The Australian Water Project

Volume 2

The opportunity of crisis: A water reform agenda

OCTOBER 2012

A COLLABORATION BY:

ceda
committee for economic development of australia

THE UNIVERSITY OF MELBOURNE | Uniwater | MONASH University

WITH SUPPORT FROM: MWH
BUILDING A BETTER WORLD

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Editors

Professor John Langford AM

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About this publication
Australian Water Project

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About CEDA
CEDA – the Committee for Economic Development of Australia – is a national, independent, member-based organisation providing thought leadership and policy perspectives on the economic and social issues affecting Australia.

We achieve this through a rigorous and evidence-based research agenda, and forums and events that deliver lively debate and critical perspectives.

CEDA's expanding membership includes more than 800 of Australia's leading businesses and organisations, and leaders from a wide cross-section of industries and academia. It allows us to reach major decision makers across the private and public sectors.

CEDA is an independent not-for-profit organisation, founded in 1960 by leading Australian economist Sir Douglas Copland. Our funding comes from membership fees, events, research grants and sponsorship.

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Foreword

It is with pleasure that I present the final instalment of CEDA's Australian Water Project – *The opportunity of crisis: A water reform agenda*.

This second volume follows the release of a discussion paper, *Crisis and opportunity: Lessons of Australian water reform* in November 2011. The Australian Water Project has been a joint collaboration between CEDA, Harvard University and Uniwater (a joint venture between the University of Melbourne and Monash University).

CEDA has undertaken this project because water is essential for the survival of our environment, our communities and our economy. The health of all is intrinsically linked to our ability to produce and manage clean fresh water.

This paper provides a number of key recommendations to improve water management in Australia around environmental, urban and agricultural water use.

Key recommendations include:

- A rigorous investigation is required into the food supply chain for irrigated agriculture – from water, to crops, to international food markets – to remove blockages and constraints so Australia can take advantage of increasing international demand. This should include a review of trade policies, transport and storage and water infrastructure.
- The insurance premium that has historically been embodied in physical infrastructure should be quantified to guide augmentation and pricing decisions. This would allow the value of water from different sources to be better priced. It would also improve the equity of urban water pricing as those who were willing to accept lower levels of reliability could receive discounts on their water bills.
- Better funding and coordination of environmental water allocation monitoring, measuring and analysis is critical before any changes are made to sustainable diversion limits. In addition, sustainable diversion limits should be set prior to water entitlements being sold off to ensure that water entitlements are not over-allocated again.

I would like to thank all the contributing editors and authors for their work on this project and in addition, sponsors MWH, the Department of Sustainability and Environment (Victoria) and the Yulgibar Foundation.

I hope you find this paper a valuable resource and that it helps drive policy changes to Australia's water management.

Professor the Hon. Stephen Martin
Chief Executive
CEDA

Foreword …cont

Everywhere I go – around the country, the region, and the world - there is always one issue that everyone wants to talk about: water.

Whether it is scarcity, abundance treatment, recycling, disposal, or competition, it is all about securing our future. No issue is more important than the sustainability of our water supplies.

Climate change, population growth, and urbanisation all add to the dilemma of how to secure our future. Australia is facing the same challenges as the rest of the world, though in some cases more transparently.

Our present decision frameworks are dominated by single-issue thinking and tension between competing demands. Nowhere has this been more apparent than in the recent stop-start efforts in developing a Basin Plan for the Murray-Darling system.

Competition for water between consumptive users, environment and other needs has divided governments, communities and families.

Our political landscape and decision frameworks are all framed at making one-off, unrelated decisions. We are not good at complexity or achieving multiple, positive outcomes. The current debate around food security, energy security, and sustainable communities as they relate to water and the resource sector is typical of our inability to have policy that crosses boundaries.

I am pleased to say that this study, the *Australian Water Project* is the first serious attempt to gather views and approaches that cross the boundaries of academia, government, industry and community.

CEDA is to be commended for assembling the range of contributors that it has and the initiative of undertaking such a complex task.

I feel that this is the first really balanced look at the issues we are facing and, rather than concentrating on the negatives, looking at the opportunities that are presenting themselves to us to secure not only our water future, but our collective wellbeing.

Peter Williams
Program Director
MWH

Reform Agenda

Editors

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Nathan Taylor

Professor John Langford is a leader in urban and rural water management reform and received an Order of Australia in 2005. He's currently the Director of UniWater, a joint initiative of the best minds in water research from the University of Melbourne and Monash University. John has worked as an engineer, water resource manager and research manager in the water industry. In 2004 he was selected by Engineers Australia as among the 100 most influential engineers in Australia. Among his many distinguishing career highlights John was the managing director of the Rural Water Corporation, Victoria's state-wide irrigation and rural water authority and the inaugural executive director of the Water Services Association of Australia.

Professor John Briscoe is the Professor of the Practice of Environmental Health, HSPH and the Gordon McKay Professor of the Practice of Environmental Engineering, SEAS Department of Environmental Health at Harvard University. He has served on the Water Science and Technology Board of the National Academy of Sciences and was a founding member of the major global water partnerships, including the World Water Council, the Global Water Partnership, and the World Commission on Dams. He currently serves on the Global Agenda Council of the World Economic Forum; is a member of the Council of Distinguished Water Professionals of the International Water Association; and will be the first Natural Resource Fellow of the Council on Foreign Relations. He has published extensively in economic, finance, environmental, health and engineering journals. Recently he authored Water Sector Strategy, India's Water Economy: Bracing for a Turbulent Future, and Pakistan's Water Economy: Running Dry.

Nathan Taylor is the Chief Economist at CEDA and a behavioural economist. He is responsible for the CEDA Research and Policy agenda which is undertaking an extensive series of reports into water, energy and population issues in 2012. He has been responsible for the projects *Crisis and Opportunity: Lessons from Australian Water Reform* and *A Greater Australia: Population, policies and governance*. He has also edited *Australia's Nuclear Options, Renewables and efficiency* and *Australia's Unconventional Energy Options*. He has authored the paper *Water Security: Water for the farm and the city*. Nathan has held policy roles at the Reserve Bank of Australia, the Chamber of Commerce and Industry WA, WALGA and others. He is the author of a book on corporate governance and cultural change and the blog *The Writings of a Naked Ape*.

Introduction

I love a sunburnt country,
A land of sweeping plains,
Of ragged mountain ranges,
Of droughts and flooding rains.

Excerpt from *My Country* by Dorothea Mackellar

Australia's climate is one of the most variable in the world and historical records since European settlement have been punctuated by severe droughts and floods. While these conditions have caused great hardship to communities, they stimulate adaptation and generate the political will for reform. Australia's past successes in managing these conditions is due in no small measure to its uncertain climate.

The drought that stretched from the mid 1990s to 2009 was the worst in recorded history, acting as a stress test of Australia's water management. It produced incredible successes, with Australia arguably achieving better economic outcomes than any other region in the world could have, given the severity of the climatic conditions. However, continued reform is needed in both the urban and rural contexts to build on past success while introducing more flexibility and responsiveness into both contexts.

The Committee for the Economic Development of Australia (CEDA) initiated the Australian Water Project with Uniwater (a joint venture between the University of Melbourne and Monash University), and Harvard University to explore water reform in Australia and propose beneficial reforms. This collaboration has produced an initial volume, a discussion paper examining *Lessons of Australian water reform* and a series of workshops in the eastern states critiquing the initial reform agenda. A series of independent papers have also been published in response to workshop findings and are accessible on the CEDA website.

This volume examines the critical issues of urban water reform, enhancing water markets and how to ensure the best environmental outcomes possible while capitalising on international developments. It outlines key challenges and proposes a suite of reforms to improve water management in Australia. These reforms are:

Water and cities: Insuring water supplies against drought

Australia has taken up an unquantified water security insurance premium in physical water supply infrastructure. This has proven to be both inequitable and inefficient. Quantifying the community's willingness to pay for water reliability, and the insurance premium required, will enhance water utilities' ability to progressively adapt and:

- Move from a philosophy of "meeting demand" to one of developing a portfolio of supply augmentation and demand management actions which ensure that customers get the combination of reliability, quality and cost that they choose;
- Inform regular reviews of the risks to the water supply having regard to the actual storage deficits in the reservoirs;
- Be a necessary reform before introducing competition for bulk water supplies;
- Clarify the cost effectiveness of the full range of water supply options including those under the heading of "water sensitive cities" for increasing urban water security, and also clarify the cost effectiveness of complex portfolios of these options, recognising that the primary job of an urban water utility is to provide customers with the

feasible combination of reliability, quality and cost of service; and

- Provide customers with a valid price signal of the costs of providing a reliable water supply.

Water and markets: Enhancing flexibility and adaptability

Australia's water markets have been very successful at allocating water to its most efficient use, thereby producing a highly responsive and integrated river system. Past reforms have created a national asset and introduced dynamic efficiency into the agricultural sector. However, there are a series of reforms necessary to enhance the responsiveness and productive use of water in this regard. Key reforms include:

- Introducing storage and delivery capacity entitlements to complement water entitlement and allocation trading. This will allow individuals to coordinate their own activities rather than being controlled by bureaucratic processes; and
- Standardise definitions across the Murray-Darling Basin to facilitate trade.

Water and the environment: Adaptive management of sustainable diversion limits

Progressive reviews of the sustainable diversion limits supporting adaptive management in the light of experience and new knowledge is necessary. However, effective adaptive management must be informed by scientifically rigorous monitoring and evaluation of the condition and response of the freshwater ecosystems to environmental watering or environmental works and measures. But it is essential that science is seen not as providing answers but providing inputs into policy processes which take account of the views of all affected parties and which make it clear that government is and must be the final judge of priorities and tradeoffs.

Without strong scientific understanding, there will be little basis to justify future adjustments to sustainable diversion limits, nor to inform any trade-offs between social, economic and environmental factors during subsequent reviews of environmental water allocations. Basin-wide adaptive management requires more long term funding to support environmental monitoring and synthesis of the data over the same time scale as the Murray-Darling Basin Plan review.

Food, water and opportunity

Emerging demand from developing countries, and ongoing climatic uncertainty, will create an excellent opportunity for Australia's agricultural sector. Reforms to water trading will enhance the capacity of Australia's agricultural sector to be flexible and adaptive to emerging climatic and international conditions. As a result, key recommendations are:

- Australian agricultural expertise is among the best in the world. Government, with the involvement of farmers and others, need to articulate a clear vision for the future of Australian agriculture, and a strategy for realising this vision. This includes, but goes far beyond water. However, as part of this the entire food and water supply chains should be examined so that any blockages, constraints, or rigidities can be removed.
- Lessons learnt from past experience need to be implemented in any future irrigation areas. Critically this involves establishing sustainable diversion limits, supported by full cost recovery pricing, and having supply decisions driven by market opportunity rather than political opportunism.

Water and cities: Insuring water supplies against drought

Australia has historically embedded an unquantified insurance premium associated with ensuring continuing reliability of a city's water supplies in the cost of the physical infrastructure of the city's water supply system. Water prices reflected the costs of building and operating the water supply system. The same level of reliability has been provided to all households across the city. Augmentation decisions have been based on the infrastructure cost of the volume of water produced resulting in highly secure sources of water being expensive during times when water was plentiful, and relatively cheap when water was scarce. Timing augmentations, particularly during extended droughts has proved particularly challenging increasing the risk of sub-optimal decisions.

Quantification of the insurance premium required to insure the city's water supply against failure to meet the required reliability of supply, and making this premium an explicit component of retail water prices would:

- Allow calculation of the cost effectiveness of individual augmentation options, and portfolios of options in providing insurance;
- Inform regular reviews of the risks to the water supply having regard to the actual storage deficits in the reservoirs;
- Be a necessary reform before introducing competition for bulk water supplies, or in accurately evaluating the whole of water lifecycle benefits of centralised and decentralised approaches to urban water management;
- Facilitate customer choice of the level of supply reliability they were willing to pay for; and
- Provide customers with a valid price signal of the costs of providing a reliable water supply.

To calculate the premium for insuring a city's water supply against failing to provide the required reliability of supply involves quantifying a number of key variables that underpin the value of the premium. The underlying variables that will determine the value of an insurance premium (*IP*) are determined by the formula:

$$IP = f(S, X, V, T)$$ where:

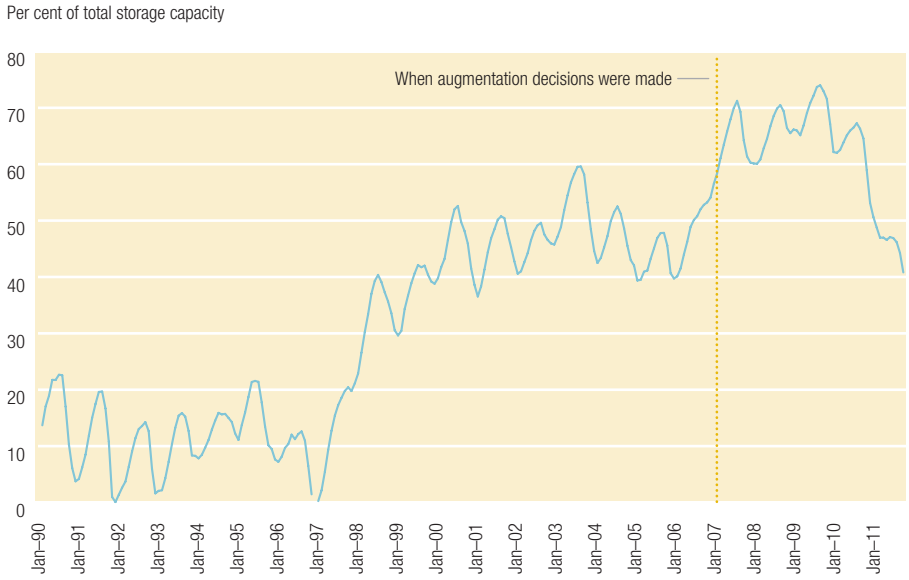
- S is the storage deficit, or the "air" in the storage systems;
- X is the amount of water demanded annually;
- V is the variability of the urban centres' water supply; and
- T is the time over which the insurance premium is calculated.

The value of an insurance premium will vary in proportion to the storage deficit or amount of air in the city's storage reservoirs, reflecting that reliability of supply becomes both more difficult to insure, and more valuable, as water becomes more scarce. The overall value of S would reflect both the total amount of air in the storage and the marginal cost of water supply from all sources.

Figure 1 describes how S would have varied for Melbourne during the recent drought.

The annual water demand represented by X would change over the time period of the insurance premium, represented by T. These changes along with any imposition of restrictions plus any demand management activities would also need to be included in the calculation of the premium.

FIGURE 1
STORAGE DEFICIT IN MELBOURNE'S MAJOR STORAGES (THOMSON, UPPER YARRA, O'SHANASSY AND MAROONDAH RESERVOIRS)



Source: Melbourne Water

Calculating the insurance premium annually at the end of the spring filling season would provide dynamic information about the current risks to water reliability. As the storage deficit in the reservoirs increased the premium would rise, until augmentation of the water supply became competitive, when the cost of the insurance premium became greater than the cost of augmentation. Annual calculation of the insurance premium provides dynamic information for planning water supply augmentation decisions which is particularly important for informing the timing of augmentation decisions during extended droughts.

The variability of the water supply produced by a particular augmentation option together with the covariance matrix reflecting its correlation with other sources of supply are critical factors in determining the value of that option for the overall insurance premium. The lower the variability and the lower the correlation with other sources of supply the greater the value of the option as insurance. Evaluating the capital and operating costs of each option in association with the insurance premium would allow all the options to be ranked in terms of cost effectiveness.

The options could include any combination of the following:

- Desalination;
- Potable or non potable recycling;
- Increased storage and or increased stream flow diversions;
- Ground water pumping;
- Water trading between the city and agriculture;
- Stormwater and/or rainwater harvesting; and
- Demand management to increase the efficiency of water use.

Ultimately the insurance premium would have to be calculated for a portfolio of sources including the existing water supply system before the most cost effective portfolio could be selected.

Clearly defined levels of supply reliability have been created by recent decisions to construct desalination plants in most of Australia's major cities. There is now scope to test customers' preferences with explicit options of reliability of supply. For example customers could be offered a lower insurance premium (and lower water prices) for accepting water restrictions if the storage deficit rose above 50 per cent, or a higher premium for accepting water restrictions only after the storage deficit has exceeded 70 per cent. This would provide a direct price signal to customers about the costs of providing a higher level of security and achieve more equitable sharing of the costs.

Water and markets: Enhancing flexibility and adaptability

Water trading ensures that water flows to its most productive use. As water grows scarce the least productive activities sell it to more productive activities. This trade involves rice growers selling to dairy selling to horticulture selling to urban centres. The least efficient irrigators sell water first, creating dynamic incentives to improve water productivity.

The benefits of water trading are most apparent during extensive droughts or periods of strong economic growth. Modelling by Monash University has shown how water trading acted as an economic stabiliser during the millennial drought, resulting in less social distress than would have occurred without water trading. The introduction of further reforms that encourage water productivity have the potential to add over 2.5 per cent to Murray-Darling Basin consumption, and substantive improvements to employment in the sector, than a business as usual approach between now and 2026.

Reforms to enhance the capacity of individual irrigators to manage their water requirements are crucial. They should focus on:

- Reforming water entitlements to enable irrigators to have more control over their storage and delivery requirements;
- Standardised definitions across the Murray-Darling Basin so that trade can be deepened and become more sophisticated; and
- More flexible water ordering systems so that river operators can provide opportunities for mutual benefit to both irrigators and environmental water holders.

a) Creation of market in delivery capacity entitlements

Delivering water on demand so that crops receive water precisely when they need water for optimum growth is a key factor in raising agricultural water productivity. Delivery of much higher flows for border check irrigation (low tech but also low energy) can substantially improve water productivity. Managing peak flows in water distribution networks will therefore become an increasingly important issue as irrigators take up the opportunities presented by the modernisation of these networks.

The unbundling of water entitlements has created separate delivery entitlements specifying a share of the delivery systems. Currently the characteristics of these delivery entitlements are typically determined by arbitrary regulatory arrangements. Creating a market in delivery entitlements would be a prudent move to manage peak water deliveries in an equitable fashion. It would allow water users more control over their use of water as they could trade preferences for its availability.

The importance of creating a market in delivery system entitlements is critical because of the substantial environmental water holdings. The consequent shepherding of environmental water downstream, combined with trading of irrigation water downstream, will increase the risk of constraints on peak flows in the river systems. Substantial economic and environmental benefits will be gained if water users, rather than water regulators, are able to determine their optimal delivery conditions.

Extension of the market in delivery entitlements to bulk water deliveries in the river systems should also be included in planning the market in delivery capacity entitlements.

b) Creation of a market in reservoir storage entitlements

Providing water users more control over managing the risk and reliability of their future water supplies to meet their individual needs has proven a very effective strategy for managing the stresses of the recent extended drought. Reforms to allow carry-over of unused seasonal water allocations are a step forward, but do not go far enough. Creation of an individual volumetric entitlement to the storage capacity of the reservoirs would allow water users to control their own "reservoir" and use their storage to best meet their individual needs for risk management. Seasonal water allocation policies could continue to allocate the current year's inflows to water users after providing for operational water, critical human needs, and sustainable diversion limits.

Creation of a market in storage entitlements would allow redistribution of reservoir storage capacity to those who could make best use of it. High value enterprises that needed insurance against future droughts could purchase or lease more storage capacity. Trading in storage entitlements would also allow more effective use of "lazy" reservoirs, such as Eucumbene which rarely spills. Water users could purchase or lease storage and store greater volumes of water as insurance against drought, while accepting the risk of the storages spilling. Trading would also facilitate redistribution of storage in the landscape, for example from shallow high evaporation storages on the flood plains to new more water efficient storages in the mountains upstream.

Establishment of a market price would also inform decisions on augmentation of reservoir capacity. It would introduce dynamic efficiency into irrigated water supply as the market price on storage would reveal inefficiencies in the current system while encouraging and funding the development of new reservoirs.

c) Enabling trading in environmental water holdings

Research has demonstrated that a greater area of red gum forest growing on the flood plains can be watered with less water and at lower cost if the capacity of reservoir outlets was increased (or operational constraints relaxed), a mixed portfolio of high and low reliability water entitlements was included in the environmental water holdings, and counter-cyclical water trading was allowed. Counter-cyclical water trading involves environmental water holders selling part of their seasonal allocations during dry periods at relatively high prices, and buying back allocations during wetter periods to enhance the seasonal floods that are vital to the health of the forest and river ecosystems.

In addition to improved environmental outcomes, counter-cyclical water trading would also provide the irrigators with a buffer against very low water allocations. However, careful management by the environmental water holders would be vital to ensure important refugia and biolinks were not damaged. Counter-cyclical trading is an excellent example of an opportunity for achieving mutual benefit for irrigators and the environment.[1]

d) Standardisation of definitions across the Murray-Darling Basin

State water allocation policies and practices have evolved in much the same way as the selection of the nation's railway gauges, and with similar dysfunctional results. Creation of water markets in the southern connected Murray-Darling Basin has exposed the weaknesses of such a chaotic system for managing an interconnected river system. Now that there is trading across state borders in the southern connected Basin, these inconsistencies are increasingly becoming a barrier to effective trade.

Smart market participants are playing off the policy differences between states at the expense of others. Currently exchange rates between different state entitlements must be calculated, or the entitlements tagged to the state in which they were created, so that they can retain their original form. Neither of these methods are fool proof in a hydrologically complex and uncertain world. Imagine the complexity of record keeping as trading grows.

The Commonwealth Environmental Water Holder, with a diversity of different state entitlements, has a challenging task in managing such a complicated portfolio. The complexity of the different state water allocation systems is making water markets and the setting of sustainable diversion limits difficult to understand, even for an expert audience and consequently weakening both water governance and the capacity for trade to flourish.

Consistent definitions of high and low reliability water entitlements should be introduced across the Murray-Darling Basin as an initial step. Water entitlements and seasonal allocations in the Murray system would then be the same on both sides of the river and downstream in South Australia. Seasonal allocations in the Goulburn and Murrumbidgee systems would be different, reflecting the different rainfall patterns and reservoir inflows, but would be based on the same general definitions. This would reduce the complexity and enhance the emerging water market. A conversion day could be set so that entitlement holders would have the same access to water on the day after the conversion as they had on the day before only expressed in different "currency" so to speak.

e) Providing more flexible water ordering

The river operators should provide a menu of choice in water delivery services (for example, when, where, how much, and at what flow rate) for both irrigators and environmental water holders, instead of simply responding to water orders. In so doing, the river operators can gain knowledge of the needs of both irrigators and the range of environmental water holders. There will be opportunities for mutual benefit that will become apparent. In much the same way as airline operators have gained a great deal of insight into the preferences of their passengers for services by providing a menu of choice in place of fixed price tickets from A to B; the passengers have gained a more flexible service and the airline operators have achieved increased revenue. River operators need to provide a flexible water ordering system.

Creation of environmental water holdings managed by a diverse group of Commonwealth and state environmental water holders provides a new challenge for the river operators. If these holdings are poorly managed, environmental water productivity (environmental benefit per unit of water used) will be diminished and opportunities for environmental and agricultural benefits lost. Greater value can be achieved for both irrigators and environmental water holders through co-operation in the management of their water deliveries. The river operators, such as the Murray-Darling Basin Authority for the Murray and Goulburn Murray Water for Victoria for example, are in an ideal position to facilitate co-operation.

In order to facilitate such co-operation the river operators must have real time information on the needs of both irrigators and environmental water holders, combined with the hydrological conditions in the river system so that they can take advantage of events such as heavy rain storms generating high river flows. River operating systems will have to be modernised to provide the real time information required and the control systems necessary to fine tune river operations in a more complex operating environment. Technology alone will not deliver the full benefit. A combination of technology, with crucial market and governance reforms, provides the best opportunities for increased benefit for both irrigators and environmental water holders.

f) Managing unfunded capital liabilities

Despite full cost recovery water pricing for all water supplies including irrigation being an important requirement of both the COAG water reform agenda of 1994 and the National Water Initiative of 2004, little progress has been made in the irrigation sector. In fact, the direction of progress has been full steam in reverse. The capital costs of the so called "gifted assets", that is infrastructure funded by government grants, which includes nearly all the infrastructure built by government authorities, are excluded from the water prices set by pricing regulators. These capital costs include current cost depreciation or renewal annuities that provide essential funding for renewing ageing infrastructure.

The current Water for the Future Plan, among others, is funding major upgrades of existing irrigation schemes including large investments in information technology, and the electrical and mechanical equipment involved in operating modern irrigation distribution systems. These technologies have much shorter economic lives than the older earthen channels and concrete drop structures they are replacing. The depreciation of these relatively short lived assets is not being set aside, creating an unfunded liability for the future.

Reform of water pricing for existing irrigation schemes is fraught and unlikely to succeed. Indeed in the immediate future such reform would be a distraction. However, the large unfunded capital liabilities cannot be ignored and at the very least should be quantified, made public, and managed, using for example the Aquamark benchmarking system of strategic asset management, developed by the Water Services Association of Australia.

Water and the environment: Managing sustainable diversion limits

Given the relatively immature state of knowledge about freshwater ecosystems and their response to water delivery, the current adaptive management approach in the Draft Murray-Darling Basin Plan is sensible. It will allow progressive reviews of the sustainable diversion limits in light of experience and new knowledge. However, effective adaptive management must be informed by scientifically rigorous monitoring and evaluation of the condition and response of the freshwater ecosystems to environmental watering or environmental works and measures. In essence, we need to actively participate in learning how best to apply water for environmental outcomes.

Without a strong scientific understanding of the ramifications of environmental water allocations, there will be little basis to justify future adjustments to sustainable diversion limits. Nor will there be any objective method to inform the trade-offs between social, economic and environmental factors during subsequent reviews of environmental water allocations.

Supporting a rigorous monitoring and evaluation program in the Murray-Darling Basin produces a greater knowledge base through which to detect the outcomes of environmental flows. This knowledge base provides a strong justification for the expenditure of government funds and the benefits derived from the use of a limited resource. A better understanding of the outcomes resulting from targeted environmental flows can also inform future management decisions. But this is only possible if knowledge of an ecosystem's response has been rigorously established during the water delivery phases.

A stronger link between environmental water delivery and its expected outcome will also improve confidence around watering decisions.

Agricultural productivity, or the value of what is produced per unit of water, has progressively increased over many decades. Improving knowledge about the consequences of environmental water delivery is required to replicate this increased productivity for environmental outcomes. This means that, over time, water managers would become more confident in the volume and timing of water delivery required to achieve desired environmental outcomes with the possible benefit of being able to achieve more with less water.

Basin-wide adaptive management requires more funding and coordination between environmental monitoring and analysis of the data being collected. It also requires specific knowledge to be developed, refining the links between environmental flows and outcomes. This should involve collaboration between governments at all levels with universities, other research agencies and/or private consulting companies. Standardising the monitoring protocol and data formats would provide efficiency gains and comparable datasets to improve Basin-wide analysis.

Accurately measuring environmental outcomes is the first step to achieving improvements in the productivity of environmental water.

Food, water and opportunity

The need for food security in the emerging economies of Asia will create opportunities for Australia as a food exporting country, particularly given the rapidly rising calorific demand and quickly degrading water sources occurring in many developing countries. Since 40 per cent of the world's food supply, and nearly half the economic value derived from agriculture, is produced on irrigated land there are significant opportunities for Australia's irrigated agriculture sector.

The historical approach has been: building dams and hoping that the benefits will filter up the supply chain to the international food markets. This is a recipe for limited success such as has occurred with the Ord River Scheme. The objectives of Australian irrigation in the 21st Century are economic growth, not the social objectives that underpinned most of the existing irrigation schemes. New water supply should be driven by economic opportunity not political opportunism.

Water pricing for new irrigation schemes is another matter altogether. Full cost recovery should be implemented from the outset. Indeed for all its alleged sins, the cotton industry in the Northern Basin has funded its own dams, pumps, channels and pipes, and is responsible for all the capital costs including renewal. Tenders or auctions of water entitlements should raise sufficient funds to pay the full capital costs of the dams and other irrigation infrastructure of any new government sponsored schemes before construction starts.

Full cost recovery pricing should be implemented from the inception of the schemes including all the capital cost and resource management charges as required by the 1994 COAG Reforms, recognising that full cost recovery pricing is essential to stimulating high value irrigation.

Sustainable diversion limits also need to be set prior to any water entitlements being sold off. This will ensure that water entitlements are not over allocated again. An independent regulator of water allocations, a Reserve Bank of Water in the irrigation scheme, should be established at the outset to ensure there is no water inflation and to prevent short term political interests subverting sustainable diversion limits.

In order to realise the international economic opportunities the whole supply chain, from the international food markets back to the crops and from the crops back to the water source, should be rigorously investigated so that blockages, constraints and rigidities can be removed enabling more flexibility and adaptability to drive economic growth of irrigated agriculture. In economic language, the "co-ordination failures" must be overcome.

Scenario planning covering the complexities of the whole supply chain from water source to international food markets should be undertaken to explore plausible futures. Opportunities for increasing flexibility and adaptability could be identified by placing the supply chains under stress by increasing the international demand for the products of irrigated agriculture while reducing the water resource available for irrigation. Trade policies, lack of long term commercial relationships, transport and storage infrastructure, water infrastructure and research and development, among other issues, should all be in the mix under consideration. Such scenario planning would bring together a range of disciplines, skills, knowledge and experience that typically does not come together to discuss water issues. The creativity generated by such planning could have far reaching implications for Australia.

Endnote

1 Farms Rivers and Markets Overview Report Victoria (2012) – Project Leader and Editor K J Langford

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