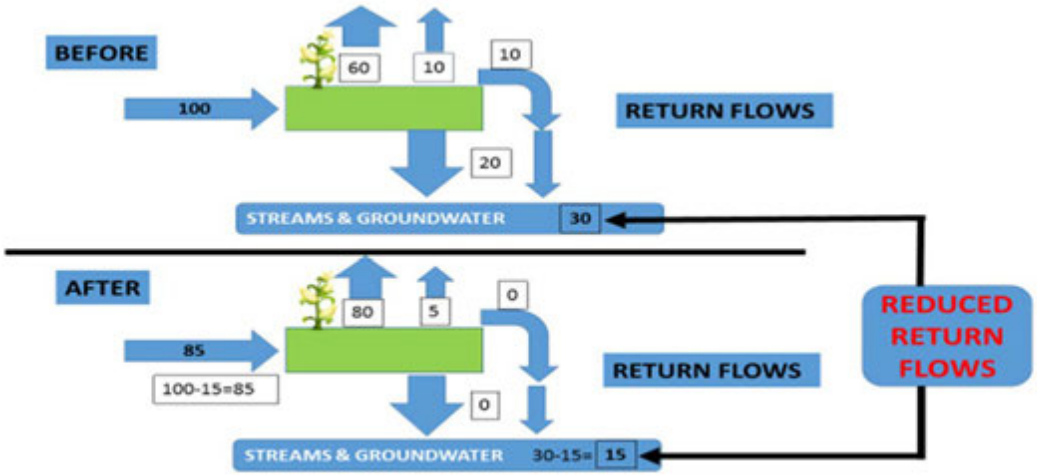
Provided by Professor R. Quentin Grafton to the Standing Committee on Agriculture and Water Resources, 21 April 2017

Response to Testimony of Mr Michael Bernard Murray to the Standing Committee on Agriculture and Water Resources 'Water Use Efficiency in Australian Agriculture' in Toowoomba City, Wednesday 5 April 2017.

1. Mr Murray has a number of errors in his testimony. Here, I only respond directly to his comments directed to the submission by Grafton and Williams.
2. The definition of irrigation efficiency in Grafton and Williams is entirely consistent with the peer-reviewed literature and what technical specialists refer to as 'irrigation efficiency'. The Committee should consult the paper by Batchelor et al. (2014, p. 141) in the Journal of Hydrology to verify our definition is consistent with the peer-reviewed literature. They note that if the "…intent is to save water…, it is vital to know whether the 'losses' from an irrigation scheme or a farming system are in fact losses at all." Thus, contrary to what My Murray states, it is he who is flawed in his testimony and who is at odds not only with the submission of Grafton and Williams but also the peer-reviewed and scientific literature.
3. Mr Murray is incorrect in his testimony that "…the total amount of water that can be consumed by agriculture cannot increase". This is because water entitlements and water allocations in the Murray-Darling Basin (MDB) are denominated in gross diversions and not net diversions (gross diversions less return flows). This means that if farmers increase their irrigation efficiency they also increase the proportion of the water delivered to their farms that is beneficially consumed by plants and, consequently, reduce the return flows to the river and groundwater systems of the landscape. Thus, if a farmer maintains the same amount of water delivered to the farm (water entitlements and water allocations remain unchanged), before and after an improvement in irrigation efficiency, this will both increase the water consumed and also reduce the return flows to streams, rivers and groundwater. This is illustrated in the Figure 1.

Figure 1: Water flow in Landscape under irrigation and the impact of WUE gains on these water flows.



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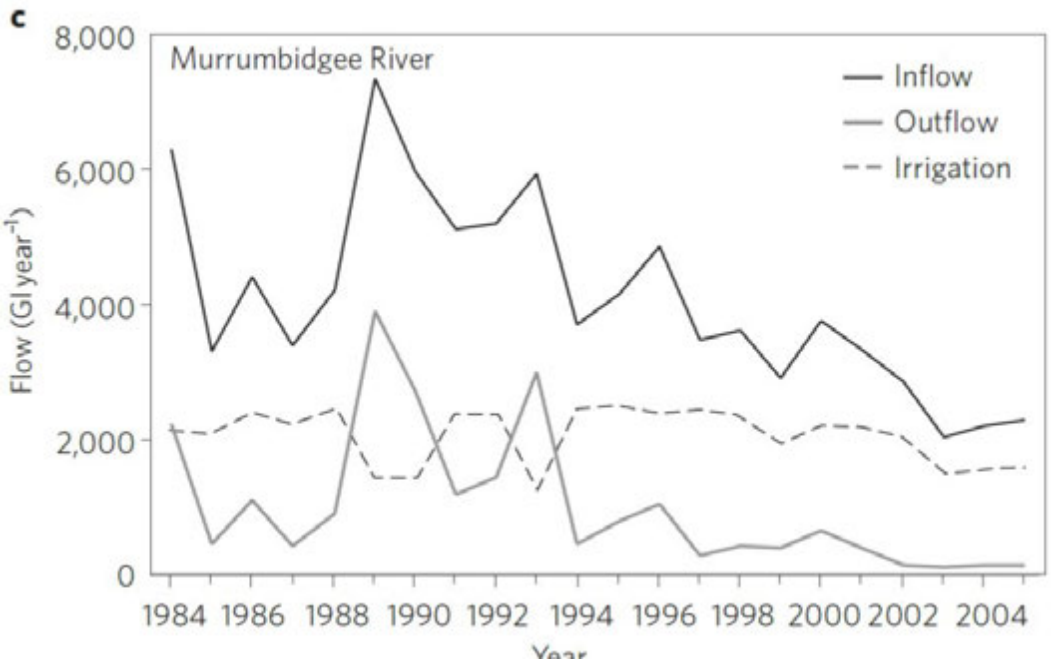
4. Mr Murray makes the point that in the MDB that the "bucket is empty" and somehow this makes subsidies for water use efficiency a good outcome for Australia. In fact, it makes such subsidies even worse because stream flows are so low relative to net inflows. In other words, increasing irrigation efficiency with subsidies in place in the MDB has reduced stream flows in a system that already suffers from low stream flows. The point is not that subsidies for water use efficiency benefit irrigators. They do. But they do not represent a positive net benefit to Australia and, in fact, reduce stream flows.
5. More generally, environmental flows and stream are treated as a residual claim in the MDB, to be met after allocations of water for extractive uses. This is a direct consequence of denominating water entitlements and water allocations as gross diversions. This means reductions in return flows as a result of subsidies for water use efficiency are *not* accounted for in terms of the water entitlements and water allocations.
6. During the 2002-2010 Millennium Drought, environmental flows across the Basin declined by about four times as much as reductions in surface water extractions by irrigators. This is shown for the Murrumbidgee River in Figure 2.[2]

Figure 2: Water Flow in Murrumbidgee at Balranald NSW



7. The proportion of diversions of net inflows can increase substantially during a prolonged drought. As a result, the proportion of water diverted of net inflows can be much more than the 40 per cent to 60 per cent observed by Mr Murray in his testimony. In fact, during the Millennium Drought, the percentage diverted of net inflows over the period 2000-2008 was 76 per cent. This is shown in Table 1 below and comes from a paper in the journal *Ambio* published by the Royal Swedish Academy of Sciences.[3]

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Table 1 Average annual net inflows in the Murray River and total water diversions by decade

	1930–1939	1940–1949	1950–1959	1960–1969	1970–1979	1980–1989	1990–1999	2000–2008
Net inflows (10^6 m^3)	8,893	5,529	14,160	7,928	12,822	9,181	9,932	4,449
Water use (10^6 m^3)	1,178	1,676	2,185	3,119	3,465	4,025	4,351	3,368
Percentage diverted (%)	13	30	15	39	27	44	44	76

Data is sourced from the Murray-Darling Basin Authority (2009): net inflows are from the first column (Murray System Inflows—no Darling or Snowy River inflows) in the Murray River inflows table; water use is the sum of Murray River (NSW) total diversion, total south Australia diversion in MDB and River Murray (Victoria) gross diversion in the Murray River water use table

8. As noted in the Grafton and Williams submission, current and past subsidies to increase water use efficiency in the MDB have reduced overall stream flows. Contrary to what is stated by Mr Murray, this does represent a change in how water is allocated within the Basin and increases beneficial water consumption at the expense of reduced stream flows. This is a case of subsidies resulting in 'more drop, more crop and less stream flow'.
9. Again, contrary to the evidence provided by Mr Murray, I can provide evidence that irrigators have increased their water application rates over the past decade. Indeed, in 2003-4 the average water application rate on cotton farms in the MDB was 6.8 million litres per hectare, but this increased by 18% over the following decade to be 8 million litres per hectare in 2013-14.
10. Current and past subsidies for water use efficiency do not 'save water' and, in fact, reduce stream flows and environmental flows. Any increase in environmental flows that have arisen in the past decade due to policy actions are due to the purchase from willing sellers (at a much reduced cost than subsidies) of water entitlements and *not* because of subsidies for water use efficiency.
11. In closing, the evidence is unequivocal. Namely, public subsidies for water use efficiency in the MDB reduce the overall net benefits to Australia. This is a clear case of a policy failure emerging from a failure to understand and fully account for all water flows in a catchment system under irrigation, including return flows. To "drive every bit of efficiency" as proposed by Mr Murray with the water that is available, and at public expense, will further reduce the overall benefits to Australians that arises from the multiple socio-economic benefits associated with the multiple uses (including stream flows) of water.

End Notes:

1. See Batchelor et al. (2014) Do water-saving technologies improve environmental flows? *Journal of Hydrology* 518: 140-149.
2. See Grafton et al. 2012. Global insights into water resources, climate change and governance. *Nature Climate Change* 3(4): 315–321.
3. See Grafton et al. (2014) Water Planning and Hydro-Climatic Change in the Murray-Darling Basin, Australia. *Ambio* 43: 1082-1092.