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REVIEW OF THE SCIENCE UNDERPINNING THE ASSESSMENT OF THE ECOLOGICAL CONDITION OF THE LOWER BALONNE SYSTEM (BY PETER CULLEN, RICHARD MARCHANT, RUSSELL MEIN)

SMARTRIVERS RESPONSE

Smartrivers member Mr John Grabbe suggested an independent review to Premier Peter Beattie in July 2002. The Premier responded by appointing Prof Peter Cullen to Chair the review.

Smartrivers is pleased that the review took place and thanks Professor Cullen and the review team members for their approach and diligence.

Smartrivers general perception of the report is that it strongly vindicates their stance over the past few years. Many of Smartrivers key points were supported explicitly and many were supported implicitly through the Panels recommendations. Only a very limited number were clearly not supported by the Panel while the majority of Governments key assertions were definitely not supported.

Smartrivers is very pleased that the Panel has told Government to involve stakeholders more meaningfully in the planning process. This outcome was one of Smartrivers key goals and it has been achieved. It is now up to Government to follow the recommendation of the Panel and accept Smartrivers proposition to jointly develop the Draft Water Resource Plan.

As with any major report, it is to be expected that no party will be 100% in agreement with the document. Smartrivers is particularly disappointed with the Panels response to TOR issue 1, Hydrology. This was reported at very much an overview level whereas many highly significant points regarding one-way errors, input data inaccuracies and the treatment of Type A water, are either not mentioned or their significance is not highlighted. These points were discussed at length in the various meetings and the Terms of Reference for the Review clearly required their reporting. This shortcoming unfortunately influenced the section on Likely Future Ecological Condition (TOR4) because that section was required to discuss sensitivity of the predictions and as that had not been addressed adequately in the hydrology section, it could not be addressed adequately in this section.

These and other points are addressed in detail below. We also present those sections where the Panel clearly agreed with submissions by Smartrivers as this is often not clear from the report and was certainly not highlighted in Ministerial press releases. The section numbers named below refer to those of the Report.

Sections 1 and 2 - Introduction and Ecological Assets

In the section on Ecological Assets, Smartrivers identified these same assets (other than biota of the Darling River) in their Risk Assessment, which was submitted to the Panel. The details provided in Appendix B of the Report are very disappointing because no authorship is attributed; they contain mainly anecdotal comment (which is not science) and unsupported views about current and future impact as a result of water extraction. The latter is apparently based solely on the authors' perceptions and they obviously have very little data upon which to base those perceptions. Any comments about future impact are inappropriate in this section, as it is intended to describe the existing assets, and the need to clearly separate current from future impacts was a requirement of the Terms of Reference.

This perceived need of the Panel to mention future risk here, and in almost every other section, is clearly in contradiction with the Terms of Reference, which required reporting separately on the current ecological condition and the range of potential future conditions. The effect of this contradiction is to decrease the importance of the results in those other sections. The potential for future impact was not a point of contention so did not require stressing.

As the Review later concludes that terminal wetlands are particularly important, it is relevant to correct an inaccurate description of the system. On page 13 it states that more than one distributary channel ends in a terminal wetland, whereas in truth only the Narran River does.

On page 13 the report states that the issues of the Lower Balonne relate to impacts of irrigation. This is only partly true and the TOR clearly noted the requirement to address other forms of impact and in fact to rank them in importance. Smartrivers has strongly advocated an integrated or holistic approach to management of aquatic environments wherein all potential sources of impact are addressed and managed according to their relative likelihood of causing harm to the system. Smartrivers' Risk Assessment document is the first attempt at this important step. The Panel strongly endorsed the use of a Risk Assessment approach and Smartrivers advocates its use as the primary driver of ecologically driven water resource planning.

Also on p 13 the report states "*The issues relating to the accuracy of river flow measurement and the validity of modelling flows can only be considered in the light of what precision is needed to address the ecological issue of concern*". While that may be true of this specific Review, it should be remembered that a different level of precision may be required for social or economic prediction and such an assessment is a mandatory component of the WRP process. That level of precision would be significantly greater than what the Panel has apparently accepted as suitable for ecological prediction. For example, a farmer could not expect a bank to support their loan application if there was a 40% uncertainty in their ability to harvest water from large floods, as is the case with the current version of IQQM used in this area.

Table 1 on page 14 would appear to be reasonably important but it is not referred to in the text. Smartrivers has put forward a set of ecologically significant flow levels in its Risk Assessment so recognises the importance of such an analysis.

Section 3, TOR 1 – Hydrology

Smartrivers has long argued that the level of measurement and sampling error involved in the estimate of flood flows leads to very high risk decision-making with respect to the possible need to reduce water extraction. The Panel concluded that the measurement of flood flows was probably +/- 25% at a number of gauges. Smartrivers remains of the opinion, and believe the result was clearly agreed in the various meetings during the review process, that the error associated with estimates of flood flows is a one-way error, it is not plus or minus but only minus. That is, gauges on the floodplain underestimate flood flow, they do not overestimate it.

The assertion by Dr Porter on behalf of Smartrivers was peer reviewed by Prof Tom McMahon and Prof John Fenton and they concluded “the DNRM rating curves require amending to take account of overbank flows”. The result, and the impact on interpretation of the proportion of flow extracted by irrigators, is unequivocal. This point should have been very clearly reported by the Panel as it related directly to the extent to which any precautionary approach to management may be required.

Smartrivers put forward a number of one-way errors which they believed existed, all resulting in overestimates of the proportion of flow extracted. In this respect Smartrivers includes not only statistical errors within the term “error”, but input data mistakes and choices made by modellers. The bulk of the time in Review workshops was spent on these issues. Debates during the sessions were not about whether they were one-way or not, because this was agreed, only about the extent of error. When specifically asked, NRM could not put forward a single item of error which could be considered one-way in the other direction. It is extremely regrettable that Prof Cullen and Dr Marchant were not present for these sessions hence did not hear these important discussions.

One particular debate was about the use of gauges on the Culgoa River for calibration and verification purposes. Earlier debates led NRM to change from calibrating against the Woolerbilla gauge to using the Brenda gauge in New South Wales. Smartrivers contended that this gauge had the same problems, ie it underestimated flood flows because much of the water by-passed the gauge and was not measured. To Prof Meins credit he requested that NSW provide data on the gauge. This arrived late in the process and was not included in the Report but again the result is unequivocal and completely supports Smartrivers stance – flood flows are significantly underestimated and consequently, the proportion of flow extracted by irrigators has been overestimated. On reviewing the NSW input, Dr John Porter stated “*From the data in the DLWC memo and the discharge rating curve for Brenda, the main Culgoa River channel capacity is in the order of 10,000 ML/d. The information also demonstrates that, during large floods, the flow in the floodplain may be many times greater. Only a part of this floodplain flow has been measured and is included in the discharge rating – and by extension, only a part of the floodplain flow is included in the model analysis as cross-border flow.*”

With respect to sampling errors, this is a statistical problem which can only be overcome by extended monitoring. It applies equally to ecological samples. It is a point Smartrivers clearly raised a number of times and it is pleasing to see it recognised by the Panel. Smartrivers acknowledges that sampling errors are two-tailed, that is, the true answer could lie either side of the estimate.

Smartrivers also strongly agrees with the Panels points regarding the statistical difficulty of using figures such as the mean annual flow and the need for event-based management. Smartrivers has advocated for some time that flow targets should be based on critical ecological requirements rather than generalised average hydrological statistics. The Smartrivers Risk Assessment stated; “*it is particularly relevant in a floodplain ecosystem with a highly variable flow regime that any flow management plan be event-based and not driven by the desire to maintain long term average statistics. The Lower Balonne system does not work on averages, it works on events eg flood and drought. Water Resource Plans in Queensland, until the Border Rivers Plan, were written with the target of achieving compliance, within single percentage point increments, of long-term average flow statistics. This has no ecological merit as it is artificially regulating a naturally variable system.*”

With respect to floods, the Report states “*Such large events are not greatly affected by storage extractions.*” This is a very important point and should have been greatly emphasised because this system is driven by floods yet the irrigators have little effect on such floods.

Smartdrivers submissions pointed out that the proportion of flow extracted decreases for flows greater than 25,000ML/d at St George (a small flood), except for a very small number of extraction thresholds on the Culgoa River. The ability of all irrigators to extract from a moderate to large flood (100,000ML/d) is limited to 25% of the peak flow and for larger floods it is smaller again. It is pleasing to see that the Panel agreed. The Report raised the point with respect to the statistical effect of large flows on the Mean Annual Flow but failed to point out the significance of the fact with respect to potential approaches to system management. While the Panels comment may seem a minor point, it is important that it is recognised by others and taken into account when hypothesising about future impacts. The CRC for Freshwater Ecology in a draft of their “Scoping Study for the Narran Lakes” suggested that extraction was greater in higher flows. Smartdrivers notified the CRC of their misunderstanding because in a system driven by flood flows, the misunderstanding is critical.

With respect to the need to better quantify flood flows, the Report states “*this is not considered crucial for management targets based on flow events of most interest*”. This statement is difficult to interpret. It may mean that flood flows are not “*of most ecological interest*” though other sections of the report conclude that they are the most important flows for the National Parks and Narran Lakes Nature Reserve. It could also mean that while flood flows are of most interest, the accuracy with which they are measured is “*not considered crucial*”. Smartdrivers does not agree because it is from these large events that we extract the bulk of our water so it is imperative that the volumetric impact of that extraction be accurately quantified. Perhaps the phrase is supporting a point made by the CRCFE in Table 1, that higher flood flows do not greatly effect the area of floodplain inundated, only the depth, hence while a large flood wets the floodplain, a very large flood wets only a little more. Smartdrivers members put forward the same contention in the Anchorage V NRM court case.

In section 3.2 Prof Mein questions the relevance of the issue of pre-development V natural flows on the basis that gauging began after the supposed period of change. Firstly, he is only questioning hydrological relevance from a measurement perspective, not ecological relevance with respect to target setting. If our aim is to return the ecology to a natural condition then natural must be defined. When the gauging of flow commenced is only relevant to the detection of change. Secondly, the point of inflexion suggested by Smartdrivers and PSM was in the 1940’s, not pre-1920 as stated in the Report.

Prof Mein also points out that the impact on runoff of a change from forest to grass is negligible when the mean catchment rainfall is less than 500mm/yr, a circumstance which he said applied to the Condamine Balonne. Smartdrivers does not assert that the change happened or would be significant in the drier western catchments. It is concerned that changes in the upper eastern catchment, where tree clearing has been extensive and rainfall can exceed 1200mm/yr, may be significant.

On page 17 the Panel recommends that NRM improve its IQQM documentation in order to know “*the impact of each revision on modelled flows*”. Smartdrivers pointed out in their comments on the first NRM submission that given all the improvements made in the model since the version released with the Draft WAMP and used by the TAP, the original version must have been extremely dubious and not of sufficient accuracy for the uses to which it was put. As an example, the modelled End Of System flow has basically not altered from then till now, despite the off-stream storage volume in the model nearly doubling, meaning other improvements in the model (correction of one-way errors) balanced the increase. What this means is that the version used in the Draft WAMP was so far wrong that while Government wanted to cut diversions by 30%, they could have actually increased them by an even larger amount and still been at the same point with respect to potential volumetric impacts!

Smartdrivers contended that NRM had not corrected all of the one-way errors and the effect of these remaining errors was to reduce the EOS MAF (End Of System Mean Annual Flow) from a realistic figure of probably over 55% to the 47% reported by NRM. While Prof Mein concentrated on the lack of statistical rigour in these figures, and we agree, the critical point for Smartdrivers is that ecologists use these figures, rubbery as they are, to predict impacts. The Panel did precisely that in Section 5, continually comparing average figures, without quoting error bands. It is imperative that these figures be estimated as accurately as possible, without all the one-way errors and for ecologists to then report on the effect of the remaining inaccuracy on their predictions. Stakeholders have a right to know the real extent of risk. This was a requirement of the Terms of Reference but it was not done.

An example of a one-way error which is still in the model is the failure to account for Type A water going into storage. NRM admitted this shortcoming in their submission and provided figures which showed that the volume of Type A water is equivalent to somewhere between 11.6 and 23.2% of mean annual diversion. This is a huge discrepancy! It is not even mentioned in the Panel's report.

Another example is the adjustment of the model upstream of St George such that more extraction occurs than is currently possible. This only came to light in the third hydrological workshop when stakeholders asked where all the water was going, because the extracted volume was not turning up as crops in the region. Up till this point all participants had believed they were working, finally, with a true "*existing case*" model, that is, a model which best reflected what was actually happening today. This was not the case. A policy decision was taken by NRM, prior to the Panel's deliberations, to increase the modelled extraction of water upstream of Beardmore Dam beyond what currently occurs, thereby reducing the amount of water entering the Lower Balonne system. This of course makes the End of System flow from the Lower Balonne look worse than it currently is. The Panel reported this in a very congenial manner; "*The comparability of the two scenarios is masked somewhat by the change in inputs for the Lower Balonne due to increased diversions upstream of Beardmore Dam. The workshop held in Brisbane on 14 November 2002 requested that the IQQM model be run without these increased diversions to assist interpretations*". This in no way reflects the outrage felt by stakeholders when they uncovered this manipulation.

On page 19 the Panel concludes "*The Panel is of the view that the current IQQM model is an appropriate tool for evaluation of strategies to meet water management targets for the Lower Balonne. It supports the involvement of stakeholders in verification of the information used in the IQQM data files.*" In his press statement announcing the release of the Report, the Minister quoted the first sentence, not the second. The reason the Panel included the second is that it was discovered during the workshops that the model actually had water being extracted on farms which had no dams to hold it! This is why the Report also states "*Clearly, in such exercises, the accuracy of representation of the major storage and diversion infrastructure in the system is important for credibility of the modelled scenarios*". We have mentioned previously that an error of 30-40% in the estimate of higher peak flows may be acceptable to the engineers who design these models but it is not acceptable to the stakeholders who will be directly impacted by decisions based on these models and the impacts predicted by ecologists, also based on these models.

Later on page 19 the Panel has a second go at NRM and its failure to consult with stakeholders. With respect to the Decision Support Tool, a model developed by consultants, they state "*It is a good example of the benefits of stakeholder input during development.*"

The Minister's press release highlights the Panels conclusion that IQQM is an appropriate model. Smartrivers did not debate this with respect to the model *per se*. Our point is that the model as developed in the Lower Balonne has always contained too many errors, particularly one-way errors, and is not accurate enough for decision-making purposes. The latest version is still not satisfactory.

Smartrivers concludes that a significant number of key points made at the workshops do not appear in the Report, or they are not highlighted. A significant potential problem with this, disregarding the issue of public perception for a moment, is that the ecologists on the Panel did not attend the bulk of these workshops. Their perception of the utility of the outputs of IQQM is mainly driven by Prof Meins interpretation of the suitability of the model. As he concluded it is appropriate, the ecologists obviously felt it was OK for them to use the statistics it produced, as they did, in order to predict the future. Even though the TOR clearly stipulated that they estimate the error or sensitivity involved in their predictions, nowhere in Section 5 do they mention the errors within IQQM (only stating that the modelling is adequate), yet the outputs of IQQM are the basis of their predictions.

Section 4, TOR 2 – Assessments of Ecological Condition

Smartrivers congratulates Dr Marchant for the effort he put into this section. Dr Marchant did not simply take the interpretations of others as correct but took the raw data, analysed it as he saw fit, and made his own conclusions. This is exactly what was needed. Overview style reviews will not find the errors because the errors are in the detail.

The Report clearly states that the original Technical Advisory Panel not only got the condition of the rivers wrong by a mile (that is, it is not severely degraded, it is in essentially reference condition), they should never have used the information put before them. They were wrong when they said the condition became worse downstream and wrong when they said it was as a result of water resource development. The Minister mentioned none of this in his press statement; in fact not commenting on the current ecological condition at all, despite this being one of the two key issues raised by Smartrivers and the core of the Review itself. In an NRM document accompanying the Ministers press release, under the heading Current Ecological Condition of the Lower Balonne, it only reports that the current ecological condition is reasonable. The term "reasonable" was not actually used in this section of the Panels report. This section of the report actually states "*the fauna at the majority of sites was indistinguishable from that expected at undisturbed (or reference) sites*". Why didn't the Minister or NRM make a lot of noise about this fantastic result? Aren't they pleased that the Lower Balonne is very healthy? One immediate impact of this conclusion is that the Condamine Balonne should no longer be classified as a stressed river by the National Competition Council, thereby removing any threat to Queensland's competition payments from this catchment, and in fact such a threat was never warranted.

Other statements in the Report which the Minister and NRM chose not to bring to the public's attention include:

"the distribution of invertebrate fauna in this region does not presently show evidence of substantial river degradation" (meaning they got it wrong).

With respect to Smartrivers sampling program; *"the sampling is sufficiently sensitive to respond to these expected temporal and spatial patterns of variation"* (that is, we got it right).

"It also reinforces the need to base management decisions on more than one data set that is all that appeared to be available to the TAP preparing the June 2000 Draft WAMP." (NRM needs to collect more data before commencing water resource planning projects).

With respect to the key data available to the TAP *“these samples were taken either during a receding flood, contrary to standard sampling protocols, or from habitats that naturally appeared to sustain very few species”* (just as Smartrivers said, unfortunately we had to say it in court).

“The Panel finds that NRM’s more recent sampling and analysis has not supported the preliminary interpretations made in the June 2000 Draft WAMP that the invertebrate fauna in the Lower Balonne downstream of the bifurcation was in a generally degraded state” (in fact the NRM submission and the TAP report did not report their findings as “preliminary interpretations”, they reported them as “conclusions”).

“It is unfortunate that the Technical Advisory Panel made these preliminary conclusions with such limited data available to them in 1999.” (it is also unfortunate that no one within NRM was capable of detecting the problem).

“NRM is advised to be more strategic in its collection of ecological data so that necessary information is available when needed for water resource planning” (stop basing decisions on insufficient data – “best available” is not always good enough).

“The Panel is of the view that from the sampling that has been undertaken to date there is no present evidence from the invertebrate faunal composition of stress increasing downstream of the Beardmore Dam or in comparison to adjacent rivers” (directly contradicts the NRM stance and supports Smartrivers).

With respect to AusRivAS models, particularly that for the pool habitat (the use of which Smartrivers has criticised) *“These are very low numbers for predictive models of this nature, making this approach less reliable”*.

“NRM believe more experience needs to be gained with the pool models in particular before confident interpretations can be made” (remembering that the data from the Lower Balonne available to the original TAP was only pool samples).

With respect to samples from the Lower Balonne in NSW *“10 of the (11) sites were indistinguishable from reference condition”* (remembering that NSW researchers do not sample pools, that the original TAP concluded that things got worse downstream and that NRM in court contended that NSW data supported the TAPs findings, which of course it does not).

“The Panel believes the invertebrate data, both the taxa present and the O/E scores from the AUSRIVAS models, do not presently provide evidence of degradation in river health. There are no trends obvious either down the Lower Balonne rivers or in comparison to other adjacent river systems.”

“Neither the SKM nor the NRM data show any clear differences in fish abundance or species diversity between the Lower Balonne and the adjacent Warrego and Moonie rivers. These adjacent rivers that do not have extensive water development.....”

“The Panel has itself carried out statistical analysis which shows that there are no significant differences in numbers of species between sites upstream and downstream of the bifurcation” (NRM and the TAP concluded the health of fish communities downstream of the bifurcation was poor).

“The Panel is of the view that attempts by NRM to model fish communities are not justified by the quantity of fish data that are currently available” (meaning NRM are spending a huge

amount of staff time and taxpayer money on trying to prop up the original conclusions. It also means they are still making the same basic mistake as the original TAP – taking the interpretation of a small amount of data too far).

“it would thus be rash to conclude that any changes in fish communities are unequivocally due to water harvesting” (considering this conclusion was made with the data now available, the conclusion at the time of the Draft WAMP was well beyond rash).

“NRM is advised to ensure all its scientific work is published in the scientific literature on a timely basis to provide this quality assurance” (NRMs internal review mechanisms, if they exist, failed to detect the major shortcomings of the TAP report. From day-one Smartrivers has ensured that all scientific reports it prepares are externally peer reviewed and it has paid off because our science is right.)

“A more recent study is the Snapshot of River Condition in the MDB (Norris et al 2001). This assessment was done from the First National Assessment of River Health and used the macroinvertebrate data from Queensland which was used by the TAP, and has not been supported by subsequent studies. This means that the biological condition for the Culgoa in Table 2 is not correct in the light of more recent information” (Smartrivers listed several other key reports which had used that incorrect data, including the National Competition Council which classified the Condamine Balonne as the only stressed river in Queensland based on statements in the Draft WAMP about the existing ecological condition. The CRC for Freshwater Ecology has published a number of documents which used that data, including that noted by the Panel, “Scoping Study for the Narran Lakes” and “Ecological Sustainability of Rivers” - a supporting paper behind the “Review of the Operation of the Cap” for the Murray Darling Basin Ministerial Council).

This section completely vindicates Smartrivers stance over the last 3 years and makes a mockery of the Governments attempts to ignore the truth and cover up their clear failings. The brochure published by the Minister after the Anchorage V DNRM court case can now be seen for what it was, a blatant attempt to fool the public that NRM had not made significant mistakes. The first NRM submission to the Panel still simply regurgitated the interpretation of the TAP and Draft WAMP, taking no notice of all the information Smartrivers had put before it or the results of the court case. The NRM Supplementary Submission included all the updated macroinvertebrate sampling yet concluded only that results ranged from poor to good and were variable. It was left to Dr Marchant to actually analyse the data and bluntly report the truth, that is, that it conflicted entirely with earlier interpretations.

The extent to which the interpretations by the original TAP have invaded the psyche of beaurocrats, academics and the broader population can be evidenced by reference to some of the documents which used that interpretation. The “Review of the Operation of the Cap”, by the CRC for Freshwater Ecology, concluded that flow regulation *“has impacted on the fish and macroinvertebrate fauna”* (underline added, we now know it has not) and that further development *“is likely to have a dramatic impact on the ecological functions and eventually the sustainability of the river system downstream of Bourke”*. They even went further *“There is a serious risk that a Cap implemented in the Condamine Balonne (based on the WAMP) will fail to recognise the relative importance and potential impact of water resource development in this sub-catchment on the ecological sustainability of the entire basin”* (underline added). The Cullen review reports *“any impacts on the Darling River are likely to be experienced in the upper reaches, probably between Bourke and the junction with the Culgoa”*. In other words if there was to be an impact it would largely be restricted to upstream of Bourke primarily because as the Panel notes, the total flow in the Culgoa represents just 20% of the flow in the Barwon-Darling where it enters. Similarly the Panel reports that they expect a *“gradual decline”* rather

than a dramatic impact. The extrapolations by the CRC bordered on hysteria and are a prime example of how the incorrect interpretations of the original TAP and the one-way error-riddled IQQM can lead to poorly based decision-making not just in the sub-catchment or even the State, but at the scale of the Murray Darling Basin.

On page 26 under Habitat Issues the Report states “*Human activities have been having impacts on the ecology of the Lower Balonne since the various bifurcation weirs were constructed*”. This is incorrect. Assuming Aboriginals had no impact, then impacts began with first settlement by Europeans in about 1850 and for about 120 years were almost solely related to land clearing and grazing. This section also notes that one effect of the weirs has been to alter the Culgoa from “*an almost permanent flowing stream to one that is now a flood pulse river*”. We are not sure where this came from but the Culgoa naturally ceased to flow approximately 25% of the time and flow variability was always been very high. The bifurcation weirs are low-level structures which are drowned out by even a small flood so have no effect on flood direction. If the Culgoa is more pulsed than it was naturally then the cause is more likely the operation of Beardmore Dam and Jack Taylor Weir, far more substantial structures which are capable of capturing small flow events.

The last sentence of this section is again about future impact so belongs in Section 5. The section on Management Issues is also inappropriate as it also concerns future scenarios.

Section 4.2 Floodplain Communities, is interesting because it develops into the area suggested by the Panel as at greatest risk. Basically the Panel concluded that as an eventual result of decreased flooding, the trees of the floodplain would give way to grasslands. This would probably only be detectable after 40 years. The prediction is based on a submission from the CRCFE and on comments from two landholders that their grasslands have lost productivity as a result of decreased flooding. The Panel correctly points out that the observations of the graziers are anecdotal and have not been assessed scientifically. Smartrivers believes that as this was a review of science, very little weight if any should have been given to the claims.

Unfortunately on page 38 (Section 6, Setting Flow Targets) the Panel states; “*We believe a loss of productivity in the grasslands is evident from landholder observation, and we anticipate a loss of the area supporting tree vegetation and its replacement with grassland over the longer time frame*” (underline added). How can thousands of correctly made scientific observations and ensuing modelling attract huge academic debate about statistical accuracy and what is an adequate amount of data upon which to base conclusions, yet the anecdotal observations by just two landholders, one of whom has been a staunch campaigner against irrigation since its inception, are regarded by the Scientific Panel as sufficient to conclude that a result “*is evident*”? In section 5.1.1 the Panel notes that the Community Reference Group advised them that three natural dry periods since 1984 could explain the landholders observations without the need to blame an assumed reduction in flooding frequency as a result of water extraction. NRM also describe the extraction regime before 1997 as “pre-development” hence the statistical probability that the landholders observations could be correctly attributed is mind-bogglingly low.

The idea that trees will give way to grass is based on the assumption that extraction will lead to reduced flooding and drier regimes, which do not favour certain floodplain trees. The hydrology section concludes that extraction will have little impact on large flood flows simply because of their magnitude. Table 1, produced by the CRCFE, notes that flows above 120,000ML/d (just into the large flood category) inundate little more floodplain area, only altering the depth of inundation. These two conclusions alone are in direct conflict with the prediction. Section 4.2 notes that Coolibahs, the tree in most question, are long lived and may persist with infrequent flooding. It also quotes Roberts and Marston (2000) as stating that they are particularly tolerant

of long periods without floods and on the Gwydir they receive floods only every 10-20 years on average. If one reviews that key reference, it appears that while the flooding regime is obviously significant, only if it basically stopped would the trees disappear. It is more likely that germination would be less frequent and the resultant trees would be of lower growth form. To suggest that they would be replaced by grassland, possibly within 40 years, is a very long stretch because the existing trees will not have even lived out their life by that time and germination and recruitment will not simply cease because flooding will still be occurring. It should also be remembered that these predictions are based on IQQM, which significantly overestimates impacts of extraction on floods.

Section 4.3 discusses the Narran Lakes. It is important to recognise what is meant by the “Narran Lakes”. The first sentence states “*There is substantial documentation relating to the ecological significance of the Narran lakes that have been listed as Ramsar wetlands*” (underline added). There are over a dozen significant lakes which make up “the Narran lakes” but only two small lakes, Back and Clear, have been Ramsar listed under the name Narran Lakes Nature Reserve. The reason the other lakes, including the large terminal lake (commonly called Narran Lake), have not been listed, is presumed because they do not satisfy the necessary criteria. For example, the terminal lake has little if any riparian zone, hence no trees for bird roosting or nesting, is largely farmed and it contains levees, fences and a cattle feed lot. This is an important point because elsewhere in the document, and in the NRM submission, the volume of “the lakes” is stated as 186,000ML, whereas the volume of the Ramsar site is only 9,600ML. If the Ramsar site is recognised as the critical area to protect, as has already been decided through listing, then how it is done and the volume of water required to do it are vastly different than if it is assumed that Narran Lake needs the same level of protection.

The Panels conclusion, “*the Narran lakes are not yet showing signs of degradation*” is almost correct; the word “yet” is inappropriate and unnecessary in a section dealing with the existing ecological condition. Smartdrivers has been fighting for several years to ensure that the mistakes of the original TAP are not made again and one of those mistakes was reporting in a way which did not clearly differentiate between the current situation and potential future situations. This is why the Terms of Reference for this Review Panel was so clear that this separation had to be made. It is a great disappointment that the Panel failed to do so.

On page 29 it is noted; “*reductions in small to medium flows of the Lower Balonne may reduce connectivity of fish populations between the Upper Balonne and the rest of the MDB*”. The impact on connectivity is caused primarily by the presence of Beardmore Dam and Jack Taylor Weir on a section of the river which is not by-passed in flood flows. This is recognised by the Panel of page 35 “*Clearly the larger structures of Beardmore Dam and Jack Taylor Weir do provide significant blockages to fish movement*”. Reinstating some small to medium flows downstream of the Weir cannot re-instate the connectivity referred to.

Section 5, TOR 4 – Likely future ecological conditions

The Panel has presented their report out of order with respect to the Terms of Reference. Terms of Reference item 3, Definition of a Healthy Working River, is presented after TOR 4 for an unknown reason. Smartdrivers understands that the order of work in the TOR was such that a target, or definition of an acceptable ecological condition, was to be produced *then* used as the basis for determining if predicted future conditions attained this condition or not. The degree of management action necessary to ensure such maintenance could then be determined. Reversing the order in effect reduces the importance of setting an appropriate target.

The most significant result of Sections 4 and 5 is that we have now shifted from a perception of current severe degradation, as per the TAP report and Draft WAMP, to one of a healthy system which may potentially decline over a 40 year timeframe. What a massive change! Smartrivers has always said that because the starting line was a system in a healthy state, this gave us time to collect the scientific data necessary to fill the key gaps and to then make informed decisions. Smartrivers has also suggested, including in submissions to the Panel, a number of actions which could be taken immediately in order to reduce the risks to ecosystem health. There is absolutely no need for radical suggestions such as the acquisition of Cubbie Station. The Smartrivers Risk Assessment concluded:

“the current level of catchment and local development does pose an unquantifiable cumulative risk to the aquatic environment, including risk associated with water resource development. The Precautionary Principle should be implemented such that development within the local area which might increase risk is largely halted while targeted data is gathered and the impact of any lag effect related to the current level of development, can be estimated. Water use efficiency strategies should be implemented during this period as a key risk mitigation measure specifically related to water resource development. Other risk mitigation measures not specifically related to water resource development should also be implemented so that the eventual need for more difficult measures such as reducing licensed entitlements, is possibly avoided.”

The Panel recognised the key bio-physical drivers of change as:

- *Changes in the flow regime (due to extractions and the compensation flows from Beardmore Dam)*
- *Changes in land use in the Lower Balonne and upstream*
- *Sedimentation*
- *Agricultural chemicals*
- *Weirs and structures on channels and the floodplain*
- *Climate change*
- *Salinity due to land clearing, excess irrigation or seepage from storages*
- *Infestation of plant or animal pests*

The Smartrivers Risk Assessment, submitted to the Panel, produced the following summary after a thorough review of all sources of risk (readers are referred to the Hazard column as a comparator with the Panels list):

Table 3-4.1 Ecological Hazards and Risk Mitigation Procedures

Ecological feature	Hazard	Risk Mitigation Procedure
Water quality	Land management practices	Adherence to Best Practice Industry Guidelines
	Effluent disposal	BP Guidelines
	Agricultural chemicals	BP Guidelines
	Reduced flushing flows	Environmental Flow Strategy
Waterbird breeding	Reduced significant flood flows reaching wetlands	Environmental Flow Strategy
	Water quality	BP Guidelines

Fish populations	Weirs and dams (barriers)	Weir Strategy
	Separation of river and floodplain	Environmental Flow Strategy, Weir Strategy, Levee Policy
	Increased no-flow period	Environmental Flow Strategy
	Water quality	BP Guidelines
	Recreational angling	Adherence to DPI guidelines
Riparian Zone	Increased no-flow period	Environmental Flow Strategy
	Rate of change in water level	Environmental Flow Strategy
	Reduced flooding	Environmental Flow Strategy
	Stock access	BP Guidelines
	Feral animal access	Control Plan
	Weeds	Control Plan
	Clearing	BP Guidelines
		Overall Riparian Zone Strategy?
Floodplain wetlands	Land development (infilling, altering watercourses and flow paths)	BP Guidelines, Levee Policy, Development Control (Local Govt and State Policies)
	Reduced flooding	Environmental Flow Strategy and Levee Policy
	Stock Access	BP Guidelines
	Feral animal access	Control Plan
	Clearing riparian zone	See above
Floodplain terrestrial ecosystems	Land clearing and development	BP Guidelines including Vegetation Management Act Levee Policy
	Reduced flooding	Environmental Flow Strategy and Levee Policy

As can be seen, many of the conclusions of the Smartrivers Risk Assessment are mirrored in the Panels conclusions. This is true of both the flow regime itself and factors other than the flow regime. For example the Risk Assessment stated:

“The catchment, particularly the upper floodplain, shows clear effects from land clearing and land use. The sources of impact are:

- *Increased runoff associated with land clearing*
- *Increased erosion associated with land clearing, land use, grazing*
- *Increased turbidity associated with the above plus effects of urbanisation*
- *Increased nutrients associated with grazing, cropping, intensive agricultural industries, clearing of the riparian zone and urbanisation*
- *Increased agricultural chemicals*
- *Loss of habitat associated with in-filling and damming of wetlands, clearing of the riparian zone, development of floodplain areas, in-river sedimentation and flow regulation in parts.”*

And “As a basis for discussion and acknowledging no quantitative links, the primary risks to the aquatic environment of the Lower Balonne associated with historic and ongoing land use are identified as follows:

- Grazing (effects on erosion, turbidity, sedimentation, nutrients, the riparian zone, floral diversity)
- Land clearing, particularly in unbunded areas (effects on erosion, biodiversity, riparian zones, possibly salinity)
- Isolation of areas of floodplain through construction of levees (effects on biodiversity as per land clearing but to a greater extent in a smaller area, loss of floodplain interaction, effects on floodplain flows).

While acknowledging the first and second point operate significantly at a catchment scale, all issues are probably of more importance at the local scale.”

To quote the key results from the Panels Report with respect to the effects of changes to the flow regime (underline added):

With respect to the Lower Balonne Floodplain; “The Panel believes that the important floodplain vegetation..... is at risk due to decreased frequency and duration of wetting due to the loss of medium sized floods” and “In particular, it is likely there will be a loss of Coolibah vegetation”

With respect to the Channels of the Floodplain; “The Panel finds that the health of the river and distributary channels is likely to decrease with the flow changes that are expected.”

With respect to the Narran Lakes; “The Panel anticipates changes in the Narran lakes will begin when the flows are altered to the extent now possible, and will continue to have increasingly obvious ecological impacts over the next forty years.”

With respect to the Darling River; “The Panel notes that the possible level of water extraction puts further flow related stress onto the already degraded upper Darling.....The ecological impacts of such flow changes are not known”.

In summary; “The Panel supports the contention of the CRC for Freshwater Ecology that there will be significant long term degradation of the Lower Balonne floodplain and of the Narran lakes in particular once the system experiences the water extraction that is possible with the present infrastructure. We see a long period of decline, with the full impacts not necessarily being fully obvious within the 40 year time scale of this assessment, due to the background high flow variability.”

The Panel noted that “Predicting future conditions is difficult” and “The lack of quantitative relationships, and the variability of the flood patterns that drive the system make it impossible to give precise predictions of conditions in 5, 10 and 20 years.”

None of the above represent news to Smartrivers. As noted above, our own Risk Assessment submitted to the Panel clearly recognised the risks and the difficulties of quantifying future conditions. Some comparative extracts from the Risk Assessment are presented below.

“As a basis for discussion and acknowledging no quantitative links, the primary risks to the aquatic environment of the Lower Balonne associated with historic and ongoing water resource development are identified as follows:

- *The effect of future water harvesting on critical aspects of the flow regime as it relates to protected areas and the floodplain in general*
- *The effect of existing physical barriers on water quality, fish movement and low level inundation of interconnecting channels*
- *The effect of current and future water storage and irrigation practices on groundwater and possibly salinity.”*

“Acknowledging an unspecified level of risk, management should aim to limit any increases in risk from any and all sources, that is, preferably do not allow an increase in the level of any risk causing factor”.

“Any environmental flow strategy developed for the Lower Balonne should be tied as directly as possible to identifiable ecological parameters, such as bird breeding on the Narran Lakes, maintaining all expected fish species in the rivers or ensuring flows reach key identified habitats or break-out points at the necessary frequency and duration.”

“The initial period of monitoring and further data gathering (gap filling) should be at least 5 years and preferably 10 because it is highly unlikely that sufficient meaningful data will be gathered in a shorter timeframe and it is also unlikely that irreversible damage will occur in that timeframe.”

With respect to salinity risk, the key conclusion of the Panel was not highlighted either in the Report or in the Ministerial press release; ***“It is likely that the particular risks of salinity can be managed in the Lower Balonne with appropriate land management”***. The Panel also pointed out that irrigators had employed consultants to develop salinity management plans. In other words, locals are again in front of the game and prepared to take the necessary actions to ensure sustainability.

Section 5.1 discusses likely changes to the flow regime and as would be expected, relies largely on the outputs of the IQQM model. The Panel notes *“the modelling used is adequate for this purpose”* (being the determination of changes in flood frequency and extent). Smartrivers finds it unbelievable that anyone could accept an error of possibly 40% in the estimate of flood peaks and an error of up to 25% in event volumes. Further, while it is not mentioned in the report, Smartrivers believes it was accepted at the workshops that many of the errors are in fact in one direction, that is, the proportion of flow extracted and therefore the impacts on flooding, have been overestimated. The simple corollary is that when the Panel concludes an impact will appear, perhaps it may not or at least, the impact may take longer to materialise than the 40 years suggested. The ecologists on the Panel were using what can best be described as a “beyond worst case” hydrological scenario when attempting to predict future ecological changes.

The Report notes that IQQM modelling was used to predict the extent of flooding. This is not possible. IQQM can be used to predict volume, frequency and duration of floods but not extent. The DST developed by SMEC can do this though no data has been presented to date. It should be remembered that both Smartrivers and the CRCFE contend that the extent of flooding alters little once the extent inundated by a large flood is reached.

The section reports that NRM modelling predicts a 50% reduction in the frequency and extent of flood events across the lower floodplain. We presume this means the two-thirds of the floodplain which exists in NSW, being the lower floodplain. Only moderate to large floods actually reach this floodplain in the natural case. The Panels next paragraph for instance notes

that small floods do not naturally reach NSW (underline added); “*Small floods (20,000ML/d), that would have occurred on average once a year on the Queensland part of the floodplain and spill onto the floodplain, are effectively eliminated by the present licences.*” The Report notes in other places that extraction will have little impact on larger floods and the impact of extraction on flows of 60,000ML/d is certainly less than 50%. It is not possible that the frequency or extent of floods in the NSW part of the floodplain could be affected by the 50% figure noted in the Report. The section of the NRM submission which covers this topic (page 32, Table 4) actually presents data on flow duration, not frequency or extent, so perhaps Panel members were confused.

A critical point repeated by Smartrivers, and we thought understood by the Panel, is that water is extracted at a number of points as one progresses down the floodplain; it is not all removed at one point as would be the case with an in-river dam. What this means is that while the total extraction between St George and the border for a flow of 20,000ML/d can indeed total all but about 450ML/d, this does not mean that flooding is eliminated throughout the system. For example a flow of 20,000ML/d at St George would still trigger significant flow in the important Sandy Culgoa and Middle Creek systems as well as trigger floodplain flow in the Chinaman and Doctors Creek systems. To say these small floods are eliminated is simply incorrect. The door to sensible ecologically based flow management is opened when the flow thresholds required to trigger significant channels is understood. The Panel appears to support this approach in general, though they missed the point in this case, staying at overview level rather than looking at the detail.

The Report notes “*extensive irrigation infrastructure has been developed in the last couple of years*”. This can only refer to water harvesting infrastructure because Beardmore Dam and Jack Taylor weir have been in place for 30 and over 40 years respectively. The Report notes that as a result of this development, (meaning water harvesting) “*Flows during drier years would be virtually eliminated while average years would be down to 20% of pre-development flows*”. The first phrase is incorrect because, obviously, little or no water harvesting occurs during drier years. Beardmore Dam and Jack Taylor Weir are the major cause of flow reductions in dry years, as was clearly shown in a figure presented to the Panel by Smartrivers. Flow reduction in dry years is also influenced by the first bifurcation weir, a point made by the Panel elsewhere in the report and again an impact not related to water harvesting. The second phrase can be found on page 38 of the NRM submission but no supporting data is presented. It is always necessary to be precise when discussing flow statistics because the same phrase can be interpreted a number of ways. In this case, if we are talking average flows and average diversions, then the figures presented by NRM are: average annual flow at St George is 1,363,000ML; mean annual diversion is 345,500ML. In an average year (average diversion / average flow), 75% of the flow remains in the river. Marvellous things statistics.

The Report notes that modelling shows the End of System Mean Annual Flow (EOSMAF) to be around 47% of pre-development and reiterates the statistical uncertainty in the figures and the recommendation not to use it for management purposes. The Report then proceeds to do just what it recommended against. Smartrivers predicted this would happen and voiced its opinion that it should be avoided completely. One of the reasons it is so important is not scientific but socio-economic; every percentage point of inaccuracy in the estimate of MAF potentially represents millions of dollars of lost rural income if a target is set based on that figure. It is absolutely crucial that if this figure is used in any way at all that it be as accurate as possible. As an example, using just the overestimate of extraction related to the failure to include Type A water in storages, and noted by NRM, this would raise the EOSMAF to over 50% of pre-development and would equate to about \$4,000,000.00 of cotton production. This is why the Community Reference Group insisted that the Panel discuss the sensitivity of their predictions.

The means to do so was open to them for as they said themselves, NRM estimated EOSMAF at 47% whereas Smartrivers thought it was possibly as high as 60%. The Panel could have undertaken their predictions of the future based on each estimate independently. If they concluded that they could not differentiate ecological impacts based on the two estimates then it makes a mockery of the process because it lacks sensitivity.

The most obvious difference between 47% and any better estimate would be that impacts must, logically, be less. There is absolutely no doubt that the true figure is better than 47% so the future scenario presented by the Panel must be taken as beyond worst case. However it is Smartrivers opinion that reverting to MAF in any way is a backward step. Our own Risk Assessment took us well beyond this and we are still waiting for NRM and others to catch up.

The Report compares flow statistics and ecological conditions in the River Murray with the Lower Balonne, that is, using the Murray as a benchmark. Smartrivers review of the TAP report noted the inappropriate choice of benchmarks and the CRC for Freshwater Ecology also later voiced concern and listed criteria which a suitable benchmark should satisfy. The Murray does not qualify as a suitable benchmark. The Panel relates the condition of fish fauna in the Murray to the median annual flow. Problems with fish in the Murray are generally assumed to be more a reflection of the effect of cold water released from deep dams such as Dartmouth and Hume, the effect of over a century of snag removal and the effect of constant water levels in the numerous relatively deep weirs and locks. The Smartrivers Risk Assessment put considerable effort into explaining why the various generalised effects of river regulation, including those just noted, do not apply to the Lower Balonne and therefore negate the use of such systems as benchmarks.

Much of section 5.1 was sourced from the CRCFE's (February 2002) assessment of flow management scenarios. It appears Prof Cullens thoughts changed little in the interim despite all the information put forward by Smartrivers and with which the Panel largely concurred. The CRC of course did not have the benefit of hearing all of what was said in the Panels hydrology workshops so their conclusion is at best out of date and at worst, exaggerated. For example in the presentation which resulted in the CRCs publication, NRM informed the CRC that the estimate of mean annual flow at St George had an error of 2% and water harvesting diversions were within 6%. They did not tell them that errors in the estimate of the more important flood peaks were between 30 and 40%!

When reviewing the potential impacts, readers should also review Table 1 of the Report in order that the effect of extractions on the average return interval of floods can be examined. This has also been done by Smartrivers in their Risk Assessment as the basis of an event based flow management plan, an approach now supported by the Panel. If we move through each of the ecological flood thresholds the CRC identified (acknowledging that they are similar but not identical to those identified by Smartrivers), and knowing that the maximum rate of licensed extraction is 25,000ML/d achieved at a flow of 60,000ML/d, the change in ARI of flood peaks can be estimated (Table 2-3.1 in the Smartrivers Risk Assessment clearly shows the rate of extraction and the residual flow in the rivers for each flood harvesting window). What this type of analysis also shows is the flow now required at St George to perform the same ecological function as would have occurred naturally. The 25,000ML/d event would, by the time it reached the border, be doing the work of a 730ML/d event, noting that it would still perform ecological work on the way through because of the location of extraction points relative to flood channel break outs, as described above. It would take a flood of 45,000ML/d (ARI of 3 years) to do the work of a 16,000ML/d natural event (with an ARI of less than 1 year). The 60,000ML/d flood at St George, with an ARI of 3.6 years, would be reduced by maximum extraction such that the effect at the border would be the equivalent of a 30,000ML/d natural flood event (measured at St George), the ARI of which is about 2 years. A 70,000ML/d event would be needed to do the work of a 45,000ML/d, or in ARI terms a change from 3 years to 4. The 95,000ML/d flood with

an ARI of about 6 years would require a 120,000ML/d flood, with an ARI of 8 years, to do the same work. The greatest proportional reduction is obviously in the low level floods, as one would expect because the licenses are concentrated (by NRM) in the low flows.

This event based analysis provides a much more representative assessment of the proportional change in the ecological work done by floods than does the generalised approach of using mean annual flows, which effectively allows the strong effect on frequent low flows to hide the relatively small impact on larger flood flows. The Panel correctly concluded "*Extractions from larger floods occurring on average every 10 years or so, will not have much impact*". Interestingly, irrigators have voluntarily capped the volume of their storages at that which would be filled, using licensed pumping conditions, in a 1 in 10 year flood.

Much of section 5.1.1 relies on figures from the Brenda gauge, a gauge now confirmed as significantly underestimating flood flows.

The general conclusion that if you take water out of a system there is likely to be change is not debated. However it is well and truly past the time that these generalisations are sufficient. We have enough information and local knowledge upon which to base a first draft flow management plan and this should be developed as soon as possible. Smartrivers has a number of scenarios which it would be pleased to put before the Minister.

Section 5.1.3 addresses the Narran Lakes. As pointed out with respect to Section 4.3, the actual Ramsar listed area does not require a volume of 186,000ML to fill it, it only requires 9,600ML. The Panel itself notes that the Lower Narran Lake (an odd term not seen before), is cropped but this is not the only reason why its ecological importance is much less than that of the Ramsar area. The figures reported with respect to the impact of extraction on three flood events tell us absolutely nothing about whether the Ramsar area would have filled in those circumstances or not, as they relate to the total volume of the terminal lake plus that of the Ramsar area. Certainly there would have been ample volume in the quoted floods to fill the Ramsar area. In fact in the flood which would have apparently been most effected by extraction, there would be enough water to fill the Ramsar area 12 times over.

Section 5.2.4 notes "*There has already been extensive loss of floodplain for agricultural development. Each levee will further isolate the river from its floodplain and will lead to further deterioration in the health of the river and the floodplain.*" The word "extensive" is highly debatable and the word "further" is simply wrong. Figures provided to the Panel by Smartrivers show that 22% of the floodplain in Queensland is leveed off to protect farming areas from floods or to produce storages. This equates to 4% of the total floodplain (most of the floodplain is in NSW). Is this extensive? The Panel unequivocally concluded that the river and floodplain showed no current signs of deterioration so how can further deterioration occur? This is just the sort of grammatical error which can influence public opinion and as stated many times, Smartrivers aims to stop it occurring.

It should be reiterated that the conclusion that increased water extraction leads to environmental risks is not news to Smartrivers. Smartrivers has stressed that the manifestation of that risk as a measurable impact is a considerable distance in the future and we are pleased that the Panel agrees. The risks can be mitigated and the impacts avoided by relatively simple management actions and Smartrivers has put options forward previously. We remain willing to work through the applicability of options with Government.

Section 6, TOR 3 – Healthy Working Rivers

With respect to Section 6.2, Smartrivers does not debate the lag effect and never has. The point to be made here is that the TAP and NRM thought that severe impact had already occurred. Smartrivers proved that this was not the case but clearly recognised, as a consequence of the lag effect, a risk of potential future impact. The Report stresses the lag effect *ad infinitum* and in areas of the document where it is simply not relevant.

Section 6.3 discusses the concept of river health and uses the mean annual flow as the key figure, though acknowledging it may not be appropriate or useful. This is extremely disappointing because Smartrivers thought that when the Panel agreed that this figure was of little if any statistical or ecological relevance that it would finally be rid of interpretations using this inappropriate yardstick. The outcome though does validate Smartrivers submission, which argued that despite that measures lack of real utility, because bodies such as the CRC had used it to draw a line in the sand, politicians, beaurocrats, the media and the general public would grasp this single figure as the measure of compliance – did they reach the target or not? It is extremely disappointing that Prof Cullen chose to use it, even with the caveat “*If we use such a measure merely as a broad indicator*”, because many readers will not. The mean, and several other statistics derived from IQQM, are commonly referred to in other sections of the Report, such as the very important section 5.1 on future conditions.

The Report states that Smartrivers did not propose any specific ecological targets. While we said that community consultation was necessary in order to set such targets we did propose examples in our cover letter and were more specific on pages 52 and 55 of the Risk Assessment.

In section 6.3 Prof Cullen puts forward his own flow classification scheme as it relates to river health. The statistic used is Maximum Mean Annual Flow Extraction. It should be noted that this classification is weighted toward rivers which are not used much, that is, there are three categories within the first 33% of use but only one for each 33% of use after that. In other words, once a river becomes a working river, whether it is sustainable or managed or something else, there is a very broad range of flow extraction levels within which it can move and still be classified in the same band. Depending on how you calculate the statistic, and what level of faith you have in IQQM, the Lower Balonne is either in the Sustainable Working River category (using MAD/EOS MAF) or the middle of the Managed River category (using simply EOS MAF). The CRCFE adds a demarcation line at 50% and using the most likely figure for EOS MAF would put the Lower Balonne in the Managed Healthy River category. Smartrivers suggested that to determine if that target was appropriate for this particular river would require community consultation regarding what constitutes important ecological aspects and how they could be weighted against socio-economic factors.

Section 6.4 commences by using other locations within the Murray Darling Basin as benchmarks and this may not be appropriate. Similarly the broad assumption that because floodplain wetlands were the first areas affected in these other regions then that would also be the case here is not supported by any comparative data. As an example, floodplain wetlands by definition are mainly driven by floods, but in the Lower Balonne the greatest impacts on the flow regime are on the small flows which would not naturally have reached these wetlands in any case.

The definition used in section 6.4 basically describes a flow management plan weighted toward protection of flood flows and perhaps, though it is not stated, some allowance for baseflow or flushing flow protection. This is logical in this system but does not address flow levels which would stimulate critical break out points to the floodplain.

Only in the second paragraph in section 6.4 is there a clear indication that a working river is acknowledged as having lower ecological targets than rivers within other categories. It appears the Panel accepts that a working river will not have a pristine fauna but does not discuss how far from pristine would be acceptable, only noting that it must still be resilient. In setting such a target it would be appropriate to see how the Lower Balonne fitted within the management regime of other Queensland rivers within the Murray Darling Basin. In this context the Queensland government has basically chosen to manage the Paroo and Bulloo as Heritage rivers and the Warrego and Moonie as rivers which perform only low levels of work. The rivers currently managed as working rivers are the Border Rivers and the Condamine Balonne. It would seem reasonable that some trade-off be effected between those rivers within the Queensland section of the basin which have largely been protected and those which are allowed to perform work of social benefit.

It would have been of greater benefit if the Panel had spent more time on defining how much work the Lower Balonne should be allowed to do and, more importantly, how much change in key ecological attributes would be acceptable under such a working regime. As an example, Dr Marchant noted that 84% of macroinvertebrate sites were classified as in reference condition according to AusRivAS protocols. Perhaps a working river such as the Lower Balonne could be allowed to have this figure reduced to no less than 25% on the proviso that no more than 15% of sites were in the severely degraded category. Smartrivers is not suggesting these numbers but presenting the example as a possible means to define ecological targets for a healthy working river.

While this section notes protection of the Narran lakes as the dominant consideration, it clarifies on page 41 that a similar process should apply to other parts of the system, such as the Culgoa Floodplain and this agrees with Smartrivers suggestions in the Risk Assessment.

The assumption that the provision of an appropriate flood regime in the lakes will also maintain the river and distributary channels is not necessarily true. The very small volume required to flood the Ramsar wetland can be mechanically maintained by only very low flows in the river. Similarly the statements on page 39 relate to a volume of 186,000ML. As discussed above this tells us nothing about the effect of extraction on flooding of the Ramsar area itself.

The conclusion that immediate action is required is not supported by any data. Graphs presented by NRM show the lakes probably went 13 years with only one bird breeding event in the 1930's and eight years with no events in late 60's. As the CRC study will be completed in 4 years and the flooding target is 3.5 years, the urgency for action is not supported. Similarly even the gathering of decent topographic information will greatly enhance our understanding of flooding in the area so any decisions should wait until at least this data is in. It is more urgent that the mistakes of the TAP and Draft WAMP are not made again, and that includes rushing into management decisions without appropriate data.

The second last paragraph on page 39 appears to suggest that water extraction reduced the duration of lake flooding in 1996 and 1997 but no data is presented to support the contention. It should be remembered that floods vary naturally in their duration.

Section 7, TOR 5 – Mitigation and reversibility

The Panel recommends discontinuing use of MAF and turning to an event based management strategy. Elsewhere in the Report the Panel recommends Adaptive Management. Smartrivers has made such recommendations previously so it is pleased to see the Panel agree.

In this section the Panel only refers to protection of flood patterns in National Parks or Nature Reserves as a mitigation tool for flow related impacts. Smartrivers believes other aspects of the flow regime also require addressing as part of a comprehensive strategy.

The Panel recommends that the wetting regime target be achieved within a 3 month period but in the next paragraph notes that the information needed to support this in the Culgoa National Park may take 5 years to collect. The importance of this information was also recognised in the Smartrivers Risk Assessment, noting *“current key information gaps relate to (note some of this information may actually be available but has not been accessed by the author): The hydrological environment of the identified areas of conservation significance, primarily Narran Lakes Nature Reserve, Culgoa Floodplain National Park and the Lower Balonne Floodplain.”*

Perhaps the Panel meant that it should be possible for all parties to sign off an acceptable version of IQQM within 3 months, though until a significant flood is gauged properly, Smartrivers is unlikely to do so. There are a number of facets of the model which require adjustment before it could be deemed acceptable to local stakeholders, including incorporation of Type A water, adjusting the upstream model to be a true existing case model and sitting with landholders to ensure each extraction point was correctly input.

The Panels recommendations to determine critical flow thresholds for the National Parks supports Smartrivers contention as expressed in the Risk Assessment that *“any environmental flow strategy developed for the Lower Balonne should be tied as directly as possible to identifiable ecological parameters, such as bird breeding on the Narran Lakes, maintaining all expected fish species in the rivers, or ensuring flows reach key identified habitats or break-out points at the necessary frequency and duration. And “These critical points and their related flood levels, along with those of other critical areas, should be used as the key drivers of an ecologically based flow management plan”.*

The Panel reports that Smartrivers contended that nothing was irreversible and then goes on to discuss the relative costs of protection versus restoration. To be clear, Smartrivers also said that the system was currently in *“not stuff up”* (ie protect) as opposed to *“need to fix”* (ie restore) mode. We could not agree more with what the Panel has said, but point out to readers that the Panel has not stated that reductions in water extractions are required, only that certain flow criteria need to be met. How they could be met is the critical task.

We feel the *“Other catchment management strategies”* section only discusses these from a risk avoidance viewpoint and underestimates the potential importance of several strategies which could significantly restore parts of the ecosystem which are already impacted. The main areas are land clearing and grazing, actions which the Condamine Balonne Water Committee clearly showed as significantly effecting turbidity, sedimentation and nutrient status, with links to algal blooms and eutrophication. Current research reported to the Panel by NRM also suggests land management actions are about equally important with water resource management with respect to determining aquatic flora and fauna distributions. In the upper Condamine clearing of the riparian zone is recognised as a significant form of impact and while the area is undoubtedly healthier in the Lower Balonne, it could certainly be improved in parts as well as protected overall.

With respect to these other forms of impact the Smartrivers Risk Assessment concluded; *“It is clear that historic land clearing and land use has impacted upon the waterways of the Lower Balonne. This impact is evident in water quality, particularly nutrient levels and turbidity, in sedimentation and in habitat loss through conversion of natural floodplain habitat to farmland. These results are based on both catchment and local scale sources of impact. The risks*

resulting from these identified sources therefore relate primarily to water quality, potential algal blooms, loss of biodiversity through loss of broadscale habitat (wetlands) and loss of biodiversity through loss of small scale habitat (river edges and specialised environments) and potential change in some components of ecosystem function as a result of all of the above.”

Smartrivers thoroughly reviewed all forms of potential impact in its Risk Assessment and a summary table is provided earlier in this critique.

Section 8, TOR 6 – Ongoing Monitoring

The great majority of the comments made by the Panel in this section again closely reflect those of the Smartrivers Risk Assessment. The example of identifying critical ecological thresholds has been noted above and further examples include the use of adaptive management *“Management must be prepared to be adaptive, that is, if monitoring shows the system is deteriorating after the action of limiting risks has been taken (ie, the first level of action has not succeeded) actions must be taken to overcome the problem. All parties must agree to this at the outset.”* Or with respect to an effective research program; *“Implementation of an agreed investigative environmental monitoring program including quantitative hypothesis-driven research to understand relationships between response variables and their drivers at a range of spatial and temporal scales”.*

We commend the Panel for recognising the importance of Ecological Risk Assessment but are surprised at the comment that *“no substantial ERA has been placed before us”*. Certainly Government has not done one but it is clear from this current document that the Smartrivers Risk Assessment has proven to be a very valuable document and reached many of the same conclusions as the Panel. Even the limitations put on such a process by the Panel *“indeed the quantitative linkages between actions and outcomes are not well enough known at this stage to do other than a simple qualitative study”* and *“Unfortunately there is insufficient information available to us to quantify the likelihood of occurrence of the potential impacts that would enable a quantitative ranking of the risks”* were clearly recognised within the Smartrivers report; *“It is acknowledged that the mechanisms of impact are poorly understood for many of these hazards and it is likely that some are either not identified or their potential level of risk is not known. Synergistic and cumulative risks are also recognised but again are difficult to assess because of our current lack of knowledge. The risk assessment will be qualitative because it would be meaningless to attempt to quantify many components given our current knowledge.”*

Table 4 of the Report presents a preliminary risk assessment and while Smartrivers generally agrees with the contents, some of the scores are debatable. The Smartrivers Risk Assessment pointed out; *“In ecological risk assessments, the assessment of the degree of hazard takes into account:*

- *the specificity (ie is the impact species specific or broadly impacting),*
- *the intensity of the impact,*
- *the areal coverage,*
- *the duration, and*
- *the resilience of the environment”.*

If we consider agricultural chemical pollution as an example, the Panel noted that any effect would likely be localised ie a small areal coverage. Similarly the duration with modern chemicals would probably be short and the resilience of the environment is high. The Panels rating of potential impact as *“could be devastating”* probably overstates the case.

It is interesting to note that the Panel rated many of the risks as minor. This agrees with Smartrivers conclusion that *“Many of these sources of risk do not apply to the Lower Balonne or if they do, the risk associated with them is relatively minor in a number of cases.”*

The Smartrivers Risk Assessment was mainly concerned with identifying potential mitigation strategies and we would be pleased to discuss these with the Minister as part of an integrated natural resource management package for the region.

Section 8.3 is in strong agreement with *Section 4 Information Gaps and future monitoring*, of the Smartrivers Risk Assessment. Any differences are relatively minor. It is interesting to note the Panels comments on the King and Day review. This review was commissioned by NRM and ran concurrent with the Cullen review. All of the information upon which Prof King prepared her report was selectively provided by NRM and the only people she spoke to who had any direct experience in the Lower Balonne were all NRM staff and/or members of the TAP. Only the first condition assessment by Smartrivers was provided, Prof King was only given on average ½ a day to review each report and she was not directed to Smartrivers for comment at all. Its no wonder the Cullen Panel “*discounted their findings*”.

Summary

The Review of Science Underpinning the Assessment of the Ecological Condition of the Lower Balonne System has been a very constructive process for a number of reasons. Smartrivers interprets the most significant outcomes as the following.

Hydrology

1. IQQM outputs have errors of up to 40% for event peaks and 25% for event volumes. This is not satisfactory when decisions to be based on it carry a very high socio-economic risk.
2. A number of one-way errors were acknowledged and their effect is to significantly overestimate the proportion of flow extracted.
3. IQQM does not model Type A water going into storage and the effect of this is that the model could be overestimating Mean Annual Diversion by up to 24%.
4. The critical calibration gauge on the Culgoa significantly underestimates flood flow.
5. Smartrivers is particularly disappointed with the Panels response to TOR issue 1, Hydrology. This was reported at very much an overview level whereas many highly significant points regarding one-way errors, input data inaccuracies and the treatment of Type A water, were either not mentioned or their significance was not highlighted.
6. Stakeholder involvement in model development and checking is critical to its validity.

Existing Ecology

1. The Lower Balonne is a healthy river, in fact the majority of sites are in reference condition
2. The condition does NOT deteriorate downstream
3. There is NO evidence of impact as a result of water resource development
4. The Technical Advisory Panel and Draft WAMP were WRONG
5. Other significant reports based on the TAP and Draft WAMP were WRONG
6. The Condamine Balonne should not be classified as a stressed river by the National Competition Council
7. The Smartrivers monitoring program and the data it generates is appropriate.
8. AusRivAS models, particularly for pool habitats, are less reliable than simple taxonomic comparisons such as used by Smartrivers.
9. NRM's attempts to model fish data are unjustified.

Defining a Healthy Working River

1. The more work a river is asked to do, the lower the acceptable ecological targets
2. The Lower Balonne is by current definition a sustainable or healthy working river

3. Key defining attributes of a healthy working river include sustainable native fish populations and sufficient resilience to recover from change.
4. The most important flows in this system are flood flows, particularly those driving the protected natural areas.

Likely future ecological condition

1. There is a risk that ecological condition will change over the long term but it is not yet determined whether that altered condition would satisfy the definition of a working river as applied to the Lower Balonne.
2. All parties agree that further water resource development poses a significant risk.
3. The ecologists on the Panel were using what can best be described as a “beyond worst case” hydrological scenario when attempting to predict future ecological changes and they did not attend hydrological workshops.
4. Significant ecosystem restoration is not required in the Lower Balonne.
5. With respect to salinity risk, the key conclusion of the Panel was not highlighted; “*It is likely that the particular risks of salinity can be managed in the Lower Balonne with appropriate land management*”.
6. Other local management practices such as bunding fields and recycling tailwater, act to reduce risk.

Monitoring

1. There is a need for consistent ongoing monitoring.
2. The Smartrivers monitoring program is appropriate.
3. There is a need to collect key data in order to fill knowledge gaps.
4. The Narran Lakes Study by the CRCE is one important source of future data.

General

1. The Panel recommends close stakeholder involvement in development of models and management approaches.
2. The process finally brought Government back to the table.
3. It is clear that landholders in this region do a lot of things right, whereas Government gets a lot of things wrong.
4. The results with respect to existing ecology and the errors noted in IQQM, conclusively and unequivocally support Smartrivers views and actions over recent years.
5. The failure of NRM to take notice of stakeholder inputs, other than through defence of their own faulty conclusions in court, is a damning indictment of their arrogance and ineptitude.
6. NRM and the Government must now admit their errors and be prepared to start working with local stakeholders by respecting and reacting to their inputs and concerns.
7. Joint development of the WRP and future ROP is the only possible way forward. Isolationist, secretive planning by NRM will not be tolerated.