Submission No 48

INQUIRY INTO WATER AUGMENTATION

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LEGISLATIVE COUNCIL GENERAL PURPOSE STANDING COMMITTEE NO.5

Inquiry into the augmentation of water supply for rural and regional New South Wales

NSW Government submission

Table of Contents

Introduction

Water is a precious and finite resource. It is essential for sustaining life and for the preservation and improvement of our standard of living. With more than 7.5 million people, New South Wales (NSW) is Australia's most populous state, and with vast farming regions, it is also Australia's most intensively irrigated state.

The effective management and use of water resources and infrastructure is critical to the ongoing welfare of the people and the economy of NSW, not only for households and agriculture, but also for mining, manufacturing and industrial sectors. The effective management of water resources also plays a key role in delivering environmental outcomes.

Over the last two decades the NSW Government has reformed water management to serve growing demands for water due to expanding cities and towns, agriculture, energy, industry and mining, and in recognition of the benefits that arise from maintaining water dependent ecosystems.

These reforms have facilitated an economically beneficial and environmentally sustainable use of water, private sector innovation and allowed water users to better adapt to changing economic circumstances and a variable climate through trade and carryover of water allocations. They have greatly improved the certainty of water rights, giving greater confidence for investment.

While there has been great success, it is important that we also consider how NSW will meet future challenges in water management.

This submission provides an overview of the water planning and practices framework in NSW, as well as specific information on infrastructure investment, environmental water and the water market. An index of the sections of this submission and how they relate to the terms of reference (ToR) is below.

Section	ToR
The water planning framework in NSW	1(a)
Water management practices in NSW	1(f)
Current programs for water infrastructure investment in NSW	1(b)
Environmental water	1(g)
Flood management issues and technologies	1(d) and 1(e)
The water market in NSW	1(h)
Attachment A – updated Government response to previous inquiry	1(c)
Attachment B – case studies into water management	1(f)
Attachment C – Infrastructure projects	1(b)
Attachment D – Impacts of MDBA releases	1(f)

The water planning framework in NSW

The key piece of legislation for the management of water in NSW is the *Water Management Act 2000*. This Act recognises the need to allocate and provide water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water licences from land.

Water Sharing Plans

The main tool the Act provides for managing the State's water resources are statutory ten year Water Sharing Plans. The purpose of a water sharing plan is to:

- provide all water users with a clear picture of when and how water will be available for extraction.
- ensure the water source is sustainable in the long-term
- protect the fundamental environmental health of the water source.

Under a water sharing plan water licences are generally perpetual and separate from land, creating opportunities and flexibility for businesses wishing to trade water. Water Sharing Plans set out the rules for access for different types of water use such as town supply, rural domestic supply, stock watering, and industry. They also ensure a proportion of water is set aside for the fundamental health of the water source and water dependant ecosystems. They protect water users' rights and access to water and establish water trading rules.

As at 1 July 2016 there are 57 Water Sharing Plans in place across NSW with only two coastal plans yet to commence. Once the remaining plans are commenced this will result in WSPs being in place across all of NSW.

Water Sharing Plans set annual limits on water extractions to ensure that water extractions do not increase and therefore erode the security of supply to all water users. Much of inland NSW is part of the Murray-Darling Basin. A cap on water diversions was introduced in the Murray-Darling Basin in 1995. The cap limited the amount of water that could be diverted for consumptive uses and to encourage the more efficient use of existing diversions. The cap was introduced in recognition that extractions were increasing significantly across the Basin, putting the health of the Murray-Darling Basin at risk.

The Murray-Darling Basin Plan sets new limits on the quantities of water that can be taken from NSW's Basin water resources for agriculture and other consumptive purposes. These limits are known as sustainable diversion limits (SDLs).

As a result of the limits on water extraction in both coastal and inland areas of NSW, any new commercial development in the main must purchase existing surface water licences or allocation water. Further commercial licences that would increase overall extractions cannot be issued– balancing supply and demand requirements.

Regional Water Strategies

The Metropolitan Water Plan for Sydney provides a guide to the process for developing regional water strategies. This process involves setting out a mix of water supply and demand management measures that ensures a secure, cost effective and sustainable water supply for greater Sydney.

In valleys where there is a major demand driver or a major shortfall between supply and demand, Regional Water Strategies are being prepared. The first of these strategies is intended

for the Hunter Region where major changes in mining, power generation, urban population growth and shift to high value agri-business are changing the supply and demand balance.

Regional Water Strategies also form part of a broader regional development program. The Hunter Regional Water Strategy is assessing infrastructure and non-infrastructure options and is supported by DPI Water and the major water utilities such as WaterNSW, Hunter Water Corporation and AGL Macquarie.

Infrastructure NSW as part of the 2014 State Infrastructure Strategy developed a needs identification framework to identify the regulated river valleys facing the most significant management challenges. The needs assessment utilised four key indices to assess water security and supply shortfalls, considering climate variability and population growth. The framework provides a decision support to identify actions for capital investment for high priority catchments, assets, towns and projects. The NSW State Infrastructure Strategy outlines the Government's priorities for water infrastructure planning and investment.

The strategic regional water planning processes will rely on robust forecasts of water demand and estimates of the volume of water under various drought scenarios. Available water supply is modelled using computer programs that simulate the water supply system that takes into account historical and future climate predictions.

Regional Urban Water Planning

Local Water Utilities (LWU) in regional urban areas of NSW plan for water supply based on DPI Water's *Guidelines on Assuring Future Urban Water Security – Assessment and Adaption Guidelines for NSW Local Water Utilities.* These guidelines include the 5/10/10 design rule for assuring appropriate and cost-effective urban water security in regional NSW, which is effectively considered to be a water equation for LWUs.

The 5/10/10 design rule involves:

a) Duration of drought restrictions to not exceed 5% of the time; and
b) Frequency of restrictions to not exceed 10% of years; and
c) Severity of restrictions to not exceed 10%. The water supply system must be able to meet 90% of the unrestricted water demand through a full repetition of the worst recorded drought, commencing with the storage drawn down to the level at which restrictions need to be imposed to satisfy a) and b) above.

The design rule enables each system's security of supply to be determined using a consistent methodology across the state, with the flexibility to adapt the design rule in a manner appropriate to each system in consultation with the utility's customers.

Water infrastructure and supply security planning for growing populations is done in accordance with the National Urban Water Planning Principles, 2008, under the National Water Initiative (NWI).

In regional NSW, this planning is undertaken by each LWU through its Integrated Water Cycle Management (IWCM) Strategy, as required by the Best-Practice Management (BPM) Guidelines[1]. The BPM Framework facilitates implementation of the outcomes required by the Guidelines and was streamlined in 2014. The framework is a locally based decision making and

[1] The NSW Government's Best-Practice Management (BPM) of Water Supply and Sewerage Guidelines was gazetted in 2007. (http://www.water.nsw.gov.au/__data/assets/pdf_file/0005/549608/best_practice_management_water_sewerage_framework.pdf)

self-regulation regime, which provides the water utilities with a charter for sound planning, pricing and management to deliver effective, efficient and sustainable urban water services in regional NSW.

To identify the best-value IWCM scenario, each LWU is required to consider and evaluate the merits of all available options/scenarios for delivering services. These broadly include both supply (infrastructure such as a dam or desalination plant or managed aquifer recharge or urban stormwater harvesting and use) and demand (water conservation) solutions.

The outcome of the IWCM strategy is a local, community supported, evidence based 30-year total asset management plan and 30-year revenue requirement plan (financial plan) to cater for local population growth and meet relevant levels of service and regulatory requirements.

The Department of Primary Industries – Water (DPI Water) reviews LWU IWCM Strategies to ensure they are soundly based and monitors and regulates the achievement of these outcomes. This will form an important basis for the development of Regional Water Strategies.

Water management practices in NSW

There are two distinct types of river systems in NSW: (i) regulated and (ii) unregulated. Regulated river systems contain large headwater storages whose releases are managed actively to meet the needs of the downstream system. Unregulated rivers are not governed by the operation of headwater storages and are directly reliant on rainfall to provide flows to the river.

Regulated rivers typically capture some of the natural peaks and troughs triggered by rainfall, allowing water users to have more control over the timing of water delivery. Access for unregulated rivers is based on fixed minimum water levels at various locations when pumping/extraction is allowed to commence. Other than carefully setting long-term sustainable flow triggers to protect the environment and other water users, water managers have limited scope to influence flows in unregulated rivers.

Specific case studies on the Broken Hill town water supply/Menindee Lakes system, South Western NSW water management practices and North Western NSW water management practices are at Attachment B. A further case study on the Murray-Darling Basin is at Attachment D.

Regulated vs unregulated

In regulated rivers, resource assessments are regularly made – typically at least once per month – and water availability is determined based on a range of factors including dam storage levels, river flows and catchment conditions. Allocations are incremented during the year if water availability improves.

Water access is managed differently in unregulated rivers. Flow trigger levels are carefully set to ensure that long-term extraction levels do not exceed prescribed limits of sustainability for that water source. A cease-to-pump level is set which means that flows below this level must remain in the river to protect the riverine environment. High priority licences can pump down to relatively low flow levels whereas irrigation purposes must wait until the river flow reaches higher levels.

Allocations at the start of the year for unregulated rivers are typically 100 per cent of entitlement, but the amount of water than can actually be taken depends on river flow conditions during the year. In dry years, when flows are low, it is common in many inland NSW rivers, that unregulated river licence holders can take no water from the river.

Supplementary water

Supplementary water is effectively surplus flow that cannot be captured or ‘re-regulated’ into storages. When storm events result in flows that cannot be captured (regulated) in storage structures such as dams or weirs for future use, and the water is not needed to meet current demands or commitments, then it is considered surplus.. Regulated rivers become unregulated for a period of time. Those water users holding supplementary access entitlements can access water during declared supplementary flow events. Given the highly variable nature of flow in Australian rivers, from large floods to zero flow, some water users, particular in the north and west of NSW, have constructed large on-farm dams. They rely on their supplementary access entitlement to store water.

Water allocations

The volume of water that licensed users can access, known as an allocation or Available Water Determination (AWD), varies from year to year based on water availability within the respective water source. The entitlement for respective licence categories is fixed to ensure that long-term sustainable extraction limits are met, and to provide equitable sharing between consumptive and environmental uses.

An AWD credits water to a user’s water account commensurate with water availability conditions at the time. For example, in dry times, towns, domestic and stock users might be allocated some of the available water but not general security entitlement holders. In this way seasonally available water is shared (allocated) across prioritised purposes, and as water

availability decreases, for example during drought, allocations are reduced accordingly meaning that water is only available for critical purposes.

At the start of each new water year on 1 July, licensed water users are provided with an opening allocation for each category. This may be anywhere between zero and 100 per cent of their entitlement.

For most licence categories, if 100 per cent of entitlement is allocated, then there is no further increase in that licence category for the remainder of the water year – on average water users are limited to using no more than 100 per cent of their entitlement per year. The highest priority categories of licence typically receive 100 per cent of their full entitlement each year. However, if a licence holder receives less than this, an increase in allocation can still occur if sufficient water subsequently becomes available from further rainfall and river flows during the year.

Water Pricing

The costs of river operations and water resource management incurred by government are shared with the holders of water access licences under principles embodied in the COAG-agreed National Water Initiative (NWI). These principles are applied by independent pricing regulators to determine the prices that should be charged in a particular water source. Water prices are independently determined by price regulators such as the Independent Pricing and Regulatory Tribunal (IPART) and the Australian Competition and Consumer Commission (ACCC), not by WaterNSW or DPI Water.

Consistent with NWI and 'impactor pays' pricing principles, and to avoid cross-subsidisation, NSW has adopted 'valley-based' pricing, where prices in each water source reflect the cost of delivering water and water management services in that particular water source.

WaterNSW's water prices are regulated by the ACCC in the inland (Murray-Darling Basin) regulated river systems and by the IPART elsewhere. From next year IPART will be setting prices for water storage and delivery for WaterNSW under accreditation by the Commonwealth. DPI Water's water charges are regulated by IPART.

Both the ACCC and IPART-determined price regimes are based on rigorous assessment of the prudent and efficient cost of supplying water or providing the relevant water management service in water sources and are set through processes that explicitly take into account equity considerations, the economic and social impacts of the charges and the community's capacity to pay.

Government agencies involved in water management and supply in NSW

Department of Primary Industries Water (DPI Water)

DPI Water is a division within the NSW Department of Industry DPI Water is responsible for surface and groundwater management in NSW, including policy and planning, and leads NSW Government representation at interstate and national water management forums. As part of the DPI corporate plan DPI Water's key programs are:

- Maximise the productive use of water
- Maintain sustainable and equitable access to and use of water
- Mitigate and manage risk from use of land and water.

WaterNSW

The delivery of water and the operation of 42 major water storages for Sydney and for rural water supply is undertaken by WaterNSW. Two thirds of water used in NSW is supplied by WaterNSW, which is a State Owned Corporation operating as a commercial business.

Major water utilities

Hunter Water provides water and wastewater services in the lower Hunter Region, including Newcastle, managing 4 dams and providing water to over half a million people. Sydney Water is Australia's largest water utility supplying water, wastewater, recycled water and some stormwater services to over 4.6 million people in Sydney, the Illawarra and the Blue Mountains. Both bodies are State Owned Corporations.

Local Water Utilities

Town water supplies outside the Hunter and Sydney are managed by over 100 local water utilities such as Local Councils.

NSW Office of Environment and Heritage (OEH)

OEH is the manager of held environmental water in NSW – that is, water specifically allocated to an environmental account through water sharing plans or licensed water recovered through NSW programs.

OEH is also responsible for implementing the Flood Prone Lands Policy and does this by providing technical, policy and financial assistance to local councils for the development of floodplain risk management plans.

Murray-Darling Basin Authority

The Commonwealth through the Murray-Darling Basin Authority (MDBA) is responsible for the development and implementation of the Basin Plan 2012. The Basin Plan is a strategic document that requires overall water extractions to be reduced across the Basin, which spans Queensland, NSW, Victoria and South Australia, by 2019.

Under the Murray–Darling Basin Agreement, the MDBA operates the River Murray system and oversees asset management (Dartmouth and Hume Dam, Lake Victoria, Lower Lake barrages, weirs and locks) with state delivery partners (WaterNSW in NSW) and is also in control of the Menindee Lakes water once the Lakes are above a certain supply level.

Commonwealth Environmental Water Holder

The water recovered for the environment under the Basin Plan is held as licensed water entitlement and administered by the Commonwealth Environmental Water Holder in consultation with OEH in NSW.

Current programs for water infrastructure investment

Water infrastructure is critical to the ongoing prosperity of Australia's agriculture, mining, manufacturing and industrial sectors. In our cities and towns, water supply infrastructure is critical to the wellbeing, prosperity and public health of households and businesses. NSW requires water security for economic growth in productive sectors such as agriculture ($11 billion in 2011/12) and mining ($22 billion in 2011/12) which jointly contribute over 7 per cent of NSW Gross State Profit and provide about 100,000 jobs across NSW. The population of NSW is projected to reach 9.7 million by 2035-36. This implies an annual increase of around 100,000 people in NSW, including around 20,000 in regional NSW.

The climate of NSW is variable with consequent impacts on water supply, demand and agricultural productivity. Climate change and variability is likely to cause more extreme droughts and floods.

The NSW Government remains committed to long term solutions to regional water security for irrigation, industry, environment and the community. Existing storages and possible future schemes for augmentation of water supply are being investigated on a number of fronts.

In September 2012, Infrastructure NSW delivered its 20-year State Infrastructure Strategy. The strategy, titled 'First Things First', was Infrastructure NSW's advice to the NSW Government to help guide future infrastructure investment. It was the first time a prioritised and costed long-term strategy had been developed for the Government's consideration. In developing the strategy, Infrastructure NSW assessed the current state of infrastructure in NSW and the needs and strategic priorities for infrastructure for the next 20 years. The strategy covered urban and regional projects and reforms across transport, freight, aviation, energy, water, health, education and social infrastructure.

The State Infrastructure Strategy was updated in 2014. The objective was to support the critical needs of regional industries and communities by ensuring water security and quality of supply. Recommendations for Water include:

- Assessing options for critical water infrastructure projects in priority catchments of the Gwydir, Macquarie and Lachlan Rivers, and in the coastal catchment of the Upper Hunter;
- Securing water supplies in high priority regional towns;
- Bringing all regional towns up to water quality and environmental standards;
- Pricing and cost recovery for water security investment (Broken Hill);
- Hawkesbury-Nepean flood mitigation options.

The 2014 State Infrastructure Strategy Update presents the forecast water supply deficiency for each LWU in regional NSW. This deficiency is the shortfall between the urban water supply available from the existing headworks infrastructure and the estimated annual demand in year 2036.

DPI Water is undertaking an analysis of the optimal mix of investment options in light of the State Infrastructure Strategy, including infrastructure, market, water use efficiency and water planning measures in priority catchments.

WaterNSW is undertaking feasibility studies on infrastructure options in the Lachlan, as recommended in the State Infrastructure Strategy. Phase 1, a scoping study to investigate potential dam sites in the Belubula and Lachlan systems, is complete. Phase 2 will further assess the short-listed dam option against other infrastructure and non-infrastructure options and will be complete by the end of 2016. A business case will then have to be prepared that demonstrates the benefits and costs of the preferred option. This is expected to be completed by end of 2017.

NSW Government programs and projects

Water Security for Regions

The NSW Government through the Restart NSW Fund has reserved funds for planning and delivery of critical water infrastructure projects in priority catchments through the Water Security for Regions program and $1 billion to establish the Regional Water Security and Supply Fund. The focus of the fund is to meet the water challenges in regional communities, including drinking water quality, water demand in growing towns and villages, drought security, dam safety and inadequate wastewater treatment. Key projects include:

- Securing Broken Hill's water supply
- Assessment of the Albert Priest Canal to secure Cobar's water supply
- Funding the backlog projects for country town water supply and sewerage projects

Two competitive rounds were held in 2013-14 and 2014-15 to enable strategic investment in water infrastructure to address drought risks. The aim of these projects is to build more drought resilience into NSW communities and businesses and to enhance towns' ability to attract more residents.

There are 33 projects in different Local Government areas with total funding of $115 million. These projects are under various stages of investigation and design, through to construction and completion. See Attachment C for a list of all projects.

Regional Water and Waste Water Backlog Program

Ensuring that our regional towns have water services of modern standards is a key priority of this Government. Under the Regional Water and Waste Water Backlog Program total funding of $110 million is being provided for previously unfunded projects. Detailed applications from Local Councils were assessed by an Independent Panel in June 2016 and recommendations will be submitted to government by Infrastructure NSW once the review process is complete.

Country Towns Water Supply and Sewerage Program

Since 1996 the NSW Government has provided technical, management and financial support to LWUs in regional NSW through the $1.3 billion Country Towns Water Supply and Sewerage Program, with development of policy and regulatory frameworks, guidelines, overseeing and monitoring of LWU performance.

The Program has driven continuing improvement of productivity and performance, ensuring water supply and sewerage services in regional NSW are appropriate, secure, affordable, cost-effective and sustainable. The key outcomes of this approach include:

- protection of public health and the environment;
- efficient urban water use, which will maximise water availability for industry, agriculture and the environment; and
- support continuing economic growth in regional NSW.

The program is funded directly by the NSW Treasury until June 2017, following which a new streamlined regulatory framework will be developed to ensure continuing sound planning, pricing and management of water supply and sewerage services in regional NSW."

Partnerships with the Commonwealth Government

National Water Infrastructure Development Fund – Feasibility Component

The National Water Infrastructure Development Fund is an allocation from the Commonwealth Government to start the detailed planning to build or augment existing water infrastructure, including dams, pipelines or managed aquifer recharge. The $509.5 million fund has two parts: the feasibility component ($59.5 million) and the capital component ($450 million).

For NSW, the Commonwealth has announced feasibility funding for:

- An investigation into a dam on the Mole river with a view to capturing large flood events occurring in the local river network and a potential to increase the security of supply for agriculture and the environment in the Border Rivers region,
- a preliminary investigation into options to improve the water supply and flood security of Dungowan Dam, near Tamworth and,
- Stage 2 feasibility study on piping the Albert Priest Channel for improving water security for Cobar and Nyngan.

Implementing the Murray-Darling Basin Plan

The Basin Plan includes enforceable limits on the quantities of surface water and groundwater that can be taken from the Murray-Darling Basin. The sustainable diversion limits (SDLs) are set initially at 2,750 gigalitres (GL) less than current diversions in the rivers. This is to be achieved by 2019 with the water being recovered by the Commonwealth to provide additional water for the environment.

An SDL adjustment mechanism is included in the Plan which potentially allows for some 650 GL of environmental outcomes to be delivered through improved use and management of water to deliver environmental outcomes rather than recovery of water.

The NSW Government has maintained a strong stance that priority must be given to recovering the water that would have otherwise been lost, through new infrastructure over further Commonwealth buybacks of water licences.

The Commonwealth Government has agreed to allocate over $1.3 billion for water infrastructure projects in NSW that would contribute to the required water recovery or improved water management. Projects funded through this allocation are outlined below.

Infrastructure Projects for Water Recovery

This includes projects administered by the NSW Government as well as those directly administered by the Commonwealth Government. These projects are important as they provide water entitlement for the Commonwealth for environmental use through efficiency measures and therefore reduce the volumes of water the Commonwealth will recover via direct buyback of water licences.

Projects directly managed by NSW DPI include:

<u>Southern Metering Project</u>

- The aim of this project is to improve metering accuracy of water extraction.
- The project will install/upgrade water meters at regulated/unregulated surface water and ground water extraction points to conform to the requirements of the National Water Initiative.
- Total funding for the project is $31.5 million (a $20 million initial pilot project was completed in 2013/14).
- Installation of meters is complete, with final reporting underway.
- Approximately 10.5 GL of water entitlements will be transferred to the Commonwealth over the life of the project.

Healthy Floodplains Project

- This is a two stage project in north west NSW involving the development of valley wide floodplain management plans which is being undertaken under contract by the Office of Environment and Heritage and the licensing of floodplain extractions by DPI Water.
- Total funding is $49 million, with $11.9 million to be funded under Stage-2 which is still to be confirmed.
- No water savings are associated with this project.

Basin Pipe Project

- This project aims to pipe existing surface water channels that supply stock and domestic supplies, reducing evaporation and increasing efficiency.
- 75 percent of the water savings are transferred to the Commonwealth with the remaining 25% staying with NSW
- The total funding available for this project is $136 million.
- 5,267 ML high security and 1,351 ML supplementary entitlement have been transferred to the Commonwealth so far.
- The Basin Pipe Project is estimated to recover up to 38 GL of shares that contribute to bridging the gap requirements under the Basin Plan.
- Negotiation with landholders is continuing for implementation of the project. All parties are required to agree before infrastructure works can be designed and construction contracted.

Irrigation Farm Modernisation Project

- The Irrigation Farm Modernisation project will improve the long term sustainability of regional communities by allowing irrigators to adapt to reduced water availability and update irrigation infrastructure in the NSW Border Rivers, Gwydir, Namoi/Peel, Macquarie/Cudgegong and NSW Barwon–Darling water management areas.
- The program aims to achieve water savings by improving on-farm water use efficiency and reduce the direct extraction of water from each valley. Water savings are transferred to the Commonwealth.
- Total funding - $ 111 million (recent $28 million additional allocation) with 100 projects approved.

Projects administered by the Commonwealth include:

Southern Basin On-Farm Irrigation Efficiency Program

- The $626 million On-Farm Irrigation Efficiency Program provides funding to irrigation groups within the southern connected system of the Murray-Darling Basin to modernise their on-farm irrigation infrastructure while returning water savings to the environment.
- Substantial funding has been provided to NSW irrigation groups The southern connected system for the program encompasses the New South Wales Murray, Victorian Murray, South Australian Murray, Campaspe, Murrumbidgee, Goulburn, Broken, Loddon and the Lower Darling (south of Menindee Lakes) river catchments.

NSW Private Irrigation Infrastructure Operators Program

- The $750 million Private Irrigation Infrastructure Operators Program (PIIOP) in New South Wales aims to improve the efficiency and productivity of water use and management of private irrigation networks and deliver water savings for the environment.
- Water entitlements resulting from water savings generated from eligible projects, both off and on-farm, contribute to the required water recovery under the Basin Plan.
- Nine projects have been approved in Rounds 1 and 2 of the program, allocating $650 million. The projects aim to improve the efficiency of irrigation systems and on-farm water

use through measures such as modernising irrigation channels, installing pumped pipeline systems and constructing secure stock and domestic water delivery systems.

- Round 3 applications closed on 12 May 2015 but the outcomes have not been announced.

SDL Adjustment Projects

A key negotiating point for NSW's agreement to the Basin Plan was that provision be made to allow up to 650 GL of the SDL reductions to be offset by environmental works or measures that will allow the environmental outcomes to be achieved with less water across the basin. These works will reduce the amount of water that needs to be recovered and are referred to as SDL adjustment projects.

NSW has submitted a range of potential projects to the MDBA and will be submitting further proposals shortly. These are listed in an information sheet on DPI Water's website at http://www.water.nsw.gov.au/__data/assets/pdf_file/0020/655211/NSW-Sustainable-Diversion-Limit-Update-May-2016.pdf.

These projects will be collectively modelled and all Basin Water Ministers must agree to the final projects to be proceeded with. Funding will be provided by the Commonwealth.

As part of this process to progress an SDL offset, the states must also assess the feasibility of operational and other constraints to the delivery of higher releases for environmental purposes. The NSW Government position remains that it will not agree to higher releases unless all third party impacts on landholders via increased flooding or infrastructure investments are addressed. Some of the constraints proposals however are also potential SDL offsets and therefore will contribute to reduced water recovery. Business cases are being developed and consultation is ongoing with stakeholder groups.

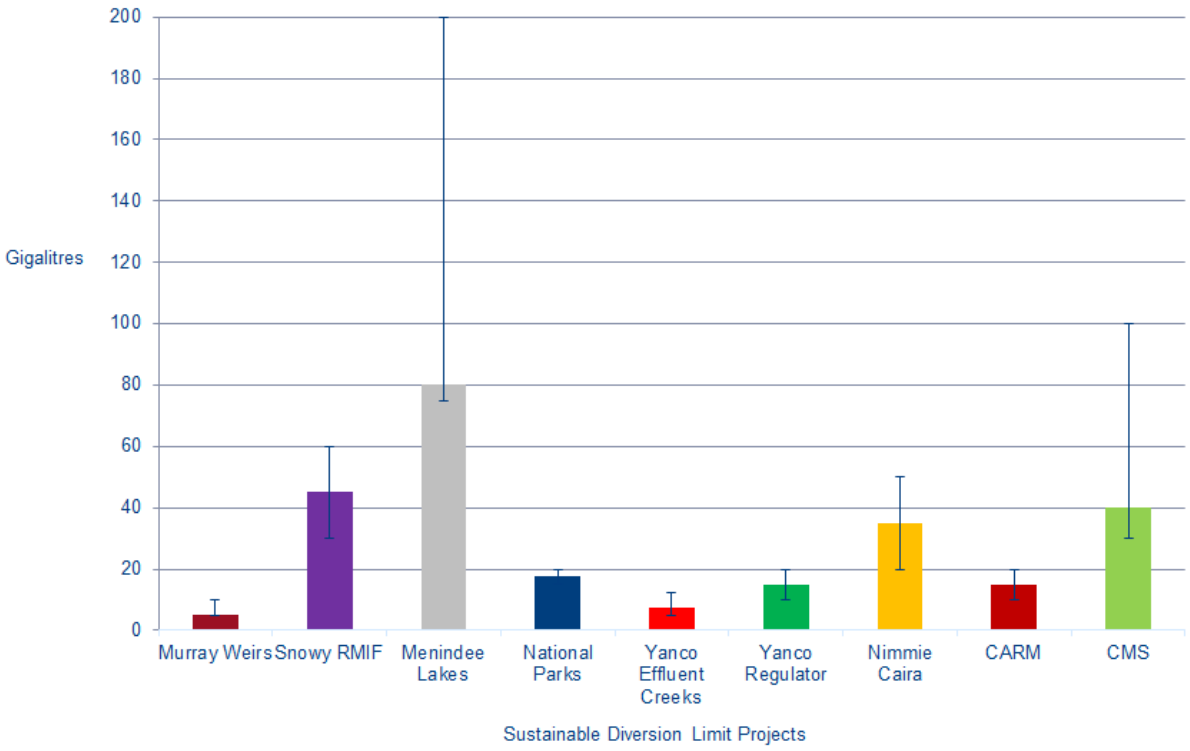

Figure 1 - Possible SDL Adjustment Range (in gigalitre long term annual average) for current projects (GL)

Great Artesian Basin Sustainability Initiative

The Great Artesian Basin Sustainability initiative (GABSI) is a partnership program between the NSW and Commonwealth governments and landholders to rehabilitate failing GAB bores and bore drains with efficient water supplies to achieve sustainable management of the GAB. Since 1999, $83 million in government funding has been committed to the program in NSW resulting in substantial water savings and improvement in artesian pressure. The program has recently been extended with a further $12 million in funding shared between the Commonwealth and other jurisdictions.

The first of seven projects under this extended program have been approved and are about to commence procurement/construction. The second schedule of approximately 16 projects is due to be submitted to Commonwealth for approval in March 2017.

Potential for aquifer recharge

DPI Water recognises that aquifer recharge is an emerging area of research and was a contributing agency to the National Water Quality Management Strategy Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Managed Aquifer Recharge. Following the commencement of the NSW Aquifer Interference Policy in September 2012, there is greater clarity around the standards of the assessment of Managed Aquifer Recharge projects regarding the potential impacts on groundwater sources.

DPI Water will assess any proposal for aquifer interference on its merits against the relevant regulations.

Flood management issues and technologies

Flood mitigation

OEH is responsible for implementing the NSW Government's Flood Prone Lands Policy, 1984. The policy aims to reduce the impact offloading and flood liability on individual owners and occupiers, and to reduce public and private losses resulting from flooding. It specifies that this is to be achieved through the preparation and implementation of a floodplain risk management plan for each floodplain, and that this is the role of councils. The NSW Government through OEH provides technical, policy and financial assistance to local councils for the development and implementation of these plans.

Prior to councils formulating a floodplain risk management plan, a flood study and floodplain risk management study are normally prepared. The entire process is overseen by a council committee and chaired by a councillor. As a member of the committee, OEH provides technical, policy and funding advice. Comprehensive technical investigations of flood behaviour through flood modelling are often used to determine the extent, level, velocity and distribution of floodwaters for a range of flood events.

OEH assists councils in preparing a study brief which outlines the extent of the flooding investigation. The scope normally includes:

- data collection
- the area of interest
- model setup and calibration
- flood modelling, and
- study report and flood maps.

This brief then forms the basis for council's tendering process. Once proposals are received OEH assists council in selecting an appropriate consultant. The study should determine the full extent of the flood liability of the land to assist council to determine appropriate planning and development controls.

OEH supports councils during this process by reviewing and commenting on the outputs from the consultants until the flood studies and plans are complete.

Information about flood history in NSW prior to 2001 is available at the OEH website: http://www.environment.nsw.gov.au/floodplains/FloodRiskNSW.htm. Information on significant floods since 2000 has been provided in Table 1.

Table 1 – Significant floods since 2000 in NSW

River System	Years			
Adelong/Tarcutta Cks	2010			
Bega	2011			
Bellinger	2013	2009	2001	
Brunswick	2012	2005	2001	
Camden Haven	2013	2009		
Castlereagh	2010			
Clarence	2013	2011	2009	2001
Darling	2012	2010		
Gwydir/ Mehi	2012	2011	2001	2000

River System	Years			
Hastings	2013			
Macintyre	2011			
Macleay	2013	2011	2009	2001
Macquarie	2010			
Manning	2011			
Murray	2012	2010	2003	
Murrumbidgee	2012			
Peel	2008	2000		

The responsibility for developing flood mitigation strategies sits with local government and the management of these strategies is catchment and affected area specific. Technical support is provided by the NSW Government, primarily through OEH. The Flood Plain Development Manual is the reference document controlling processes and actions to better equip communities to manage flooding.

Through the Australia New Zealand Emergency Management Committee (ANZEMC), a National Flood Warning Infrastructure Working Group has been established to further address the flood warning infrastructure issues through the development of national technical standards and risk based infrastructure plans.

Hawkesbury Nepean Flood Review

In recognition of the complex nature of flood mitigation in the Hawkesbury-Nepean valley, the Government has extensively reviewed the risks associated with floods in the area. In June 2016, the Premier announced funding of $58 million for the implementation of the Hawkesbury-Nepean Valley Flood Risk Management Strategy. The strategy is a comprehensive long-term plan to manage the risk posed by regional floods in the Hawkesbury-Nepean Valley for the NSW Government, local councils, businesses and the community. The strategy commits to undertaking detailed concept designs, environmental assessments and preparation of the full business case in 2019 to raise the Warragamba Dam wall by around 14 metres for flood mitigation. Along with raising the dam wall, the strategy includes increasing community flood risk awareness, improving flood evacuation road signage and working with the Bureau of Meteorology to improve flood forecasting.

Floodplain management plans

Floodplain management plans (FMPs) are being prepared as part of the NSW Healthy Floodplains Project (HFP). The NSW HFP commenced in 2010 to reform the management of water on floodplains through the development of floodplain management plans as well as the licensing of floodplain harvesting water extractions. The HFP is one of four State Priority water efficiency projects funded by the Commonwealth Government under the Water for the Future Initiative.

This is part of the Intergovernmental Agreement on Murray-Darling Basin Reform signed by the Commonwealth Government and contributing States and Territories in July 2008.
The management of floodplain extractions will be carried out by DPI Water by implementing the NSW Floodplain Harvesting Policy which will licence water extractions from the HFP designated floodplains.

The HFP will allow the development of rural FMPs under the *Water Management Act 2000* and provide the framework for coordinating the development of flood works on a whole of valley basis. The valley FMPs will:

- integrate management measures from existing adopted Part 8 (*Water Act 1912*) rural FMPs
- provide certainty for landholders about where they can construct works on the floodplain by specifying rules for the types of flood works that can be allowed in different floodplain management zones within the valley floodplain
- streamline the approval process for new and amended flood works by providing clearer and consistent assessment criteria and rules for advertising flood work applications
- provide accurate mapping of the passage of floodwaters through the valley floodplain using a range of tools (digital elevation models coupled with hydraulic computer models, flood imagery and local knowledge to identify flood flow paths to be left unobstructed) in order to minimise the risk to life and property from the effects of flooding and maintain flood connectivity to key ecological and cultural assets that are dependent on flooding.

The first floodplain management plans are currently being developed by OEH in consultation with DPI Water under the *Water Management Act 2000* for five valleys in the northern Murray-Darling Basin, which are the Barwon-Darling, Gwydir, Border Rivers, Macquarie and Namoi valleys. The current progress of reach each of these Floodplain Management Plans is shown in Table 2 – Floodplain Management Plan progress by valley

Table 2 – Floodplain Management Plan progress by valley

Floodplain Management plan	Current Status	Anticipated dates
Gwydir	Being considered by Government	Aug 2016
Upper Namoi	Draft Floodplain Management plan completed for Public Exhibition	May 2017
Lower Namoi/Barwon Darling	Draft Floodplain Management plan completed for Public Exhibition	Dec 2017
Border Rivers	Technical modelling underway	Apr 2018
Macquarie	Data collected to inform technical modelling	Apr 2018

Environmental water

In NSW, WSPs provide the framework within which all water use is planned and coordinated. WSPs specifically share the water resource in each valley, including a proportion of water to support the environmental needs of NSW riverine and wetland systems.

DPI Water is responsible for ensuring the rules in WSPs that provide water for the environment (i.e. planned environmental water) are applied. The *Water Act 2007* (Cth) requires that the planning and management of environmental water in NSW must be consistent with the Basin Plan.

OEH manages allocated environmental water, including adaptive environmental water licences held by the NSW Government and callable water allocations established under water sharing plans. OEH also cooperates with the Commonwealth Environmental Water Holder on the management of environmental water held by the Commonwealth Government.

Allocated environmental water includes:

- planned environmental water allowances (or environmental contingency allowances) accrued through the regulated river WSPs
- environmental water licences arising from the purchase of entitlements by governments and the recovery of water savings from infrastructure projects.

The NSW Government does not intend to purchase any more water. The NSW Minister for the Environment holds around 190,000 megalitres in various forms of entitlement. The volume of water available for use each year is determined by the annual allocations of water to these entitlements, in the same way water is made available to all other water licence holders.

Water is made available to planned environmental water allowances by rules described in the WSP relevant to that valley. These valley specific allowances have various size limits and rules on how and where they can be used, which are also specified in the relevant WSP.

OEH also trades a small proportion of available water allocation, in most years, to help achieve the following program objectives:

- to assist in covering the use charges incurred when using environmental water
- to implement other actions of equal or greater benefit to the environment if use of water is not required in that season
- to effectively use the entire water portfolio for the benefit of the whole of NSW.

As an example, in 2013/14, OEH traded 22,650 megalitres of water allocation across the Gwydir, Macquarie, Lachlan, Murrumbidgee and NSW southern Murray-Darling Basin valleys. Trading will continue to occur in future years to manage the portfolio for the maximum environmental benefit.

Murray-Darling Basin Plan

The Basin Plan gives effect to the Commonwealth *Water Act 2007* to strike a balance between water provided for riverine and wetlands environments and extractive water use within the Murray-Darling Basin. It provides directions for the management of water for the environment in NSW.

The Southern Connected Basin Environmental Watering Committee (SCBEWC) was also established in 2014 to ensure coordination between Basin State and Commonwealth Government environmental water holders.

There are a range of new planning instruments from the Basin Plan that will affect water for the environment. These include the following valley based plans:

- Long-term Watering Plans

- Annual environmental watering priorities
- Water Quality and Salinity Management Plans
- Water Resource Plans, to replace existing Water Sharing Plans. These will set out arrangements to share water as well as establish rules to meet environmental and water quality objectives and consider potential and emerging risks to water resources.

Other Basin Plan projects such as those undertaken to relieve Sustainable Diversion Limit requirements and Constraints Management may also impact on how effectively water for the environment can be managed.

OEH is responsible for the development of the Long-term Watering Plans (for environmental water), and Annual Environmental Watering Priorities

Long-Term Watering Plans

Long-term Watering plans will provide long-term objectives and strategies for managing environmental water in each of the major regulated valleys. These objectives will also give effect to the Basin Water Strategy by contributing to basin-wide environmental outcomes and will direct annual water planning.

Long-term Watering Plans must also be considered in the development of new Water Resource Plans.

Annual Environmental Watering Priorities

The Basin Plan also requires each state in the Murray-Darling Basin to prepare annual environmental watering priorities which outline how environmental water may be used in the coming year, depending on ecological and climatic factors and water availability. Priority environmental watering statements for 2015-16 are listed on the OEH website.

Coordinated management of environmental water

OEH manages the delivery of environmental water in collaboration with a range of stakeholders and agencies. The primary forums for this collaboration are the valley specific Environmental Water Advisory Groups (EWAGs). EWAGs are comprised of local community members, water managers, landholders, Aboriginal groups, independent scientists, local government representatives and relevant partner agencies including the Commonwealth Environmental Water Office.

Working in partnership with stakeholder groups and other agencies, OEH identifies priority watering sites and activities and then delivers water to achieve the desired ecological outcome. The management of environmental water takes into consideration infrastructure requirements, the needs of other river users, ecological responses, monitoring and reporting. Typically, an annual water plan would identify a range of objectives, such as:

- building resilience into an ecosystem;
- triggering plant and animal breeding cycles;
- maintaining refuge during dry times; and,
- building on the successes of previous watering events.

Decisions for individual watering events to achieve planned objectives are then made based on a number of considerations, including:

- rainfall events;
- climatic conditions;
- water availability;
- water use;
- stakeholder support; and,
- ecological outcomes.

While the *Water Act 2007* requires the Commonwealth Government to deliver outcomes at a basin scale, this is achieved by working closely with the states and using the existing state frameworks and forums. This ensures all environmental water is used in a coordinated way to achieve the most efficient outcome possible.

Monitoring and Reporting of environmental water use.

There is extensive monitoring and reporting on the use of environmental water across NSW. All environmental watering targets and events include monitoring to assess the effectiveness of environmental water. OEH undertakes the following monitoring activities across all major valleys:

- inundation mapping, to map the timing and extent of environmental water;
- wetland vegetation condition and extent mapping, to assess the response of vegetation to environmental water; and
- fauna surveys, to assess the response of selected fauna species to environmental water.

The Commonwealth Government also specifically monitors for outcomes achieved from the use of Commonwealth water in the Gwydir, LachIan, Murrumbidgee and Murray Valleys. Results from this monitoring are also used by OEH to help refine and improve future environmental watering.

OEH reports extensively on the use of environmental water in a number of ways, including:

- regular reports to DPI Water on the status of OEH Basin Plan implementation projects;
- individual watering event reports;
- regular updating of the DPIW Water Information Portal;
- annual valley specific outcomes reports including volumes used, outcomes achieved and environmental water trading activities; and,
- an annual report to the Murray-Darling Basin Authority on use and the outcomes achieved against the Murray-Darling Basin Plan.

Communication and Engagement

National scale water reform over the last decade has raised awareness of environmental water. Increased awareness has not necessarily come with an increased understanding and the delivery of water for the environment is still perceived by some regional communities as problematic.

OEH is currently working to better understand community perceptions of environmental water and its management. The results from this process will help refine communications and engagement into the future.

OEH is establishing a new approach to communicating with and engaging stakeholders based on the following elements:

- increasing transparency, detectability and accessibility of information about what it does and the purpose behind it;
- focus on people's values when building awareness and understanding of water for the environment;
- facilitate stakeholder involvement in the delivery of water for the environment;
- maintain momentum by nurturing existing relationships and expanding trusted networks;
- link to production values that community hold and explain socio-economic and ecosystem service benefits; and,
- normalise the delivery of water for the environment.

Environmental water management in other jurisdictions

Environmental water is managed differently by different jurisdictions. The Victorian Environmental Water Holder (VEWH) is an independent statutory body responsible for making decisions on the most efficient and effective use of Victoria's environmental water entitlements.

The VEWH works with land managers and local water utilities to ensure environmental water entitlements are used to achieve the best environmental outcome with the water that is available.

The VEWH acts independently from, but is accountable to, the Victorian Government on decisions about environmental water. It exists as a separate entity from the agencies responsible for regulation, legislation and planning.

Similarly, at the Commonwealth level, the Environmental Water Office supports the Commonwealth Environmental Water Holder to plan, manage and monitor a large portfolio of water for the benefit of the environment. As per the *Water Act 2007* (Cth), the Commonwealth Environmental Water Holder is not subject to the direction of the Secretary of the Department of the Environment or the Minister in relation to undertaking its role. As an independent holder, reporting requirements related to use and dealings are transparent to the community, increasing trust and greater understanding.

The water market in NSW

Trade of water allocation has been occurring in the regulated rivers in NSW since the early 1980s under the *Water Act 1912*. The *Water Management Act 2000* and subsequent amendments provide for expanded trade opportunities, including permanent tagged interstate trade. Interstate trading has been ongoing since 1998. Groundwater trading is available in all groundwater sources that are under a water sharing plan.

Water trading in NSW is permitted through dealings. Dealings are dealt with according to the provisions of the *Water Management Act 2000* and in particular:

- the water management principles of the Act;
- the access licence dealing principles of the Act;
- aby access licence dealing principles established by the Minister; and
- access licence dealing rules established by any relevant water sharing plan

The water trading market is well established in some water sources and the irrigation and mining industries have come to strongly rely on water trading opportunities to manage their own business risk and deal with climatic circumstances. The benefits of water trading include:

- providing water users with the flexibility to adjust to changes in water availability
- enabling water to move from lower to higher value uses
- assisting farmers to adjust business both on a short as well as long term basis.

With embargoes in place on the issue of licences for new entitlements, trading is the only way that new enterprises can get access to water entitlements.

The National Water Initiative looks at trade as a whole, through both intra and interstate trade to foster economic development and promote water use efficiency by encouraging water to move to higher value use. Anyone who wishes to purchase a NSW water entitlement and identify the relevant use and works approval to get the water delivered can do so.

There is significant intrastate trade occurring in all of NSW. Interstate trade is mainly in the interconnected Southern Murray-Darling basin, namely, the Murrumbidgee and Murray Rivers but there is also trading between NSW and Qld on the Border Rivers. Interstate water trade has been supported and implemented through the MDBA's Tagging Entitlements for Extraction in another State Protocol 2010.

Trade in the Murray-Darling Basin

In addition to the above, trade in the NSW part of the Murray-Darling Basin is conducted as per the Commonwealth Water Market Rules (from January 2010) and Water Trading Rules in the Murray-Darling Basin Plan that commenced on 1 July 2014. From 2019, water trading will be addressed through the Water Resource Plans in the Basin while the Water Sharing Plans on the Coast will continue to address water trading on the Coast. Water trading includes both trade of annual water allocations and sale of water entitlements.

The Australian Competition and Consumer Commission (ACCC) provides advice to the responsible Commonwealth Minister on the water market, trade and charge rules for storage and delivery, planning and management, provides advice for infrastructure operators within the Murray-Darling-Basin and ensures its rulings are enforced.

The ACCC sets termination fee rules for trade out of irrigation corporations, private irrigation districts and water trusts that commenced on 1 September 2009. DPI Water will be required to facilitate the implementation of these rules, which will have implications for compliance, metering and licensing activities.

Certain tasks have transitioned to the ACCC over the current determination period, and it now sets water market rules (from 1 January 2010); water charge rules for water planning and

management (from 24 July 2010); water charge rules for infrastructure operators (from 12 January 2011); and water trading rules in the Basin Plan (from 1 July 2014).

In addition, under Part 4 of the *Water Act 2007* (Cth), the ACCC is required to monitor and report on regulated water charges, transformation arrangements, and compliance with the water charge rules and water market rules.

Trends in Water Trading

Trade of water allocation in NSW (Allocation Assignments) is shown in Figure 2. The majority of this trade occurs in the NSW regulated water sources with the majority of this being in the Murray-Darling Basin.

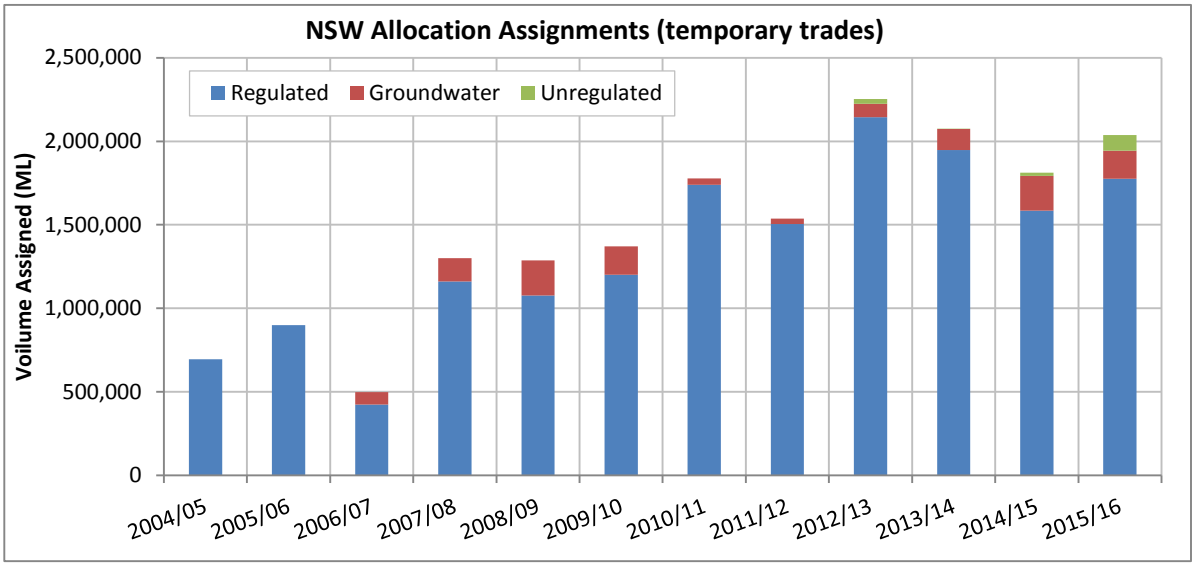

Figure 2 - Water Accounting System (Source: DPI Water & WaterNSW)

A history of Interstate trade in allocations since the commencement of the water sharing plans is shown in Figure 3. The majority of trade moves out of NSW to the other states. The net assignment out since the commencement of the plans is 2,365,140 ML (note trade figures for 2015-16 reflect trade up until the end of May 2016).

A history of trade in entitlements since the commencement of the water sharing plans is shown in the graph below for trades greater than $0/ML broken down into water type. The majority of trade is in the regulated systems.

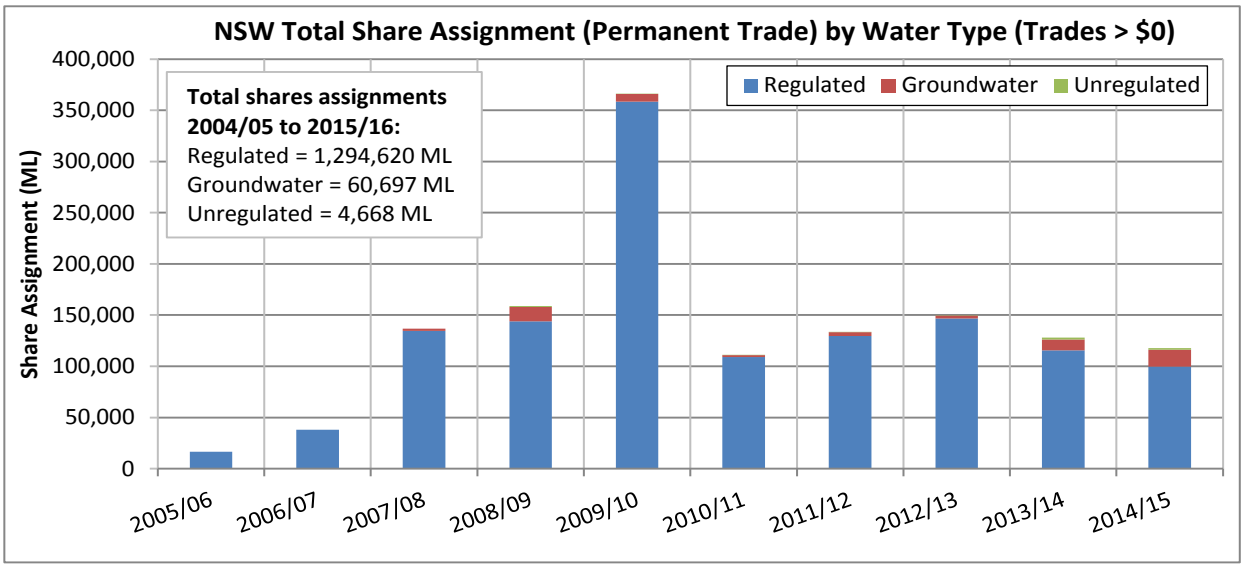

Figure 3 - NSW Total Share Assignment by Water Type (Source: DPI Water Licensing System)

With the entrance of the Commonwealth into the water market to purchase licences for environmental use, significant volumes have been purchased. Figure 4 gives an indication of the volume of share assignments (trade in entitlements) that moved water from consumptive licences to the environmental licences for a price of greater than $0 per ML. This excludes those licences for which shares were assigned from already held government licences to environmental. The majority of share assignments are resulting from environmental water buy back.

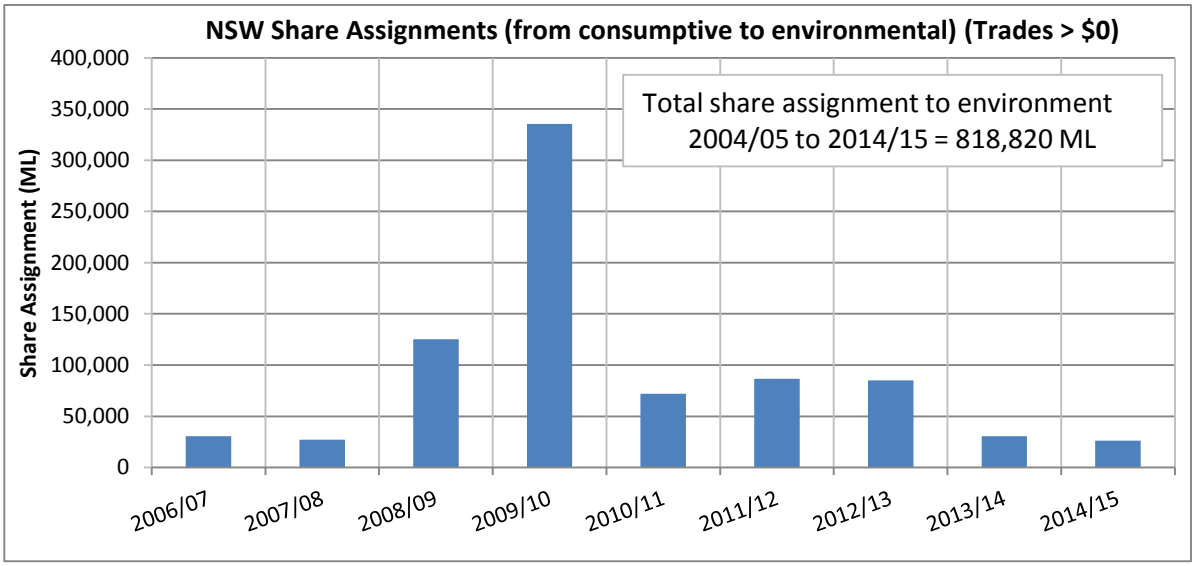

Figure 4 - NSW Share Assignment from consumptive to environmental (Source: DPI Water Licensing System)

Additional water purchases that also form part of the trade market are transfers which represent change of ownership of a water access licence. This can be because the licence has been sold to someone else. In addition leasing of all or part of an access licence for a term also contributes to the trade market.

Water Market Reporting

The NSW Government has established a publicly accessible water trading register. A Water Access Licence Register has also been established and is searchable via the internet. NSW has also established a number of free online public registers providing a range of information.

DPI Water produces Annual Water Accounting reports for regulated river systems that contain information on trends in temporary water trading in valleys. Trade applications are processed as per nationally agreed service and reporting standards for trade processing times under the COAG Water Reforms. http://www.nationalwatermarket.gov.au/water-market-reports/trade-processing.html

Performance against agreed trade processing service standards are monitored and reported in accordance with monitoring and reporting frameworks for allocation and entitlement trades by each of the MDB States and Territory. Trade processing information for NSW is available at http://www.water.nsw.gov.au/water-licensing/registers

DPI Water and WaterNSW provide trade information to Bureau of Meteorology (BoM). BoM produces national water market reports. BoM website has monthly data on trade in water entitlements (http://www.nationalwatermarket.gov.au/water-market-reports/index.html) and weekly data on trade in water allocations (http://www.nationalwatermarket.gov.au/water-market-reports/index.html)

Private Irrigation Corporations, Irrigation Districts & Trusts, DPI Water and WaterNSW also provide information to the ACCC for its Water Monitoring reports in the Basin under the Commonwealth *Water Act 2007*. The ACCC monitors the implementation of the water market rules that facilitates trade out of private irrigation entities and the water charge rules. https://www.accc.gov.au/publications/accc-water-monitoring-report/accc-water-monitoring-report-2013-14

The Department of Agriculture and Water Resources publishes reports on the average prices of offers pursued from recent Commonwealth Government water entitlement purchasing tenders. Average prices of offers pursued from recent tenders

As per the Bureau of Meteorology (BoM) website, to inform the water entitlement purchasing program, the Commonwealth Government commissions quarterly Murray-Darling Basin Water Entitlement reports which are available on the Commonwealth Department of Agriculture and Water Resources website.

The reports list the volume weighted average prices for water entitlement transfers in the Murray-Darling Basin, drawing on information from the State water registers of New South Wales, Victoria, Queensland and South Australia and from Murray Irrigation Limited's water exchange. The reports (from September quarter 2009) also include buyer bid and seller ask prices identified from surveys of water brokers and water trading exchanges in the southern Murray-Darling Basin. Market price information for Murray-Darling Basin Water Entitlements

Other means of accessing market information is through private water trading companies such as Waterfind - www.waterfind.com.au

Responsibilities

WaterNSW is responsible for receiving and processing applications for allocation trade on a day-to-day basis and for displaying publicly the inter-valley transfer (IVT) account balance. In early 2016 WaterNSW, with support from DPI Water, implemented a near-automated system of opening/closing access to trade around the physical constraint of water delivery. Triggers are publicly available that allow water users to see the status of trade on any day and to estimate the likelihood of changes.

MDBA's River Murray Operations (RMO) is responsible for efficient River Murray operations and 'calling' IVT water when most useful to the Murray. RMO's primary responsibility is therefore to effectively and efficiently manage the Murray system operational requirements and risk. However, while meeting this responsibility, RMO must consider actions that will keep State trade open. Therefore RMO will consider using IVT to meet Murray needs, in preference to calling water from the upper Murray storages, if either source of water would efficiently meet the required demand and if the IVT balance is close to the upper limits. However, RMO will not 'call' such IVT water if there is a risk that it will not be useful.

While DPI Water avoids participation in the water market, it is responsible for protecting third parties and will close trade if circumstances arise that could affect third-parties. DPI Water will also aim to open trade at the earliest practical opportunity.

Improvements to the processing of trade applications in 2016, in particularly the transparency of information publicly available and near-automatic opening and closing of trade in response to trade volumes provides water users with a more efficient and equitable opportunity to trade their account water.

The IVT account tracks the balance of net trade out of the Murrumbidgee valley meaning that traded water can be called and used when required in the Murray to maximise water use efficiency.

Further improvements are foreshadowed from investment in fully automated, online systems that provide objectivity, transparency, efficiency and convenience for water users wanting to participate in water trades.

Inter-valley transfers

Water can be sold from one person's account in one valley and purchased for use by another person in another valley, within a water trading framework and within physical limitations. The tracking of this exchange is done using an IVT account for each valley.

In NSW the main IVT activity is between the Murrumbidgee and Murray valleys. The trade of water between the Murray and Murrumbidgee River systems is controlled under Schedule D of the Murray-Darling Basin Agreement, Chapter 12 of the Basin Plan and under the respective statutory NSW regulated river Water Sharing Plans.

When water is sold to the Murray, the Murrumbidgee water user's account is immediately debited and the Murray water user's account is simultaneously credited.

The RMO meets the immediate increased Murray liability caused by the trade with Murray water in the first instance, with a view to 'calling' the physical Murrumbidgee water later. This is effectively a temporary 'borrow' of Murray water until 'payback' from the Murrumbidgee, to match the trade, is physically delivered at a later date.

The Murrumbidgee IVT account balance therefore reflects, at any point in time, the volume of undelivered Murray water – water still in the Murrumbidgee valley storages that has been sold to the Murray but is yet to be physically delivered to the Murray.

The IVT account balance is carried from one water-year to the next. IVT account balance reduces in two ways:

- Water paper-traded into the valley (also known as back-trades).
- Water physically delivered from the valley – accounted as flow past Balranald.

To protect third parties from potential impacts the IVT account is operated within limits. Once the account balance hits the limit, that is, moves beyond the acceptable operating range, trade is closed.

Lower Limit (zero GL)

A negative account balance means that water is 'owed' from the Murray to the Murrumbidgee. Since water cannot be physically delivered uphill into the Murrumbidgee, trade into the valley is closed until trades out of the valley restore a positive account balance.

Upper Limit (100 GL)

A large positive account balance means that a large volume of (Murray) water is occupying Murrumbidgee storages. Under wet conditions this can mean reduced allocations for Murrumbidgee water users because the presence of Murray water prevents more Murrumbidgee water from being stored. Additionally, if the IVT water spills from the Murrumbidgee storages, this will result in a loss of 'payback' water to Murray water users. In addition, under very dry conditions it can be 'expensive', in terms of transmission losses, to deliver large volumes the full length of the Murrumbidgee system to Balranald, meaning reduced water availability for Murrumbidgee water users. The potential for these third-party impacts on water users is limited by adopting an upper limit to the volume that can accrue as undelivered trade water – the maximum (100 GL) IVT balance.

Historically, 'paper' trades would occur in and out of the valley, which allows the IVT account balance to fluctuate within the normal operating range. Combined with a call-out for Murray delivery as required, this would reduce the IVT balance and generally keep it away from the upper operating limit.

The market has matured significantly in recent times and a higher level of market activity not previously seen has begun to emerge, prompting a review of 'normal' IVT account operations.

Conveyance

Conveyance is a category of water entitlement (licence). This entitlement was originally issued to Irrigation Corporations and reflected the volume of water needed to operate their channel systems to deliver water orders for the different categories of water licence (towns, domestic, stock, high security, general security). It is the water needed to deliver water. The respective water sharing plans prescribe how available water accrues to this entitlement but it generally has similar reliability (water availability) as high security and greater reliability than general security entitlement.

With investment in water savings and improved water use efficiencies, some conveyance water has been sold by Irrigation Corporation and is now held by others, including the environmental water holder.

Licenced conveyance information is available publicly on the NSW Water Register, and to licence holders via the Water Accounting System and IWAS (WaterNSW). Allocation volumes are also included in regular (typically once or twice per month) water allocation statements. Conveyance information is also reported on an annual basis to the Bureau of Meteorology (National Water Account, Water Regulations), MDBA (MDB Plan), Bureau of Statistics (Water Account Australian) and forms part of DPI Water General Purpose Water Accounts.

It is reported as a volume available in an allocation account. The allocation account volume is determined based on accounting rules associated with the corresponding water source and licence category such as AWDs, trade and carryover.

Loss Water

Water managers, when budgeting to operate the regulated river system for the water year, must set aside enough water to overcome natural river losses (typically, evaporation, evapo-transpiration, soakage into the riverbeds and banks). Once these 'operating' losses are set aside water can then be allocated to other priority needs through the Available Water Determination process.

Typically, at the start of the water year, a conservative estimate of river losses is made based on historic observations from previous years, and a volume is set aside accordingly

The 'water budget' is re-assessed at least monthly, and water savings that accrue from losses that are less than anticipated, is allocated to water users. Therefore, in some months when there has been no rainfall or increased inflows, there can still be a small allocation improvement from a reduction in the losses need to be set aside for the remainder of the year.

These volumes are reported as a component of the Resource Assessment process in the monthly or twice-monthly water allocation statements. Components of it are also reported in other processes such as evaporation loss from storages and rivers (General Purpose Water Accounting Reports).

Carryover

Carryover refers to the water remaining in water accounts at the end of the water year (30 June) that is credited to that account on 1 July for use in the following water year. The rule is prescribed in the WSPs and varies between water sources and licence entitlements.

Typically high priority licences, namely towns, domestic, stock and high security entitlements are not permitted to carryover water. Water remaining in these accounts is forfeited at the end of the year and forms part of the water available for allocation the following year. Apart from very dry years, these accounts normally receive a full allocation on 1 July, therefore carryover is not needed.

General security entitlement holders are the main beneficiaries of the carryover opportunity. Although water users place varying degrees of importance on carryover – some avoiding it, others maximising the opportunity, it is becoming more popular as water users become more sophisticated. It provides a degree of insurance and assurance should water allocation in the new year commence at low levels as they often do for general security entitlement holders.

In the NSW Murray valley, general security entitlement holders can carryover up to 50 per cent of their entitlement. Therefore, an account corresponding to an entitlement of 100 shares, can carryover their account balance up to a maximum of 50 megalitres. The carryover limit in the Murrumbidgee valley is 30 per cent of entitlement for general security and conveyance entitlements.

Carryover is a popular option used by many water users to ensure that a minimum volume of water is available early in the following water year regardless of allocation announcements.

Carryover forms part of an access licence allocation account and is reported through the Water Accounting System and IWAS at a licence holder level. It is reported at a water source/licence category level as part of the Resource Assessment process in the regular water allocation statements. It is also reported on an annual basis to BOM (National Water Account, Water Regulations), MDBA (MDB Plan), and forms part of DPI Water General Purpose Water Accounts.

Attachment A – Updated Government response to the report of the Legislative Council Standing Committee on State Development on the adequacy of water storages in NSW

The table below either provides additional information about the implementation of the Committee's recommendations (marked as update) or indicates that the previous response stands (maintain previous response).

Recommendation	NSW Government Response
1: *That the NSW Government clearly communicate to stakeholders the purpose of all major water storages in NSW.*	**Update** Major water storages in NSW are managed by WaterNSW. Information about the purpose of major storages is available on WaterNSW website - NSW Major Dams.
2: *That the NSW Government report on the outcomes of its review of the potential role for Warragamba Dam in flood mitigation.*	**Update** The Hawkesbury-Nepean Valley Flood Management 2013 Review (Stage One) was completed in early 2014 with the reports published on the DPI Water's website (http://www.water.nsw.gov.au/water-management/water-availability/flood-management/hawkesbury-nepean-valley-flood-management-review). In response to the Stage-One recommendations the NSW Government established the Hawkesbury-Nepean Valley Flood Risk Management Taskforce, headed by an Independent Chair in 2014 to develop a comprehensive regional Hawkesbury-Nepean Flood Risk Management Strategy to significantly reduce the potential economic and social impact of flooding in the Valley. The Strategy comprises a mix of infrastructure, non-infrastructure and improved flood risk management measures that contribute to preventing or mitigating the flood, more coordinated and strategic planning and preparing for floods including increasing ability to evacuate as well as responding to and recovering from floods in the Valley. In June 2016, NSW Government announced that it plans to raise the wall of Sydney's Warragamba Dam to significantly reduce the flood risk in the

Recommendation	NSW Government Response
	Hawkesbury-Nepean Valley with $58 million in funding allocated for detailed concept designs and environmental assessments. The funding package will also be used to increase community flood risk awareness, create evacuation signage, improve flood forecasting and integrate the flood risk management with regional planning. Final approval of the project will be subject to the preparation of a business case.
3: *That the NSW Government and local councils continue to support and promote demand management practices and urban water conservation measures such as stormwater harvesting and recycling waste water.*	**Update** In relation to stormwater harvesting, the NSW Government is currently progressing the development of an Urban Stormwater Harvesting Policy in consultation with Local Government. In relation to water recycling, the Best Practice Management (BPM) Framework was streamlined in 2014 reducing the regulatory burden and compliance costs without diminishing the effectiveness or efficiency in achieving the outcomes of the BPM Framework. The BPM Framework addresses the 10 key national requirements for urban water supply and sewerage. Water planning for the metropolitan areas of greater Sydney and the lower Hunter aims to achieve an optimal mix of demand and supply measures to secure drinking water supplies for over five million people in NSW. Demand management measures are an integral part of both the Metropolitan Water Plan for Sydney and the Lower Hunter Water Plan. Strategies to reduce potable water demand include water recycling and reuse for a range of non-drinking purposes, permanent Water Wise Rules, and other water efficiency initiatives. In addition, the *Water Industry Competition Act 2006* enables private sector involvement in the water industry, supporting additional opportunities for water recycling and stormwater harvesting.
4(i): *That the NSW Government:* • *financially support the agriculture sector to use more efficient water practices and encourage contributions from industry and*	**Maintain previous response** The NSW Government has continued to have a strong focus on water efficiency, particularly in the Murray-Darling Basin. The NSW Government has supported

Recommendation	NSW Government Response
the Commonwealth Government to support research and development in this area	substantial Commonwealth funding into on-farm efficiency and water delivery efficiency programs to recover the water required under the Basin Plan.
4(ii): *ensure that after the 2,750 gigalitres in sustainable diversion limits for the Murray-Darling Basin Plan objective has been met, any further funding for on-farm efficiency savings should be provided based on:* *1. State funded projects returning 100 per cent of water savings back to the irrigator, and* *2. any State participation in federally funded programs for on-farm water savings be based on irrigators retaining at least 50 per cent of the savings.*	**Update** The Basin Plan sets a sustainable diversion limit (SDL) for each catchment and aquifer in the Basin, as well as an overall limit for the Basin as a whole. In order to meet the new limits, 2,750 GL of water needs to be recovered Basin-wide; NSW's share of this "SDL gap" is 1,312 GL. Approximately 870 GL of water recovered up till May 2016. On 22 April 2016, Ministers agreed to a Sustainable Diversion Limit Adjustment Mechanism (SDLAM) package of supply, efficiency and constraints measures. Ministerial Council has also requested that the Commonwealth amend the Basin Plan to provide for a second SDL adjustment step by 30 June 2017. This would allow for a second tranche of projects to be developed to further improve the outcomes of the Basin Plan. An overview of the SDL adjustment mechanism and inter-jurisdiction review process was provided in the first Stakeholder Update made available in January. The outcomes of prefeasibility assessment of potential projects were summarised in the January and June 2015 Stakeholder Updates. Both of these updates are available on the DPI Water website - www.water.nsw.gov.au. Jurisdictions are now considering phase 2 proposals against the guidelines endorsed by the Basin Officials Committee.
5:*That the NSW Government develop a state-wide policy of waiving fixed water charges during exceptional drought conditions.*	**Maintain previous response** The NSW government will continue to assess the effects of exceptional drought conditions as and when those conditions occur. At times of exceptional drought, the NSW Government will consider the appropriate measure in response to drought conditions.
6: *That the NSW Government review the management and impact of water releases*	**Update** The management of the Tumut River has been reviwed many times since the

Recommendation	NSW Government Response
from Blowering Dam on the Tumut River.	construction of the Snowy Hydro Scheme. DPI Water manages an annual program works and measures designed to maintain the river, prevent erosion and unplanned inundation. Since 2013/14, DPI Water has spent approximately $2 million on an annual program of works and measures designed to manage and maintain the Dam and River.
7: *That the NSW Government review the environmental flow allocations for all valleys in NSW and make representations to the Commonwealth Government for it to review the environmental flow allocations for NSW valleys in relation to the Murray-Darling Basin Plan.*	**Update** Environmental flow provisions in NSW's existing water sharing plans were developed in consultation with local communities. The Basin Plan was developed on the basis that the water committed to the environment under the water sharing plans would not be reduced, with additional environmental water to be recovered. The environmental water provisions in NSW water sharing plans in the Basin will be reviewed as part of the development of the water resource plans. More specifically, it has recently been announced that that a review of the translucent flow rules will be undertaken by DPI Water to determine whether the intended environmental outcomes can be achieved with a more flexible approach. NSW has developed strategies for improving the efficiency and effectiveness of licensed environmental water delivery while maintaining the same reliability of supply of water to consumptive users as at the establishment of the Basin Plan. These prerequisite policy measures, set out in the Basin Plan and required to maximise the SDL adjustment for NSW, will provide the ability to use environmental flows at multiple sites (environmental flow reuse) and the ability to allow the call of held environmental water from a storage during an unregulated flow event (piggybacking).
8: *That the NSW Government amend the principles of the Water Management Act 2000 to ensure that the commercial water supply for towns and utilities and high security needs in regulated rivers are prioritised above*	**Maintain previous response** The NSW Government does not propose to amend the water management principles set out in the *Water Management Act 2000*.

Recommendation	NSW Government Response
environmental needs.	
9: *That the NSW Government clarify with the Commonwealth Government the NSW Government's liability for environmental water releases made under the Murray-Darling Basin Plan that inundate private land, in time to feed into the process of developing the water sharing plans that must comply with the Plan and be enacted by 2019.*	**Update** This issue is being determined as part of the constraints management strategy under the Basin Plan, which is reviewing the impacts of increased environmental releases.
10 & 11: *That the NSW Government:* • *fund and implement the Computer Aided River Management (CARM) system across all NSW river systems.* • *implement the water-metering project across NSW, to support the state-wide implementation of the Computer Aided River Management system.*	**Update** The CARM project was run by WaterNSW and has been implemented in the Murrumbidgee. Recognition of the operational efficiencies anticipated from CARM is being sought via the SDL adjustment mechanism in the Murrumbidgee. WaterNSW is also assessing the feasibility of a Northern Rivers' Computer Aided River Management project. The proposition is to deliver a staged system to maximise river operational efficiency benefits therefore underpinning river system reliability, security and water recovery. Successful application of the CARM hydrodynamic operating system requires more than an operational perspective; each river system is different with differing community, environmental and economic demands. This necessitates a whole-of-valley perspective before and during the application of CARM which is unique to each river valley. The metering projects in the Southern valleys of Murray, Murrumbidgee and Lower Darling are underway. An alternative approach to monitoring in the norther valleys was agreed, and as a result, these remaining valleys which were not part of the metering project will be required to provide accurate meters on an individual basis to comply with metering standards.

Recommendation	NSW Government Response
12: *That the NSW Government:* • *make representations to the Commonwealth Government to resolve who will provide funding for the augmentation works at the Menindee Lakes; and* • *re-affirm and complete plans to enable construction to commence as soon as practicable*	**Update** Securing Broken Hill's water supply is now backed by almost $500 million investment package – consisting of a range of short term water projects – such as a new reverse osmosis plant – and a long term solution of a pipeline from the Murray River. This investment will address decades-long supply issues that continue to hold back the city from reaching its full potential. It will also bring significant catchment-wide benefits for the northern and southern irrigation industries – and sit at the heart of NSW commitments under the Murray-Darling Basin Plan. The pipeline project helps NSW meet its targets under the Murray-Darling Basin Plan – reducing our need to take further productive water to meet recovery targets and helps our northern and southern irrigation industries. The NSW and Commonwealth governments have been involved in negotiations for a number of years over proposed changes for improved management arrangements and infrastructure for Menindee Lakes to achieve water savings. With the long term solution for Broken Hill now resolved, DPI Water is developing the concept designs for potential new infrastructure and management arrangements that would improve the management and efficiency of the Menindee Lakes system.
13: *That the NSW Government make representations to the Commonwealth and South Australian Governments to initiate a review of the current management of the lower lakes of the Murray-Darling Basin. This review should focus on returning the lakes to an estuarine system by building barrages upstream rather than at the mouth, thereby reducing the volume of water currently required and improving the productive and*	**Maintain previous response** The NSW government raised these issues during the development of the Murray-Darling Basin Plan, where there was considerable debate around the management of the Lower Lakes and barrages.

Recommendation	NSW Government Response
environmental outcomes for NSW.	
14: *That the NSW Government, in undertaking the review of the NSW Dam Safety Committee and its relevant legislation, take into consideration the concerns raised in this inquiry and that the outcomes of the review be made public.*	**Update** The Dam Safety Review was undertaken in 2013 and the *Dams Safety Act 2015* was passed by Parliament in September 2015. The new legislation sets out a best practice framework for dams in NSW. It establishes a new Dams Safety Committee which has membership from a broad range of expertise and qualifications including dam engineering, operations and management, mine engineering, emergency management, and public safety risk analysis and best practice regulation. The Act gives Dams Safety NSW clear powers to regulate and gives dam owners clear responsibilities for dam safety. An Interim Dams Safety Advisory Committee is currently being established and will work to establish criteria for declaring dams as well as dam safety standards. These dam safety standards will provide a framework for a broad range of options to be applied to achieve safe dams. A key aspect of the standards will be to ensure risk and cost benefit analysis are incorporated into decisions about dam safety. Once the dam safety standards are in place Dams Safety NSW will be established. It is anticipated this will be in mid-2017.
15: *That the NSW Government investigate the potential of strategically placed en-route storages to extend water use and provide flexibility in water delivery in some river systems, particularly in the Murray-Darling Basin.*	**Maintain previous response** One of the SDL adjustment proposals in the Murrumbidgee involves changes to the Yanco Weir and regulator. This proposal would improve operational flexibility while also enhancing environmental outcomes for the mid Murrumbidgee wetlands.
16: *That the NSW Government commit to continuing an integrated water management and conservation policy, and that it foster*	**Maintain previous response** The Best Practice Management Framework operates in parallel with Council's Integrated Planning and Reporting (IPR) Framework, to ensure that long-term

Recommendation	NSW Government Response
responsible use of water in urban, industrial and agricultural settings.	community planning includes appropriate management of the urban water cycle.
17: *That the NSW Government ensure that new storage proposals are comprehensively assessed in terms of costs, benefits, storage efficiency, geological suitability of the site, environmental considerations, community expectations and other factors as appropriate.*	**Update** Refer to response under Terms of reference 1b) of this submission for NSW Government's action to ensure new storage proposals are assessed appropriately.
18: *That the NSW Government establish an Integrated Water Management Taskforce comprised of representatives of each of the key water user groups and government, with the following roles:* • *to drive innovation in responsible water conservation, use and management; and* • *to build collaborative relationships and promote the sharing of knowledge and expertise between and within water user groups across NSW.*	**Maintain previous response** The NSW government maintains that while there is benefit in an integrated approach to water management, there are numerous existing stakeholder and industry groups already operating in this regard.
19: *That the NSW Government commit to investing in water efficiency research and development, to inform an integrated, best practice approach to water management, and to further advances in this area.*	**Update** The NSW Water Supply and Sewerage Performance Monitoring Report 2014-15 disclosed performance indicators for all NSW water utilities including 105 regional utilities and four metropolitan utilities. The report demonstrated that pricing was a strong signal to encourage efficient water use. Pricing reform has assisted the NSW utilities to achieve a 50% reduction in residential water supplied per property since 1991 (from 330 to 166 kL/property). This equates to a saving of over 95 billion litres per year and over $1 billion in capital expenditure savings over the past decade for augmenting headworks and treatment capacity.

Recommendation	NSW Government Response
	Additionally, the NSW Government manages Sustaining the Basin Projects which includes the Southern Metering Project, Health Floodplains Project and Basin Pipe Project. These alongside Irrigated Farm Modernisation Project, managed by NSW Agriculture are funded under the Commonwealth's Sustainable Rural Water Use and Infrastructure Program.

Attachment B – Case studies into water management

Case study: Broken Hill town water supply / Menindee Lakes system

Broken Hill was established in 1883 and is a substantial regional centre (current population 19,048), but has never had a permanent local water supply which meets the town's needs. The demand for a secure water supply was thought to have been met with the completion in 1968 of the Menindee Lakes Water Storage Scheme, which supplies Broken Hill via a 93 kilometre-long pipeline. However, severe drought conditions in recent years triggered a water supply emergency and clearly demonstrated that the Menindee Lakes alone cannot be relied upon for a secure, permanent town water supply.

The Menindee Lakes system is a man-made water storage based around a series of natural ephemeral lakes. These storages are managed primarily for the supply of consumptive and (increasingly) environmental entitlements downstream in the Lower Darling River and (predominantly) the Murray River. However, management of the Lakes is constrained to take into account local environmental and cultural heritage values through such measures as reductions to the original full supply level, and ensuring regular relief from inundation for floodplain vegetation.

Hydrology

The Menindee Lakes are a series of large, shallow, circular depressions to the west of the Darling River in far western NSW. Historically, they fill with water during flood times and then gradually empty via downstream channels and direct evaporation. The lakes system was converted for use as a regulated storage in the 1950s by blocking off the Darling River channel to create Lake Wetherell and constructing a series of regulators between the other main lakes Pamamaroo, Menindee and Cawndilla (see Figure 5).

The naturally hot, dry and windy conditions combined with the large shallow storages mean that evaporation rates are very high, much higher than any other major regulated river storage in NSW (see Table 3) – on average of 426 GLs per year. Combined with rising temperatures potentially due to climate change, evaporation rates may increase into the future (see Figure 6).

Conversely, transmission losses to deliver water downstream are comparatively low because the regulated river reaches in the Lower Darling and Tandou Creek are relatively short (see Table 3). The combination of high evaporation losses and low transmission losses means that Menindee Lakes is highly inefficient as a water storage and point towards the early use of Menindee Lakes water to maximise the value and productivity of that water.

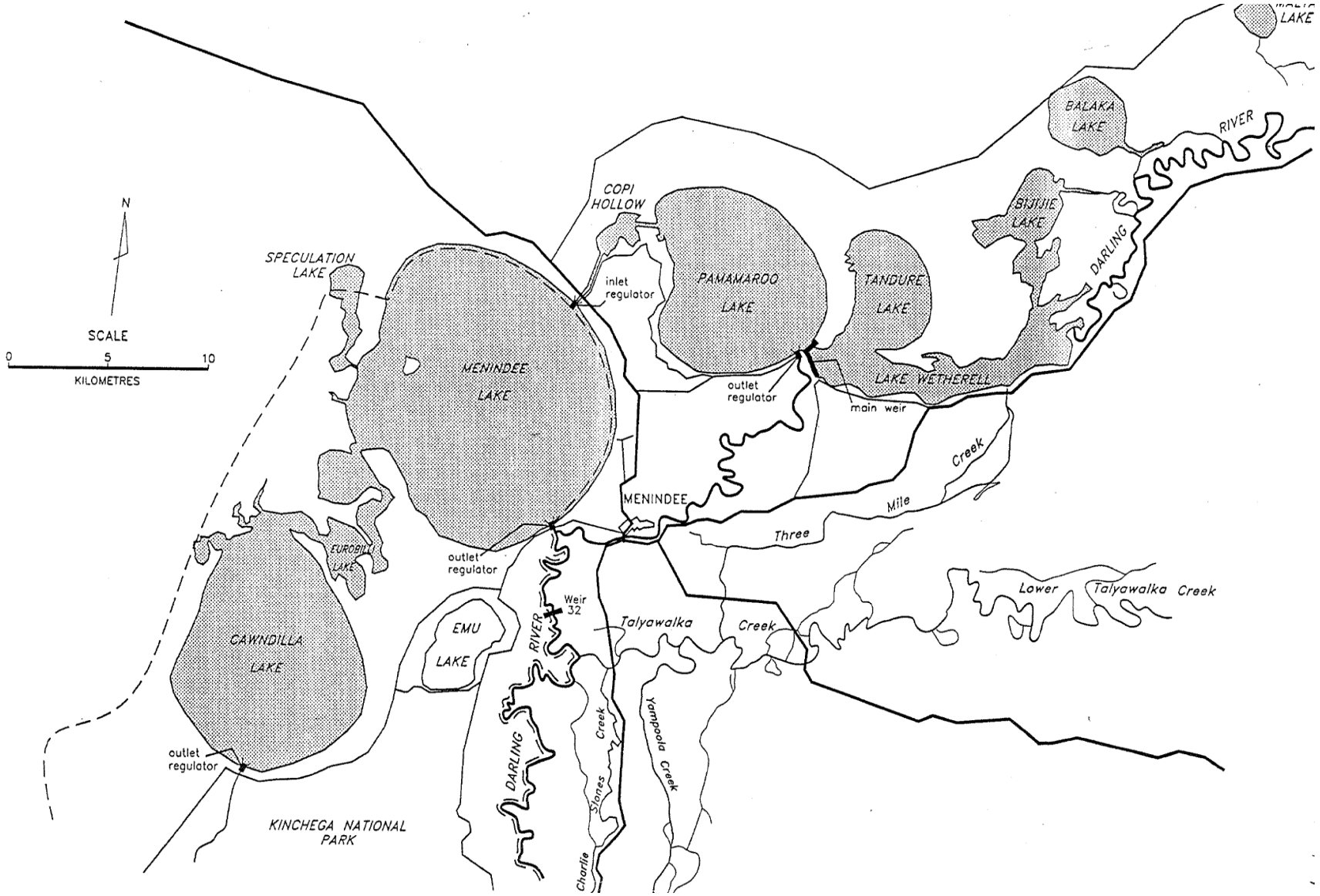

Figure 5 - Map of the Menindee Lakes system

Table 3 - Evaporation and transmission losses of selected NSW regulated rivers

Water Source	Storage(s)	% of overall resource		Assessment period	
		Evaporation	Transmission	Start	End
Lower Darling	Menindee Lakes	69%	11%	Feb-14	Jun-16
Namoi	Keepit, Split Rock	24%	28%	Jun-16	Jun-18
Gwydir	Copeton	11%	28%	Jun-16	Jun-18
Lachlan	Wyangala	10%	56%	Jun-16	Jun-18
Macquarie	Burrendong, Windamere	8%	56%	May-16	Apr-17
Murrumbidgee	Burrinjuck, Blowering	2%	29%	Oct-15	Jul-16

The Lakes are an important asset for a host of environmental, cultural and economic reasons. The Lakes represent a unique ecosystem in the semi-arid environment, and are important breeding grounds and food supply areas for many native fish and migratory bird species. The Lakes are also culturally important for the local Aboriginal people, with many burial and other sacred sites. Economically, the Lakes are a focal point for regional tourism and recreational activities and also support local irrigated agricultural enterprises.

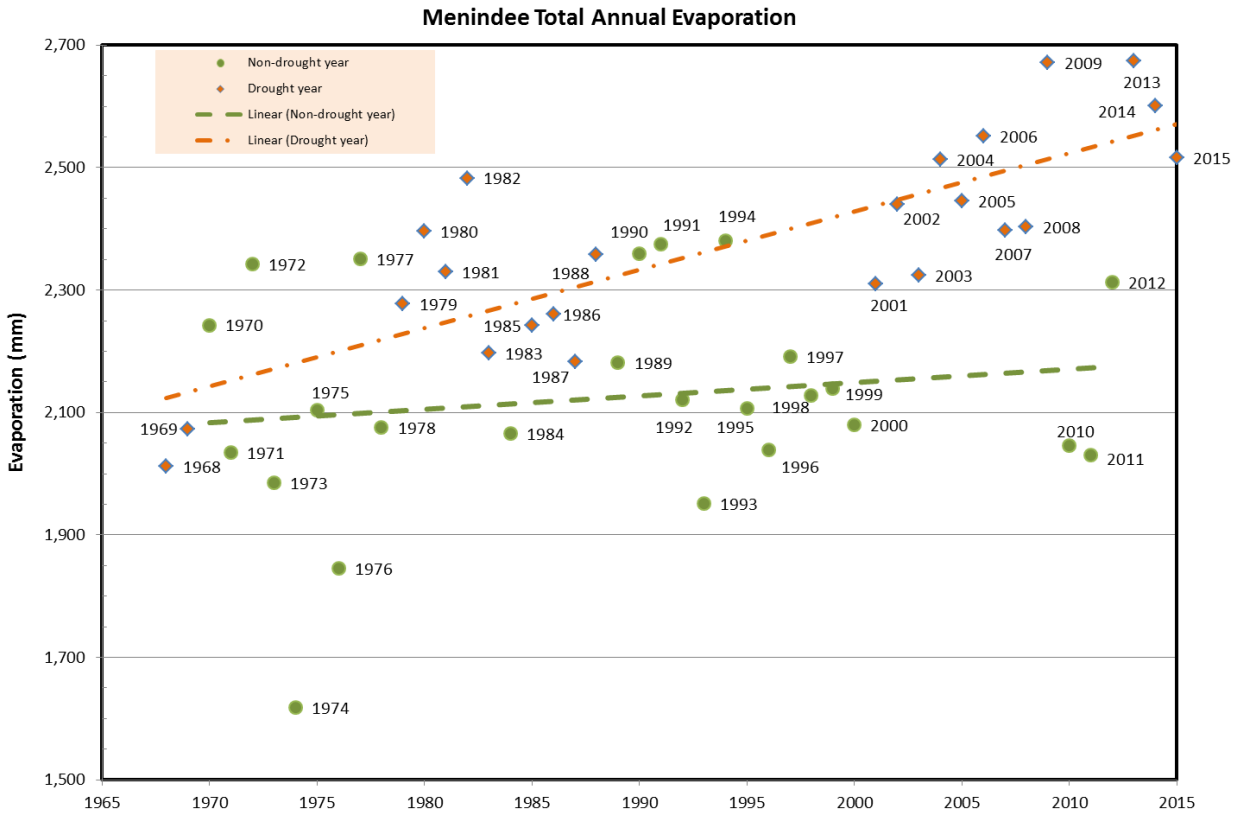

Figure 6 - Annual pan evaporation rates at Menindee township

River system

The Lakes are situated in a strategic location from a water resource management perspective – the Lakes serve as a hinge point between the northern and southern catchments of the Murray-Darling Basin. Decisions here have the potential to affect water users both upstream and downstream of Menindee.

Many rural landholders in the Murray-Darling Basin have strong and diverse views about the operation of the lakes system.

The township of Broken Hill and water users in the Broken Hill Lower Darling are concerned about upstream extraction having the potential to impact downstream environmental, community and productivity outcomes.

However, northern users assert that their use of water is highly efficient and provides a significant economic benefit to the State. They are critical of the massive 'losses' from the Menindee system that come from having to store hundreds of gigalitres of water to provide security of supply to Broken Hill's population which uses less than 10 GL of water per year.

The local Menindee and extended Broken Hill communities have long been in need of a longer-term solution for water security in the area.

DPI Water has an important role to manage the competing needs for available water in the long-term and thereby deliver an equitable and sustainable balance of social, economic, environmental and cultural outcomes.

Water security and competing uses

Water security underpins the economic prosperity of NSW regional towns and centres and is fundamental to driving the sustainable growth of the $12 billion primary industries sector.

Over recent decades there have been three main functions of the Menindee Lakes:

1. Supply the Murray River;
2. Supply Broken Hill
3. Supply the Lower Darling River.

While meeting these demands, storages also provide recreational, cultural and environmental facility and also attract tourism.

The primary function of the storages, consistent with its original construction, is to supply the southern Murray connected regulated river system for use by NSW, Victoria and South Australia. Under the Murray-Darling Basin Agreement and when in MDBA control, half of the inflow and half of the storage in the Menindee lakes system are attributed to Victoria and half to NSW resources. When in NSW control, the resource is not shared but used solely for local NSW needs.

Another high priority need is the domestic water supply needs of Broken Hill (and other local townships). With a population of almost 20,000 people, Broken Hill's water security is vital for its long-term viability. During both the Millennium drought and the current drought of 2012-2016, significant temporary physical works and operational contingency measures were implemented to extend the available supply in the Lakes.

A third important function of the Lakes is to supply water to landholders along the Lower Darling River – a sparse rural population reliant on water for domestic and stock needs (grazing) and some small but crucial volumes to irrigation development in the downstream reaches closer to Wentworth.

Figure 7 indicates that the volumetric water requirements of the second and third functions described above are very low. However in order to meet these requirements, a disproportionately large volume of water must be held in storage to overcome the large

evaporation (in the case of Broken Hill) and transmission losses (in the case of the Lower Darling).

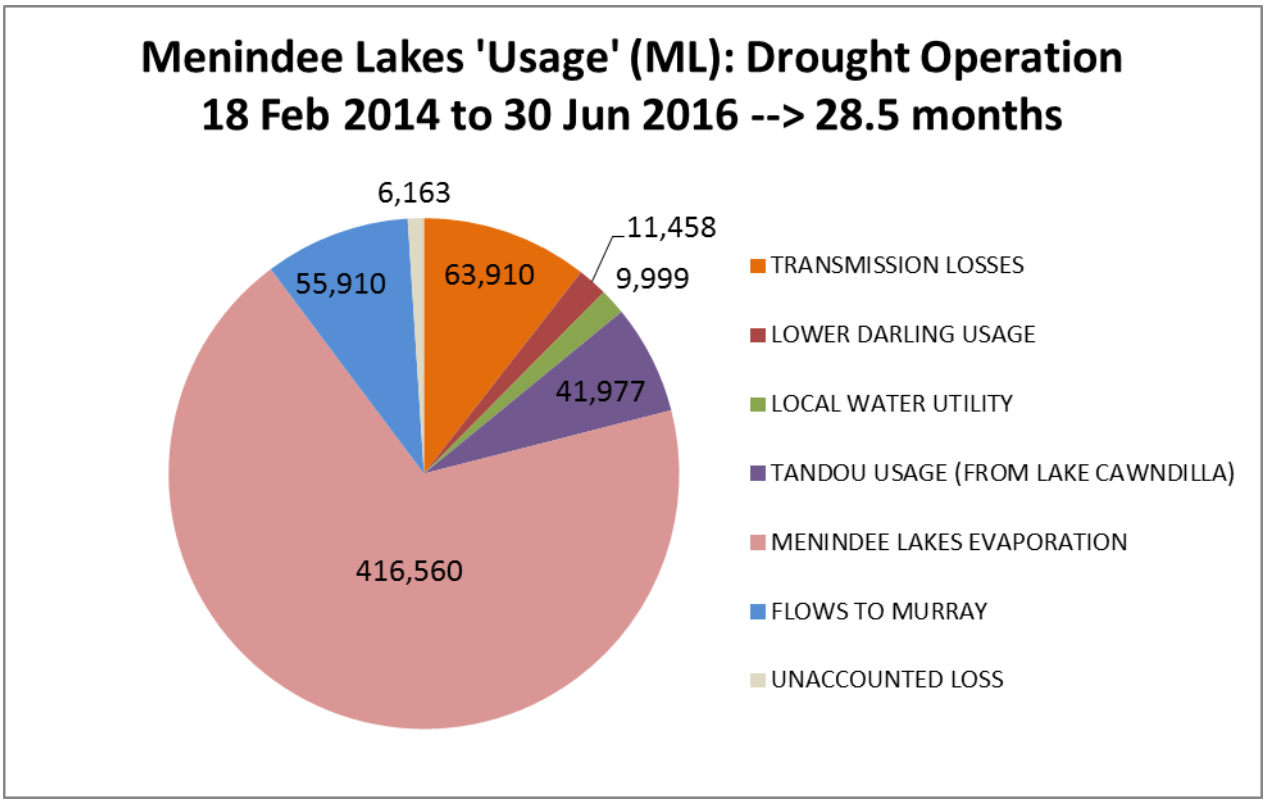

Figure 7 - Accounting of water in Menindee Lakes since coming into NSW control

Reliance on these lakes will not be sufficient to provide the necessary water security for Broken Hill, particularly if climatic extremes persist into the future. A water supply option for Broken Hill that does not rely on Menindee Lakes will not only provide certainty and security for the people of Broken Hill but also allows NSW realise the full economic value of this precious water resource.

Securing Broken Hill's water supply has been identified as a high priority for regional community's water security and has been allocated funding under the NSW Government's Rebuilding NSW: Regional Water Security and Supply Fund and Restart NSW. On 16 June 2016, the NSW Government announced that a 270-kilometre pipeline will be built from Wentworth, on the Victorian border, to the Broken Hill water treatment plant water supply pipeline to provide water to Broken Hill from the Murray River.

The water security package represents the single biggest investment to secure a town's water supply in the history of NSW. It means that the towns of Broken Hill and surrounding communities are no longer solely reliant on notoriously unreliable flows in the Darling River and reduce the need for further buybacks of productive water.

Once the pipeline is constructed and functioning, there will be opportunity to change the way the Menindee Lakes system is operated to achieve efficiencies and water savings and to boost productivity and benefits to a wide range of stakeholders. A suite of proposed measures could involve a shift in the use of Lake Cawndilla as a regulated storage to reflect natural flows regimes, increasing outlet capacities, providing greater regulating ability between (and within) lakes, regulating the offtake to the Great Darling Anabranch and operating rule changes.

Recent operations of Menindee Lakes

Recent years have been dominated by extended drought. The Millennium drought at Menindee Lakes extended from 2001 to 2010, with a brief reprieve in 2004/05. Floods broke the Millennium drought in the period 2010 to 2012, before a return to drought from late 2012 to the present day (June 2016). The storage volumes, releases and drought periods from 2000 to 2016 are shown in Figure 8.

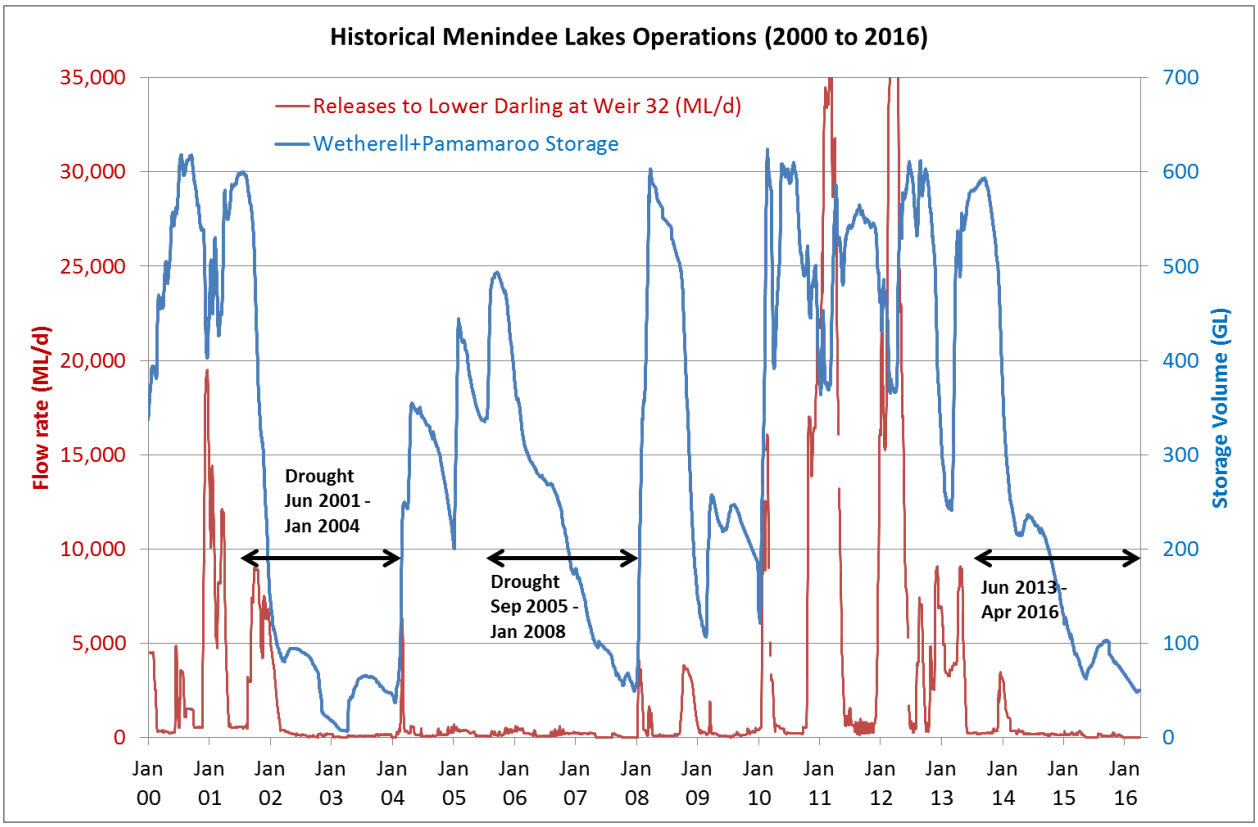

Figure 8 - Menindee Lakes operations from 2000 to 2016

Flood Operations

In 2012, the Lakes were operated to minimise downstream flood damage and to maximise the available stored resource at the end of the event. This required fine balancing to avoid exceeding the water level limitations of the storage itself. In October 2012, a total peak volume of 2,038 GL was reached, only 11GL (6cm) less than the maximum allowable surcharge, shortly before regulated delivery of water recommenced. This maximised the amount of available resource available before going into drought.

'Normal' MDBA operations

The MDBA took over management responsibility when the storage fell below the full supply volume of 1731 GL on 1 December 2012. To meet downstream demands in the Murray River system, releases from Menindee Lakes were prioritised over the more efficient upper Murray storages when natural tributary flows alone contributed insufficient volumes.

Releases in the summer of 2013/14 were not particularly high or particularly unusual. They were aimed at meeting the requirements of licence holders in the Lower Darling and Murray and to provide in-stream benefits in the Lower Darling, including stimulating a native fish spawning event. This contributed to the efficient use of Murray storages, improved productivity of water use and provided riverine health benefits. Even still, over half the volume of reduction between December 2013 and February 2014 was due to losses, with only 47 per cent to licensed use in the Murray and Lower Darling.

DPI Water undertook an analysis to determine the likely outcome had NSW not complied with the inter-jurisdictional Murray-Darling Basin Agreement, and restricted call-out to Lake Menindee only, or seasonal minimums, whichever was the greater. The 'cost' to Murray water users in this instance would have been about 100 GL and the 'benefit' to Lower Darling water users would have been about 9 months extra access at seasonal minimum flows, enabling about 12 gigalitres more in diversions (see Attachment D for more detail). Had this more conservative approach been adopted, Murray water users would have missed out on 100 GL of productive water and Lower Darling water users would still have had to endure severe restrictions for an extended period of time.

During the period of 'normal' operations from 1 December 2012 to 17 February 2014, NSW worked closely with the MDBA to seek the efficient operation of individual storages in the lakes. This included prioritising more water in the more efficient upper two lakes (Wetherell and Pamamaroo), providing greater security for local needs during drought. When control reverted to NSW as total storage fell below 480 GL on 18 February 2014, the only water that remained in the inefficient lower two lakes was inaccessible. In other words, the volume remaining in the more valuable upper two lakes was maximised.

Drought Operations

When management responsibility reverted back to NSW on 18 February 2014, local needs became the primary focus: securing Broken Hill's water supply and meeting the needs of Lower Darling water users. As the drought extended, the focus progressively narrowed towards highest priority needs. The main actions taken by NSW are summarised in Table 4.

Table 4 - Summary of drought contingency actions since February 2014

Action	Dates applied
Reduced releases to the Lower Darling below normal monthly minimums	September 2014 to April 2015 July 2015 to December 2015
Construction of a temporary bank to transfer water from Lake Pamamaroo to Copi Hollow, providing water quality and (some minor) water security benefits	November 2014 to present (June 2016)
Pumped water from the shallow Lake Tandure to the deep channel in Lake Wetherell to reduce evaporation	December 2014 to January 2015 April 2016 to May 2016
Temporarily restricted lower priority licences in upper connected NSW catchments to increase the volume of inflow to Menindee Lakes	28 January 2015 to 29 May 2015
Construction of two temporary block banks in the Lower Darling River channel to provide remnant pools for survival watering when continuous river flows ceased	February 2015 to present (June 2016)
Ceased continuous releases to the Lower Darling River	May 2015 to July 2015 December 2015 to present (June 2016)
Reduced allocations and introduced restrictions on water use for Lower Darling licence holders	July 2015 to present (June 2016)
Commissioned a reverse osmosis treatment plant to reduce salinity for Broken Hill's drinking water supply; Menindee township secured on a local	January 2016 to present (June 2016)

bore	
Construction of emergency back-up bores in the bed of Lake Menindee for Broken Hill's short-term supply	Proposed late-2016

Many of these actions were found to be successful during the Millennium drought and reintroduced recognising the unavoidable social, economic and environmental costs as the severity of the water shortage increase.

Of these actions, the temporary restriction (embargo) on upstream water access for four months in late-summer and autumn 2015 was particularly high profile. A total volume of up to 65,000 megalitres was restricted over four events (see Figure 9). This was made up of supplementary access in the NSW Border Rivers (28,000 megalitres) and Gwydir (21,000 megalitres) regulated rivers, as well as B-class access in the Barwon-Darling unregulated river (15,000 megalitres). These categories of licence are considered low reliability and rely on sporadic high flows, however entitlement holders rely on them heavily to top-up on-farm storages and manage their water-dependent production.

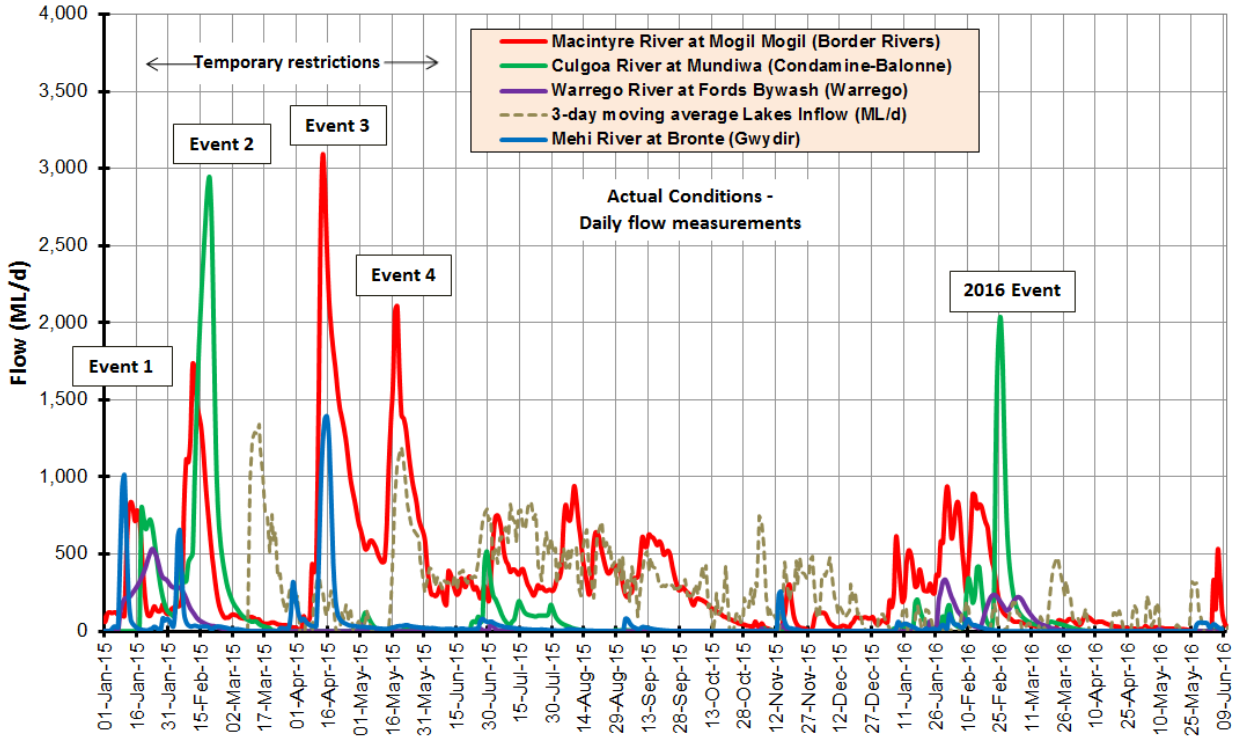

Figure 9 - Inflows to the Barwon-Darling River and Menindee Lakes

The decision to restrict access was made primarily to ensure critical supplies to Broken Hill from Menindee Lakes were not interrupted. The water supply extension would ensure sufficient construction lead times to implement short-term emergency groundwater supplies. The combined inflow to Menindee Lakes from these events provided approximately 40,000 megalitres. This represented an extension to Broken Hill supply of approximately 8 months. When the short-term works had progressed sufficiently in late 2015 and Broken Hill's supply was assured until at least autumn 2017, the embargo was lifted.

Had the embargo not been implemented, it is likely that the short-term works to commission a reverse osmosis treatment plant to supply Broken Hill may not have been commissioned in time, leaving the city of Broken Hill without safe drinking water.

Case study: South Western NSW water management practices

The following outlines some key aspects in south-west and northern NSW, particularly in relation to their impact on the management of Menindee Lakes.

Hydrology

The Murray River is one of the most highly regulated rivers in NSW. Water resources are shared between NSW, Victoria and South Australia as part of the interstate Murray-Darling Basin Agreement, administered by the Murray-Darling Basin Authority (MDBA). The system contains large and deep headwater storages which typically receive reliable winter precipitation as well as spring snowmelt flows, and a Required Annual Release from the Snowy Mountains hydro-electric scheme.

River system

The Murray and Lower Darling river systems (including Menindee Lakes) are operated by the MDBA on behalf of NSW, Victoria and South Australia, to direct releases from the storages to meet demands. The MDBA operates four major storages – Dartmouth Dam, Hume Dam, Lake Victoria and the Menindee Lakes (which are leased from New South Wales) and shares available resources to respective States in accordance with the Agreement.

Under current 'normal' operations, the Menindee Lakes storage is under the management responsibility of the MDBA. If demands on the Murray River downstream of the Lower Darling confluence cannot be met by tributary flows, releases are prioritised from the most inefficient storage in the Murray system (Menindee Lakes) in preference to the other more efficient storages. If however the Lakes are in flood (inflows are forecast to exceed maximum surcharge volume) or drought (storage below 480 GL), NSW resumes management responsibility.

When total storage at Menindee Lakes falls to 480 GL, the system comes under NSW management and is operated to meet the specific local water needs, whereby the Menindee resource is dedicated to Broken Hill and Lower Darling water needs only, until it next rises above 640 GL and returns to MDBA management. This practice has been in operation for decades under the Murray-Darling Basin Agreement.

The operating release capacity of the Lakes is currently restricted due to the existing physical arrangement of the Lakes and the capacity of the Lower Darling River channel. The shallow lakes and flat terrain mean there is limited head difference available to drive high flow rates. This limits the ability of the MDBA to meet downstream water needs in a short time from this highly evaporative storage. The Menindee Water Savings Project, an initiative of the Commonwealth and NSW Governments, is a range of infrastructure works and operational arrangements expected to allow larger releases and provide additional operational flexibility. Detailed plans are currently being developed for stakeholder consultation, however it is expected that annual water savings of up to 80 GL could be achieved in reduced evaporation and more efficient operation without reducing the reliability of water access for existing entitlement holders.

Constraints Management

As part of the Basin Plan, assessment of removing constraints to higher environmental releases is required. In NSW, constraints management aims to reinstate the passage of a modest pattern of environmental flows and optimise the environmental benefit gained from flow events that will reconnect rivers and floodplain environments.

The NSW Government approach to constraints management is aimed very firmly at achieving not just positive environmental outcomes, but economic and socio-economic benefits for farming businesses and communities as well.

Under the Constraints Management Strategy (CMS) seven key geographic areas (river reaches) of NSW have been targeted for further investigation, including the:

- Hume to Yarrawonga Reach of the Murray River
- Yarrawonga to Wakool Junction Reach of the Murray River
- Gwydir River
- Murrumbidgee River
- Lower Darling River Reach

For example, the Hume to Yarrawonga Reach of the Murray River supports nationally and internationally significant ecological systems as well as extensive areas of irrigated and dryland agricultural production, on which the economy of the region depends. There is a range of flow constraints within the reach, with the main operational constraint being an upper regulated flow of 15,000ML/day at Tocumwal during winter and spring and 10,600ML/day during the summer months. The reach also includes a 250ML/day constraint to managed flows leaving the Koondrook-Perricoota Forest.

In the above reach the CMS aims to produce environmental, social and socio-economic benefits for the Yarrawonga to Wakool Junction Reach, and proposes releasing managed environmental flows at levels that are safe, sensible and have no unacceptable third party impacts.

Constraints management has the potential to achieve greater environmental outcomes using less water because it facilitates reconnection of floodplain environments more often and to a greater degree than under current conditions. In this context constraints management constitutes a “supply” measure under the SDL Adjustment process. Supply measures have the potential to reduce the volume of environmental water required to achieve an equivalent environmental outcome with managed environmental flow releases.

Case study: North Western NSW water management practices

Hydrology

The Barwon-Darling river system has amongst the lowest flows in the world for rivers of comparable size and they are highly variable. In the last 120 years of recorded climate, extended droughts - where the river ceases flowing for up to a full year - are interspersed with large floods rivalling the largest flow rates recorded in eastern Australia. Managing water resources within this context is a significant challenge.

Rainfall variation occurs at different time scales. In general terms, over the 120 years of recorded data in NSW, it can be seen broadly that the 50 years up to 1950 were generally dry, the next 50 years up to 2000 were generally wet, and last 15 years since then have been comparatively dry. Short-term variations occur within these periods, for example the Darling River floods in 2010-12.

Potentially larger variations in water availability are being detected from the emerging analysis of paleo-climatic records (1,000’s of years). It suggests that climate change could exacerbate the ‘extremes’ we have experienced in the past 100 years. While it is difficult to define what is "normal", water resource managers seek to make best use of the resource in the midst of this large variability and uncertainty. In Australia it is crucial that large towns and cities are not entirely reliant upon a local river source only, but have alternative water supply options in place.

The Barwon-Darling River system is unique in NSW because it is an unregulated river located both downstream and upstream of regulated river systems. As an unregulated river, water is only available for extraction when there is sufficient flow in the river. When conditions are very dry and minimum flow triggers are not met, like the last three years, access is severely limited.

Water security and competing uses

On a day-to-day basis, the statutory water sharing plan determines access to water by assigning priorities to different categories of licence. Long-term average annual extraction limits have been capped to stay within sustainable limits. This protects the environment as well as the security of the entitlement for all water users.

In the Barwon-Darling River, under no flow or very low flows conditions, access is restricted to critical human needs. As flows increase and further triggers are met, access is progressively extended to other licence categories. High flows are typically required before large scale extraction for irrigation can occur.

First priority of access is given to basic landholder rights as well as domestic and stock and LWU access licences, totalling almost 8 GL in annual entitlement. In practise, annual usage is typically much less than the entitlement. These licence holders can extract water under low flow conditions and, in some cases, no flow conditions.

Second priority is given to ‘A class’ access licence holders, totalling approximately 9 GL of entitlement. These water users have high priority needs that require modest volumes of water each year to support permanent plantings or high value perennial crops for instance. Extraction is allowed when flows at the relevant reference points equal or exceed the triggers.

Third priority is given to ‘B class’ access licence holders, totalling approximately 119 GL of entitlement. These licence holders represent a range of different water uses and typically rely on periodic flows to replenish local storages and enable productive use. Extraction is allowed when flows at the relevant reference points equal or exceed the triggers, which are higher than for ‘A class’.

Fourth and lowest priority is given to ‘C class’ access licence holders, totalling approximately 45 GL of entitlement. These licence holders typically have the capacity to store higher flows for later use, and are less reliant on access on a year-to-year basis. Extraction is allowed when flows at the relevant reference points equal or exceed the triggers, which are higher than for both ‘A class’ and ‘B class’. Figure 10 illustrates both cumulative drought inflows to Menindee Lakes in recent droughts and 18-month forecast based on flows at transit as at 11 July 2016.

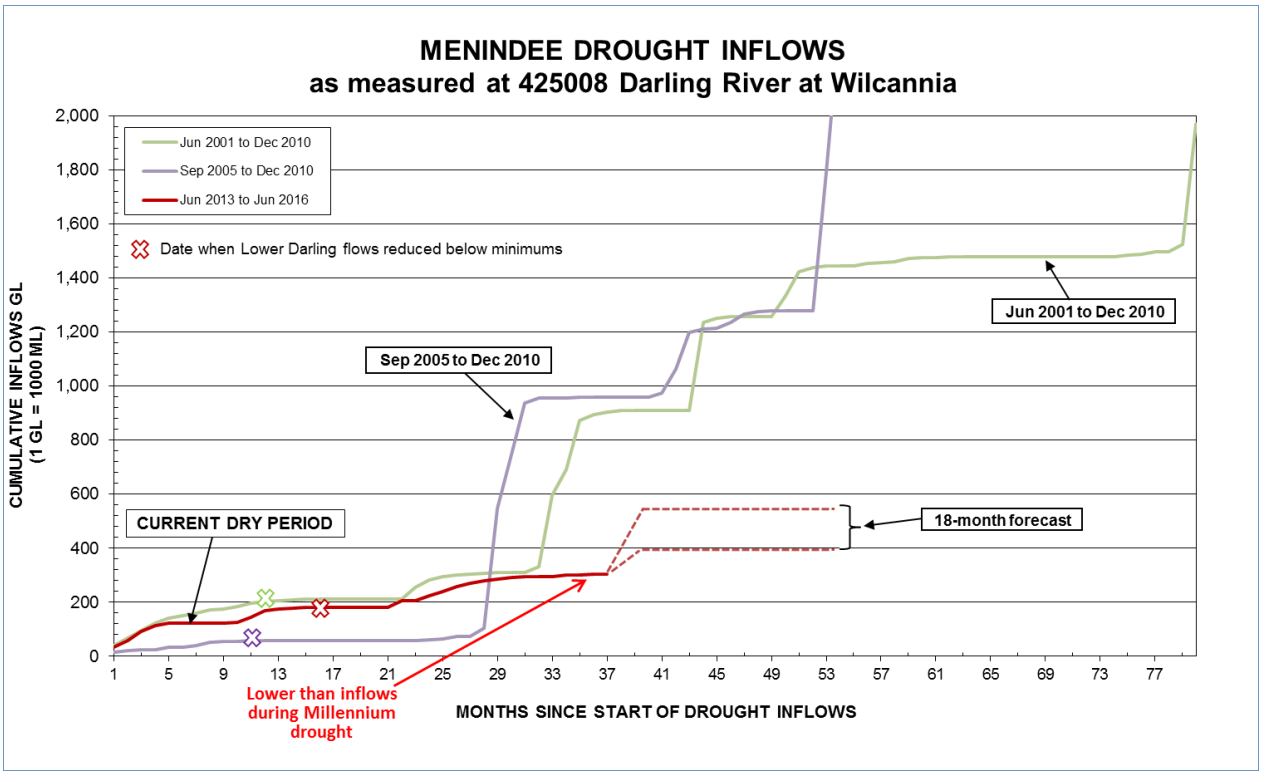

Figure 10 - Cumulative drought inflows to Menindee Lakes in recent droughts

Attachment C: List of projects funded under Water Security for Regions – competitive rounds

	Project	Recipient
2014-15	Baan Baa Water Supply Provision Project	Narrabri Shire Council
	Narrandera Replacement of No. 1 bore Project	Narrandera Shire Council
	Gilgandra Water Security Project	Gilgandra Shire Council
	New Bores at Brewarrina and Gongolgon Project	Brewarrina Shire Council
	Pipeline from Scone to Murrurundi	Upper Hunter Shire Council
	Rankin Springs Supply Upgrade Project	Carrathool Shire Council
	Installation of Bore - Mendooran	Warrumbungle Shire Council
	Installation of Bore - Coolah	Warrumbungle Shire Council
	Timor Dam - Feasibility Study	Warrumbungle Shire Council
	Installation of Bore - Binnaway	Warrumbungle Shire Council
	Bombala Water Treatment Plant	Bombala Shire Council
	Crookwell Water Supply Upgrade	Upper Lachlan Shire Council
	Boggabilla to Toomelah Pipeline Project	Moree Plains Shire Council
	Kyogle Water Supply Augmentation Project	Kyogle Council
	Cowra Three Bores Project	Cowra Shire Council
	Pipeline from Orange to Blayney and Carcoar	Orange City Council
	Condobolin Bores Project	Lachlan Shire Council
	Pipeline from Orange to Molong Dam and Molong to Cumnock and Yeoval	Cabonne Council
2013-14	Angledool Bore Installation	Brewarrina Shire Council
	Raise weir and construct fish hatchery	Walgett Shire Council
	Glen Innes Off Stream Storage	Glen Innes Severn Council
	Wallabadah bore and pipe	Liverpool Plains Shire Council
	Upgrade Lachlan River Intake - refurbish bore number 8	Parkes Shire Council
	Narromine and Trangie additional bores	Narromine Shire Council
	Tumbarumba Connection of Two Bores	Tumbarumba Shire Council
	Willow Tree Pipeline: From Quirindi and reservoir	Liverpool Plains Shire Council
	Grawin bore and tanks	Walgett Shire Council
	Warren, Collie and Nevertire bores	Warren Shire Council
	Bourke Bore Water	Bourke Shire Council
	Wilcannia, Ivanhoe and White Cliffs Bores	Central Darling Shire Council

Connect Forbes Bore: connect bore water to town water supply system	Forbes Shire Council
Nimmitabel Lake Wallace Project	Cooma Monaro Council
Single Storage at Nyngan	Bogan Shire Council

Attachment D: Impacts of the MDBA releases during summer 2013-14

Background
Full Supply Level (FSL) of Menindee Lakes is 1,730 GL. Under the Murray-Darling Basin Agreement (the Agreement) water **above** 480 GL is shared equally between NSW and Vic. Above 480 GL, Lower Darling water users have access to full allocations, and evaporation losses are met as part of the shared NSW and Victorian resource.

Below 480 GL (about 28%), all water is dedicated solely to Lower Darling water rights and entitlements. There is no more external call on the resource for the Murray valley. Water reaching the Murray will be the result of seasonal minimum releases designed to maintain Lower Darling in-stream health.

The 480 GL was established in the 1960's as the volume of water needed to ensure that water requirements in the Lower Darling could be met through a repeat of the worse drought on record. This trigger volume took into account the physical lie of the lakes, including that some water will remain essentially un-useable to the Lower Darling as dead storage (mostly within Lake Cawndilla), when the system reaches 480 GL.

The 480 GL reserve is effectively an agreed balance between water security for the city Broken Hill and Lower Darling water users versus productive use of the water in the Murray before it is lost to evaporation.

Currently, structural adjustments in the design and operation of the Menindee Lakes Scheme are being investigated to identify what water savings (reduced evaporation loss) might be possible without impacting the balance between water security and productive water use.

It is important to recognise that the current 'balance' has been established for decades. Water-dependant industries above and below Menindee have established and now support regional communities. Rather than 'lock-in' more evaporative losses, by setting aside more reserves in Menindee, the NSW government is looking for more efficient ways to deliver water for everyone.

Key Information
The MDBA call-out of water from Menindee Lakes from 2 December 2013 to 17 February 2014 was consistent with its rights under the Agreement. Total storage at the commencement of these releases was 932 GL (about 54%).

NSW typically discusses with MDBA its proposed calls of water, and negotiates a balance to ensure that as much water as practicable is retained in the upper storages when the Lakes reach 480 GL. In this instance NSW negotiated the peak flow rate down from 7,000 ML/d to 3,500 ML/d, to reduce the draw on the upper two lakes (Wetherell and Pamamaroo).

In November 2013 a design release pattern, about 155 GL in volume with a peak flow of 3,500 ML/day, was agreed. A combination of storages was used, in priority order: Lake Menindee (outlet fully open), Lake Wetherell (to expose the floodplain only) and Lake Pamamaroo.

The call-out aimed to provide in-stream benefits in the Lower Darling, including stimulating a native fish spawning event, plus meet irrigation and environmental requirements in the Lower Darling and Murray. It would also allow aeration of the Wetherell floodplain vegetation after a long period of inundation.

What if NSW did not fulfil its obligations under the Agreement?
The chart below compares the combined Lake Wetherell and Lake Pamamaroo storage volumes for two scenarios:
1. Actual operation – includes MDBA callout volumes over the summer of 2013/14, and
2. Minimum releases only (excluding Lake Cawndilla)

Scenario 1 – Actual operation
At 2 December 2013: Wetherell 169 GL, Pamamaroo 333 GL, Menindee 138 GL, Cawndilla 277 GL, Total 932 GL

At 18 February 2014: Wetherell 68* GL, Pamamaroo 183 GL, Menindee 45** GL, Cawndilla 184 GL, Total 480 GL

In this period the total storage reduction was 932 GL to 480 GL, some 452 GL, and 155 GL was measured at Weir 32. It is estimated that 150 GL reached the Murray, half of this was NSW water (75 GL) and half was Victorian. In this time 53 GL was released from Lake Cawndilla, approximately 4GL was used for local needs and the balance, some 240 GL, was losses.

In accordance with the agreement, when the Lakes fell to 480 GL (18 February 2014) they came into NSW control. (And when they next rise above 640 GL they will revert back to MDBA control).

Releases since 18 February 2014, while in NSW control, have been at seasonal minimums or less.

Scenario 2 – Modelled minimum releases only
At 2 December 2013: Wetherell 169 GL, Pamamaroo 333 GL, Menindee 138 GL, Cawndilla 277 GL, Total 932 GL

At 8 August 2014: Wetherell 66 GL, Pamamaroo 268 GL, Menindee 14 GL, Cawndilla 132 GL, Total 480 GL

In this period 70 GL would be measured at Weir 32, and about 50 GL would reach the Murray. Again half of this is NSW water (25 GL) and half is Victorian. With 53 GL also released from Lake Cawndilla and approximately 8GL used for local needs, the balance (321 GL) is apparent* losses.

* In the period April to July 2014 there was a small inflow event, some 47 GL, which was passed into Lake Pamamaroo. Therefore the actual losses under Scenario 2 would be close to 350 GL and the 480 GL trigger would be reached 2 to 3 months earlier than 8 August 2014.

Observations
1. About 100 GL **less** water reached the Murray under Scenario 2.
2. (This water would need to be met from Murray resources and would manifest as reduced allocations).
3. There was about 110 GL **more** losses incurred under Scenario 2.
4. 'Productive' water use (155 GL + 53 GL + 4 GL) under scenario 1 was 47% of the total storage reduction.
5. 'Productive' release (70 GL + 53 GL + 8 GL) under scenario 2 was 29% of the total storage reduction.

Note: * This is approx. maximum channel storage at Lake Wetherell
** This is dead storage only at Lake Menindee

6. ‘Losses’ (240 GL) under scenario 1 comprised 53% of the total storage reduction.
7. ‘Losses’ (350 GL) under scenario 2 comprised 77% of the total storage reduction.
8. Under Scenario 2, the 480 GL trigger was reached nearly 6 months **later** (8 August 2014). However, without the 47 GL inflows, it would have been 3 to 4 months later.
9. Actual conditions at 8 August 2014 were:
   Wetherell 71 GL, Pamamaroo 149 GL, Menindee 10 GL, Cawndilla 131 GL, Total 361 GL
10. Therefore 119 GL **more** water was apparently available in the upper two storages at 8 August under Scenario 2. However, excluding the 47 GL inflow, this volume would be 72 GL.
11. This translates to an extra 6 to 9 months of supply to the Lower Darling (at most an extra cropping season in 2015/16).
12. Historical figures (Table below) indicate maximum usage of about 12 GL/year in the Lower Darling.

Conclusion

If NSW acted outside of the inter-jurisdictional Murray-Darling Basin Agreement, and restricted call-out to Lake Menindee only, or seasonal minimums, whichever was the greater, the ‘cost’ to Murray water users in this instance would have been about 100 GL and the ‘benefit’ to Lower Darling water users would be about 9 months extra access at seasonal minimum flows, enabling about 12GL more in diversions.

Operational decisions associated with water sharing involve a complex balancing of factors including ‘costs’, ‘benefits’ and an assessment of likely future inflows. For example, in November 2013, when the decision on the call-out was being taken, there was still a good chance of getting a summer inflow to the Lakes to back-fill the upper storages. If not that summer, the chances would be better for the following summer (northern wet season). There was a high probability that the significant benefits that accrued to the Lower Darling and Murray would have come at no noticeable cost to Menindee water security. Water managers were not to know that an unprecedented three consecutive summers with no significant flows to the Darling River to replenish the Menindee system was commencing.

Holding water for long periods at Menindee is ‘expensive’ compared to other storages due to the large, shallow lakes in an arid location. Evaporation is by far the largest ‘water user’. A balance is required between storage (security) and usage (productivity). If the water were held purely for local security, most of it would evaporate and productive return on that water would be minimal. If the water was used entirely to maximise productive return in the Lower Darling and Murray, there would be minimal security. The current balance, enshrined in the Agreement, is the 480GL trigger point. A higher trigger point will impact more on NSW and Victorian Murray water users, a lower volume will impact on Lower Darling and Upper Basin water users.

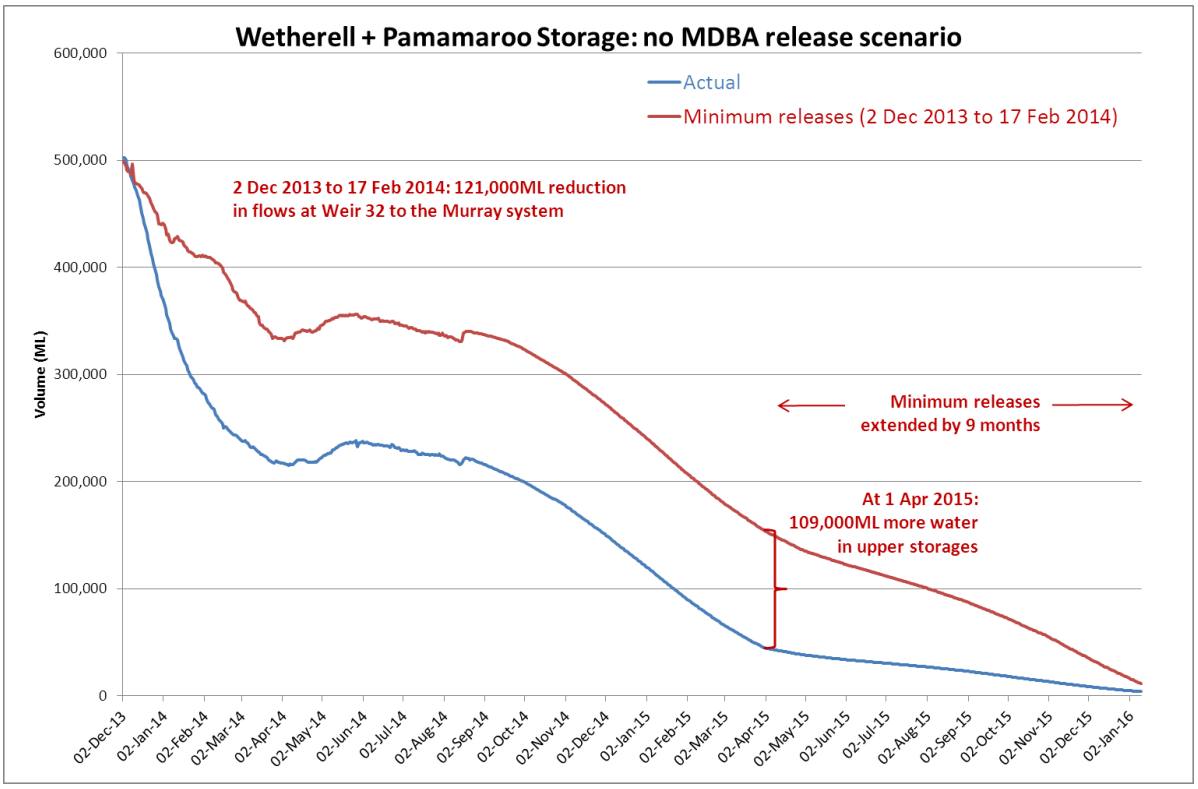

Table 1: Historical Water Use in the Lower Darling (ML)

	HS	GS	D&S	TWS	Total L Darling
Shares:	*3,486*	*7,603*	*527*	10,000	21,616
2013-14	3,182	2,994	580	4,940	11,697
2012-13	3,503	2,764	750	1,140	8,157
2011-12	2,892	2,256	566	1,061	6,776
2010-11	1,746	2,017	463	920	5,146
2009-10	3,013	2,352	522	3,929	9,816
2008-09	3,309	2,469	507	1,658	7,943
2007-08	3,427	2,203	358	3,568	9,556
2006-07	2,055	1,721	201	3,993	7,970
2005-06	4,377	3,609	242	6,085	14,313
2004-05	4,343	3,146	192	6,254	13,934