

Review of biodiversity considerations within the United Wambo Open Cut Coal Mine Project (SSD 7142)

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Summary

1. I have conducted a review of the biodiversity considerations within the proposed United Wambo Open Cut Coal Mine Project (Project).
2. In my opinion, the removal of a large patch of Central Hunter Valley Eucalypt Forest and Woodland (CHVEFW) Critically Endangered Ecological Community (CEEC), which is in relatively good condition and is strategically important for landscape connectivity, is contrary to the objectives contained within the Conservation Advice provided by the Commonwealth Threatened Species Scientific Committee, as this patch:
 - Is critical to the survival of the CEEC;
 - Should be protected within the reserve system;
 - The action is contributing to the most important of threats to this community, “... *vegetation clearing and landscape fragmentation*”
3. Proposed offset measures fall short of providing a transparent and verifiable outcome because:
 - Land-based offsets proposed are small and scattered and cannot replace the importance of the 178 ha patch to be cleared;
 - Mine rehabilitation outcomes for this community have not verified a lasting and reproductively fit community can be created;
 - Retirement of species credits for the southern myotis bat are not adequately accounted for;
 - Offset Strategy falls very short of adhering to the majority of principles in the Commonwealth Offset Policy,
 - Assessments of significance of the removal of the vegetation for the Project have not adequately dealt with the loss of this key, large patch of CHVEF and its importance for maintenance of valley connectivity for wildlife. Questions remain as to the adequacy of the Regent Honeyeater (*Anthochaera phrygia*) impact assessment and a number of other threatened species.

Acknowledgements

4. This Expert Advice has been prepared for EDO NSW, acting on behalf of the Hunter Environment Lobby (HEL)

5. I have read the Expert Witness Code of Conduct in Schedule 7 of the *Uniform Civil Procedure Rules 2005* and agree to be bound by it.

Scope

6. I was asked to prepare a report to the Independent Planning Commission (IPC) for consideration as part of their determination of the Project.
7. The following documents were reviewed for this report:
 - a) DPE Major Project submission process
 - i. All relevant EIS documentation;
 - ii. All relevant Response to Submissions documentation
 - b) IPC Review:
 - i. Review Report (Executive summary, pp. i-ii; Recommendations – Biodiversity, pp. iv-v; Comments and Findings – Biodiversity, pp. 30-38).
 - c) Response to IPC Review:
 - i. Response to IPC Review (Biodiversity, pp. 39-55);
 - ii. Appendices.
 - d) Response to Request for Additional Information:
 - i. Response to Request for Additional Information.
 - e) DPE Final Assessment Report:
 - i. Final Assessment Report (Executive Summary, p. 5; Responses to the Commission’s Review – Biodiversity, pp. 27-37);
 - ii. Appendix F – Recommended Conditions of Consent.

Expert Assessment

i. Is the proposed Project consistent with the Conservation Advice for the Central Hunter Valley Eucalypt Forest, particularly the statement that areas that meet the minimum (Moderate quality condition class) Condition thresholds, or are within the buffer zone, are considered critical to the survival of the Central Hunter Valley eucalypt forest and woodland ecological community.

Size and condition

8. The vegetation community on the site conforms to the listing as critically endangered by the Commonwealth as Central Hunter Valley Eucalypt Forest and Woodland (CHVEFW), this ecological community is highly fragmented; with an estimated median patch size of 1.7 ha. Almost all (86%) of the remnants are less than 10 ha in size. Only 2% of patches of the ecological community are larger than 100 ha in size (CoA 2016).
9. The state equivalent for this community is ‘Central Hunter Grey Box – Ironbark Woodland’ which occupies an area estimated to be 32% of the pre-European distribution (Peake 2006). Mapped occurrences of the community include 27 remnants greater than 100 ha and more than 1,000 small remnants less than 10 ha indicating a high level of fragmentation (Peake 2006). However, these estimates are 12 years old and considerable amounts of this endangered ecological community (EEC) have been removed, particularly by the coal industry, in the Hunter Valley over the last 12 years, amounting to hundreds of hectares.

10. Due to this high level of historic fragmentation, high levels of edge effect (indirect impact from surrounding lands, such as noise and feral animal penetration), use by stock, and low levels of protection, many of the smaller remnants in the Hunter Valley are in a reduced condition, often as 'canopy only' communities. The Conservation Advice for CGVEFW states that: *"Areas that meet the minimum (Moderate quality condition class) Condition thresholds, or are within the buffer zone, are considered critical to the survival of the Central Hunter Valley eucalypt forest and woodland ecological community"*.
11. The condition, including the species composition and diversity of the community in question at the site, has been described as being in a 'moderate to good' condition in the information provided by the proponent in the Biodiversity Assessments (Umwelt 2016).
12. Such important patches need to be retained in perpetuity. It is noted that none of the offsets proposed contains a patch of similar size. Just in terms of size alone, the patch in question is irreplaceable.
13. **Due to the size, condition and location of the remnant patch of CHVEF in question, it is considered critical to the survival of the Central Hunter Valley Eucalypt Forest and Woodland ecological community.**
14. The most overriding threat to this community is, according to the Conservation Advice on this community, *"... vegetation clearing and landscape fragmentation. Mining, agriculture and horticulture have been and continue to be the main drivers of clearing; remaining areas of the community are highly fragmented, isolated and much less resilient to on-going impacts."*
15. Thus, the proposal **will be contributing to the most important of the threats to this community** and is contrary to the advice contained within the approved Conservation Advice for the community. A full list of the most important recovery objectives is provided in the Appendix.
16. The Conservation Advice for this critically endangered ecosystem states the community needs better protection to, *"...help protect the landscapes that provide the connectivity of wildlife corridors and refuges essential to the long-term productivity, health and biodiversity of the region."*
17. The Framework for Biodiversity Assessment (FBA) methodology used in this instance has failed to consider issues of landscape connectivity or cumulative impact adequately. Just as a significant issue as the extent of removal of the CEEC, is the impact the proposal will have on the ability for wildlife to disperse through the valley. This Project will not only remove one of the last significant stands of the CEEC, but one of the few vegetated corridors in the valley itself (see figure below).
18. The assessment report assumes the proposed offset arrangements will be suitable for the listed matters through an increase in connectivity for these fauna species. In my opinion, the proposed offsets are likely to be inadequate to offset the proponent's credit liability:
 - due to their small size and location in landscape, and
 - the unresolved issues and the time taken to achieve suitable habitat components for these species from mine rehabilitation efforts (see below).
19. The Conservation Advice also identifies the importance of increasing the extent of the community within the reserve system, to *"ensure that patches of particularly high quality or importance in a landscape context are considered for inclusion in formal reserve tenure or other land tenure for biodiversity conservation purposes."* The patch proposed to be removed certainly meets the description of being of, 'particularly high quality or importance in a landscape context'.
20. Therefore, the removal of this important patch is also contrary to the Conservation Advice for the Commonwealth listing **due to its landscape value and because of its potential value to the reserve system.**



Figure 1. The lowland linkage running in the direction of the Golden Highway, linking vegetation from Warkworth to Jerry's Plains.

ii. In your opinion, and considering the merits of the proposed Project, are the proposed biodiversity offsets, particularly in relation to the Central Hunter Valley Eucalypt Forest and Woodland, adequate and appropriate?

21. Total impact of the Project will result in the removal of 527 ha of native vegetation, including 178.43 ha of Central Hunter Valley Eucalypt Forest and Woodland generating a 26,383 ecosystem credits liability and 564 species credit liability for the Sothern Myotis (bat). The Regent Honeyeater was not identified as requiring offset (OEH Letter, December 2017) though may need to be under any *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval.
22. Adjoining areas of forest to the mine, within and outside buffer zones, are subject to indirect impact, none of which has incurred an offset liability. Indirect impacts are widely recognised as having potentially significant impacts on vegetation and fauna. For example, excessive dust can inhibit flowering and fruiting of plants (Forbs 2009), reducing fecundity; the creation of new forest edges due to clearing will be used by foxes, whose overall impact increases as the size of the remnant decreases (Seymour et al. 2004). While many of these impacts are difficult to quantify in detail, a generalised indirect impact index could have been created for use in the FBA so that offset liability for indirect impacts are quantified for use in the Calculator. This is one of the chief shortcomings of the current Offset Policy for Major Projects in NSW, but which remain important in considering the merits of the Project.
23. The Project is to be 'staged' but most of the clearing is associated with Stage 1. 85% of the total impact will be undertaken in Stage 1, a significant loss in a short period of time, reducing ability of fauna to successfully disperse and find alternative refuge.
24. At least 7 out of the 10 principles of the Commonwealth offset policy have not been met by the current proposal, particularly as the proposal cannot:

1. *deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action* (for both CHVEF and the Regent Honeyeater a net loss is likely)
3. *be in proportion to the level of statutory protection that applies to the protected matter* (in this case critically endangered, no allowance for this provided)
4. *be of a size and scale proportionate to the residual impacts on the protected matter* (one large remnant being offset by several scattered, smaller parcels is not proportionate to the impact)
5. *effectively account for and manage the risks of the offset not succeeding* (no provision for failure of rehabilitation)
6. *be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs* (mine rehabilitation is a mandatory requirement under the Mining Act)
7. *be efficient, effective, timely, transparent, scientifically robust and reasonable* (the proponent states their intention to achieve ecosystem outcomes from rehabilitation within the lifetime of the project. The evidence provided by the proponent does not support this outcome, in that it would be expensive in terms of materials and time, issues of weeds are not settled, and there remain questions as to the accuracy of the Umwelt (2017) review given no data was provided to support these claims)
9. *be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty* (lack of account of other factors, ie critically endangered status, lack of consideration of indirect impacts in the credit liability, use of rehabilitation without any contingency suggest this is not being achieved).

Ecosystem Credits

25. The proponent proposes that the ecosystem credits for the Project will be retired in full, with two additional offset sites provided since the EIS, namely Jerrys Plains and Brosi and the provision of credits generated through mine rehabilitation.
26. The retirement of credits or the offset of impact for this Project relies largely on the merit of the **rehabilitation** aspect of the proposal. 21,446 ecosystem credits are proposed to be created from a combination of land-based offsets and from rehabilitation. In Stage 1 (first seven years), rehabilitation will contribute 4,230 credits to reducing the offset liability by a significant proportion (1/6) including 2,437 credits for the establishment of CHEVF. A proposed area of 878 ha for the generation of ‘credit-generating ecological mine rehabilitation’ has been identified.
27. However, some communities have not had their residual liability dealt with through the offset strategy. This includes HV_905 (800 credits short – this is the target CHVEFW community, raising questions about the claim that this matter has been retired in full); HV_906 (158 credits short) and HV_945 (289 credits short). The Final Assessment report has not identified how these may be retired other than through ‘additional’ land-based offsets or the BC Fund. The DPE is satisfied these can be retired within 12 months of the approval though no indication is provided as to the feasibility of this.
28. There are serious questions of scientific merit as to the use of mine rehabilitation as a means to retire credits generated by the removal of good condition mature ecosystems. The most important is that there is insufficient scientific evidence that complex ecosystems, such as those targeted here, can achieve a condition that would resemble a functioning, self-generating community. There is also evidence that the significant impacts of development have become acceptable during decision making because of the use of offsets (Devictor 2015; Maron et al. 2015; Bull et al. 2015; Moreno-Mateos et al. 2015; Spash 2015). This is despite that fact that it is

now commonly accepted among the scientific community that current offset policy in NSW promotes 'net loss' outcomes.

29. There have been considerable attempts at making rehabilitation acceptable for the offset scheme in NSW, but the chief constraint is the issue of a healthy and living soil that can support the level of ecosystem function required. The most recent example comes from Glencore's joint partnership project with the University of Newcastle. While good results for groundcover (a chief issue for rehabilitation projects) could be achieved using high levels of maintenance, this was reliant on the availability of forest (natural) soils and mulching. Addition of organic matter can achieve good results, but it also encourages weeds and exotic grasses:

"Subsoils and forest topsoil, even when highly degraded, still provide the best outcomes in terms of species diversity and sustainability of populations of EEC and other local species. When combined with mulch the effect is increased and in some cases the addition of OGM (organic matter) may further increase outcomes. The main usefulness of OGM is the high ground cover of selected native species it can produce. But a major problem is that it also encourages weedy species and invasive grasses which require intensive management and can ultimately threaten the outcome." (Castor et al. 2016).

30. The work undertaken by Castor et al (2016) shows encouraging results for future attempts to create ecosystems, though highlights the still experimental nature of this kind of work and the high level of intervention required to achieve good results. Question relating to the creation of more complex habitat features such as hollows and flowering resources has not been resolved.
31. Umwelt (2017) has provided other evidence to the DPE on the success of other rehabilitation programs, admitting that *"locating suitable offset areas is becoming more difficult"*. This is largely because of the endangered and highly fragmented status of this community and suggests heavily that any significant stands left must not be cleared. In this sense increasing use of mine rehabilitation, as is evident in this offset strategy, is only facilitating the loss of further irreplaceable Hunter box-ironbark woodlands.
32. In the Umwelt (2017) review (for which no site data was provided) current rehabilitation at United Mine site was assessed for its compliance with the Commonwealth Central Hunter Valley Eucalypt Forest and Woodland CEEC thresholds, as contained in the Conservation Advice for the ecological community (TSSC 2015). The Conservation Advice shows that woodland with a condition ranging from medium to very high can be considered to be part of this CEEC. However, only 1 in 4 rehabilitation sites matched the correct canopy species composition; all sites showed some groundcover with varying degrees of extent of cover; 2 of 4 sites met conditional threshold of 'understorey species' but did not meet requirements for weed cover. No information was provided in the review for extent of groundcover species such as grasses and forbs. Overall only one site was thought to conform to the thresholds for moderate-very high condition CHVEFW. None of the sites in the study conformed to the minimum patch size or canopy height required for the community.
33. Results from other rehabilitation experiments in the review by Umwelt (2017) varied considerably, and the same issues occurred across all experimental sites. Despite this, the DPE seemed persuaded that the rehabilitation proposal contained adequate verification.
34. In my opinion, these rehabilitation experiments have not resolved the following issues:
- While trees can grow vigorously during early life, the dense stands that have ensured in many experiments reduced their growth after 5-10 years and can create problems with soil erosion (pers. obs). None of the rehabilitation areas have achieved the minimum height considered necessary to meet the requirements of CHVEFW or have reached an ecologically sustainable density.

- None of the sites used in the Umwelt study (2017) have achieved reproductive success, a key matter affecting the sustainability of rehabilitation projects.
- Questions on the role of soil suitability, groundcover and weed management in limiting short and long term success are not resolved.
- The fact that the proponent is proposing to retire a significant proportion of its credit liability without sufficient verification and over such a large area, is not consistent with the precautionary principle or other aspects of ecological sustainable development as claimed in the DPE's Final Assessment Report (Appendix D. Updated statutory considerations).

Species credits

Southern Myotis

35. The proponent is proposing to create most credits for the retirement of the credit liability for the **southern nyotis** in Stage 2 of the mine development, 8-14 years after commencement of the mine in the EIS documentation, though in the DPE's Final Assessment Report this requirement is not specifically mentioned. This ignores the ecology of this species, its breeding and foraging requirements.
36. The southern myotis almost exclusively forages over water with larger productive streams and water bodies (Campbell 2011). It roosts in confined spaces, such as caves, tunnels tree hollows, drains, bridges. Sometimes it roosts exclusively in tree hollows (Caddle 1998).
37. Under the FBA (and the current BAM) a species is deemed to be a 'species credit' species because its presence cannot be predicted by vegetation type alone. The southern myotis has been determined to be a species credit species due to its specific water foraging and roosting requirements. The rehabilitation of creek zones, specifically Swamp Oak Forest, has not been documented anywhere by the proponent. One has to imagine how the species credit liability is actually going to be offset under the proposed offset strategy as the proponent would either have to:
- create water bodies with appropriate feed for the southern myotis (which is evolved to take small water animals in mid-flight), and/or
 - create sufficient hollows to support a local population of southern myotis.
- Just identifying existing riparian creek zones as an offset is insufficient, without taking into consideration, condition of the site and suitability for this species.
38. Based on consideration of the ecological facts, there is little reasonable chance that either outcome could be achieved within 8-14 years following commencement of the mine, or even in 20 years. The proposed time-frame and questions as to the suitability of the site could result in the outcome being a net loss for this species, at least for the foreseeable future. Certainly the specifics on how the offsets may be retired has not been addressed adequately by the proponent.

b) Provide any further observations or opinions that you consider to be relevant, having regard to the circumstances of this matter.

Significance of Impact

39. A proper consideration of the assessment of significance test for NSW-listed matters, according to section 5A of the EP&A Act, has not occurred. In my opinion, there are at least 11 threatened

fauna species and a number of endangered ecological communities that are at risk of significant impact. For example, the proponent says in relation to the Regent Honeyeater:

“The regent honeyeater is unlikely to occur in the additional disturbance area, as identified by six years of targeted winter bird surveys failing to identify the species and as the preferred habitats of this species are absent. Appendix 13 details an assessment of the impacts of the Project on the regent honeyeater according to the Significant Impact Guidelines (DoE 2013), which identifies that the Project is unlikely to have a significant impact on the regent honeyeater.”

40. In its controlled action determination by the Commonwealth, it was determined that the Regent Honeyeater, a critically endangered species, was one of the matters for which a significant impact may occur.
41. The Regent Honeyeater is a species credit and while not detected on the site by the proponent, Regent Honeyeater habitat was mapped by the proponent. The proponent went further to elaborate in its Additional Information Response (October 2018) how the Matters of National Environmental Significance have been offset under the Commonwealth standards using land based offset ratios. The Regent Honeyeater has been offset at a habitat ratio of 6.9:1 if all the alleged potentially suitable habitat for this species is taken into account on the offset lands.
42. However, assessment of impact on this species has been poor. The proponent’s Response to Submission (Part B) states in relation to Regent Honeyeater that there have been a number recorded in the vicinity of the Project area over the years, but that none had been detected in the Project during surveys over the six years. The proponent states that; *“While the project will likely exacerbate habitat loss for the species in potential foraging habitat ...”* their current scarcity was due to a lack of suitable feed trees and the small number of birds remaining in the population.
43. The last point is correct. There are very few remaining Regent Honeyeaters left occupying the Hunter region (Birdlife Australia, May 2017), with a total population size estimated to be only a few hundred animals. Loss of potential foraging habitat is also an accurate assessment. One record of the Regent Honeyeater was found 500m from the boundary of the Project area in riparian vegetation in association with Wollombi Brook (RTS Part B, p. 79), but the box-ironbark community at the Project site is entirely suitable for this species, as pointed out in the Regent Honeyeater Recovery Plan.

“Most records of regent honeyeaters come from box-ironbark eucalypt associations, where the species seems to prefer more fertile sites with higher soil water content, including creek flats, broad river valleys and lower slopes. Other forest types regularly utilised by regent honeyeaters include wet lowland coastal forest dominated by swamp mahogany (Eucalyptus robusta), spotted gum-ironbark associations and riverine woodlands (where it is known to feed on nectar from Amyema cambagei) (Menkhorst, 1997; Geering & French, 1998; Oliver et al., 1998; Oliver et al., 1999). This riparian habitat is also selected as breeding habitat in some years (Geering and French, 1998; Oliver et al., 1998; Oliver et al., 1999). Often this is adjacent to box-ironbark woodland. Remnant stands of timber, roadside reserves, travelling stock routes and street trees also provide important habitat for regent honeyeaters at certain times (Franklin et al., 1987, 1989; Ley & Williams, 1992; Webster & Menkhorst, 1992; Oliver, 1998).”

44. The Central Hunter Valley is identified in the Recovery Plan as one of the few ‘regular and subsidiary areas’ for the Regent Honeyeater as well as being mapped as a key breeding area. The

ecological community can be particularly valuable as a source of winter-flowering eucalypts for transient threatened species such as the Regent Honeyeater and swift parrot (*Lathamus discolor*). The ecological community overlaps with the Lower Hunter Valley Important Bird and Biodiversity Area (IBA).

45. The proponent makes the comment that Regent Honeyeaters are not likely in the valley when there are other more nutritious environments to be in. This is missing the point that the valley and associated alluvial and clayey soils are where the most nutritious trees should be. Mining and associated indirect impacts have made large areas of the valley less suitable for sensitive and rare species.
46. Given the information provided above, little consideration has been given to the importance of high condition, connected, large valley remnants for maintaining the habitat of threatened species, particularly those reliant on higher nutrient woodlands for their survival (eg. the Matters of National Environmental Significance, the koala, spotted-tailed quoll, swift parrot and Regent Honeyeater).
47. Like the assessments for several of the other identified threatened species in the EIS, the Regent Honeyeater significance of impact assessment undertaken pursuant to Section 5A of the *Environmental Planning and Assessment Act 1979* is clearly inadequate.
48. OEH, in a letter dated the 11/12/17, stated that in its opinion, the mapping of habitat for the Regent Honeyeater seemed adequate under the NSW Offset Policy but that offset arrangements may not meet the requirements under the EPBC Act and that additional offsets may be required. While this is acknowledged in the DPE's Final Assessment Report, in my opinion the Regent Honeyeater is only one matter for which the Commonwealth may require additional offset.

References

Birdlife Australia (2017). Swift Parrot and Regent Honeyeater: Update from May 2017 surveys. Dean Ingwersen, Mick Roderick & Caroline Wilson.

Bull, J.W., Hardy, M. J., Moilanen, A., and Gordon, A. 2015. Categories of flexibility in biodiversity offsetting, and their implications for conservation. *Biological Conservation* 192, 522–532. DOI: 10.1016/j.biocon.2015.08.003

Caddle, CR (1998). Tree roost selection by the large-footed myotis (*Myotis macropus*). BSc Honours Thesis. The University of Melbourne.

Campbell, S. (2011). Ecological specialisation and conservation biology of Australia's Large-footed Myotis: a review of trawling bat behaviour. In 'biology and conservation of Australian bats' (Eds. B. Law, P. Eby, D. Lunney, and L. Lumsden) pp. 72-83 (Royal Zoological Society of New South Wales).

Castor, C., Scanlon, R., Nussbaumer, Y. and M. Cole (2016). Ravensworth Hunter Ironbark Complex Research Program: Final Report. University of Newcastle, Glencore, CSER Research.

Commonwealth of Australia (2016). Central Hunter Valley eucalypt forest and woodland: a nationally-protected ecological community. Commonwealth of Australia.

DoE (2016). 'Central Hunter Valley eucalypt forest and woodland CHVEFW: a nationally-protected ecological community, Commonwealth of Australia 2016'.

Devictor, V. (2015). When conservation challenges biodiversity offsetting. *Biological Conservation* 192, 483–484. DOI: 10.1016/j.biocon.2015.09.032

Forbs, BC (2009). Tundra Disturbance Studies, III: Short-term Effects of Aeolian Sand and Dust, Yamal Region, Northwest Siberia. *Environmental Conservation* 22 (4), pp. 335-344.

Maron, M., Bull, J. W., Evans, M. C., and Gordon, A. (2015). Locking in loss: Baselines of decline in Australian biodiversity offset policies. *Biological Conservation* 192, 504–512. DOI: 10.1016/j.biocon.2015.05.017

Moreno-Mateos, D., Maris, V., Béchet, A., and Curran, M. (2015). The true loss caused by biodiversity offsets. *Biological Conservation* 192, 552–559. DOI: 10.1016/j.biocon.2015.08.016

Peake, T. (2006). The Vegetation of the Central Hunter Valley, New South Wales: A Report on the Findings of the Hunter Remnant Vegetation Project, Volume 1. Hunter-Central Rivers Catchment Management Authority (N.S.W.)

Seymour, A.S., Harris, S. and White, P.C.L. (2004). Potential effects of reserve size on incidental nest predation by red foxes *Vulpes vulpes*. *Ecological Modelling* 175(1), Pages 101-114

Spash, C. L. (2015). Bulldozing biodiversity: The economics of offsets and trading-in Nature. *Biological Conservation* 192, 541–551. DOI: 10.1016/j.biocon.2015.07.037

Threatened Species Scientific Committee (Commonwealth) (2015). Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s266B): Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community

Umwelt (2016), United Wambo Open Cut Coal Mine Project. Environmental Impact Statement. United Collieries.

Umwelt (2017). 'Assessment of Mine Rehabilitation Against Central Hunter Valley Eucalypt Forest CEEC'. Report prepared on behalf of the NSW Minerals Council.

Appendix: Priority recovery and threat abatement actions for Central Hunter Valley eucalypt forest and woodland (from Conservation Advice TSSC 2015)

- Avoid further clearance and fragmentation of the ecological community and of surrounding native vegetation (e.g. during mining and infrastructure development). Older regrowth and unmodified areas are particularly important.
- Minimise unavoidable impacts from any developments or other activities in areas adjacent to the ecological community that might result in their further degradation (for example by applying recommended buffer zones around the ecological community).
- Regeneration, revegetation and rehabilitation of the ecological community; with an appropriate mix of species (e.g. not just *Allocasuarina luehmannii* (bulloak) in the canopy).
- Implement effective control and management techniques for invasive species (e.g. African olive), as per Invasive species section below.
- Implement appropriate fire management regimes that take into account results from research, as per Fire section below.
- Strategically manage grazing (e.g. through fencing, stocking density, seasonality, weed prevention), as per Trampling, browsing or grazing section below.
- Ensure that patches of particularly high quality or importance in a landscape context are considered for inclusion in formal reserve tenure or other land tenure for biodiversity conservation purposes.
- Develop and implement strategic responses to rural tree dieback.