QUESTIONS ON NOTICE FOR CEWH

1. Previously you have identified that cold water pollution has a significant adverse impact on native fish populations. Many studies over more than a decade support this conclusion. The MDBA have stated that native fish are one of the four key indicators they use to evaluate the health of the Basin. Can you advise what steps you have taken to eliminate the effects of cold water pollution on native fish populations to enable successful spawning?

   State governments have responsibility for the design, construction and maintenance of dams. There are a number of engineering options for reducing or eliminating cold water pollution, such as the use of surface pumps, multi-level outlet structures and submerged curtains, floating intakes, and stilling basins. For example, the NSW government has installed Australia's first temperature control curtain at Burrendong Dam on the Macquarie River.

   The main step the Commonwealth Environmental Water Holder (CEWH) can take to manage cold water pollution is through the timing of a watering action. The risk of cold water pollution is much lower at cooler times of year (winter and early spring) when dam water temperatures are not stratified. Environmental watering typically targets this time of year (particularly in the southern Basin), to align with natural cues including those for native fish spawning. Other options include timing releases with downstream tributary flows, which will dilute the cold water, and releasing water at a rate and/or volume unlikely to cause a significant risk in receiving water temperatures.

   Commonwealth environmental water has already supported successful native fish spawning across the Basin. This includes golden and silver perch, which are thought to be 'flow-dependent specialists' and require water to be flowing quickly at the right time of year and temperature in order to breed successfully (*see the CEWH's supplementary submission for details*).

   Despite this success, the CEWH is supportive of action to address cold water pollution and continues to work with state governments and water authorities on collaborative measures, which would further improve the environmental outcomes that can be achieved in the Basin's rivers.

2. What is your understanding of the cost of modification to a major storage like Lake Hume to alleviate, once and for all, cold water pollution affecting spawning activities of native fish for hundreds of kilometres downstream?

   Costs will vary depending on the engineering solution pursued and the specific characteristics of the dam. The cost of construction of the temperature control curtain on Burrendong Dam was $4 million.

   The following advice has also been provided by the Murray-Darling Basin Authority (MDBA) in relation to cold water pollution at Hume Dam:

   The temperature of water discharging from Hume Dam is understood to be within + 2°C of the natural temperature of the River Murray at that location. Any temperature differentials diminish as the distance downstream of the Dam increases and are understood to be non-existent by Howlong; a distance of about 60 km. Such temperature differentials do not constitute "cold water pollution" and the MDBA is not aware of evidence that the relatively small temperature differentials at Hume Dam are impacting "spawning activities of native fish for hundreds of kilometres downstream".

   Hume Dam is extremely exposed to prevailing south easterly winds and as such wave action immediately upstream of the dam can be significant. This means that suspended curtains to limit outflow to surface layer or floating turbines to mix water would be extremely difficult to moor. The only likely viable option to eliminate any temperature differential at Hume Dam would be a substantial concrete structure upstream of the power station inlets and probably also covering the irrigation intakes. The cost of such a structure would likely be in the order of $40 million to achieve a relatively minor change in temperature in the River Murray.

3. The Basin Plan is a very ambitious and expensive investment by taxpayers, currently estimated at about $13 billion. The primary purpose of the Plan is to achieve environmental objectives through environmental watering, which the CEWH manages along with state EWH. What role does the CEWH have in monitoring and evaluating the achievement of environmental objectives?

   The Basin Plan sets out the reporting obligations and principles for undertaking environmental monitoring and evaluation for state and Commonwealth agencies. When viewed together, these provisions broadly confer the following roles:

   - **Murray-Darling Basin Authority** is focussed on monitoring and reporting on the changes in environmental health at a Basin-scale (including the achievement of the Basin Plan's objectives and the Basin-wide Environmental Watering Strategy targeted outcomes)
   - **Basin States** are focussed on reporting on the changes in environmental health over time at a wetland and catchment scale
   - **Commonwealth Environmental Water Holder** is focussed on monitoring and reporting on the outcomes from Commonwealth environmental watering (including the contribution to the Basin Plan's environmental objectives).

   The Commonwealth Environmental Water Office (CEWO) has been monitoring and evaluating the environmental response from Commonwealth environmental watering since 2010. The CEWO relies on monitoring and evaluation results not only to fulfil legislative and Basin Plan reporting obligations but also to:

   - improve environmental water use planning and delivery
   - demonstrate environmental outcomes
   - build our combined knowledge of the ecological systems in which we operate.

   Monitoring of environmental responses has more recently been strengthened by transitioning from short (annual) to longer term (5-yearly) projects as part of the $30 million Long Term Intervention Monitoring Project. Under this Project, the CEWO has engaged some of Australia's leading research institutions to lead teams that include locally based land and water managers, to determine whether Commonwealth environmental water is achieving the outcomes expected of it at the asset and Basin scale.

   In addition to monitoring the environmental response, operational monitoring is undertaken for all Commonwealth environmental watering actions (typically by state government delivery partners). This involves collecting on-ground data about the environmental water delivery action such as volumes, timing, duration, location, flow rates and river heights.

   All CEWO monitoring and evaluation design documentation, reports and results are made available on the CEWO website and by distributing through local stakeholders.

4. You have previously identified four key indicators used to establish environmental objectives to be achieved from environmental watering. These are river flows and connectivity, native vegetation, waterbirds and native fish. What specific benchmarks have you identified for these four key indicators to help evaluate accomplishment of your objectives?

   Benchmarks for the 'expected outcomes' in the Basin-wide environmental watering strategy

   The Basin Plan identifies a number of environmental objectives and targets for water-dependent ecosystems in the Murray–Darling Basin. The Basin-wide environmental watering strategy (the Strategy), which was prepared by the Murray-Darling Basin Authority, provides the next level of detail on the environmental objectives and targets, with 'quantified expected outcomes' identified four components: river flows and connectivity; native vegetation; waterbirds; and native fish. Examples of the outcomes expected by 2024 include:

   - a 20–25% increase in waterbirds
   - a 10–15% increase in mature Murray cod and golden perch at key sites
   - maintenance of the current area and condition (and in some regions, improved condition) of river red gum, black box, coolabah and lignum communities
   - improved overall flow, such as 10% more flow in the Barwon-Darling, 30% more flow in River Murray and 30–40% more flow to the Murray mouth.

These outcomes are the Murray-Darling Basin Authority's best assessment of how the Basin's environment will respond over the next decade as a result of implementing the Basin Plan, given current operating rules and procedures. Addressing constraints to environmental water delivery would be expected to improve the environmental outcomes that are achievable, beyond those outlined in the strategy.

The benchmarks (or reference points) for these outcomes are detailed in the Strategy and differ for each component. For example, Appendix 3 details quantified areas (based on 2013 data) and condition scores for vegetation (based on 2007 data) for catchments across the Basin. The reference point for outcomes for short-lived fish is pre-2007 populations, which was prior to the major losses caused by extreme drought.

Benchmarks for the Commonwealth environmental watering monitoring programme

Quantifying the benefit of Commonwealth environmental water

The CEWO Long Term Intervention Monitoring Project is working to quantify to the fullest extent possible the benefit of Commonwealth environmental water (and other held environmental water delivered in conjunction with Commonwealth environmental water) to Basin Plan environmental objectives.

The use of benchmarks or reference points is an important component of quantifying the benefit. There are a number of different ways in which our monitoring and evaluation experts use benchmarks to inform their evaluation. For example, some of our monitoring projects use inference over time; that is, monitoring at the same location before and after the watering action. Other projects use inference over space; monitoring at sites that received and did not receive environmental water. Other projects use a combination of these two. The Murray Darling Freshwater Research Centre is using a combination of analytical models and quantitative analysis to link short term environmental watering responses to five year changes in the condition of the system.

Evaluating the contribution of Commonwealth environmental water to Basin Plan objectives

Basin Plan environmental objectives are set at the Basin-scale over a decadal time frame. In contrast, environmental water actions are managed at the site, area or valley scale over periods of days, weeks or months. There is therefore a need to link the findings of our monitoring and evaluation providers to the longer-term Basin-scale objectives of the Basin Plan.

The CEWO facilitates this process through an environmental water outcomes framework (Attachment A), developed in collaboration with the MDBA. The framework identifies outcomes that can be expected in less than one year and between one and five years. When these shorter-term outcomes are achieved over multiple years, the best available science indicates that they will cumulatively contribute to the longer term objectives and outcomes in the Basin Plan and the Basin-wide environmental watering strategy.

5. In answer to a question from the September 18 hearing you said "The Commonwealth Environmental Water Holder has not and will not place water orders that would flood private land, without the consent of the landholder." To alleviate concern from Basin communities about this issue, and clarify responsibility, shouldn't the Commonwealth consider indemnifying states and river operators for flooding from Commonwealth environmental watering events, if this should occur?

Any decision to indemnify river operators is a matter for Commonwealth and state governments.

State agencies and river operators are responsible for the physical release of Commonwealth environmental water to the intended environmental asset. These agencies have statutory obligations in relation to the delivery of water that apply regardless of whether the water is intended for consumptive or environmental use.

The role of the Commonwealth Environmental Water Holder (CEWH) is to manage the Commonwealth environmental water holdings within existing rules and regulations. In this regard, the CEWH is a diligent, responsive and prudent water manager. A precautionary approach is taken to managing environmental water

to eliminate, to the fullest extent practical, the risk of unintended impacts on landholders, irrigators and other third parties.

6. Does the CEWH pay the same storage, distribution and infrastructure costs as irrigators? If not, why not?

   Yes. The CEWH pays the same storage and infrastructure costs as other equivalent water entitlement holders.

   The CEWH also provides its state delivery partners with a financial contribution for the payment of costs they incur in holding delivery shares and for other charges associated with the use of irrigation distribution networks. The CEWH's contribution to the cost of using irrigation distribution networks is made on a pro-rata basis, depending on the volume of Commonwealth environmental water delivered using irrigation infrastructure during the year.

7. If the CEWH does not pay the same costs as irrigators, are irrigators indirectly subsidising the costs of environmental water?

   No. As noted above, the CEWH pays the same storage and infrastructure costs as other equivalent water entitlement holders. Irrigators do not subsidise the costs of Commonwealth environmental water through their fees and charges.

8. Do you think it would be advantageous to amend carryover rules? If so, what improvements could be made?

   State governments set the rules that apply to the carryover of water. Carryover rules vary markedly for different entitlements and in different water plan areas across the Basin. The carryover limits, account limits and use limits apply to all entitlement holders, including the Commonwealth.

   Carryover is an essential management tool for all water users. It can be used to reserve water in good years to manage the risk of low water availability in the future or to meet early season demands. For environmental water managers, carryover is critical for watering actions in winter and early spring, which often occur prior to increases to seasonal allocations for many entitlement types.

   Changes to carryover rules are the responsibility of state governments and would require careful consideration and modelling to investigate the impact of any changes on the reliability of supply for all water users. As a Basin-wide operator, the CEWH would be supportive of steps taken to achieve greater consistency of rules, particularly between connected systems (e.g. NSW Murray and Victorian Murray entitlements), noting that there are often good reasons for differences between catchments. In catchments where rules place tight limits on the capacity to carryover water, there may be value in revisiting these rules to see if they are still required or if the limits are set at an appropriate level.

   The CEWH is opposed to any changes that would remove the Commonwealth's right to carryover water. This would unfairly diminish the environment's water security and severely limit the ability to efficiently and effectively achieve the environmental outcomes sought with the Basin Plan.

The Commonwealth Environmental Water Outcomes Framework is available at https://www.environment.gov.au/water/cewo/publications/environmental-water-outcomes-framework and is summarised in the below table.

Table 1: The 1 and 5 year expected outcomes from Commonwealth environmental water and how they will contribute to Basin outcomes [*note that the expected outcomes of the Basin-wide environmental watering strategy will be achieved through the efforts of all governments in implementing the Basin Plan, and not solely through Commonwealth environmental water. The monitoring of the Basin-wide environmental watering strategy outcomes is the responsibility of the Murray-Darling Basin Authority*].

Basin Plan Objectives	Basin Outcomes		Basin-wide Environmental Watering Strategy – Expected Outcomes	5 year Expected Outcomes	1 year Expected Outcomes
Biodiversity (Basin Plan S. 8.05)	Ecosystem diversity			• Species diversity	
	Species diversity	Vegetation	• Maintenance of the current extent of river red gum, black box, coolibah forest and woodlands; existing large communities of lignum; and non-woody communities near or in wetlands, streams and on low-lying floodplains • Maintain the current condition of lowland floodplain forests and woodlands of river red gum, black box and coolibah • Improved condition of southern river red gum	• Vegetation diversity • Growth and survival	• Reproduction • Condition • Germination • Dispersal
		Macroinvertebrates		• Macroinvertebrate diversity	
		Fish	• Improved distribution of key short and long-lived fish species across the Basin • Improved breeding success for short-lived species, long-lived species and mulloway • Improved populations of short-lived species, long-lived species, Murray cod and golden perch	• Fish diversity • Larval and juvenile recruitment	• Condition • Larval abundance • Reproduction
		Waterbirds	• Maintained current species diversity of all current Basin waterbirds and current migratory shorebirds at the Coorong • Increased abundance with a 20–25 per cent increase in waterbirds by 2024 • Improved breeding events for colonial nesting waterbird species and an increase in nests and broods for other waterbirds	• Waterbird diversity • Waterbird population condition (Abundance and Population structure)	• Survival and condition • Chicks • Fledglings
		Other vertebrate diversity		• Adult abundance	• Young
Ecosystem Function (Basin Plan S. 8.06)	Connectivity		• Maintained base flows - at least 60 per cent of natural levels • Improved overall flow • Maintained connectivity in areas where it is relatively unaffected • Improved connectivity with bank-full and/or low floodplain		• Hydrological connectivity including end of system flows

			flows • Maintain the Lower Lakes above sea level		
			• Improved movement with more native fish using fish passages		• Biotic dispersal and movement
					• Sediment transport
	Process				• Primary productivity (of aquatic ecosystems) • Decomposition • Nutrient and carbon cycling
	Water quality	Chemical			• Salinity • Dissolved oxygen • pH • Dissolved organic carbon
		Biological			• Algal blooms
Resilience (Basin Plan S. 8.07)	Ecosystem resilience			• Population condition • individual refuges • landscape refuges • ecosystem recovery	• Individual survival and condition (Individual refuges) • Individual condition (Ecosystem resistance)