

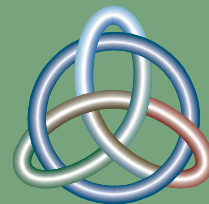
# The Water Map of Melbourne

FINAL REPORT  
To



Smart Water Fund

From



**EARTH SYSTEMS**

*Environment – Water – Sustainability*

**December 2004**



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## 1 Executive Summary

Earth Systems received Smart Water Round 2 Funding on May 12<sup>th</sup> 2004 to produce *The Water Map of Melbourne*- poster (130 cm x 90 cm) and CD ROM. The project was completed during a 7 month period from May 24<sup>th</sup> to December 10<sup>th</sup> 2004. Additional financial support for the project was provided by [EPA Victoria](#) and the [City of Melbourne](#). Earth Systems are satisfied that all components of this Smart Water funded project have been completed to the highest standard with no major hindrances to the project's timeline. All funds have been expensed.

*The Water Map of Melbourne* was officially launched on October 22<sup>nd</sup> 2004 during National Water Week. Chris Lee, Manager of Smart Water Fund, launched the map with Richard Seddon, Chairman Earth Systems and Nigel Murphy, Earth Systems Director also speaking at the launch. As part of the communications and distribution component of the project, Earth Systems distributed 3000 free posters and CD ROMs across Melbourne, including 2 each to all metropolitan Melbourne schools (Primary and Secondary). The feedback on the project has been positive, including good media coverage around the launch of the map.

A key objective of this project was to combine all vital and accessible data about water use, issues and sustainable practices across Melbourne onto one resource that all members of the Melbourne community can identify with and understand. As with previous Earth Systems maps, it was identified that there was a real need for presenting the wide range of multi sectoral data and information about water use and conservation on one resource in a way that engages young people and the general community. It is always a challenge to combine this complex array of data sources, as information is available from so many different stakeholders.

*The Water Map of Melbourne* comprises both a spatial (map layers) and a non-spatial (charts and tables) component and aims to increase awareness and knowledge of the issues, achievements and impacts associated with water use across Greater Melbourne. The CD ROM also includes photos, which are linked to specific spatial data points.

*The Water Map of Melbourne* is a resource for all those with an interest in Melbourne's use of water and the life cycle of water in a city - including professionals needing a ready reference for key water trends, statistics and noteworthy events, and students wanting information about major issues facing Melbourne's future water resource management and use.



Maps for the guests at the launch of *The Water Map of Melbourne* - photo taken Rod Campbell

## 2 Rationale for *The Water Map of Melbourne*

With climate change predicted to add pressure to Melbourne's water supply, and population continuing to increase, Melbourne is facing some serious water challenges, including ensuring a secure supply of water and protecting our natural assets, such as Melbourne's creeks and rivers and Port Phillip Bay. We need to look at our water consumption and recycling levels if we wish Victoria to have a sustainable water future.

Have you ever wondered where Melbourne's water comes from? Or how much water Melbourne uses or recycles? Did you know that rainfall across Melbourne varies from less than 500 mm/year in the west, to over 1400 mm/year in the east? Why is this the case, and how has it affected the development of Australia's second largest city?

These challenges (and questions), and some solutions to the issues, were tackled by Earth Systems as part of a Smart Water Fund Round 2 project *The Water Map of Melbourne* (poster map and CD ROM) for release during National Water Week 2004.

*The Water Map of Melbourne* project draws important water-related information from a wide range of resources, including books, reports, websites and water industry publications, into a single, easy-to-use resource. Both the map and the CD ROM present this information as spatial points on a map of Greater Melbourne, in addition to charts and tables, covering major water related topics. A multidisciplinary Technical Review Committee independently reviewed the data presented within this project, to ensure the project provides a balanced, factual and interesting view of Melbourne's water resources, identifying areas of achievement and concern, as well as new developments and recycling schemes within the greater Melbourne region.

The CD ROM and poster are designed to be visually appealing and fun resources, yet at the same time, they are packed with essential information and statistics relating to Melbourne's water resources. The unique format and compilation of data on two complementary media allows the user to determine the amount of information they extract from the map, ranging from something as simple as the location of the first attempt at European settlement in Port Phillip Bay, to Melbourne's complex water supply and treatment systems and the issues that the city faces in ensuring a secure and environmentally sustainable future supply of water into the future.

Both resources are important educational tools for students, and anyone with an interest in water or environment issues.

### 2.1 Project Objectives

*The Water Map of Melbourne* was designed to:

- Bring together Melbourne's water-related data from a wide selection of areas, ranging from natural water resources and aquatic biodiversity to water use, storage and treatment;
- Achieve an increased awareness and knowledge of Melbourne's water resources and the issues that surround water use, reuse and quality; and
- Facilitate assessment of change.

### 2.2 Project Team

*The Water Map of Melbourne* project team members were highly skilled, most of whom had worked on previous Earth Systems' environmental maps. Nigel Murphy, Catherine Oke, Georgia Garrard and Colin Pike all worked on the successful *The Australian Water Map* in the same roles as they were appointed for this project. Jenny Ha joined the team to coordinate the CD ROM component of the project, and Natasha Jerrard created the Flash animation for the CD ROM and provided input into the graphic design for the CD Rom and poster map.

## Team Members and Project Roles:

Mr Nigel Murphy - Project Director  
 Dr Catherine Oke – Project Manager / Technical Review Committee  
 Ms Georgia Garrard – Research and Steering Committee Coordinator  
 Ms Jenny Ha – CD ROM technical and artwork Coordinator  
 Mr Colin Pike – Cartographic Design and Development  
 Ms Natasha Jerrard – Graphic Design, CD Art Work

### 3 Approach

Earth Systems has created many successful maps displaying a wealth of natural resources and environmental data and information. Through a careful process of data review, collection, preparation and validation, Earth Systems ensures that all information depicted on our maps is from credible sources, and is technically accurate, representative and non-biased. We also ensure that the maps are presented in a manner which allows for the inclusion of the maximum amount of data, without compromising the visual appeal. The same approach was used for *The Water Map of Melbourne*. Details for each activity are indicated below.

#### ◆ Initial Data Review

Review of data already owned by Earth Systems, including sourcing information from *The Australian Water Map* and the *Environment Map of Australia*. Identify gaps in knowledge, and sources for further information and data.

#### ◆ Data Collection

Collect further information required from water authorities, websites, journals, reports and newsletters.

#### ◆ Data Review and Validation

Determine from total data collected, which information is to be used, ensuring it is credible, representative, technically accurate, non-biased, and not a prediction. This process involved input from the Technical Steering Committee and other relevant data providers - see below.

#### ◆ Technical Steering Committee

A Technical Steering Committee (Table 1) was established to review the map and to provide independent multidisciplinary advice. The Committee was comprised of a group of experts in fields relating to all aspects of water in Melbourne.

**Table 1 Technical Steering Committee**

Name	Organisation / Specialist areas
Dr Peter Fisher	Water consultant
Peter Donlon	Water Services Association of Australia
Graham Rooney	Melbourne Water
Jim Elliott	Commonwealth Bureau of Meteorology
Sheridan Blunt	City of Melbourne
Associate Professor Ian Rutherford	University of Melbourne
Dr Catherine Oke	Earth Systems
Dr Jeff Taylor	Earth Systems
Nigel Murphy	Earth Systems
Lance Lloyd Director	Lloyd Environmental Pty Ltd
Monique Sweetland	Research Consultant
Jane Ryan	DSE Water Sector Group

The Steering Committee members were contacted at a number of stages during the development of the project to ensure that the data presented on the map and CD ROM was balanced and representative of

the state of Melbourne's water resources. They were also involved in final reviews of the initial and final draft maps.

#### ◆ **Data Providers**

Data review involved communicating and meeting with representatives of The Department of Sustainability and Environment (DSE), all water authorities and retailers and relevant local government offices to discuss the project, data to be included and any gaps identified relevant to the data provider. Whilst most of the presented data was easy to obtain, Earth Systems enlisted the help of various data providers, in particular DSE, Water businesses and the EPA to obtain non-published data, such as spatial layers in GIS format. All input and copyright is acknowledged on the map.

#### ◆ **Data preparation**

Transformation of data to appropriate spatial and non-spatial formats as per the lists indicated under Map Development below. All data files were created in Microsoft Excel for transfer to software for either CD ROM or poster Map creation.

#### ◆ **Map design**

Earth Systems created a visually appealing poster map with a map of Melbourne in the centre of the poster, surrounded by charts and tables; and CD ROM with a series of interactive layers and charts accessed from an easy to navigate homepage. Spatial information in the form of text boxes overlaid the map of Melbourne, with the use of symbols to identify which water category is being discussed – see Map Production below.

#### ◆ **Map development / Cartography**

Data presented on the map takes the following forms:

- ◆ Points, areas and lines on a map of Greater Melbourne;
- ◆ Bar and line graphs;
- ◆ Pie charts;
- ◆ Tables; and
- ◆ Mini maps of Melbourne

All spatial layers created for the poster map, were transferred as individual layers for use on the individual screens on the CD ROM. All charts and tables were transferred as individual images for use on the CD ROM. Spatial layers and charts and tables are created initially in Microsoft Excel for transfer to either Map Info / Corel Draw for the poster map, or to Fireworks / Photoshop for the CD ROM development.

#### ◆ **Map and CD ROM production**

3 full drafts of the map (poster and CD ROM) were created for review by Earth Systems, the independent Technical Steering Committee and other data providers. The A0 (130 x 90 cm) poster maps were printed on recycled content Monza gloss paper. The CD ROM is packaged in a cardboard wallet.

#### ◆ **Communications and Distribution**

The communications component of the project included a launch during National Water Week, distribution of maps and CD ROMs to 3000 recipients, media release and follow up with articles placed and sponsorship / involvement in various water related activities.

## 4 Content and Design

The extensive data review, validation and presentation process led to the creation of a unique product. This section details the final components of *The Water Map of Melbourne*.

### 4.1 Content

The final map and CD ROM are made up of 58 newly created spatial layers (maps) and 54 newly created charts and tables (see Table 2), using key data sources (see Reference Section) and Earth Systems' data library. Additional charts (10), and images from the State Library of Victoria and Earth Systems also feature on the CD ROM. The interactivity of the CD ROM allows maps, charts and images to be linked.

All spatial layers presented on the poster are presented on one map of Greater Melbourne. The development of the base map used digital data received from the DSE. The base map covers 'Greater Melbourne', including Whittlesea to the North and Mornington Peninsula to the south, and Geelong in the West and Pakenham in the East, at a scale of 1:150,000.

**Table 2 Maps and Charts Displayed on The Water Map of Melbourne.**

- Note: if there is a double up of a chart name it means it is displayed in two different sections on the CD ROM; those in red are shown only on the CD ROM.

Category 1 RAINFALL, RUNOFF & STORMWATER	
MAPS	CHARTS
Average Monthly Rainfall	Australia's Average Annual Areal Actual Evapotranspiration
Extreme Water Events	Australia's Average Annual Rainfall
Stormwater and Runoff	Average Annual Rainfall - Melbourne and Environs
	Breakdown of World's Freshwater
	Changes to River Flow in the Melbourne Region
	Litter on Port Phillip Bay Beaches by Number
	Melbourne Annual Rainfall since 1856
	Melbourne's Water Cycle
	Rivers in the Melbourne Region
	Theoretical Streamflow by River Basin
	Water Balance of the Continents
Category 2 WATER SUPPLY	
MAPS	CHARTS
Major Irrigation Districts	Melbourne's Water Storage 1990 - 2004
Major Water Supply Achievements	Melbourne's Mains Water Losses
Melbourne's Groundwater Resources	Melbourne's Water Supply Infrastructure - Key Statistics
Notable Water Supply Events	Melbourne's Water Storages by Capacity
Reservoirs	Melbourne's Water Supply Landmarks
Retail Water Company Boundaries	Schematic Representation of the Thomson Reservoir
Rivers and Catchments	Sources of Melbourne's Mains Water
Water Diversions	Victorian Water Sector Administrative Framework
Water Supply History	Water Storage per Capita
Water Supply Infrastructure	
Water Supply Landmarks	

Water Supply Mains/Aqueducts	
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**Category 3 WATER QUALITY**

MAPS	CHARTS
Major Water Quality Achievements	Downstream Variation in Yarra River Water Quality
Major Water Quality Impacts	Drinking Water Quality
Notable Water Quality Events	Groundwater Quality and Use
Water Quality	Major Sources of Nutrients to Port Phillip Bay
Water Quality History	Melbourne's Water Quality Landmarks
Yarra River Catchment Boundary	Metal Loads to Port Phillip Bay
	Nitrogen and Phosphorous in the Bay

**Category 4 STREAM & RIVER HEALTH**

MAPS	CHARTS
Aquatic Biodiversity	Condition of Melbourne's Waterways
Change in Wetland Extent 1788 - 1994	Downstream Variation in Yarra River Water Quality
Community Initiatives	<a href="#">Environmental Status of Australian River Basins</a>
Introduced Species	Extent of Remnant Wetlands in Victoria
Major Water Achievements	Health of Melbourne's Creeks and Rivers
Major Water Impacts	Yarra River Flow Rate at Warrandyte 1882 - 1991
Notable Water Events	
Ramsar and Nationally Significant Wetlands	
Rivers and Catchments	
Threatened Species	
Water History	

**Category 5 WATER USE**

MAPS	CHARTS
Major Irrigation Districts	Distribution of Groundwater Bores
Major Water Use Achievements	Early Water History in Central Melbourne
Major Water Use Impacts	Melbourne's Annual Mains Water Consumption 1891 - 2003
Melbourne's Groundwater Resources	Melbourne's Agricultural and Horticultural Water Use
Notable Water Use Events	National Water Use by Manufacturing Industries
Reservoirs	Residential Water Consumption in Australian Cities
Retail Water Company Boundaries	Victoria's Water Use
Rivers and Catchments	Water Supplied by Melbourne's Water Businesses
Water Saving and Recycling	Water Use in Greater Melbourne
Water Use History	Water Use in Melbourne Households
Water Use Landmarks	Water Use per Dwelling - Selected Municipalities

**Category 6 WASTEWATER**

MAPS	CHARTS
Major Wastewater Achievements	Australia's Largest Wastewater Treatment Plants
Major Wastewater Impacts	Level of Water Treatment in Australian Capital Cities



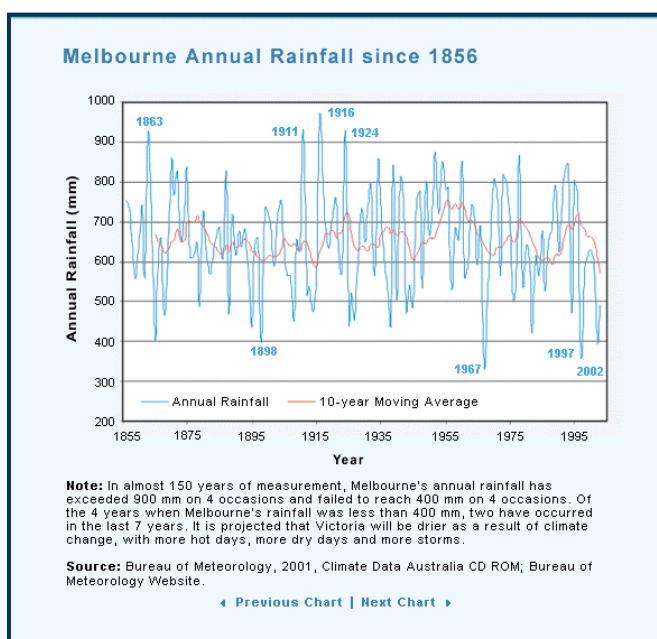
Notable Wastewater Events	Melbourne's Wastewater Infrastructure - Key Statistics
Retail Water Company Boundaries	The Development of Melbourne's Sewerage System
Sewerage Mains	Treatment Plants - Inputs and Discharges
Wastewater History	Wastewater Collected - Greater Melbourne 98/99 to 02/03
Wastewater Infrastructure	
Wastewater Landmarks	
Wastewater Treatment Plants	
Water Reuse and Wastewater Recycling	

**Category 7 REUSE & RECYCLING**

MAPS	CHARTS
Major Water Reuse and Recycling Achievements	Melbourne's Biosolid Reuse
Water Reuse and Recycling	Percentage of Water Recycled by City Water Businesses
Water Treatment Plants	Percentage of Water Recycled by Melbourne Metropolitan Water Businesses
	Water Reuse by Melbourne's Sewage Treatment Plants

**Category 8 TRENDS & FUTURE DIRECTIONS**

MAPS	CHARTS
Major Water Achievements	Household Water Saving Practices
Notable Water Events	Household Water Use and Water Saving Appliances
Water History	Melbourne Annual Rainfall since 1856
Water Saving and Recycling	Melbourne's Annual Mains Water Consumption 1891 - 2003
	Melbourne's Water Storage 1990 - 2004
	Per Capita Changes in Water Use 1970 - 2000
	Price of Commonly Purchased Liquids
	Proposed 2050 WaterSmart Strategy for Melbourne
	Urban Domestic Water Prices



Example of a chart on *The Water Map of Melbourne* CD ROM

## 4.2 Map Design

The design of the map followed the layout of previous Earth Systems maps – *The Australian Water Map* (2003), *The World Environment Map* (2002) and *The Environment Map of Australia* (2000) – see [www.earthsystems.com.au/map](http://www.earthsystems.com.au/map)

The colours of the contours of the base map were chosen in accordance with classic topographic maps – using a blend from green (lowest) through yellows to browns (highest).

Chart colours were selected to match those of the contours and the colours of the logos, in particular the blues and greens of the Smart Water Fund logo.



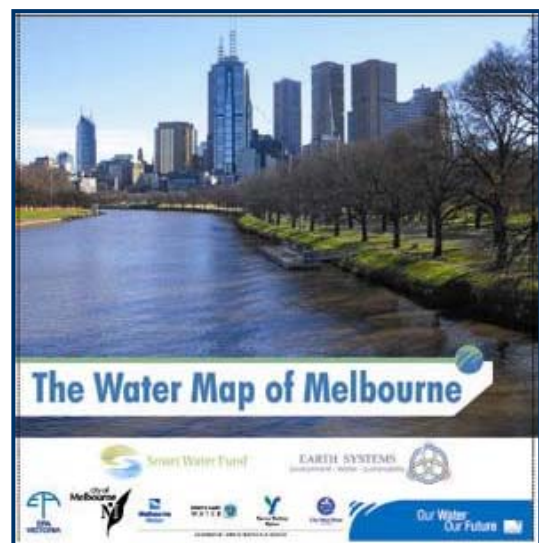
Image of the poster (130 x 90 cm) version of *The Water Map of Melbourne*.

### 4.3 CD ROM Design

The CD ROM design follows a web based look with a home page (initial screen), with links to the charts and interactive maps under each category.



Initial Screen – *The Water Map of Melbourne* CD ROM



Cover and disk art for *The Water Map of Melbourne* CD ROM.

#### 4.4 Communications

The official communications component of this project revolved around the launch of the map during National Water Week, on October 22<sup>nd</sup> and subsequent media activities. Chris Lee, Manager of Smart Water Fund, launched the map at the 60L Green Building in Carlton – chosen for its central location and its inclusion on the map as a major water saver. Richard Seddon, Chairman Earth Systems and Nigel Murphy, Earth Systems Director also spoke at the launch.

A total of 250 people were sent an invite to the launch, including all water authorities and organisations from Melbourne and Victoria. 65 people accepted the invitation, 50 replied that they could not attend and approximately 60 attended.

A media release was written and sent to all general and water/environment related media. We received front page coverage on the *The Age* Friday 22<sup>nd</sup> October and a mention in *The Age* Editorial Saturday 23<sup>rd</sup> October. The Australian Water Association also featured the launch in their weekly news bulletin.

Additional coverage includes an article in the Irrigation Association of Australia Newsletter <http://www.irrigation.org.au/backwash/nov04.html>, mention and giveaways on Triple R Radio and The Smart Water Fund Newsletter. Articles were written for potential inclusion in The Herald Sun (arranged by Fenton and DSE). The December edition of River Basin News will also feature an article. Many water related publications have unfortunately declined to cover the launch of this map as it is Melbourne focused and their publications have Australia wide coverage. The Earth Systems website has a page dedicated to *The Water Map of Melbourne*, with links to all sponsors – [www.earthsystems.com.au/map](http://www.earthsystems.com.au/map)

During the Month of November Earth Systems also had a display at the Museum of the map and CD ROM, with map giveaways.



Chris Lee, Manager Smart Water Fund, Launching *The Water Map of Melbourne*

Chris Lee, Manager Smart Water Fund, Nigel Murphy, Director Earth Systems and Richard Seddon, Chairman Earth Systems.

#### 4.5 Map and CD ROM Distribution

Earth Systems distributed 3000 free maps and CD ROMs across Melbourne. 2602 maps were sent out to primary and secondary school principals with the assistance of The Department of Education and Training. The map tube contained a letter to the school principal from Smart Water, including a note of recommendation from the Geography Teachers Association. 2860 CDs were sent out to schools and water educators with the assistance of Melbourne Water, to all relevant teachers and principals.

The remaining 140 CD ROMs and 400 maps were distributed to sponsors, key water events (Melbourne Museum during the month of November, National Water Week, the map launch), the CERES Sustainable Schools Program, the Victorian Geography Teachers Association, councils, libraries and other water related organisations.

#### 5 Conclusions

*The Water Map of Melbourne* is a great educational resource, with the formats complementing each other well. The poster map allows for all layers to be seen at the one time, giving users a real spatial appreciation of water resources, management and issues in the city of Melbourne. The CD ROM then allows users to spend more time viewing each individual layer, to gain a more in-depth knowledge of each specific topic. The CD ROM also allows users to be able to view the charts and tables as full screens, individually, again allowing more time to take in the information presented.

At the beginning of this project, Earth Systems set out to create a map which brought together Melbourne water-related data from a wide selection of areas, ranging from natural water resources and aquatic biodiversity to water use, storage and treatment. In doing so, the hope was to achieve an increased awareness and knowledge of Melbourne's water resources and the issues that surround water use, reuse and quality; and for this in turn to facilitate assessment of change. With time, *The Water Map of Melbourne* should achieve these aims, as all schools in Melbourne now have this valuable tool in their classrooms, and many people in the greater community have access to the map via a library, their local council or through water retailers and Earth Systems.

#### 6 Future Plans

In the future if funds were available Earth Systems would like to be update the information found on *The Water Map of Melbourne* on a regular basis.

In addition, there is a National Archives of Australia touring exhibition titled "Just Add Water - Schemes and Dreams of a Sunburned Country" which will feature an interactive *The Australian Water Map* which Earth Systems is creating. Ideally when this is exhibited in Melbourne *The Water Map of Melbourne* interactive CD ROM can also feature as way of comparison (or more specific information). Earth Systems will communicate with the Melbourne Museum to discuss any collaboration on this project.

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Listed below is an indicative list of references used to create *The Water Map of Melbourne*.

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CERES, [www.ceres.org.au](http://www.ceres.org.au)

City of Melbourne, [www.melbourne.vic.gov.au](http://www.melbourne.vic.gov.au)

City West Water Limited, [www.citywestwater.com.au](http://www.citywestwater.com.au)

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