Review of McPhillamys Gold Project (SSD 9505): Independent Planning Commission (IPC) public hearing

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I have prepared this report in conformance with the expert witness code of conduct, and I am willing to be bound by it (*Uniform Civil Procedure Rules 2005*).

I have been asked to produce an expert report that addresses the following questions:

Expert opinion sought

16. Within the constraints of the time available, please prepare an expert report that addresses the following:

    a. Please summarise any water quality impacts to arise as a consequence of the Project.
    b. In your opinion, does the Department's Assessment Report and Recommended Conditions of Consent accurately and adequately consider, and respond to, the water quality impacts of the Project?
    c. What, if any concerns do you have about the water quality impacts of the Project, bearing in mind the mitigation measures proposed?
    d. Provide any further observations or opinions which you consider to be relevant.

17. We request that you provide us with a draft of your report for review before finalising it. The purpose of this is not to influence the conclusions or recommendations you make but to ensure that the report is clear and addresses the issues adequately to inform the Minister.

Please summarise any water quality impacts to arise as a consequence of the Project.

I agree with the Department's Assessment Report (DPIE report) that 'surface water quality is a key issue for this project: On page 47 (Section 235) of the report states: **'**Surface water quality: potential impacts associated with any discharges or seepage from the mine site, including the proposed use of cyanide in processing of ore;'
However, I am surprised that the pipeline and transfer of about 13 ML a day of coal industry wastewater was not also mentioned as a key surface water issue. In my view the pipeline transferring 13 ML of coal industry wastewater is a substantial water quality and ecological risk that received very limited attention in any EIS documents (also the Department's Assessment Report ort and the Recommended Conditions of Consent for the Project). I consider the risk of accidental leak, seepage or major discharge from the pipeline is a substantial environmental risk. It is possible that a malfunction of the pipeline causing an accidental leak could cause severe water pollution from any location along the pipeline route. This could cause a major contamination event if the leaking wastewater enters creeks,

rivers and wetlands that are in the vicinity of the pipeline. 13 ML a day of brine generates very larges flow volumes. A discharge from the pipeline for one second would be 150 litres. A short leak or break could have very serious adverse consequences.
The accidental release of contaminated coal industry wastewater and potential impacts was given inadequate detail in any of the Environmental Impact Statement (EIS) or project details.

Assessment of cumulative impacts flawed.
The EIS and the DPIE report (Department's Assessment Report , p47 section 237) both define the drainage catchment potentially affected by this project as the upper Belubula River catchment upstream of Carcoar Dam. This is misleading as the catchment potentially affected, realistically, is the entire Belubula River catchment. This comment is based on water flow and the extent of the downstream discharge plume of potential contamination. As an example, the operation of the Clarence Colliery, near Lithgow, caused water pollution downstream for more than 22 km (Wright et al. 2017). Even based on the modification of Belubula River flow, as detailed in the EIS, the impacts downstream will extend well downstream of Carcoar Dam. The whole catchment perspective would include the existing Cadia Gold and Copper mine. A whole Belubula catchment environmental assessment would include the potential combined environmental impacts of the two mines (the proposed mine and the Cadia mine) which could have overlapping downstream impacts that should have been examined for a more complete assessment of potential /likely cumulative impacts.

On page 107 of the EIS Appendix J Surface Water Assessment, the following statement is made about cumulative mining impacts, in the area of the project:

'There are no other mining developments located in the Carcoar Dam catchment hence there are no cumulative mining impacts expected during operations'

I strongly disagree with this statement.

EPA regulation of surface water pollution unclear and uncertain.
In the water quality assessment of the EIS the guideline used to assess results selected the most harmful level of protection available in the ANZECC water quality guidelines. That is, they selected the '80% species protection'. In my opinion the Belubula River and adjoining lands is a sensitive environment (agriculture, conservation of native flora and fauna, protection of fisheries) that deserves a much higher level of protection.

I recommend that the level of protection should be for 95% of species (ANZECC, 2000). This is the second most stringent level of protection for river biota. The highest level of 99% species protection is appropriate for waterways in National Parks and similar areas of high conservation significance. The 80% level of species protection is

appropriate for highly urbanised or highly industrial waterways. The suggestion in the EIS, the Department's Assessment Report and the Recommended Conditions of Consent that this mine operation will, at some time in the future, develop 'site-specific water objective' is alarming and inappropriate. This implies that they could allow even greater concentrations of ecologically harmful pollutants than are currently recommended at the ANZECC 80% species protection level.

I am very concerned about exactly how the EPA would enforce any future environmental regulation of water quality impacts from the Project. This includes both the mine operations (construction, operation, post mine closure) and also the operation of the brine pipeline from Lithgow. See section 241 of the DPIE report:

> 241. Baseline monitoring results indicate that water quality in the Belubula River typically exceeds the ANZECC water quality objectives (WQO) for electrical conductivity (salinity), nitrogen and phosphorous at most monitoring locations. Exceedances of ANZECC WQO levels of metals including zinc arsenic and cadmium were detected in some samples but less frequent. The EPA agreed with the surface water assessment that site-specific water quality objectives should be used rather than the ANZECC criteria.

This statement implies that the EPA regulation of future water quality aspects of this project will use 'site-specific water quality objectives' that will potentially allow a higher concentration of key pollutants related to this project. It is inappropriate that the exact detail of such 'site-specific water quality objectives' is not available at this stage of the project assessment.

Such lack of detail regarding the water quality objectives that will be used to measure water quality performance for the Project is a major shortcoming. I have concerns that the 'site-specific water quality objectives' will be developed without appropriate scrutiny. I have previously seen 'site-specific water quality objectives' that have been used inappropriately that have enabled polluting industries to generate poor surface water quality with ecologically harmful concentrations of several pollutants, particularly elevated concentrations of heavy-metals. An example of this is the Tahmoor South project (Tahmoor Colliery), an extension of an existing mine. The Tahmoor South EIS derived 'site-specific water quality objectives' in the EIS documents. Due to ongoing pollution that the site-specific water quality objectives failed to recognise, the pollution of the Bargo River from colliery wastes continues. The EPA EPL licence for the colliery (EPL 1389) currently allows serious water pollution (Fleming et al. 2021) but seeks vastly improved waste treatment to actually achieve water quality consistent with ANZECC (2000) guidelines rather than the 'site-specific water quality objectives'.

In the recommended 'Conditions of Consent' there were no details provided on the future EPA EPL licence (EPA pollution licences: Environment Protection Licences 'EPLs') for the mine. Based on the text above (and including section 241 of the DPIE report) it appears possible that the EPA water quality licence will offer very weak protection of Belubula River water quality. This could be through ineffective regulation that allows environmentally hazardous concentrations of pollutants to potentially be mobilised from the mining operation to the Belubula River.

The lack of detail on the range and expected concentrations of pollutants that could be generated by the different facets of the mine operation is also a major oversight in the EIS documents, the DPIE report and also the 'Conditions of Consent'.

> 272. The EPA advised that based on the proposed design there would be minimal risks to the environmental values of receiving waters, and that any residual water pollution risks can be appropriately managed through standard management and mitigation practices and relevant licence conditions.

This statement provides no guidance about what 'appropriately through standard management and mitigation practices and relevant licence conditions' actually means.

Given the lack of detail on the range and concentration of pollutants that might be generated by the Project, I refer the IPC to contaminated seepage from the Sunny Corner Mining Area. This is a derelict mining area, between Bathurst and Lithgow, that included several gold mines and associated metal processing facilities. Most mines closed more than a century ago. As part of previous research project I sampled water from Daylight Creek. This small creek was 1 km downstream from the derelict Sunny Corner gold mines, which continuously release seepage from the mines and associated workings (Wright & Ryan, 2016). Daylight Creek had five metals that were detected at highly dangerous concentrations for aquatic life. The creek water samples were independently tested by a commercial NATA-accredited analytical laboratory. The results from Daylight Creek had the following concentrations (Wright & Ryan, 2016):

1. Lead. 1370 µg/L. This is 145 times higher than the ANZECC (2000) Lead 80% species protection (<9.4 µg/L).
2. Cadmium. 126 µg/L. This is 157 times higher than the ANZECC (2000) Cadmium 80% species protection (<0.8 µg/L).
3. Copper. 1420 µg/L. This is 568 times higher than the ANZECC (2000) Copper 80% species protection (<2.5 µg/L).
4. Nickel. 273 µg/L. This is 16 times higher than the ANZECC (2000) Nickel 80% species protection (<2.5 µg/L).
5. Zinc. 32,600 µg/L. This is 1051 times higher than the ANZECC (2000) Zinc 80% species protection (<2.5 µg/L).

I have quoted these pollutant concentrations as they provide some indication of hazardous contaminants that could potentially be generated by a gold mining operation in the Central West of NSW. I consider it important to consider these details as the EIS and the Departments Assessment Report and the Recommended Conditions of Consent all provided no information on the name and potential concentration of contaminants that may be potentially generated by the project.

Such a lack of information on the range and concentration of pollutants that may be generated by, and accumulate within this proposed mining operation is a major shortcoming for the EIS as it fails to articulate how EPA regulations will protect Belubula River surface water quality from any pollution generated by the Project. My personal experience of 'standard EPA licence conditions for mining activities' (section 272 of Recommended Conditions of Consent) is that the majority of mining Environment Protection Licences 'EPLs' that I have investigated have resulted in poorly regulated water pollution.

In my experience, EPA pollution licences (commonly called Environment Protection Licences 'EPLs') regularly enable substantial water pollution and degradation of river ecosystems by mine operation (Belmer & Wright, 2020). I have investigated mines when pollution from the derelict operations, even decades after the mine has ceased operation, continue to cause water pollution and ecological damage in waterways below the mine. This includes highly metal-contaminated seepage from the Sunny Corners gold mines, that closed about a century earlier (Wright & Ryan, 2016). The Canyon Colliery (Blue Mountains, Grose Valley) continues to release highly metal-contaminated drainage more than20 years after it closed (Wright et al. 2011; Price & Wright, 2016).

Some examples of inadequate EPLs that were used to regulate pollution from mining activity:

Berrima Colliery: Berrima Colliery is a closed underground colliery, in the NSW Southern Highlands, that operated for more than a century. It released contaminated mine drainage into the Wingecarribee River, part of Sydney's main Warragamba Drinking Water Catchment (Wright & Belmer, 2018). The EPL (EPL 608) for this mine had discharge limits for four pollutants only (pH, oil & grease, total suspended sediment, biochemical oxygen demand). It did not include any discharge limits for any metals. When the mine closed and flooded, the underground workings of the mine drainage dissolved sulfur which increased the acidity and mobilised dangerous concentrations of metals (nickel, zinc and manganese). None of these metals were specified on the mines EPL (Wright & Belmer, 2018). Examination of historic water quality data (Wright & Belmer, 2018) showed that the elevated metals were present in the mine's wastewater when the mine had been operating, yet metals were not subject to any discharge limits on the mine's EPL, despite its location in such a sensitive location (drinking water catchment).

Tahmoor Colliery: Tahmoor Colliery is an active underground coal mine. It releases effluent to the Bargo River, under EPA regulations according to EPL # 1389 (Fleming et al. 2021). The mine EPL allows very high concentrations of

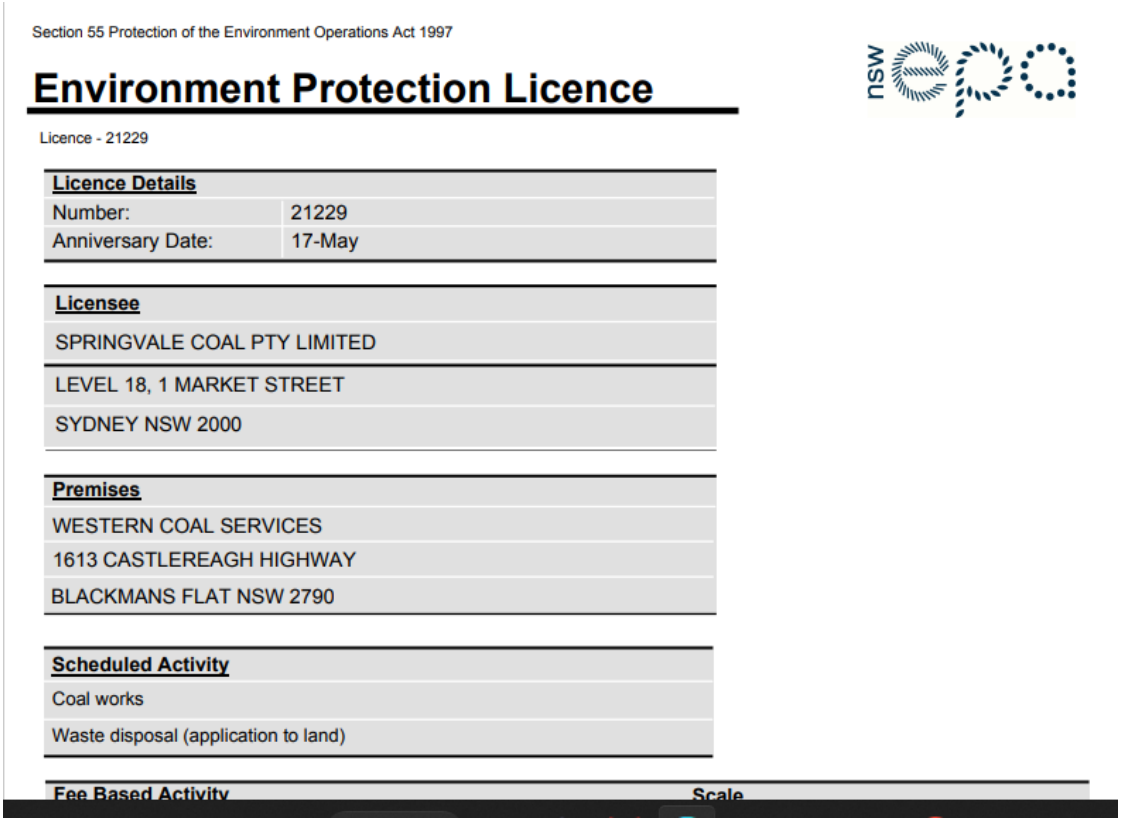
nickel, zinc, arsenic, nitrogen and salinity amongst other pollutants to be released. The EPL currently imposes discharge limits for all of the pollutants at concentrations many times higher than the ANZECC (2000) guideline for 95% protection of aquatic species. The mine's effluent release accounts for 65% of the river flow (in median flow conditions) and is a river valued for conservation and also primary contact recreation (Fleming et al. 2021).

Clarence Colliery: Clarence Colliery is an active underground coal mine operation. It releases effluent to Wollangambe River, which is one of the major rivers flowing into Blue Mountains National Park, and the Greater Blue Mountains World Heritage Area. Earlier research discovered severe water pollution and major ecological impairment of the river ecology due to contamination from the mine's waste discharge (Wright et al. 2017). The EPL for this mine had enabled very weak regulation of the pollution that allowed poorly treated wastes to damage a UNESCO World Heritage Area River. The EPL has undergone several modifications over the last 20 years and the mine now releases less contaminated wastewater. My team's research has engaged with the EPA, over several years, and contributed to revisions of the EPL (Fleming et al. 2022).

Western Coal Services (WCS): The wastewater discharge from Centennial Coal's 'Western Coal Services' (WCS) operation is regulated by NSW EPA under Environment Protection Licence (EPL) 21229. This allows wastewater to be discharged from licenced discharge point (LDP) LDP001 into a drain (Lamberts Gully) that flows into Neubecks Creek, also known as Wangcol Creek. Neubecks Creek is a small tributary of the Coxs River. The discharge point is located adjoining the Castlereagh Highway at Blackmans Flat, near Wallerawang. The wastewater is regulated by EPL 21229. The most hazardous contaminants of ecological concern in this wastewater discharge (EPL 21229; LDP001), include elevated salinity, and elevated concentrations of zinc, nickel, and manganese.

The WCS EPL 21229 specifies discharge limits for four pollutants (pH, total suspended solids, oil & grease and turbidity). The EPL also requires that the licensee also monitor a range of five other pollutants, in addition to those four that have discharge limits. These are generally 'grab' single samples of the wastewater, when it is being discharged at a frequency of once per month. The five pollutants are conductivity (salinity) and four metals (iron, manganese, nickel and zinc).

The results are regularly reported by the licensee and they show that the waste discharge has elevated and potentially harmful salinity levels, and metals concentrations (manganese, nickel and zinc in particular).



Section 55 Protection of the Environment Operations Act 1997

Environment Protection Licence

Licence - 21229

Licence Details	
Number:	21229
Anniversary Date:	17-May

Licensee

SPRINGVALE COAL PTY LIMITED

LEVEL 18, 1 MARKET STREET

SYDNEY NSW 2000

Premises

WESTERN COAL SERVICES

1613 CASTLEREAGH HIGHWAY

BLACKMANS FLAT NSW 2790

Scheduled Activity

Coal works

Waste disposal (application to land)

Fee Based Activity **Scale**

This example (Western Coal Services EPL 21229) of waste discharge to Neubecks Creek is not just an example of ineffective EPA licencing (via EPL 21229), as it enforces no discharge limits on the most environmentally hazardous pollutants (salinity, manganese, nickel or zinc). It is also an example of an EPL that fails to respect the environmental values of a waterway receiving effluent. The licence enables the pollution of Neubecks Creek, a tributary of the Coxs River, with harmful pollutants. The Coxs River is a highly valued and sensitive river. It has numerous uses and values. It is the second largest river feeding Sydney's main water supply, Warragamba Dam. The Coxs River is also very popular for fishing, primary and secondary contact recreation and has high conservation significance as it flows into the Blue Mountains World Heritage Area. The EPL 21229 fails to protect these values. This shares some similarity to a previous major source of water pollution to the Coxs River from the now closed Wallerawang Power Station. Wastewater released from the Power Station under EPL 766 caused substantial pollution of the Coxs River with salt and metals that were enabled through an ineffective EPL that failed to impose any discharge limits on the most harmful pollutants in the wastewater (salinity, copper, aluminium, nickel, zinc, fluoride, boron; Graham and Wright, 2011).

In addition, this example is highly relevant for the Project as this effluent is almost certainly going to be transferred into the pipeline as the water supply for the Project. It is very difficult to confirm this as inadequate details in the EIS for the exact sources of coal industry waste that were to transferred in the pipeline from Wallerawang to the Project were available. The EIS Appendix X. Pipeline development water assessment (p46, section 5.3.3 provides inadequate detail on the 'brine', apart from it having an average total dissolved solids of 3500 mg,L. It fails to identify other contaminants, in addition to salinity, particularly omitting information on zinc and nickel that are known to be measured in very high concentrations in EPL 21229. The data from this EPL 21229 provides some indication of the range and concentration of pollutants that could represent future 'brine' quality in the pipeline.

This information was not provided in any EIS or DPE documents. This is a major omission from both documents.

Parameter	Unit of Measure	Result	Limit	Exceedances
		03/11/2022		
pH	pH units	6.7	6.5-8.5	No
Total suspended solids	mg/L	<5	30	No
Electrical conductivity	µS/cm	2550	#	No
Oil & grease	mg/L	<5	10	No
Turbidity	NTU	14	50	No
Iron (dissolved)	mg/L	0.08	#	No
Manganese (dissolved)	mg/L	1.72	#	No
Nickel (dissolved)	mg/L	0.18	#	No
Zinc (dissolved)	mg/L	0.09	#	No

*# No concentration limit NR Not Recorded * Limit does not apply when the discharge occurs solely as a result of rainfall measured at the premises which exceeds a total of 56 millimetres of rainfall over any consecutive 5-day period*

Proposed conditions of consent

I recommend that a draft EPL for the Project should be available for consideration in this assessment process, rather than after the Project is approved. The proponent's aim that the Project will be a 'nil-discharge mine' is laudable. But a well-designed EPL should be imposed on the Project to provide ongoing assurance that this aim is achieved in the construction, operation and after the closure of the mine (Graham & Wright, 2012). An environmentally effective

EPL for the Project would include an monitoring regime that provides ongoing assurance that the 'nil-discharge' aim for the mine operation is being achieved.

Central to the EPA licence (EPL) for the Project would be early detection of any changes in water quality in the Belubula River due to the mining operation. I recommend that sampling sites, for the EPL, are located on the River upstream of the mine and downstream of the mine. These monitoring points should be specified in the EPL, along with the pollutants that should be specified, and the sampling frequency. As a precedent, the EPLs for Clarence Colliery (EPL 726), and also Westcliff Colliery (EPL 2504) have included EPL monitoring points in the main waterway in those cases, receiving mine effluent discharge.

I regard EPL 726 as the most effective EPL for a mining operation in the NSW Sydney Basin or Central West. It uses ANZECC (2000) trigger values as the basis for discharge limits for hazardous metals (Belmer & Wright, 2020). Any future EPL for the Project should follow a similar approach, even if the proponent aims to be 'nil-discharge mine'.

A review of published literature on water contaminants released by gold mine operations could provide a wide list of likely contaminants that might be generated by the Project. Based on the hazardous concentrations of metals found in Daylight Creek, due to continuous seepage from the derelict Sunny Corner gold mines (Wright and Ryan, 2016), I recommend that arsenic, lead, cadmium, copper, nickel and zinc are also included. In addition, pH, salinity (as electrical conductivity), total suspended solids, turbidity, oil & grease should also be included. This information is urgently needed to help inform development of an appropriate and effective EPA EPL for the Project. In essence, you need to make some predictions about pollutants that are likely to be generated, in order to develop an EPA EPL.

I am particularly concerned that the Project and EPA intend to develop 'site specific water objectives'. These should have been made available as part of this EIS process.

Water Discharges

B49. The Applicant must ensure that all surface discharges from the site comply with all relevant provisions of the POEO Act, including any discharge limits (both volume and quality) set for the development in any EPL.

I disagree that EPLs should only apply to discharges, as numerous operational issues could release pollutants to the local environment. This could be an accidental release from an operational failure, such as a pipe leakage, a pump malfunction, or a failure of a tailings dam. The pollution could also be through a seepage to the surface water, via a groundwater pathway. The installation of monitoring sites upstream and downstream of the operation should be included in the EPA EPL for the Project.

I also recommend that continuous operation of water quality sensors (pH, turbidity and salinity/electrical conductivity) also be specified in the EPL to enable rapid detection of any potential release of contamination, and swift implementation of appropriate corrective actions.

310.	Regis also proposes to install a reverse osmosis (RO) plant on the site to treat water sourced from the pipeline to produce potable water.

Further details of an RO plant is needed. For example, where will the concentrated brine be disposed of? The concentrated brine (see EPL results for 21229) is likely to contain highly dangerous concentrations of salt, nickel, zinc, manganese and potentially other contaminants not specified in the EPL.

References

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Qualifications and experience

I am an environmental and water scientist with more than 30 years of experience investigating the impact of human activities on waterways in NSW. I am currently employed as an Associate Professor in the School of Science at Western Sydney University. Earlier in my career I was a freshwater scientist, working in various roles at Sydney Water. This included working as a scientific officer in Sydney Water's scientific laboratories at West Ryde. I then worked as catchment officer in Sydney Water's drinking water catchments. After I received my PhD, I was awarded a Postdoctoral Research Fellowship in freshwater ecology and water pollution research at Western Sydney University. I seek to manage industry problems with evidence-based science. I have specialist scientific expertise in freshwater ecology, water chemistry, pollution ecology of waters, freshwater macroinvertebrates as pollution indicators, impact of urban development, sewage effluent, agricultural, and mine waste impacts on streams and rivers. I have expertise in the sampling design of environmental science studies and statistical analysis of environmental data. I have published (as senior or junior co-author) more than 80 peer-reviewed publications. I have provided independent expert testimonies for environmental science matters for the NSW Land & Environment Court. I am an enthusiastic participant in community engagement activities in my field of expertise.

Qualifications

2006. Doctor of Philosophy, University of Western Sydney.

1995. Master of Science (by research), Macquarie University.

1988. Bachelor of Applied Science (Agriculture), Hawkesbury Agricultural College.