

Attachment A

Draft Lachlan Regional Water Strategy – EES comment

1. General Comments

EES has reviewed the Draft Lachlan Regional Water Strategy (RWS) and provides the following comments for consideration.

EES understands that the recent extremely dry conditions in the Lachlan are a key driver for the RWS and existing commitments. The drought conditions experienced over the past two years have highlighted the issue of water security and reliability for industry, as well as risks to groundwater supplies and users. Further, the drought has highlighted the vulnerabilities in water dependent ecosystems. Although adapted to a highly variable climate, river regulation and extraction, coupled with intense drought, has stressed and contributed to a decline in the condition and extent of our water dependent ecological communities.

EES notes the five broad ranging objectives of the RWS which includes “protect and enhance the environment”. A number of options in the RWS stand to contribute to improved environmental outcomes, for example addressing cold water pollution, fish passage and extraction at pump offtakes, environmental and water quality restoration works and floodplain management. However, EES also notes the range of infrastructure and efficiency options aimed at increasing the capacity to capture and store increasing quantities of water in the upper Lachlan System. Such supply measures pose significant risks to downstream priority environmental assets, water users and communities.

I draw your attention, in particular, to the Wyangala Dam wall raising government commitment. As you’re aware, increasing storage capacity does not create more water in the system, rather it enables the capture of more water upstream and reduces flow downstream to other users and/or the environment. In this sense increasing the capture of water in Wyangala will result in a redistribution of water from the Lower Lachlan system to water consumers in the upper to mid reaches of the Lachlan. There are equity issues here for stakeholders in the Lower Lachlan, and further EES has significant concerns for nationally recognised wetlands and birds in the Lachlan valley.

In NSW, the Lachlan valley still retains a comparatively good connection between the river and its floodplain. Although Wyangala Dam does capture medium to large floods, there is still sufficient rainfall and flooding to maintain most of the downstream floodplain and riparian priority assets in line with the natural sequence of large wetland inundations (1 in 10 to 15 year whole of system flood events). This frequency and magnitude of flooding has meant that the Lachlan system is still capable of supporting significant colonial bird breeding events (eg. 100,000+ nests in Booligal SCA), and a diverse and large number of migratory shorebirds and threatened species (EPBC Protected Matters) at sites such as Lake Cowal. This is significant at the both the population and Basin-scales, as they are some of the largest and reliable bird breeding colonies in NSW. Increasing the storage capacity of Wyangala by 50% will reduce flooding of the Lachlan downstream wetlands such as Booligal and Lake Cowal and will impact significantly on bird breeding and foraging habitat as well as a variety of other ecosystem processes EES considers the cumulative impact of the addition of the raised wall, on top of the existing dam, to have significant ramifications for the downstream ecology of the Lachlan valley. There is a risk that raising the wall will trigger a critical tipping point which may result in a significant decline or a collapse in Lachlan wetland systems and ecosystems.

As an alternative, EES suggests prioritising assessment of inefficiencies and exploring opportunities for improvements in existing water management arrangements and delivery infrastructure. This may

include upgrading and automating aging infrastructure, changes to ordering and accounting to minimise end of system surplus, reviewing the drought of record allocation basis, and investing into private irrigation efficiency in the Lachlan.

The Wyangala project is only at INSW Gateway 1 and is dependent upon finalisation of design, business case, and EIS and a number of approvals prior to any works proceeding. EES supports the consistent RWS reference to the project as 'detailed business case development of raising Wyangala Dam'. This should replace the short-form 'Wyangala Dam raising project' (pg. 97) and Snapshot (pg. 8) "\$650 million to raise Wyangala Dam wall" (also noting the outdated costing).

Summary:

- River regulation and extraction, coupled with intense drought, has contributed to a decline in condition and extent of NSW water dependent communities

- Supply measures such as the Wyangala Dam upgrade and the Lake Rowlands pipeline retain water in the upper catchment and pose significant risks to downstream priority environmental assets, water users and communities.

- As an alternative, EES suggests prioritising assessment of inefficiencies and opportunities for improvements in existing water management arrangements and delivery infrastructure.

2. Consistency with the Murray Darling Basin Plan

EES would like to see further details regarding consistency between the RWS Option packages and the NSW Government's commitments under the Murray Darling Basin Plan. Of most relevance is the commitment to a sustainable level of take of water for consumption and the commitment to "no net reduction" of planned environmental water. Proposals which capture more water from the river and floodplain, such as Wyangala Dam wall raising and Lake Rowlands projects, pose a threat to those Basin Plan commitments.

Summary

Water supply measures pose a risk to meeting NSW commitments under the Basin Plan, particularly in relation to meeting the sustainable diversion limit and the "no net reduction" in planned environmental water test.

3. Water sharing arrangement implications

In addition to the Wyangala Dam option, there are three options that could impact on the current water sharing arrangements in the Belubula River system:

- i) Construction of a pipeline between Lake Rowlands and Carcoar Dams (Option 1);
- ii) Potential raising of the Lake Rowlands dam wall (Option 2)
- iii) Construction of a pipeline to transfer water from Carcoar Dam to Orange (part of Option 6).

Options 1 and 2 (i and ii respectively) listed above will capture high flows that would otherwise maintain flows in Coombing Creek, which is an important tributary that contributes to base flow and some degree of natural flow variability in the Belubula River. Whilst Option 6 (iii) could further

impact on low flows in the Belubula River, especially during droughts when risks to town water security are highest.

It is currently unclear how inter-valley or water source transfers would affect respective water users (urban versus rural), the Sustainable Diversion Limits and Water Sharing Plans (WSP) of the respective water sources including the Belubula Regulated, Lachlan Unregulated and Lachlan Regulated systems. For example, the three Lake Rowlands and Carcoar options raise and set a precedent around complex questions regarding infrastructure use and water sharing arrangements during competing demand periods, i.e. proposals to transfer water from a dam in an unregulated water source owned by and operated for town water utility and security (and respective works approvals) to a dam owned by and operated by WaterNSW for general security and high security license holders in regulated water source. EES suggests that further consideration to these issues is required.

Summary

Options that include inter-valley or water-source transfers could impact on current water sharing arrangements, Sustainable Diversion Limits and elements of relevant Water Sharing Plans. Further consideration on these potential impacts is required.

4. Economics

EES notes the negative impact of flooding on some businesses and on Lachlan valley townships. EES also supports the RWS inclusion of the economic benefits that flooding can provide to certain agricultural industries such as floodplain grazing and cropping, as well as eco-tourism. However, the economic benefits of flooding appear to have been omitted from the RWS. EES has identified an error in the agricultural data which outlines the economic contribution of irrigated agriculture. EES understands that the figure for hay and cereals (\$76 and \$780 million respectively) is the economic contribution of all cereals in the Lachlan valley including dryland and floodplain cereals. The value of irrigated agriculture is significantly less and this error should be rectified. Further the value of floodplain grazing has not been included in the agricultural data.

EES has also reviewed the [REDACTED]. It is noted in this report that the key water users to inform economic values is limited to 'town water supplies, irrigators, mining companies and recreational water users'. It does not include floodplain graziers, eco-tourism and conservation (e.g. The Nature Conservancy \$55 million acquisition of Great Cumbung Swamp properties) hence the analysis does not represent the full costs and benefits of overbank flooding. EES also notes the 'willingness to pay models' for households and businesses are based on two studies from the ACT and the data is 8 to 14 years old (2006 and 2012). EES questions the validity of applying these models and assumptions to a regional/rural market.

EES notes the commitment in the RWS to support the most cost-effective options to achieve the objectives of the RWS, as is consistent with NSW government policy. However, EES notes the number of high cost options being prioritised for assessment over other lesser cost options and is concerned that the affordability criteria is being overlooked. The RWS includes recommendations for numerous reviews which are likely to provide strategic solutions for improving the efficiency and reliability of our water supplies in considerably more cost-effective ways. As noted above, EES suggests that DPIEW prioritise such reviews and the assessment of non-build options before exploring high-cost infrastructure options, for which there is limited evidence of economic benefit and willingness to pay.

Summary

The economic benefits of floodplain agriculture have been excluded from analysis and in some cases incorporated into irrigation benefits.

EES recommends prioritising the most cost-effective options such as efficiency opportunities prior to exploring high cost infrastructure options.

5. Clarification of Risks to Groundwater and Town Water Security

Groundwater resources play a significant component of the water resources in the Lachlan valley. The alluvial groundwaters act as a drought reserve and are the main source of town water for towns located off the Lachlan River. In addition, in response to the Millennium drought there was significant investment in 'drought proofing' town water supply through programs which significantly reinforced groundwater infrastructure and water recycling schemes.

To illustrate, Hillston, Melbergen and the Goolgowi - Merriwagga water schemes draw their water from the Lower Lachlan Groundwater Basin. Parkes Local Shire Council recently upgraded to eight bores that collectively allow an increasing extraction capacity while spreading the drawdown of water over a larger area. Forbes Shire Council supplies potable water to Forbes, Calarie and Daroobalgie as well as other villages of neighbouring shires, including Gunningbland, Bogan Gate, Trundle, Tullamore and Tottenham and has three groundwater bores that provide a back-up water supply in the event of an extended drought. Lachlan Shire Council estimate they will have completed the Condobolin bore field pipeline (3 bores 28 km pipeline) and sourced additional groundwater reserves for Cowra (25 km pipeline) within 2 to 3 years. In summary, Cowra, Parkes, Forbes, Condobolin, Lake Cargelligo, and Hillston have or will have emergency drought groundwater supplies. Booligal has the option to source town water from the Murrumbidgee Gunbar Water private pipeline.

The reduction in system-scale floodplain inundations from the proposed Wyangala and Lake Rowlands augmentations combined with the Mid and Lower Lachlan efficiency options will result in a decline (potentially significant) in the recharge of these important groundwater resources. This poses additional unknown risks to town water supply. EES considers that the issues and risks around Groundwater management have not been adequately articulated or explored by the RWS.

Within this context, EES seeks clarification regarding Snapshot (pg. 35) "*Wyangala Dam is unlikely to fall below dead storage based on long-term paleoclimate records and short term climate projections - the towns of Cowra and Forbes, which are supplied from water stored in Wyangala Dam, are at a low risk of experiencing water supply shortfalls based on their current water access licence volumes*". This is in apparent contradiction to a statement and Table 2 (pg. 74) describing Cowra and Forbes as having a "very high water security risk".

Summary

The high priority supply options such as Wyangala wall raising will result in a reduction of groundwater recharge increasing the risks to town water supply. Further analysis is required.

6. Modelling and Methodologies

EES welcome further and timely engagement with DPIEW (including proposed timeframes) on addressing some of the modelling and methodology issues outlined in the RWS itself.

Specific recommendations include:

- i) Ensure alignment in the modelling approach between both the RWS option assessment and for any associated EIS assessment.
- ii) Update models to accurately incorporated environmental water use behaviour (including the inter-relationship between HEW, PEW and other forms of water including stock and domestic/replenishment, consumptive demand, etc). This will enable a more accurate assessment of impact of options on environmental water, as well as floodplain harvesting, and groundwater-surface water interactions or dependencies. EES has done and is willing to continue to support DPIE Water in this work.
- iii) Further engagement on how the method for assessment of environmental outcomes will be used to supplement the economic assessment. It is proposed that *“shortlisted options will be hydrologically modelled and the results will be compared to the base case to identify changes in the volume of water across indicator sites for a number of relevant flow metrics”*. Require further consultation and details on the base case and additional lines of evidence to be considered. A more robust approach could include hydraulics, geomorphology, inundation mapping and analysis, and functional attributes in the interpretation of outputs from hydrological models based on assumptions. Environmental water managers and independent scientists could be included in this assessment and Review Committee or ‘expert judgement’. The assessment and its conclusions (and findings of Review Committee) to be fully documented and any final impact rating justified and explained in detail how reached those conclusions, including assumptions and conflicts/trade-offs.

7. Stakeholder engagement

Stakeholder feedback to EES indicates that the RWS engagement process needs to be broadened to include the whole catchment and all water users. The perception is that there has been a concentration of engagement effort and long-listing of options arising from the upper part of the valley growth centres with lesser efforts in the lower reaches and communities.

EES considers it important that stakeholders have confidence in the development of the RWS and the modelling and assessment framework to support the selection of Option packages. Additional supporting documents (including independent reviews, previous studies to inform long list selection, preliminary and strategic business cases) if made publicly available will contribute towards building this support. This will provide transparency and build confidence in the community that the identification, assessment and final recommendation of Option packages is consistent with the NSW Government’s policies for evidence-based and cost-efficient decision-making.

In addition, the DPIEW may also elect to publish the broad range of stakeholder feedback and input via a response to stakeholder advice report that outlines how the DPIEW has considered that advice, including concerns about third party impacts.

EES encourages further targeted face to face stakeholder engagement with potentially affected downstream water users (floodplain graziers, stock and domestic and replenishment, environmental stewards including NPWS) to further understand the risks and opportunities in that section of the river. Further consultation with whole-of-Lachlan stakeholders may also identify additional Options

that address the project objectives (including flood mitigation) while optimising the trade-offs between the RWS strategic objectives.

Summary

EES has received feedback that RWS consultation has been lacking in the lower Lachlan. EES suggests that improving the transparency of the process and available materials will increase confidence in the RWS and may also reveal alternative more cost-effective Options.

8. Floodplain Risk Management and Flood Mitigation

Flood risk management for communities relies on a range of factors including maintaining the natural flood function of floodplains, building and maintaining local flood risk management measures, operating flood warning systems and arrangements, effective flood emergency management planning and land use planning that considers flooding. This requires a partnership between all levels of government and with the community.

The NSW Government supports the proactive management of flood risk to local communities across NSW through the Floodplain Management Program, managed by DPIE EES, and the work of NSW State Emergency Services in emergency management planning with communities. This Floodplain Management Program continues to improve the understanding and management of flood risk to local communities so that they can be more flood resilient. Consideration should be given to identifying this ongoing government commitment to flood risk management in the RWS. DPIE EES can provide more specific advice on the program and more recent investment in the valley to include in the finalisation of the strategy if desired.

Water supply dams such as Wyangala Dam can have some flood benefits. However, dams can only influence flooding where flood producing rainfall occurs upstream of the dam and the dam has air space capacity available to absorb enough of the flood volume to impact on peak downstream behaviour. The benefits of dams on flooding generally reduce the further you are from the dam. The operation of dams for water supply (with the aim of keeping the dam full) can be in conflict with its operation for flood mitigation (keeping it as empty as possible so the available storage can influence downstream peak flood conditions).

The RWS is inconsistent in relation to the benefits of the upgrade of Wyangala Dam for flood mitigation. The above advice is reflected in the statement in Section 1.4 on page 30 which highlights the raising may provide some flood management benefits. However, the statement in Table 3 on the Long List of Options and Government Commitments suggest a higher degree of benefit and is inconsistent with the earlier statement. Table 3, point 2 below should be changed to “may provide some flood management benefits for towns downstream of the dam” for consistency and to reflect the limitations of water supply dams in relation to flood mitigation.

This change can ensure that the capability of the upgrade of the dam to reduce flooding is not over-estimated by the community.

Summary

There are inconsistent statements in the RWS in relation to the flood mitigation benefits of the Wyangala Dam proposal.

The RWS would benefit from reference to the NSW Floodplain Management Program.

Staff at EES have reviewed the Draft Lachlan RWS in detail, and they will continue to provide more detailed feedback, and advice in relation to environmental options, through the working group forums. In the interim a worksheet outlining EES assessment of the RWS Options to date (Attachment B) has been attached.

Option Category	Option Number	Option Name	OPTI EES			Previous Name
			Hydrological / ecological impact category (drop down menu)	Hydrological / ecological impact score (auto filled)	Surface water hydrological modelling required if proceed (drop down menu)	
Maintaining and diversifying water supplies	Government commitment 1:	Water transfer pipeline between Lake Rowlands and Cascoar Dam	Minor / Moderate impact	-1	Yes	Relatively localised impacts restricted to Coombing Creek. Project objective is to capture and re-regulate 'surplus' flows that spill on average 40% of the time - capture of all 40% of spilling flows would have a significant impact even if mitigation measures employed but application of transitory rules and adherence to environmental water requirements would reduce downstream impacts. Requires hydrological modelling under different resource availability scenarios (RAS) for Coombing and Balubula water-dependent ecosystems and end of system flow rule in Balubula water sharing plan. Risks to flows are higher in dry and very dry RAS due to competition from towns and high value industries as Water Management Act allows for precedence to those 'customers'. Could affect reliability of FW. Especially concerned about maximum durations of cease to flow events, very low flows, baseflows and small freshes occurring at target frequencies and flow rates for required durations.
Maintaining and diversifying water supplies	Government commitment 2:	Wyangala Dam raising project	Major / Extreme impact	-2	Yes	Increased river regulation (loss of flow variability), worsening cold water pollution, significant loss of floodplain connectivity in Mid and Lower Lachlan and inability to meet Basin Plan requirements to 'protect and restore the Murray Darling Basin's significant water dependent ecosystems. Major loss of ecosystem function (large-scale colonial bird breeding, productivity, dispersal) and RRG and Black Box communities off the river channel. Impacts disproportionately compounded if combined with Options 25 and 26 (mid and lower Lachlan effluent efficiency pipe and trough).
Maintaining and diversifying water supplies	Government commitment 3:	Lake Rowlands augmentation	Minor / Moderate impact	-1	Yes	Moderate, and perhaps Major impact especially on low flows and dam spills (seasonal high flow, variability, first flush) if combined with Option 1. Focus on the 'unfilled space' i.e. what will be operating protocols during dam spills and drought, and whether appropriate environmental flow rules is reinstated for Coombing Cr. Possibly a cumulative moderate/major impact on environment, especially on low flows and cease to flow, if combined with Options 1 and 3. Also depends on the location and volume of water to be piped to these townships and interactions between surface and ground water resources in these regions. Will require hydrological modelling to determine specific impacts. Extraction of groundwater from borefields especially during dry periods is likely to exacerbate already over-extracted aquifers and needs to consider the long term impact on groundwater recharge and first flush for Balubula River (Ecological) and Lachlan River (Options 1, 2 and 3 are combined (cumulative)). This could be lessened by implementation of Managed Aquifer Recharge and water reuse/conservation measures by townships. Additional negative impacts on culturally significant water-dependent sites.
Maintaining and diversifying water supplies	Option 4	Expansion to the piped town water supply system	Minor / Moderate impact	-1	Yes	Option 8 in combination with Options 1, 2, 3 and 4 requires cumulative impacts to be assessed, especially during dry to very dry resource availability scenarios and in the context of long-term projections of regional growth (population and critical water need industries such as abattoirs and mining). Whilst this option may improve water security for towns, our concern is that growing demand by industry and population growth will take more and more water from the Lachlan as option 8, ultimately putting stress on the system that is not sustainable and in combination with Water Mgt Act 'critical human needs' definition - can lead to tipping points being exceeded and resource compromised to extent will also impact on communities/towns/industry as well as environment.
Maintaining and diversifying water supplies	Option 5	Replacement and upgrade of existing pipelines	Minor / Moderate impact	-1	Yes	Transferring water out of the catchment via pipes removes water from the system that otherwise would have been supporting water dependent species. Also a risk of inter-basin transfers of organisms (relatively minor issue in MDB).
Maintaining and diversifying water supplies	Option 6	Inter-regional connections project investigation	Minor / Moderate impact	-1	Yes	The removal of some surface water during times when there are good flows and storing it underground, is a better alternative to enlarging weirs to long as transitory rules are followed to ensure that freshes and floods are not lost. Recharge from stormwater will have less environmental impact than extracting water from the river. MAR should be beneficial to the river ecosystem because it reduces river regulation (i.e. potential to increase flow variability) and should reduce pressure on low flows during droughts. Could reduce impact of option 4 on over extracted groundwater.
Maintaining and diversifying water supplies	Option 7	Water quality treatment works	No/ little change	0		
Maintaining and diversifying water supplies	Option 8	Managed aquifer recharge investigation and policy	Minor / Moderate improvement	1	Yes	Re-using wastewater is a great option to reduce extraction pressure on surface water flows and reduce the need for additional infrastructure works (such as pipelines and dams). However stormwater harvesting impacts on local waterways and their environmental and cultural values to be assessed (e.g. Golden Creek in Drangell). Should be Tier 1 - do review and assessment to identify and quantify 'the need' and assess sustainable limits to growth. Groundwater systems are already over/extracted. Best if followed through option 8.
Maintaining and diversifying water supplies	Option 9	Reuse, recycle and stormwater projects	Minor / Moderate improvement	1	Yes	Large benefits for aquatic biota in river between Wyangala and Forbes effects of CWP already modelled. Moderate to major improvement depending on suite of measures included in package.
Maintaining and diversifying water supplies	Option 10	Reliable access to groundwater by towns	Major / Extreme improvement	2	Yes	Would need to see details to provide greater comment on level of improvement could potentially be major improvement if widely taken up. Projects which address fish obstructions will have a significant impact on fish migration and recruitment but the strategy needs to be implemented in a systematic way and to be effective. This is already being investigated in the Northern Basin and is a project that should be implemented across the state. Benefits community and the environment and could also contribute to cultural outcomes (depending on location and how implemented).
Protecting and enhancing natural systems	Option 11	Cold water pollution mitigation measures	Major / Extreme improvement	2	Yes	We are in significant need of a floodplain management plan for the Lachlan to guide works. Floodplain flows are critical for waterbirds and floodplain wetland vegetation, connecting these habitats to the river and supporting ecosystem functions (such as sediment and nutrient transport), as well as groundwater recharge in some locations. Frequent overland flows will reduce the risk of severe hypoxic, blackwater events. Strategy urgently needed to prevent out of control floodplain harvesting (note that storage volumes of structures need to be estimated scientifically, rather than by misleading self-reporting).
Protecting and enhancing natural systems	Option 12	Environmental restoration works	Major / Extreme improvement	2	Yes	Should reduce fish mortality significantly. There should be some monitoring of the effectiveness of screens. Will improve environmental awareness and appreciation. Could have a large benefit if carried out in combination with other options to support First Nation participation in water management.
Protecting and enhancing natural systems	Option 13	Improved management of wetlands on private land	Minor / Moderate improvement	1		Option 2 would severely impact on Murrie Lake, Easabalong Lagoon, Lake Wilpinas, to Lake Pimparru Creek and Willandra Lakes as all high commence to fill and long duration floodplain wetlands (and some very high volumes to fill) dependent upon airspace and dam spills.
Protecting and enhancing natural systems	Option 14	NSW Fish Passage Strategy	Major / Extreme improvement	2	Yes	Again, should be part of Tier 1 suite of options (reviews and quantify need and risks, improved information and modelling) before infrastructure-based Tier 2 type projects (e.g. Options 1 to 6).
Protecting and enhancing natural systems	Option 15	Active management of flows	Minor / Moderate improvement	1		Groundwater is already over allocated and extracted in the Lachlan. Sustainable access will need to be looking to scale back extractions, certainly not increasing access.
Protecting and enhancing natural systems	Option 16	Water quality restoration works	Minor / Moderate improvement	1		Option 22: Sustainable access to groundwater by all users.
Protecting and enhancing natural systems	Option 17	Floodplain management works	Minor / Moderate improvement	1		Option 23: Improved transparency and certainty in managing groundwater resources sustainably.
Protecting and enhancing natural systems	Option 18	Diversion screens to prevent fish extraction at pump offtakes	Minor / Moderate improvement	1		
Protecting and enhancing natural systems	Option 19	River Ranger Program	Minor / Moderate improvement	1		
Protecting and enhancing natural systems	Option 20	Secure flows for water-dependent cultural sites	Major / Extreme improvement	2	Yes	
Protecting and enhancing natural systems	Option 21	Improved understanding of groundwater processes	Major / Extreme improvement	2	Yes	
Protecting and enhancing natural systems	Option 22	Sustainable access to groundwater	Minor / Moderate improvement	1		
Protecting and enhancing natural systems	Option 23	Improved clarity in managing groundwater sustainably	Minor / Moderate improvement	1		
Supporting water use and delivery efficiency and water conservation	Option 24	Water efficiency projects (towns and industries)	Minor / Moderate improvement	1		
Supporting water use and delivery efficiency and water conservation	Option 25	Lower Lachlan efficiency measures	Minor / Moderate impact	-1		The volumes allocated to replenishment flows (environmental objectives as well as S&O) under the WSP were compensation for the 1961-1974 dam upgrades and should be retained for the environment. The lower Lachlan effluent creeks contain the majority of DWA wetlands including Booliggi Wetlands. As the replenishment flows are an environmental allowance in terms of extent under WSP, the environment relies on those base replenishment flows to piggy back on to target and meet the EWR of a number of unique DWA (nationally significant wetlands) e.g. Lake Tarong and Murrumbidgee (Swamp)/Lake Merrimajool which are large wetlands at the end of the creek systems. For example, Lake Tarong requires an additional 12 to 15 GL to fill and up to 2 months to travel from Cuba Dam to Tarong. The 9 GL replenishment flows in the Murrumbidgee enable us to target Murrumbidgee, Lake Cuba Dam and Lake Tarong for efficient volumes of additional HEW. Without that base 9 GL the environment would have to provide the full conveyance. Similarly, Merrimajool Creek supplies the Booliggi Wetlands (Top Gum, Booliggi Swamp) which in 2016 produced the largest draw-necked ibis event in Lachlan known history (over 200,000 nests and up to twice that in number of birds). The annual replenishments currently maintain the ecological character of the Booliggi Bank colonial bird breeding site e.g. Ighum doesn't like being wet too long and the annual flows have prevented Ighum encroaching into the deep water and open channels sections necessary for bird breeding.
Supporting water use and delivery efficiency and water conservation	Option 26	Mid Lachlan efficiency measures	Major / Extreme impact	-2		Risks as for Option 25. The mid Lachlan anabranches carry the majority of the flow through mid Lachlan and provide critical return flows (closed system). The Wallaroo Wallamundry has some of the best native fish habitat in the Lachlan Catchment and habitat for threatened species, including freshwater catfish, briggs, glossy black cockatoos and provides critical refuge and breeding habitat for waterbirds e.g. Magpie Geese breed at Tarnel Lagoon, cormorants and grebes along the River Red Gum (mid channel) (Gosbong and Tarabanda Creeks) and Island Creek is home to the very rare and threatened Hasley's River Snail. The Mid Lachlan is a localised flyway for migratory and resident shorebirds/waders, a particularly vulnerable group. Boodere Creek is recognised in the Ngunnagan Consultation Report and provides for cultural practices and resources.
Supporting water use and delivery efficiency and water conservation	Option 27	Improvements to the storage effectiveness of Lake Carlingfo	Minor / Moderate impact	-1		Option requires a detailed assessment of design and operational rules. We have evidence to demonstrate that LC functions as both a nursery and a refuge for fish and birds and presumably any dividing measures would mean either reduced access and connectivity available for birds. Water levels in the lake fluctuate over the season and between years depending on RAS. Large portions already dry out under current operations and provide drying-wetting nutrient driven productivity, and the areas will only be grazed if not utilised as storage. The value of LC system is that a number of different, complex habitats types are currently connected with the Flowsways allocated for the inlet and outlet regulation. Recent fish monitoring has highlighted its role as key off channel nursery ground for threatened fish species (freshwater catfish, Murray Cod, Golden Perch) and additional monitoring is in place (FishOn for genetic studies) to understand if Golden Perch are breeding in the lake (no evidence of them breeding naturally elsewhere in Lachlan). In summary, high environmental impact by interfering with migration and dispersal of fish, and isolating critical habitats for native fish, waterbirds and other biota (turtles, shrimp, etc.) of high cultural value as well. For more detail is needed in this proposal (e.g. operational management).
Supporting water use and delivery efficiency and water conservation	Option 28	Review of water trade in the Lachlan region	No/ little change	0		
Supporting water use and delivery efficiency and water conservation	Option 29	Water pricing pilot study	No/ little change	0		
Supporting water use and delivery efficiency and water conservation	Option 30	Urban water restriction policy	No/ little change	0		

Supporting water use and delivery efficiency and water conservation	Option 31	The 'Sheet of Water' storage	Minor / Moderate impact	-1	
Strengthening community preparedness for climate extremes	Option 32	Efficiency for drought security program	Minor / Moderate impact	-1	
Strengthening community preparedness for climate extremes	Option 33	Drought operation rules	Major / Extreme impact	-2	
Strengthening community preparedness for climate extremes	Option 34	Review of water accounting and allocation process	Minor / Moderate improvement	1	
Strengthening community preparedness for climate extremes	Option 35	Investigation of licence conversions	Minor / Moderate improvement	1	
Strengthening community preparedness for climate extremes	Option 36	Improved data collection and storage	Minor / Moderate improvement	1	
Strengthening community preparedness for climate extremes	Option 37	Training and information sharing programs: - new climate data/modelling - managing groundwater resources sustainably	No/Title change	0	
Strengthening community preparedness for climate extremes	Option 38	Investigation to maintain amenity for regional towns during drought	Minor / Moderate impact	-1	
Strengthening community preparedness for climate extremes	Option 39	In-stream storage for the Lower Lachlan	Major / Extreme impact	-2	Yes
Strengthening community preparedness for climate extremes	Option 40	Land use change impact on water resources		NA	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 41	Culturally appropriate water knowledge program	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 42	Water-dependent cultural practice and site identification project	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 43	Shared benefit project (environment and cultural outcomes)	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 44	Aboriginal cultural water access licence review	Major / Extreme improvement	2	Yes
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 45	Water portfolio project for Aboriginal communities	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 46	Co-management investigation of Travelling Stock Reserves	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 47	Regional Aboriginal Water Advisory Committee	Minor / Moderate improvement	1	
Improving the recognition of Aboriginal people's water rights, interests and access to water	Option 48	Regional Cultural Water Officer employment program	No/Title change	0	
Maintaining and diversifying water supplies	Options 1, 3 & 4	Combined options - Water transfer pipeline between Lake Rowlands and Crooke Dam, Lake Rowlands augmentation, and Expansion to the closed reservoir at Crooke Dam	Major / Extreme impact	-2	

As with most options, it depends on how the proposal is implemented and operational rules. Potentially efficiency and environmental gains if bypass only activated during Very Dry and Dry RAS allowing for a drying down phase (restore more natural wetting and drying cycles to the system). Then reactivate system and shut down bypass in medium to wet RAS for environmental benefits. However, this would depend on land management as Sheet of Water is private land on the water front so will and has been heavily grazed in the past which would limit the environmental benefit. Combine with Option 13: Sheet of Water also provides relatively shallow open water habitat for a range of species, and requires fish surveys to confirm its role within the Lake Cargelligo nursery ground system, and with the FishWay already allocated against the LC list, this option could have negative environmental impacts as well. More information required.

There is insufficient information on proposed measures and how this will impact on the environment. Whilst main benefits will go to industry and towns, measures could reduce pressure on environment during droughts, and maintain integrity of FWS. This may have a significant impact if it involves disconnecting parts of the river system. Rules need to ensure that environment is not sacrificed. Current drought has shown that biota that require permanent water have been severely impacted and existence of some species threatened very important for security of town supply

Would influence how water is used in the catchment and should be assessed against relevant EWRs in the LTWP

Option 37-Education and capacity building program
Option 38-Investigation to maintain amenity for regional towns during drought

Tonganny Weir currently fulfils this role for upstream wetlands so would like to see Tonganny retained or considered for automation and upgrade as well as part of this discussion. Otherwise, proposal is for new structure at Whealbah solely to improve irrigation delivery and this could be done by operational rule changes e.g. imposing a incentives change irrigator behaviour in relation to current no penalty rainfall rejection (no caprol order anytime and not be debited unless environment who is held to the lead time). Potential impacts to riparian environment upstream from weir pool effects, risks to downstream water quality as weir pools associated with BGA and stratification (low DO), and impact on variability and low flow in river channel below without any clear improvement in capacity to deliver environmental water to lower Lachlan wetlands.

Unclear what the effects on water use and the environment might be

Option 40-Culturally appropriate water knowledge program

Unclear what the effects on water use and the environment might be

Option 41-Water dependent cultural practice and site identification

Unclear what the effects on water use and the environment might be

Option 42-Shared benefit project (environment and cultural outcomes)

Unclear what the effects on water use and the environment might be as no new water - redistribution of existing water security so impact on other users needs to be assessed and likely use of CCA.

Option 43-Aboriginal cultural water access licence review

Unclear what the effects on water use and the environment might be

Option 44-Water portfolio project for Aboriginal communities

Unclear what the effects on water use and the environment might be

Option 45-Co-management investigation of Travelling Stock Reserves

Unclear what the effects on water use and the environment might be

Option 46-Regional Aboriginal water advisory committee

Unclear what the effects on water use and the environment might be

Option 47-Regional cultural water officer employment program

Combining options 1, 3 and 4 would increase the pressure on stored water and potentially cause major impacts on Crooking Creek from reduced flow.

Yes

No

Possibly

Insufficient information

Insufficient knowledge

Hydrological/Ecological change category	Estimated percentage change in hydrology / ecology	Long list score
Major / Extreme impact	more than 20% change in a negative direction	-2
Minor / Moderate impact	3-20% change in negative direction	-1
No/little change	Less than 3 % change in any direction	0
Minor / Moderate improvement	3-20% change in a positive direction (i.e. >3%)	1
Major / Extreme improvement	More than 20% change in a positive direction (i.e. >20%)	2
Insufficient information to assess Insufficient knowledge (cultural)		NA

Change category	Estimated percentage change in hydrology / ecology
Major / Extreme impact	More than 30% change in a negative direction (i.e. < -30%)
Major / Extreme impact	More than 20% change in a negative direction (i.e. < -20%)
Minor / Moderate impact	More than 10% change in a negative direction (i.e. < -10%)
Minor / Moderate impact	More than 3% change in negative direction (i.e. < -3%)
No / little change	Less than 3 % change in a negative direction (i.e.< 0%)
No / little change	0%, rounded to the nearest whole percentage point
No / little change	Less than 3% change in a positive direction (>0% and <3%)
Minor / Moderate improvement	More than 3% change in a positive direction (i.e. >3%)
Minor / Moderate improvement	More than 10% change in a positive direction (i.e. >10%)
Major / Extreme improvement	More than 20% change in a positive direction (i.e. >20%)
Major / Extreme improvement	More than 30% change in a positive direction (i.e. >30%)