Review of components of the Environmental Impact Assessment for the proposed raising of Warragamba Dam

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This review is largely confined to considerations of how the EIS assesses effects on biodiversity values, particularly threatened plant species and Threatened Ecological Communities (TECs) as these are within my fields of expertise. It has very little regard to impacts on threatened fauna, as this is known to be dealt with to some degree by other reviewers.

Confused compilation and multiple errors and inconsistencies

Components of the Environmental Impact Statement (EIS) that were read at least in part include the Upstream, Construction Site, and Downstream Ecological Assessments and Biodiversity Assessment Reports, and the Biodiversity Offset Strategy. Even within this subset of documents, the EIS appeared to be relatively poorly compiled and checked. It sometimes uses inconsistent terms and acronyms, contains 'cut and paste' errors (including sections that are from the draft EIS and that were retained in the final EIS even though the final EIS has taken a different approach to some issues), and has errors that are a result of updates not being made consistently over the course of the documents' evolution. Even where there has been selective editing of the draft to favour the proponent's interests in the final EIS, this hasn't been done consistently. There does not appear to be an adequate level of review and proof-reading within and between the many component documents. This is important in any case, but more so because the EIS has been developed over several years and has numerous authors, with others involved in editing. For such an important statutory assessment, it is disappointing that the EIS lacks consistency and accuracy and contains obvious errors and some potentially confusing inconsistencies. Whilst some of the inconsistencies and errors are minor and readily resolved, others are substantial and have direct implications for the review of the EIS by interested parties, statutory authorities, and the Minister for Planning.

A problematic process

The EIS is what would be expected from a system in which the proponent selects and funds the consultant to prepare the assessment. An EIS is meant to be objective but is rarely so because of the relationship between proponent and client and because consultancies depend on satisfied clients to be paid their full fee and to have reasonable prospects of retaining the client and gaining a beneficial reputation to attract more business. This problem is not specific to this proposal. It arises because there is far too much potential for a proponent to select a consultancy known, believed, or marketing itself as favourable to the proponent's interests; and for the proponent to further bias the process by asserting influence through contractual aspects such as budget, timing, and editorial process.

Proponents should not be able to select the consultancy firm that assesses their project and should have no capacity to undermine the integrity of the work of that firm, directly or indirectly, in completing what should be an objective assessment made to inform government(s) and the public.

The process by which the SMEC was selected over other tenderers likely remains commercially confidential. It is something that should at least be known to the Parliamentary Select Committee. Consultants are often selected through competitive tendering. This can mean that the cheapest or a lower-cost tender is awarded the contract, and this may result in substandard quality and/or insufficient quantity of work being done by the consultant. Conversely, a more expensive or even the most expensive tender may be awarded the contract because the proponent is aware that the firm has a culture favourable to the proponent's interests, and the proponent is willing to pay more, sometimes much more, to get such an assessment. Again, these issues are not specific to this EIS nor to SMEC: they are systemic. In this case, the process by which the consultancy firm was selected, the details of their tender, any contractual disputes between the parties, and any evidence of the proponent seeking to or actually influencing the EIS process are matters of public interest and can explain at least some of the problems evident in this EIS.

Government should give serious consideration to reforming the EIA process, especially for major projects, so that a proponent cannot select the consultant and cannot directly or indirectly bias the assessment process and associated documents. The connection between proponent and consultant needs to be broken. This could be done by DPIE selecting each consultant from a pool of accredited firms and individuals that charge standardised fees or where DPIE must also consider differing fee proposals in terms of value for money and the tenderer's capacity to do the required work with the specified budget and timetable. The EIS is meant to serve the public interest and be adjudicated by public officials and the relevant Ministers. It should not function as an advocacy document. Allowing a government agency to choose the consultant(s) for EIAs isn't without risks, but if an adequately independent body within that agency made such decisions and membership was not limited to public servants who are subject to government direction, the selection process would still be better than the current model.

A conflicted proposal

The project is compromised by claiming to be primarily for flood mitigation to protect existing built assets on the Hawkesbury-Nepean floodplain, yet it is also clear that the project could enable further urbanisation and increased settlement density on the floodplain. It has long been criticised as insincerely motivated and driven primarily by property development interests.

It is further compromised by assessing the proposed 14 m headwall extension (albeit inadequately), whilst noting that construction includes measures to accommodate a potential future 17 m extension, the inundation impacts of which are not considered at all. The additional 3 metres beyond the assessed 14 metre extension is said to be a requirement in response to forecast climate warming that could produce more extreme rainfall and flooding. The proposal is arguably 'staged development' that does not disclose the impacts of what is a predicted second stage that is clearly identified as being likely to be necessary. On that basis alone, the EIS cannot inform the Minister of the proposal's true impacts on relevant values upstream and downstream of the dam.

Notably, the EIS claims the Probable Maximum Flood "is highly unlikely to occur in nature", so has no regard to it when considering upstream impacts on biodiversity, yet the EIS plans for the 3m future extension based on forecast climate extremity inclusive of a worsened PMF.

The proposal entails very significant upstream and construction site impacts on threatened biota (including Critically Endangered ecological communities and species), even within the limited scope used by the EIS. Those impacts include threatened species and communities that government has been and is still investing in to aid their conservation. The proposal is in strong conflict with the aims of NSW and Commonwealth biodiversity conservation laws and policies, and generates an acute farce in which one arm of government invests in threatened biota conservation, including in the subject area, and another proposes to destroy or degrade those same assets, all with public funds.

Upstream biodiversity impacts are assessed primarily using a version of the 1 in 20-year flood and a relatively small impact area, but downstream economic benefits are assessed on much less likely and much more extreme flood potentials. This is inconsistent and indicative of bias that is evident when comparing the draft EIS with the final EIS.

The upstream biodiversity assessment is required to respond to numerous criteria in the FBA that relate to avoidance of impacts on prescribed biodiversity values (see tables s8.7). That section reveals just how dramatic and extreme the conflict is between this proposal and biodiversity conservation objects. The EIS repeatedly claims that it strikes the "optimum balance between effective downstream flood mitigation and minimising, as much as possible, impacts associated with upstream temporary inundation" and that the scale and nature of the project are such that there are minimal options to avoid impacts on a range of FBA-prescribed values. Had this project been adequately evaluated at a preliminary stage when considering all flood management options, it could and should have been ruled out because of the extreme conflict with biodiversity values (amongst others). The NSW Government has wasted considerable public funds pursuing this project when it could sensibly have been abandoned with relatively little investment needed to justify that outcome.

The EIS does not adequately respond to impacts on the Greater Blue Mountains World Heritage Area (GBMWHA). The proposal is clearly in fundamental and irreconcilable conflict with Objective 1 of the Strategic Plan for the WHA ("maintain, and wherever possible, improve the current and future integrity of the GBMWHA") and would damage or destroy components of listed Outstanding Universal Values for which the WHA was declared. Again, if Government had assessed this proposal properly when considering the full range of flood mitigation and management options, it should have ruled out enlarging Warragamba Dam because of unavoidable conflict with the GBMWHA and associated values.

The project appears to have been pursued primarily for ideological and political reasons, and is not based on good science, ethics, or cost-benefit analysis. Many obvious reasons not to proceed with the project appear to have been ignored or dismissed as manageable when they clearly cannot be managed effectively, if at all.

Conflict in the proposal also arises in that the higher dam would result in longer duration of flooding downstream due to the necessary release of detained flood waters from the dam. The EIS reveals that the proposal would not and cannot prevent significant flooding on the Hawkesbury-Nepean floodplain, not least because the Warragamba catchment is only one source of floodwaters to that area, and that some flooding is a result of relatively localised rainfall outside the Warragamba catchment. At best, the project is a partial flood mitigation measure, and a very economically, ecologically, and culturally expensive one. It represents a worst-case example of so-called 'end of pipe engineering' in which a technological 'fix' is applied to a problem without adequate regard to what might be done to reduce the problem in a more systematic manner.

The EIS does not adequately consider alternatives like catchment management, particularly in the highly cleared Mulwaree, Wollondilly and Coxs catchments. Those areas contain municipal and farm dams that could be enlarged to provide floodwater detention with little or no biodiversity impacts, and that if done well, could generate some biodiversity benefits. Over-cleared catchments could be strategically revegetated to reduce erosion and runoff. Highly eroded and degraded streams could be reconstructed to reinstate the 'chain of ponds' morphology that is believed to be their natural state (in lower order streams). This would retain more water, including floodwaters, in those catchments and their floodplains, potentially improving landscape productivity for farming and for biodiversity, if appropriately managed. Rather than investing a large sum to construct a higher Warragamba Dam, which also represents a single point of failure, funds could be invested in improvement of many smaller dams in highly modified landscapes, and in stormwater management of urban centres (e.g. Goulburn, Lithgow, Moss Vale, Mittagong/Bowral, Blue Mountains villages) where runoff could be detained in tanks and artificial wetlands, reducing peak flows into the Warragamba catchment. This approach would foster regional employment, improve water quality, potentially improve biodiversity values and rural productivity, and spread the risk of failure across many structures and areas, rather than concentrating risk at one point where failure could be catastrophic.

It is conceivable that alternatives to the proposal that could result in reduced inflows to Warragamba Dam, such as the above-described catchment remediation and stormwater detention, have been rejected because WaterNSW profits by selling 'raw water' to Sydney Water Corporation, so would not want to see reduced supply into this dam. This could represent a conflict of interest for WaterNSW and may explain why it favours a larger Warragamba Dam, especially because it would be relatively easy to convert the proposed flood mitigation extension to the headwall into a permanent increase in the maximum storage level. This raises another potential conflict of interest because greater storage could equate to greater revenue. This situation could also influence how the current and future supply levels are managed. There is considerable temptation not to release water from the dam to create a flood detention buffer when forecasts indicate this might be prudent. If the forecast inflows do not eventuate or are much less than forecast, water that could have been sold would have been released unnecessarily. These potentially conflicted situations suggest that a very high level of independence is required to ensure that WaterNSW operates the existing and any future higher dam with appropriate regard to environmental flows, flood detention, and potable water supply. Independent oversight appears to be warranted.

The EIS has not adequately considered the full range of alternative flood mitigation strategies, including progressive acquisition of the most vulnerable properties on the Hawkesbury-Nepean floodplain. Purchased properties could be sold or leased for suitable uses. Some may be revegetated and provide significant carbon sequestration, biodiversity values, amenity, and other benefits such as a reduced heat island effect. Parts of the acquired floodplain properties could be converted to regional open-space inclusive of appropriate recreational opportunities. All such alternatives avoid harm to the Greater Blue Mountains World Heritage Area and associated conservation reserves, as well as avoiding the costs of and impacts on biodiversity and cultural heritage values. There are far more benefits arising from these alternatives, and costs are likely to be less in real terms. A proper cost-benefit analysis of alternatives to a higher Warragamba Dam has not been undertaken. Earlier consideration of alternatives has been tokenistic and partial.

The project generates significant conflict between biodiversity legislation and its objectives, and between biodiversity conservation policy at State and national levels. The EIS notes that the proposal is within the scope of the Key Threatening Processes (KTPs), 'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands' and 'Clearing of native vegetation'. This conflict is obvious and clearly does not require an EIS to make this apparent. Had this profound conflict been given due weight early in the NSW Government's deliberations about the relative costs and benefits of flood mitigation options, it should have been sufficient to cause the project to be dismissed at an early stage.

Other significant conflicts generated by the project are shown in Table 7-9 of the upstream Biodiversity Assessment Report (BAR) and include: 'Impacts that would substantially reduce the width of vegetation in the riparian buffer zone bordering rivers and streams 4th order or greater' (yes, impact includes those up to a 9th order stream); 'Any impact on a CEEC[1] (unless specifically excluded in the SEARs) because it is likely to cause the extinction of the CEEC from the IBRA[2] subregion or significantly reduce the viability of the CEEC' (yes, inundation of White Box, Yellow Box, Blakely's Red Gum Grassy Woodland CEEC). The EIS claims this is unlikely to cause its extinction in the subregion or reduce its viability. I agree that the project would not cause its extinction in the subregion, but it would clearly undermine its viability there and further undermine its viability in general. As is common in assessments, the fact that this is a Critically Endangered ecological community that is already severely imperilled tends to be downplayed.

Table 7-9 notes that no declared Critical Habitat will be affected, which is true, but this is largely an artefact of DPIE and the Minister not pursuing the concept of Critical Habitat beyond a very few declarations. Had this concept been researched and declared properly, there would be many more areas declared as Critical Habitat and the project would affect some of them, for e.g., *Solanum armourense*, *Eucalyptus benthamii* and perhaps *Hakea dohertyi*.

[1] Critically Endangered Ecological Community
[2] Interim Biogeographic Regionalisation of Australia

Whilst not legally relevant because the project application was lodged prior to these amendments, the National Parks & Wildlife Act now allows for declaration of Areas of Intergenerational Significance (AIS). This was a recommendation of the bushfire inquiry, and is intended to guide fire management, especially in an emergency. Some AISs have been declared but evidence so far suggests that these are not always well-researched, not always adequately informed by science, and potentially subject to political considerations. For example, AIS should be declared for the Kedumba population of *Eucalyptus benthamii*, but at the time of writing, this has not happened, even though the science is very clear. An AIS has been declared for *Solanum armourense* but only on land remote from the impact area of the project, even though post-fire surveys by DPIE show a significant increase in the already relatively well documented occurrences near the Wollondilly River. Those occurrences are largely in the project impact zone, and this *appears* to be why they are not included in an AIS declaration.

Table 7-9 also includes disclosure that "the Project would potentially impact on the following species: *Hakea dohertyi*, *Eucalyptus benthamii*, *Solanum armourense*" in the context of the question of whether the project would have an impact on a threatened species or population nominated in the SEARs because it is likely to cause extinction of a species or population in an IBRA subregion, or significantly reduce the viability of a species or population. The response to these criteria does not make it clear which subcriteria have been triggered, but the evidence is that the project would at least reduce the viability of populations of these species. These are very substantial issues in any case, but more so because they entail occurrences in NPWS estate and within the GBMWHA. Of the three species, impacts on *E. benthamii* are the most serious because the project would significantly harm the only known viable population of this species. All other occurrences are either very small outliers; very small and highly threatened remnants; or in the case of Bents Basin, a relatively small remnant subject to significant threats, some of which are intractable (beyond NPWS management).

<u>Misuse of uncertainty</u>

The language used in most of the EIS is seemingly intended to downplay the impacts of the project rather than being honest about the probability and extent of inundation and other harmful effects. For example, the Biodiversity Offsets Strategy says in relation to impacts on the World Heritage Area, that "Areas of the GBMWHA could be potentially impacted by temporary inundation during major flood events from the existing dam, however these impacts would not be significant and would not result in the material loss or degradation of the biodiversity-related outstanding universal values of the GBMWHA as the area…within the upstream impact area is (304 ha) is very small relative to the overall area of the GBMWHA; and comprehensive mitigation and offsetting measures have been identified which would ensure that any project impacts on the GBMWHA result in a net benefit to biodiversity-related World Heritage outstanding universal values." The reality is that areas of the WHA would be impacted (not "could be potentially") by temporary inundation, and the EIS elsewhere assumes *total loss of biodiversity values* within its albeit minimised impact area, which is hardly consistent with impacts not being significant and not resulting in material loss of degradation of biodiversity-related values. In this context, the EIS is more 'spin' and much less science. Its various components are not always consistent, with some being more transparent about impacts, and others seeking to conceal or downplay them.

The EIS misuses the inherent uncertainty associated with predicting future rainfall and flooding patterns in the dam's extensive catchment. The misuse arises in a manner that is apparently intended to favour the proponent's interests in seeing the project approved and impacts downplayed. I discuss this later in more detail. An EIS is meant to be precautionary in its approach, with the precautionary principle being long enshrined in NSW law as a tenet of environmental impact assessment. SMEC emphasises that it uses a precautionary approach, and in some regards, it does, but only partially. The precautionary principle requires that the assessment should consider the worst-case impact scenario: in this case, the Probable Maximum Flood inclusive of the best available climate warming scenarios over the life of the project. Whilst low probability, high impact events are rare, they are increasingly likely under a destabilised climate that will continue to worsen for decades, even if its drivers were to cease today.

The draft EIS contains very relevant information in its Table 7-1, along with informative flood duration curves. Both are apparently absent from the final EIS. The final EIS argues that because the PMF is highly unlikely to occur, "more weight should be given to flood events with a relatively greater chance of occurrence". It is correct that the lower impact, higher probability events are more likely to cause harm from inundation than the higher impact, low probability events simply because they would be expected to occur more often. But such an approach is insufficiently risk averse and arguably prejudicial. It is used in the final EIS to argue that impacts of the PMF should be given little weight, even though the PMF would have the greatest impact in terms of area and perhaps also duration of inundation. The more probable, lower extent flood events must also be considered because they are more likely to occur and recur, but the PMF or equivalent worst-case must be used to assess impacts on biodiversity and cultural heritage.

As discussed below, the upstream BAR accepts total loss of biodiversity values, which is a precautionary approach, but only does this within its greatly reduced impact area.

Flawed assessment method undermines the upstream BAR and the Offsetting Plan

Section 1.5.2 and the associated Table 1-2 are important to understand what SMEC was required to consider in its upstream biodiversity assessment (and the BAR), and how it progressively whittles down this area, seemingly to argue down the scope of impacts on biodiversity and thus the number, type and cost of biodiversity offsets required. It is noteworthy that at an earlier stage in the project, Government or perhaps just the proponent, took the position that it would not be purchasing biodiversity credits for upstream impacts because those impacts won't happen and won't be confidently quantified until inundation occurs. This is indicative of the evasive approach that has been taken, and the inversion of the precautionary principle, seemingly to downplay the significant damage that the project would cause, and perhaps to reduce the inherently vast cost of generating biodiversity credits for that damage. It appears that there has been a shift in the Government and/or the proponent's position, as the upstream BAR calculates impacts and credit requirements, and there is an associated Biodiversity Offset Strategy. Perhaps the proponent accepted that it could not avoid up-front purchase of at least some credits for damage caused by future inundation, but it seems that it only agreed to this based on a significantly smaller 'impact area'.

The upstream BAR defines the '**study area**' as the area between Full Supply Level of the current dam, and the Project PMF. This equates to **5280 ha**, a portion of which is already potentially subject to flooding caused by the occluding effect of the current dam (water backs up behind it for some distance upstream because the dam prevents floodwaters draining as they would have prior to its construction). The EIS's first move to reduce the actual impact assessment area is to then define the '**field survey area**' as the "area within a representative 1 in 100 chance in a year (rainfall/flood) event (1% AEP) within the Project, plus nine percent climate change". The latter relates to a 9% modelled increase in extreme rainfall under a warming climate. It notes that this 'field survey area' was defined by input from the former NSW Office of Environment & Heritage and the former Commonwealth Department of Environment and Energy. This reduces the assessment area to **~3740 ha**. It would be interesting to know the basis on which those government agencies agreed to the significantly smaller assessment area.

The next 'downsizing' endeavour is to further reduce the notional impact and assessment area by defining the '**upstream impact area**' as "the area between the likely inundation level with the Project (10.25 m above FSL, RL 126.97 m AHD) and the likely inundation level for the existing dam (2.78 m above FSL, RL 119.5 m AHD). This is particularly important because the basis in which the 'likely inundation level with the Project' is determined to be 10.25 m above FSL (for a headwall increase of 14 m) is based on a 1 in 20 year rainfall event. The actual impact area is then whittled down further by claiming that the current dam already causes flooding up to 2.78m above its height due to water backing-up in feeder streams. The result of these calculations is to reduce the impact area to **~1400 ha**.

The BAR correctly states that the exact effects of the inundation that would result from the project will be "dependent on multiple factors, such as the timing and magnitude of rainfall events, catchment conditions at the time of the rainfall event, the existing storage level, the depth and duration of inundation, and the tolerance of plant species to inundation." Most of these parameters can only be modelled, and modelling is only as good as the data and assumptions that it uses. To be fair, it is very difficult to predict future climate, including rainfall and flooding, as climate change models have generally been found to be too conservative and there are significant uncertainties such as the extent to which existing change will cause positive feedback loops, and the extent to which the world will reduce emissions, and by when. Because of these inherent uncertainties, and because even the most well-regard climate change models have under-predicted current levels of climate disruption, a very precautionary approach is warranted. Essentially, a worst-case climate warming model should be applied. This isn't the case in this EIS.

It is also beyond the scope of the EIS to know the tolerance of all potentially affected plants and soil biota to a speculative inundation regime, especially under a destabilising climate. The EIS can only use existing data about such things, which is quite limited. This further necessitates a very precautionary approach. In this aspect, the BAR takes the right approach by assuming 100% biodiversity loss, but it only does this within its much smaller 'upstream impact area' of ~1400 ha, which is dramatically smaller than the worst-case inundation area of 5280 ha. This appears to be the crux of the compromise that was supposedly agreed to by OEH and DAWE: a much smaller impact area but 100% biodiversity loss within it, rather than a larger impact area but varying levels of biodiversity loss and degradation within it.

It is noteworthy that the modelling used to define the 'upstream impact area' is highly speculative, based on what is really a tiny time-series of rainfall and flood data from a climatic perspective, and that requires expert interpretation. Most readers of this very extensive EIS would be overwhelmed by its size and complexity well before having to contend with trying to interpret hydrological modelling that includes predictions of future rainfall events in a destabilising and increasingly uncertain climate. Without genuinely independent and expert scrutiny of the hydrological model and associated methods used to define the 'upstream impact area', the public and the Minister for Planning cannot have confidence in the biodiversity assessment nor the cultural heritage assessment because both are strongly constrained by the implications of the model's predictions. In my view, the BAR and the associated offset plan fail to achieve their lawful purpose because they are based on an impact assessment area that appears designed to minimise calculations of harm and associated offsetting costs.

Whilst I understand the arguments put in the EIS about the uncertainties and relative probabilities of future harm associated with the project upstream and downstream of the wall, I believe that the EIS does not take a suitably precautionary approach. It should have assessed upstream impacts based on what it defines as the 'study area' of ~5280 ha. Within this, it could reasonably have allowed for the fact that the current dam causes some flooding above the FSL. It could also have done more to reasonably consider the impacts of potential inundation of threatened plant species and ecological communities, and on relevant Plant Community Types (PCTs). It is easier to consider the likely impact of inundation at a PCT level because some are clearly riparian and evolved with some level and duration of natural inundation, and others are not at all adapted to inundation, so likely to be much more sensitive to it. It is reasonable not to try to assess the impacts of speculative inundation on each non-threatened plant species within the impact area as there is insufficient data to do this well, and it is unreasonable to expect an EIS to fund the research needed to fill that knowledge gap. But threatened plant species should be assessed on a precautionary basis, accepting that there is often no information available about their relative sensitivity to inundation. This is where the BAR has a praiseworthy aspect: it assumes total loss of biodiversity values (which amounts to total clearing) within its relatively smaller impact assessment area. It should have used this same approach in the more credible and much larger impact area but might have reasonably backed away from an assumption of total loss for PCTs that can credibly be assumed to be more tolerant of inundation because they're associated with watercourses that flood, irrespective of any dam.

Use of repealed biodiversity assessment law, method, and threatened biota status

The EIS uses the defunct Framework for Biodiversity Assessment (FBA) and Biobanking Assessment Method (BBAM) under the repealed Threatened Species Conservation (TSC) Act rather than the Biodiversity Assessment Method (BAM) under the current Biodiversity Conservation (BC) Act. Whilst potentially lawful under the transitional provisions between the TSC and BC Acts, Government could have required the EIA to be made under the BC Act and BAM and should have done so to demonstrate a willingness to align the project with its new legislation. There are some aspects of the EIS that have regard to the BC Act and the listing and status of threatened entities under it. This is positive but indicates that it would have been prudent to place the EIS under the BC Act rather than under the TSC Act through the transitional provisions. Council's legal advice is that the timing of key components of the project are such that it should have been assessed under the BC Act and the BAM.

The BC Act and the BAM sets a higher standard for the accreditation and compliance of ecologists who operate under it, and the Act imposes significant penalties for breaches. This is notable because the lead ecologist assessing this project within SMEC resigned citing her employer's attempts to submit her work with edits that she did not make or support. This was reported to DPIE and recently to the NSW Parliamentary Select Committee on the Proposal to Raise the Warragamba Dam Wall, but I am unaware of any regulatory action by DPIE to address this very serious allegation. It is conceivable that if the alleged misconduct by SMEC had occurred under the BC Act and BAM, DPIE may have had clearer grounds to intervene and potentially prosecute.

The BAM uses an online calculator (BAM-C) to determine impacts and credit requirements from field data and associated assumptions. I am advised that the BAM Calculator would have generated a lower biodiversity credit requirement than does the BBAM and its BioBanking Credit Calculator (BBCC), however it is based on more recent data and revised formulae. Whilst it may have generated lower credit requirements, it sets a higher standard for areas proposed as offsets than does the BBAM. I'm advised that under the BBAM, an isolated paddock tree of *Eucalyptus benthamii* could be treated as an offset, whereas under the BAM, it could not because it would not be regarded as fit for that purpose.

Notably, the EIS does consider the list of species requiring urgent management intervention following the 2019-20 fires (DAWE, 2020) but does not undertake any further assessment of those biota, e.g., platypus and Blue Mountains perch.

The merits of post-fire surveys

Others have expressed concern about both the lack of post-wildfire survey and assessment in the EIS; and that the EIS does not consider the likely worsening of conservation status for some species and ecological communities because of the drought, wildfire, and subsequent extreme rainfall and erosion. The scientific community is struggling to undertake the fieldwork and assessments needed to understand the effects of these events, especially the wildfire on biodiversity values. Considerable time is required to complete fieldwork and analysis, and then to propose changes to the conservation status of affected entities, with more time needed for the already overwhelmed and under-resourced Threatened Species Scientific Committees to assess that information and propose changes to threat status. In my extensive experience with the process for reviewing and listing threatened species and communities under NSW and Commonwealth laws, it takes roughly 3 years for such a nomination to reach a preliminary determination by either Committee, with additional time required for public consultation, the making of any amendments, and the finalisation of the Committee's decision. Both Committees have a backlog of nominations to process and existing listings to update, and neither are established in ways that allow them to cope with the volume of potential nominations to add species and communities to legislation or to increase the threat status of affected entities. Therefore, it is not reasonable to expect SMEC or the proponent to delay assessments until all such post-fire research, nominations and listings/changes are completed.

However, it is reasonable to expect SMEC to have regard to the likely effects of the drought/wildfire/erosion event on biota that is within the scope of its assessment. This should include some post-fire survey of key species and communities where significant post-fire changes are likely or have been detected through research by others (such as surveys undertaken by DPIE or its contractors). For at least two threatened plant species within the impact area, DPIE has funded post-fire surveys that would be available to SMEC, with one of these potentially requiring a significant increase in the number of species credits required because that plant's population has increased post-fire and post-drought.

The issue of post-fire surveys is partly an issue of timing and need not reflect the proponent or consultant trying to avoid this issue. The consultant had completed the survey work that they were willing to undertake prior to the wildfire. It would be onerous to impose the need to resurvey all areas post-fire to reflect more recent conditions. Were Government to deem resurvey necessary, the considerable additional costs would need to be funded. Post-fire surveys are desirable in several regards but need to be done safely and in a manner that does not cause excessive damage to post-fire regrowth vegetation.

The drought that preceded the wildfire would have had a suppressive effect on vegetation and potentially on native fauna. As the fieldwork was conducted during the drought, this should be factored into considerations such as the condition of vegetation and the potential for surveys to under-estimate the diversity and abundance of threatened biota. The wildfire and subsequent rainfall have had significant effects on vegetation, fauna and habitats. Others have raised concerns that the wildfire is known or likely to have further imperilled threatened biota through mortality, loss of key habitats e.g. burning of hollow-bearing trees, and habitat degradation e.g. water pollution caused by a combination of severe fire and high intensity rainfall leading to extreme erosion. This is a very legitimate concern for some fauna and for some fire-sensitive flora such as rainforest communities and rainforest species. Even some areas of fire-adapted sclerophyll vegetation were badly affected by the combination of extreme events.

Were post-fire surveys to be conducted at a suitable time that allows for human safety and sufficient vegetation recovery, it seems likely to have documented increased cover and abundance of weed invasion in already disturbed areas (this has been widely reported and I have observed it within the study area); the spread of weeds into previously unaffected areas (also widely reported); reduced cover and abundance of 'native' mesophyll invaders such as *Pittosporum undulatum* which had been spreading from dry rainforest into sclerophyll communities (very evident in aerial imagery); significant decline in condition of badly burnt, fire-sensitive communities such as some rainforest and riparian vegetation; improved native flora diversity in long-unburnt sclerophyll communities that burnt in the wildfire; improved native flora diversity and cover in previously long-unburnt sclerophyll communities that did not burn in the wildfire but where the end of the drought has caused significant regeneration; dramatically increased abundance of fire-facilitated native flora that may have been rare or even absent over large parts of the study area (this includes increases in some threatened flora that are advantaged by fire); reduced abundance of some fauna; increased abundance of other fauna; decreased availability of some critical fauna resources through loss of hollow-bearing trees; potential increase in availability of the same resource due to on-going tree decline and death caused by drought and fire; decreased woody debris for some time post-fire, potentially followed by a return to pre-fire levels or a possible increase in levels in badly burnt sites where many trees have been badly damaged or killed.

In short, there are a range of changes that post-fire surveys would be likely to detect. Some would reduce the apparent impacts of the proposal because some threatened species would be at least temporarily less abundant in the impact area or even now locally extinct. Some would increase the apparent impacts of the proposal because some species are now more abundant, sometimes dramatically so, but this could lead to SMEC arguing that even though a greater number of individuals would be affected by the project, this would represent a smaller proportion of the pre-fire population.

An example of a dramatic post-fire change in the abundance of a threatened plant species is the Endangered *Commersonia prostrata* in Wingello State Forest. Pre-fire numbers were very low and declining. Post-fire numbers are an estimated 10,000 plants, making it the largest or near-largest documented nationally. Were even a fraction of this dramatic post-fire response to occur in a threatened species within the project's inundation area, it could have large implications for offset calculations and costs.

Another such example could be the threatened shrub, *Gyrostemon thesioides*, which is mentioned in the Upstream BAR on page 158. It is considered cryptic and believed to respond to suitable disturbance such as flooding or perhaps fire. It may be present in soil seed bank within suitable habitat, but no adult plants may be detected if the area is surveyed in the absence of suitable disturbance. SMEC excluded this species from targeted survey based on this advice, which was probably adequate at that time, but which is now unsound given the fire and flood has occurred within potential habitat for the species. Were it subject to targeted survey now, many individuals might be detected in situations where there were previously none. This could significantly affect impact assessment and offset requirements.

I support the call for post-fire resurvey or at least the use of available post-fire survey data given how severe the drought, wildfire and rainfall events were and that there is considerable potential for these to have altered the abundance and extent of threatened biota, and the condition of vegetation that must be assessed under the BBAM. Post-fire assessment would produce mixed results for a revised BAR. The additional costs to the proponent (which as a government entity, is funded by the public) would be substantial but are likely to provide important information to better understand the proposal's impact on biodiversity values. However, the merit of such surveys is undermined by the fact that SMEC uses a much-reduced impact assessment area in the BAR. Post-fire surveys would be likely to change some factors in the BAR and the Offset Plan, including the abundance of some threatened species and the condition of some TECs and PCTs. Changes in vegetation post-drought and post-fire will likely affect analysis of how some vegetation survey plots align (or not) with TEC definitions based on the percentage of listed species present, and the occurrence of any TEC-indicative species. This could affect mapping of TECs and thus calculations of impacts and offset requirements.

<u>Deficiencies in the use of the FBA</u>

SMEC's vegetation survey plots do not provide an adequately representative sample of vegetation that would be affected by the proposal. Figure 4-2 in the Upstream BAR shows their distribution, with large areas not sampled or under-sampled, and other areas relatively over-sampled. This appears to be primarily a result of limited terrestrial access to some areas, with other sites having good access via fire trails. Some sites appear to have been accessed by boat, but there has not been sufficient use of this means of access to enable adequate sampling across the study area.

Table 5-5 of the Upstream BAR lists the candidate threatened flora species and Endangered Populations. These are then assessed to determine which require further assessment.

It is noteworthy that *Commersonia prostrata* is listed as a candidate threatened plant species in the Upstream BAR but was dropped from further assessment based on a deficient conclusion that it would not be present in the study area because the "associated PCT and edaphics not present". In my considerable experience with this species, it should have been included in assessments and it could occur in the study area. It is also known to decline to tiny numbers in the absence of suitable disturbance and during drought, but to experience dramatic increase in numbers when drought ends and/or fire affects its habitat. It is also known to tolerate some inundation and has been observed colonising the receding shoreline of the Thirlmere Lakes, so could survive on the shores of Lake Burragorang, even in areas with little or no other native vegetation.

It appears that SMEC excluded this species from consideration based on a defective species profile provided by DPIE. Under-resourcing and insufficient expertise within DPIE and DAWE mean that it is common to encounter species profiles that are outdated or inaccurate, and when relied upon by consultants unfamiliar with those species, this can lead to poor quality decisions about whether a species may or may not occur in an impact zone.

Whilst I agree with the decision by SMEC to exclude *Eucalyptus macarthurii* from the assessment process, again, the stated reasons for exclusion are deficient. SMEC only refers to the habitat of this species in the Southern Highlands, but it also occurs on the Boyd Plateau. Those populations occur in very different habitats and PCTs, but SMEC only considered those of one population. The occurrence of the two species in these different habitats is evident in a search of BioNet Atlas. The public on-line species profile refers to occurrences in the "Moss Vale District to Kanangra-Boyd National Park" however in the Habitat and ecology section, the profile states that the species "Occurs on grassy woodland on relatively fertile soils on broad cold flats". This is deficient and does not include all habitats in the Southern Highlands and has no regard to the very different habitat on the Boyd Plateau (which ranges from swamp margins to relatively dry, montane forest). This was brought to the attention of the Authorised Officer for this species in mid-November 2021, with a request for corrections to be made.

I do not agree with SMEC's decision to exclude *Thesium australe* from further assessment. The species is poorly known and very likely under-detected because it is small and readily obscured by the grasses that it parasitises. It is strongly associated with the grass, *Themeda australis*, which is common in parts of the study area. SMEC exclude it based on there not being any of the listed associated PCTs present in the study area. This method is unsound and fails to consider what is and is not known of the species and why. It is likely that this species occurred and occurs primarily on private grazing land that is under-surveyed due to tenure and land use. In my view, it could readily occur in the grassy woodlands and grassy forests within the study area. It was listed in the SEARs. Reliance on DPIE's list of PCTs associated with a species is a poor method because this assumes that there are sufficient spatially reliable records of the species and sufficiently accurate PCT mapping. In my experience reviewing DPIE's PCT associations for threatened flora, the method used can be weak or even dangerously misleading.

Another example of a potentially unsound exclusion is that of *Pultenaea elusa*. This species is known only from two collections in 1938 and with no location data other than that it was found on swamp margins in Wingello and Penrose in the Southern Highlands. Until very recently, BioNet Atlas misattributed one of these two records to *P. parrisiae* subsp. *elusa*, which whilst a synonym for the species prior to a taxonomic change in 2004, could have caused DPIE's list of associated PCTs to be flawed and only based on the one record at Wingello. It is possible to extrapolate which PCTs the species may have been collected from, but this is not a robust sample to inform such an association given there are only two old records with poor spatial accuracy. The species is small, seemingly very cryptic because it has been searched for but not found since 1938, and it may depend on a specific disturbance regime to become apparent. Yet just because DPIE's list of associated PCTs indicates that it would not be present in the study area because those PCTs do not occur there, SMEC excluded it without further consideration. It may be reasonable to exclude it, but the basis on which this was done is superficial and assumes that the PCT associations are robust, which too often, they are not.

Whilst SMEC excludes a small number of threatened plant species that I believe should have been included, or where the exclusion is reasonable but the basis for it defective, they include a greater number of species that I would have excluded based on my knowledge of them and because I do not rely on DPIE's sometimes poor PCT/species associations.

Table 5-5 informs a secondary list of target species to be considered in surveys or dealt with in Expert Reports. This list of species is large, yet Table 5-9 shows the very much smaller list of threatened plant species (10) for which surveys were conducted, and for many of these, the specified level of survey effort was not completed. Survey effort does not meet the FBA/BBAM guidelines for most of the relevant threatened entities at risk from the project. Where a consultant cannot[3] or chooses not to complete the specified survey effort set by DPIE/OEH (hours, kilometres, and for some species, season), they have two options: presume that the affected biota is present and generate a 'species polygon' for each entity to show where it is deemed likely to occur and why e.g., based on known habitat requirements; or provide an Expert Report. Page 204 of the Upstream BAR explains how SMEC generated the 'species polygons' (Appendix B of that report).

SMEC acknowledges some of the limitations of its surveys and says that it dealt with this by assuming that a species is present if potential habitat occurs in the impact area and if it occurs in that habitat in other locations "in the locality". Tables 5-14 and 8-5 list the plant species (species credit species) presumed present in the study area. This is where Expert Reports[4] could have been used to deal with these species rather than having to presume their presence using a prescribed method that can and does result in significant over-estimation of the number of species, the area of habitat or number of individuals to be removed and thus, the calculated biobanking credit requirements.

SMEC could have sought and used Expert Reports for many plant and animal species that it accepts are affected by the project. On page 158 of the Upstream BAR, SMEC writes that "Expert reports were sought for additional flora species but no experts were available". As someone who would readily be accepted by DPIE as an expert for many threatened plant species within the assessment area of the project, I wasn't approached to provide a fee estimate to provide Expert Reports. In the context of other projects, I am currently accredited as an Expert Report author for 6 threatened plant species, with 4 Reports completed and 2 in final draft awaiting updated vegetation maps from the lead consultant. There is some overlap between those accreditations and species that are in SMEC's list of flora that must otherwise be presumed present and offset on that basis. Note that becoming accredited as a prospective Expert Report author is only done on a 'needs basis', i.e., when a proponent identifies that they want or need an Expert Report for a particular entity, and they engage the prospective author to apply to DPIE for accreditation in that context. This is very different to the 'Threatened Species Expert' registry that DPIE holds for internal purposes such as when it needs to seek advice on a particular species, population or community. Within that registry, I am listed as a TSE for roughly 30 plant species and several ecological communities. There are numerous other TSEs recognised in that registry, and there are often a small number of TSEs for each entity, though some only have one TSE per entity.

SMEC obtained an Expert Report for one of several relevant orchids (*Pterostylis saxicola*) and for seven frog species. It isn't clear to me why it chose those species over others. For some species, an Expert Report may be unhelpful because the author may not be able to refine the expected area of occurrence and/or number of individuals to be affected beyond what the standard assessment method provides. However, SMEC does not explain this, even though it is a legitimate reason not to use an Expert Report when one would otherwise seem appropriate.

[3] Reasons for not being able to complete the specified survey effort include inaccessible/unsafe terrain, lack of access due to objections from a landowner, inability to undertake survey at the required time of year for that species, and unsuitable survey conditions that make survey of little or no value (e.g., recent fire, severe fire, severe drought, etc.). A proponent or the lead consultant can also make an economic decision that the specified survey effort is more costly and time-consuming than obtaining an Expert Report, especially when that Report *may* advise that the threatened entity is unlikely to be present.

[4] Under the FBA, an Expert Report author must be accredited in that capacity by the Chief Executive of OEH based on possessing specialised knowledge based on training, study or experience to provide an expert opinion in relation to the biodiversity values to which the Expert Report relates. Under the FBA, an Expert Report can only be used for species credit species (including Endangered Populations), not for ecosystem credit species.

I find SMEC's claim that "…there were no experts available" to be extremely dubious given my knowledge of this 'market'. In some cases, a suitable expert may not exist – some species are so poorly known that no-one could claim expertise about them. In other cases, one or more prospective Expert Report authors may exist, but they may be unavailable or require a fee that the consultant is unwilling or unable to pay. I am reliably advised that the major reason for SMEC not obtaining the many more Expert Reports that could have been generated to cover under-surveyed species is that Water NSW declined to pay for them. To be fair, the number of such reports that could have required would have made for a very substantial cost, but this needs to be weighed against the fact that these reports can legitimately exclude a species from further consideration if the author makes a cogent case that it is highly unlikely to be present, and an Expert Report can reduce offset obligations if the author reports that the species could only occur in a small part of the impact area. Rather than using Expert Reports in situations where it arguably should have, SMEC is instead obliged to use the 'presumed present' method to calculate loss of habitat or individuals. Whilst this can be precautionary, it is only reasonable when the assumptions about where those species are presumed to occur and in what numbers, are sound. SMEC had to use a method prescribed in the FBA and BBAM that is based on the relationship between records of the species within relevant IBRA subregions, and mapped PCTs. For example, if Species X must be presumed present because SMEC chose or could not survey it as prescribed by the guidelines, and they do not use an Expert report for it, they have to calculate losses based on the number of affected hectares of PCTs in which the species is known to occur in the subregion. This is a very broad-brush method that does not have regard to how rare some species are and that they do not necessarily occur in all or even most occurrences of relevant PCTs within relevant subregions. In short, it tends to **dramatically over-estimate losses and therefore credit requirements**. The list of threatened plant and animal species "assumed to be present within the study area" is in Table 5-14 and the calculated hectares of habitat loss or number of affected individuals, along with Biobanking credit requirements (per the BBCC) is shown in Table 8.2.1.

The EIS's handling of the difficulties of undertaking the required survey effort for threatened species can be contrasted with that of the Cumberland Plain Conservation Plan which engaged the services of numerous Expert Report authors for flora and fauna and was ultimately granted sufficient time and funds to enable them to complete their work, for it to be reviewed, and for amendments to be made to reflect changes in vegetation mapping. In stark contrast, the Warragamba EIS appears to have been constrained by a mix of insufficient budget, perhaps by insufficient time to complete surveys and/or Expert Reports, and/or insufficient effort to obtain Expert Reports.

Because the Upstream BAR (in particular) underinvested in surveys that meet the FBA guidelines, and severely underinvested in Expert Reports, it had to take a very precautionary approach when assessing potential losses of many threatened species (flora and fauna) that it assessed as potentially present in the impact area. As noted earlier, I would have readily excluded some flora species, but included a much smaller number. I believe that an expert panel convened by DPIE would support my views in this regard.

The SEARs excluded a small number of species, such as *Callistemon megalongensis*, yet SMEC seems to have included it anyway, or else confused it with *C. purpurascens*. Because of the very precautionary approach used to generate the list of species presumed to be affected, and because of some ridiculously unsound aspects of the FBA method for generating species polygons for very rare and highly range-restricted species[5], **the calculated area of habitat loss (within the smaller impact area) and the associated biodiversity credit requirements are very much higher than they could have been**. Because WaterNSW apparently did not want to invest in adequate surveys or sufficient Expert Reports, it has effectively pushed an artificially higher cost for biodiversity offsets onto the public purse. Those very large costs would not come from WaterNSW's ordinary budget, whereas the costs of surveys and Expert Reports would have come from its project budget – one that was apparently far too small to do the job properly.

[5] For example, *Persoonia glaucescens* is relatively well surveyed across its known range in the Wingecarribee and southern Wollondilly LGAs to which it is endemic, but because it partly occurs in the Burragorang IBRA Subregion and in PCTs present in the impact area for the higher dam, the 'assumed present' method used in the BAR generates a calculation of 9 ha of habitat loss for this very rare and range-restricted species. As an expert on this species, I could readily have excluded it from the impact considerations and offset obligations because I can confidently show that it is extremely unlikely to occur in the impact zone – even the inundation zone based on the PMF.

As an example, had it invested in more Expert Reports for strategically selected species, it could very likely have eliminated them from further consideration and thus from offsetting requirements. Instead, it has had to presume the presence of species that I doubt occur in the impact area, and it has had to calculate offsets for very speculative losses.

A related issue arises in terms of post-fire surveys, in that had these been done adequately and strategically, it may have been possible to exclude or properly quantify losses of *Gyrostemon thesioides*. But because it was not surveyed at all, is not subject to an Expert Report, and has not been reconsidered post-fire/flood, it had to be presumed present within potential habitat, generating a calculated loss of 886 ha of habitat.

Even though I would confidently exclude some species from the credit calculations, and this would significantly reduce 'on paper' impacts and actual offsetting costs, this would not change the fact that there are still species for which habitat losses are very substantial, and for which offsetting costs would be high, especially when aggregated. The situation also has no effect on the very significant calculated losses and offset requirements for TECs, the extent of which is based on earlier DPIE vegetation maps.

It is also noteworthy that had SMEC been allowed to undertake the required level of survey effort for at least a much greater number of candidate species, there is an increased likelihood that its ecologists could have found more threatened species than were known to occur in the area (they added three, even with their very constrained survey effort). More survey might also have found more occurrences of threatened species that were already known from the area, and could have found species not previously known to science.

<u>Inability to offset certain impacts</u>

Even if the EIS entailed thorough assessment of ecological impacts and appropriately precautionary calculations of biobanking credit requirements, it is starkly evident that impacts on some affected entities cannot be offset. This is because there are no other locations where credits are available.

Eucalyptus benthamii

The Upstream BAR calculates a loss of 44 ha of habitat for *Eucalyptus benthamii.* This entails the majority of known and potential habitat for this species in the Kedumba catchment, which is also the only known large and viable population of the species. Forty-four hectares is likely an underestimate because of how SMEC determines is 'impact area'; however, because this species evolved to tolerate some flooding, at least some individuals within even the maximum extent of potential inundation would be unlikely to be killed by flooding, even after multiple events. The true impacts of the proposal on this and many species are unknown, but for the purposes of exemplifying the limitations of biodiversity offsets, the actual impact on this species is particularly relevant. This is because there are no credible offsets available or likely to be made available for this species, and what little potential for offsets exists, is nowhere near sufficient to cover the losses that SMEC has calculated.

Other than poorly documented occurrences of the species in Nattai National Park, and a small and very threatened population in Bents Basin State Conservation Area, all other known occurrences of this species amount to scattered trees in very vulnerable situations where natural habitat values are highly compromised by factors that cannot be corrected on those sites e.g. flood regimes are disrupted by large storages upstream and by landscape scale clearing of floodplain vegetation for agriculture, alluvium mining, and for housing. The proponent could purchase land or enduring rights to land that is or was habitat for the species, assuming there are willing sellers; it could mitigate threats such as weeds and grazing/browsing by livestock or feral animals; and it could plant thousands of trees, such situations are not in any way like-for-like when compared to the wild occurrence of the species in the Kedumba Valley. Securing remaining habitat in the Nepean system and funding threat mitigation for those sites would be beneficial but has a low level of security, not least because some threats are intractable and beyond what any on-site management can overcome.

This species has long been listed as Vulnerable under State and Commonwealth biodiversity laws. However, this status is a legacy of its classification under the defunct ROTAP scheme that assigned threat status based on a simple system used at the national scale. In many cases, a plant species' ROTAP code of Vulnerable or Endangered resulted in it being given that status in law, and this has often persisted for decades with a full conservation assessment using modern criteria and methods. A review of its status using the Common Assessment Method was conducted in 2021. This Method is based on that used by the International Union for the Conservation of Nature and is equivalent to the method used by the NSW and Commonwealth Threatened Species Scientific Committees. That assessment found that the species warrants Endangered status and may warrant Critically Endangered status depending on how much habitat and how many individuals are predicted to have been destroyed by earlier clearing and inundation, as well as the likely impacts of the proposed higher dam. At the time of writing, the assessment is before the NSW Scientific Committee.

Eucalyptus benthamii has been regarded as being threatened by enlargement of Warragamba Dam well before the current proposal. The only relatively large population occurs in the lower Kedumba catchment and extends to the current high-water level of the existing dam. Any increase in the dam's capacity will flood more of this remnant population and degrade its habitat. Significant loss of habitat and very likely significant loss of many individuals would have occurred because of clearing for agriculture in the Burragorang Valley and by later inundation caused by the construction of Warragamba Dam. Enlarging the dam increases losses of what is already a species that has seen most of its habitat cleared for a mix of timber, agriculture, mining of alluvium, and to a lesser degree for housing.

This species once extended from at least Yarramundi, upstream to Camden and perhaps to Menangle Park, as well as into Werriberri Creek catchment to the west. It was subject to logging and clearing well before it was first known to science and records of its occurrence began to be documented. The Yarramundi population is considered extinct, and the nearest remnants are now well to the south at Wallacia where the species is reduced to a small number of trees. The species is now in a perilous situation in the Nepean catchment, being reduced to isolated trees, fragmented linear remnants, and very rarely to small populations such as that in and adjoining Bents Basin SCA. Most occurrences in the Nepean are now unviable without major interventions to manage a range of threats. Some of those threats are unmanageable, such as altered hydrology caused by large dams in the upper catchment, and by extensive clearing of the catchment. Even with large investment, the Nepean populations would require continuous support to mitigate the fact that they no longer have a flood regime aligned with seedling recruitment, and that floods now bring large numbers of weed propagules that colonise bare alluvium rapidly, often overwhelming any of the tree's seedlings that might establish. The Nepean population is in a 'critical condition' and will long necessitate 'life support'. Were the species not currently subject to a nomination as Endangered or Critically Endangered, the Nepean population could sensibly have been recognised as an Endangered Population, at least under the TSC Act.

A related issue is that much of the habitat of *E. benthamii* in the Kedumba is recognised as Burragorang Riverflat Forest which is within the scope of the Coastal Floodplain Eucalypt Forest / Riverflat Eucalypt Forest on Coastal Floodplains TEC. This community has been heavily depleted by earlier clearing and inundation by the current dam. What remains would be further depleted and degraded by any increase in dam wall height. This TEC cannot be offset in the IBRA Subregion nor readily (if at all) within the IBRA Bioregion. Across is range, this TEC has been extensively cleared, is very poorly reserved, and even the reserved areas are highly threatened by weeds and often by altered hydrology. Some lower-lying remnants are at risk of saltwater incursion from rising sea level. It is likely that any proposed offsets would have to be found outside the Bioregion, potentially in the North Coast or South East Corner Bioregions. These would not be like-for-like.

Burragorang Riverflat Forest is likely to be a significant habitat for koala and greater glider, amongst other forest fauna. Riverflat forest occurs in relatively well-watered sites that are often relatively fertile, especially compared to nearby sandstone-based habitats. They can be drought and fire refugia and can be more productive and important for some forest fauna because the foliage is likely to have a relatively higher moisture and nutrient content. This is especially important for koala and greater glider. Yet by its nature, this project has a disproportionately higher impact on 'riverflat forest'.

Callistemon sp. nov. Burragorang / Tonalli Cove

This plant is an undescribed potential new species that was discovered near Tonalli Cove prior to this project being announced. The plant was brought to the attention of SMEC ecologists who advised that they had also detected it and found it to occur in only a small part of their study area. Due to a mix of underfunding, understaffing, and the process of moving the NSW Herbarium from Sydney to Mt Annan, this species has not been subject to the research required to determine how best to classify it. It is part of a group of species subject to some taxonomic debate. The upshot of which is that some currently recognised species may be better recognised as subspecies or varieties of a single variable species. This entity may fall into that situation or could warrant recognition as a separate species. It has traits that appear to justify species status. It has been subject to some preliminary genetic assessment, but the results are not known to me. Until its taxonomic status is determined, it cannot be formally described, so cannot be nominated for recognition as a threatened species. My assessment of it is that all but a few outlying plants of it would be easily within even the 1:20 year inundation zone. It tolerates inundation to some degree and in some areas, has colonised dam edges for several metres in from the current maximum water level. I have seen it surviving in areas that have been inundated, but it is unlikely to persist as there are no mature individuals within areas that are subject to prolonged inundation. It appears to colonise the lake shores when levels are low but doesn't persist when levels return to full or near-full height. It may tolerate flooding for some days, perhaps even some weeks, but even if it can survive inundation, its habitat is likely to degrade with increased weed invasion and some slumping and erosion as water levels retreat, rise again, then retreat over many years.

Ideally, the project should have funded the research necessary to resolve the taxonomic and conservation status of this apparent species. Mining companies have been known to fund work of this kind, even if it results in them having to fund translocation and other mitigation measures. As far as I can tell, this potentially new species that would warrant recognition as threatened irrespective of any proposal to raise the dam wall, has not been considered in the EIS.

Solanum armourense

This plant species is accepted to be heavily affected by the project, with numerous records and many hectares of known and likely habitat within SMEC's impact area. The EIS seems to acknowledge that the project could undermine the viability of this species within the relevant subregion(s). This species is not readily offset because other than for a single roadside record, is only reliably known from NPWS estate. Future targeted survey may detect more of it on freehold land, but this does not guarantee that the owner(s) will agree to secure the population under a biobanking agreement, nor that sufficient individuals or area of habitat would be present to offset the obligations generated by the higher dam wall. The species is currently classified as Endangered. Were the project to occur and were targeted surveys to not find significantly more habitat and individuals, it would warrant upgrading to Critically Endangered.

Hakea dohertyi

A similar situation exists for *Hakea dohertyi*, which is assessed in the EIS has having its viability within the Burragorang Subregion significantly reduced by the proposal. Like the *Solanum*, this species has occurrences on high ground that are unaffected by the proposal, but at least one known population at lower elevation would be entirely inundated. It is much less likely to tolerate temporary inundation than the *Solanum* based on where it occurs and that as *Proteaceae*, it is dependent on symbiotic soil fungi for nutrient harvesting. It seems likely that even relatively brief inundation would kill or at least significantly deplete the fungi, which would not have evolved with inundation as the *Hakea* does not ordinarily occur in riparian or floodplain habitats. It also seems likely that irrespective of soil biota, the *Hakea* would be killed (drowned) quite quickly by inundation and that it would be relatively less tolerant of higher soil nutrient loads elevated by contaminated flood waters. Whilst the information available to me indicates that the potentially flooded population is smaller in extent and numbers than occurrences on higher ground, it is reasonable to conclude that impacts on the lower-lying population would put the local population at risk of extinction and would undermine the species' viability in the Burragorang Subregion. I am unaware of any potential to offset losses of this species and its habitat.

Construction site biodiversity losses

SMEC faced a significant constraint at this site because prescribed bushfire had affected part of their survey area sufficiently recently such that it was not appropriate to undertake conventional surveys, especially for flora species and completion of vegetation community (PCT) mapping. SMEC acknowledge that drought also constrained their surveys. They appropriately used the 'presumed present' method for a selection of flora and fauna species that have potential to occur in at least part of their assessment area. In general, this method tends to over-estimate threatened species occurrence and extent relative to what optimal surveys might reveal. But it can also result in some species not being detected. Table 10-28 shows the large list of threatened flora species treated as 'presumed present', and the theoretical loss of habitat for each, and the associated biobanking credit requirements. In my view, these calculations heavily over-estimate real losses and equally over-specify credit requirements. To that extent, such calculations are precautionary because they would result in the purchase of more credits than is likely to have been needed were surveys able to be completed in the impact area. But this also comes at considerable economic cost, with the public ultimately having to fund such purchases. Irrespective of the calculations, I am not at all convinced that biobanking would achieve a genuine 'no net loss' outcome for many of these species, and in some cases, there won't be any credits available for a range of reasons. An example of this is *Haloragodendron lucasii*, which whilst exceptionally unlikely to be present in the impact area, is only known from conservation estate in northern Sydney, with no occurrences in situations where they could be secured to yield biobanking credits. The situation is the same or similar of other species in Table 10-28. Even where I am aware of occurrences of these species outside NPWS reserves, there is no guarantee that those occurrences are suitable for or would become available for biobanking, nor that they could provide the required number of credits. To that extent, the associated Offset Strategy is highly speculative and theoretical. It should not be considered credible until it can prove that the required number of credits have been secured through binding agreements for all species and TECs.

The construction of the higher wall would entail substantial on-site habitat clearing, including removal of what SMEC have credibly assessed as an area of the Critically Endangered Shale/Sandstone Transition Forest (SSTF) (as PCT 1281, 1.64 ha proposed for clearing with a further 8.12 ha at risk from indirect impacts such as edge effects and weed invasion) at what is likely a limit of its distribution. This is a SAII-listed entity under the BC Act and BAM, meaning that proposals to clear it require additional assessment because it is already significantly imperilled by extensive historic and modern clearing, with further clearing pressures from urban, rural-residential, infrastructure, and mining land uses. There is potential to offset the loss of this area of SSTF through conventional biobanking mechanisms, but whether or not this results in genuine 'no net loss' is often an issue of what is being measured and how. In my view, the proposal would result in net loss of SSTF because in many cases, offsets are not in situations where the relevant biodiversity asset would have otherwise been destroyed were it not for being secured under a biobanking agreement. I believe that an SAII assessment of the proposed clearing should be included, though I accept that the loss of 1.64 ha is a small proportion of the TEC's extent. Cumulative impacts of recurrent small losses across its range also warrants consideration. I note that in Table 10-24, SMEC conclude that this occurrence of SSTF TEC is important because it is on the edge of the community's range and that "the Project has the potential to significantly reduce the viability of the CEEC in the IBRA subregion."

The EIS should also have considered the potential for PCT 1081 (0.3 ha proposed for clearing) to be within the scope of the EPBC Act listing of Shale/Sandstone Transition Forest. Whilst this PCT is not within the scope of the more circumscribed BC Act listing of this community, I believe it is or can be within the scope of the broader EPBC Act listing. In my extensive experience with this issue, parts of this PCT can fit the EPBC Act listing depending on factors such as floristic composition, lithology, soils, extent of any rock outcrop, and proximity to areas that are clearly within the scope of Shale/Sandstone Transition Forest. Whilst the area of proposed clearing is small, the relevant vegetation should be assessed to determine if it fits the EPBC Act listing of SSTF.

The EIS reports that it reviewed the online statutory Biodiversity Values Map and that it did not capture any parts of the construction area. The EIS states "No areas of biodiversity value were identified within the development site". This is misleading unless it is understood to mean that "The Biodiversity Values Map did not designate any parts of the development site as significant within the limitations of that Map." The EIS should also have explained that the BV Map is not static – it is regularly amended to include new and improved information, so any search of it is only relevant at that point it time. More importantly, the BV Map is known to not show areas that are within its scope simply because there are no maps or inadequate maps for those values, or because existing maps are wrong. In this case, the EIS maps Shale/Sandstone Transition Forest at the construction site, but the BV Map does not. The EIS should have explained the limitations of the BV Map so that readers can better understand its limitations.

The EIS specifies the use of artificial fauna habitats (as 'nest boxes') as a mitigation measure. It states "Nest-boxes are useful in reducing the impact to fauna habitat within the development site. Equivalent nest-boxes should be erected for each natural hollow that is removed during the construction phase. Replacement nest-boxes should be suitable for all threatened and non-threatened fauna inhabiting the development site. Nest-boxes are to be erected before removal of hollow-bearing trees. Prior to vegetation clearing, a nest-box plan should be prepared…(which) should provide the following details: the number and size of the hollow bearing trees to be removed…specification of nest-box size and materials….". This looks very sensible, but it is not supported by current scientific literature. Some authorities are now refusing to accept the use of such artificial habitats as a mitigation measure because the available, albeit incomplete, scientific literature does not find that this method is effective for most threatened species, and can have detrimental effects, including favouring relatively abundant species over threatened species, and even facilitating invasion or growth of invasive species populations.

In addition, it is not reasonable to be able to determine the specifications of hollows that are proposed to be removed because the type and dimension of all hollows cannot be determined until they have been removed. Thus, the proposed plan is unworkable. As an example, an ecologist can observe with binoculars, that a tree contains a hollow and this may entail seeing which species is using it at that time. More often, observation is limited to seeing an entry to a hollow, but the ecologist cannot know the dimensions of the hollow, nor necessarily which species it is suitable for or are using it. Because of this, it is not feasible to create artificial hollows to replace those that would be removed, prior to their removal. Only if the ecologist were to climb each tree to access each hollow, then insert a suitable viewing and measuring device to determine its dimensions and which species is or might be using it, can the required information be obtained. Even were that information accurately obtained and replacement structures made, the literature indicates that often, artificial structures are not used by target species. Greater success has been obtained by cutting hollows into living or dead trees, but there is insufficient data available at this stage to determine its effectiveness for replacing the removal of natural hollows.

The EIS states that 14.19 ha of suitable habitat for the Vulnerable *Grevillea parviflora* subsp. *parviflora* would be removed. This is a significant loss. It then states that "A total of 22.42 ha of suitable habitat (inclusive of the 20.06 ha) for other threatened flora species will be cleared." It isn't obvious to me where the 20.06 ha comes into these calculations.

Downstream biodiversity effects

The floodplain below the dam is highly modified by land clearing, urbanisation, former and on-going mining of alluvium, and exotic flora and fauna are widespread and often common. Because of these factors, the project has relatively less potential to cause significant harm to what remains of the floodplain and nearby vegetation compared to impacts upstream of the dam wall. It has some limited capacity to reduce flood-related harm to vegetation that can flood due to extensive alteration of the catchment(s). But conversely, it still has potential to further disrupt riparian and floodplain vegetation and habitats by reducing flood severity but increasing flood duration in some areas. Most of the remnant vegetation and habitat on the floodplain is highly threatened and listed as Critically Endangered, Endangered, or at least Vulnerable ecological communities, none of which are or can be adequately reserved due to extensive clearing and fragmentation.

The EIS claims that because the project has no impact on local flooding (below the dam), any flood-dependent native vegetation would be largely dependent on local catchment flows, not overbank flooding from the river. I am not at all convinced that this is correct. It is correct that the causes of local flooding are not directly affected by the proposal. However, it does not follow that local flooding is and always has been the source of inundation that supports flood-dependent or flood-advantaged remnant vegetation. Were the proposed works operating as intended, they would reduce, to some degree, riverine overbank flooding, and this could affect remnant vegetation that evolved to depend on or be advantaged by such floods.

The downstream biodiversity impacts component of the EIS rightly claims that because the project could result in an increased duration of flooding when stored floodwater is released from the higher dam, vegetation that is intolerant of this longer duration of inundation could be harmed. Conversely, it could also reduce riverine flooding of wetlands and associated treed vegetation that may be dependent on such events.

It appears that for the 1 in 5 chance in a year flood, the project results in only minor reductions in flooding in some areas, moderate to significant reductions in others, and increases in some such as the Nepean River near and upstream of Wallacia for some kilometres. This persists but is intensified to varying degrees with less likely flood events. The project seems surprisingly ineffective at mitigating flood heights and increases flood duration once the dam discharges. It is only for the most extreme and least likely modelled floods that the project has a relatively significant effect on reducing the area subject to inundation. But this comes with significant upstream biodiversity and cultural heritage impacts, and great economic cost to establish the project, plus significant on-going operational costs.

My main downstream concern is the increased duration of flooding in some areas. This includes *Eucalyptus benthamii* populations downstream of Bents Basin SCA. These are small and now relatively isolated, but their potential to be compromised or destroyed only worsens the species' predicament. This species is not only flood tolerant, but long believed to be dependent on flooding to facilitate seedling recruitment. However, the species is relatively unlikely to be tolerant of prolonged inundation as it is a riparian and nearby floodplain tree, not a wetland species. It also occurs on relatively well-drained alluvium, further suggesting it may be relatively intolerant of prolonged inundation. The CSIRO inundation tests on a plantation of this species at Deniliquin suggest the species can tolerate and may benefit from inundation for at least six weeks, but that site and those circumstances may not be a good comparison with natural occurrences of the species. If this tree was tolerant of prolonged inundation as can occur on wetland margins and along poorly drained and swampy watercourses, it would be expected to occur or have occurred in those habitats within its range, but this is not the case. The only known occurrences are all in other situations. This is a fast-growing, very tall species that could theoretically compete with tree species that are tolerant of boggy conditions, such as *Eucalyptus amplifolia*, *Melaleuca decora*, *M. linariifolia*, and *M. styphelioides*, but it has never been documented in those habitats.

S.6.3 of the downstream biodiversity chapter correctly lists potential impacts on floodplain vegetation and habitats. It assesses those impacts through a risk assessment. The project has some potential to reduce unnatural flooding of terrestrial habitats that only flood infrequently because of catchment modifications such as extensive clearing of vegetation and extensive urbanisation. It also has some potential to reduce harm caused by current levels of flooding, for example spread of weeds, but the advantages are probably relatively minor. Most other potential effects are negative to varying degrees. Some are genuinely hard to quantify because the effects may be subtle and only evident over the medium to long term. Such effects are even more difficult to quantify given the increased and increasing instability of the climate, with more acute oscillations between drought and flood being predicted.

The EIS tends to dismiss some potential impacts on habitat because it views those effects as temporary, suggesting that damage will be undone by natural processes. This does not take adequate account of cumulative impacts, and naively assumes that some impacts associated with either reduced flooding or increased flood duration will reverse naturally. In relatively natural vegetation with minimal threats, flood damage may be sensibly deemed temporary, and recovery would be anticipated given sufficient time between flood events. But most, perhaps all the vegetation that remains within and adjoining the floodplain is subject to multiple threats such that natural recovery from flood damage cannot be sensibly anticipated. For example, in weed-free catchments, flooding of riparian and floodplain vegetation may cause damage of various kinds, but may also facilitate regeneration of species advantaged by such disturbance. Yet in weed-affected catchments, the same flood event could result in a worsening of weed cover and an increase in weed diversity, with concomitant declines in native species cover and diversity. Much of the remnant vegetation within the potential downstream impact zone is not managed for conservation or not effectively so. Weeds and feral animals, along with other threats such as plant pathogens, recreational pressures, arson, timber theft, etc. are often ubiquitous, though to very variable degrees. Some sites are in good condition with few threats, and those threats may be well managed. Others have many threats that may be unmanaged, poorly managed, or beyond management. When climate warming is added to this situation, the likelihood that downstream habitats within the impact area will be resilient to further disruptions caused by the project is relatively low.

Notably, the EIS does not propose to offset any potential biodiversity loss and degradation in the downstream assessment area.

<u>The Biodiversity Offsets Strategy (BOS)</u>

The BOS specifies how the required biodiversity offset obligations will be met or might be met. It includes the use of 'nest boxes' to compensate for the removal of hollow-bearing trees at the construction site. As noted earlier in the review of the construction site BAR, peer-reviewed literature does not adequately support the use of 'nest boxes' as a compensatory measure because the success rate is low and such structures are readily used by non-target species such as common native fauna and invasive exotic fauna (pest species).

The BOS is heavily reliant on protecting land owned by WaterNSW under a Biodiversity Stewardship Agreement (BSA). This would not be credible offsetting because such lands are already owned by the NSW Government and are subject to its laws and policies, plus most land owned by WaterNSW is de facto managed for conservation because the primary land use is catchment protection. Examples include parts of the Woronora Plateau and its upper Nepean River system that are not currently within NPWS estate, largely because of conflicting current or prospective mining. Placing such areas under a BSA may have negligible real benefits for biodiversity and have little credibility unless it can be shown that parts of those areas were otherwise at genuine risk of destruction or serious degradation. The use of one or more BSAs over WaterNSW land as a form of biodiversity offsetting has little to no credibility.

The BOS also relies on the potential purchase of land (not owned by WaterNSW) and its protection under a BSA. Again, this only has credibility if that land and relevant biodiversity values were otherwise at risk of destruction or serious harm. An example of a credible acquisition would be where the State purchases land owned by a mining company that has a current approval for surface mining operations, and where that operation would proceed were it not for the land being purchased for offsetting, with cancellation of the mining approval and all associated rights. Such a scenario is highly unlikely to occur. Another scenario might involve areas of rural freehold held by private or corporate owners and where existing approvals or rights are causing or could reasonably cause the loss or serious degradation of relevant biodiversity values. In such a case, acquisition of the land and its placement under a BSA would be a more credible offsetting method. But it should be noted that under the Biodiversity Conservation Act, the rights of a land owner to clear large areas of vegetation are highly constrained, with the Court having repeatedly enforced the need for a proponent to first avoid harms, then mitigate them, and only use offsetting as a last resort. The purchase of rural land where existing lawful activities are causing loss of biodiversity values is a more credible offset scenario because it would entail measures such as ending or preventing excessive land clearing around property boundaries, removing livestock, and ending or preventing vegetation clearance that is otherwise permissible under relatively lax and self-regulated codes of practice.

Another mechanism proposed by the BOS is the acquisition of land for reservation under a Plan of Management. This is unclear but seems to refer to reservation under the NP&W Act. Again, this is only a credible offset mechanism if the land was otherwise at risk of serious harm or degradation, which is often not the case in rugged, non-arable terrain that is likely to contain species and habitats like those that would be harmed by the dam project.

The BOS can also discharge some credit requirements by purchasing them from existing BSA sites. It is likely that some of the required credits would be available through the credit market, but not for all PCTs, TECs, or species, nor in sufficient quantities. It is also reasonable that credits would be available through prospective BSAs and that the project could lead to many new BSAs being made, at least in part to supply credits to meet the project's requirements. But again, this only has credibility on sites where biodiversity values were otherwise imperilled, and where the BSA can reliably prevent such loss or degradation.

One of the most dubious means of meeting credit requirements is the funding of 'supplementary measures', which can only be done as a last resort when other options have been adequately explored and ruled out. The 'supplementary measures' option is fraught because it can see the NSW Government effectively outsourcing its biodiversity conservation obligations to entities with large or very specific credit obligations. For example, Species X may need certain conservation measures that have not been funded under the grossly inadequate Saving Our Species program or through other DPIE funds. For eligible projects, Government could approve the discharge of credit obligations through the funding of those conservation measures – works that ordinarily should be publicly funded and done by agencies such as DPIE and the NPWS. The 'supplementary measures' option appears to have been legislated to allow major projects that cannot meet their biodiversity offset requirements to be approved anyway, as long as the proponent funds prescribed works, many of which are the core business of the State and that would ordinarily be done by the State were it not for chronic underfunding of many conservation projects.

Another option to discharge credit obligations is to purchase them from the Biodiversity Conservation Trust, which must then find equivalent credits through BSAs that may never exist. The BCT charges what amounts to a brokerage fee such that using this option can cost more than buying credits from the market. But when the market can't supply the required credits, paying the Trust to find them is an option. The main problem is that for some PCTs, TECs, and species, there may be little or no prospect of securing the required credits. The funds would just sit in the BCF *ad infinitum* or until government changes the rules and allows those monies to discharge credit obligations such as through the purchase of non-like-for-like acquisitions.

The BOS or more specifically, the Warragamba Offset Program (WOP) would entail creating an advisory committee (powers not specified, so may be tokenistic) containing representatives from DAWE, DPIE, NPWS, LLS, BCT, GBMWHA Management Committee, WaterNSW, Infrastructure NSW, and other parties as required, with an independent chairperson. This looks positive but given that the bulk of members would be from the same government that is the proponent of the proposal, and that must ultimately fund offsetting and management costs, the potential for bias and suboptimal outcomes is substantial. It is not an equivalent body to the Threatened Species Scientific Committee. It is positive that the WOP for upstream impacts would be implemented "prior to Project operation" but this may mean that the construction work occurs but is not made operational until the WOP has been fully implemented. It is potentially problematic that the works specified in the WOP, whilst needing to be done by a person accredited under the BC Act/BAM, may be selected by the proponent and thus subject to direction by the proponent in ways that may result in suboptimal or biased assessments and advice. I raise this given what has come to light in relation to the senior project ecologist in SMEC resigning due to being allegedly subject to pressure to use her accreditation to endorse documents and assessments that she did not agree with. I recommend that the BAM accredited person or persons undertaking works for the WOP be independent of the proponent and appointed by the proposed advisory committee. WaterNSW and Infrastructure NSW, as proponents, should not vote on that appointment because of the potential conflict of interest.

Incomplete assessment of costs – especially operating costs

The economic costs of the proposal are obscured by incomplete and prejudicial assessment of the project's potential impact on upstream, construction site and downstream threatened biodiversity values and therefore the much greater ecological offsetting costs. The EIS is such that the Minister for Planning is not correctly informed about the true impacts or true costs for biodiversity offsetting obligations. The document is more than misleading in this regard. It systematically downplays the size, magnitude and significance of biodiversity impacts, yet because of how it has had to calculate offsets, it very likely generated highly inflated biobanking credit costs.

The EIS relies on a watered-down version of modelled impacts using the 1 in 20 year flood when considering effects on upstream biodiversity, arguing that the more extreme events do not warrant consideration or cannot sensibly be used to assess impacts because such events are relatively rare. Yet in the downstream impact assessment components of the EIS, this rationale is reversed, with extreme but much less likely flood events used to claim great economic and some biodiversity benefits from the proposal.

Furthermore, the project requires the inclusion of an Environmental Management Plan relating to NPWS estate that would be affected by the proposal. The EMP's exact content is not specified in the EIS or elsewhere but would include environmental remediation of lands affected by temporary inundation arising from the project. In my view, the costs of implementing that plan could be very large and enduring, and in any case, the EMP cannot mitigate all impacts; it can only ameliorate some of them at best. When Government considers the proposal, it must consider not only the cost of construction and the full costs of biodiversity offsets when properly assessed, but also the on-going costs of the EMP's implementation.

Conclusions

The EIS is for a staged development but only assesses part of the first stage (14m wall height increase) when the second stage is clearly 17m. It claims that the second stage increase in the height of the wall is unlikely to be needed for some decades, but there is effectively nothing to stop the proponent from changing that position and bringing forward that plan based on one or more extreme rainfall events and the associated flooding.

Setting aside the issue of a future second increase in wall height, the EIS does not properly inform the Minister or the public about the full potential impacts of the 14m higher wall proposal, in part because impact assessment is based on the 1 in 20-year flood model, not on the maximum level of inundation and duration that could occur. SMEC's 'impact area' is vastly smaller than the area that could credibly be subject to increased inundation and associated harms generated by the project.

Whilst the EIS reveals very significant impacts on biodiversity values associated primarily with potential inundation, but also at the construction site, those associated with inundation are only a portion of what is likely to be generated. The costs of biodiversity credit requirements arising from the EIS are very large, in part because of the reliance on the 'presumed present' method for many species of flora and fauna. But the cost would be likely be much higher if the EIS had assessed the full area and duration of inundation that the higher wall could cause, such as the PMF with appropriate consideration of the effects of climate warming. Had such costs been credibly predicted before the EIS commenced, Government may have been averse to pursuing raising of the dam wall because of the very high cost when compared to alternatives such as phased acquisition of flood-affected properties and/or catchment management.

The EIS is something of a hybrid document because it contains some good ecological assessment by the senior ecologists within SMEC who developed it to the draft stage, yet it is also flawed due to how the ecological component of the document has been altered or constrained, apparently to suit the proponent's case. There are significant aspects of the EIS that are unsound because SMEC was apparently not given the budget and or the time to complete the recommended level of survey for all relevant threatened species or to obtain Expert Reports to be better informed about how the project would affect them. The failure to complete compliant survey effort or to replace this with Expert Reports has meant that the impacts of inundation had to be based on the presumed presence of many threatened species, some of which could have been excluded through Expert Reports. Such reports could also have calculated much lower loss of habitat and individuals than is generated by the very coarse and often excessively precautionary method that is used for species that are simply presumed present. The effect of this is that even within the smaller 'impact area' used by SMEC, predicted impacts on threatened flora and fauna species are often artificially high, and so too are the associated biobanking credit requirements. WaterNSW has apparently chosen not to spend its money on allowing SMEC to use preferred methods to assess impacts and credit requirements, and this has led to excessive figures for losses and credit requirements that would ultimately need to be met by the taxpayer.

Setting aside its flawed methods, the EIS shows very substantial impacts on highly threatened species and ecological communities. Were the flaws remedied, the project would still entail significant losses or degradation of threatened ecological communities and species, and very large biobanking credit obligations and costs. This would be poor if the proponent were a for-profit corporate interest, but the situation is worse when the proponent is an arm of government – the same State government that made laws and policies encouraging the conservation of these species and communities. Indeed, public funds such as the Saving Our Species program and the Environmental Trust, as well as recurrent DPIE and NPWS funds, have been and are still used to survey, monitor and conserve some of the threatened entities that this proposal would harm and, in some cases, dramatically imperil. It seems perverse than one arm of government proposes such harm whilst one or more others are working to protect those values. The situation is dramatically worsened because the would-be harm to some of those species and communities cannot be offset because credits are not and cannot be generated elsewhere.

The BOS and WOP associated with the project entail some aspects that lack credibility because they include purchasing or otherwise securing lands that are not really at risk of losing their biodiversity values. These would not be credible offsets, e.g., placing WNSW-managed land under NPWS co-management – something that has ordinarily occurred and that would be expected to continue irrespective of the project. The BOS seems to indicate that some offsets would be generated by converting relevant State Conservation Areas to more secure reservation classes such as National Park. This is not genuine offsetting and is somewhat equivalent to claiming that a car can be afforded higher performance by changing its colour or adding decorative stripes. Most SCAs, whilst not as secure as National Park or Nature Reserve, are not actively at risk of losing key biodiversity values in ways that simply changing their classification would remedy. The WOP also entails proposed purchase of lands for addition to NPWS. Such acquisitions are only credible offsets if those lands and their relevant biodiversity values are at real risk of destruction unless acquired and reserved.

The project is fundamentally in conflict with the objectives of several NSW laws and policies, with the EPBC Act, and the World Heritage Convention. Proposed offsetting and mitigation measures are inadequate to compensate for those conflicts and associated harms.

The EIS does not adequately consider alternatives to the project, but instead mirrors earlier incomplete evaluations of selected options. The true up-front and on-going costs of the project, even only in economic terms, are extremely large and ethically problematic, and make acquisition of flood-affected properties a much more sensible and effective option. Acquisitions fix the problem of properties being flood affected, whereas the higher dam wall can only mitigate those problems to some degree, yet increases the duration of flooding below the dam, and has devastating impacts at the construction site and upstream.