

Improving Water Information Program



Australian Government

Bureau of Meteorology

Progress Report

Advances in water information made by the Bureau of Meteorology in 2011



Water Information
DATA · INFORMATION · INSIGHT

Improving Water Information Program Progress Report:
Advances in water information made by the Bureau of Meteorology in 2011.

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Front cover: Breached levee on the lower Loddon River, February 2011. Photo courtesy of North Central Catchment Management Authority.

Inside: Barwon Water, Lynton Crabb, CSIRO, Neil Duncan, Steve Keough, North Central Catchment Management Authority, David Perry, Luke Shelley, Philip Smith, WA Water Corporation.

Back cover: Googong Dam, Australian Capital Territory. Photo courtesy of Lynton Crabb.

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Craigbourne Dam, Tasmania

Introduction

“Great strides have been made in the first four years of the Program. Several landmark products were launched this year, each the culmination of several years’ work.”

Australia has long been a place of climate variability, renowned as a land of drought and flooding rains. This contrast has never been more evident than over the past 18 months, when an extensive period of drought was followed by a record-breaking deluge that caused havoc in many regions. While water storages were replenished in these areas, it was a testing time for governments, industry and communities. Notably, southwest Western Australia missed out on this rainfall and is still experiencing a prolonged period of low run-off.

With climate change expected to enhance the frequency of extreme weather, the events of 2011 remind us of the need to take the long view, while preparing for and responding to short-term challenges. Progress made through the *Improving Water Information Program* is increasingly enabling Australia to do this.

Great strides have been made in the first four years of the Program and in delivering on the Bureau’s statutory obligations under the Commonwealth *Water Act 2007*. This report provides an overview of progress made in 2011.

Several landmark products were launched this year, each the culmination of several years’ work.

The Bureau published its first Australian Water Resources Assessment, a regular assessment of Australia’s water resources that will assist us in gauging the impact of past and present water management practices.

The launch of the National Water Account 2010 by the Parliamentary Secretary for Sustainability and Urban Water, Senator the Hon. Don Farrell, in November 2011 was a significant milestone on our journey towards the annual production of a mature National Water Account.

It’s great to know about previous weather events, but we are always asked what might happen next. As well as providing the latest rainfall outlook, our three-month streamflow forecasts now provide water managers with unprecedented foresight about likely inflows into major rivers and storages.

Water resources analysis and reporting is only as good as the underlying data. Data collection continues to advance and an expanding range of datasets is now available.

The National Water Information Briefings held in capital cities throughout November–December 2011 enabled us to demonstrate the practical value and use of water information to our many stakeholders across the nation. Through this process we were able to obtain valuable first-hand feedback about our products and services.

I am pleased to report on the extensive progress we have made over the first four years of the *Improving Water Information Program*. These advances, and the many more we have under development, are making Australia better equipped to manage water scarcity, water quality and flood risk.

Dr Rob Vertessy
Acting Director of Meteorology





Campaspe Weir, northern Victoria, January 2011

Improving water information

The Australian Government's *Improving Water Information Program* began in July 2007 as a ten-year initiative. It is implemented through a \$450 million investment led by the Bureau of Meteorology and supported by water agencies across Australia.

A comprehensive, reliable and up-to-date picture of Australia's water resources is emerging as the Program progresses and 2011 was a year of many achievements. The Bureau made substantial advances in its mission to ensure Australia is better equipped to manage water scarcity, water quality and flood risk through ready access to high quality water information at the national level.

The journey so far

The *Improving Water Information Program* is contributing to:

- increased transparency of water information underpinning water policies and management decisions
- consistent national information to benchmark the performance of managed water systems
- public disclosure of water entitlements, allocations, trades and use, improving the performance of water markets
- improved water availability forecasts, leading to greater certainty in water resources planning
- improved flood estimation, enabling safer and more cost efficient infrastructure design
- improved community understanding of water resources management.



Bureau staff working together at the Flood Warning Centre in Brisbane.

Program objectives

Having established strong foundations, our efforts have turned to building new water information systems, harmonising diverse datasets and analysing them for hydrologic insights.

The *Improving Water Information Program* is working to achieve the following ten objectives:

1. Establish enduring national water data sharing and licensing arrangements.
2. Develop and disseminate national water information standards.
3. Build and maintain the Australian Water Resources Information System to underpin all of the Bureau's water information products and services.
4. Collate, standardise and archive water data gathered by over 200 organisations named in the schedules in the Water Regulations 2008.
5. Support water data collecting organisations to improve their hydrologic observing networks and information systems to enhance the quality of primary water information available to the Bureau.
6. Provide the Australian public with free online access to reliable water information that is readily understood.
7. Analyse trends in water availability and quality across the nation, and convey this information to the public via Australian Water Resources Assessments.
8. Publicly disclose water entitlements, allocations, trades and take for all major urban and rural water supply systems in an annual National Water Account.
9. Provide effective and reliable streamflow forecasting services for high priority water supply systems.
10. Enhance the science and technology base of the Bureau's water information products and services by supporting strategic research and development.



Water information value ladder: the *Improving Water Information Program* is playing a critical role in ensuring all Australians benefit from and use the full spectrum of water information.

Water information questions

The water information products and services developed by the Bureau have national reach and are readily available to the public, free of charge. Each year we are making substantial steps towards answering fundamental questions about Australia's water resources, such as:

- How much water is available today and how does that compare with the past?
- Who is entitled to use water, how much can they use and under what constraints?
- How much water is being traded and at what price?
- How much water is being allocated to the environment?
- How is the rate and pattern of water use changing?
- How is the quantity and quality of water in our rivers and aquifers changing?
- How much water is being lost to evaporation and leakage?
- What are the hydrologic impacts of land management changes and climate change?



West of Sydney, Warragamba Dam is one of the largest domestic water supply dams in the world (Source: Sydney Catchment Authority).

1. Sharing data

Objective: Establish enduring national water data sharing and licensing arrangements

About this objective: For a national water information service to succeed, it is vital to establish national data sharing and licensing arrangements. With more than 200 organisations collecting a piece of the national water information puzzle, cooperation and collaboration are critical. For these to be robust and enduring, a national leader with a legislative mandate is required.

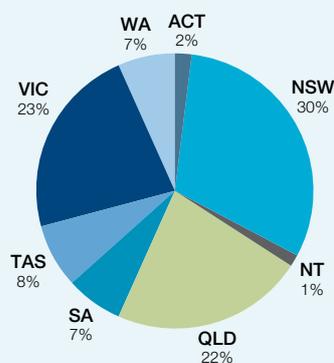
The *Water Act 2007* came into effect in March 2008. Part 7 of the Act empowers the Bureau to collect and publish water information. This legislation ensures that water data will be shared freely as a public resource.

The Water Regulations 2008 came into effect in July 2008. They define who must give specified water information to the Bureau, and the time and format in which it must be supplied. The Regulations individually name over 200 persons (organisations) required to give the Bureau specified water information that is in their possession, custody or control.

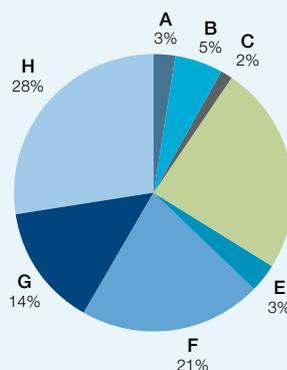
2011 achievements

- We ran a consultation program in all capital cities throughout January–February 2011 to discuss and collect feedback on proposed changes to the Water Regulations 2008. The workshops were attended by 153 representatives of persons named in the Regulations.
- We wrote to persons named in the Regulations in December 2011 to advise that an amendment will be made in early 2012. We distributed an Information Bulletin to affected stakeholders detailing the changes.

Water Regulations organisations by State/Territory



Water Regulations organisations by category



- A – Lead water agencies
- B – Other State/Commonwealth agencies
- C – Hydroelectricity generators
- D – Major storage owners or operators
- E – Rural water utilities
- F – Urban water utilities
- G – Catchment management authorities and others
- H – Flood forecasting and warning water information providers

Note: Organisations can be listed in one or more categories in the Regulations

“Through this program the Bureau continues to improve curation and dissemination of the water information that is vital to our work.”

DR FRASER MACLEOD, EXECUTIVE DIRECTOR, MURRAY-DARLING BASIN AUTHORITY

- We developed an improved *Regulations Online* website to assist water data providers to better understand their responsibilities under the Regulations and to support their interactions with the Bureau. The website has greater functionality and flexibility and will support improvements in data transmission to the Bureau.
- We continued to develop the Water Data Transfer Format (WDTF) in preparation for mandating that data supplied under the Regulations be provided to the Bureau in that format. WDTF provides a national standard for translating water data into a common format and enables us to more efficiently collect and process water information data files. Developments included the establishment of stronger governance processes for revision of the standard and support tools for data supplying agencies. We announced that lead water agencies will be required to send their data in WDTF from July 2013, with a timeline for other organisations to be issued in 2012.
- In collaboration with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities and lead State and Territory water agencies, an agreement was reached on a common set of terms to aggregate and report national water markets information. This agreement enables disparate water markets information collected under the Water Regulations 2008 to be ingested into the Australian Water Resources Information System, developed into a standard format and made available through web-based products.
- We applied the Creative Commons Attribution Licence as the default licence to all water information products to permit the broadest reuse of water information, meeting the policy objectives of the *Water Act 2007*. The Licence ensures that organisations or individuals that supply information are correctly attributed for their information. Our approach aligns with the Australian Government’s *Declaration of Open Government*, which commits agencies to a culture of openness and recognises that public sector information is a national resource that should be available on the most unrestricted terms whenever possible. To date, 184 organisations – providing about 85% of the nation’s water data – have adopted the Licence.



Creative Commons promotes a culture of openness and the release of public sector information on the most unrestricted terms whenever possible.

2. Setting standards

Objective: Develop and disseminate national water information standards

About this objective: Improving Australia's water information begins with standardising data collection and reporting regimes. The Bureau is working closely with water agencies, researchers and expert panels to develop a range of national standards that will harmonise water data collection, analysis and reporting across the nation. Under the *Water Act 2007*, the Director of Meteorology has the power to issue water information standards, including water accounting standards. To date, the standards developed by the Bureau have been disseminated on a voluntary-adoption basis.

2011 achievements

- In consultation with industry stakeholders, academics and practitioners, we developed a classification system for Australian streamflow data collected from organisations named in the Regulations. The application of a classification system to these data will allow potential users to better assess the suitability of the data for a wide range of possible uses in hydrologic analysis and modelling.
- We established the Water Information Standards Business Forum, bringing together key water industry representatives to inform the development of water information standards. Following consultation with 50 stakeholders, we published the *National Water Information Standards Development: An industry needs analysis*. This work proposes a framework for developing national water information standards and provides priorities and guidance for the Standards Business Forum.



Left: Flow monitoring equipment enabling river height and river flow data to be transferred daily to the Bureau has vastly improved data quality.

Middle: Bureau hydrologist Katrina Annan calibrating a rain gauge in a remote part of the Kimberley, WA.

Right: The International Water Accounting: Current practice and potential development report was published in September 2011.

“Advances being made in water information standards are already having a beneficial impact across the water sector.”

MARTIN READ, MANAGER WATER ASSESSMENT, DEPARTMENT OF PRIMARY INDUSTRIES, PARKS, WATER AND ENVIRONMENT, TASMANIA

- Standards for the deployment, calibration and use of acoustic doppler current profilers (ADCP) were developed with funding from our Modernisation and Extension of Hydrologic Monitoring Systems Program. An ADCP is a sonar instrument that accurately measures flood flow and reduces the safety risk associated with taking streamflow measurements in extreme situations. The standards provide a national procedure for the use of this equipment to improve the quality and consistency of data we receive.
- We contributed to the development of WaterML2, an international standard for hydrological data transfer. The specification of WaterML2 is being completed by the Open Geospatial Consortiums Hydrology Domain Working Group, with significant input from the Bureau–CSIRO Water Information Research and Development Alliance. The specification is well advanced and will be released in early 2012.
- We released an exposure draft of *Australian Water Accounting Standard 1: Preparation and presentation of general purpose water accounting reports*. In response, we received 55 submissions regarding various aspects of the Standard. The Water Accounting Standards Board is using this feedback to develop the Australian Water Accounting Standard.
- The Water Accounting Standards Board and the Auditing and Assurance Standards Board issued a joint consultation paper to guide the development of an assurance standard for information presented in water accounting reports. The *Assurance Engagements for General Purpose Water Accounting Reports* consultation paper received 18 responses from organisations within both the assurance and the water sectors. Feedback is being used to develop a water accounting assurance standard exposure draft for further public comment.
- The Water Accounting Standards Board Office completed a desktop review of relevant international water accounting and reporting activities, and prepared a report of its findings. The *International Water Accounting: Current practice and potential development report* describes water accounting activities of international bodies and the development of corporate sustainability reporting. The work will assist the Office to identify opportunities for collaboration in developing Australia’s water accounting approach.
- We have initiated development of a National Aquifer Framework that will provide a common national classification system for hydrogeologic units and aquifers. The Framework will enable key groundwater datasets to be harmonised, resulting in improved management across jurisdictional boundaries. This work involves extensive collaboration with groundwater experts from State agencies and consulting firms, and will be completed in mid-2012.
- We published comprehensive metadata lists for surface water following detailed industry consultation. These lists will be incorporated into the Water Regulations in early 2012. The inclusion of metadata will enable users to better understand and use the Regulations data.



Sontech M9 acoustic doppler current profiler on a travellerway.

3. Building systems

Objective: Build and maintain the Australian Water Resources Information System to underpin all of the Bureau's water information products and services

About this objective: The Bureau is building the Australian Water Resources Information System (AWRIS) to receive, ingest and normalise water data gathered from around the nation, and to deliver a range of water information products and services. AWRIS is spatially enabled using the Australian Hydrological Geospatial Fabric.

2011 achievements

- We released Version 2.0 of the Australian Hydrological Geospatial Fabric (Geofabric) which updates all components of Version 1.0 and introduces new data layers, including a groundwater cartography product, a hydrology reporting catchments product and a hydrology reporting regions product.
- We built a content management system to simplify production of the National Water Account. This enables us to receive data from reporting partners electronically and will generate HTML content for web-based publishing of the Account. The tools will streamline workflow, improve processes and consistency, and enhance our ability to produce the National Water Account on an annual basis.
- We are working with the National Water Commission to deliver Phase 2 of the National Groundwater Information Systems (NGIS) project. This project is building standardised datasets for groundwater bore stratigraphy. The datasets will be used to analyse and present three-dimensional aquifer volumes to enable the national assessment of groundwater resources.
- We began implementing hosting arrangements for the *Atlas of Groundwater Dependent Ecosystems*, being developed by SKM with funding support from the National Water Commission. For the first time, this national Atlas will collate relevant information on the hydrogeology and ecology of these ecosystems into one web-based location, to be hosted by the Bureau. The Atlas enables important links to be made between surface ecosystems and groundwater information, and will underpin future management systems to protect vulnerable environmental assets.
- We completed a significant upgrade of the AWRIS computing infrastructure, adding a further 300TB of data storage and increasing our virtual server infrastructure four-fold to 944 cores, across 40 enterprise class hosts. These upgrades enable us to store much larger volumes of data and perform many more computations, giving us the ability to deliver an extended range of products and services.
- We implemented a new times series data management system (WISKI/TSM), greatly enhancing our ability to curate the extensive water datasets we receive under the Water Regulations 2008.
- We developed a web-based system to enable Australia's 84 water restriction setting entities to update the status and definition of water restrictions in their jurisdictions. This product enables timely and accurate reporting of water changes in restriction settings and will simplify the Bureau's task of providing national reports on water restriction status.
- We implemented a customer relationship management system to track and manage our extensive interactions with stakeholders throughout Australia. The system enables us to better coordinate our engagement activities and communication, particularly with persons named under the Water Regulations 2008.

“Building infrastructure to meet the technical challenge of this Program has been a significant task. The Bureau is now much better placed to manage the enormous amount of data generated presently and into the future.”

TINO GALATI, MANAGER ASSET INFORMATION SYSTEMS, WATER CORPORATION,
WESTERN AUSTRALIA

Geofabric Version 2.0

The Geofabric is a specialised Geographic Information System (GIS) that maps the spatial relationships between important hydrologic features such as rivers, dams, lakes, aquifers, diversions and monitoring points. Version 2.0 includes several new components to increase its usability and function.

Components released with Version 1.0 were updated with improved stream connectivity and new hydrological features, such as water storage inflow and outflow nodes.

Geofabric products are accompanied by a product guide, metadata, product schemas, data dictionaries, data product specifications and tutorials to assist users.

The Geofabric project is led by the Bureau of Meteorology in partnership with Geoscience Australia, the Australian National University Fenner School of Environment and Society, and the CSIRO Water for a Healthy Country Flagship.



Left: Geofabric Project Manager Elizabeth McDonald introducing Geofabric Version 2.0 at the spatial@gov conference in Canberra, November 2011.

Middle: Dr Rob Vertessy explaining the Australian Water Resources Information System at the OzWater'11 Conference, May 2011.

Right: Geospatial Database Developer Darren Smith working on the Geofabric architecture.

4. Data warehousing

Objective: Collate, standardise and archive water data gathered by over 200 organisations named in the schedules in the Water Regulations 2008

About this objective: The *Water Act 2007* empowers the Bureau to collect water data from around the nation and to make these freely available to the public. For data to flow to the Bureau and out to the public, we must negotiate and monitor data supply agreements, develop data management procedures and assemble teams to curate the information we store.

Our data warehousing activities in 2011 mostly involved design and development work to equip us for further progress in 2012.

2011 achievements

- Since 1 July 2008 when the Water Regulations 2008 came into effect, we have received nearly 13 million water data files from over 200 agencies across the nation and now receive over 10,000 new files per day. The data encompasses 75 variables across ten categories of water information, including streamflow, groundwater, climate, water storages and water entitlements, allocations, trades and restrictions.
- We have extended the data ingestion capability of the Australian Water Resources Information System. The system now ingests data files that are encoded using the Water Data Transfer Format (WDTF), the new national standard promoted by the Bureau.
- We initiated a project to ingest WDTF data from all of the lead water agencies, providing each agency with dedicated technical support.



Left: The monitoring sites catalogue exposes information on environmental monitoring sites across Australia.

Right: Data from Barwon Water storages, including West Barwon Reservoir, are now available on the water storage product.

“A solid foundation has been established to make data readily available to support decision-making across the water sector.”

ADRIAN SPALL, DIRECTOR WATER INFORMATION MANAGEMENT, DEPARTMENT OF SUSTAINABILITY AND ENVIRONMENT, VICTORIA

- We expanded the information available through both Water Storage and Water Markets, two of our online products. Data for eight Barwon Water storages were added to Water Storage, increasing its coverage to 269 water storages, and Water Markets now includes Queensland water markets data.
- We made significant progress in the development of a new water information catalogue that will be operational by mid-2012. This new map-based catalogue allows users to search for and download information contained within the AWRIS data warehouse.



McDonalds Swamp, a significant wetland near Kerang, Victoria.

5. Improving observations

Objective: Support water data collecting organisations to improve their hydrologic observing networks and information systems to enhance the quality of primary water information available to the Bureau

About this objective: Under the Water Regulations 2008, more than 200 water data providers are required to provide specified water information to the Bureau. The Australian Government's \$80 million Modernisation and Extension of Hydrologic Monitoring Systems Program (M&E Program), administered by the Bureau, is equipping data providers with the resources they need to update their monitoring systems and improve data quality and delivery to the Bureau.

2011 achievements

- We completed the fifth and final funding round of the M&E Program, having allocated \$78.1 million across the entire program to 464 individual projects. M&E funds have been used to modernise streamflow, groundwater and water storage monitoring networks, and to improve the transfer of water data to the Bureau. These investments arrested recent declines in the quality and coverage of hydrologic monitoring networks, and significantly enhanced data sharing.
- We continued to receive extensive real-time information as a result of the significant rollout of telemetry systems supported by the M&E Program. More than 600 monitoring sites have been, or will be, equipped with new telemetry systems, enabling real-time access to vital water information. These investments greatly improve the use of hydrologic data by water managers and the general public, lower the cost of data acquisition and reduce the duration of monitoring system outages.
- The accuracy of Australian streamflow measurements was greatly enhanced through the purchase of 145 acoustic doppler current profiling meters across 25 projects supported by the M&E Program. These meters significantly improved the accuracy and minimised the safety risk associated with measuring high streamflows and estimating water volumes downstream, particular during large floods.
- We published the final *Strategic Water Information Management Plans* on the Bureau website. These plans provide detailed descriptions of the current water information monitoring systems in each jurisdiction, highlight gaps in monitoring and outline priorities for future investments.

“Investments made through the five-year Modernisation and Extension of Hydrological Monitoring Systems Program are paying dividends by supporting hydrologic monitoring networks and promoting greater data sharing.”

GREG LONG, DIRECTOR WATER ACCOUNTING, DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT, QUEENSLAND

Overview of funding allocated through the M&E Program from 2007–12

Round	Year	Projects funded	Organisations funded	Total funding awarded (excl. GST)
1	2007–08	55	20	\$8,336,237
2	2008–09	132	50	\$19,861,071
3	2009–10	119	46	\$19,897,126
4	2010–11	94	37	\$19,999,273
5	2011–12	67	27	\$10,000,000
Total		467		\$78,093,707

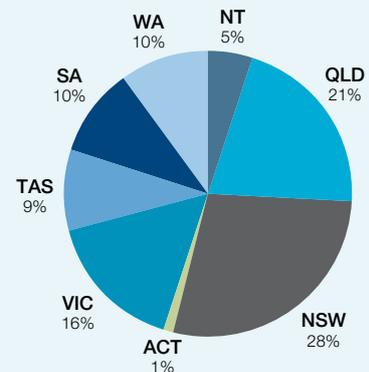
Distribution of M&E Program funding by theme group: total over five rounds

Theme group	Amount invested (\$ million)	Percentage of total fund
Equipment and networks	\$40.4	51.7%
Data management and systems	\$15.7	20.0%
Data quality assurance / quality control	\$1.3	1.7%
Data rescue	\$2.2	2.7%
Geofabric / National Groundwater Information Systems	\$9.0	11.6%
Water accounting	\$3.4	4.3%
Coordination	\$4.5	5.7%
Standards	\$1.5	1.9%
Hydrographic training	\$0.2	0.3%



Left: A water monitoring officer of the Department of Primary Industries, Parks, Water and Environment (Tasmania) sets up an acoustic doppler at the South Esk River

Distribution of funding by State/Territory Total over five rounds



Right: Distribution of M&E Program funding by jurisdiction: total over five rounds.

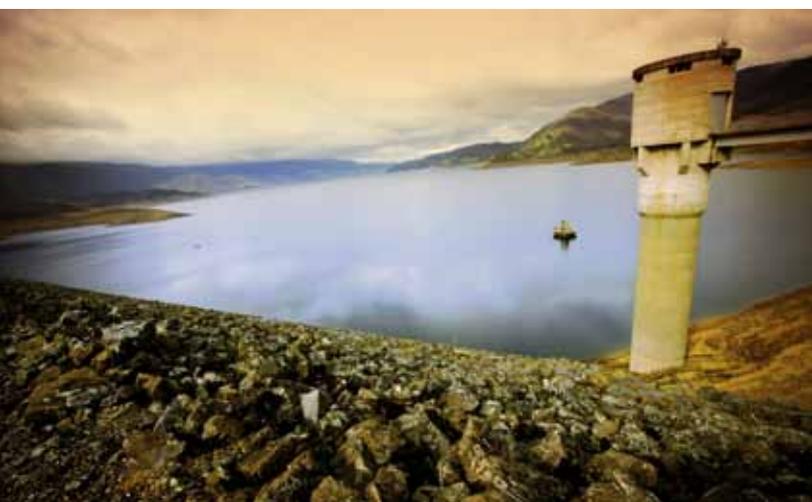
6. Publishing information

Objective: Provide the Australian public with free online access to reliable water information that is readily understood

About this objective: The Bureau is striving to make most of Australia's water information freely and publicly accessible, and to package it in a way that maximises its value and use. This not only assists water managers and policy-makers to perform their jobs better; it also helps to satisfy the information needs of water-dependent businesses, farmers, industry, educators and the general community.

2011 achievements

- We worked with the National Water Commission, the parties to the National Water Initiative, the Water Services Association of Australia and numerous urban industry representatives to establish a set of national standards for urban water definitions and types. The definitions provide clear and meaningful descriptions of potable water, non-potable water, raw water, stormwater, recycled water and desalination water for adoption Australia-wide. This will improve planning, reporting and policy-making across states and jurisdictions, and will assist urban water sector reform discussions and communication. The information is published in the *2010–11 National Performance Framework: Urban performance reporting indicators and definitions handbook*, which will be revised annually to ensure definitions, calculations and examples of indicators are consistently interpreted and applied.
- We expanded the water storage dashboard on the Bureau's website, which provides daily updated water storage values for 269 dams, representing over 94% of the nation's water storage capacity. We added one data provider per month from November 2011 to increase the dashboard's data coverage (percentage of capacity and number of storages). About 24,000 people visited the Water Storage webpage this year, while there were over 21,000 downloads of the Water Storage iPhone app. This brings the total number of downloads to over 30,000 since November 2010.
- We published the *Australian Water Information Dictionary*, providing online definitions of technical terms and acronyms used in our water information products and services. Over time, the dictionary will evolve to encompass a wider variety of water information terms providing a consistent approach to describing Australia's water resources.



Left: Data for Blowering Dam in NSW is included in the water storage dashboard.



Right: Manager Climate Monitoring – National Climate Centre, Dr Karl Braganza, describing longer term rainfall trends at a National Climate and Water Briefing.

"It's vital that water information is published in a consistent manner. The increasing availability of water information is contributing to improved awareness of water resources and is a valuable aid to inform decision-making."

BRUCE RHODES, MANAGER WATER RESOURCES, STRATEGIC PLANNING,
MELBOURNE WATER, VICTORIA

- We delivered a revised dataset for design rainfalls to Engineers Australia for evaluation ahead of a planned public release in mid-2012. This dataset is used to estimate the expected rainfall intensity for storms of different durations and return frequencies (hence it is called the Intensity–Frequency–Duration dataset). The dataset is used by engineers and hydrologists to design structures including gutters, pipes, culverts, stormwater drains and retarding basins. This is the first update of this product in 25 years.
- In revising the Intensity–Frequency–Duration (IFD) product, we used a greatly expanded rainfall database that includes rainfall data from agencies named in the Water Regulations 2008. In addition, more statistically rigorous techniques and methods appropriate to Australian rainfall data were adopted to improve the value of this product. We applied quality control procedures to nearly 20,000 daily-read rainfall stations and 4,000 continuous rainfall stations in the preparation of preliminary IFD estimates.

National Climate and Water Briefings

We commenced monthly National Climate and Water Briefings in August 2011 as a regular stakeholder engagement initiative. About 50 stakeholders attended each of the five briefings held to date.

The briefings provide senior policy and planning managers from about 30 organisations with the latest insights from climate and water forecasts, enhancing their own decision-making and planning.

A range of representatives from government agencies attended the briefings, including people from disaster recovery, emergency management and other areas that have a strong economic and community-safety focus.

With a focus on 'demystifying' the science, the briefings improve stakeholders' understanding of the climatic and hydrologic conditions of the previous and coming few months.

The briefings allow us to hear from participants about how they use the information we provide and how we can better address their business needs.

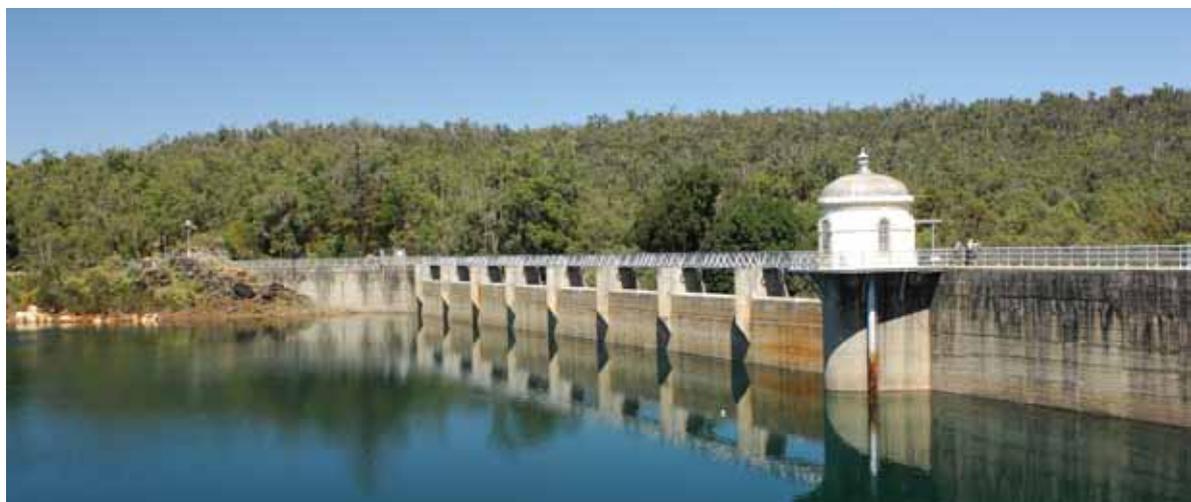
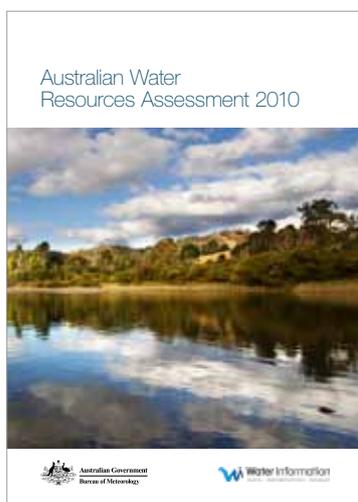
7. Assessing water resources

Objective: Analyse trends in water availability and quality across the nation and convey this information to the public via Australian Water Resources Assessments

About this objective: Australian Water Resources Assessments are periodically published by the Bureau to describe changes in the availability, condition and use of our nation's water resources. The assessments require detailed climatologic and hydrologic analyses to be undertaken on 13 regions spanning the continent.

2011 achievements

- The Bureau's first national water resources assessment – the *Australian Water Resources Assessment 2010* – was published in December 2011. The 2010 Assessment presents a national overview of climate and water resources for 2009–10 and an analysis of water resources across 13 regions of Australia.
- The assessment was underpinned by a new landscape water balance model, AWRA-L, developed by CSIRO scientists through the Water Information Research and Development Alliance. The AWRA-L modelling system provides a state-of-the-art representation of water balance at the national scale. AWRA-L is a grid-based, distributed biophysical model that simulates most components of the catchment water balance. It has been applied to the entire Australian continent at a grid resolution of 5 km, running on a daily time step from the beginning of 1900 to the present. It enabled us to paint a much richer picture of changes in Australia's water resources than was possible from point-based observational data alone.



Left: The Bureau's first Australian Water Resources Assessment, launched in December 2011.

Right: Mundaring Weir, an important water source for Western Australians and part of the State's heritage.

“The Australian Water Resources Assessment helps us understand the current state of the nation's water resources and to estimate the impact and sustainability of our water use.”

TIM GOODES, DEPUTY CHIEF EXECUTIVE, DEPARTMENT FOR WATER, SOUTH AUSTRALIA

The state of the nation's water resources

The *Australian Water Resources Assessment 2010*, published in December 2011, is the first in a regular series of such reports and delivers on a requirement of the *Commonwealth Water Act 2007*.

This web-based report assesses Australia's water resources in 2009–10 in the context of the long-term hydrologic record. It updates earlier assessments of Australia's water resources and will be repeated regularly by the Bureau from now on.

The 2010 Assessment uses the best available water data, models and analyses, underpinned by a water balance framework, to describe and interpret the state of the nation's water resources. The report comprises a national overview chapter and 13 regional chapters, with the regions based on the new drainage division boundaries derived from the Geofabric. A Technical Supplement provides additional detail on the data selection, analysis and water balance modelling techniques used in preparing this report and the level of peer review and acceptance they received.

This report will assist all Australians, in particular policy-makers and planners, to understand the current state of the nation's water resources and to gauge the impact of past and present water management practices.

Key findings from the 2010 Assessment

- Australian rainfall in 2009–10 was 13% above the long-term (July 1911 to June 2010) average; evapotranspiration was 4% above the long-term average and landscape water yield was 40% above the long-term average.
- Deep soil moisture stores increased in the northeast and southeast of the country, but decreased in the west.
- The total water stored in major water storages in Australia increased from 46% to 52% of accessible volume, driven primarily by increases in the Murray–Darling Basin, Tasmania and North East Coast regions.
- Urban water use decreased from 1,719 GL in 2005–06 to 1,497 GL in 2009–10. These volumes are totals for all the urban centres evaluated in the 2010 Assessment. Residential water consumption accounted for 68% of urban use in 2009–10.
- Annual agricultural irrigation water use in Australia in 2009–10 was approximately 6,600 GL, up 1% on 2008–09.
- Widespread heavy rains fell in the Northern Territory and Queensland between 22 February and 3 March 2010 causing significant flooding in the Lake Eyre Basin region, in the south of the North East Coast region and in the far north of the Murray–Darling Basin region.

8. Accounting for water

Objective: Publicly disclose water entitlements, allocations, trades and take for all major urban and rural water supply systems in an annual National Water Account

About this objective: As competition for water resources intensifies, it is more important than ever to account for how water is distributed across Australia in a transparent and rigorous way. Water accounting is the systematic process of identifying, recognising, quantifying, reporting and assuring information about water, the rights or other claims to it, and the obligations against that water.

The *Water Act 2007* requires the Director of Meteorology to annually publish a National Water Account. This will inform water resources planning, water market activity, investment decisions, environmental management decisions and community dialogue. Over time, the National Water Account will create a deep knowledge base from which to inform policies and management decisions to enhance the security of Australia's water supply for all uses.



Left: The National Water (NWA) 2010 home page. The NWA was developed as an online resource to improve usability.

Right: The Hon. Don Farrell, Parliamentary Secretary for Sustainability and Urban Water, joins Rob Vertessy in launching the National Water Account 2010.

“For the first time, we are able to reconcile water entitlements, allocations, trades and take across Australia's major water supply systems. Importantly, it's in a format that is easily understood and readily accessible.”

PAUL PENDLEBURY, DIRECTOR WATER SYSTEMS, OFFICE OF WATER, NEW SOUTH WALES

2011 achievements

- We published the National Water Account 2010, containing a set of water accounting reports for eight nationally-significant water management regions: Adelaide, Canberra, Melbourne, Murray–Darling Basin, Ord, Perth, South East Queensland and Sydney. Information presented is similar in style to financial accounting reports and includes the total water resources, the access rights to that water and the actual water extraction. It uses the best available data and includes information that previously was difficult to access or unavailable to general users.
- We developed the Urban System Analysis Tool (UrbanSAT), which was vital in producing the National Water Account 2010. The UrbanSAT provides a nationally consistent and systematic approach to the capture, analysis and presentation of water movement through urban water distribution systems. The UrbanSAT enables the National Water Account to present a unique view of water movements and usage in urban centres, and was successfully applied to the Adelaide, Canberra, Melbourne, Perth, South East Queensland and Sydney urban water supply systems. The development and application of UrbanSAT also helped to consolidate and standardise urban water definitions.

Australia's first National Water Account

Water accounting is a relatively new form of water resource reporting. It is a systematic process of identifying, recognising, quantifying, reporting, assuring and publishing information about water and people's rights and obligations with respect to it. The Bureau is leading the development of water accounting in Australia and the National Water Account is our flagship water accounting report.

The National Water Account 2010 is the most comprehensive snapshot of water accounting information ever prepared for Australia and provides information that previously was difficult to access or unavailable to general users in a standardised form. It presents a cross-jurisdictional perspective on water and the rights and obligations with respect to that water.

We prepared the National Water Account 2010 in partnership with over 30 organisations across Australia, with contributions from a further seven organisations. The production of the Account involved substantial consultation and collaboration with all these organisations.

Publishing the National Water Account is a statutory obligation of the Bureau of Meteorology under the Commonwealth *Water Act* 2007. It is an annual publication for the period from 1 July to 30 June.

ACCOUNTING FOR WATER

The Perth region water account at a glance

The Perth region report of the National Water Account 2010 includes information about the region, its water resources, land use and water-related infrastructure.

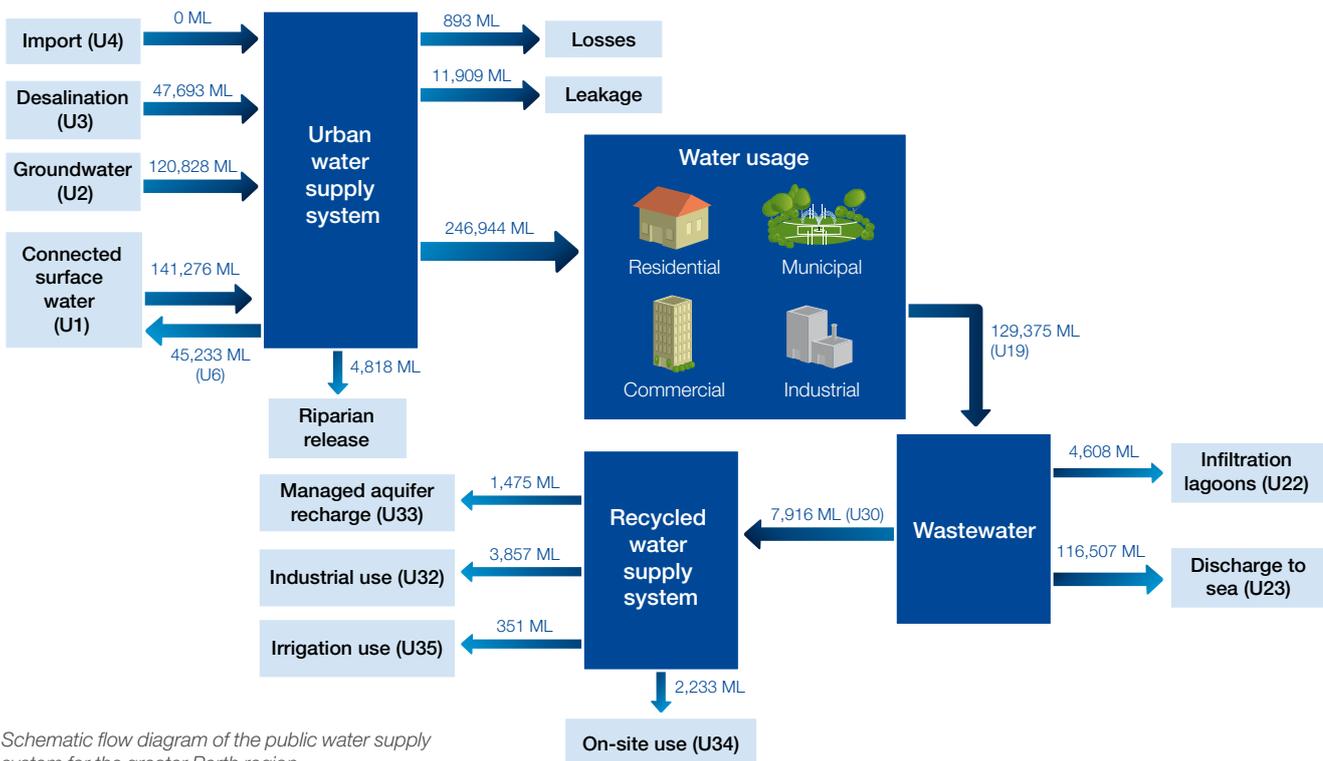
The Perth region is home to waterways and wetlands of environmental and cultural significance, such as the Swan-Canning River and Harvey Estuary systems. There are also important groundwater resources within the region, such as the Gnangara Mound, that support numerous wetland ecosystems and are a vital source of public water supply.

Water for metropolitan Perth comes from three primary sources: reservoirs, aquifers and desalinated water. According to the National Water Account 2010, the statement of physical water flow shows that during 2009–10, a total of 310 GL of water was supplied to Perth’s urban water system – 141 GL from reservoirs, 121 GL from aquifers and 48 GL from the Perth Seawater Desalination Plant. Most of this water was for residential use.

In addition, a further 76 GL of groundwater was extracted from domestic bores. There are about 170,000 residential bores in the Perth metropolitan area.

During the reporting period, there was limited scope for more water to be taken from reservoirs and aquifers for urban water supply. During 2009–10, rainfall over the Perth region was well below average, reducing the amount of run-off into the public water supply reservoirs. As a result, reservoirs were only at about 25% capacity.

Alternative water resources, such as seawater desalination and water recycling, are increasingly being used in the Perth region. During 2009–10, approximately 6 GL of treated wastewater was re-used for irrigation and local industry, and a further 1.5 GL was pumped back into the aquifers.



Schematic flow diagram of the public water supply system for the greater Perth region



The Perth Seawater Desalination Plant

9. Forecasting flows

Objective: Provide effective and reliable streamflow forecasting services for high priority water supply systems

About this objective: Australia's highly variable climate has increased demand for timely and accurate water availability forecasts, prompting the Bureau to expand its services to include continuous short-term streamflow and seasonal streamflow forecasts. The Bureau's seasonal and short-term streamflow forecasting services are expected to have a major impact on Australian water policy development and practice. They will provide a much stronger and more timely information base for decisions about water allocations, cropping strategies, water demand, purchasing environmental water, water trading and drought management.

2011 achievements

- Our Seasonal Streamflow Forecasting service provided reliable and accurate forecasts during times of very high streamflows. The forecasts, updated each month, estimate streamflows or inflows to water storages over the next three months based on statistical modelling that uses predictors representing climate and catchment conditions. The service was extended to 36 locations in New South Wales and Victoria, covering 16 river basins in the Murray–Darling and South East Coast drainage division.
- This new service provided crucial guidance for water managers in the southeast Murray–Darling during a time of very wet conditions across most catchments driven by a strong La Niña event. The forecast results during this period were very accurate and were significantly better than using historical or climate-based forecasts for decision-making. Where the climate drivers were more neutral throughout the year, the forecast results were of similar accuracy to that of historical or climate-based forecasts.



Left: Bureau Hydrologist Trudy Wilson presents Seasonal Streamflow Forecasting to workshop participants at a National Water Information Briefing.
Right: Goulburn–Murray Water staff working to mitigate the impact of the flooded Little Murray and Murray Rivers at Benjeroop, northern Victoria, February 2011.

“The Bureau's streamflow forecasts are improving the ability of water managers to respond to challenges presented by climate variability.”

STEWART CHAPMAN, SENIOR MANAGER WATER, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT DIRECTORATE, ACT

- We completed an evaluation of dynamic climate and hydrologic modelling methods to enhance our statistical seasonal streamflow forecasts. This approach uses downscaled rainfall forecasts from the Bureau's climate model POAMA (Predictive Ocean Atmosphere Model for Australia) and catchment scale rainfall-runoff models to generate one month and three months ahead probabilistic streamflow forecasts. The results are promising and over the next few years will be integrated with the existing statistical approach. This will enable the extension of the seasonal forecasting service to more catchments and different time scales across Australia.
- We piloted a probabilistic seven-day streamflow forecasting service, which promises to greatly improve the operation of reservoirs and the management of environmental water reserves, as well as provide longer lead times for potential flooding. The service development encompasses a range of activities, such as data quality assurance, model development and calibration procedures, automating forecasting processes and the communication of model outputs via web-based products. We tested the new forecasting system at three key locations within the Ovens Valley in Victoria and are now planning test applications in other catchments.

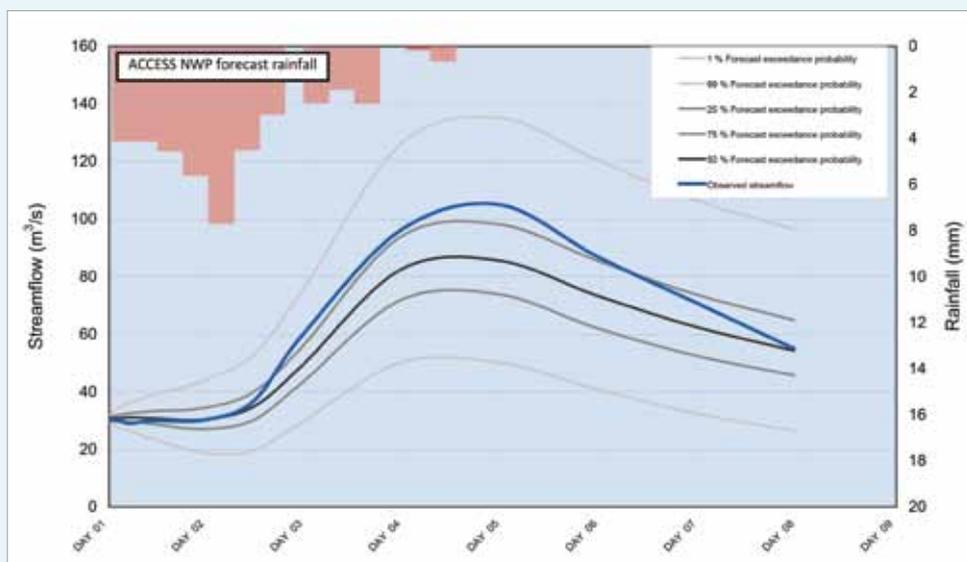
Short-term Water Information Forecasting Tool (SWIFT)

Each day, SWIFT provides a seven-day streamflow forecast for three locations in the Ovens Valley, Victoria. The forecasts are probabilistic, meaning that they include the range of flows that are likely to occur as well as the most likely streamflow.

SWIFT uses daily-updated rainfall forecasts generated by the Bureau's Numerical Weather Prediction system, ACCESS. The forecast rainfall is fed into a hydrologic model to produce a streamflow forecast for the next seven days. Various combinations of model input parameters are considered, resulting in an 'ensemble' of forecasts spanning the range of possible streamflows and indicating the most likely flow.

Forecasts from SWIFT can assist managers of water reservoirs and environmental water reserves to assess when and how much water to release from storage. SWIFT can also be used to provide longer warning lead times for flooding, providing the community and emergency service agencies with additional preparation time.

SWIFT will be tested on more catchments through 2012, ahead of an operational rollout to a number of locations across Australia in 2013.



An example SWIFT forecast for the Ovens Valley, which couples a hydrological model with a meteorological model.

10. Research and development

Objective: Enhance the science and technology base of the Bureau's water information products and services by supporting strategic research and development

About this objective: The Bureau invests in research and development to ensure that its new water information role is supported by the best available science and technology. We invest primarily through our water information joint venture with CSIRO, the Water Information Research and Development Alliance (WIRADA). Other important collaborations include the eWater Cooperative Research Centre and the Centre for Australian Weather and Climate Research.

2011 achievements

- WIRADA scientists made significant advances in developing the Hydrologist's Work Bench (HWB), a productivity tool that uses scientific workflow technologies to automate repetitive hydrologic analysis and forecasting tasks. The HWB work focuses on the analyses supporting the Australian Water Resources Assessment and on the production of the Australian Hydrological Geospatial Fabric (the Geofabric).
- Significant progress was made in developing the river network component of the Australian Water Resources Assessment (AWRA) modelling system. An external interface was developed for eWater's Source River model to link it to the AWRA Landscape (AWRA-L) model. River model testing was undertaken on 40 river reaches in the Namoi River basin and a preliminary version of the river model was used in the developmental AWRA system. The river model handles the fluxes and storages of catchment run-off generated from AWRA-L once it enters the river network, which are key elements required to deliver the water accounts and water resources assessments.
- WIRADA scientists developed a high-resolution (30 m), drainage-enforced digital elevation model (DEM-H) for the Australian continent, based on the Shuttle Radar Topographic Mission (SRTM) data. A range of new techniques were developed for treating sensor artefacts, gaps, offsets due to trees, noise and lack of hydrological connectivity in the SRTM data, which have garnered international attention. Drainage networks, catchments and topographic attributes derived from the DEM-H will underpin the next version of the Geofabric (Version 3), to be released in 2012–13.
- WIRADA scientists developed a methodology for estimating daily actual evapotranspiration (AET) across the Australian continent. They evaluated eight different approaches for calculating AET against *in situ* measurements and multi-year water balance estimates from 585 catchments. This research indicated that a combination of some of the methods provides the best AET estimates for use in the Bureau's water resources assessment and water accounting activities.
- WIRADA scientists completed an evaluation of the utility value of dynamic climate and hydrologic models for seasonal streamflow forecasts. They linked downscaled rainfall forecasts from the Bureau's climate model POAMA to catchment scale rainfall-runoff models, generating probabilistic streamflow forecasts for one to three months ahead. The resulting Dynamic Modelling System will be integrated into the Bureau's operational Seasonal Streamflow Forecasting service, enabling extension of the service to more sites and time scales.
- The Bureau is collaborating with The University of Melbourne on an Australian Research Council linkage project that will support the aim of providing predictions of decadal and long-term water availability (over the next ten to 30 years). The project involves assessing and reducing the range of uncertainty about future annual river flows. This technique is used to generate rainfall sequences that include multi-year to multi-decadal dry and wet periods. Application of the technique to key water supply systems is planned for 2012, providing a foundation for the routine estimation of climate change impacts on long-term water availability.

"The Water Information Research and Development Alliance is yielding a suite of innovations that are being converted into new water information products and services provided by the Bureau."

DIANA LEEDER, EXECUTIVE DIRECTOR, DEPARTMENT OF NATURAL RESOURCES, ENVIRONMENT, THE ARTS AND SPORT, NORTHERN TERRITORY

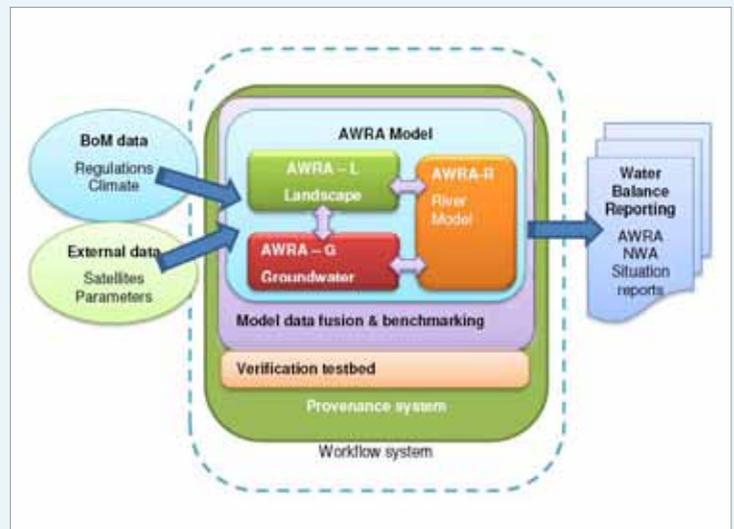
Australian Water Resources Assessment model

The Australian Water Resources Assessment modelling system is a grid-based, distributed biophysical model that simulates various components of the catchment water balance. It is being applied to the entire Australian continent, initially at a grid resolution of 5 km, filling in the gaps in Australia's water balances caused by the low density of water observations over large areas.

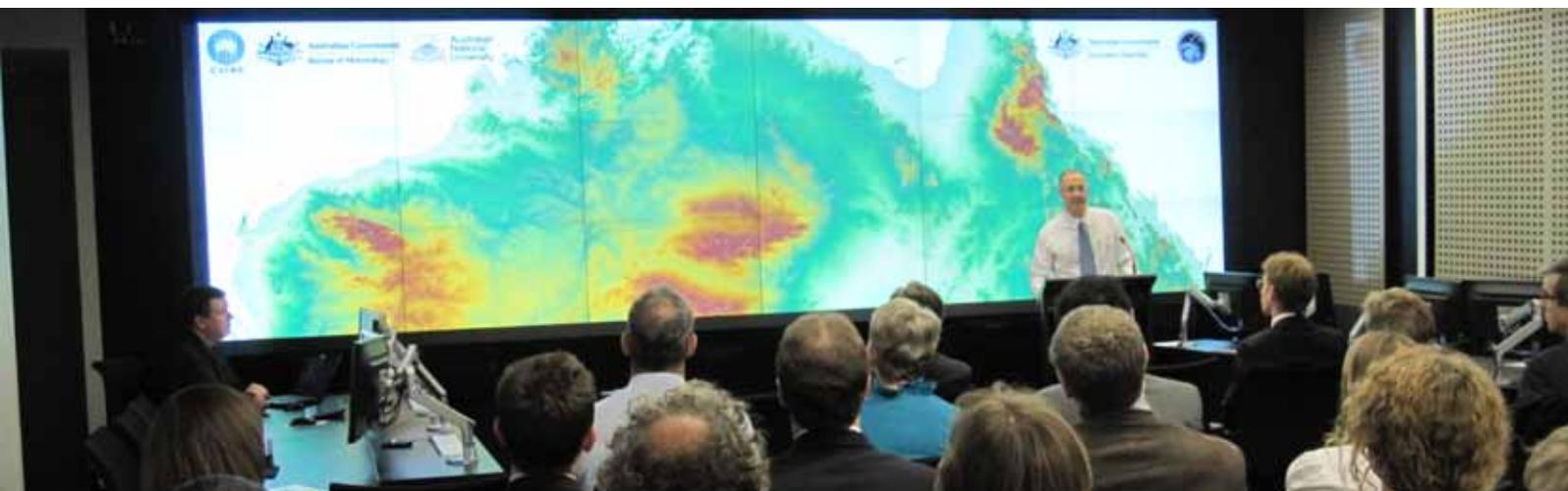
The AWRA modelling system is being developed through the Water Information Research and Development Alliance to support the Bureau's National Water Account and Australian Water Resources Assessment products. The modelling system will improve the robustness of estimated regional water balance flows. It includes the following components:

- A **holistic water balance modelling system** consisting of landscape (AWRA-L), river (AWRA-R) and groundwater balance (AWRA-G) components and allows dynamic linkage between them. While development has focused on the landscape component to date, the AWRA modelling system will provide a consistent water balance estimation system.
- A **model-data fusion system** to update and constrain model estimates according to observations where appropriate.
- A **benchmarking system** to test that the model and input data are accurately reflecting observations.

In 2011, the AWRA modelling system v1.0.0 was installed and run for the first time on the Bureau's computing infrastructure.



AWRA modelling system conceptual diagram



Director of CSIRO's Water for a Healthy Country Flagship, Dr Bill Young, at the launch of the one-second (or 30 metre resolution) hydrologically enforced digital elevation model, November 2011.

Stakeholder consultation

Australian Water Information Advisory Committee

The Australian Water Information Advisory Committee (AWIAC) provides strategic advice to the Bureau on the emerging water information needs of government and industry. It guides our water information activities to maximise their contribution to the water reform objectives set out under the National Water Initiative. Members of AWIAC provide high-level advocacy for national reform in water information management.

Membership in 2011:

- **Dr Rob Vertessy**, Deputy Director (Climate and Water), Bureau of Meteorology
- **Dr Russell Mein**, Chairperson
- **Mr Warwick Watkins**, Former Director General, Department of Lands, New South Wales
- **Mr Tony Slatyer**[^], Deputy Secretary, Department of Sustainability, Environment, Water, Population and Communities
- **Ms Chloe Munro**[^], Chairperson, National Water Commission
- **Mr Ken Matthews**^{*}, Former Chairperson, National Water Commission
- **Mr Rob Freeman**^{*}, Chief Executive, Murray–Darling Basin Authority
- **Mr Ross Young**^{*}, Executive Director, Water Services Association of Australia
- **Mr Adam Lovell**[^], Executive Director, Water Services Association of Australia
- **Chris Bennett**^{*}, Chief Executive Officer, Irrigation Australia
- **Dr James Horne**^{*}, Former Deputy Secretary, Department of Sustainability, Environment, Water, Population and Communities

* retired from AWIAC during the year.

[^] joined AWIAC during the year.

Meetings held in 2011:

- AWIAC-6 4 March 2011

Jurisdictional Reference Group on Water Information

The Jurisdictional Reference Group on Water Information (JRGWI) is the primary vehicle for coordinating the Bureau's water information activities with those of the States and Territories. Comprising representatives from the lead water agencies in each State and Territory, JRGWI provides a forum for members to articulate water information priorities in their jurisdictions and gives feedback to the Bureau on its various water information products and services.

Membership in 2011:

- **Tino Galati**, WA Water Corporation, WA
- **Patrick Seares**, Department of Water, WA
- **Tim Goodes**, Department for Water, SA
- **John Barrett**, Office of the Chief Information Officer, SA
- **Diana Leeder**, Department of Natural Resources, Environment, the Arts and Sport, NT
- **Martin Read**, Department of Primary Industries, Parks, Water and Environment, Tas.
- **Greg Carson**, Hydro Tasmania, Tas.
- **Adrian Spall**, Department of Sustainability and Environment, Vic.
- **Bruce Rhodes**, Melbourne Water, Vic.
- **Fraser MacLeod**, Murray–Darling Basin Authority
- **Lawrence Lingam**, Murray–Darling Basin Authority
- **Stewart Chapman**, Environment and Sustainable Development Directorate, ACT
- **Paul Pendlebury**, Office of Water, NSW
- **Ray Boyton**, Office of Water, NSW
- **Greg Long**, Department of Environment and Resource Management, Qld.

Meetings held in 2011:

- JRGWI-11 14–15 April 2011
- JRGWI-12 15–16 September 2011

National Water Account Committee

The National Water Account Committee (NWAC) provides important stakeholder advice and collaboration on the development, implementation and production of the National Water Account. NWAC reviews all water accounting standards recommended by the Water Accounting Standards Board and advises the Bureau on their utility for the NWA production process.

Membership in 2011:

- **Louise Minty** (Chair), Bureau of Meteorology
- **Adrian Bugg**, Australian Bureau of Statistics
- **Tim Fisher**, Department of Sustainability, Environment, Water, Population and Communities
- **Will Fargher**, National Water Commission
- **Peter Gee**, Water Services Association of Australia
- **Clarke Ballard**, Irrigation Australia
- **Penny Douglas**, Department of Environment and Resource Management, Qld.
- **Lindsay Preece**, Department of Water, WA
- **David Nicholls**, Department of Primary Industries, Parks Water and Environment, Tas.
- **Paul Pendlebury**, Office of Water, NSW
- **Stewart Chapman**, Environment and Sustainable Development Directorate, ACT
- **Adrian Spall**, Department of Sustainability and Environment, Vic.
- **Diana Leeder**, Department of Natural Resources, Environment, the Arts and Sport, NT
- **Karin Geraghty**, Department for Water, SA

Meetings held in 2011:

- Meeting 10 23 February 2011
- Meeting 11 15 June 2011
- Meeting 12 26 October 2011

Water Accounting Standards Board

The Water Accounting Standards Board (WASB) is an independent advisory board to the Bureau. The Board is working with the water industry to develop consistent standards for water accounting. WASB also provides advice to the Bureau and the National Water Account Committee for water accounting standards matters relevant to the National Water Account.

Membership in 2011:

- **Mike Smith** (Chair)
- **Peter Day**
- **Denis Flett**
- **Jayne Godfrey**

Meetings held in 2011:

- 8 February 2011
- 12 April 2011
- 14 June 2011
- 30 August 2011
- 29 November 2011

Standards Business Forum

The Standards Business Forum aims to bring key water industry representatives together with the Bureau to inform the development of water information standards.

- **Brendan Moran** (Chair), Bureau of Meteorology
- **Liz Marchant**, ANZLIC
- **David Lemon**, CSIRO
- **John Patten**, Department of Water, WA
- **Karin Geraghty**, Department for Water, SA
- **Greg Long**, Department of Environment and Resource Management, Qld.
- **Mark Randall**, Department of Environment and Resource Management, Qld.
- **Jeffery Chamberlain**, Department of Primary Industries, Parks, Water and Environment, Tas.
- **Martin Read**, Department of Primary Industries, Parks, Water and Environment, Tas.

STAKEHOLDER CONSULTATION

- **Brett Miller**, Department of Sustainability and Environment, Vic.
- **Damian Skinner**, Kisters
- **Peter Heweston**, Kisters
- **Ed Couriel**, Manly Hydraulics Laboratory
- **Paul Rasmussen**, Melbourne Water
- **Lex Cogle**, Murray–Darling Basin Authority
- **Alex McMillan**, Natural Resources Commission
- **Daniel Wagenaar**, Department of Natural Resources, Environment, the Arts and Sport, NT
- **Simon Cruickshank**, Department of Natural Resources, Environment, the Arts and Sport, NT
- **Tony Bernardi**, Department of Primary Industries, NSW
- **Grant Robinson**, Office of Water, NSW
- **John Hockaday**, Office of Spatial Policy
- **John Weaver**, Office of Spatial Policy
- **Mic Clayton**, Snowy Hydro
- **Tony Polcheb**, Sydney Water
- **Gavin Sigley**, uniDap Solutions
- **Brad Fuller**, Water Corporation, WA
- **Tino Galati**, Water Corporation, WA
- **Stewart Chapman**, Environment and Sustainable Development Directorate, ACT
- **Andrew Terracini**, Bureau of Meteorology
- **Andrew Woolf**, Bureau of Meteorology
- **Ben Rashid**, Bureau of Meteorology
- **Bruce Bannerman**, Bureau of Meteorology
- **Eliane Prideaux**, Bureau of Meteorology
- **Jane Warne**, Bureau of Meteorology
- **Kate Roberts**, Bureau of Meteorology
- **Kema Ranatunga**, Bureau of Meteorology
- **Linton Johnston**, Bureau of Meteorology

- **Luigi Incani**, Bureau of Meteorology
- **Paul Sheahan**, Bureau of Meteorology
- **Todd Lovell**, Bureau of Meteorology
- **Tony Boston**, Bureau of Meteorology

Meetings held in 2011:

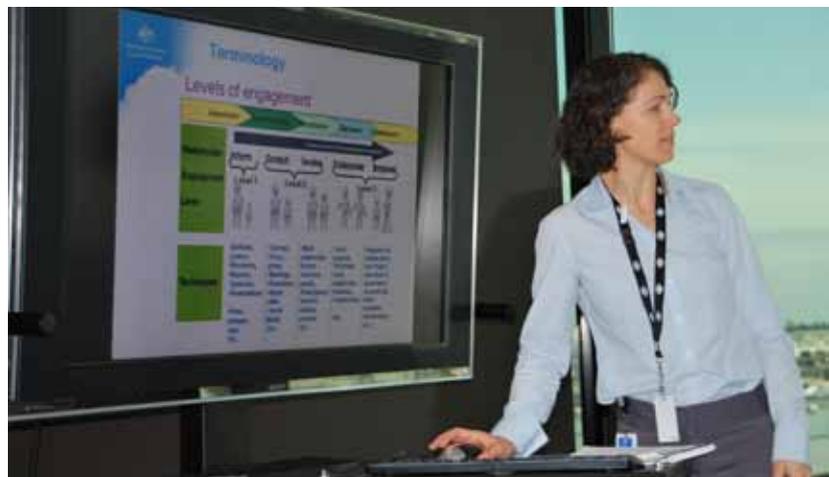
- 24 November 2011

National Groundwater Information System Steering Committee

This National Groundwater Information System (NGIS) Steering Committee provides advice on developing and implementing the national groundwater information initiative. This includes endorsing the NGIS workplan and budget, and periodically evaluating project progress against the workplan. The Committee is supported by a NGIS Technical Committee, which provides technical advice on Phase 2 of the NGIS project

Membership in 2011:

- **Tony Boston** (co-Chair), Bureau of Meteorology
- **Matt Kendall** (co-Chair), National Water Commission
- **Adam Sincok**, National Water Commission
- **Alys Wall**, Bureau of Meteorology
- **Carl Daamen** (alternate: Dovey Dee), Bureau of Meteorology



The Bureau's Liz Boulton conducting stakeholder engagement training for the Climate and Water Information Services Program during 2011.

- **Jane Coram** (alternate: Ross Brodie), Geoscience Australia
- **Peter Baker**, Department of Sustainability, Environment, Water, Population and Communities
- **Glen Walker**, CSIRO
- **Chris McAuley**, Department of Sustainability and Environment, Vic.
- **Barry Croke**, Australian National University
- **Lisa Bambic**, National Water Commission
- **Ross Brodie**, Geoscience Australia

Meetings held in 2011:

- 19 January 2011
- 23 March 2011
- 31 August 2011
- 6 December 2011

National workshops

<i>Activity</i>	<i>Detail</i>
Bayesian Total Error Analysis (BATEA) Theory and Software Workshop	Canberra, 22–23 February 2011
Workshop for AWRA-R Geofabric product requirements	Canberra, 13 May 2011
Bureau Seasonal Streamflow Forecasting presentation	Canberra, 15 June 2011
Experts Meeting on Extended Hydrological Prediction	Melbourne, 7–9 July 2011
Joint Extended Hydrological Prediction, WIRADA and BATEA Project Workshop on seasonal streamflow forecasting	Melbourne, 15 July 2011
Australian High Quality Streamflow Reference Stations for Water Forecasting Services	Canberra, 5 October 2011
Commonwealth Groundwater Workshop	Darwin, 18 October 2011
National Water Information Briefings November (all capital cities)	November–December 2011

Expert panels

The Bureau's expert panels provide advice on technical and user requirements for water information products of national significance.

Geofabric Steering Committee

Members: Tony Boston (Chair), Greg Scott, Michael Hutchinson, David Lemon, Andrew Woolf, Paul Sheahan.

Geofabric Project Management Group

Chaired by Elizabeth McDonald with representatives from the Bureau and Geofabric partner organisations (Geoscience Australia, CSIRO and the Australian National University).

Australian Water Data Transfer Format

Members: Jonathan Doig, Paul Sheahan, John Argus (for John Patten), Craig Walker, Ken Aitken, Peter Martin, Peter Heweston, Tony Boston, Ross James, David Lemon, Gavin Walker.

Communication

Newsletters

We produced ten issues of our monthly internal water information newsletter, *Climate and Water Update*. In addition to Bureau staff, over 300 key external stakeholders requested to receive this newsletter.

We distributed water information updates through four issues of our external newsletter, *enGauge*. This electronic newsletter provides 2,300 subscribers with product updates and special announcements.

Website

We maintain an active water information website at www.bom.gov.au/water. During 2011, the site was visited by over 165,000 unique visitors, resulting in close to 1.5 million page views.

Videowall

The new (6 m x 2 m) video wall in the Bureau's Canberra office wall expanded our ability to effectively communicate water information. It was used for many workshops and public events requiring high-end data visualisation in 2011. The events included the monthly National Climate and Water Briefings and the launches of the one-second Digital Elevation Model, the National Water Account 2010, and the Australian Water Resources Assessment 2010.

National Water Information Briefings: products in practice

Building on the successful National Water Information Seminar Series in 2009, National Water Information Briefings were held in all Australian capital cities during November and December 2011. These briefings demonstrated the practical value and use of water information for people in water resources policy, planning and management.

We presented information about:

- global and national trends in water resources and their impacts
- advances in sharing, standardising and archiving Australia's water data
- innovative geospatial water data and modelling tools
- Australia's first National Water Account
- the Bureau's first Australian Water Resources Assessment
- new developments in water forecasting technology and applications.

Practical workshops formed part of each briefing, demonstrating the application of the Geofabric, National Water Account and Seasonal Streamflow Forecasts to industry users.



Left: Bureau of Meteorology presenters at the National Water Information Briefing in Melbourne.

Right: Geofabric Project Manager Elizabeth McDonald and Geospatial Coordinator Matthew Brooks share their knowledge with spatial@gov conference participants.

“The quality of the briefing was such that I would have no hesitation in attending future Bureau of Meteorology briefings, workshops or presentations. The professionalism and honesty of all who represented the Bureau on the day were outstanding.”

NATIONAL WATER INFORMATION BRIEFING PARTICIPANT

More than 1,000 people participated in these briefings, as detailed below.

Melbourne	8 November 2011	160
Brisbane	10 November 2011	150
Darwin	15 November 2011	44
Sydney	23 November 2011	145
Hobart	24 November 2011	79
Adelaide	30 November 2011	170
Perth	1 December 2011	112
Canberra	6 December 2011	145

Official product launches

In 2011, we conducted three official launches of new water information products and services.

- The National Water Account was launched by the Hon. Don Farrell, Parliamentary Secretary for Sustainability and Urban Water at the Bureau’s Canberra Office on 3 November 2011.
- Version 2.0 of the Australian Hydrological Geospatial Fabric was launched at the spatial@gov Conference in Canberra on 15 November 2011. The launch was attended by over 100 spatial technology experts from government and the private sector.

- The Australian Water Resources Assessment 2010 was launched in Canberra on 15 December 2011.

We also worked with CSIRO and Geoscience Australia to launch the one-second (or 30 metre resolution) hydrologically enforced digital elevation model in Canberra on 11 November 2011

Conference participation

Sponsorship of, and active participation in, major national water conferences is an effective way for us to communicate our progress in delivering the *Improving Water Information Program*. Significant events we participated in are listed below. At most of these we submitted technical papers, staffed trade stands, and provided financial support via event sponsorship.

- Greenhouse 2011: The Science of Climate Change, 4–8 April 2011, Cairns
- Australian Bureau of Agricultural and Resource Economics and Sciences Outlook 2011, 1–2 March 2011, Canberra
- International Union of Geodesy and Geophysicists, Earth on the Edge: Science for a Sustainable Planet, 28 June–7 July 2011, Melbourne.
- spatial@gov Conference, 15–17 November 2011, Canberra
- International Congress on Modelling and Simulation, 12–16 December 2011, Perth.



Water Accounting Manager, Dr Grace Mitchell, provides an overview of the National Water Account 2010 at its launch in November 2011.

Notes



Australian Government
Bureau of Meteorology

www.bom.gov.au/water



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