The MDBA has claimed on several occasions that the proposed Basin Plan will achieve an optimal balance between environmental, economic and social outcomes. To establish such a balance, the MDBA has gathered information on benefits and costs of the proposed Basin Plan. Under the conditions that the obtained data is sufficient and the applied evaluation technique are realistic, policy makers can use the collected information to apply a cost benefit analysis (CBA) in order to assess the viability of an environmental policy like the proposed Basin Plan. Unfortunately, both of these prerequisites have not been met:

The basic principle underlying a CBA is to compare all current and future economic costs and with any potential future benefits. The prerequisite for a reliable CBA is that all costs and benefits can be measured and converted into today's dollar value. After this has been achieved, a particular policy is only be chosen if the value of the benefit side is greater than the value for the cost side.

Aside from well known difficulties in measuring all possible costs and benefits of the proposed basin plan, there are further problems that cause complications for finding an optimal policy outcome. An optimal policy that aims to achieve a balance between environmental, economic and social outcomes needs to take in consideration the following three uncertainties;

- A first uncertainty relates to the scale and timing of environmental benefits. The extent to how an ecosystem improves over time has not yet been researched sufficiently as data and estimation techniques are scarce and imprecise. To support this argument one can look at the predictions that are made about future tourist revenue as a result of an improved river system health. These estimates are highly uncertain as insufficient knowledge exists on how people will adapt to changes in environmental conditions.

- A second uncertainty relates to the current and future economic costs associated with the proposed basin plan. Given the limitations of the long run economic modelling conducted by ABARES and Monash University (see here) a comprehensive evaluation of the direct and indirect costs associated with the proposed basin plan remain uncertain, especially in light of the ambiguity over key policy aspects (i.e. shared reductions).

- A third uncertainty relates to the appropriate *discount rate* that should be used for the CBA A discount rate is an interest rate that is used to compare dollar values at different time periods. Approximations are often used for discount rates (i.e. marginal return on capital), however it remains difficult to find one single figure especially given the long term costs and benefits associated with the proposed basin plan.

These uncertainties are not exclusive to policies aimed at environmental aspects but the magnitude and the duration of the impact are found to be much larger than with other policies. An optimal policy is therefore of crucial importance in order to achieve a balanced result.

Most CBA that were commissioned by the MDBA have used linear functions (i.e. straight lines) to explain the benefits and costs associated with the proposed basin plan. This runs contrary to most environmental policy analysis because environmental cost and benefit tend to be highly nonlinear. In the context of the proposed basin plan this would mean that the damage to agricultural production does not increase at the same rate with an increase in water reduction as a result of higher SDL.

Instead, the costs are likely to be small for low levels of water reduction, but then become severe once a particular threshold is reached. These threshold effects are of particular importance because they can tip the balance in favour for one instead of all three desired policy outcomes and therefore fail to achieve a triple bottom line. Unfortunately, these threshold points are often unknown and hence an environmental policy in the magnitude of the proposed basin plan should be carefully designed to not risk the devastation of industries and communities.

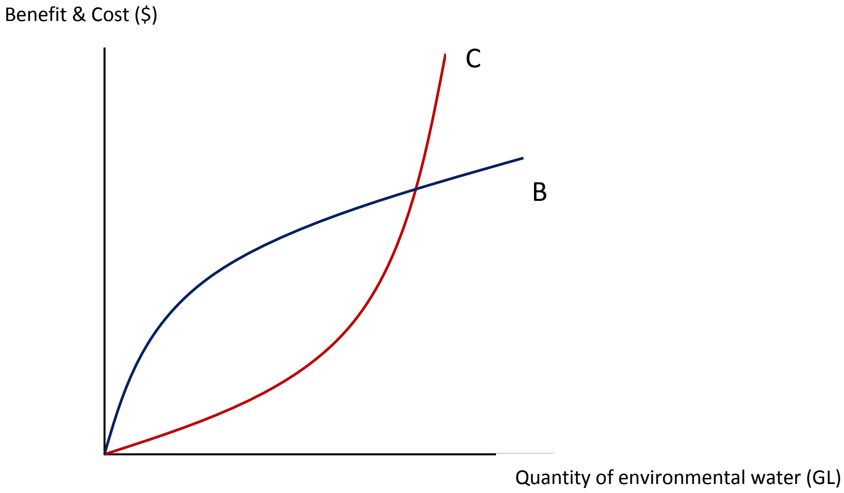
Furthermore, environmental policies usually impose sunk costs on society through permanent changes in the current status quo. These sunk costs can take the form of discrete investments (i.e. installing more water efficient equipment) or expenditure flows (i.e. future price premium paid for additional energy resources that are used in conjunctions with the newly installed equipment). These long term changes are often irreversible and should be carefully taken into consideration when evaluation a particular policy.

Likewise, the benefits associated with environmental policies like the proposed basin plan are also likely to be non linear. It could be argued that the environmental benefits through increased water availability are larger for small levels of additional water recovered but might be small for large level of water recovered as the eco system has already been restored to good health.

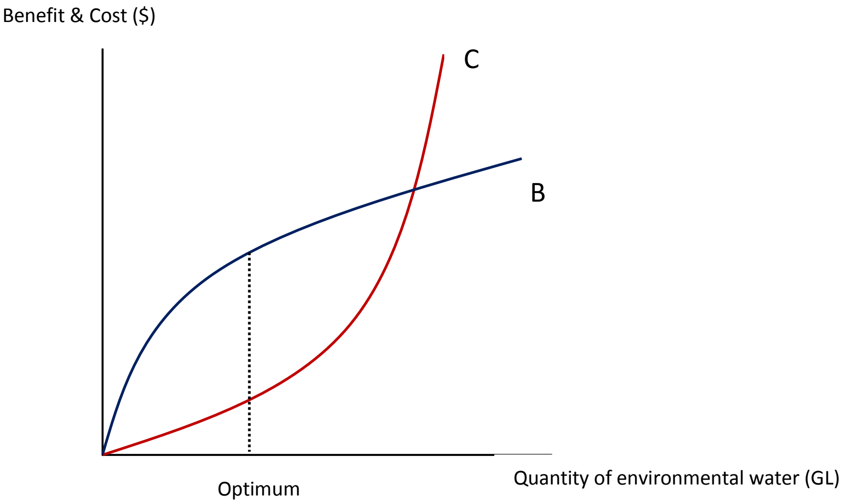
All these examples show very clearly that one cannot simply use straight lines when determining the optimal level of environmental water much less relay on legal convenience to determine a volume. One way to achieve a more realistic representation of the benefits and cost curves associated with the proposed basin plan is to include non-linearity (i.e. upwards or downwards curved lines) into the analysis. The basic rationale for these assumptions is outlined below in more detail.

It is generally understood that greater reduction in water availability for consumptive use will increase environmental benefits and economic costs. However the shape of the benefits and cost curves are usually not identical. Assuming that all possible changes to current status quo range between zero and one hundred percent, we can explain how costs and benefits change with low and high levels of water reduction through SDL.

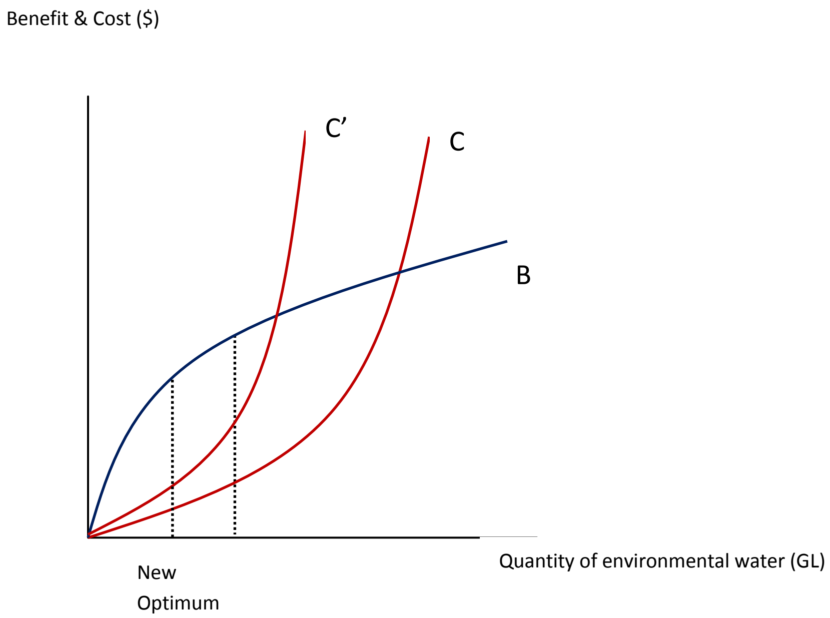
Focusing on the benefit side, we could describe the benefit curve associated the environmental benefit function as *concave*. A concave curve means that for an increases in additional water for the environment from zero to ten percent will have a relatively large incremental benefit whilst increases in additional water from ninety to one hundred percent will have smaller incremental benefits as the ecological system has already been restored to a reasonable good health. Likewise, the cost curve associated with the proposed basin plan can be described as *convex*. A convex curve means that for an increase in additional water available for the environment from zero to ten percent is likely to have a smaller economic cost to irrigated agricultural production but an increase from ninety to one hundred percent has large effects because the flow on effects on industries dependent on irrigated agriculture become more severely.



Having constructed a more realistic image of the costs and benefits associated with the proposed basin plan, we can refine the quantity of optimal water reduction by comparing the distance between the cost and benefit curve. The optimal level would be achieved where the net benefit is maximised.



To find this optimal point we need to account for additional uncertainties related to the proposed basin plan. Uncertainty over valley specified water reductions, the speed and magnitude of the reduction and the proportion of water recovered through buybacks or infrastructure create additional costs for irrigated industries and irrigation dependent communities. These added uncertainties are likely to causes the cost curve to fluctuate within a particular band and hence makes finding the optimal level of environmental water more difficult. Fluctuations here can be represented through differences in the slope of the cost curves.



This variability in the cost curve creates additional restriction for an optimal policy design as too high levels of water reduction can magnify the costs and will not result in a balanced outcome of the basin plan. Certainty over these policy aspects should be created in order to narrow the margin of error for an optimal basin plan policy.

The role of uncertainty in an optimal environmental policy is especially important given that environmental changes occur over a very long time horizon. It is difficult enough to predict all possible costs and benefits but additionally uncertainties create more opportunities to miss the mark for an optimal policy.

The analysis above has shown that a correctly specified cost benefit analysis is a powerful tool to assess the viability of the proposed basin plan and determine the point where the balance for environment, economic and social outcomes have been met. Unfortunately, inaccurate information gathering on the benefit and/or cost side together with simplified assumptions on the curvature of the function have lead to vastly different outcomes and are potentially responsible for incorrect policy recommendations.