

50

WARRAGAMBADAM

50th Anniversary 1960-2010



50

Contents

- 01 Welcome
- 02 Introduction to Sydney Catchment Authority
- 04 Indigenous people and the Burrigorang Valley
- 05 Heritage
- 06 Auxiliary spillway and raising the dam wall
- 08 Deep water access and new visitor centre
- 10 Healthy catchments – Special Areas
- 12 Partnerships and education
- 14 Droughts, fires and floods
- 16 Timeline 1840-2010

Centre Warragamba Dam, Official Opening Booklet, 1960



Stairs lead to inspection galleries within the dam wall (left). Visitors enjoy the renewed Haviland Park (opposite).

Welcome

Warragamba Dam
50th anniversary
1960 – 2010

Welcome to Warragamba Dam.

We hope that you enjoy this commemorative booklet and keep it as a souvenir of your visit to the dam.

Since Warragamba Dam opened in 1960, Sydney's population has more than doubled from 2.1 million to about 4.5 million. Today the dam still provides about 80 percent of the city's water.

This booklet highlights key changes made over the past 50 years to ensure Warragamba Dam remains a vital part of the water supply.

Also included is a reprint of the original opening day booklet from 14 October 1960. The 1960 document provides a glimpse of the immense effort needed to build the dam – a project which employed 1,800 people working around-the-clock shifts seven days a week from 1948 until 1960.

Congratulations to all who were involved in building the dam, their families and to everybody who has since worked to improve the dam and its catchments.

50 Sydney Catchment Authority

**Warragamba Dam
50th anniversary
1960 – 2010**

The NSW Government established the Sydney Catchment Authority (SCA) in 1999 to manage and protect the water catchments and supply high quality raw water. This is done by managing dams, pipelines and pumps to store and transport water, and working in partnership with catchment communities.

About 4.5 million people in Sydney, the Illawarra, Blue Mountains, Southern Highlands and the Shoalhaven depend on the water which the SCA supplies to Sydney Water, Shoalhaven City Council and Wingecarribee Shire Council.

The SCA builds on the significant achievements over many decades by its predecessors. The SCA's achievements include:

- major upgrades to Warragamba Dam including the auxiliary spillway, outlet valves, electrical system and deep water pumping station
- environmental flow upgrades at dams and weirs to improve river health
- major improvements to dams and weirs to allow for fish passage
- continued science and water quality research
- equipment to monitor the behaviour and conditions in the lakes behind the dams
- successful partner programs with landholders, industry, other government agencies and local councils
- the Sustaining the Catchments Regional Plan for the drinking water catchments
- new tools and ongoing support for councils and developers to ensure that developments in the drinking water catchments have a neutral or beneficial effect on water quality
- the Catchment Decision Support System to help prioritise catchment health activities
- the Healthy Catchments Strategy to guide catchment improvement work.



Galleries inside the massive dam wall (right) allow for inspections and ongoing maintenance. Warragamba Dam's radial gates (opposite) automatically open when the water reaches full storage level. Screens are moved up and down to draw the best quality water (centre).



Indigenous people and the Burratorang Valley

**Warragamba Dam
50th anniversary
1960 – 2010**

Before it was flooded in the 1950s, the Burratorang Valley was home to many groups of the Gundungurra nation who lived throughout the valley's rich network of rivers and permanent waterholes, hunting grounds and bush crops.

Colonial powers quickly recognised the value of the fertile and beautiful valley and in 1826 divided it into small holdings for settler farmers. Many Gundungurra and people from other Indigenous groups moved to Aboriginal Reserves in the valley, located on higher ground, and worked on settlers' farms or farmed the reserves.

According to the local Indigenous creation story, Burratorang Valley was gouged out in the Dreaming (Gunyungalung) during a long cross-country battle between Mirragan, a large tiger cat, and his quarry the part fish, part reptile Gurangatch, who lived in a waterhole where the Wollondilly and Wingecarribee rivers meet. By the time their battle was over, Gurangatch had carved out the Wollondilly and Coxs rivers of the Burratorang Valley, including the deep waterholes where he rested and tried to hide from Mirragan.



(From left) SCA catchment officer Tony Kondek and Gundungurra people Nathan Brown, elders Jean Murphy, Dawn Harris and Ron Fletcher, on a visit to Burratorang Valley.

Heritage

**Warragamba Dam
50th anniversary
1960 – 2010**

The heritage of Warragamba Dam is part of a much bigger story. It begins with the traditional Indigenous land owners and encompasses the history of Sydney and regional areas as they grew from a small colony established at Sydney Cove in the late 18th century. The people of Sydney and NSW have always faced the challenge of securing a reliable water supply. This demanded an immense effort in building dams and other works over the past 200 years.

Heritage is also a story of migrants adding to the city's population, with some toiling as workers to build the dams. It is also the story of many Indigenous and other people who were forced to move when the Burratorang Valley was flooded.

The SCA has sought to take great care to mark and respect this heritage in its renewal of the Warragamba Dam precinct. Haviland Park includes a tribute to workers who lost their lives during dam construction, and interpretive signage which describes the dam and some of its history.

As a piece of crucial infrastructure for Sydney the dam needs to be maintained and progressively upgraded. Protecting heritage is not only about preservation – but also taking heritage values into account in new works.

In renewing Haviland Park, the SCA kept the original formal design. However, many of the original trees had to be replaced. The park was built on the dam's construction site and was officially opened in 1965 by E J Walder, President of the Metropolitan Water Sewerage and Drainage Board. Part of the park again become a construction site when the auxiliary spillway was built between 1998 and 2002.

When upgrading an asset of heritage significance the SCA protects the heritage values in a number of ways. These include photography before and after the change, and in some cases items that have been replaced are retained because they help tell the story of the dam.



An original outlet valve being installed during the 1950s (top) is preserved within Haviland Park (right). The park as it was (above).



50 Infrastructure milestones

Warragamba Dam
50th anniversary
1960 – 2010

Since Warragamba Dam opened in 1960, the demands of a growing population, modern dam safety standards and uncertain rainfall have resulted in a number of major improvements to the dam.

To meet modern dam safety standards, in the late 1980s the dam wall was strengthened and raised, and in the early 2000s an auxiliary spillway was built to divert floodwaters around the dam in a rare and extreme flood.

Concern about drought led to construction of a deep water pumping station in the mid 2000s to access water deep in the dam.

Major upgrades to Warragamba Dam over the past 25 years include:

Raising and strengthening the dam wall – When new rain and flood event studies showed that Warragamba Dam could experience floods much larger than allowed for in its original design, the height of the dam wall was increased by five metres and strengthened using post-tensioned steel cables to tie the upper wall to its base. These major works between 1987 and 1989 ensured the dam meets modern international dam safety standards.

Auxiliary spillway – To withstand a worst-case scenario flood, an auxiliary spillway was constructed from 1998 to 2002. In extreme floods the spillway on the dam's east bank will allow floodwaters to pass safely around the dam, reducing the pressure on the dam wall. This safeguards the water supply and protects the areas downstream from a dam break.

Outlet valve replacement – This project saw the four original Larner-Johnson needle valves deep inside the dam replaced with new Erhard butterfly valves manufactured in Germany. These outlet valves allow water to be released from the dam and into the two large pipelines which carry the water 26 kilometres to the Prospect Water Filtration Plant.



The auxiliary spillway (above left and right) and deep water access project (centre). Senior water systems operator Tony Jensen in the valve house (opposite).



Infrastructure milestones

Warragamba Dam
50th anniversary
1960 – 2010

Other major upgrades to Warragamba Dam and its grounds over the past 25 years include:

Deep water pumping station – To access deep water in the dam during drought, a deep water pumping station was completed in 2006. Deep water lies below the lowest outlet point in a dam that water can be extracted from. A team of international saturation divers, or aquanauts, working at a depth of 85 metres cut a two metre hole through a section of the dam wall to allow deep water to be pumped into the Warragamba pipeline.

The pumping station used a refurbished cavern that was a part of the Warragamba Emergency Supply Scheme built in the 1930s. Along with a similar project at Nepean Dam, Warragamba deep water access increases the amount of water that can be drawn out of the dams each year by about 40 billion litres and provides around an extra six months' water in a drought.

Electrical upgrade – To improve safety, reliability and efficiency, the dam's entire electrical network was upgraded between 2007 and 2009. The project replaced 170 kilometres of cables inside the dam wall, replaced or installed 233 light switches, 155 general power outlets and 500 fluorescent light fittings, and installed 1200 energy efficient light bulbs.

Visitor centre and grounds – In November 2009 the Warragamba Dam grounds reopened to the public following the \$240 million program of dam upgrades which lasted more than a decade. In addition to some of the projects described above, major upgrades during that period also included improvements to the dam grounds, a new visitor centre and viewing platforms overlooking the dam and Lake Burragorang, upgrades to Haviland Park including landscaping and new picnic facilities, as well as a new operations building and workshop.



The deep water pumping station under construction and completed (left and centre). Young visitors learn about water as a precious resource (right). The auxiliary spillway takes shape (opposite).





50 Healthy catchments

Warragamba Dam
50th anniversary
1960 – 2010

Catchments
In a catchment, all rain and run-off water eventually flows to a creek, river, lake or ocean, or seeps into the ground to become groundwater. The catchments cover 16,000 square kilometres – an area one quarter the size of Tasmania. They stretch through the Blue Mountains to the land surrounding Lithgow, and past Goulburn to the headwaters of the Shoalhaven River near Cooma. The catchments are home to 120,000 people who live in towns and regional cities and on farms.

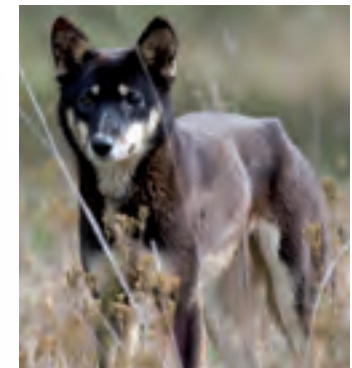
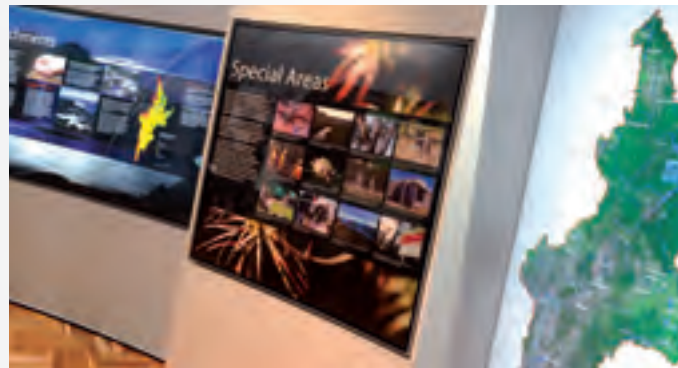
Special Areas
The Special Areas cover about 3,700 square kilometres of land around the water storages. The first Special Area, the Metropolitan Special Area, was declared in 1880 to protect land of the Upper Nepean catchment. Special Areas were later declared in Woronora (1941), Warragamba (1942), Shoalhaven (1970), Fitzroy Falls (1973), Wingecarribee (1973), Blue Mountains (1991) and Prospect (2008).

Warragamba's Special Area is a large area of undisturbed bushland which acts as a buffer to help stop pollutants from entering the drinking water storage. Except for some walking corridors, public access is prohibited in the parts of the Special Areas closest to the water storages. Feral animals, weeds and bushfires in Special Areas are managed by the SCA and partner agencies to minimise the impact on the land and water quality.

A haven on our doorstep
Wildlife researchers have discovered more than 440 different animal species in the protected Special Areas of the drinking water catchments. Public access restrictions have made these areas a haven for 34 frog, 59 reptile, 65 mammal and 281 bird species.

- Researchers were astounded to discover:
- 37 endangered or vulnerable species
 - 323 species, bringing total known numbers to 442
 - a new koala colony in the south of Nattai National Park
 - a new population of the endangered brush-tailed rock wallaby
 - important roosting caves for threatened bat species
 - platypus in the Wollondilly River.

Surveys uncovered forest enclaves filled with vulnerable woodland bird species which have virtually disappeared from western Sydney in recent decades. Other investigations found the Special Areas boast 1,400 native plant species and 75 eucalypt species, perhaps the highest diversity of eucalypts in the world.



Native wildlife thrives within the protected Special Areas (left, right and opposite). The Water for Life exhibition tells the story of catchments and our water supply (centre).





50 Healthy catchments

Warragamba Dam
50th anniversary
1960 – 2010

Partnerships and education

With more than 60 percent of the land privately owned, keeping the catchments healthy and protecting water quality is a shared responsibility between catchment communities, catchment users and the SCA.

The SCA relies on communities, stakeholders and agencies for their knowledge, support and involvement to manage the catchments.

Activities to protect and improve the health of the drinking water catchments include providing landholders with information about best practice and supporting on-farm training courses. The SCA offers grants to help farmers do work such as installing stock watering troughs and building fences to keep cows away from creeks. The SCA assists councils to upgrade sewage treatment plants which discharge treated water into catchment creeks and rivers.

The SCA also enforces regulations which restrict access to the Special Areas – land which surrounds the storage lakes. The organisation is also a significant contributor to regional planning for the drinking water catchments and works with councils to help them make decisions to

ensure that new developments have a neutral or beneficial effect on water quality. The SCA also conducts and supports research into water quality issues.

The opening of the new Warragamba Dam Visitor Centre provides educational facilities where visitors can learn about the drinking water catchments and water storage challenges.

Exhibits include a timeline history of the water supply and the interactive 'drops of wisdom' display. Other attractions include water stories, the centre's temporary exhibition program, and activities for different age and interest groups.

Each year more than 6,000 students travel to Warragamba Dam to learn about where drinking water comes from and what happens to it before they use it. Students share their ideas about how they can help protect the water supplies. They also learn about the work that scientists do to help manage waterways and protect natural habitats.



Agriculture is a significant catchment activity (opposite). Stock watering troughs and creek fencing protect water quality (left). Training courses (centre) for landholders focus on best practices.



50 Droughts, fires and floods



Surface water drinking supplies are precious natural resources and vulnerable to the vagaries of nature. Some of the SCA's most significant challenges are related to coping with the natural environment and the droughts, fires and floods that are a feature of this environment.

Drought

Drought has shaped the history of water supply since the early days of European settlement when Governor Arthur Phillip had tanks carved into the sandstone banks of a stream, later known as the Tank Stream.

The water stored in the tanks helped the community survive the dry summer of 1789-1790. In the late 1830s drought drove the price of a bucket of water to six pence, which was about half a week's wages. The 1849 drought prompted a special committee to "report on the best means of procuring a permanent supply of water to the City of Sydney".

Many droughts followed including the record drought of 1934 to 1942 which left Sydney with only "weeks of water" and led to the Warragamba Emergency Scheme. The scheme involved building a weir and pumping station on the Warragamba River. In 1942 investigations began to find the best site to build Warragamba Dam.

In August 1998 heavy rain filled Warragamba Dam to its full storage level. Unfortunately, following this, Sydney experienced the worst drought since 1942. Warragamba Dam dropped to its lowest storage level of 32.5 percent in February 2007.

From 2003, water transfers began from Tallowa Dam to Sydney and the Illawarra. During the drought a volume equivalent to almost 30 percent of greater Sydney's water came from Tallowa Dam.

A number of strategies to secure Sydney's water supply were investigated and implemented through the NSW Government's Metropolitan Water Plan. Four main elements make up the plan: dams, recycling, desalination and water efficiency.

Fire – 1957 and 2002

Hugh McCormack, a former dam builder, recalls the day in early December 1957 when "everybody was on tenterhooks" with fire approaching: "Everybody was spread out around the firebreak –

1,500 men, and a very daunting prospect it was to see the trees just 100 feet away bursting into flame and becoming an inferno of embers and branches blowing over towards us."

"We kept the fire at bay by beating out any embers that came onto our side of the firebreak with wet sandbags. We stamped out any embers that landed on doormats of the houses behind us, we hosed down the smouldering timbers supporting the high level reservoir. It was a frantic effort, very dangerous and potentially disastrous."

The bushfires in 2001-2002 burnt much of the Warragamba village and damaged a number of significant heritage buildings and structures at Warragamba Dam including the suspension bridge, a workshop and an original staff mess and lecture room from the 1950s.

The 235 metre suspension bridge was built to let workers cross the construction site and was enjoyed by the public until it was closed in 1987 due to termite damage. The bridge was removed for safety reasons after the Christmas Day bushfires of 2001. The support tower was retained to mark the bridge location.

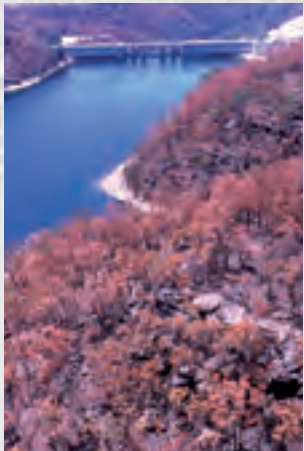
Floods

Managing floods, as well as droughts, is an important part of maintaining the water supply. During the construction of Warragamba Dam, floods caused work to stop many times to ensure the safety of the workers and the equipment. Since it was completed in 1960, the dam has spilled nearly 50 times.

The future

Climate change is one of the greatest challenges facing water authorities today. Planning for droughts, fires and floods has been part of the water supply equation since the beginning. Climate change, however, is an emerging issue and ongoing science and research is needed to inform water supply planners on its likely impacts.

Further information about securing water for people and the environment, and about the dams and drinking water catchments, is available at the Water for Life exhibition at the Warragamba Dam Visitor Centre, or from www.waterforlife.com.au.



The exposed bed of Lake Burragarang shows farm rain water tanks (opposite) and the old Wollondilly River bridge (top). Bushfire reached the dam wall in 2001 (middle).



50 Timeline

1845

The deep and narrow gorge of the Warragamba River, at the exit to Burratorang Valley, was identified as an ideal place for a dam by Polish explorer Count Paul Strzelecki. It took a century to overcome the limitations of engineering and economics before a dam could be built across the gorge.



1850

Sydney's population: 50,000.



Early 20th Century

A population boom after World War I (1914-1918) followed by the worst drought in recorded history placed immense pressure on Sydney's water supply. Building Warragamba Dam was delayed by the Great Depression (1929-1932) and World War II (1939-1945).

1937-1940

The Warragamba Emergency Scheme began in response to the record drought which left Sydney with only weeks of remaining water supply. A 15 metre high overshot weir and a pumping station were built on the Warragamba River and a 1.2 metre diameter pipeline was laid to Prospect Reservoir. The scheme started supplying water in May 1940.

1938

Samuel T Farnsworth, Engineer-in-Chief of the Metropolitan Water Sewerage and Drainage Board, proposed developing the full water supply potential of the Warragamba River by building Warragamba Dam.



1950

Sydney's population: 1,557,220.



1960

Opening of Warragamba Dam on 14 October.

Sydney's population: 2,132,680.

1840 1860 1880 1900 1920 1930 1940 1950 1960

WARRAGAMBADAM

50th Anniversary 1960-2010

1934-1942

Record Drought

Water restrictions were introduced in Sydney during a record eight year drought.

1948-1960

From 1948 until 1960 about 1,800 people (mostly men) of 30 nationalities worked three shifts a day, seven days a week, to build Warragamba Dam.



1987-1989

The dam wall was raised by five metres and strengthened using post-tensioned steel cables to tie the upper wall to its base.



1998-1999

The Sydney Catchment Authority (SCA) established as an independent authority to manage the catchments, improve treatment processes, and upgrade monitoring and research.



Late 2001- early 2002

Christmas Day bushfires burn the suspension bridge and other buildings of historical significance at the dam.

2002

The Warragamba Dam auxiliary spillway, begun in 1998, was completed. The auxiliary spillway is designed to protect the dam up to a 1:100,000 year flood, and would only come into effect in a flood that had one chance in 750 of happening in any given year (a 1:750 flood).

2003-2008

As the drought continued, a volume equivalent to almost 30 percent of greater Sydney's water came from Tallowa Dam. Without the transfers from the Shoalhaven River, total dam storage would have dropped to around 13 percent.

From 2004

The new millennium began in drought, and a number of strategies to secure Sydney's water supply were investigated and implemented through the NSW Government's Metropolitan Water Plan.



2008

Work began on a major upgrade (due for completion in 2012) to the drum and radial gates on the top of Warragamba Dam.

2009

Sydney's population: 4,440,870.

2010

The Healthy Catchments Strategy is developed. The strategy outlines how the SCA works to protect and improve the health of the drinking water catchments. It describes how the best science and technical information, best management practices, and experience of landholders is used to identify the key priorities and activities for protecting water quality.



1970 1980 1996 1998 2002 2004 2006 2008 2010

1998

In August 1998, good rain across the catchments saw dam levels rise from 55 percent to 100 percent in three weeks and Warragamba Dam's flood gates released water over the central spillway.

From August 1998-2007

Prolonged periods of low rainfall and the worst drought since 1942.

2006-2007

Warragamba pumping station number 9 was refurbished and recommissioned in 2006 to pump water from the newly cut deep water access outlets in the dam wall.

2009

Opening of Warragamba Dam's new visitor centre and picnic facilities including viewing platforms overlooking the dam and Lake Burragorang.

2010

Warragamba Dam celebrates its 50th anniversary. The Water for Life exhibition opens at the Warragamba Dam Visitor Centre.



WARRAGAMBADAM
50th Anniversary 1960-2010

PHOTOGRAPHS

Adam Hollingworth ©SCA. Pages: cover, inside front cover (left, right), 1, 2 (centre, right), 5 (right), 7, 8 (right), 10 (centre, right), 11, 12 (centre), 13, back cover

Arthur Jenkin. Page: 5 (top)

Peter Rae ©Fairfax Media. Page: 14 (top)

Nicholas Sutcliffe ©SCA. Page: 12 (left, right)

TVU ©SCA. Pages: 3, 4 (right), 6 (left, centre, right), 8 (left, centre), 9, 10 (left), 14 (middle, bottom), 15

Sydney Catchment Authority
Level 4, 2-6 Station Street
Penrith NSW 2750
Telephone: 1300 722 468
www.sca.nsw.gov.au

ISBN 978-1-876951-51-1

©SCA 2010
Design and artwork by Klik Creative
Printed by Focus Press

