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CSIRO submission to the Productivity Commission: Interim report on the Murray-Darling Basin Plan Implementation Review 2023

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Introduction

CSIRO welcomes the opportunity to provide input to the consultation process in relation to the Productivity Commission's Interim Report on the Murray-Darling Basin Plan, released on 30 October 2023.

Over the past 15 years CSIRO and delivery partners have delivered a suite of integrated water resource assessments to underpin regulatory decisions and development decisions, beginning with the landmark Murray-Darling Basin Sustainable Yields Project in 2007-8.

CSIRO continues to undertake major Basin-wide studies to support policy makers and river managers to understand and manage the system's ecological assets of significant environmental, cultural, social and economic value.

In this submission CSIRO provides information in relation to four specific topics arising from the interim report, in areas reflecting CSIRO's technical expertise in:

- Climate change impacts on water
- Hydrological connectivity of the Murray-Darling Basin
- Monitoring, evaluation and reporting; and
- Groundwater.

CSIRO would welcome an opportunity to discuss this submission with the Productivity Commission as well as broader topics of relevance to this review process.

CSIRO Response to the Productivity Commission Report

1. A response to – Information Request 6.1: Embedding climate change science into the Basin Plan framework

Section 21 (4) of the Water Act (2007) does state that the Basin Plan should "act on the basis of the best available scientific knowledge and socio-economic analysis". Section 22 (3) then goes on to say that "The risks dealt with must include the risks to the availability of Basin water resources that arise from…the effects of climate change". On this basis we assume that the risks from the effects of climate change must be defined on the basis of best available scientific knowledge.

As recognised by the United Nations, water availability is a key impact of climate change (https://www.unwater.org/water-facts/water-and-climate-change). Kirono et al. (2020) developed projections for four drought metrics (percent time spent in droughts, mean drought duration, mean drought frequency, and mean drought intensity) for the Australian continent using CMIP5 global climate model simulations. They found that the percent of time spent in drought is likely to increase in most parts of the MDB under a possible but extreme RCP8.5 emissions future (equivalent to 4.3C increase in temperature by 2100). The mean duration of droughts and intensity of droughts is likely to increase for most of the basin, particularly the northern and southern areas.

As referenced in the Productivity Commission report, CSIRO has developed climate scenarios and storylines for the Murray-Darling Basin (Zhang et al, 2020). A comprehensive literature review of the current and future hydroclimate of the MDB can be found in Chiew et al. (2022).

In November 2023, CSIRO were commissioned by the MDBA to develop basin-scale hydroclimate projections for use in the Murray-Darling Basin Sustainable Yields 2 project. These will be used by the MDBA and Basin states to assess future water resources across the Murray-Darling Basin, forming part of the Basin plan review.

Scientific rigour and use of 'best available' models, data and information, and the update of this on a regular basis, is core to the rigour of water planning.

2. A response to Box 4.1 – Concerns about connectivity in the Murray-Darling Basin

Basin-wide hydrological connectivity is integral to a healthy Murray-Darling Basin. Hydrological connectivity supports ecosystem function within the Basin, including supporting the habitat and movement of native fish, waterbirds, and vegetation. It is particularly important for native fish population growth and recruitment, as many native fish species' lifecycles are completed at different spatial scales and in different parts of the Basin. Managing the rivers as a connected system for the benefit of ecosystem function is part of the Basin Plan and the Basin-wise Environmental Watering Strategy.

Many hydrodynamic, inundation and river routing models in the Murray-Darling Basin are limited to specific regions in the Basin, creating a knowledge gap.

CSIRO has undertaken research to address this knowledge gap (Sengupta et al, 2023), developing methods and models for estimating basin scale lateral connectivity (inundation extents and surface water depths) and longitudinal connectivity (in-channel velocity, depth, and cross-sectional area). An important goal of this research was to develop methods that can be practically applied at the basin scale with available data, computational power, and time, which is an advance on existing physical process-based modelling approaches.

3. A comment on – Effective monitoring, evaluation, and reporting

Efficient data systems play a pivotal role in monitoring and managing water-related information. Transparent data systems ensure that the origin, collection methods, models and processing of environmental information are openly communicated.

The ability to discover and analyse data related to water resources is vital for making informed decisions. Trustworthy data systems contribute to building confidence in data. It can also advance use of data for inference using artificial intelligence and machine learning methods, to provide more dynamic assessments of trends, change and prediction (https://www.csiro.au/en/news/all/articles/2020/november/designing-trustworthy-machine-learning-systems). Human-centred design and appropriate governance are critical to developing data systems.

4. A comment on – Interim recommendation 6.2 Publishing material used for decisions

The Murray-Darling Water and Environment Research Program (MD-WERP) has (as of November 2023) published 10 CSIRO reports accessible from the MD-WERP homepage at https://getinvolved.mdba.gov.au/murray-darling-water-and-environment-research-program. It also provides links to 12 peer-reviewed articles in international journals at https://getinvolved.mdba.gov.au/md-werp-journal-articles.

5. A note on groundwater

Within the MD-WERP and other research programs, CSIRO has published research on trends in groundwater levels (Fu et al., 2022), the impact of climate change on groundwater and recharge (Crosbie et al., 2011; Crosbie et al., 2013; Crosbie et al., 2023a), changing surface water - groundwater interactions in the Murray-Darling Basin due to climate change (Crosbie et al., 2023b) and groundwater system resilience under historical conditions (Rojas et al., 2023).

There is already evidence of changing rainfall patterns in the Murray-Darling Basin (Whetton and Chiew, 2021), and groundwater levels have been observed to be falling in the eight main alluvial groundwater systems (Fu et al., 2022). These have flow on effects to reduce groundwater recharge and change the connection status between rivers and groundwater to increase river losses and reduce baseflow. These all have implications for surface-water accounting and regulation and can adversely affect terrestrial and aquatic GDEs (Doble et al., 2023).

A recent paper by Doble et al. (2023) emphasised the importance of groundwater in the Murray-Darling Basin, and recommended:

> Improved data systems and acquisition through automation and novel data sources, and growing capability in integrated, risk-based modelling
>
> Quantification of the groundwater/surface-water connection response to declining groundwater levels and assessing GDE water requirements and thresholds
>
> Adapting policy to support active management of groundwater where required, including conjunctive use and water banking
>
> Improving knowledge sharing and water literacy, including understanding community values of groundwater and GDEs, and better definition of local and regional resilience, to support future decision-making.

Groundwater management and groundwater under climate change need prominence in Basin water management, and the upcoming review of the Murray-Darling Basin Plan provides an opportunity to reassess groundwater management using a more integrated approach.

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