect between mine workings and stored waters, as well as surface/groundwater and mine workings has not been carried out*. The SCA's concerns regarding the location of the Corrimal Fault (and other geological features) is rebutted in Wollongong Coal documentation on the basis of past mining experience in other seams at the mine. This is an example of the type of matter that, given the potential consequences of 'getting it wrong', should be subjected to risk assessment. Furthermore, this risk assessment should include input from appropriate specialists, particularly in the structural geology of the Sydney Basin.

In summary:

1. I have no reason to doubt the predictions of subsidence effects and impacts in the material I have reviewed.
2. However, I also have no basis for deciding, firstly, what level of confidence can be placed in all the hazards and required controls having been identified and, secondly and most importantly, what is the level of residual risk.
3. Under many other circumstances, this would be of limited concern because the associated consequences of unplanned outcomes are not severe or long lasting. However, given that one of the potential risks in this case relates to the Sydney water supply (there are also others), a much higher level of risk assessment is required to better establish the level of confidence that can be placed in predictions and the consequences should outcomes be more adverse than predicted.
4. It may be that modification(s) to the mine plan, such as moving the starting point for Longwall 7 further outbye, could constitute a sufficiently robust control as to significantly reduce the scope of further risk assessment.

Should you have any queries arising from this review, please do not hesitate to contact me.

Yours sincerely



Emeritus Professor JM Galvin

Tammetta, P. (2013). Estimation of the Height of Complete Groundwater Drainage Above Mined Longwall Panels. *Groundwater*, 51(5).