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Dear Inquiry Secretary,

As a professor in the faculty of Rural Science at UNE in Armidale for 20 years, with a major research interest in drinking and recreational water quality as well as in agriculture, I wish to submit a statement to the Inquiry. My direct experience in measuring the toxicity of the Darling river during the 1990 algal bloom, and in demonstrating in 1983 liver injury to the people of Armidale from toxic blue-green algae in their water supply, has convinced me that much more attention needs to be paid to water quality. A major element in water quality is flow, which will be enhanced by adoption of the Basin Plan.
yours sincerely,
Ian Falconer

Submission to the House of Representatives- Australian Parliament
Inquiry into the impact of the Murray-Darling Plan in Regional Australia

From Em. Professor Ian R. Falconer, AO, PhD, DSc, FRSChem

Benefits and cost savings arising from adoption of a Basin Plan

The purpose of this submission is to highlight the direct and indirect benefits to regional communities arising from the adoption of a Basin Plan.
Until now the focus of discussion on the 'Guide to the Basin Plan' has been on the negative economic impacts of sustainable diversion limits, which reduce water available for irrigators. While these negative impacts have been extensively studied and publicised, little attention has been paid to the long-term gains for Basin communities resulting from adoption of the Plan.
These can be categorised into

1) **Economic benefits from less saline water in the rivers**
2) **Economic benefits from nutrient reduction in the rivers**
3) **Economic benefits from improved recreational and social amenity**
4) **Economic benefits from biodiversity enhancement**

These benefits are in addition to the targeted aims of the Basin Plan, which include Australia meeting its international treaty obligations for wetlands, and improving the ecological functioning of the Basin wetlands and rivers.

1) Salinity The sub-surface water over much of the Basin is highly saline, and both agriculture and most native vegetation depend on soils that are relatively free of salt. Due to the recent drought the saline water tables have deepened, removing

salt from the root zones to the benefit of crops. Now that the land is re-hydrating the water tables across the Basin will rise bringing salt back to the surface. Current salt interception schemes are inherently short-term, as well as costly, as they largely depend on pumping saline water, extracted from the saline groundwater, to the surface for evaporation. Surface evaporation ponds simply raise the level of salt on the land, with the possibility of washing back into the river in floods. Some salt interception schemes use reinsertion of saline water back into the groundwater, further away from the river, which will eventually seep back into the river.

The ultimate process for removal of salt from the Basin, for the benefit of agriculture and the environment, must be to flush the salt out of the Murray Mouth. This requires effective environmental flows, which will continually deplete Basin salt loads. The Murray Mouth has to be open, and the flow through the mouth to be sufficient for the purpose. It has recently been calculated that a minimum of two million tons of salt need to be flushed out annually, to maintain a balance with salt entry into the rivers. The pre-development salt removal through the Mouth was appreciably greater than this quantity.

Irrigated crops are sensitive to salt, though this varies with crop, cotton being tolerant of salinity that would kill salad crops. Salinities in the Basin vary, in general the northern region rivers are more saline than the south. As water flow generally arises from the north or east, then flows southwest to South Australia, high salinities in southern Queensland (for example) will move through the Basin progressively. The only mechanism for amelioration, in the long-term, is to have sufficient flows through the Darling to wash out the salt. This cannot be achieved if the majority of the river flow is captured for consumptive use from tributary rivers upstream.

Increasing the environmental flows within the rivers of the Basin is essential in the long-term to maintain water quality for both agriculture and human consumption. A major aim of the proposed Basin Plan is to achieve these flows.

There are therefore considerable future economic benefits from salinity reduction through the Water Quality and Salinity Management aspects of the Plan, and significant losses if the Plan is not adopted.

2) Nutrients. A proportion of these enter the rivers through natural mechanisms such as lightning forming nitrates and phosphate-rich rocks dissolving in rainwater. They also arise from agricultural fertiliser use, and particularly from processed sewage inflows. Wherever there is a return of water from land to the rivers, whether from excess irrigation water; from surface flow after rainfall in dryland agriculture; from sewage discharge or stormwater runoff from urban areas, nutrients enter the rivers. The turbidity after rain carries soil with attached nutrients, particularly phosphate. Sedimentation of soil particles in slow moving water results in nutrient-rich layers at the bottom of weir pools and naturally deep stretches of rivers. The combination of enriched nutrient concentrations and warmer water leads to the formation of potentially toxic blue-green algal blooms.

These occur more frequently in periods of low flow, when surface water temperature is higher and an anaerobic layer of water sits over the sediments. Under these conditions phosphate is mobilised from the sediment and made available for the growth of the algae, supplementing the phosphate already present.

The most severe case of a river becoming poisonous through blue-green algae was the Darling in 1990. Stock deaths were estimated at 10,000, and toxicity was demonstrated in the drinking water supply to Bourke. In this case the algae were producing paralytic shellfish poisons that are quickly neurotoxic, accounting for animals found dead in the river.

Last year a large water bloom of potentially toxic blue-green algae occurred in the Murray about Easter time. On this occasion the organism was one that produces a potent liver poison. A 'Red Alert' was declared, and the drinking water treatment plants advised to supplement the standard treatment with activated carbon to remove toxins and odours. Recreational use of the river was to be avoided and warnings were issued. Treatment costs for drinking water increased and river recreation decreased.

Effective environmental flows are the best means of preventing and removing toxic algal blooms. In the Darling River case heavy upstream rainfall over Christmas washed the organisms downstream and the flow destroyed the accumulations of organisms. The increased availability of environmental water under the Basin Plan can be used for the direct prevention or amelioration of algal water blooms, benefiting water users in all categories. Increased water flowing over floodplains and through wetlands reduces nutrient concentrations as particles are removed and soluble nutrients taken up by plants. Water quality is increased. In this way adoption of the Basin Plan, which provides the necessary environmental water, will be a direct economic benefit to basin communities.

3) Recreational and social amenity. Rivers and wetlands are presently a substantial source of recreational activity and income for the inland communities of the Basin. Boating, fishing, watersports, river trips and camping all feature in the interests and pleasures of Basin communities. Smelly rivers with dead fish and half-dead trees mitigate strongly against recreation and move holidaymakers elsewhere. Improved river environments with increased native fish, clearer water and healthy vegetation should be major achievements of the Basin Plan. Increased access to wetlands with observation sites, bird hides and marked walking tracks with interpretive signs can increase use and encourage visitors to stay, rather than drive through inland towns. When the wetlands have been restored to a condition in which we can be proud, then a major effort in providing access and amenity will much assist Basin communities through their own recreation and visitor income. A case worthy of attention is the Macquarie Marshes, which are currently in a deplorable condition and access is greatly limited. With effective water supply and management these marshes can be a major attraction to visitors in an area where job diversity is low.

3) Biodiversity. The biodiversity of wetlands, riparian zones and floodplains provides both direct and indirect economic benefits. Floodplain wetting by overland flows results in a massive increase in biodiversity, and a major economic benefit to flood plain graziers and opportunist croppers. Floodplain grazing and ecology have been severely disadvantaged by upstream water diversion on a massive scale in the northern Basin. More than 1,000GL of water has been impounded in southwest Queensland by cotton irrigators, which is equal to the volume provided annually by the Snowy Hydro Authority to the Murray River.

Floodplains have an integral part in the Basin ecology, contributing to biodiversity and wetland replenishment. They support bird breeding and marsupial survival when an overland flow occurs.
The assessment of the ecological health of the Basin rivers by the MDB Authority shows only the Paroo River in good health, with the Lower Murray and Condamine-Balonne in very poor health. While it is difficult to assign a dollar value to ecosystem health, the effects of poor health are clear to see, with rivers full of carp and wetlands and riparian zones full of weeds.

Conclusions. The waters and the wetlands of the Basin need to be 'fit-for – purpose' for all the activities within the Basin. Water quality needs to be fit to drink without costly treatment, safe to swim in, and water for agriculture needs to be of a quality that provides good crop growth. Water for food processing needs to be safe for consumers. The floodplains and wetlands are needed to support biodiversity and nutrient reduction resulting in healthier rivers. Currently water quality is marginal/poor. Improved quality of water in the Basin will provide substantial economic benefits to all users, including regional towns.
Adoption of a Basin Plan that will limit irrigation use of Basin water, so that the water of the Basin is 'fit-for-purpose', will be a long-term benefit to all communities of the Basin.

Relevant reference-
Falconer, I.R. (2005) Cyanobacterial Toxins of Drinking Water Supplies, pp.279, CRC Press, London and New York.