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31st October, 2014

Mining and Industry Projects
NSW Department of Planning & Infrastructure
GPO Box 39
Sydney NSW 2001

Dear Sir,

State Significant Project - Airly Mine Extension (SSD 12_5581)

Further to our previous submission earlier today we ask that you please also accept this submission and it's attachments ..Ian Wrights Report and its attachments as annexure No. 5.

Capertee Valley Environmental Group Inc. (CVEG Inc.) writes again objecting to the approval of the above
mentioned mine extension and as mention in previous submission CVEG jointly with Capertee Valley Alliance (CVA) engaged the
Environmental Defenders Office who in turn engaged Experts to review Airly Mine Extension's EIS.

CVEG Inc supports the submissions of CVA , and relies upon the expert opinion evidence contained in such submission with the knowledge an consent of CVA, and the authors of such expert reports. In the interest of brevity, and to avoid repetition, CVEG Inc's submission does not refer expressly
to the entirety of the expert opinion evidence presented by CVA.

Fauna

The impacts on fauna species, especially bats, is based on the assumption of minimal surface impacts and the Pells report suggests this may not be the case.

Biodiversity Assessment

Centennial use the Biodiveristy Offsets Policy for Major Projects to say they don't have to do an offset but they don't seem to have strictly applied the Framework for Biodiversity Assessment that underpins it. This oversight by Centennial should be rectified in order to assertain if indeed Centennial are correct and don't need to do an offset.

Conclusion

CVEG Inc. again requests that the same evaluation should apply to this proposal as did the Coalpac Consolidation Project which the Department of Planning determined should be refused because impacts on the area's conservation values would be 'unacceptable'.

Yours faithfully

Veronica Sanday
Veronica Sanday

Hon. Secretary
For the Management Committee
Capertee Valley Environmental Group Inc.

30 October 2014

NSW Government
Department of Planning & Environment

Dear Sir/Madam,

Submission to Airly Mine Extension Project

I am an independent environmental scientist working as an Environmental Lecturer at University of Western Sydney. One of my research interests is freshwater pollution ecology and a second is the regulation of water pollution. This current proposal is of practical interest to me on both fronts and I will be watching this case with great interest.

Please find my attached submission to the proposed Airly mine extension.

Yours sincerely

Dr Ian A Wright
Lecturer (Environmental Science)
University of Western Sydney

Personal submission on the proposed Airly Mine Extension Project

Dr Ian A Wright (Environmental Science Lecturer, University of Western Sydney)

30 October 2014

I am an environmental scientist, educator and researcher and have worked as an environmental scientist with industry for more than 25 years. My qualifications include a Master of Science and a PhD degree. I am an advocate for sustainable water and catchment management and I strongly support multi-disciplinary projects. I seek to manage industry problems with evidence-based science. My scientific expertise covers many fields: 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. The greater majority of my research has been conducted on waterways, or topics, in the Hawkesbury-Nepean catchment and Sydney basin. 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) 39 peer-reviewed scientific publications. My research and industry experience has led to requests for my participation in voluntary reviews of research manuscripts for academic journals. I have also provided independent expert testimonies for environmental science matters for the NSW Land & Environment Court.

Summary

The surface water assessment documents provided for the Airly Mine Extension Project clearly highlight the importance of water pollution as a major environmental issue associated with the current mining activities and the proposed mine extension. The current coal mining operation is generating waste water that is highly saline and is also enriched with ecologically hazardous concentrations of metals and nutrients. The EIS documentation indicates that larger volumes of waste water are likely to be discharged to local waterways from three discharge points as part of the extended mine operation. The waterway currently receiving mine waste water (Airly Creek) from the current mine operation is a highly polluted waterway with degraded ecosystem health. The cause of this pollution is unclear, but is at least partly due to the current and previous mining activities. The EIS documents propose the use of '*site specific trigger values*' that in my opinion are inappropriate and seek to legitimise ongoing water pollution from the current mining operation to the expanded mine operation. The existing EPA licence held by the mine for discharge of contaminated mine water currently applies no effective limits for pollutants identified in the surface water assessment. Although the EIS documentation identifies the presence of many water quality pollutants at ecologically hazardous (and probably toxic)

concentrations in the current and expanded mine waste water, there are no discharge limits on these pollutants (e.g. salinity, nitrogen, phosphorous, ammonia, turbidity, zinc, nickel) in the EPA waste discharge licence (EPL #12374). In my opinion, the expanded mine operation appears likely to continue to generate environmentally damaging waste water that will be unregulated with an ineffective EPA environmental protection licence. Inadequate information is also presented on the likely adverse impacts on such water pollution to downstream waterways in the Hawkesbury-Nepean catchment and local and regional water users (agriculture, human recreation, conservation and biodiversity). Potential adverse impacts on Greater Blue Mountains World Heritage area streams and rivers from the current, or future extended, mine operation is a serious omission from this EIS documentation.

Site Specific Trigger Values

A major shortcoming of the '*Airly Mine Surface Water Impact Assessment*' (July 2014 documents) are the 'Site Specific Trigger Vales' that have been calculated and are presented in Table 1-8. The ANZECC (2000) water quality guidelines is quoted as the source of the methodology used to derive these trigger values. I am very familiar with the ANZECC (2000) methodology recommended for calculation of local water quality guidelines. I have used this methodology, with research colleagues, to derive local guidelines (or trigger values) for the Georges River catchment waterways (Tippler et al., 2012). The ANZECC (2000) methodology for calculating local trigger values (see Chapter 3 of the ANZECC guidelines – section 3.1.4 'Defining a reference condition') relies on the use on non-impacted local waterways. I strongly disagree that the approach used in this documentation is consistent with ANZECC (2000) methodology.

I do not believe that water quality results from Airly Creek can be reasonably used to represent 'reference condition' as this is defined in ANZECC (2000), section 3.1.4. It is my professional experience that Airly Creek ranks as one of the most polluted waterways that I am aware of (from my 25 years of experience as a water scientist in the Hawkesbury-Nepean catchment). It is consistent with a waterway that is highly degraded from coalmine wastes (e.g. Banks et al., 1997; Younger, 2003; Johnson, 2003). The July 2014 Surface Water Impact Assessment used only data from Airly Creek as the source of water quality data on 'reference condition'. In my opinion this is unacceptable and generates misleading information that will downplay the environmental hazards posed by coal mine wastewater to the local and regional environment.

The Surface Water Assessment provided limited and inadequate water quality data on a wider range of regional waterways. However, the Aquatic Ecology and Stygofauna Assessment (Cardno) provided more detailed information on regional water quality and confirmed that Airly Creek had the most degraded water quality and aquatic ecosystem in their survey of local waterways. This report also supports my belief that mining activities are as least partly

responsible for the water pollution in Airly Creek. See the following text extract from the Aquatic Ecology report (Cardno):

'Initial sampling of the aquatic ecosystem indicated that the highest level of biological impairment generally occurred at sites on Airly Creek followed by Torbane Creek. Biological impairment at these sites is likely to be a result of extensive deforestation and use of land in the catchment for agriculture and mining activities.' *(extract of text from section 4.8.3 of the Aquatic Ecology Assessment).*

In my professional experience the water quality data summarised from Airly Creek in Table 1-8 of the Surface Water Assessment represents highly contaminated water. The table below (Table 1) illustrates some examples of water quality variables and also includes 'site specific trigger values' as presented in the EIS documents (Surface Water Assessment). Calculation of 'site specific trigger values' should be based on water quality at 'reference' creeks in the local waterways, away from any coal mining operation. I expect the water quality in Airly Creek is strongly reflective of the current coal mining activities in the area, and thus it appears illogical to me to use highly contaminated water quality to be used as a basis of comparison, to protect local water quality from coal mine water pollution. My concerns are supported by reviewing the ANZECC (2000) text on calculation of site specific trigger values.

Table 1 Comparison of Site Specific Trigger Values nominated in the Airly Mine Surface Water Assessment to the Environmental Protection Licence (EPL 12374) currently used by EPA to regulate water pollution from the discharge of Airly mine wastewater.

	SSTV nominated in Surface Water Impact assessment (Table 4-5)	EPL Licenced Discharge Limits (LDP001; LDP002; LDP003)
pH (pH units)	6.5 – 9.0	6.5 – 9.0
Electrical conductivity (µS/cm)	2998	-
Total Suspended Solids (mg/L)	68	50
Oil & Grease (mg/L)	-	10
Turbidity (NTU)	83	-
Ammonia (mg/L)	0.9	-
Total Nitrogen (mg/L)	1.88	-
Total Phosphorus (mg/L)	0.24	-
Nickel (mg/L)	0.099	-
Zinc (mg/L)	0.072	-
Copper (mg/L)	0.013	-
Arsenic (mg/L)	0.024	-

Environment Protection Licence 12374

A second linked concern is that the proposed expanded mine operation seeks to continue use of the current NSW EPA 'Environment Protection Licence' (EPL) #12374 (see section 4.8.2 of the Surface Water Assessment).

The current Airly mine operation holds an EPA Environment Protection Licence (EPL #12374). The only pollutants that are permitted to be discharged from the Airly Mine (according to EPL 12374) are:

- Oil and Grease (10 milligrams per litre)
- pH (6.5-9 pH)
- Total Suspended Solids (50 milligrams per litre)

See Table 1 which shows a range of water quality attributes (as per the SSTV nominated values) that represent a range of the most serious and environmentally hazardous pollutants in Airly Creek, and in the current and expected mine waste water. These pollutants (salinity and metals in particular) have been linked to coal mine waste water pollution in the Sydney and Blue Mountains area (Belmer et al. 2014; Wright and Graham, 2012; Wright and Burgin, 2009) and internationally (e.g. Banks et al. 1997; Johnson, 2003; Younger, 2004). This table also lists the current EPL 12374 discharge conditions. The disconnection between the pollutants and the EPA licence is obvious and of great concern. This is a major issue that needs to be addressed as part of this proposed development.

I regard the three pollutant discharge limits, currently in EPL 12374, as being inappropriate and ineffective if the true purpose of the EPL is actually to protect the water quality of Airly Creek, and other waterways downstream of the waste discharge as is clearly defined in the guiding legislation: *Protection of the Environment Operations* Act (1997). Section 45 of this legislation covers matters that the EPA needs to consider when issuing an EPL and in my opinion the current EPL #12374 does not reflect S.45 part (c) of POEO Act:

'*the pollution caused or likely to be caused by the carrying out of the activity or work concerned and the likely impact of that pollution on the environment'.*

Having environmentally appropriate discharge conditions for a mine's EPA Environmental Protection Licence is the most important means for regulating the water pollution impacts from this mine and its extended operation. They will 'drive' industry to treat waste water to the level required to discharge to local waterways. Contaminated water is routinely treated by industry to meet stringent EPL conditions.

In my opinion EPL 12374 needs to specify pollutants in contaminated waste water from the coal mine, with discharge limits that conform to the ANZECC (2000) water quality guidelines and protection of downstream water uses and ecosystems. Given the high conservation value of waterways in the downstream Greater Blue Mountains World Heritage Area this should be based on protection of 99% of species (as per Table 3.4.1 of Chapter 3 'Aquatic Ecosystem' in ANZECC, 2000).

The inappropriate use of Environmental Protection Licences (EPL) is a highly controversial issue and is generating increasing community concern (Graham and Wright, 2012). For example, recently the NSW EPA has progressively modified the EPL held by Endeavour Coal (West Cliff Colliery at Appin) from a licence that was very similar to the one currently held for Airly mine (EPL 12373)(Wright, 2011). The West Cliff EPL (EPL 2504) has been modified to include the actual pollutants in the mine waste water that are likely to contribute the environmental damage caused by the mine discharge. This current development assessment is an ideal opportunity for the Minister of Planning to address such an important issue that will have such long-term benefit for the sustainable management of water pollution from this proposed mine expansion. Addressing this issue as part of the current development assessment process is of obvious importance.

A very important statement appears on page 6 of Appendix C 'Airly Mine Surface Water Impact Assessment. This statement explains the potential expected water quality expected to be discharge to waterways of the Airly Creek catchment. The production bore was reported in the Appendix C to have highly elevated salinity (median of 4735 µS/cm); and ecologically hazardous levels of two metals (results for other metals was not available) Nickel (median of 0.29 mg/L) and Zinc (median of 0.251).

'Sites LDP001, production bore and 35 ML Discharge Dam represent the quality of current and future discharges to the Airly Creek catchment.' (page 6 of Appendix C)

This information highlights how the expanded mine operation is likely to generate larger volumes of highly polluted waste water that is likely to worsen the already degraded water quality and ecological health of Airly Creek, and extend the negative impact further downstream.

In my professional opinion, the EPL 12374 for this current mine operation needs to be modified to include at least six additional pollutants (salinity, nitrogen, phosphorus, turbidity, ammonia, zinc and nickel) and impose meaningful limits that actually protect downstream waterways from pollution. The SSTV nominated in the Surface Water are inappropriate for the reasons explained previously.

The current water quality and stream ecology information provide inadequate information to make a detailed and informed assessment about the downstream implications of water pollution

likely to be generated from the extension of the Airly mine operation. The waterways further downstream (in the Colo River catchment) are of extreme environmental significance, and as such the Colo River is listed as a 'Wild River' in NSW and a large part of the area is protected as part of the Greater Blue Mountains World Heritage Area (UNESCO, 2009). Recent research has shown that another mine (Clarence Colliery) is generating damaging water pollution that extends at least 20 km downstream of that mine's discharge into the Greater Blue Mountains World Heritage Area (Belmer *et al.*, 2014). Previous research has shown that mine pollution in the Blue Mountains area can persist for extended periods of time following a mine closure (Wright and Burgin, 2009). I am concerned that this mine may also be causing adverse impacts into conservation areas, including the World heritage Area further downstream. Inadequate data is presented in the EIS to make an informed assessment on this matter.

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The potential and reality of the environment protection licensing system in New South Wales: The case of water pollution

Kristy Graham and Ian A Wright*

The legislative basis and intent for pollution licensing in New South Wales is comprehensive and provides the Environment Protection Authority (EPA), as the regulatory authority for most pollution, with the ability to consider and protect a range of environmental values through the environment protection licensing system. Despite this ability, this is not occurring in New South Wales. The current regulation of pollution is far from achieving its aims to protect and enhance the quality of the environment, to maintain ecologically sustainable development and to prevent degradation of the environment. These aims are enshrined in the objects of the Protection of the Environment Operations Act 1997 (NSW) (POEO Act) and were widely proclaimed with the introduction of the Protection of the Environment Operations Bill in 1997. This article focuses on the current failures in the implementation of the pollution regulation framework, which have resulted in the degradation of many waterways as a direct result of industrial waste discharges, licensed under the POEO Act. It makes a number of key recommendations for reform of the pollution licensing system, including greater consideration of cumulative impacts of key pollutants, broader coverage of licences, expanded use of market-based approaches, independent monitoring and enforcement, continuous improvement and enhanced public participation. Although this article focuses on case studies involving water pollution, many points are applicable to the licensing and regulation of other types of pollution.

INTRODUCTION: LEGISLATIVE BASIS OF POLLUTION LICENSING IN NEW SOUTH WALES

The New South Wales environment protection licensing system, or pollution licensing as it would be more appropriately called, is established under the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act).[1] The objects of this Act provide a background as to what the environment protection licensing system is aiming to achieve, including: to protect, restore and enhance the quality of the environment in New South Wales; the need to maintain ecologically sustainable development; to provide increased opportunities for public involvement and participation in environment protection; to ensure the community has access to relevant and meaningful information about pollution; and to reduce the risks to human health and prevent the degradation of the environment through the use of mechanisms that promote, inter alia, pollution prevention and cleaner production.

The POEO Act establishes types of premises or activities required to hold an Environment Protection Licence (EPL)[2] and provides for a range of conditions that may be attached, such as those: requiring monitoring; requiring pollution studies and reduction programs; or implementing tradeable emissions schemes or green offsets schemes.[3] Many licences include concentration or volumetric limits for certain contaminants, which specifies the concentration of a pollutant that may be discharged

* Kristy Graham, Environmental Scientist at NSW Environmental Defenders Office (2007-2010); Ian A Wright, Lecturer in Environmental Science at University of Western Sydney.

[1] *Protection of the Environment Operations Act 1997* (NSW), Ch 3.

[2] *Protection of the Environment Operations Act 1997* (NSW), Sch 1.

[3] *Protection of the Environment Operations Act 1997* (NSW), s 63.

or emitted from a certain point.[4] EPLs are designed to regulate all types of pollution including air, water, noise and waste pollution in an integrated way[5] and are administered by the Environment Protection Authority (EPA).

The EPA is the statutory body established under the *Protection of the Environment Administration Act 1991* (NSW) and was given responsibility for the EPL system under the POEO Act. Although it has been a part of a broader government department for a number of years, recent (November 2011) legislative amendments have elevated the function and responsibilities of the EPA, which now directly reports to the New South Wales Minister for the Environment. The Board of the EPA has been reconstituted with the number of Board members dropping from 10 to five, with four members having particular expertise (such as environmental science, environmental law, business and risk management). One Board member will be the Chairperson, who is directly responsible for the EPA.[6] The fulltime Chairperson will oversee the strategic and day-to-day running of the EPA with the support of four part-time Board members.[7] In undertaking their licensing functions, the EPA is required to take into consideration a number of factors, including: any protection of the environment policies; the objectives of the EPA; the pollution caused or likely to be caused and its impact on the environment; practical measures that could be taken to both prevent the pollution and to protect the environment from harm as a result of the pollution; and, in relation to water pollution, the environmental values of the water affected by the activity or work and the practical measures that could be taken to restore or maintain those environmental values.[8]

In terms of enforcement of licence conditions, there are strong powers given to the EPA to ensure compliance. Prompt reporting of pollution incidents to the EPA is a particularly high priority for the latest legislative changes. Failure to report pollution, by people responsible for causing the incident, now attracts the most severe penalties under the POEO Act, with a maximum of $2,000,000 for corporations, with a further penalty of up to $240,000 per day for continuing offences. Lesser penalties apply for people responsible for causing pollution, which attracts a maximum penalty of $1,000,000 for corporations and up to $120,000 per day.[9] The EPA is also able to suspend or revoke an EPL if conditions have not been complied with,[10] and the Minister may also suspend or revoke a licence if the holder is convicted of a major pollution offence.[11]

EPLs were introduced with the intent of streamlining previous pollution licences and promoting an integrated approach to environment protection.[12] They were hailed as an integral tool in pollution prevention and therefore in preventing degradation of the environment.[13] The POEO Act was also intended to give the EPA "teeth" in enforcement of licence provisions and more generally in environmental protection.[14]

[4] Eg in EPL 766 there is a 100 percentile concentration limit of 1,600 mg/L for sulfate for discharges from licensed discharge point 4: New South Wales Government, *Environment Protection Licence 766* (Office of Environment and Heritage, 2011), http://www.environment.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=30764&SYSUID=1&LICID=766 viewed 16 July 2012.

[5] New South Wales, *Debates*, Legislative Assembly, 13 November 1997 (Pam Allen) – Second Reading Speech, *Protection of the Environment Operations Bill* (POEO Bill Second Reading Speech).

[6] New South Wales Government, *The EPA Board* (Office of Environment and Heritage, 2012), http://www.environment.nsw.gov.au/whoweare/epaboard.htm viewed 16 July 012.

[7] *Protection of the Environment Legislation Amendment Act 2011* (Cth).

[8] *Protection of the Environment Operations Act 1997* (NSW), s 45.

[9] *Protection of the Environment Legislation Amendment Act 2011* (Cth).

[10] *Protection of the Environment Operations Act 1997* (NSW), s 79(5).

[11] *Protection of the Environment Operations Act 1997* (NSW), s 82.

[12] POEO Bill Second Reading Speech, n 5.

[13] POEO Bill Second Reading Speech, n 5.

[14] POEO Bill Second Reading Speech, n 5.

In practice, however, these "teeth" are not utilised to their full capacity; community feedback suggests many circumstances of licence breaches or unlicensed discharges where no further action is taken by the EPA. It is also clear that at many localities EPLs are not preventing degradation of the environment. This is exemplified by a recent, landmark industrial incident where atmospheric discharge of a hazardous material (sodium chromate) to the Stockton residential area from the Orica industrial complex on Kooragang Island (near Newcastle) occurred in August 2011.[15] There was a slow and seemingly ineffective response to the incident with local residents being informed three days after the "fallout" was deposited on their residential properties.[16] This created considerable media attention and community outrage and led to legislative amendments to the POEO Act.[17]

Concern has been expressed from local communities relating to pollution discharged from licensed premises in a number of catchments around New South Wales. Research on individual waste discharges highlight that EPLs are not always achieving their stated objectives. Particular problems include: how concentration limits are set for contaminants regulated by EPLs; the lack of consideration of the cumulative impacts of multiple licensed discharges in catchments; the limited coverage of EPLs, meaning that many contaminants are being discharged but are not regulated; the limited enforcement of licence conditions by the EPA, including a lack of independent monitoring; the lack of publicly available pollutant information collected by licensed premises (in accordance with their EPLs); and the limited opportunity for public participation in the licensing process.

Although this article focuses on water pollution, many points are applicable to the licensing and regulation of other types of pollution, eg air. The articles uses a number of case studies to demonstrate failings of the current licensing and pollution regulation framework, and provides suggestions for reform to ensure that pollution licensing in New South Wales achieves its objectives.

CRITIQUE OF THE CURRENT WATER POLLUTION LICENSING SYSTEM

Environmental values not reflected in licences

EPLs do not currently state which aspects of the environment they seek to protect. For wastewater discharges to waterways (such as rivers, streams and lakes) this could easily be achieved by naming the most important environmental values of waterways in the potential waste discharge contamination zone and catchment. According to the ANZECC guidelines, determining the environmental values of waterways is an essential first step in managing water quality within catchments.[18] Environmental values establish the goals for water quality in the catchment and then water quality measures and discharge conditions can be implemented to protect these from adverse impacts of industrial waste discharges. Although the environmental values of waters to be affected and practical measures that could be taken to restore or maintain those environmental values must be considered by the EPA in undertaking its licensing functions,[19] EPLs do not currently reflect these. Currently, licence concentration limits for contaminants, or the decision on whether to include licence limits for various contaminants, appear not to be determined with reference to the receiving environment and protecting its environmental values. Key values for all waterways have been established through the New South Wales water quality objectives,[20] and so these identified values should be reflected and protected by the EPL system, with concentration limits set with reference to protecting the identified values. This is currently not occurring.

[15] "10kg of Chrome 'Rained Down' from Orica", *Newcastle Herald* (17 August 2011) p 1.

[16] O'Reilly B, *A Review into the Response to the Serious Pollution Incident at Orica Australia Pty Ltd Ammonium Nitrate Plant at Walsh Point, Kooragang Island on August 8, 2011* (New South Wales Department of Premier and Cabinet, 2011), http://www.nsw.gov.au/sites/default/files/Orica-review.pdf viewed 16 July 2012.

[17] New South Wales, *Debates*, Legislative Council, 8 November 2011 (John Ajaka) – Second Reading Speech, *Protection of the Environment Legislation Amendment Bill 2011*.

[18] ANZECC (Australian and New Zealand Environment and Conservation Council), *Australian and New Zealand Guidelines for Fresh and Marine Waters* (Department of Sustainability, Environment, Water, Population and Communities, 2000), http://www.environment.gov.au/water/policy-programs/nwqms/#guidelines viewed 16 July 2012.

[19] *Protection of the Environment Operations Act 1997* (NSW), s 45.

[20] New South Wales Government, *Water Quality and River Flow Objectives* (Office of Environment and Heritage, 2006).

Case study

The Upper Coxs River has identified water quality objectives of protecting aquatic ecosystems, primary and secondary contact recreation, visual amenity, drinking water at point of supply, irrigation water supply, homestead water supply and for aquatic foods,[21] and has also been identified as having areas of high conservation value.[22] The Coxs River is also one of the largest rivers flowing into Warragamba Dam, the largest storage reservoir in Sydney's drinking water supply.[23] Due to the importance of the Coxs River as part of the drinking water catchment for Sydney, the Sydney Catchment Authority (SCA) has also identified a broad range of water quality objectives that apply in the Coxs catchment, and other catchment areas.

The water quality in the Upper Coxs catchment is degraded, largely from the discharge of 22 licensed premises,[24] and has been identified as a priority catchment for improvement in water quality by the SCA.[25] One of the main causes of degradation to water quality in the catchment is saline water discharges,[26] which has been shown to affect a wide range of freshwater aquatic biota.[27] Despite this, none of the EPLs for the 22 licensed premises in the catchment contain licence limits for salinity, although a number require monitoring. Background salinity levels in the upper reaches and clean tributaries are in the range of 39-70 uS/cm.[28] Moving downstream, salinity levels in the Coxs River increase as more coal mines and power stations discharge into it.[29] At one licensed discharge point salinity has been measured at up to 2,380 uS/cm,[30] nearly seven times higher than the ANZECC water quality guideline. This concentration of salinity does not ensure protection of aquatic ecosystems[31] and is illustrative of the lack of regard for environmental values in establishing licence limits. It also demonstrates that the EPL system is currently not working to protect identified environmental values of the catchment from "licensed" water pollution.

Concentration limits not set based on scientific knowledge

The setting of concentration limits to be included as wastewater discharge conditions in licences must also be based on sound scientific knowledge of the impact of various contaminants on water quality, a process clearly established in the ANZECC guidelines, which have been adopted nationally.[32]

[21] Healthy Rivers Commission of New South Wales, *Independent Inquiry into the Hawkesbury Nepean River System: Final Report August 1998* (1998).

[22] Hawkesbury Nepean Catchment Management Authority, *Upper Coxs River Subcatchment* (2008).

[23] Sydney Catchment Authority (SCA), *Annual Water Quality Monitoring Report 2008-2009* (2009).

[24] Including coal mines, coal-fired power stations and sewerage treatment plants

[25] SCA, n 23. Despite the Sydney Water Board identifying this as an important source of water pollution in Sydney's largest water supply catchment, the SCA do not have a routine water quality monitoring site in the Upper Coxs Catchment.

[26] Jones H, *Water Quality of Coxs River and Tributaries* (Report 92/41, Australian Water Technologies, 1992).

[27] Hart B, Lake P, Webb J and Grace M, "Ecological Risk to Aquatic Systems from Salinity Increases" (2003) 51 *Aust. J. Bot.* 689; Neilsen D, Brock M, Rees G and Baldwin D, "Effects of Increasing Salinity on Freshwater Ecosystems in Australia" (2003) 51 *Aust. J. Bot.* 655; ANZECC n 18; Potapova M and Charles D, "Distribution of Benthic Diatoms in US Rivers in Relation to Conductivity and Ionic Composition" (2003) 48 *Freshwater Biology* 1311; Kefford B, Nugegoda D, Metzeling L and Fields E, "Validating Species Sensitivity Distributions Using Salinity Tolerance of Riverine Macroinvertebrates in the Southern Murray-Darling Basin (Victoria, Australia)" (2005) 63 *Can. J. Fish. Aquat. Sci.* 1865; Metzeling L, Perris S and Robinson D, "Can the Detection of Salinity and Habitat Simplification Gradients Using Rapid Bioassessment of Benthic Invertebrates be Improved through Finer Taxonomic Resolution or Alternative Indices" (2006) 572(1) *Hydrobiologia* 235.

[28] Wright I, *Investigation of Water Quality in the Upper Coxs River: Focus on the Influence of Wallerawang Power Station, Delta Electricity, Wastewater Discharges* (report filed in proceedings *BMCS v Delta Electricity* (2009) 170 LGERA 1).

[29] Lithgow Environment Group, *Streamwatch Data* (2011); Wright, n 28; New South Wales Government, *Audit of the Sydney Drinking Water Catchment* (Department of Environment Climate Change and Water, 2010) Ch 6.

[30] Wright, n 28

[31] ANZECC water quality guidelines provide a trigger value of 350 uS/cm for salinity in south-eastern Australia Upland waterways. That salinity results are elevated to levels that signify a clear risk of ecological stress to aquatic biota is demonstrated by Hart et al, n 27; Neilsen et al, n 27; ANZECC, n 18; Potapova et al, n 27; Kefford et al, n 27; Metzeling et al, n 27.

[32] ANZECC, n 18.

Currently the setting of licence limits, if any are included, appears to be driven by the licence holder and what is achievable. This reflects a trend to a more cooperative approach to pollution licensing[33] and means environmental values and the concentration limits needed to ensure their protection are not key considerations in the licensing process, despite the POEO Act encouraging this.

Case study

The water quality in the Upper Georges River is highly degraded below Brennans Creek.[34] Further investigation has shown that the two waterways in this catchment are impacted by discharge from coal mining wastewater from West Cliff Colliery via Brennans Creek Dam.[35] Salinity has been identified as a major contributor to degraded water quality downstream of the discharge point;[36] however, there are currently no licence concentration limits for salinity for discharges to the Upper Georges River from this mining operation (see Table 1). Salinity has been identified by the EPA as an issue requiring attention in the catchment, and EPL 2504 requires Endeavor Coal to derive a scientifically justifiable licence limit that will apply to discharges from Brennans Creek Dam, with the intention of incorporating this concentration limit into the EPL.[37]

Although this condition and its reference to the ANZECC water quality values and relevant scientific literature is a positive step and should be reflected in licence conditions around New South Wales, a licence concentration limit should have been set for salinity when the licence was first issued. Saline discharges, and studies of these have been occurring since at least 2002, and damage to the aquatic ecosystem of the Upper Georges River has already occurred. This could have been avoided with more stringent licence conditions from the beginning of the operations.

It also appears somewhat ironic that through this licence condition the polluter is asked to nominate the salinity concentration limit. However, if the EPA ensures the suggested limit is scientifically justifiable and protective of identified environmental values, it will still generate a good environmental outcome for salinity in the waterway.

Cumulative impacts of multiple discharges within catchments

In addition to the current lack of consideration of the environmental values of the receiving environment, the cumulative impacts of the total discharges within catchments are not considered in setting licence concentration limits or in issuing EPLs. Cumulative impacts of multiple contaminants, which possibly act in a synergistic way, also cause additional stress to aquatic ecosystems.[38] Individual premises currently appear to be considered in isolation, despite provisions under the POEO Act for the making of Protection of the Environment Policies (PEPs) for the purpose of managing the cumulative impact on the environment of existing and future human activities.[39] Any PEPs that have been made must be considered by the EPA in undertaking its licensing functions.[40] However, as there are currently no PEPs made under the POEO Act, licensing decisions continue to be made without any reference to the cumulative impacts of discharges within catchments.

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[33] Bates G, *Environmental Law in Australia* (7th ed, LexisNexis, 2010).

[34] Georges River Combined Councils' Committee *Georges River Community River Health Monitoring Program Catchment Scorecard* (2011); BHP Billiton, *Environmental Assessment Bulli Seam Operations* (2009), http://www.bhpbilliton.com/home/aboutus/regulatory/Pages/default.aspx viewed 16 July 2012.

[35] Wright IA, *Assessment of Impacts of Mine Drainage Discharge to Brennans Creek and Upper Georges River* (unpublished report, 2010).

[36] Wright, n 35

[37] New South Wales Government, *EPL 2504* (Office of Environment and Heritage, 2012), http://www.environment.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=30896&SYSUID=1&LICID=2504 viewed 16 July 2012.

[38] Folt CL, Chen CY, Moore NV and Burnaford J, "Synergism and Antagonism Amongst Multiple Stressors" (1999) 44 *Limnology and Oceanography* 864.

[39] *Protection of the Environment Operations Act 1997* (NSW), s 10.

[40] *Protection of the Environment Operations Act 1997* (NSW), s 45.

Case study

There are 22 licensed premises in the Upper Coxs River and a long history of contamination in the catchment with a multitude of water quality issues, such as eutrophication, salinity, heavy metals and their biomagnification,[41] yet no assessment of the acceptable maximum environmental concentrations for various contaminants has been undertaken or incorporated into the EPLs. This is despite a commitment by the New South Wales government in 2001, as a result of the Healthy Rivers Commission Independent Inquiry into the Hawkesbury Nepean River system, to consider the cumulative impacts of discharges within subcatchments.[42] As a PEP wasn't made, despite the recommendation by the Healthy Rivers Commission,[43] there has been no catchment or subcatchment-wide consideration of key contaminants.

Limited coverage of pollutants

Another key shortcoming of the operation of the current EPL system is that concentration limits, or even the requirement to monitor discharge, are not included for all pollutants being emitted from licensed premises. Hence premises may be emitting a number of contaminants not mentioned in their EPL, and exactly what is being emitted is often unknown by regulatory authorities, the facility and the community. Additional to this is the fact that some pollutants may be required to be monitored yet there is no concentration limit set in the EPL. The EPA receives monitoring data as part of the "annual returns" required for each EPL outlining the concentrations being discharged for all of these pollutants, yet under s 120 of the POEO Act they are not allowed to be discharged. This means the EPA is aware of the scale and nature of discharges in many catchments, yet chooses not to directly regulate these through concentration limits in the relevant EPLs.

Related to this issue is that there is no comprehensive assessment or monitoring program undertaken by industry, the EPA or any other government body to determine if all pollutants being emitted are being regulated. Without a program such as this there is no way to know if what is being regulated through the EPL is an accurate reflection of what is being discharged by any licensed (or unlicensed) premises.

Independent monitoring has been shown to be successful in catalysing water quality improvements. For example, the EPA (and its predecessor, the State Pollution Control Commission) conducted major water quality studies in the Lower Hawkesbury Nepean River that established the contamination of the lower reaches of the river with elevated nutrients.[44] This has led to tightening up of the EPL conditions for nutrients being discharged by wastewater treatment plants, and therefore major investment by Sydney Water (the major owner of several point-sources of nutrients into the river) in improved sewerage treatment that has resulted in improved water quality in the area.[45]

Case studies

Delta Electricity's EPL for the Wallerawang Power Station (EPL 766) does not currently contain licence concentration limits for salinity, copper, nickel, arsenic, zinc, aluminium, boron or fluoride (see

[41] Jolly VH and Chapman MA, "A Preliminary Biological Study of the Effects of Pollution on Farmers's Creek and Cox's River, New South Wales" (1966) 27 *Hydrobiologia* 160; Birch G, Siaka M and Owens C, "The Source of Anthropogenic Heavy Metals in Fluvial Sediments of a Rural Catchment: Coxs River, Australia" (2001) 126 *Water, Air and Soil Pollution* 13; Battaglia H, Hose GC, Turak E and Warden B, "Depauperate Macroinvertebrates in a Mine Affected Stream: Clean Water may be the Key to Recovery" (2001) 138 *Environmental Pollution* 132; Jasonsmith JF, Maher W, Roach AC and Krikowa F, "Selenium Bioaccumulation and Biomagnifications in Lake Wallace, New South Wales, Australia" (2008) 59 *Marine and Freshwater Research* 1048; Lithgow City Council, *State of the Environment Report* (2011).

[42] New South Wales Government, *Statement of Joint Intent for the Hawkesbury Nepean River System* (2001).

[43] New South Wales Government, n 42.

[44] NSW Environment Protection Authority, *An Inventory of Pollutant Sources in the Hawkesbury-Nepean River Catchment* (1993); NSW Environment Protection Authority, *Water Quality. Hawkesbury-Nepean River System June 1990 to June 1993* (1993).

[45] Sydney Water and CSIRO, *Environmental Response to WaterPlan 21 STP Initiatives – Hawkesbury-Nepean River Catchment* (2002); New South Wales Government, *Hawkesbury-Nepean Environmental Monitoring Program: Final Technical Report* (Department of Environment and Climate Change, 2009), http://www.environment.nsw.gov.au/resources/water/09112hnrempfintechrpt.pdf viewed 16 July 2012.

Table 1); however, all of these have been measured at environmentally hazardous levels in the Tortuous watercourse, licensed discharge point 4.[46] The EPA is currently revising EPL 766 to add concentration limits for most of these pollutants[47] following longstanding concerns expressed by the Blue Mountains Conservation Society and the Lithgow Environment Group about the water pollution of the Upper Coxs River from the Wallerawang Power Station and the lack of effective regulation.[48] To address the shortfall of scientific water quality data, the Blue Mountains Conservation Society commissioned water quality assessment of discharges from Wallerawang Power Station and waterways in the Upper Coxs River catchment.[49]

Additionally, EPL 766 imposes load-based licence fees for salt and selenium discharges from Wallerawang Power Station into Wallerawang Dam; however, there are currently no licence concentration limits for these discharges (see Table 1). This means that although these contaminants are being discharged, they are essentially unregulated by the EPA. Even for those pollutants acknowledged as being a problem by the EPA (through charging load-based licence fees), concentration limits are not set.[50]

Studies on the Grose River and the Dalpura and Jinki Creeks in the environmentally-sensitive Blue Mountains World Heritage Area have shown that ecologically damaging levels of zinc continue to be discharged, through infiltration and leaching of contaminated water from the mine workings, into the Dalpura and Jinki Creeks from the now closed Canyon Colliery, despite the mine ceasing operation in 1997.[51] EPL 558 permitted wastewater discharges from the mine with zinc concentration several hundred times above ANZECC guidelines for ecosystem protection (see Table 1). The mine has closed, the EPL has been surrendered, but the pollution continues and the discharge is currently unregulated and is in a regulatory vacuum.[52] As the EPL for the mine has been surrendered and site remediation conditions do not cover ongoing water pollution, the company is not held responsible for the ongoing pollution. This demonstrates the need to ensure all discharges in catchments are regulated, including once premises have ceased operations, to enable management and ongoing improvement in water quality.

Lack of independent monitoring and enforcement

Monitoring of compliance with licence conditions is undertaken by licenced premises, and self-reported to the EPA through their annual returns. Annual returns, and the information contained within them, is not freely available to the community. There appears to be little or no independent monitoring of compliance with licence conditions and no auditing of self-reporting requirements. Additionally, self-reporting of monitoring data does not appear to be rigorously analysed or result in enforcement action being taken by the EPA. An examination of New South Wales Land and Environment Court cases that involved pollution, from 2000 to 2011, revealed the majority came to the attention of the EPA by public complaints (often due to reports of unpleasant odours) or due to EPL licence holders informing the EPA of an incident. In contrast, there were few pollution cases that were triggered as a response of EPA examination of EPL annual return performance data. There are three notable exceptions. The first was *EPA v Ballina Shire Council* (2006) 148 LGERA 278, where it

[46] Wright, n 28.

[47] New South Wales Government, *Licence Variation Application for EPL 766* (Office of Environment and Heritage, 2010), http://www.environment.nsw.gov.au/resources/licensing/DeltaApplication.pdf viewed 16 July 2012.

[48] Lithgow Environment Group, *Submission to EPA*, "Re: Variation to Delta Electricity's EPL No. 766" (2011), http://www.environment.nsw.gov.au/resources/licensing/LithgowDeltaLicenceVariation.pdf viewed 16 July 2012.

[49] Wright, n 28.

[50] Delta Electricity, *2007 Annual Return for Licence EPL 766 – Salt and Selenium* (2008) p 42

[51] Wright IA and Burgin S, "Comparison of Sewage and Coal-mine Wastes on Stream Macroinvertebrates within an Otherwise Clean Upland Catchment, Southeastern Australia" (2009) 204 *Water, Air and Soil Pollution* 227; Wright IA and Burgin S, "Effects of Organic and Heavy-metal Pollution on Chrionomids within a Pristine Upland Catchment" (2009) 635 *Hydroboloiga* 15; Wright IA, Wright S, Graham K and Burgin S, "Environmental Protection and Management: A Water Pollution Case Study within the Greater Blue Mountains World Heritage Area, Australia" (2011) 28 *Land Use Policy* 353.

[52] Wright et al (2011), n 51.

was found the operators of a landfill failed to provide leachate volume data, although this was required as a condition of their EPL annual returns. The data was not provided for a lengthy period (more than two years) and the EPA repeatedly requested the data and were assured by the licensee it was being collected. In a second case, *EPA v Transpacific Industries* [2010] NSWLEC 85, it was reported that the EPL holder submitted false information, as part of their self-reported annual returns, by omitting elevated levels of pollutants that were in excess of their EPL discharge conditions. A third case, *EPA v Norco Co-operative* (2000) 108 LGERA 137, resulted from an EPA investigation after an EPA officer reviewed annual return data, required under the *Pollution Control Act 1970* (NSW). The annual return indicated a number of incidents of non-compliance with wastewater licence conditions. This legislation was repealed by the POEO Act, but was similar in that it also required licence holders to submit annual returns, as specified in their pollution licences.

Case study

Delta Electricity have reported high levels of salinity[53] and other contaminants from licensed discharge point 4 in their annual returns, yet no enforcement action has been taken by the EPA. There are currently no discharge limits on salinity in EPL 766 (see Table 1). This is despite the fact that water quality is a priority issue for the catchment given that the Coxs River supplies water into the Warragamba drinking water catchment and is a popular recreational trout fishing stream. The SCA does not regularly measure water quality at any site in the vicinity of this outfall. The solitary example of independent monitoring in the area was the local community Streamwatch group, who originally alerted the wider community to the high levels of certain contaminants being discharged from Wallerawang Power Station.

Public participation

Public participation and community involvement feature heavily in the objects of the POEO Act; however, in the implementation of the EPL system community participation is often difficult and seemingly ineffective. This is partly a result of many details of licences and the licensing process not being publicly disclosed. Some of these details include the rationale for setting or not setting licence concentration limits, how licence concentration limits are derived, and the location of discharge points. This makes it difficult for the public to understand the environmental implications of the licence conditions, as well as constructively engage in the licensing process.

All EPLs and their variations are accessible through the internet on a public register.[54] This is useful in informing the public of the licence conditions for premises; however, annual returns are not included. Annual returns include all information obtained from self-monitoring of premises as required by licence conditions, including information about water quality in the catchment and of discharges from premises. Recent legislative amendments (POEO Act, s 66) now require annual "monitoring data that relates to pollution" to be made freely available by the EPL licence holder upon request. Previously, annual returns could be accessed under the *Government Information (Public Access) Act 2009* (NSW), but this process was cumbersome and expensive for the public.

Although public submissions are required to be considered in connection with a licence application,[55] they are rarely required to be considered for licence variations.[56] This means that, once a licence is issued, community submissions and community values for particular catchments have much less influence on licence conditions than what a licensed premise is prepared to voluntarily

[53] Delta Electricity (2006) annual returns from 2005 report an average salinity from LDP4 of 1,767 uS/cm and a maximum of 2,040 uS/cm. Delta Electricity (2007) annual returns from 2006 report an average salinity from LDP4 of 1,973 uS/cm and maximum of 2,526 uS/cm. Delta Electricity (2008) annual returns from 2007 report an average salinity from LDP4 of 2,264 uS/cm and a maximum of 2,695 uS/cm. Delta Electricity (2009) annual returns from 2008 report an average salinity from LDP4 of 215,464 uS/cm with a maximum value of 264,700 uS/cm; however, it is assumed there was a typographical error in these values and that the measured values would be an average of 2,154 uS/cm and a maximum of 2,647 uS/cm.

[54] New South Wales Government, *POEO Public Register* (Office of Environment and Heritage), http://www.environment.nsw.gov.au/prpoeoapp viewed 16 July 2012.

[55] *Protection of the Environment Operations Act 1997* (NSW), s 451(i).

[56] *Protection of the Environment Operations Act 1997* (NSW), s 58(6).

commit to. There is also no requirement for notification of neighbours about the application for a licence, or of exceedances of licence conditions, despite notification of neighbours occurring for relatively minor local developments under the *Environmental Planning and Assessment Act 1979* (NSW).[57]

The limited opportunity for public input into the setting of licence concentration limits for pollutants, and in ongoing variations of licences, means the community has little influence in shaping the key feature of licences used to ensure environmental protection. If licence concentration limits were set to protect key environmental features or community values, eg contact recreation, stock and domestic use, then the public would have much greater confidence in this process. However, given that this does not occur, community groups and the general community in the environs of the discharges currently have little faith in the EPL system protecting their local environment.[58]

There are also no public appeal rights to challenge the grant of a licence under the POEO Act, something that is included in the *Environment Protection Act 1970* (Vic), s 33B enabling the public to use the court system to ensure licences fulfill their role in environmental protection.[59]

KEY RECOMMENDATIONS FOR REFORM

Licence limits to reflect receiving environment and address cumulative impacts

In exercising its licensing function, the EPA should have the overall goal of achieving or maintaining the environmental values of the catchment and waterways through EPLs, particularly for activities likely to cause water pollution.[60] This means ensuring water is of sufficient quality to, for example, protect aquatic ecosystems, enable secondary contact recreation, or for fisheries production, as applicable for each catchment. As this is fundamental to each EPL, it is recommended that the environmental values of the receiving environment should be stated clearly on each EPL. To ensure environmental values of the catchment are reflected and protected by the EPL system, licence concentration limits should be established by first studying the environmental values of the receiving environment, taking into account the established water quality objectives (see Fig 1, Box 1).[61] With a clear idea of what uses or elements of the catchment EPLs should be protecting, the maximum level of various substances that will not cause an impact on those values in the catchment can be established based on scientific evidence (see Fig 1, Box 2).

Setting catchment-wide concentration limits for specific pollutants should particularly focus on the impact of those pollutants on the values or uses being protected in a waterway, eg aquatic ecosystems, stock and domestic use, irrigation use, drinking water. The framework for establishing robust values for various water quality parameters is outlined in the ANZECC guidelines.[62] This is a system that should be used in the setting of catchment-wide concentration limits, ie using the trigger values established under the ANZECC guidelines to protect identified and agreed values of each waterway, and then deviating from these values if there is further catchment-specific information available on the extent of harm from various concentrations of the contaminant (see Fig 1, Box 2).

[57] Smith S, *Proposed New Pollution Control Legislation in NSW: Background and Commentary* (Briefing Paper No 5/97, NSW Parliamentary Library Research Service, 1997).

[58] Exemplified by the fact that the Blue Mountains Conservation Society felt compelled to take action to restrain a breach of s 120 of the POEO Act given the lack of faith in the EPA to adequately licence and enforce conditions of licences: *Blue Mountains Conservation Society v Delta Electricity* (2009) 170 LGERA 1.

[59] Victorian Government, *EPA Works Approvals and Licences* (EPA Victoria), http://www.epa.vic.gov.au/compliance-enforcement/licences/default.asp#appeals viewed 16 July 2012.

[60] *Protection of the Environment Operations Act 1997* (NSW), s 45F1.

[61] New South Wales Government, n 20.

[62] ANZECC, n 18.

These established catchment-wide limits could then be formalised as a PEP under the POEO Act[63] to ensure this is considered and incorporated in all licensing decisions in the catchment.[64]

This fits well with the role and intention of PEPs, which were included in the POEO Act as an instrument to provide the means to set environmental goals, standards, protocols and guidelines to deal with the new generation of environmental problems. PEPs are required to be taken into account by public authorities, the EPA and planning authorities when making decisions affecting the environment.[65] When the POEO Act was introduced, it was hailed as an important mechanism to manage the cumulative impacts of development, by setting out the ambient environmental goals that the entire community is striving for, and form the backbone of the POEO Act's integrated approach to environmental protection.[66] Another benefit of PEPs is that they are implemented through a wide range of mechanisms, such as EPLs, development consents and regulations, which enable the goals, standards and guidelines to be put into enforceable instruments.[67] Despite this, no PEPs have been made and so this valuable tool is not being utilised.

Once the catchment-wide concentration limits (load limits or a cap) are established for key pollutants, this can be divided between the premises in the catchment to allocate the total concentration between licensed facilties, ensuring the total catchment-wide limits are not exceeded (see Fig 1, Box 3). Local studies should also be used to establish appropriate conditions for each licence. For example, these may be used to establish the likely dilution of discharged pollutants in the environment and the downstream extent of the pollutant discharge "plume". Calculation of EPL conditions should be based on rigorous evidence from environmental science and avoid "desktop" studies. Entrance of new premises emitting key pollutants could be accommodated by a reduction of the concentration limits of existing premises, or the establishment of a trading scheme to enable new premises to buy existing permits (Fig 1, Box 3).

A system such as this would ensure the cumulative impact within a catchment was within ecological limits; however, ongoing monitoring of environmental impacts of discharges should occur and amendments of licence conditions made if cumulative impacts are found to be unacceptable (see Fig 1, Box 4.1). The existence of a PEP would ensure existing licences, over a period of time, could be amended to incorporate cumulative impacts of all discharges within a catchment, as the PEP would mean the EPA would need to consider it in undertaking all its licensing functions, including reviews and variations of licences as these were undertaken.

Broader coverage

Given that many licences fail to include all the pollutants being emitted by a facility, or concentration limits for those listed, a comprehensive program of water quality monitoring, auditing of current licence requirements within the catchment, and then review and variation of licences should be undertaken. This should ensure licence conditions include concentration limits and the requirement to monitor all pollutants that have been measured in the catchment and that are likely to be emitted or discharged by each facility. Such information was required for Sydney Water to measure and publicly report a complex array of pollutant concentrations and loads discharged to the environment in treated sewage effluent, under the *Sydney Water Act 1994* (NSW).[68] The cumulative impact of all EPL discharges and how they are affecting the protection of key environmental values should also be considered, as discussed above. This would ensure that in future the EPA is regulating all pollutants being emitted in a catchment (Fig 1, Box 4.2).

[63] *Protection of the Environment Operations Act 1997* (NSW), Ch 2.

[64] *Protection of the Environment Operations Act 1997* (NSW), s 45 F1.

[65] POEO Bill Second Reading Speech, n 5.

[66] POEO Bill Second Reading Speech, n 5.

[67] POEO Bill Second Reading Speech, n 5.

[68] *Sydney Water Act 1994* (NSW), s 23, Sch 10.

The use of market-based approaches

Market-based approaches have long been seen by governments as a way to achieve environmental objectives at least cost to business and to the economy generally.[69] To enable the EPL system in New South Wales to more effectively achieve its aims, market-based approaches should be investigated to efficiently achieve catchment-wide targets for key pollutants and also to provide a real economic incentive to minimise pollution – a key component of ecologically sustainable development.[70]

In order to more efficiently achieve catchment-wide targets for various pollutants, an auction of pollution units could be used to allocate the total catchment-wide concentration limit between premises, and a trading scheme established to enable new premises to enter the catchment (see Fig 1, Box 3). Essential to the environmental integrity of this type of mechanism would be first establishing a catchment-wide cap on the pollutant, as discussed above (see Fig 1, Box 2). Trading schemes for water pollutants have been demonstrated to be effective, with the Hunter River Salinity trading scheme demonstrating salinities consistently below the scheme target since commencement.[71]

Further to exploring the use of additional market-based instruments, State-wide instruments should be strengthened to create better economic incentives to improve water quality. Load-based licensing is currently the main market mechanism used in the management of water quality in New South Wales; however, given the degraded water quality in many catchments[72] it could be argued that the costs of polluting under this mechanism are not high enough to provide a real incentive for cleaner production. For example, the load-based licence fee for total annual load of selenium discharge in 2006 from Delta Electricity (EPL 766) into the Coxs River and Lake Wallace was $765.65.[73] The adequacy of this fee is dubious as selenium has been identified as bioaccumulating and biomagnifying in the food chain in Lake Wallace,[74] and such a minimal load-based licence fee is unlikely to act as an incentive to reduce its discharge.

The authors propose amendments to Sch 1 of the *Protection of the Environment Operations (General) Regulation 2009* (NSW) to include a much broader range of facility types in the list of those required to pay load-based licence fees for water pollutants,[75] to expand the list of pollutants to which load-based licence fees apply,[76] and to increase the pollutant fee units.[77] All of these measures would provide a much stronger economic incentive for water quality improvements.

Independent monitoring and enforcement

Adequately funded, independent monitoring of water quality as well as monitoring of compliance with licence conditions is essential to ensure all pollutants being discharged are regulated, and that there is adequate incentive for accurate self-reporting by licensed premises (see Fig 1, Box 4). There is one independent body in New South Wales that currently performs this function, the Natural Resources Commission, under the *Natural Resources Commission Act 2003* (NSW). The authors are not aware if the Natural Resources Commission provides independent advice on pollution discharges for EPLs.

[69] Bates, n 33, Ch 13.

[70] *Protection of the Environment Administration Act 1991* (NSW), s 6(2); *Protection of the Environment Operations Act 1997* (NSW), s 3.

[71] New South Wales Government, *Scheme Successes* (Office of Environment and Heritage, 2010), http://www.environment.nsw.gov.au/licensing/hrsts/success.htm viewed 16 July 2012.

[72] Hawkesbury Nepean Catchment Management Authority, n 22.

[73] Delta Electricity, *2006 Annual Returns for Licence EPL 766* (2007)

[74] Jasonsmith et al, n 41.

[75] *Protection of the Environment Operations (General) Regulation 2009* (NSW), Sch 1.

[76] *Protection of the Environment Operations (General) Regulation 2009* (NSW), Sch 2.

[77] *Protection of the Environment Operations (General) Regulation 2009* (NSW), cl 19(7).

One of the objectives of the *Natural Resources Commission Act* is "establishing a sound scientific basis for the properly informed management of natural resources in the social, economic and environmental interests of the State".[78]

Following independent monitoring of EPL discharges, there should be enforcement of discovered breaches of the POEO Act, including breaches of licence conditions (see Fig 1, Box 4.3). Although the POEO Act contains strong enforcement provisions, a more cooperative approach to licensing has been followed by the EPA, which has weakened the "teeth" in the legislation – one of the key features of the POEO Act when it was introduced.[79]

It is noted that the EPA is required to audit, on an industry-wide or regional basis, compliance with licence requirements under the POEO Act[80] and whether such requirements reflect best practice in relation to the matters regulated by the licences. It is unclear how regularly these are undertaken; however, it is suggested they should be done on a regular basis so they are able to be considered when licences are renewed. For example, it is suggested that a five-yearly review be conducted on a regional basis to examine the collective contribution of each point-source to regional environmental impacts. An area that would particularly benefit from this approach is the Upper Coxs River, where all 22 licensed EPL discharges should be reviewed both collectively and individually. Such a review should be supported by independent monitoring and assessment of the regional environment, rather than merely assessing the 22 discharges at different times based on "end-of-pipe" performance.

These should also be made publicly available, so the community is aware of the progress made in various catchments towards protecting key environmental values.

Continuous improvement

Pollution Reduction Programs are another key feature of the licensing system, and are a way to implement continuous improvement for licence holders.[81] However, they are currently not used as conditions in all EPLs, which means not all licence holders are required to improve their environmental performance. To ensure continuous improvement on a catchment-wide basis every EPL should implement a Pollution Reduction Program to regularly review and reduce the discharge of key pollutants of concern (see Fig 1, Box 5). Licensed premises need to begin an ongoing cycle of continuous improvement in order to meet the water quality objectives for the catchment and this is a simple way to stimulate this.

Continuous improvement has been pursued in some catchments for some contaminants, eg the large improvement in the quality of treated sewage effluent in the lower Hawkesbury Nepean River over the last 15 years. Sydney Water treat the majority of catchment sewage and its treatment plants have progressively discharged lower loads of nutrients into Hawkesbury Nepean catchment waterways, dropping from 8.1 tonnes (phosphorus) and 276 tonnes (nitrogen) in 2006/2007 to 6.6 tonnes (phosphorus) and 238 tonnes (nitrogen) in 2010/2011.[82] A major factor in the continuous improvement in this area was the active role the EPA took in collecting water quality data and reporting on regional water quality issues, such as blue-green algae.

Public participation

A number of changes to the POEO Act would ensure greater public participation in the licensing process, which although an objective of the Act is provided only lip service by the EPA in carrying out their licensing functions. A key change would be to make annual returns, which are the self-reporting tool used by licensed premises, publicly available in conjunction with the EPA public register of EPL

[78] *Natural Resources Commission Act 2003* (NSW), s 3.

[79] POEO Bill Second Reading Speech, n 5.

[80] *Protection of the Environment Operations Act 1997* (NSW), s 78(4).

[81] POEO Bill Second Reading Speech, n 5.

[82] Sydney Water, *2010/11 Annual Report* (2011).

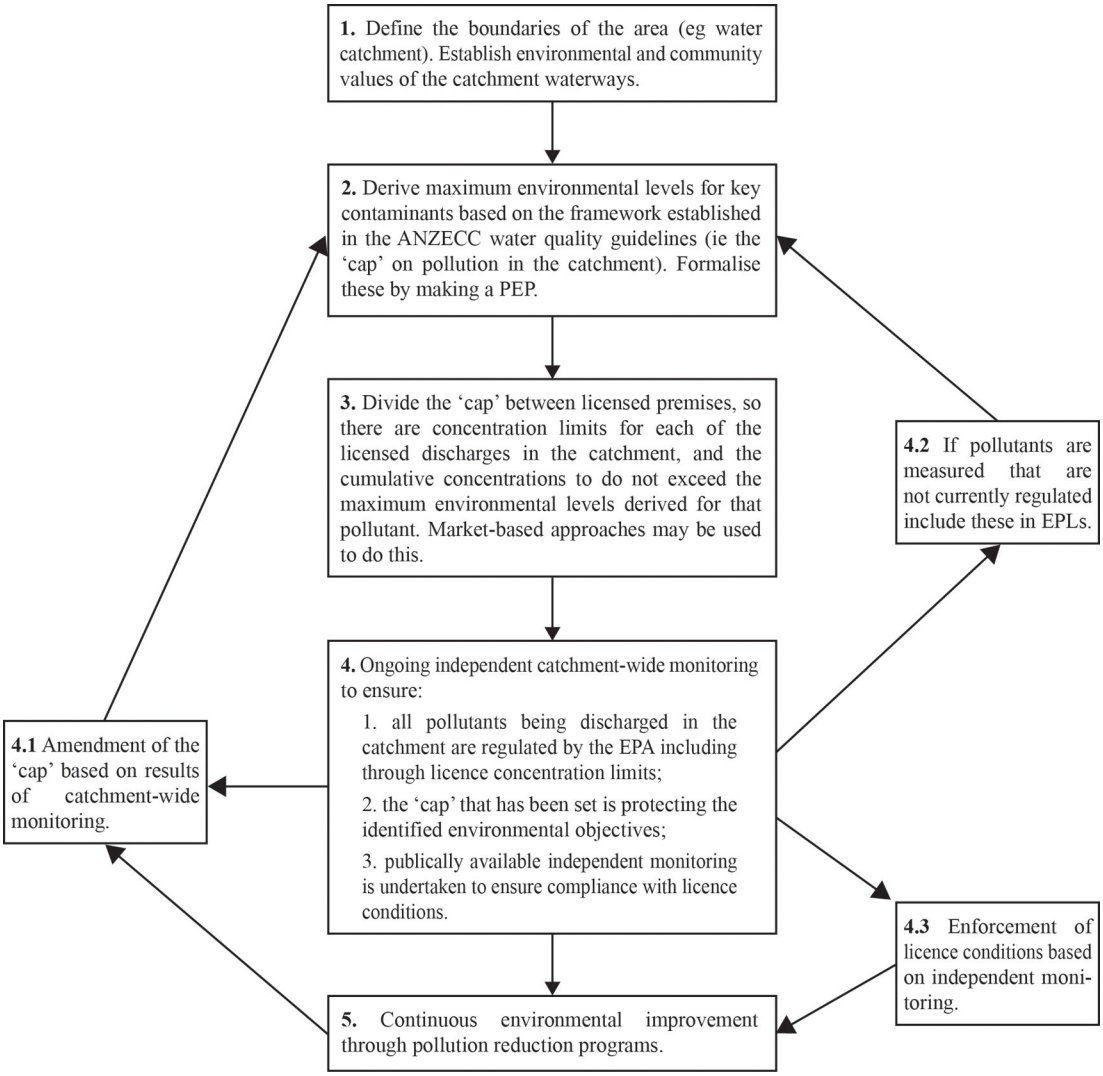
licences.[83] Additional amendments to the Act should be made to ensure the EPA considers public submissions on any licence application and in the review and variation to any EPL. In the absence of using the EPL system to protect established values for catchments, eg the water quality objectives, community input is essential in determining what kinds of impacts are acceptable from licensed premises. The EPA should explain the scientific basis for their EPL decisions.

TABLE 1 Wastewater discharge water quality conditions under the POEO Act, as specified in the following EPL 100% discharge limits (note: EPL 558 has been surrendered)

	EPL 558	EPL 766	EPL 2504
Discharges to	Dalpura Ck and Jinki Ck (Grose River catchment)	Lake Wallace and tributaries of the Coxs River (Upper Coxs River catchment)	Brennans Ck (Georges River catchment)
Number of points specified in licence to discharge to surface waters	2	7	6
Oil & Grease (mg/L)	10	10	10
Biochemical Oxygen Demand (BOD mg/L)	-	-	30
pH (pH units)	-	6.5-8.5 and 6.5-9.0	6.5-9.0 and 6.5-8.5
Total Suspended Solids (mg/L)	-	30	30 and 50 mg/L
Sulfate (mg/L)	-	1,200 and 1,600	
Turbidity (NTU)	-	25	
Iron (mg/L)	1	-	-
Zinc (mg/L)	5	-	-

[83] Environmental monitoring data collected as part of EPLs is now required to be made available to the public under the *Protection of the Environment Legislation Amendment Bill 2011* (NSW) (see n 17).

FIGURE 1 Overview of how the EPL system should function for regulating catchment-specific water pollution



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Viewpoint

Environmental protection and management: A water pollution case study within the Greater Blue Mountains World Heritage Area, Australia

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ABSTRACT

The Grose River is contained almost entirely within a World Heritage Area. While sewage pollution in the area has been addressed, pollution at damaging levels continues from a disused coal mine, closed in 1997. Despite some surface rehabilitation, no action has occurred to remediate zinc polluted waters emanating from the mine. We examine the historical regulation and management of the Australian Commonwealth and New South Wales governments and highlight gaps in both regulatory systems. We conclude that there is an urgent need to improve regulation of water pollution, mining and management of the environment in highly valued world heritage areas.

Introduction

The encroachment of human activities has modified most ecosystems of the globe (e.g., Botkin and Keller, 2009). Due to human activities it is becoming increasingly difficult to identify any natural environment that has not been altered to some extent. One approach to limiting the adverse impacts generated by humans has been to identify particularly 'valuable' or 'unique' environments and to manage them as protected areas. This approach regulates threats of human disturbance for selected 'protected areas' (Pimm et al., 2001). The form of protection varies internationally and there are a wide range of reserve classifications, including nature reserves, national parks, national monuments, and wilderness areas. Protected areas may be terrestrial, marine and/or freshwater (WDPA, 2009). Protection of large terrestrial reserves also often offers some protection for waterways within their boundaries (Fitzsimons and Robertson, 2005), although reserve boundaries rarely enclose the entire catchment watershed (Linke et al., 2008). This is one of the issues in the ongoing debate over the most appropriate approach to protecting aquatic ecosystems compared with terrestrial reserves (Moulton, 2009).

The Blue Mountains region is environmentally one of the most highly valued and comprehensively protected areas in Australia. The region has unique geology and biodiversity, and was considered of sufficient international significance to be declared a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Estate because of the area's natural values (UNESCO, 2009; Commonwealth Government, 2009a). In the 50 years since the initial creation of the Blue Mountains National Park, the area has continued to expand (NPWS, 2001). Several adjoining National Parks are now collectively regarded as part of the Greater Blue Mountains area. The majority, but not all areas are naturally vegetated and most of the area is considered to be in good ecological condition (Commonwealth Government, 1998).

The Blue Mountains region has historically witnessed considerable conflict between development and conservation (Mosely, 1999). Issues such as increased urban development, tourism, forestry, infrastructure development, and mining have frequently created strongly divergent views. The source of the environmental conflict has often originated from a 50 km string of settlements, stretching from Penrith in the east to Mt Victoria and Lithgow in the west. This ridge-top development bisects the National Park and houses a population of more than 80,000 residents (BMCC, 2002). It also caters for a large number of tourism visitors (Commonwealth Government, 1998; BMCC, 2002). Water pollution is one of many threats to the National Park that generates environmental conflict in the management of the area (Berman et al., 1987).

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Historically, a major source of water pollution in the Blue Mountains area has been sewage effluent. In July 1980 there were 12 sewage treatment plants (STPs) servicing a population of 46,000 in the Blue Mountains (MWS&DB, 1987). In the 1980s and early 1990s six STPs disposed of their wastewater into streams that flowed into the National Park estate lands (Berman et al., 1987).

Another source of water pollution throughout Australia, and in the Blue Mountains, has been water contamination from mining. The Blue Mountains region has had coal and other mining activity for more than a century (Macqueen, 2007). Although many of the mines have been closed, there are several active coal mines in the Western Blue Mountains, particularly in the Lithgow and upper Coxs Valley area (Lithgow Tourism, 2009).

One part of the Blue Mountains National Park that has been adversely affected by pollution by a combination of sewage effluent and mining pollution is the upper reaches of the Grose River, an otherwise pristine environment that is protected as a declared Wilderness Area within the National Park lands, and is also part of the Greater Blue Mountains World Heritage Area. The upper Grose River catchment (Fig. 1) is used as a case study for this paper. Regulation and management of water pollution in this area reflects a number of the strengths and weakness of regulation of coal mining, water pollution, and management of waterways within Australia's protected areas. Recommendations are made for future management to minimise the chance of similar environmental contamination issues arising in other protected areas.

Environmental protection of the Blue Mountains

The Blue Mountains became a popular holiday destination for Sydney residents, particularly since the construction of the first railway link between Sydney and mountains in the late 1800s. Over time, the impressive scenery of the area has become increasingly widely appreciated. The bushland has also become a popular destination for bush walking and camping along walking trails (Macqueen, 2007).

Over the 20th century there was a gradual increase in the recognition of the environmental values of the Blue Mountains. Conservation of large tracts of the area was advocated by the Sydney Bushwalking and Mountains Trails Club from early in the 20th

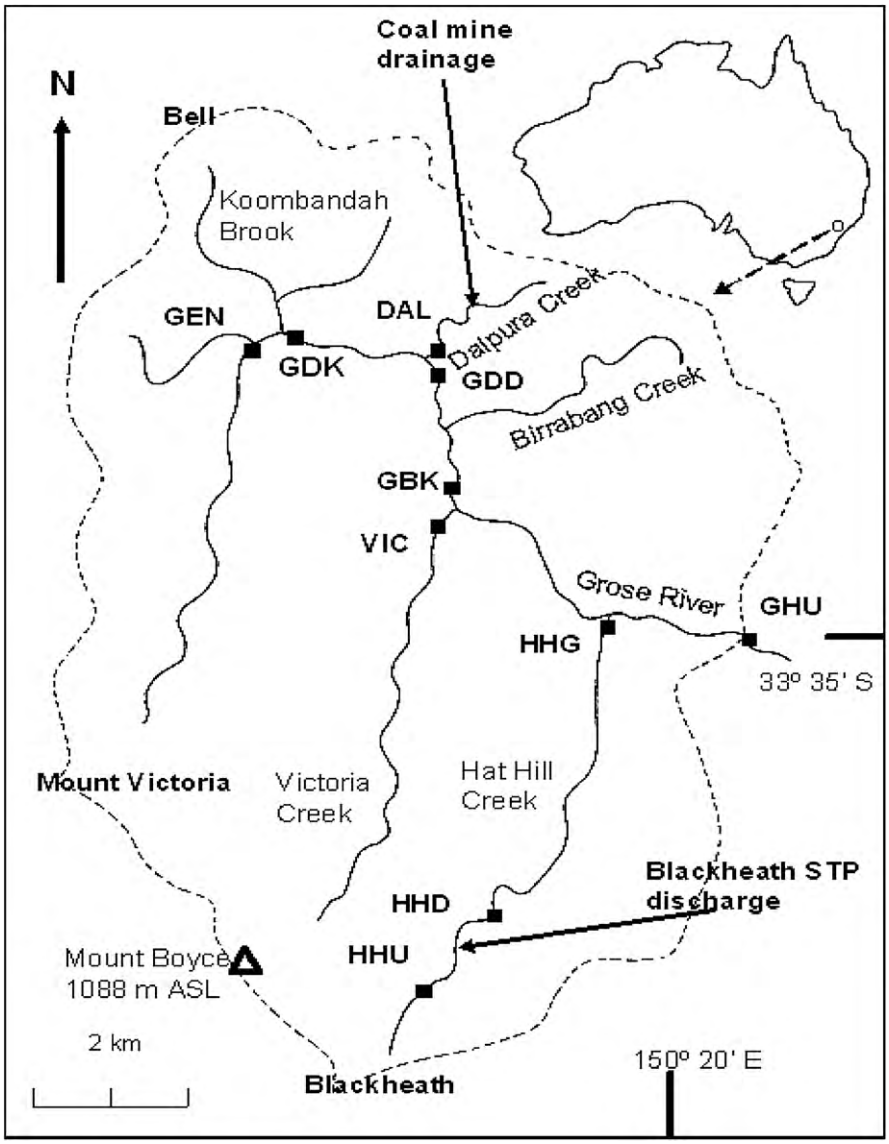

Fig. 1. Map of survey sites (square symbols), waterways and waste discharge points in the upper Grose River study area (sampled by Wright and Burgin, 2009a). Approximate catchment boundary of study area is indicated by dashed line. Inset shows location of study area in south-eastern Australia.

century (Macqueen, 2007). In the 1930s they were a small, but vocal and articulate group led by the pioneer Australian conservationist Myles Dunphy. In 1932 he presented a far-sighted and ambitious plan for a Blue Mountains National Park with 'primitive-areas'. However government action to formally protect the area was slow, although a watershed decision for the area was the 1959 gazettal of the initial segments of the Blue Mountains National Park (Mosely, 1999). Its boundary has since expanded, and in 1974 management responsibility for the national park estate was entrusted to the newly instigated New South Wales National Park and Wildlife Service (NPWS), now a division of the Department of Environment and Climate Change and Water (DECCW). The Australian Commonwealth Government also gained environmental management responsibilities in the Blue Mountains with the listing of the Greater Blue Mountains Area as a World Heritage Area in 2000 (DECC, 2009).

Sewage effluent disposal

The Blue Mountains encountered widespread water pollution from 12 sewage treatment plants that serviced the wastewater needs generated by townships of the Blue Mountains (Berman et al., 1987). Six of the STPs used to discharge directly to National Park streams. In 1980 the management of the area's sewerage (and water supply) system was transferred from the Blue Mountains City Council to the Sydney Water Board (now Sydney Water Corporation). The condition of the STPs at transfer was regarded as being 'antiquated' (Commonwealth Government, 1998). The Water Board admitted that water pollution from the Blue Mountains STPs caused unacceptable water pollution to Blue Mountains streams, particularly to waterways within the National Park boundary (MWS&DB, 1987). A 20-year improvement strategy has led to major modifications to the Blue Mountains sewerage system and treated effluent is now released to waterways away from the National Park. This has been achieved by transferring the effluent flows to a large treatment plant at Winmalee, in the lower Blue Mountains, that now releases its wastewater effluent to a small tributary of the Nepean River (Sydney Water, 2009).

Coal mining pollution

Coal seams exist under much of the Blue Mountains and coal mining was identified as a potential source of environmental conflict in the Blue Mountains World Heritage nomination (Commonwealth Government, 1998). Across New South Wales coal mining is licensed under the *Mining Act* (1992) and administered by the New South Wales (NSW) Department of Mineral Resources, now part of the NSW Department of Industry and Investment (I&I). Previously, coal mining in NSW was regulated by the *Mining Act* (1906) and more recently the *Coal Mining Act* (1973). However, under the *National Parks and Wildlife Service Act* (1974) coal mining was not a permitted activity in NSW national parks.

The New South Wales Government has regulated water pollution from point-source waste discharges since the early 1970s, initially under the *Clean Water Act* (1971) by the State Pollution Control Commission, and more recently under the *Protection of the Environment Operations Act* (1997) by the Environment Protection Authority (EPA, now a division of DCCEW). This approach to regulation and control of water pollution has relied on a 'command and control' approach, with licences being issued for discharges into waterways. These 'Environment Protection Licences' under the *Protection of the Environment Operations Act* (1997) specify concentration limits for various pollutants that are permitted to be discharged. This is an equivalent 'permit' approach to that pioneered in the United States (US) under the US *Federal Water Pollution Control Act* (1948), now the US *Clean Water Act* (1972). As with NPWS, the EPA has also been incorporated into the larger NSW environmental agency DECCW.

The Grose River

The Grose River catchment is nestled in the approximate centre of the Greater Blue Mountains area, to the immediate north of the urban corridor that runs between Penrith and Mount Victoria. The Grose River forms part of the headwaters of the Hawkesbury—Nepean River, one of the largest coastal draining river systems in south-eastern Australia. It rises at nearly 1000 m, near Mount Victoria and flows without barrier to its confluence with the Hawkesbury—Nepean River. At its closest point, the Grose River catchment is approximately 60 km west of Sydney (Fig. 1). The area is rugged, with deeply incised sandstone and shale canyons, valleys and gorges. Much of the area is not serviced by vehicular or walking trail access (NPWS, 1999).

The majority (approximately 95%) of the upper Grose River Catchment is natural bushland in undisturbed condition due, in part, to its rugged nature and lack of formal access (NPWS, 1999). The margins of the catchment are subject to human disturbance including the two small townships of Blackheath and Mount Victoria, local and main roads, and a passenger and goods railway line. Despite the protection of a large proportion of the Grose River catchment as a protected area (National Park, Wilderness Area, World Heritage Area), the Grose River has suffered two different forms of water pollution. The first was organic pollution from treated sewage effluent from Blackheath sewage treatment plant (STP) (Wright and Burgin, 2009a). The second was contaminated drainage from a derelict coal mine, the Canyon Coal Mine.

Blackheath sewage treatment plant

Blackheath STP was built in 1938. It was one of the six Blue Mountains treatment plants that discharged wastewater into National Park streams. Ownership and management of Blackheath and all other Blue Mountains STPs were transferred from Blue Mountains City Council to the Sydney Water Board in 1980 (MWS&DB, 1987). It was the last of the STPs that discharged to waterways flowing into Blue Mountains National Park. Blackheath STP was closed and demolished in mid-2008 (Sydney Water, 2009). For 70 years it had discharged effluent into Hat Hill Creek, a tributary of the Grose River in the headwaters of the Hawkesbury—Nepean River catchment (Fig. 1). The Blackheath plant was situated a short distance upstream of this National Park boundary, and provided secondary treatment of wastewater from approximately 5000 residents (EPA, 2008). Since its closure, sewage from Blackheath is transferred to Winmalee STP in the lower Blue Mountains for treatment and disposal to a tributary of the Nepean River (Sydney Water, 2009).

The Blackheath STP was licensed to discharge wastewater under conditions detailed in Environment Protection Licence (EPL) 1712, under the *Protection of the Environment Operations* (POEO) *Act* (1997). The licence specified a set of conditions which included limits on the concentration of pollutants allowed in waste discharges for 16 pollutants, mostly heavy metals and nutrients, with average and 90th percentile limits specified for each of the pollutants (see Table 1; EPA, 2008). The effluent outflow ceased in mid-2008 with the STP being fully decommissioned.

While in operation, effluent discharges from Blackheath treatment plant caused organic pollution of Hat Hill Creek and the

Table 1
Pollutant discharge limits in the Blackheath STP and Canyon Coal Mine Environment Protection Licences. All units in micrograms per litre unless otherwise specified.

Attribute	Blackheath STP EPL #1712		Canyon Coal Mine EPL #558
	Average	90th percentile	100th percentile
Aluminium	870	6100	–
Cadmium	0.2	0.7	–
Copper	35	96	–
Cyanide	57	500	–
Iron	610	8100	1000
Lead	4.4	7.6	–
Mercury	0.8	1.3	–
Total nitrogen (mg/L)	–	45	–
Total phosphorus (mg/L)	–	10	–
Zinc	90	240	5000
Hydrogen sulphide	340	2300	–
Chlorine (mg/L)	–	6.1	–
Nitrogen (ammonia) (mg/L)	–	35	–
BOD (mg/L)	10 (1)	20	–
TSS (mg/L)	10 (1)	20	–
Faecal coliforms (colonies per 100 mL)	–	200 (2)	–
Oil and grease (mg/L)	Annual load limit 1570 kg	10	

Grose River. While still in operation in 2003, total nitrogen (N) and total phosphorus (P) levels in Hat Hill Creek were elevated approximately 130 times above background levels (Wright, 2006). Nitrogen rose from 102 μg/L above the sewage effluent outfall to 14,316 μg/L downstream. Phosphorus rose from 3.8 μg/L above the STP to 507 μg/L below (Wright and Burgin, 2009a). Although pollution levels dropped with distance downstream, nutrient levels remained substantially above background levels and lifted nutrient levels in the Grose River. Based on a 2003 survey of macroinvertebrates, waste discharges from Blackheath STP also had an adverse impact on aquatic ecosystems (Wright and Burgin, 2009a,b).

The Canyon Colliery

For more than 50 years the Canyon Coal Mine conducted underground coal mining in the upper north-west corner of the Grose River catchment. The mine lease was granted before the area was declared National Park (Macqueen, 2007). Two drainage shafts from Canyon Colliery were constructed in the late 1970s to dewater the mine, directing the majority of the flow into Dalpura Creek, a tributary of the Grose River (Catalyst, 2008). A second drainage shaft was also constructed, directing a lesser volume of mine drainage into Jinki Creek, another small tributary of the Grose River (Fig. 1). The mine was closed in 1997 because it had exhausted its coal lease (Macqueen, 2007). Consequently, the mine was permanently closed in 1997 and the lease was surrendered in 2005. Effluent from the mine continues to flow into Dalpura and Jinki Creeks (I. Wright, pers. obs., November 2009).

The mine drainage from the derelict Canyon Coal Mine is contaminated with ecologically damaging levels of zinc (Wright and Burgin, 2009a,b) due to 'acid mine drainage', a common environmental problem in coal and metal mines (Johnson, 2003). Zinc can be highly toxic at trace levels to aquatic biota (ANZECC and ARMCANZ, 2000). In 2003, about 6 years after the mine ceased operation, a analysis of water and river invertebrates concluded that the Grose River was impaired due to the mine drainage (Ian Wright, Ph.D. Thesis, 2006). Zinc levels in the upper reaches of the Grose River rose from less than 10 μg/L zinc to 388 μg/L due to the inflow from the mine (Wright and Burgin, 2009a). While zinc levels dissipated with distance downstream, they were all higher than the ANZECC and ARMCANZ (2000) guidelines for aquatic ecosystem protection (trigger value for protection of 95% of species of 8 μg/L). Macroinvertebrate survey results confirmed that the mine waste was having an adverse toxic impact on the stream-dwelling macroinvertebrates of the upper Grose River (Wright and Burgin, 2009a,b).

Canyon Coal Mine was operated according to conditions detailed in Consolidated Coal Lease (CCL) 742 approved in February 1990 by the then New South Wales Minister for Mineral Resources. This Lease provided the government's expectations for environmental management, and other matters, for the operation of Canyon Coal Mine. The Lease contained a clause (No. 27) that addressed the issue of water pollution:

> The registered holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation of any stream or watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction which may be given by the Minister with a view to preventing or minimising the contamination, pollution or siltation of any stream, watercourse or catchment area, or undue interference to fish or their environment.

As with the Blackheath STP, the discharge of wastewater from the coal mine was also regulated under the *Protection of the Environment Operations Act* (1997) with a licence for point source discharge of wastewater, 'Licence EPL 558' (EPA, 2001). The Colliery Licence only specified three pollutants, including zinc concentrations, to a maximum of 5000 mg/L of effluent (Table 1). Following cessation of the mine's commercial production of coal in 1997, the pollution discharge licence for the coal mine was surrendered in 2001.

The *Mining Act* (1992) provides that conditions may be imposed on mine leases that require environmental rehabilitation of a mine site after mining activity has ceased. The lease for Canyon Colliery (CCL 742) included clauses explaining the required rehabilitation that would be expected after the mine activity ceased. Repair to disturbance to the natural environment is carried out by the former lease holder, according to a mine closure plan that must be approved by Department of Primary Industries (DPI). Advice from DPI discussed the rehabilitation of surface works at the mine—this included the demolition of buildings and revegetating of the disturbed area at the surface workings of the Mine (I. Wright, pers. comm. from DPI, 16 October 2008). The zinc polluting discharge flowing from the Mine was not part of the rehabilitation plan (Letter from DECC Director-General to I. Wright, 22 January 2008). We believe that this was an oversight by DPI.

Since the commercial operation at Canyon Colliery ceased in 1997, and the coal lease was surrendered in October 2005, the DPI has been responsible for overseeing the environmental rehabilitation of the natural environment previously disturbed by the coal mining activity.

Critique of New South Wales regulatory system for coal mining and STP effluent pollution

There are shortcomings in the NSW regulatory system controlling coal mining and water pollution, which emerge from this case study. A major shortcoming is that the water pollution licensing system focusses on procedural requirements as opposed to achieving environmental outcomes. For example, the receiving waterways below both waste discharges are tributaries that flow directly into a highly valued conservation area (National Park, Wilderness Area and World Heritage Area). We consider that the licence would have been more likely to succeed in protecting the condition of the upper Grose River if it had specified ongoing monitoring of the health of the stream environment, rather than only specifying end-of-pipe discharge limits from both the coal mine and the STP. As was identified by the ecological research conducted by Wright and Burgin (2009a,b) both waste discharges were causing significant degradation of the health of the river ecosystem below each point source discharge.

Other shortcomings include the lack of opportunity for public input to the pollution licensing system, and the lack of implementation of the legislation to realise the bold objectives of the POEO Act. One of the main objectives of the Act is 'to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development'. Under the licensing conditions of both water pollution discharges in this case study, it appears unlikely that either waste discharge could have satisfied the objectives of the POEO Act. In particular, both pollution sources failed to: '*protect, restore and enhance the quality of the environment*' (POEO Act, Section 3 Objective a).

This is, at least in part, because despite the extensive regulatory regime for pollution in NSW, the current system focusses on process as opposed to environmental outcomes. This approach is a common criticism of the 'command and control' regulatory approach to pollution (e.g., Bates, 2002). If environmental outcomes had been stated in the pollution licensing process, we find it inconceivable for a licensed zinc discharge of 5000 μg/L in a World Heritage Area where background levels are below 10 μg/L. The permitted level of zinc from the Canyon Coal Mine was more than 600 times the Australian water quality guideline for zinc of 8 μg/L. The only scenario under which such an outcome could be acceptable for environmental protection would be where the waste discharge was strongly diluted by river flows. Based on data collected in 2003 in the Grose River (Wright and Burgin, 2009a), it was estimated that the Canyon Colliery contributed approximately 40% of the Grose River flow immediately below Dalpura Creek. Given such a low degree of dilution, 5000 mg/L of zinc is substantially above recognised safe levels for aquatic ecosystems (ANZECC and ARMCANZ, 2000). Under such conditions, even maintaining strict adherence to the licensing conditions would not have provided environmental benefits to the Grose River.

This lack of protection would have been less likely to occur if the community had the opportunity to have input into the pollution licensing system. However, there is no public submission process for input into granting or setting licence limits of waste discharge agreements, 'Environment Protection Licences', under the POEO Act. The licence limits are set at the discretion of DECCW. Once planning approval has been provided by the NSW Planning Minister, under the *Environment Protection and Assessment Act* (EP&A) (1979, amended 2008), an Environment Protection Licence may not be refused and must be substantially consistent with any approval given by the Minister (s 75V EP&A Act). In the future, all applications for planning approval of coal mines will be dealt with under Part 3A *Environmental Planning and Assessment Act 1979*, as directed by Schedule 1, *State Environmental Planning Policy (Major Projects), 2005*. This means that there is no direct avenue for public participation in the licensing process, or in setting licence limits and, in addition, there are no third party rights of appeal once a licence is issued.

The review of Environment Protection Licences is required within 5 years of their issue, and public notification is required, however public submissions are not required to be sought or considered in any changes to the licence. When the *Protection of the Environment Operations Bill* 1997 was debated by the New South Wales Parliament there were concerns raised about the lack of public participation in the licensing system, with greater opportunities for input and appeal in similar pollution licences in Queensland, South Australia and Victoria (Smith, 1997).

The difficulty in ensuring that strict environmental outcomes are maintained is that the licensing process must balance the need to protect the environment with the benefits to the community from undertaking activities such as mining (Farrier and Stein, 2006). Establishment of discharge limits perhaps requires continuous modification of licence conditions based on regular monitoring that is focussed on environmental protection. However, it is unclear who is currently responsible for the coal mine drainage, given that it continues to flow and pollute, despite its environmental protection licence being surrendered. This has occurred despite many worldwide examples where pollution continues after commercial production ceases, often associated with mining or industrial sites, such as the closure of coal mines in the United Kingdom (Younger, 1993).

Although the senior author sought the rationale from senior officers in DPI as to why the mine rehabilitation plan did not address the continued discharge of pollution, an answer was not forthcoming. It is our view that the process for surrendering a licence should have involved checking to ensure that the waste discharge has ceased, which it clearly has not, we suggest that the POEO Act needs modification to ensure that licences are not surrendered if they still generate pollution.

Now that the licence has been surrendered, potentially the most logical approach to rehabilitation from the NSW Government is to obtain funds from the *Derelict Mines Program*, administered by a joint steering committee that comprises DECCW and I&I. Based on the priorities of the program (risks to public safety, pollution impacts, contamination, erosion or land degradation, and public concerns), realistically the only criteria that would meet the guidelines is 'pollution impacts'. Even if public concern for pollution of a seldom visited wilderness area was substantial, the type of rehabilitation offered (detailed site assessment, reduction of safety hazard by fencing and fillinGaps ig shafts, management of water and sediment movement, acid mine drainage management, monitoring and revegetation of sites; I&I, 2009) are also not a good match with the restoration requirements of the site.

Commonwealth involvement in the Grose River

The role of the Commonwealth Government in regulating environmental matters is constrained by its powers established under the Constitution (s 51) with regulation focussing on matters of national significance, including nationally threatened species,

Ramsar wetlands, World Heritage Areas and migratory species, which are covered by the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC) (1999). The EPBC Act establishes an assessment and approvals process for actions that may significantly impact a matter of national environmental significance, of which world heritage areas are one (EPBC Act, Part 3). This means that any new activity which is proposed that may significantly impact a World Heritage Area, or values that have been identified as having national significance, requires approval from the Commonwealth Government under the EPBC Act. The two waste discharges that caused pollution to the Grose River began before the Blue Mountains World Heritage Area was nominated, and indeed before the EPBC Act was enacted. The EPBC Act lacks provisions to deal with existing impacts that degrade World Heritage Areas. Under the current Act, if the Canyon Colliery was to lodge a development application, the Federal Minister for the Environment would have the power to refuse approval based on the impact of the mine on the World Heritage Area. However, there is no power under the EPBC Act to order remediation or clean up of existing pollution, or to assess the impacts of existing actions. The limited scope of the Act and its resulting inability to deal with often serious threats to the values of areas of national environmental significance has been highlighted in the recent independent review of the EPBC Act (see EDO submission on the EPBC Act online at http://www.edo.org.au/edonsw/site/policy.php).

There are two important precedents where the Commonwealth Government has taken direct action to rehabilitate or prevent freshwater pollution from mine activity. Firstly, the Commonwealth Government created the Supervising Scientist to be an environmental watchdog for uranium mining at the Ranger Uranium Mine, in the Kakadu area, Northern Territory (Commonwealth Government, 2009b). This was created following the Ranger Uranium Environmental Inquiry, conducted from 1975 to 1977, which found that the proposed mine could result in unacceptable environmental damage. The Commonwealth Government accepted the findings of the enquiry and created the Office of the Supervising Scientist in 1978, under the Commonwealth *Environment Protection (Alligator Rivers Region) Act* (1978) to ensure that all aspects of the mine were carried out in a manner that would protect the environment. The Office of the Supervising Scientist is probably a unique body of its kind in Australia that provides independent assessment with a clear central objective of ensuring that the mining does not damage the local and regional environment. It also funds a substantial research program that allows it to generate scientific knowledge to help it fill information gaps that may impede the Office making a decision based on relevant scientific knowledge (Commonwealth Government, 2009b).

A second precedent was the Captains Flat mining area in NSW, which had been generating severe heavy-metal pollution of the Molonglo River for many decades (Nicholas and Thomas, 1978; Norris, 1986). In 1976, the Commonwealth Government funded extensive environmental rehabilitation of the former contaminated mine site to mitigate and reduce water pollution. The reason for the action was perhaps not to protect a river in a National Park or World Heritage Estate, but may have been prompted because of its strategic importance to the landscape of Australia's capital city as Lake Burley Griffin, Canberra, is an artificial impoundment of the Molonglo River.

The Grose River case study is a reminder that the Commonwealth and New South Wales environmental relationship remains young and has potential for improvement. Understandably, from time to time, problems occur that are not adequately managed by one of the two levels of Government best suited to deal with the issue. Perhaps such limitations relate to the 'Constitutional uncertainty' that was discussed in the 1999 Senate review of the Commonwealth Environmental powers (Parliament of Australia Senate, 1999). Although there appears to have been continued reluctance to intervene, the review did suggest that the Commonwealth Government should take a stronger role in environmental matters, with the Senate Committee's recommendations:

> The Commonwealth should exercise a leadership role in the protection and improvement of the Australian environment. This role should be supported by the unsparing use of all Constitutional power available to the Commonwealth to act in the field of the environment.

Outlook for water pollution in the upper Grose River

As previously indicated, Blackheath STP was closed in mid-2008 and the disposal of treated sewage to Hat Hill Creek was terminated. Sampling in the area by the senior author (unpubl. data) in Hat Hill Creek, 18 months after the treatment plant closure has indicated that the improvement of water quality was considerable. Water quality below the outflow had improved to a level effectively equivalent to background water quality. However, the outlook for the water pollution in the upper Grose River remains bleak due to the continued heavy-metal contamination from the Canyon Coal Mine. Overseas examples of derelict coal mines suggest that the pollution may continue for centuries (e.g., Herlihy et al., 1990; Younger, 1993).

Lessons to be learnt from past errors

There are three broad issues behind the previous and current water pollution in the upper Grose River that could be better managed in the future: (1) setting of waste licence limits for specific pollutants and protection of receiving waterway values; (2) regulation of continuing pollution after closure of a mine; and (3) collective action between all regulatory authorities and both levels of Government.

In terms of setting licence limits for pollution licences, our biggest criticism of the current system is that licences should be set in a manner that ensures discharges do not threaten identified environmental values in the receiving environment. The ANZECC and ARMCANZ (1992, 2000) water quality guidelines provide a recommended approach (for all Governments in Australia and New Zealand) for developing locally relevant guidelines to meet certain waterway outcomes. In the case of the Grose River the uses and values of the receiving waterway would probably have been 'Protection of the aquatic ecosystem' given the sensitivity of the area and the aims of the *National Parks and Wildlife Act* (1974).

The environmental impact of sewage pollution in the upper Grose River was recognised as being unacceptable, and was solved, but coal mine drainage was ignored. The closure of Blackheath STP and 11 other STPs in the Blue Mountains was largely due to Sydney Water Board's bold decision in the late 1980s to remove sewage pollution from high conservation value waterways in the Blue Mountains. This was identified by the Water Board in a landmark 'environmental value approach' to sewage management (Berman et al., 1987), as reported in the Water Board's 1988–1989 Annual Report:

> Consideration is being given to a scheme to transport effluent out of the National Park area for treatment at Winmalee. This scheme would avoid completely the addition of any (treated) effluent to streams within the Blue Mountains National Park.

The ongoing problem of mine drainage from the Canyon Coal Mine has never received similar attention and action to sewage pollution. After the mine's closure, all government agencies appear

to have failed to address the water pollution that continues to be emitted from the coal mine. It is unclear why the mine owners were not required to decontaminate the mine drainage. We suggest that, no matter how remote the area, all applications for surrender of waste discharge licences/coal mine leases should include a thorough physical assessment to ensure that the contamination has ceased. There appears to have been limited dialogue between the two (NSW) regulatory agencies that managed the coal mine (DMR) and the water pollution (EPA), particularly during the months before and after the coal mine closed in 1997. DMR regulated the mining activity, and also has responsibilities for the formal 'mine closure' process that operates when a coal mine's operations permanently cease. At the time of writing, the mine has been closed for 12 years, and although terrestrial rehabilitation of the mine is still underway and appears to have been focussed on areas disturbed by surface operations at the mine, there has been no activity to remediate the mine drainage pollution.

Conclusions

There has been considerable debate on the topic of conservation of freshwater aquatic reserves in Australia (e.g., Fitzsimmons and Robertson, 2005) and internationally (e.g., Moulton, 2009). The Grose River situation is perhaps of some relevance for this debate. The Grose River flows within a catchment that is broadly protected by the Blue Mountains National Park, but this has not prevented the river itself from being polluted. This case study reinforces the importance of integrated natural resource management for waterways and their catchments. All major sources of disturbance and pollution of a river within its watershed need to be considered. The two pollution sources in the Grose River came from relatively minor land uses, but collectively had a disproportionately negative influence on the water quality and ecological health of the Grose River.

Perhaps all point sources of water pollution should be subject to 5-year licence reviews to ensure that any adverse environmental impacts they create are not beyond reasonable limits. If problems were identified, actions could be directed to reduce the impacts. This could also include reassessment of security bonds retained by government to ensure that they remain commensurate with the passing of time and/or increase in line with inflation. We note that the security bond on the Canyon Coal Mine, as approved in 1990, was the comparatively trivial amount of AUD$133,500.

In relation to the continuing pollution, the ecologically toxic coal mine drainage (Wright, 2006) may have 'fallen through the cracks' in regulations between the responsible agencies, with the Department of Primary Industries' mine closure plan having only had regard for the surface works, and the Department of Environment and Climate Change accepting the surrender of the Environment Protection Licence. In both cases, it appears that regulatory authorities failed to hold the owners of the coal mine responsible for long-term remediation of the drainage beyond the commercial life of the coal mine. As a consequence of inaction it appears that the Grose River will join a growing international list of derelict mines that continue to contaminate rivers and lakes (e.g., Johnson, 2003).

Perhaps an unusual feature of the Grose River contamination is that it has occurred in such an environmentally valued river, flowing in the centre of such highly protected lands (National Park, Wilderness Area and World Heritage area) that are also thoroughly regulated by NSW and Commonwealth Government agencies. It begs the question: if this continued drainage from a coal mine is allowed to continue to pollute a river in such an environmentally significant and protected area, what are the chances of similar pollution at less protected areas?

Recommendations

In summary, we suggest that the Grose River pollution may be regarded as an Australian case study from which lessons may be learnt for improved management of coal mining, water pollution and protection of high-conservation catchments and rivers. We recommend that permissive discharges of waste material to waterways (termed Environmental Protection Licences in NSW) clearly detail the values of the aquatic environment that they intend to protect. This should be consistent with community-derived aims and values for the receiving environment. Scientifically credible and comprehensive environmental indicators that are consistent with Australian Water Quality Guidelines (ANZECC and ARMCANZ, 2000) need to be regularly monitored in the receiving environment, as well as the waste discharge, to ensure that the impact is within specified limits. Environmentally robust discharge licences are needed to protect waters from pollution impacts and enable timely corrective actions to be taken to reduce, or remove, unacceptable waste releases. An improvement in regulation and protection of rivers from pollution would reflect an increasing public demand for protection of the environment (e.g., DECC, 2006).

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