Australian freshwater study

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The Ian Potter Foundation

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Outline

This paper provides an overview of water governance issues related to the sustainable management of fresh water resources in Australia. It is one of six papers produced for the Ian Potter and Myer Foundations' Australian Freshwater Study.

About the Australian Freshwater Study

The Ian Potter Foundation and The Myer Foundation have funded a study of major issues affecting Australia's freshwater systems. The Foundations want to better understand the ways philanthropic investment might catalyse changes to the management of Australia's freshwater resources that will protect their ecological integrity, make access to them more equitable, and ensure Australia's long-term water security.

The consulting firms Point Advisory and Alluvium have been commissioned to undertake the study and have prepared a set of short issues papers covering water governance, economics, freshwater ecosystems, First Peoples' water rights, and social values. The issues papers are the first step in the project. They provide a "long list" of major issues facing the management of fresh water in Australia as well as a general indication of options for philanthropic intervention. In parallel, Point Advisory and Alluvium are working on identifying more detailed options for philanthropy to intervene to catalyse change. Both work streams will be consolidated into a final report that matches issues with options and recommends a short list of specific future interventions to the Foundations for more detailed review.

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Image credit: Scott Kelly/NASA, taken 12 October 2015, photo of Australia taken from the International Space Station "#EarthArt A single pass over the #Australian continent. Picture 15 of 17. #YearInSpace". posted to Twitter <https://twitter.com/StationCDRKelly>, accessed via <https://www.flickr.com/photos/nasa2explore/22208561922/in/album-72157659515819800/>

Acknowledgement of First Peoples and Country

We acknowledge Australia's First Peoples and pay respect to the past, present and future Elders of Australia's First Peoples' communities. We honour the deep spiritual, cultural and customary connections of Australia's First Peoples to their lands and waters.

What is Water Governance?

The OECD defines water governance as the *'range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision makers are held accountable for water management'* [1]. Thus, water governance addresses the role of institutions and relationships between organisations and social groups involved in water decision-making.

Further, the OECD notes that: '*Policy responses to water challenges will only be viable if they are coherent and integrated; if stakeholders are properly engaged; if well-designed regulatory frameworks are in place; if there is adequate and accessible information; and if there is sufficient capacity, integrity and transparency.'*

Principles of water governance

The OECD [1] has provided 12 principles that should be addressed by governments to design and implement efficient, effective and inclusive water policies. These are:

- **Principle 1:** Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities
- **Principle 2:** Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales
- **Principle 3:** Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use
- **Principle 4:** Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties
- **Principle 5:** Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy
- **Principle 6:** Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner
- **Principle 7:** Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest
- **Principle 8:** Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders
- **Principle 9:** Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making
- **Principle 10:** Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation
- **Principle 11:** Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations
- **Principle 12:** Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed.

Strategic basin water resources planning

An important component of the practical implementation of water governance policy is through integrated water resource management plans (WRP). These WRPs are strategic plans that are used to manage a basin's water resources and their users in order to identify and satisfy social, cultural, economic and environmental priorities.

UNESCO [2] has provided 10 golden rules that need to be addressed in developing strategic water resource plans:

- **Rule 1:** Develop a comprehensive understanding of the entire system
- **Rule 2:** Plan and act, even without full knowledge
- **Rule 3:** Prioritize issues for current attention, and adopt a phased and iterative approach to the achievement of long-term goals
- **Rule 4:** Enable adaptation to changing circumstances
- **Rule 5:** Accept that basin planning is an inherently iterative and chaotic process.

- **Rule 6:** Develop relevant and consistent thematic plans
- **Rule 7:** Address issues at the appropriate scale by nesting local plans under the basin plan
- **Rule 8:** Engage stakeholders with a view to strengthening institutional relationships
- **Rule 9:** Focus on implementation of the basin plan throughout
- **Rule 10:** Select the planning approach and methods to suit the basin needs.

Murray-Darling Basin

Water Resource Plans will be an integral part of implementing the Murray-Darling Basin Plan. These WRPs will indicate how each region aims to achieve community, environmental, economic and cultural outcomes and ensure that state water management rules meet the Basin Plan objectives. They will set new rules on how much water can be taken from the system, and ensure the sustainable diversion limit is not exceeded over time.

Jurisdictions are currently preparing WRP for 14 surface water regions (catchments) and 11 groundwater regions [3]. These need to be completed by June 2019.

The Murray-Darling Basin WRPs will address:

- Compliance with the SDL and water trade rules
- Protection of water for the environment
- Water quality and salinity objectives
- Aboriginal values and uses
- Measuring and monitoring
- Arrangements for extreme weather events.

Context

Water governance in Australia has undergone significant developments from pre-European Indigenous water governance, through colonial and state government-led water resource development, to a post-1994 focus on improving transparency, governance and adaptability of water resources management. First Peoples' governance of water is not widely understood and Aboriginal and Torres Strait Islander people currently have limited influence on policy and management. Contemporary governance of freshwater in Australia reflects the multiple and often conflicting values of society and the tensions inherent in the distribution of a finite resource. The need to consider these conflicting values and tensions means that outcomes are often suboptimal against any specific value.

As discussed in the ***Overview Paper***, Australian water governance has been a political issue since the late 19th century, leading to references in the constitution as part of the federation of Australia in 1901 [1]. Australian water resources governance has been subject to significant influence by vested interests, usually aimed towards government investment in infrastructure whose cost is not recovered from users. Rural water resources governance has been strongly influenced by farming (usually irrigation) interests. This is a natural consequence of the democratic process but has led in part to economic activity being strongly dependent on government investment. In addition, it has led to uneven stakeholder influence. Some stakeholders are able to exert a high degree of influence, others have difficulty exerting influence or even gaining entry to the debate.

Water reforms over the past three decades, including COAG (1994), the National Water initiative (NWI, 2004), the Commonwealth Water Act (2007) [2] and the Murray-Darling Basin Plan, [3] have brought significant improvements in transparency, cost recovery, recognition of multiple values and stakeholders, as well as in governance. Both surface and groundwater resources are now subject to system assessment, planning, consultation and clear frameworks for distributing, sharing and reallocating water, in response to its varying annual availability. It is therefore clear that the management of water resources in Australia is much improved over what it was in the 1990's. However, full clarity and full stability have not proved achievable to date, as was shown during the Millennium Drought, when economic and political pressures influenced institutions and their capacity to participate in river basin planning and management.

Issues identified

Since 1994 much has been achieved in water reform throughout Australia. This review has identified a number of key issues that need to be addressed to ensure this reform agenda is continued. At a high level there is a need for a new strategic long-term sustainable national water management strategy (or perhaps an updated NWI); better linking of water management with catchment and land management; and the establishment of an independent statutory authority to oversee the effective implementation of this long-term water strategy. An additional six issues have been identified that if successfully addressed will enhance specific deficiencies in current water management in Australia.

These issues identified and further expanded in this paper are:

1. Australia needs a strategic long-term sustainable national water management strategy that includes a clear articulation of environmental, social, cultural and economic costs, benefits and trade-offs. This strategy needs to be implemented across all jurisdictions.
2. Water management strategies must be better linked to catchment and land management strategies.
3. Australia needs an independent statutory authority to oversee the effective implementation of a long-term sustainable water (and linked catchment) management strategy.
4. Water policy and management agencies must go beyond particular interest groups and market values in their planning and management.
5. First Peoples must be given greater involvement in water policy and management.
6. Urban water management agencies must place greater emphasis on developing adaptation strategies to address future population growth and climate change.
7. Rural water management agencies must develop comprehensive adaptation strategies to address future climate change impacts on environmental assets and irrigated and dryland agriculture.
8. Improved research, monitoring and assessment programs are essential to provide decision-makers with better information and help assess the effectiveness of water management at appropriate spatial and temporal scales.
9. The regulation, compliance and enforcement of existing water policy, regulations and laws must be improved.

The opportunities for philanthropic organisations to assist in addressing these issues are highlighted.

1 Australia needs a strategic long-term sustainable national water management strategy that includes a clear articulation of environmental, social, cultural and economic costs, benefits and trade-offs. This strategy needs to be implemented across all jurisdictions.

Australia has a National Water Initiative (NWI) but this needs to be updated to provide an authentic and legitimate multi-decadal national water strategy that is also linked with a national climate strategy and a national water research strategy. It is crucial that Australia has such long-term strategies for managing our water resources, given our dry and highly variable climate, and the importance of water to our environment, economy and to urban and rural communities.

Over the past two decades, the Australian and state/territory governments have increasingly recognised the environmental, economic and social importance of water to the Australian economy, and the exposure to risk due to climate change. This awareness lead in 2004 to the establishment of the National Water Initiative (NWI), a landmark initiative that established guiding principles for the effective management of Australia's water resources. [4] [5] The Productivity Commission, in its recent inquiry into National Water Reform [6] found that "the NWI remains nationally relevant and the principles it contains are sound" and that "there has generally been good progress by States and Territories in implementing the NWI".

However, the NWI is now 14 years old, and was negotiated at a time when the focus was squarely on the over-allocation of water for consumptive purposes in the Murray-Darling Basin and was aimed squarely on improving current (at that time) water management. However, there remains unfinished business in some jurisdictions to fully implement entitlement and planning reforms and economic regulations. [7] Additionally, the risks from

future climate change and population growth, have become much more obvious and urgent, and need to be better incorporated into a national water strategy. The Productivity Commission also noted in its recent inquiry that "Australia needs a new phase of water reform". [6] Importantly, the NWI has "unfinished business" and current Commonwealth, state and territory government policy suggests that there may now be a risk of "erosion of hard-won reforms through backsliding". [6]

The current lack of long-term planning combined with the lack of regular updating and revision of water strategy exposes Australia to many risks. A short-term, political focus on water does not foster the much-needed assessment of long-term risks, scanning of new evidence and questioning of assumptions.

What can be done

A consolidated, long-term sustainable water strategy would support Australia's readiness for a significantly different climate over the next 50 years and would assist in ensuring Australia's resilience to this and other risks. These issues are not adequately captured and addressed within shorter water planning timeframes.

Australia does have an existing national water strategy – the NWI – but this needs to be updated. In 2017, the Productivity Commission flagged several reform priorities that should be incorporated into a renewed NWI by 2020, including: the water needs of Indigenous Australians; and significantly enhanced national policy settings in urban water management, environmental water management and new infrastructure. [6] Additionally, any new sustainable water strategy must also include a water quality management strategy; this is missing from the current NWI. These are further discussed in the issues below.

To achieve such a long-term water strategy (perhaps a renewed NWI) will require the commitment of the Australian and all jurisdictional governments. The consequences of not acting will be as the Productivity Commission states: *'Failure to act now risks the gains made to date and means opportunities for greater efficiency, improved liveability and more sustainable environments would be lost.'* [6]

Additionally, given the uncertainties surrounding future pressures, such as climate change, and the response of freshwater ecosystems to these changes, there must be increased focus on understanding the adaptive management of these ecosystems [8] [9] and the need to increase the adaptive capacity of all water users and government water agencies (see also Issue 7). This need for increased focus on adaptation will be greatest in the southern parts of Australia, where it is predicted that this dry part of the climate will get even drier. The environmental, social and cultural costs of over-use of water also need to be articulated more clearly and included in public debate. [10] [11]

Philanthropic organisations could play an important role in public advocacy and lobbying governments to establish a new or updated long-term national sustainable water strategy. To be enduring, this strategy needs to have bipartisan support of the political parties. Philanthropic organisations could also support independent research and practical demonstration projects to showcase more sustainable lifestyles and farming methods suitable to Australian conditions in a changing climate.

Philanthropic organisations could also highlight the increased need for improved information on the potential future changes in climate and the impacts these changes will have on particular geographic regions, waterways and land uses. Also important will be the identification of possible adaptation processes that may be useful in particular regions, and equally important, understanding where adaptation may not be possible, and what the consequences are if that was the case.

2 Water management strategies must be better linked to catchment and land management strategies

The management of water throughout most of Australia typically occurs in isolation from the management of land and catchments, despite it being well known that what goes on in the catchment can have a major impact on both the quantity and quality of water resources and on freshwater ecosystems.

Integrated catchment management (ICM or integrated natural resource management) has a chequered history in Australia. [12] Victoria has the most extensive ICM framework, which has been in existence for over 20 years since the establishment of the *Catchment and Land Protection Act 1994* (the CaLP Act). [13] A number of other jurisdictions have natural resources management groups, but these generally do not have a statuary base and are poorly funded. [14]

ICM is the coordinated and sustainable management of land, water and biodiversity resources based on catchment regions. ICM incorporates environmental, economic, social and cultural considerations, and seeks to ensure the long-term viability of natural resource systems, and human needs for both current and future generations. However, environmental, social and cultural considerations are difficult to quantify and are often under-represented and under-valued in cost-benefit trade-offs, resulting in greater weight given to economic values.

In Victoria, the ten Catchment Management Authorities (CMA) are involved in the delivery of environmental water in addition to their responsibilities for land and biodiversity management. [15] The CMAs are also responsible for the management of waterway health. They are the "champions" of the waterways and speak on behalf of the waterways in the overall management of the states' water resources.

Unfortunately, this is not the case in other jurisdictions. Generally, water, waterways and catchment (land and biodiversity) management are the responsibility of separate agencies, with a major power imbalance between the water supply agencies and those responsible for maintaining the ecological health of waterways. Regrettably, the Commonwealth *Water Act 2007* and the 2012 *Murray-Darling Basin Plan* are also only focused on the water resource and not linked closely to the sustainable management of the land and catchments.

The need to coordinate the management of land, water and biodiversity is well known, with some of the reasons being:

- land management (such as agricultural, forestry and bushfire management) can influence the quantity and quality of water reaching waterways, for example. forested areas produce less (but better quality) runoff than cleared areas
- farm dams, river regulation, water diversions and floodplain levees affect the natural water regime (flow quantity, quality, seasonality, frequency, variation and duration), impacting life-cycles and recruitment of riparian-dependent species
- the effectiveness of the management of land (and particularly urban and agricultural land) can significantly influence the quality of waterways and wetlands – catchment runoff can have elevated levels of salinity, turbidity, nutrients, pesticides and pathogens [16]
- Management of the riparian (bankside) vegetation is also important for the protection of bank stability and in-stream habitat (particularly logs) and the filtration of run-off entering waterways.

What can be done

Only Victoria has governance arrangements linking waterway management and catchment management. The other Australian jurisdictions and the Commonwealth (through the Water Act [2] and the Murray-Darling Basin Plan, [3] also need to more closely link water resources management and integrated catchment management.

Philanthropic organisations could play a role in facilitating this process by show-casing examples of effectively linked catchment and water management, and in developing an understanding of why states other than Victoria have not adopted such governance arrangements. This could also include facilitating lobbying efforts to ensure appropriate legislative changes are made in the future.

3 Australia needs an independent statutory authority to oversee the effective implementation of a long-term sustainable water and catchment management strategy

Since the abolition of the National Water Commission in 2014, Australia has no overall independent statutory authority responsible for reviewing and auditing state and federal water management frameworks and practices.

The Commonwealth government established the National Water Commission (NWC) in 2004 as an independent statutory authority responsible for monitoring, auditing and assessing progress in implementing the National Water Initiative (NWI) throughout Australia. In the period until its abolition, the NWC published many reports on progress by the jurisdictions in implementing the NWI. [17] This evidence-based, independent advice was provided to the Council of Australian Governments (COAG), the Australian government and the Australian community. The NWC also had responsibility for reviewing the implementation of the Murray-Darling Basin Plan, which commenced in 2012. [3] This review process is now the responsibility of the Productivity Commission. [18]

The political influence and uneven power dynamics over water management described in the *Overview paper*, are real since all government agencies, regulators and information providers can be directed by the Minister of the day.

Clearly, in a democracy key elements of policy can be expected to be under direction of the government of the day. These include legislation, implementation of policy, regulation and expenditure of funds allocated by parliament. However, governance, probity and effectiveness of long-term strategy implementation are best supported by "arms-length" separation of planning, management and implementation from the Minister and government(s) of the day.

The water resource institutions currently established to manage water (e.g. the Murray Darling Basin Authority (MDBA), Commonwealth and state agencies, urban water utilities, rural water agencies) can be limited in their long-term strategic planning potential by the short-term interests of a Minister or a board appointed by state and Commonwealth interests. Perceived and actual differences in the ability of groups with a strong interest in water management to access Ministers and other key decision-makers increases the conflicts associated with both short- and long-term water management (see Issue 4 below).

In a recent paper, Ken Matthews has discussed some of the issues associated with Ministerial decision-making, particularly when the Minister is not interested in science and other advice, or even dismissive of it. [19] He argues that "we need decision-making machinery that is more constraining of political choices and therefore provides more certainty of rational, reasonable, science-informed outcomes." His solution is to add decision-making criteria into legislation and binding policies, to ensure that "the professional advice and assessments provided to the Minister are required to be published, and […] published before the minister decides."

What can be done

Australia is now without a national independent statutory authority with responsibility for reviewing and auditing state and Commonwealth water management frameworks and practices. The establishment of such a body is urgently needed to provide public confidence that a recommended long-term national sustainable water (and linked catchment) strategy is being adequately implemented.

While the Productivity Commission has responsibility for independently reviewing the implementation of the Murray-Darling Basin Plan, there is no independent organisation responsible for reviewing other water management practices.

Additionally, there is a need to strengthen the decision-making processes in water management such that the "political" judgements ultimately made by Ministers must take into consideration scientific and other advice, with this advice available to the community before decisions are made.

Philanthropic organisations could play an important role, through public advocacy and perhaps also seed funding, in getting a national independent statutory water authority re-established, and in strengthening decision-making processes in water management.

4 Water policy and management agencies must go beyond particular interest groups and market values in their planning and management

Current Australian water agencies do not adequately include some important stakeholders who feel disempowered because of skewed power dynamics and difficulties in accessing and understanding highly technical information. First Peoples, as well as advocates for broader social and ecological values, need to be included in water planning and decision-making.

Effective water resource management must balance the needs of a wide range of stakeholders. And this can only occur if these stakeholders are adequately involved in the decision-making processes, and consultations are specifically designed to increase stakeholder trust. The research literature suggests that perceived discrimination, powerlessness and exclusion tend to diminish trust. [11] [20] [19]

Water resources policy and management is highly technical, specialised and complex. In practice this leads to different interest groups having an uneven ability to access, understand and use information and data. For example, irrigation industry stakeholders and their representative associations have sufficient funds and technical skills to be able to routinely process the complex technical information and to effectively lobby political decision-makers. Others, such as First Peoples are generally less well funded and often lack the technical skills required to allow them to exercise comparable influence. There is still much to be done to provide programs that could build capacity and assist non-technical stakeholders to better understand the issues being discussed.

Additionally, in the creation of the current market-based system there was an allocation of water entitlements (water rights) that could be perceived as creating windfall gains for certain interest groups (e.g. irrigators) and a barrier to entry for other interests. The property-based system of water entitlements protected the interests of one interest group, but now only allows other parties to enter if they have the money to buy these entitlements—such as the Commonwealth Environmental Water Holder. Both First Peoples' and the environment have been disadvantaged by the way the current system was initially established.

As noted above, power dynamics in Australian water resources management can be skewed. Irrigator lobby groups are arguably very influential in rural and agro-politics and have the advantage of the specialised technical and policy knowledge of their stakeholder base. During the early consultation on the Murray-Darling Basin Plan these stakeholder groups demonstrated their ability to rally considerable numbers to consultation meetings and to gain media exposure. [21] In rural communities, local environment groups, floodplain graziers and Aboriginal communities struggle to get the influence and political attention afforded to the irrigation industry and its dependent towns and other industries.

Institutional structures and their engagement methods often perpetuate these power dynamics. For example, rural water management agencies are established to serve the interests of their customers, largely the irrigation community. And while their engagement with their customer base through regional committees (e.g. Water NSW Customer Service Committees) is generally good, engagement with environmental groups and First Peoples' who do not hold water entitlements is poor. Recent restructures have also reduced the capability and corporate memory of many government water agencies, leading at times to an imbalance of knowledge between policy/regulatory agencies and industry. [22]

More recently, environmental water holders (for example, the Commonwealth Environmental Water Holder (CEWH) and the Victorian Environmental Water Holder (VEWH)), and in Victoria, the Catchment Management Authorities, are becoming increasingly better linked to other interests. Environmental groups have, at times, been influential in water politics, for example in the 1990s reforms. However, more recently the environmental management of freshwater resources has not attracted the same focus from the environmental movement as forestry, climate change, coal-seam gas and the Great Barrier Reef.

Historically, First Peoples' have been largely excluded from the allocation of water rights, and from the development of water resources policy and management in Australia. This is a key governance issue that is discussed further in Issue 5 below.

The question of whether largely single-interest rural water agencies are still relevant in the contemporary management of water resources has not yet been widely debated. A more effective model may be for these existing agencies to take on responsibility for environmental watering in addition to irrigation water supply, or for new regional water authorities to be established with responsibility for all water uses (e.g. was for towns, irrigation, industry and the environment).

What can be done

Non-government and/or philanthropic organisations could play an important role in this issue by funding the establishment of specialist capability and knowledge to support marginalised interests to engage in water policy and management debates, and to participate in the water market (see also Issue 5). They could also help to build capacity and skill up groups and individuals to be more active in their communities.

They could also support research to develop techniques for more equitable evaluation of environmental, social and cultural costs and benefits, to be used in evaluations of the benefits and impacts (costs) of implementing water management strategies.

Philanthropic organisation may also wish to facilitate a process to assess whether there are more equitable models for rural water agencies that allows for a more coordinated management of consumptive and environmental water in the regions, and perhaps also includes other aspects of waterways management.

5 First Peoples' must be given greater involvement in water resources policy and management

First Peoples' communities need to be provided with the rights, access, engagement and capacity building to ensure their genuine involvement in water resources management in Australia. Currently, First Peoples are largely without any water entitlements to be used for economic, environmental or cultural purposes.

First Peoples' communities have been routinely excluded from water resources policy and management since European settlement in Australia. [23] [24] Unable to be landowners, First Peoples were also barred from the initial allocation of water rights. [25] [26] This has resulted in a major and important group of Australians being significantly disadvantaged in the management of water – for them an important economic and cultural resource. [23] [24] [31]

In recent years, there have been increased efforts to involve First Peoples' communities in the management of water across Australia. Federally, the MDBA has established two Aboriginal advisory bodies, one in the southern Basin (MLDRIN; http://www.mldrin.org.au/) and one in the northern Basin (NBAN; http://nban.org.au/). Also, in 2015 the CEWH entered an agreement with the Ngarrindjeri Regional Authority (NRA) [27] for delivery of environmental water to protect cultural values in the lower River Murray region of South Australia [28]. Recently, the Australian Government (2017) developed a module to the NWI regarding the engagement of Indigenous peoples in water planning and management. [29]

The states and territories have also been active in this area. In 2017, the Northern Territory government introduced policy to establish Strategic Aboriginal Water Reserves in most Water Allocation Plans. [30] The supporting legislation for this policy (Water Amendment (Strategic Water Reserves) Bill) is currently being drafted. [27] Additionally, there have been efforts to establish a collaborative governance framework for the Fitzroy River (Mardoowarra) in Western Australia that aims to protect the cultural and environmental values that underpin the river's National Heritage Listing. [31]

The Victorian government has introduced a new *Yarra River Protection (Willip-gin Birrarung Murron) Act 2017*, [32] and associated Yarra River Action Plan. [33], [34] This Act is an Australian first in three respects:

- it focuses on managing the Yarra River (Birrarung) and its associated public parkland and open spaces as an integrated system;
- it uses Traditional Owner language in the Act; and
- it establishes the Birrarung Council as a statutory body to provide independent advice with Traditional Owners as members of this Council. [35]

The National Cultural Flows Research Project is also of considerable importance to First Peoples. This project was completed in July 2018 and aimed to secure a future where Aboriginal water allocations are embedded within Australia's water planning and management regimes, delivering cultural, spiritual, social, environmental and economic benefit to communities in the Murray-Darling Basin and beyond. [36] Over six years, technical experts worked in collaboration with representatives from two case studies of First Nations – the Nari Nari and the Murrawarri – to develop and implement methods to describe and measure Aboriginal cultural water uses and values in quantifiable water volumes. Using established ecological and socio-cultural monitoring techniques, the project was able to demonstrate the cultural, ecological, social, and well-being outcomes of participation in a cultural flow planning process. Importantly, the project established fundamental differences between cultural and environmental flows. This project also included development of legal and policy options to underpin Aboriginal access to water rights and representation in water planning. (***see also the First Peoples' Water Rights issues paper***).

What can be done

The meaningful involvement of First Peoples' communities in water resources development in Australia is a long-term challenge requiring much greater involvements of governments and the philanthropic sector for four reasons:

- there is no agreed framework that spells out how First Peoples' communities should be involved in water resources development in Australia
- there is no consideration of the differences across First Peoples' communities in what they may wish to achieve, for example, some groups may be willing to trade water they have, while others may wish to retain this water for cultural practice [23], [37], [29], [6]
- some First Peoples' communities lack the technical and literacy skills to allow them to be fully engaged – this will require considerable capacity building to overcome
- many Australian water resource management agencies also lack the skills (and in some cases the desire) to fully engage with First Peoples' communities and genuinely involve them in water planning and management. [24]

Philanthropic organisations could assist in supporting First Peoples' wish for greater access to and involvement in water resources policy and management, and where appropriate to facilitate mechanisms and processes to achieve this outcome. Expansion of the methodologies developed in the National Cultural Flows Research Project should be supported.

Very few First Peoples' groups or organisations actually own water entitlements. To address this imbalance in the Murray-Darling Basin and other regulated systems where the available water resource is fully allocated, would require these groups purchasing (or being gifted) water entitlements. Philanthropic organisations could play a role here in providing funds to allow the purchase of water entitlements by particular First Peoples' groups.

In northern Australia, where there is still unallocated water, it would be possible for governments to grant water allocations to Aboriginal groups. Philanthropic organisations could play a role here in identifying relevant Aboriginal groups and facilitating the process of them interacting with government agencies to secure water entitlements.

6 Urban water management agencies must place greater emphasis on developing adaptation strategies to address future population growth and climate change

All Australia's major cities are experiencing substantial population growth that will likely continue into the future. This will result in major challenges for water resource management when coupled with the predicted changes in climate.

The Productivity Commission estimated that by 2050, Australia's capital cities will need to cope with an expected additional 8.3 to 13.3 million people, and an Australian population expected to be between 34.3 and 41.9 million people. [6] Additionally, climate change is predicted to lead to more variable and less rainfall, at least in the more southern cities. [38]

In the future, urban water management agencies will be challenged with providing safe and adequate drinking water and sewerage services to an increased population, and this from a diminishing water resource. The experiences of Melbourne and Adelaide during the Millennium drought (2000-2010) are illustrative of what may occur in the future without adequate planning. In 2006-2007, both cities were close to running out of water, with all major water supply dams at very low levels. At the time, state governments reacted to this crisis by deciding to build very large desalination plants to buffer the impact on city populations should this lack of rainfall occur in the future (as it most certainly will).

In addition to the desalination plants, there is now increased focus in Melbourne and Adelaide on using water efficiently, using diverse sources of water (e.g. storm water runoff, aquifer recharge), and optimising the water grid and market. [39] While these are encouraging trends, they largely focus on the "supply" side of urban water management, that is increased water supply to cope with increased water demand. There are suggestions that this approach is unsustainable, and that there needs to be greater effort on water conservation measures or "demand" management. [40]

A related issue will be the adequate protection and management of urban waterways for ecological and recreational purposes as Australian cities expand in size. [34] Currently, only Melbourne has a system where the major water utility (Melbourne Water) has responsibility for waterway health, in addition to responsibility for drinking water supply and wastewater treatment. [35] In the other capital cities, there appears to be a power imbalance between the major water utility and the managers of waterway health.

What can be done

It is vital that the major Australian urban water utilities adequately plan for a future with less traditional water sources (i.e. rainfall) and a significantly increased population. There are signs that this is happening, as illustrated by the recent strategic plan published by Melbourne Water addressing how that city plans to secure their water supply into the future. [41]

Additionally, there would be significant advantage if all major urban water utilities were also given responsibility for managing the health of the city's waterways. Both climate change and the population growth will result in major challenges to the sustainable management of urban waterways that would likely be best addressed by the major utilities rather than by local government.

Philanthropic organisations could play a role in this issue by public advocacy promoting the need for future sustainable urban water management planning in our major cities, including the need for effective mechanisms to ensure cities' waterways are adequately managed into the future. They could also showcase case studies, such as Adelaide's permeable paving and aquifer recharge systems, and support conferences, workshops or webinars to share successful technologies.

7 Rural water management agencies must develop comprehensive adaptation strategies to address future climate change impacts on environmental assets and irrigated agriculture

Future climate change predictions for Australia are of concern. They predict a hotter and drier future, which will result in significant impacts on both irrigated and dryland agriculture, and on water-dependent environmental assets (waterways, wetlands, floodplain forests).

A hotter, drier future predicted for much of southern Australia will have implications for agriculture, both dryland and irrigated agriculture, and for catchment ecological assets, such as waterways, wetland and forests. [10] The Climate Council has renewed its call for Australia to rapidly phase out the use of fossil fuels. The National Climate Change Adaptation Research Facility (NCCARF) has reviewed the possible changes and has also provided advice on possible strategies for adapting to these changes. [42] [43]

Agriculture

Overall, agricultural production levels are predicted to decline over much of southern Australia, due to more variable and lower rainfall and higher temperatures. In particular, potentially longer and more prevalent droughts will be critical disruptors of agricultural production.

These impacts may have major implications for Australia's food production. Many commodities will become more difficult and more expensive to grow, and this may result in higher food prices in cities and reduced competitiveness in overseas markets. Additionally, farmer income and welfare, and the survival of many rural communities, could be adversely affected. While those involved in irrigated agriculture may have a greater capacity to adapt to these climate change impacts, there will be major challenges in doing this given that water will become scarcer and more expensive. [10]

Freshwater ecosystems

Natural ecosystems have been identified as one of the most vulnerable sectors to climate change in Australia. [44] The potential outcomes for biodiversity and freshwater ecosystems from climate changes are complex. Higher and sometimes extreme temperatures, longer droughts, more extreme floods, the possible faster growth of some plant species (e.g. blue-green algae), and more extreme fire regimes will all influence freshwater ecosystems in the future.

Possible impacts on freshwater ecosystems from the above changes include: changes in species distribution and abundance; changes in individual species biology; changes in biotic interactions; changes in species assemblages; increased abundance of some pest species; and impacts on ecosystem services. [44]

What can be done

It is clear that climate change will result in major changes in both agriculture and freshwater ecosystems throughout most of Australia. And while adequate planning and building of additional infrastructure can minimise some of these changes, this is unlikely to be sufficient. Australian society will need to adapt to a new future.

Agriculture – The National Climate Change Adaptation Research Facility (NCCARF) identified a number of possible adaptation strategies that will be required to ensure Australia has a sustainable agricultural industry into the future. [42] These will require the industry to make significant changes to current soil and agro-ecological management in one or both of two ways: changes to business practices particularly in moving to lower water use methods, and/or changes to the location of farming businesses.

Key needs to support future adaptation, identified by include:

- education and extension, especially in the form of on-ground practitioner assistance for improved soil agro-ecological management, and maintenance of industry knowledge
- good science as a basis for policy-making, including more investment in social science research
- Improved seasonal weather predictions, at a regional and district level, rather than further downscaling of climate model outputs for the far future

- removal of subsidies for inputs (e.g. water irrigation infrastructure), development of policies for increased risk management and decision-making, and rewarding good land management (e.g. soil carbon markets), and
- policy certainty and adaptability, including monitoring and evaluation feedback loops to assess policy outcomes. [42] [45]

The development and implementation of appropriate agricultural adaptation strategies will require a sustained effort by governments, supported by agricultural sector groups.

Freshwater ecosystems – these will be affected by the inevitable general reduction in water availability, and also by changes in extreme events (e.g. longer droughts and more intense floods). NCCARF suggest that existing knowledge, skills and management principles will continue to be the core of managing freshwater ecosystems under climate change. These will include: [43]

- identifying, protecting and planning for refugia
- maintaining appropriate connectivity of habitats and landscapes
- managing and implementing biosecurity measures
- managing existing threats (e.g. feral species, disease, tree clearing) and pressures (e.g. excess sediment loads, nutrients and pesticides into waterways), and
- effective monitoring of change and timely and appropriate management responses.

In the short term, there will need to be increased focus on the adaptive management of freshwater ecosystems and a need to increase the capacity of all water users and government water agencies to adapt. [8] [9] While active adaptive management can slow or facilitate changes (e.g. species migration), current ecosystems are likely to be fundamentally changed over relative short timeframes. Thus, the adaptation challenge regarding freshwater ecosystems is that Australians will need to accept that many existing ecosystems will be altered by climate change.

The extent of these impacts needs to be more clearly described and debated. Wider community discussion is needed about the likely changes and losses, what can be done about these, and how we might need to adapt to accept these inevitable changes. Governments are commencing these discussions, as illustrated by the Queensland government's recent discussion paper on a biodiversity and ecosystem climate adaptation plan. [44]

In addition, all jurisdictions and the Commonwealth need to review the adequacy of their water resource management policies to handle the above challenges to agriculture and waterways due to climate change. As noted in Issue 2, water and catchment management are not well linked in most jurisdictions, resulting in major power imbalances between the rural water agencies and those responsible for maintaining the ecological health of waterways.

Philanthropic organisations could also play an important role in facilitating appropriate community discussions to ensure farmers, rural communities and the wider population are aware of the likely future climate, agricultural system, and water ecosystem changes and what they will mean for their communities. There is a crucial role for civil society organisations to increase awareness of how future landscapes and freshwater ecosystems will look in the face of climate change impacts. This need for increased focus on adaptation will be greatest in the southern parts of Australia.

Philanthropic organisations could play a role in facilitating processes to ensure appropriate legislative changes are made when needed in the future, perhaps through funding support for non-government organisations such as the Environmental Defenders Offices. They could also facilitate public discussion about the extent of possible changes and losses, and the impacts on communities, particularly downstream communities, which are likely to be most adversely affected; and also showcase case studies to demonstrate practical alternative livelihoods, urban design and farming methods for lowering water demand.

8 Improved research, monitoring and assessment programs are essential to provide decision-makers with better information and help them assess the effectiveness of water management at appropriate spatial and temporal scales

Australian water authorities require high quality information for decision-making and to ensure their management of surface and groundwater resources is efficient and effective. However, this information is not always available, and where it exists it is often not independently reviewed or made accessible to a wide audience.

Decision-making by Australian water authorities is complex, involving technical, environmental, economic, social and cultural information (e.g. traditional ecological knowledge and management practices). Confidence in these decisions is dependent upon the quality of the information, the transparency of the process, the availability of the data and information used, and the quality of the models used to bring together different data/information sources. Additionally, community confidence in the effectiveness of the management of water resources requires that rigorous monitoring of the water allocations (both consumptive and environmental) made by the relevant agency is undertaken and the results validated and made publicly available. [22] [45]

In general, Australia has a relatively comprehensive water information system in place. This was particularly improved as a result of the *Water Act 2007* when the Australian government provided funding for the Bureau of Meteorology (an independent organisation) to upgrade its capacity of collect and analyse water quantity and quality data from around Australia. The Bureau now compiles annual national water accounts from information provided by the states and territories. However, the reliability of these accounts is highly reliant on state government systematic data collection across all regions. This is an issue in that not all regions have adequate data coverage, as many data points have been closed down in recent years due to state budget cuts, or are short-term, where data are only collected for the duration of a project. Additionally, the Bureau does not currently assess the effectiveness of these water accounts because of a lack of funding.

Management of most of the southern Australian regulated rivers and major groundwater regions, is generally well-resourced and well monitored, with this information publicly available. However, this is not the case for the majority of river and groundwater systems in the north and central regions of the country, where there are few hydrological gauges, water meters and monitoring bores. In these cases, generally poor information is available regarding basic resource management, ecological outcomes and cultural needs.

What can be done

In most jurisdictions, improved data, information and knowledge are required to support freshwater resources decision-making and to ensure their management is efficient and effective. [20] Over the past decade or so, the ability of jurisdictions to monitor water quality, quantity and ecological health has reduced due to cuts in funding. This is a serious situation and needs to be urgently addressed.

There is also a need for a significant lift in research effort to provide information on the likely changes in freshwater ecology that will occur due to climate change in specific regions of Australia, and to also provide guidance on possible adaptation strategies to mitigate these changes.

Additionally, increased effort in freshwater ecological monitoring is required to provide Australians with confidence that these freshwater resources are being adequately managed, particularly in areas outside the major surface and groundwater regions. Recent technological developments suggest that more efficient and lower cost monitoring methods are likely to become available in the near future.

Philanthropic organisations could play a role in helping to identify technological changes that could result in more efficient and lower cost water monitoring methods; lobbying state governments to adequately fund the monitoring of essential water information; and facilitating (and possibly funding) the identification of the priority research needed to assess the likely changes in freshwater ecology due to future climate change.

9 The regulation, compliance and enforcement of water policy, regulations and law must be improved

Recent events have revealed that regulation, compliance with and enforcement of rural water management plans in some Australian jurisdiction are inadequate, leading to a lack of confidence by the community, irrigators and environmentalists in water management processes.

Recent revelations of non-compliance and lack of enforcement of illegal water extractions in NSW, showed that water regulators lack independence from political influence, and also lack adequate resourcing, regulatory tools and technology. [46], [47] Metering, measurement, accounting and audit were all found wanting and appropriate institutional separations between management and enforcement was not always in place. A small number of irrigators appear to prioritise short-term profit at the expense of compliance with the law.

The regulation, compliance with, and enforcement of rural water management plans all need to be strengthened to provide confidence to the community, irrigators and environmentalists that water extractions and use are in accordance with the relevant water resources plan.

A predictable regulatory framework and secure property rights are generally seen as fundamental to a modern market economy. However, "regulatory capture" by the agricultural industry is arguably a risk to governance integrity in any industry or sector. [48] Recent developments in Australia's banking and finance sector, previously held as a best practice model for successful regulation, show the risk is ubiquitous and requires ongoing vigilance and safeguards. There is a considerable body of literature exploring best regulatory practice.

In common with any robust market, the stakes are high. Water is money. A few hundred megalitres of water may equate to tens of millions of dollars of cotton, nuts, or indeed trade in the water itself. Without the integrity of a robust regulatory framework, there are incentives for water theft, inaccurate water accounting, and inefficient allocation of water. Water allocation decisions made routinely by the "resource manager" function in rural water agencies (and the resulting water accounting) involve highly market sensitive information and therefore pose a possible risk of conflicted commercial advantage, at best, and corrupt behaviour, at worst. Agencies have "arm's length" arrangements in place for this and are governed by a range of legislative provisions. Independent audit is made publicly available by some agencies, but not all.

What can be done

There are ongoing and systemic weaknesses in regulation, audit, compliance and enforcement in NSW water law. [46], [47] Recent, independent reviews show weaknesses perpetuated by poor resourcing, restructuring, political interference, lack of audit, lack of use of available modern technology (e.g. remote sensing of water distribution). [46] [49]

Both NSW [50] and the Murray-Darling Basin Authority [51] have recently taken steps to increase their ability to monitor and report on compliance with water resource management plans. NSW established a Natural Resources Assess Regulator in 2018 [50] to ensure compliance with water law in that state, while the MDBA has established a separate compliance section within the Authority. The compliance and enforcement of water resources management has been high profile in NSW, Victoria, Queensland, South Australia and the ACT, but not so in Western Australia, Tasmania and the Northern Territory.

While these are welcome reforms, all Australian jurisdictions need to adequately separate the water management and compliance/enforcement sections of their agencies. Ideally, a truly independent or non-government entity should be established to ensure compliance in water management is occurring throughout Australia (see also **Issue 1**).

Philanthropic organisations could play an important role here in two ways. First, by facilitating a regular independent review of the effectiveness of the Murray-Darling compliance compact; and second, by facilitating a similar independent review of the effectiveness of the compliance and enforcement of water management in the other jurisdictions outside the Murray-Darling Basin. A system of report cards similar to those produced for the Moreton Bay catchment 'Healthy Waterways' program could be developed for all Australian catchments.

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