Integrated Water Management Strategy

2014–2024

Towards a more water sensitive Boroondara

BOROONDARA
City of Harmony

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Cover image:
Residents enjoying Koonung Creek Reserve wetland, Balwyn

Executive Summary

The aim of this Integrated Water Management Strategy (IWMS) is to set the strategic direction and implementation approach for improving water cycle management across the municipality over the next decade. It builds on Council's achievements over the past decade to save water, improve stormwater quality and protect the health of our waterways.

The strategy draws on contemporary theory and practice in integrated water management, and contributes to the shared ambition for greater Melbourne to become a 'water sensitive city' over time. It considers Boroondara's unique urban context together with the risks posed by climate change, and focuses on the role Council can play in effectively managing water resources for the ongoing liveability, amenity and resilience of our built and natural environments. **Working in partnership with the water sector and our community will be critical to Boroondara becoming more water sensitive**.

The strategy was drafted with input from a cross-departmental working group, together with technical input from expert consultants DesignFlow. DesignFlow were commissioned to prepare a water balance, identify a suite of potential stormwater treatment and/or harvesting projects, provide advice on appropriate targets, and make recommendations relating to strategy implementation.

In an already urbanised municipality like Boroondara, **being more 'water sensitive' means that we (being Council, residents and community organisations, businesses and developers) better understand and value water as a finite and vulnerable resource that is critical to our way of life**, and that this is reflected in water sensitive *behaviours*. These behaviours should, ideally, be supported and reinforced through investing in **'adaptive, multi-functional water sensitive infrastructure and urban design' incorporated into new and existing buildings, landscaping, streetscapes and open spaces.**

Koonung Creek Reserve wetland

The **potential benefits** of making this transition include:

- **Water security for greener neighbourhoods, enabling optimum health of canopy trees and other vegetation, even in drier times**
- **Cleaner, less polluted waterways, supporting biodiversity**
- **Improving liveability and amenity**
- **A city more adapted and resilient to heatwaves and other weather extremes**

The Strategy's vision is for **"...a healthy, green and resilient city... where a diversity of water sources is available so that the right quality of water is available when and where it is required... contributing to healthier waterways and open spaces for greater community well-being."**

A set of **six guiding principles** have also informed the IWMS's broader objectives and key strategies, being:

- **Valuing water**
- **Leadership by Council within the community**
- **Balance competing objectives and pursue multiple benefits**
- **Partnership approach**
- **Action prioritised by impact**
- **Consider the impacts of climate change**

[1] Brown, et al (2008) Transitioning to Water Sensitive Cities: Ensuring Resilience through a new Hydro-Social Contract. Proc. 11th International Conference on Urban Drainage, Edinburgh, Scotland, UK

The IWMS identifies **four overarching objectives** with **associated targets**.

Objectives	By 2024
Minimise use of drinking water	**Council target:** 20% reduction in use of drinking water by 2024 compared to 2011/12 levels **Community aspiration:** Resident use of drinking water down to 153 litres per person per day
Increase local water harvesting and 'fit-for-purpose' reuse	**Council target:** Harvest 30ML per year of stormwater for irrigation of public open space **Community aspiration:** 30% of single dwellings have a rainwater tank installed by 2024 Half of these households have their rainwater tank connected to internal uses such as toilet and laundry
Remove pollutants contaminating our stormwater before it enters our waterways and Port Phillip Bay	**Council target:** Remove pollutants flowing from our municipality to waterways: • 182 tonnes of Total Suspended Solids (TSS) removed per year • 370 kg of Total Phosphorous (TP) removed per year • 3,000 kg of Total Nitrogen (TN) removed per year
Support local flood management activities in a way that better protects properties from flooding while also protecting the environment, amenity and function of Council assets.	No specific target has been set for the flood management objective as there is currently no quantifiable progress indicator relating to Council's flood management activities. Progress will be monitored via implementation of the key strategies and a target may be set in future if a suitable indicator is established.

Fifteen inter-related strategies have been proposed that will contribute to achieving these objectives.
The strategies can be broadly categorised into:

- **Integration of water sensitive urban design (WSUD) and water efficient practices into Council facilities.**
- **Partner with key stakeholders to implement strategically prioritised WSUD infrastructure projects, such as large scale raingardens and wetlands that deliver multiple social and environmental benefits.**
- **Promoting inclusion of WSUD in the planning and construction of buildings and new precincts on private land across Boroondara.**
- **Engaging with the community around adopting water sensitive behaviours and solutions.**
- **Better managing and mitigating local flood risk through mapping and upgrade and renewal works.**

Implementation planning and progressive project delivery (subject to project feasibility and annual budget approval / co-funding) will be undertaken over a medium-term (two to four years) time horizon. Annual monitoring of performance will be undertaken to track progress towards meeting objectives and targets.

Permeable surfaces enable water to flow into the soil and eventually the groundwater

1. Introduction

Water is vital for life. It is critical to our hydration and the hygiene of our bodies, buildings and streets. It sustains our parks, gardens, waterways and wildlife. It is a vital input for the food we eat and the goods and services we rely on.

Over the past decade the water sector has evolved to recognise that — beyond the essential services of water supply, wastewater removal and flood and drainage management — water is integral to the liveability and long term sustainability of our cities. To ensure these outcomes, water must be managed in a more integrated way — for both ongoing water security *and* environmental health, at a lower cost over the long term.

There has been a shift in thinking around the role local governments can play, with greater expectation on local government to plan and manage water resources more holistically. Water management is an important component in the delivery of many of Council's core services, including: park and sports field maintenance; flood mitigation and drainage works; operation of community leisure centres; land use planning, and permit approvals. Council's influence in the community also makes it well placed to promote sustainable water management.

Few cities have become truly 'water sensitive'. Our current focus, like many cities, is to move beyond where we are now - a 'waterways city' - to a water-cycle city initially, and ultimately a 'water sensitive city', as illustrated in Figure 1.

For the Boroondara community to continue to enjoy a high quality urban and natural environment – in the context of a changing climate and growing population – we need to partner with water sector stakeholders and our community to adopt more water sensitive behaviours and infrastructure. Managing water in an integrated and sustainable way will be key to maintaining Boroondara's liveability over the long-term.

This Integrated Water Management Strategy (IWMS) sets out Council's vision for a water sensitive Boroondara, recognising that all aspects of the water cycle are linked and need to be considered together in order to set targets for improvement and developing actions to achieve these targets. The IWMS replaces the previous Water Strategy (2004) and Stormwater Environmental Management Plan (2003).

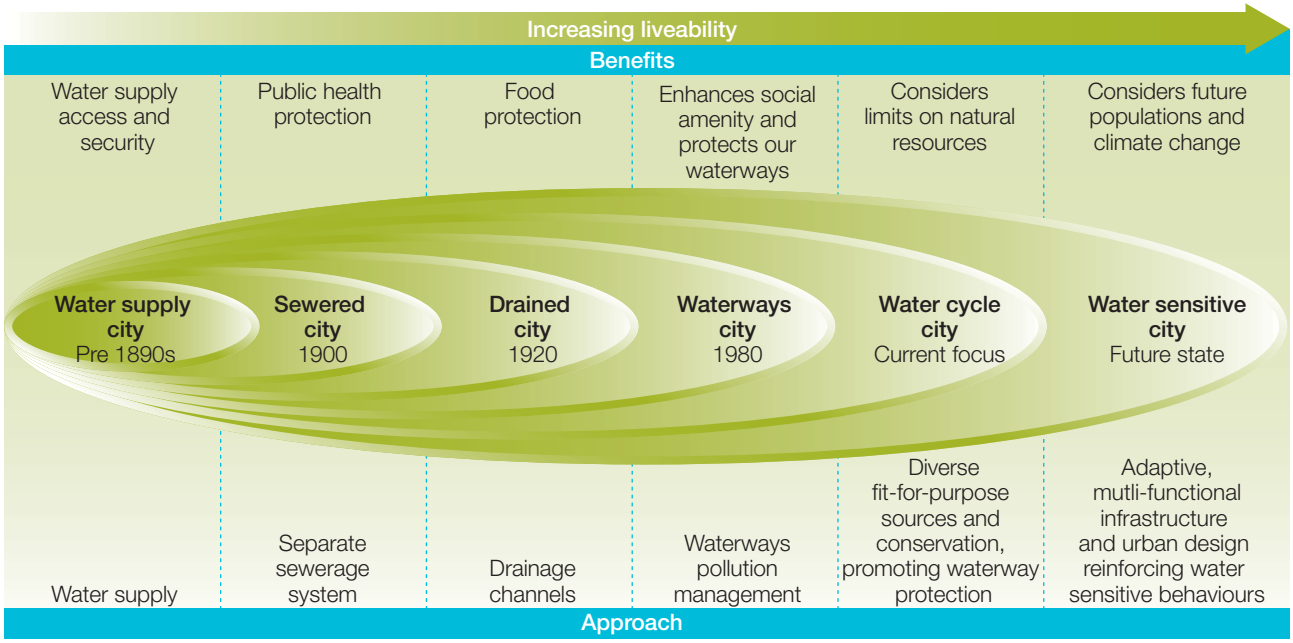


Figure 1 Transitions in urban water management
(Courtesy of City of Melbourne, adapted from R Brown et al)

2. What is meant by becoming 'water sensitive' in Boroondara?

In an already urbanised municipality like Boroondara, what does being more 'water-sensitive' mean? What shared understanding is required between community members, local businesses and local government? And what are some of the key practical actions that we (as a community) can prioritise and invest in?

Water sensitive attitudes and values include:

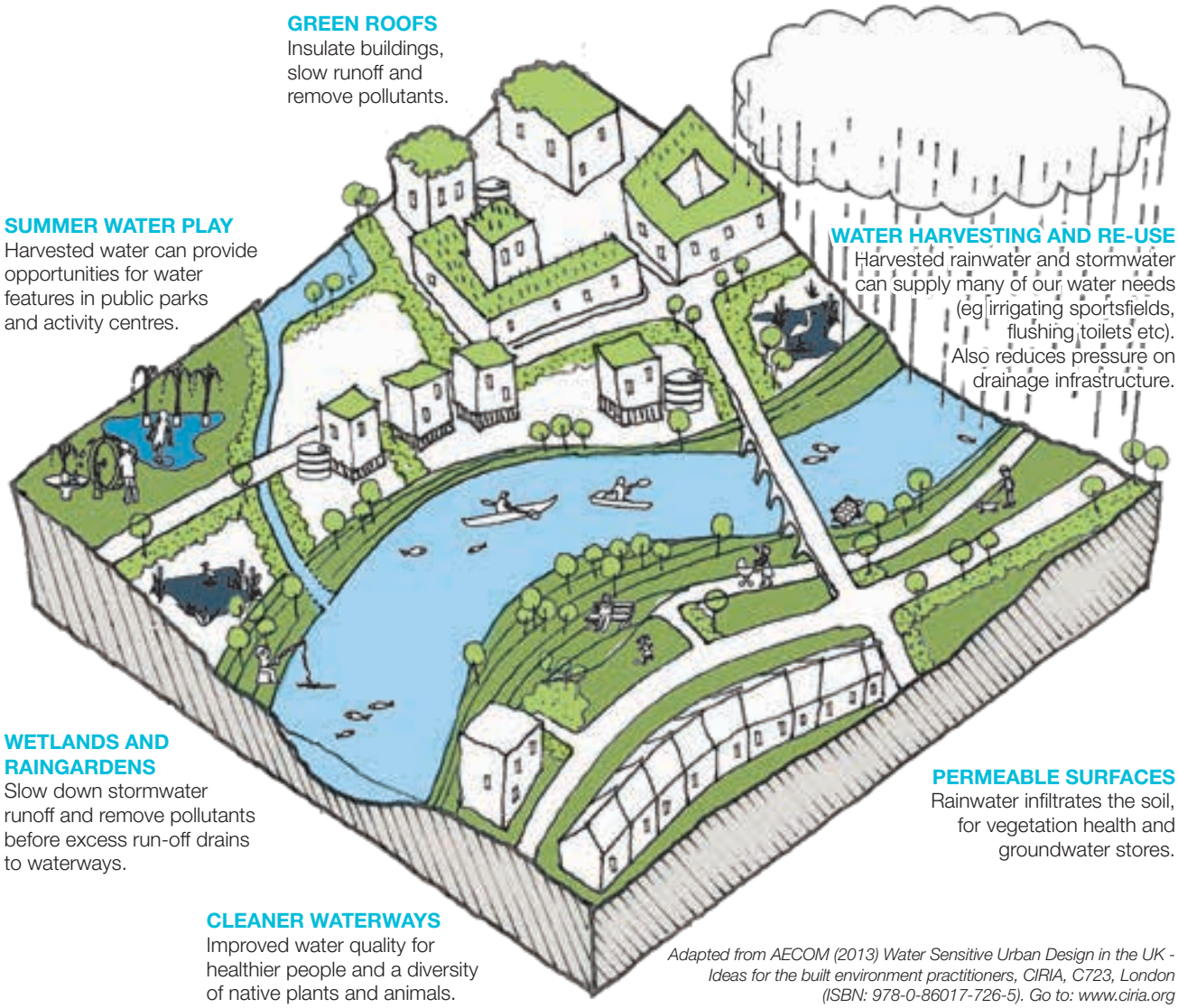
- Understanding that **fresh water is a finite and vulnerable resource**, essential to sustain life, development and the environment.
- Appreciating that our **municipal waterway corridors** - the Yarra River as well as Back, Koonung and Gardiners Creeks - are **valuable community assets** to be celebrated and enjoyed. **They warrant protection from pollution and degradation**.
- Belief that high quality **drinking water should ideally be saved for 'premium' uses**.
- Understanding that by locally harvesting and reusing more rainwater, stormwater and grey water, **we could collectively meet many of our own water needs** (for example, for clothes washing, irrigation and toilet flushing).
- Willingness to comply with water saving rules and/or water restrictions.

Water sensitive buildings and landscaping include use of:

- **Water-efficient fittings** (taps, showerheads and toilets) and whitegoods (washing machines, dishwashers).
- **Rainwater tanks** installed to capture rainwater for household uses including clothes washing, swimming pools and vehicle washing (and, in the absence of a grey water system, also for toilet flushing and gardening). Water tanks that have spare capacity can help mitigate the flood risk during intense rainfall events.
- **Permeable landscaping materials** that allow water to penetrate into the soil (eg mulch, gravel, permeable paving etc) in preference to concrete or other hard paving that directs all rainwater straight into the stormwater drain.
- **Grey water systems** — to capture and, where necessary, treat shower and laundry water — to supply alternative water for toilet flushing and garden irrigation.
- **Raingardens and green roofs** to slow down and filter run-off, which can help reduce pressure on drains and lessen local flood risks.

Water sensitive streets and open spaces incorporate features like:

- **Carefully designed and constructed wetlands and bioretention systems** that act to reduce the volume and velocity of stormwater flows, and remove harmful pollutants, before discharging to our waterways and (ultimately) Port Philip Bay.
- **Reuse of locally harvested stormwater** — that has been filtered through wetlands or raingardens — to establish and maintain vegetation in nearby streets, and public parks, gardens and reserves.
- **Water-efficient irrigation systems** to maintain soil and vegetation health.
- **Use of permeable landscaping and carefully planned streetscapes** that allow water from minor rain events to 'passively irrigate' street trees and other vegetation, rather than runoff into the underground pipes, floodways and waterways.



Adapted from AECOM (2013) Water Sensitive Urban Design in the UK - Ideas for the built environment practitioners, CIRIA, C723, London (ISBN: 978-0-86017-726-5). Go to: www.ciria.org

Figure 2 Characteristics of a water sensitive city

The green roof at Minifie Childcare Centre slows the flow of water running off the roof. It also removes pollutants, attracts native birds and insects and helps keep the building cool in summer

3. Why aim to be a ‘water sensitive city’? What are the benefits?

Together with the efforts of neighbouring municipalities, and in partnership with key stakeholders in the water sector, Boroondara can make an important contribution to Melbourne’s transition towards being a ‘water sensitive city’. There are many potential benefits of making this transition — some are local, some regional, some tangible, and some intangible. Of course, many of these benefits are closely interrelated to one another.

The Glen Iris wetland treats polluted stormwater runoff before it reaches our waterways

Young Boroondara residents investigating Gardiners Creek water quality and wildlife during Council’s ‘Catchment Crawl’

Water security for greener streets, parks, gardens and reserves

- Capacity to maintain well-vegetated parks and gardens (supported by ready access to treated locally harvested stormwater)
- Healthier canopy and street trees, especially during dry times, without relying exclusively on drinking water or recycled water trucked from distant sources.
- Grassed sports fields and ovals remain safe and useable throughout dry weather.

Water sensitive urban design can be incorporated into our local parks and play spaces ©DesignFlow

Cleaner, less polluted waterways

- Removing pollutants and reducing the flow of stormwater during rain events means cleaner and less polluted local creeks and Yarra River.
- Reducing the volume of stormwater helps avoid the emergency release of sewage into waterways during extreme rain events.
- As well as invisible pollutants like nitrogen and phosphorous, there would be less unsightly litter polluting our waterways and Port Philip Bay.

Improved liveability and amenity

- Abundant healthy vegetation (especially trees) improves local air quality by: absorbing air-borne pollutants such as nitrogen oxide and sulphur dioxide; and producing life-giving oxygen. Access to 'fit for purpose' water can help establish and ensure the survival of more shade-giving canopy trees and other vegetation essential to the character of Boroondara's suburbs.
- High-quality open space and natural areas that integrate well-designed and maintained wetlands and/or other water features provide attractive options for recreation, relaxation and connecting with nature.
- Local waterways and vegetated riparian zones provide landscape amenity for residents and visitors (including birds and other wildlife).
- Reduced disruption of community facilities and recreation areas due to flash flooding.

Health and wellbeing benefits

- Access to healthy natural environments can improve the mental health of individuals, reducing stress and anti-social behaviour
- High quality green spaces facilitate social interactions, building community connections and sense of place.
- Cool, green streets and parks encourage people to walk or cycle, rather than driving, increasing their physical activity.

A city more adapted and resilient to heatwaves and other weather extremes in a changing climate

- Canopy trees and other vegetation (including green walls and green roofs) provide shade and keep local streets and buildings cooler during summer heat and heatwaves, possibly reducing heat related stress and mortality.
- Incidence and impact from flash flooding and storm events may be reduced through integrated management of stormwater and landscapes.
- Access to harvested rain and stormwater for irrigation helps keep our ornamental, fruit and vegetable gardens alive during dry weather.

Ecological and biodiversity benefits

- Healthy waterways and wetlands that support a diversity of macro invertebrates, fish and aquatic plants - a complex and delicate ecosystem.
- Over time, constructed wetlands and biofiltration systems, together with associated plantings, provide valuable feeding and nesting sites for water birds and other wildlife.
- Healthy vegetation (including trees and turf) sequesters large amounts of carbon and, through evapo-transpiration, returns fresh water to the environment and ameliorates the urban heat island effect.
- Healthy soils that retain moisture and support diverse microorganisms and plant growth.
- Potential to increase 'environmental flows' in our river system, through reduced demand on water supply catchments and creation of permeable surfaces.

Potential financial savings and avoided costs

- Savings on water utilities (reduced drinking water consumption).
- Avoided costs of carting in recycled water for park and streetscape irrigation during future water restrictions or drought.
- Avoided waterway rehabilitation costs (eg following erosion or pollution events).
- Deferral or avoidance of upgrades to drainage networks.
- Reduced costs to water authorities for waste water pumping and treatment.
- Deferral or avoidance of the need for further high-cost and energy-intensive water supply infrastructure such as desalination.
- Reduced costs from flood damage to property and infrastructure.

4. Reflecting back on our water journey so far

4.1 Pre-settlement

In a natural water cycle, such as which existed pre-settlement, soils and vegetation intercept, absorb and filter rainfall (refer to Figure 3). Most rainfall returns to the air through evapotranspiration, the process where water is absorbed through plant roots and then released to the atmosphere through the leaves. A substantial amount of water also soaks into the soil and eventually contributes to groundwater levels and stream flows. Only on rare occasions (eg heavy rain for areas adjacent to streams) does direct surface water run-off to creeks and streams occur[2]. Flooding is also part of the natural water cycle. With 24 tributaries and a catchment area that covers about 4000 square kilometres the Yarra was historically an unpredictable river, with frequent severe floods. Floodplains - areas of flat land adjacent to rivers - have been subject to inundation even before European settlement and play a major role in dissipating the power of floodwater. Floodwaters retain and replenish wetlands, and support the flora and fauna of floodplains and river systems. The alternate wetting and drying of billabongs, such as at Willsmere-Chandler Reserve, is a natural process that allows a variety of plants and habitats to occur over time in the same area.

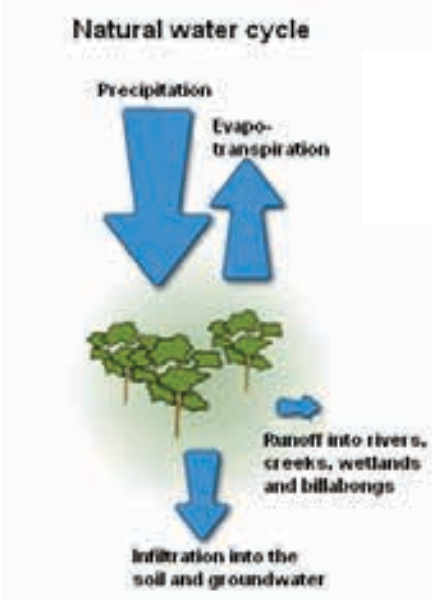


Figure 3 **Water cycle in a natural catchment (arrow size reflects relative volumes)**
(Adapted from Hoban, 2006)

4.2 Urbanisation

Melbourne grew rapidly following the discovery of gold in 1851 and by the 1880s had a population of around half a million people.

Early industries grew along the banks of the lower Yarra River and some reaches of its near-city tributaries, rapidly degrading the water quality until Melbourne's fresh water had to be sourced from elsewhere. Industries then began using the river and its tributaries to dispose of harmful chemicals and other industrial waste.

The rapid growth of Melbourne meant that a sewerage system was necessary to protect public health. In 1897 the first Melbourne homes were connected to the sewerage system[3]. However, it wasn't until the 1920s and '30s that action was taken to develop a drainage system for Melbourne. The focus was on minimising flooding by diverting water away from newly built up areas as quickly as possible.

There have been several significant flooding events in Boroondara since settlement, with the first recorded in 1891.

Urban development (including roads and railways) has constricted the once natural floodplains and can inadvertently block overland flow paths needed to move water during large rain events. Localised flooding can occur when the amount of storm water runoff exceeds the capacity of the drainage network, as the water has no other location to go.

Our waterways increasingly suffer from what has been termed 'urban stream syndrome' as rain in our built up areas results in large volumes of fast moving and polluted stormwater flow through the drainage network to our waterways, causing erosion and degradation of river ecosystems.

The environmental impact of becoming a 'drained city' was recognised in the 1980s with the introduction of environmental protection legislation. Action to reduce stormwater pollution was ramped up during the 1990s, with a focus on reducing litter entering our waterways and targeting 'pollution hotspots'. Figure 4 illustrates the key impacts on the water cycle in an urban context, and also compares this with an urban environment that integrates water sensitive urban design.

2 Melbourne's Water Future 2013
3 http://www.melbournewater.com.au

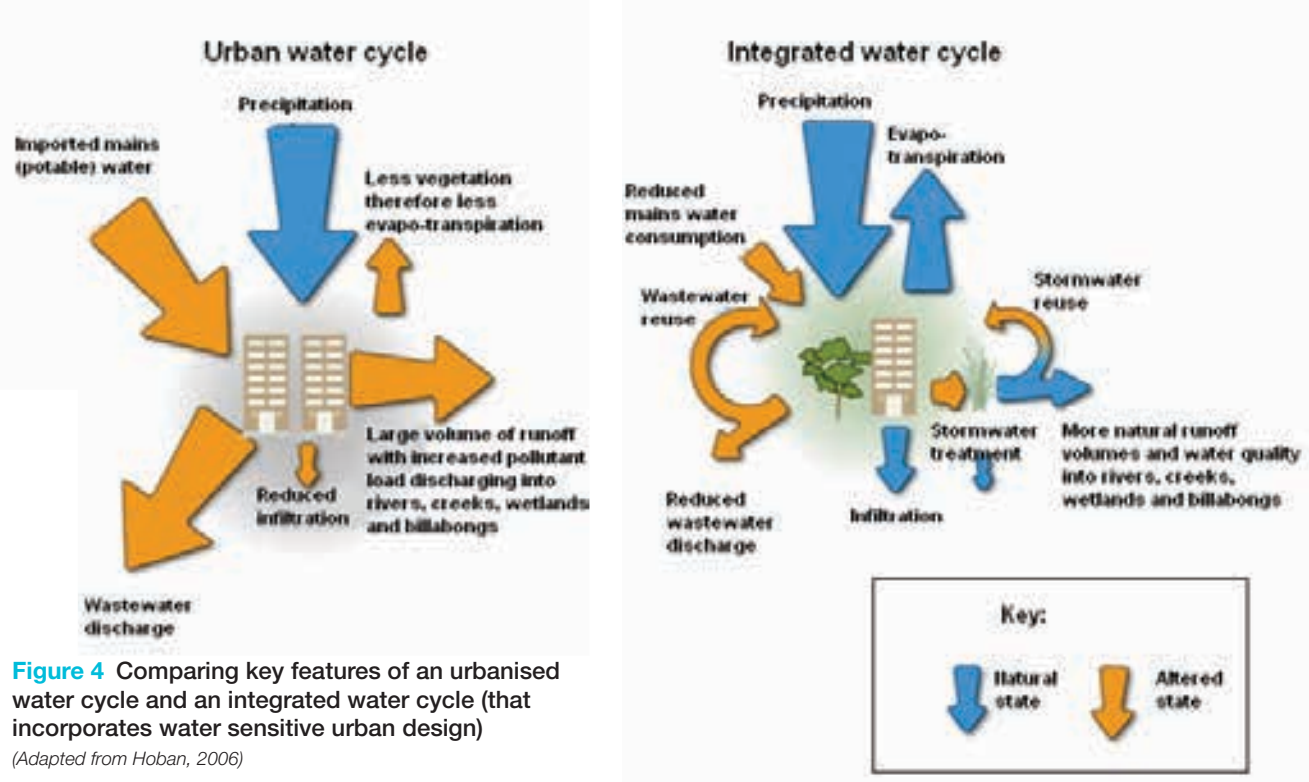


Figure 4 Comparing key features of an urbanised water cycle and an integrated water cycle (that incorporates water sensitive urban design)
(Adapted from Hoban, 2006)

4.3 Over a decade of drought and the shift to water wise action

During the late 1990s drought conditions began to spread across south-eastern Australia, in what ultimately became known as the 'Millennium Drought' and 'The Big Dry', lasting through until Autumn 2010. The drought forced governments and the water industry to re-think how we plan and manage water in both cities and rural areas.

Early in the new millennium, many local councils began to focus on water conservation and on measures to improve stormwater quality. With support from Melbourne Water, Council developed a Stormwater Environmental Management Plan in 2003 with the objective of reducing litter, sediment and other pollutants from reaching our waterways.

Council also developed its first Water Strategy in 2004, including a target to reduce Council's water consumption by 30% (from 1998/99 levels) by 2013/14. It proposed many water saving actions for Council and the community.

4.3.1 Council water saving since 2004

Since the 2004 strategy was adopted, Council has taken significant action to save water. Spurred on by the drought and water restrictions, Council managed to achieve its water saving targets ahead of schedule (see Figure 5). Significant water saving initiatives by Council include:

- **Converting 46 of Council's sportsgrounds to drought tolerant 'warm season' grass species**, along with water efficient sub-surface irrigation systems. Once established, ovals with warm season grasses can be maintained during summer with less than half the water needed to maintain traditional 'cool season' turf species.
- Partnering with Melbourne Water through their Living Rivers Program and developers Stockland to develop Glen Iris wetlands and thus access water from a **large underground tank at Burke Road South for local irrigation**.

- **Installing rainwater tanks at Council facilities** — including Ashburton Pool and Recreation Centre, Boroondara Sports Complex, Camberwell municipal offices, Riversdale Depot and various sports pavilions — to supply water for irrigation, toilet flushing, pool backwash and vehicle wash down.
- **Retrofitting leisure centres and other Council facilities with water-efficient fittings and fixtures**, such as dual flush toilets, flow control (restriction) valves and efficient showers and taps.
- **Planting dry tolerant plant species** in many Council parks and gardens and replacing over 70% of annuals with hardy perennial plants.
- Significant **increase in use of organic composts and mulches** to ensure soils have high water holding capacity and healthy structure.
- Significant roll out of **drip line irrigation** for gardens and trees where practical and appropriate.

As the length and severity of the drought increased, water restrictions (which prohibited use of drinking water for open space irrigation) resulted in Council trucking in over 89 ML of Class A recycled water from Brushy Creek sewage treatment plant, at a cost of around $2.5M over four years or in excess of $28 per kL. This imported recycled water was used to keep our many sports fields usable and the established vegetation alive in our parks and gardens.

While there has been a significant rise in Council's drinking water use since the end of the drought (and lifting of associated water restrictions), water use in 2012/13 was still almost 50% less than during 1998/99 (the baseline year) despite an increase in service delivery (see Figure 5).

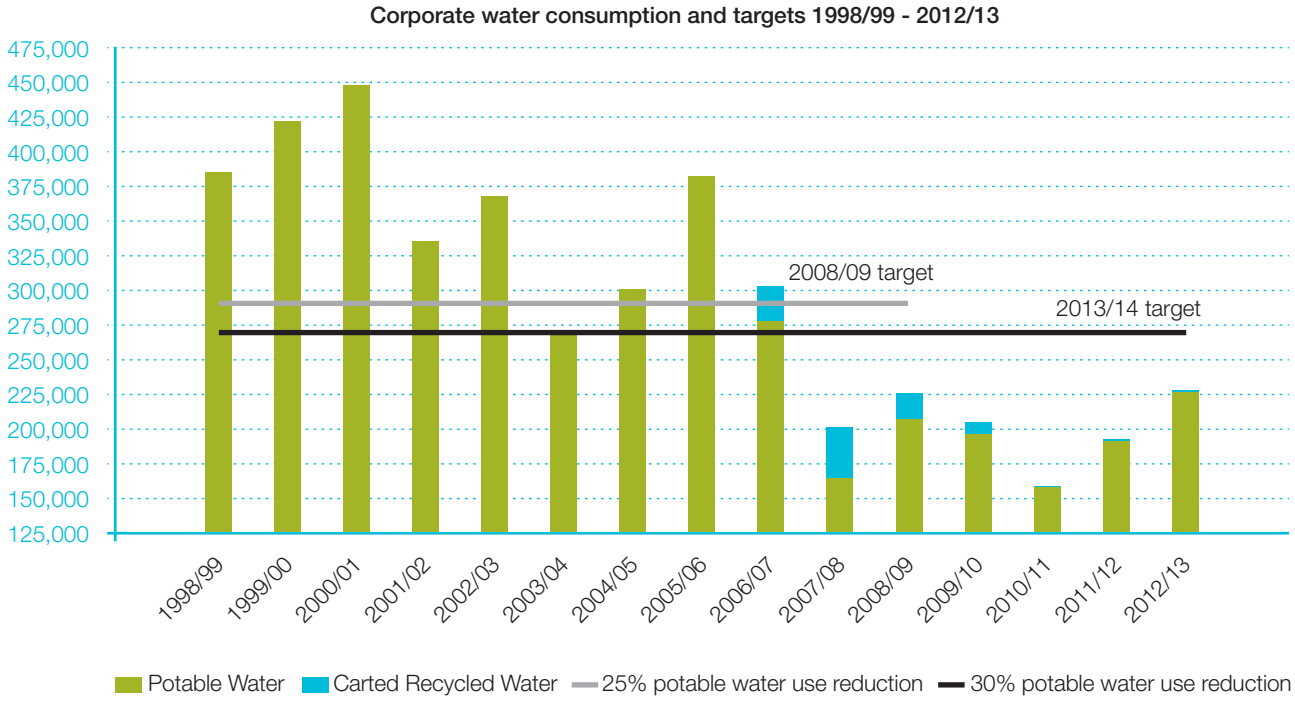


Figure 5 Council's annual water use against water saving targets set in the 2004 Water Strategy

4.3.2 Community water saving

Residential demand accounts for over 80% of drinking water consumed across Boroondara. In part due to the number and size of residential gardens in Boroondara, water consumption per Boroondara resident tracks significantly higher than the Melbourne average.

Like other communities, the residents of Boroondara responded to the drought and water restrictions by saving water at home. Water wise homes and gardening became a key theme for Council's Living for our Future community education program. Encouraged by the Victorian behaviour change campaign 'Target 155' and other water saving incentives, many community members adopted a 'water saving ethic'.

Sustainability Victoria's 2009 Green Light Report found that:

- 90% of Boroondara residents had dual-flush toilets
- 72% had low-flow showerheads
- 24% had rainwater tanks
- 6% had professionally installed greywater recycling systems, and
- 44% had a front-loading washing machine (notably higher than the Melbourne average of 30%).

These more water efficient homes combined with adoption of water-wise behaviours to see average residential demand in Boroondara drop from its peak of nearly 250 litres per person per day in 2002/03 to as low as 164 litres, by the end of the drought (2010/11). Unfortunately, the end of the drought and easing of water restrictions saw residential use of drinking water in Boroondara rise back to over 190 litres per person per day in 2012/13 — significantly higher than the Melbourne average of 149 litres[4] (see Figure 6).

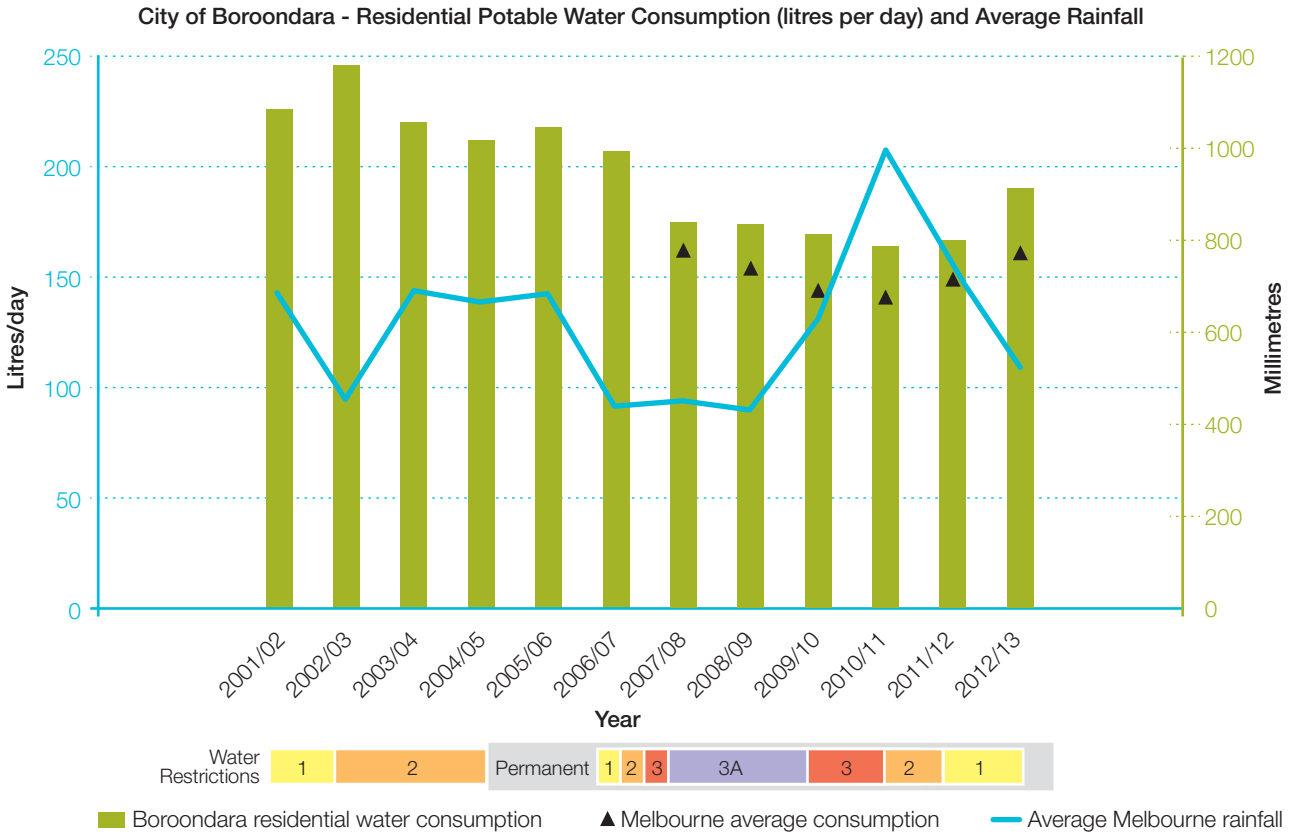


Figure 6 **Residential drinking water use in Boroondara (average per person per day) and annual rainfall**

[4] Melbourne Water 'Water Outlook' 2012

4.3.3 Council stormwater quality initiatives since 2003

Since the adoption of the Stormwater Environmental Management Plan in 2003, Council has partnered with Melbourne Water to complete a number of projects to improve stormwater quality. These co-funded initiatives fall into three related categories:

1 **Raingardens and tree pits in streetscapes and car parks**— smaller-scale WSUD to treat run-off from roads, footpaths and carparks. These projects have generally been undertaken as part of streetscape or carpark renewal works. Examples include:
- Marquis St, Ashburton (streetscape rain gardens)
- Marwal Avenue in North Balwyn Village (streetscape rain gardens)
- Swinton Avenue, Kew (nature strip)
- Deepdene Park (carpark)
- Glenferrie Road 'climber frames' (kerbside planted pits)
- Irymple Ave and Winmalee Road (nature strips)
- Kyora Parade Park.

2 **Constructed wetlands and larger raingardens** — larger-scale WSUD systems integrated into public open space and treating stormwater from a bigger catchment. Examples include:
- Glen Iris wetland (constructed in 2009 as a partnership project with Melbourne Water and developers Stockland).
- Koonung Creek Reserve wetland (renovated in 2008)
- Cascade Reserve Walmer Street, Kew (park bioretention system)
- Hambledon Street, Hawthorn (raingarden adjacent to Scotch College)
- Willsmere Park (WSUD).

For a full listing of Council's existing raingardens and wetlands see Appendix 1 or visit http://www.boroondara.vic.gov.au/wsud.

Image 1 Hambledon Street raingarden treating stormwater before it enters the Yarra River

Image 2 Kerbside raingardens and 'butt bin' at Marquis Street, Ashburton

3 **Reducing litter polluting our waterways, primarily through membership of the Lower Yarra Litter Strategy (LYLS)**. LYLS is a partnership between the Metropolitan Waste Management Group, Melbourne Water, the Victorian Litter Action Alliance and the Cities of Port Phillip, Melbourne, Yarra, Boroondara and Stonnington. Actions supported through LYLS include:
   - Installation and maintenance of 'gross pollutant traps' (GPTs) across the drainage network
   - Installation of 51 cigarette 'butt bins' in busy shopping centres across Boroondara
   - An education and engagement campaign to help traders at the Camberwell market reduce litter and other stormwater pollution.

   The community has also contributed to protecting the health of our waterways through attending sustainability events, undertaking revegetation and clean-up activities along Boroondara waterways, participating in raingarden workshops, and undertaking water sensitive activities around their homes, such as installing downpipe diverters and raingardens.

4.3.4 Council flood management initiatives

Council has undertaken improvements to areas known to be flood prone within Boroondara over last 10 years. For example, drainage issues in Jacka Street were improved by the provision of a large underground detention system.

The increased density of development in Boroondara has increased pressure on Council's drainage network, particularly during high rainfall. Council now requires developers to provide on-site stormwater detention to restrict the rates of stormwater flow to figures in line with the capacity of the existing stormwater drainage network.

Litter traps along the Yarra River collect huge amounts of rubbish and litter that flow into waterways from stormwater
© Yarra Riverkeeper Association

5. Our current water balance

'The physical characteristics and catchment properties within a municipality, such as land use, amount of impervious area, and rainfall characteristics, strongly influence the amount of stormwater that is generated and subsequent impacts on river health. Integrated water management requires a sound knowledge of water (and pollution) sources and flows, their inter-relationships and the risks and opportunities they present'.[5]

As a foundational aspect of developing the IWMS, Council commissioned specialist consultancy DesignFlow to prepare a water balance to better understand the urban water cycle in our municipality. The water balance accounts for annual volumes of:

- drinking water supplied to the municipality
- rainfall across the municipality
- stormwater generated and associated pollutant loads
- harvested rainwater and stormwater
- pollutants removed by existing WSUD measures
- waste water (sewerage) exported.

See Figure 7 for a diagrammatic summary of the water balance (based on 2011 data from a variety of sources including Yarra Valley Water and Bureau of Meteorology). The water balance and associated analysis has assisted in defining achievable and sustainable targets for municipal water management over the coming years (see section 7.3).

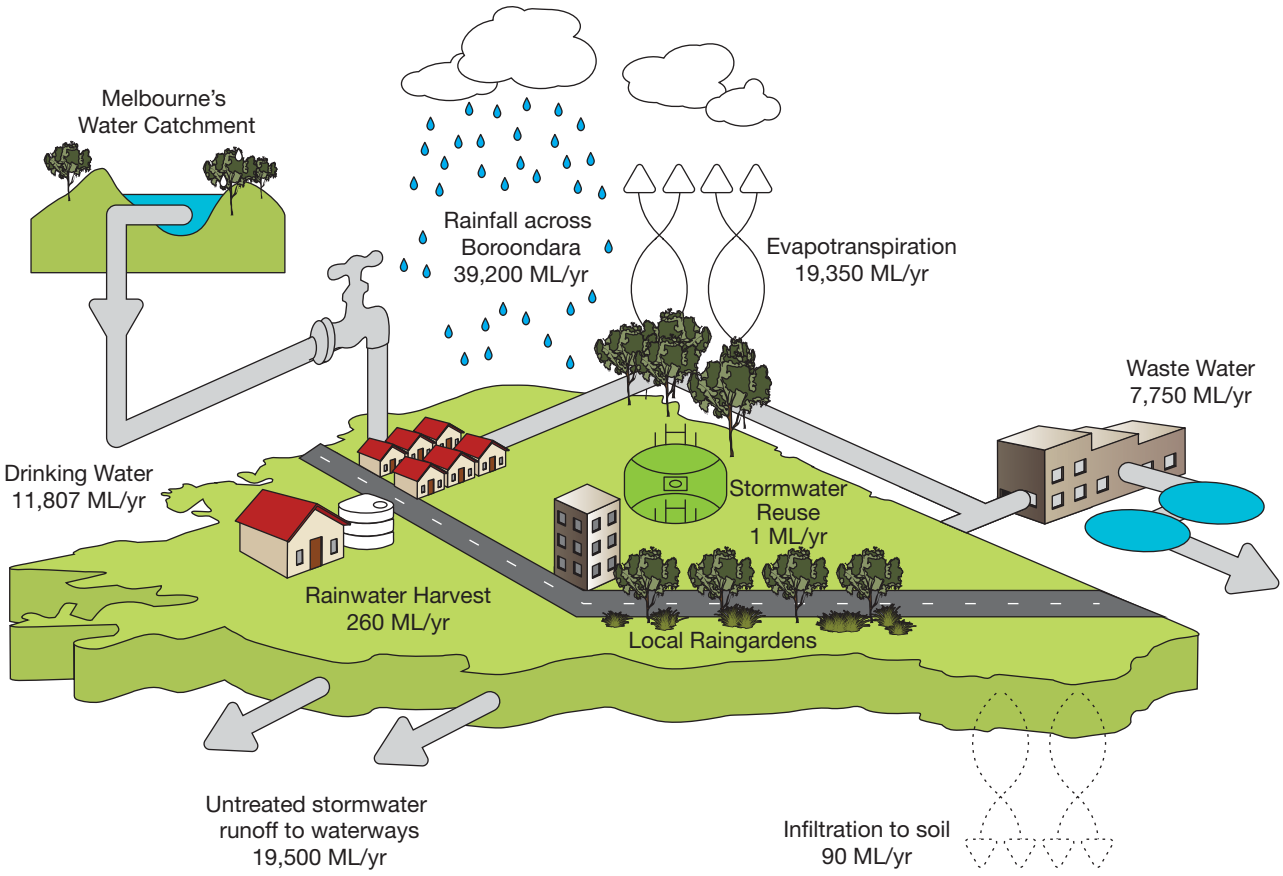


Figure 7 A visual summary of Boroondara's water balance

[5] Melbourne Water 2011, Developing a Strategic Approach to WSUD Implementation: Guidelines for Councils.

5.1 Key findings and challenges

Together with the annual inventory of Council and community water use, the water balance has highlighted and clarified a number of important themes and challenges for water cycle management in Boroondara.

We are relying heavily on drinking water from Melbourne's catchments

- In 2011 we 'imported' almost 12,000 ML of mains 'drinking water' (also known as 'mains' or 'potable' water). We collectively use this high quality 'drinking water' for flushing toilets, irrigating green spaces, street sweeping, washing clothes etc.
- Around 30% of household drinking water is used for toilet flushing and clothes washing, and almost 20% for irrigation.
- The major uses of drinking water by Council in 2011/12 were:
  - irrigating Boroondara's many public parks and gardens (45%) and
  - running our five aquatic and leisure centres (34%).
- The security of our drinking water supply relies on the dams in Melbourne's water catchments, as well as the high-cost and energy-intensive desalination plant, and while water is currently cheap, prices are rising above the rate of inflation.

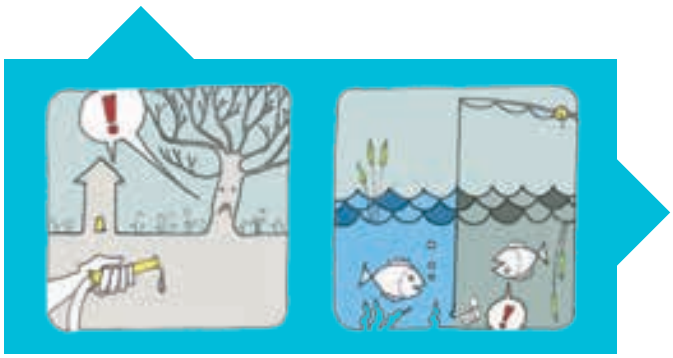


Image courtesy of CIRIA from AECOM, 2013

We are only harvesting a tiny proportion of the rain that falls across Boroondara

- Around 39,200 ML of rainwater falls across the 'catchment' of Boroondara each year.
- We are harvesting less than one percent of this rainfall via rainwater tanks and through wetlands (such as Glen Iris).
- Harvesting more rainwater and stormwater for reuse in toilet flushing, laundries, and for garden and open space irrigation could significantly reduce our reliance on drinking water without sacrificing hygiene or vegetation health.

Around half of all rainfall ends up as polluted stormwater that flows directly to our waterways

- Almost half (19,500 ML/yr) of the rain that falls across the municipality runs off hard surfaces such as roads, roofs and driveways and into the stormwater drains. In 2011 this untreated stormwater carried an estimated 2,284 tonnes of damaging pollutants (suspended solids, Nitrogen, Phosphorus) into our waterways and the Bay.
- Across the lower Yarra catchment, the cumulative impact of frequent and large flows of untreated stormwater is devastating to river health and in-stream ecology. This is most obvious to the public when extreme storm events lead to erosion damage, high pollution levels and algal blooms causing fish deaths and beach closures (as happened in Port Phillip Bay 2012)[6].
- Over the past ten or so years Council, with support from Melbourne Water and other stakeholders, has installed a number of WSUD features across the municipality (see Section 4.3.3 and Appendix 1 - List of existing WSUD assets). While these WSUD assets are mostly relatively small-scale, modelling suggests they remove around 33 tonnes of pollutants a year from municipal stormwater flows.

[6] A Cleaner Yarra River and Port Phillip Bay Action Plan 2012

Wastewater

- Boroondara generates around 7,750 ML of wastewater per year, which flows through the sewer network to Melbourne Water's Eastern Treatment Plant in Bangholme.
- Using water efficient fixtures (eg showerheads and toilets) and appliances (eg washing machines and dishwashers) reduces pressure on the existing sewer infrastructure, which is particularly important given population growth.
- Similarly, reuse of greywater (from the laundry and shower) to irrigate gardens and/or flush toilets can greatly reduce wastewater flows, as well as reduce use of valuable drinking water.

Retrofitting existing suburbs to be 'water sensitive' is challenging

- A growing population means an increase in our overall demand for water and, due to housing development, some increase in land covered by hard surfaces such as roofs and driveways. If these newly 'impervious surfaces' are directly connected to the drainage network — and not detained for treatment through WSUD — then stormwater volumes and pollution will increase over the coming years.
- In established municipalities like Boroondara, one of the challenges involved in addressing stormwater pollution is identifying and allocating adequate public open space that is suitable for installation of treatment solutions like wetlands and raingardens. While our community is broadly supportive of the merit of reducing stormwater pollution, public open space across Boroondara is highly valued and subject to many competing demands. Proposed stormwater treatment projects must be thoughtfully located, designed, and communicated to foster community acceptance.
- Some sites that might otherwise be suitable for WSUD systems are on land that was historically used for landfill. The presence of contaminated soil poses project risks and costs, and will sometimes mean a project is not feasible.
- While identifying suitable open space for stormwater treatment can be challenging, there are opportunities to locate stormwater treatment assets within or near parks or reserves that require water for irrigation. Prioritising stormwater treatment projects that can also supply water for local reuse makes sense as they deliver multiple benefits to the local community.
- Stormwater treatment and harvesting projects need a close match between three key criteria: an adequately sized catchment to generate sufficient flows; space for, and ease of treatment and (in the case of harvesting for reuse), adequate end-use demand. It is not always possible to achieve this balance.
- Some water saving solutions that are increasingly common in larger housing developments on the urban fringe (such as supply of recycled water via a 'purple pipe' system) are not yet feasible for established housing stock. While retrofitting individual houses with greywater systems is possible, it requires commitment from homeowners to cover capital cost and undertake ongoing maintenance.

6. Developing the Integrated Water Management Strategy

6.1 Roles and responsibilities in integrated water management

Governance roles and responsibilities for managing water in Victoria are complex and involve a range of state government departments, agencies, and local councils. Clearly defined roles and responsibilities, together with effective collaboration and partnerships, are needed to drive the transition to integrated water cycle management.

Key stakeholders	Roles and responsibilities include...
Householders, businesses, and community groups	• **Adopt water sensitive behaviours** and technologies across homes, businesses and organisations • Engage with Council on local water projects. • **Advocate for the our waterways**, including through community engagement and education for example Yarra Riverkeepers.
Local councils	• **Manage municipal stormwater** to protect our waterways (consistent with State Environmental Protection Policy). • Maintain **council (local) drainage network** • Manage risks and communication associated with local flooding. • Implement relevant **planning and building policy** and regulation, local laws. • Increasingly, implementation of local alternative water harvesting and supply projects, community education and community engagement.
Melbourne Water (Victorian Government)	• **Water supply wholesaler** (to water retailers). • **Manage Melbourne's water supply catchments** • Manage **regional (main) drainage network** and regional flood mitigation • Manage **larger (trunk) sewer network and treatment plants** • **Caretaker of waterways** in the Port Phillip and Western Port region
Yarra Valley Water (Victorian Government)	• **Water supply retailer** (to individual homes and businesses), including potable and recycled water • Manage the **local sewerage network** • Deliver community education programs
Office of Living Victoria (Victorian Government)	• **Drive urban water reform to enable whole-of-water-cycle management** as the standard approach to planning and delivering water cycle services to communities across Melbourne and Victoria
Environmental Protection Authority (EPA), Victoria	• **Protection of waterways** through administration of the Environmental Protection Act 1970 and State Environmental Protection Policy (Waters of Victoria). • **Pollution monitoring**, investigation and enforcement. • **Regulation** of treatment and use of recycled water (in conjunction with Department of Health)
Department of Health, Victoria	• Research, policy development and education relating to the use of **alternative water supplies** • Review and endorsement of recycled water schemes
Universities and the CRC for Water Sensitive Cities	• The Co-operative Research Centre (CRC) is leading an extensive **10-year national research program** to support an evidence-based transition to integrated water cycle management.
Port Phillip and Westernport CMA	• Peak natural resource management body in the Port Phillip and Western Port region to develop and oversee the implementation of a Regional Catchment Strategy.

6.2 How does the IWMS relate to other Council documents?

The IWMS sets out Council's approach to managing our urban water in an increasingly integrated way. Importantly, the following Section 7 sets guiding principles, objectives and targets that will contribute to realising Council's long-term vision and Council Plan key directions including 'enhancing the environment' and 'ensuring liveability and amenity'. The IWMS is also informed by and aligns with a number of related strategies and plans that address the sustainable development and enhancement of our built and natural environment.

Our Boroondara - Our City our Future
Long term vision and plan

Council Plan
Themes include Sustainable environment, Enhanced amenity, Quality facilities and assets

IWMS

Sets the strategic direction and targets for water cycle management across the municipality

Operational plans

- IWMS Implementation Plan (to be developed)
- Flood Management Plan 2012 (as revised)
- Drainage Asset Management Plan 2009 (as revised)
- Sustainable Buildings Guidelines 2010 (as revised)

Other related strategies and planning documents

- Municipal Strategic Statement and Local Planning Policy
- Urban Biodiversity Strategy (2013)
- Boroondara Open Space Strategy 2013
- Sustainable Buildings Policy (2010)
- Park Masterplans
- Glenferrie Water Management Plan 2013

6.3 How has the IWMS been developed?

This IWMS has been informed by a number of key tasks and processes, including:

- Review of the original 2004 Water Strategy outcomes and lessons.
- Annual inventory of water use by Council and the broader community.
- Establishment of an internal IWMS reference and working group, with representation from relevant departments including Environment and Sustainable Living, Parks and Gardens, Projects and Strategy, Asset Management, Infrastructure Services, Strategic Planning and Statutory Planning. Business Development and Leisure Services were also consulted for feedback on relevant issues.
- Staff participation in professional development (eg training, networking etc) focused on local government's role in contemporary integrated water cycle management (eg provided by Clearwater (Melbourne Water), the CRC for Water Sensitive Cities and others).
- Reviewing current water cycle strategies (or equivalent) from State Government and other councils in the Melbourne region.
- Consideration of all relevant external legislation, and both internal and external strategies and plans (see Appendix 2).
- With the support of a Melbourne Water grant, commissioning of a water balance to account for water flows in our municipality (see Section 5)
- Preliminary identification of potential opportunities for significant Water Sensitive Urban Design (WSUD) treatment systems (including some with stormwater harvesting for local reuse)
- Review and feedback on the draft IWMS from the community, key water sector stakeholders and independent experts prior to its finalisation for adoption by Council.

Strategy Development Process

Yarra Riverkeeper Ian Penrose runs regular walks and talks to help people learn about reducing pollution in the Yarra River and protecting wildlife that depend on the river for habitat

7. Our path to a water sensitive future

7.1 Our long term Vision for a water sensitive Boroondara

*The City of Boroondara is a **healthy, green and resilient city** where the natural environment and green infrastructure is valued and protected and we are able to adapt to the impacts of climate change.*

*A **diversity of water sources** is available so that the right quality of water is available when and where it is required. Boroondara manages its water sustainably to meet the needs of the environment and the community, contributing to **healthier waterways and open spaces** for greater community wellbeing.*

*Boroondara's **residents and business community celebrate our water sensitive city** and are engaged around management of local water resources, contributing to a sense of place and community ownership. Our waterways are a vibrant part of our community and are attractive to wildlife and for recreation.*

Vision

- Healthy, green and resilient city
- Diversity of water sources
- Healthier waterways
- Community engaged and celebrating our water sensitive city

Guiding principles

- Valuing water
- Leadership by Council within the community.
- Partnership approach
- Balance competing objectives and pursue multiple benefits
- Action prioritised by impact
- Consider the impacts of climate change

Objectives

- Minimise drinking water use
- Maximise local water harvesting and 'fit for purpose' reuse
- Remove pollutants flowing from our municipality into our waterways
- Support flood management activities in a way that better protects properties from flooding while also protecting the environment, amenity and function of Council assets.

7.2 Guiding principles

Valuing water – One of our most valuable resources is water. Water is not only vital for drinking and for healthy, active and productive communities; it plays an essential role in protecting our local amenity and valuable urban ecology. The recent prolonged drought highlighted the need to conserve water and use it in the right way throughout our city. This includes increasing fit-for-purpose water use where appropriate in infrastructure, buildings, parks and gardens and reducing use of premium drinking water where it is not required.

Leadership by Council within the community – Implementation of this Strategy demonstrates Council's commitment and leadership to the community, key stakeholders, other councils and Council staff.

Partnership approach – Integrated water management is a shared responsibility. Partnering with project beneficiaries to co-fund implementation actions and involving residents and businesses, is critical to realising the aspirations for a water sensitive city.

Balance competing objectives and pursue multiple benefits – Integrated water management should be implemented in a way that maximises community well-being and other potential co-benefits (social, financial and environmental). The application of this principle will ensure a balanced response to potentially competing objectives included in other Council policies and strategies.

Action prioritised by impact – Where there are so many competing demands for resources and funding, it is critical to prioritise actions according to greatest social, environmental and economic benefits per dollar invested.

Consider the impacts of climate change – Our climate is changing and we are already seeing some impacts with regard to extreme weather. It is important that Council and the local community recognise the risk that climate change poses to our assets, services and people, and that we plan ahead to ensure greater resilience to expected heatwaves, droughts, floods and storms.

7.3 Objectives and targets

To help us move towards our vision of becoming a more water sensitive city, **four overarching objectives** have been identified, which **relate to the key areas of influence for Boroondara**:

1. **Minimise use of drinking water**
2. **Increase local water harvesting and 'fit-for-purpose' reuse**
3. **Remove pollutants contaminating our stormwater before it enters our waterways and Port Phillip Bay**
4. **Support local flood management activities in a way that better protects properties from flooding while also protecting the environment, amenity and function of Council assets**.

Targets have been proposed for objectives 1-3, which can help drive action, and provide measures for annual monitoring and reporting on progress over time. Consistent with the approach of other councils, two complementary types of targets have been developed - 'Council targets' and 'Community aspirations'. Progress towards Council targets is more directly within Council's control. Community aspirations are to a large extent beyond the direct control of Council and rely on community education programs delivered in partnership with water authorities. Nevertheless, setting shared aspirations is considered an important element in fostering community behaviour change.

Achievement of the proposed Council targets by 2024 is subject to:

- confirmation of the feasibility of a number of high-priority treatment and harvesting projects; and
- securing required Council and/or external funding from potential beneficiaries to implement these projects over the coming decade.

7.3.1 Objective 1: Minimise use of drinking water

A key part of being 'water sensitive' will be working hard to minimise our demand for drinking water drawn from Melbourne's dams and in the future, the desalination plant. The water conservation targets acknowledge the lifting of water restrictions, and reflect ongoing opportunities for long-term behaviour and infrastructure changes.

	By 2024
Council target	20% reduction in use of drinking water compared to 2011/12 levels *This equates to a 60% reduction based on 1998/99 levels*
Community aspiration	Resident use of drinking water down to 153 litres per person per day - an 8% reduction in use of drinking water compared to 2011/12 levels *This equates to a 32% reduction based on 2001/02 levels*

7.3.2 Objective 2: Increase local water harvesting and 'fit-for-purpose' reuse

Our water balance showed that we are harvesting less than one percent of the rain that falls in the Boroondara 'catchment'. Harvesting more rain and stormwater for reuse could significantly reduce our reliance on drinking water. The concept of 'fit-for-purpose' means the quality of water is matched to the end-user requirements.

	By 2024
Council target	Harvest an additional 30ML per year of stormwater for irrigation of public open space *In 2012/13 Council used 140ML of drinking water for the irrigation of public open spaces*
Community aspirations	30% of single dwellings have a rainwater tank installed by 2024 Half of these households have their rainwater tank connected to internal uses such as toilet and laundry *This compares to approximately 24% of dwellings that had rainwater tanks installed in 2009* *Source: Sustainability Victoria Green Light Report (2010)*

Note:
- The biggest opportunities for stormwater harvesting will be where water has been captured and treated through WSUD treatment assets eg wetlands or raingardens (refer to Objective 3) and then stored for local reuse.

7.3.3 Objective 3: Remove pollutants contaminating our stormwater before it enters our waterways and Port Phillip Bay

Stormwater quality can be improved through reducing pollution at the source, and also by slowing and treating the flow prior to discharge into receiving waters. One of the main ways Boroondara can remove pollutants from stormwater is through roll-out of water sensitive urban design (WSUD) principles and infrastructure. WSUD seeks to minimise impervious surfaces, reuse water on site, incorporate detention and retention basins to reduce peak flows, and use biofiltration systems or wetlands to remove pollutants.

At its best, WSUD enables the built environment to mimic the hydrology of natural (undeveloped) catchments and waterways. WSUD infrastructure can be applied at all scales: in an individual home (eg a rain tank for toilet flushing); along a streetscape (eg street tree pits); across a neighbourhood (eg a raingarden in the local park); or city-wide (eg significant wetlands with water harvesting).

Council targets	By 2024
Pollutant	**Quantity removed**
Total Suspended Solids (TSS) *(dirt, grit, car tyre residue etc)*	182 tonnes per year
Total Phosphorous (TP) *(fertilisers, air-borne pollutants)*	360 kg per year
Total Nitrogen (TN) *(detergents, fertilisers)*	3,000 kg per year

Notes:

- No target is set for gross pollutants (including litter) as it is most effectively addressed through non-structural initiatives such as education campaigns and effective monitoring of these is difficult.
- Total suspended solids (TSS) is a measurement of dirt and dust particles suspended in the water and is also an indicator of other pollutants in runoff that can attach to these particles. Phosphorus and nitrogen are also an important measure of waterway health as they are commonly found in runoff from soil, lawns, and pet waste, and contribute to the growth of algae and noxious aquatic plants.
- No community aspirations have been set for removal of pollutants. Data on the activities undertaken on private land to reduce polluted stormwater runoff is not readily available therefore it would be difficult to measure progress towards any community aspiration that was set.

Wetlands contribute to improving the quality of our waterways by treating stormwater runoff to remove pollutants

7.4 Priority strategies to achieve objectives and targets

A combination of strategies is proposed to contribute to achieving each objective. Some implementation strategies contribute to achieving two or all three objectives. For example, residents installing rainwater tanks plumbed for internal use are: saving drinking water (objective 1); increasing local water harvesting and reuse (objective 2); and removing pollutant run-off from their lot (objective 3).

For each strategy, the range of potential benefits are noted (refer to section 3 for further explanation of each benefit type).

Benefits key

7.4.1 Key strategies proposed to minimise use of drinking water (Objective 1)

Ref	Key strategies proposed	Benefits
1.1	**Progressively improve the water efficiency of Council buildings**. Use enhanced metering and monitoring to identify cost effective opportunities for water saving technologies — including fixtures/fittings, appliances, building plant, rain tanks etc — installed either through maintenance, scheduled renewal or retrofit initiatives as appropriate. Notes: • As high water using facilities, water saving opportunities at aquatic and leisure centres warrant priority attention. • Council's Sustainable Buildings Policy stipulates that newly constructed buildings should incorporate water efficiency and rainwater harvesting (for internal reuse) as standard practice.	
1.2	**Progressively reduce Council's reliance on drinking water for open space irrigation**, through: • water efficient irrigation and landscaping • use of locally harvested rainwater and treated stormwater where appropriate and available (links to strategy 2.2 below) in Council's parks and gardens.	
1.3	Partner with key stakeholders, including Yarra Valley Water and Melbourne Water, in projects and programs that **engage local residents and businesses in adopting behaviours and solutions that conserve drinking water** for premium uses. Target behaviours / solutions: • Water efficient whitegoods, fittings and fixtures • Rainwater tanks, plumbed for internal use • Grey water irrigation systems • Water-wise landscaping and gardening.	

7.4.2 Key strategies to increase local water harvesting and 'fit-for-purpose' reuse (Objective 2)

Ref	Key strategies proposed	Benefits
2.1	**Identify, map and analyse Council facilities and open spaces with significant (current or future) water demand suitable for transition to use of non-drinking water.** Considering 'future demand' would aim to foresee potential for sustainably integrating harvested water within the public realm to provide urban cooling and improved landscape amenity (eg ephemeral water features, for food production etc). This exercise will consider the sites most suitable for transition to non-drinking water, and ensuring available water - either treated stormwater or rainwater - is fit for purpose.	
2.2	Partner with key stakeholders and potential beneficiaries, including Melbourne Water and Office of Living Victoria, to **plan and deliver stormwater harvesting projects** that are strategically matched with identified current or future water demands (see strategy 2.1 above) and stormwater treatment infrastructure (see strategy 3.1 below).	
2.3	**Promote inclusion of water harvesting and reuse measures within the planning and design stages of new and retrofit developments** through provision of timely guidance and, where relevant and appropriate, planning permit conditions.	
2.4	Partner with key stakeholders, including Yarra Valley Water (YVW) and Melbourne Water (MW), in projects and programs that **engage local residents and businesses in adopting water harvesting and 'fit for purpose' reuse**. Target behaviours / solutions: • Rainwater tanks, plumbed for internal use • Grey water irrigation systems	

7.4.3 Key strategies to remove pollutants contaminating our stormwater before it enters our waterways and Port Phillip Bay (Objective 3)

Ref	Key strategies proposed	Benefits
3.1	**Plan and progressively deliver a program of larger scale WSUD infrastructure (wetlands and biofilters)** that are carefully selected and designed to maximise both pollutant removal and other co-benefits (eg landscape amenity and activation, water harvesting and reuse, enhanced biodiversity etc). Notes: • Initial stages of program planning will include assessing the feasibility and relative priority of identified opportunities for WSUD infrastructure. • Securing appropriate levels of co-funding from beneficiaries will be critical to delivery of a number of projects.	

Continued >

3.2	**Build and maintain Council's internal capacity** (technical expertise, resource allocation, operational processes/guidelines etc) to cost-effectively plan, design, construct, maintain, and renew existing and new WSUD infrastructure for sustained performance and co-benefits.	
3.3	**Integrate WSUD principles and cost-effective solutions into the design and construction of Council drainage and streetscape renewal works** (eg footpaths, kerb and channel, car parks).	
3.4	**Promote adoption of integrated water management within local development planning (and construction**) through the planning process and associated guidance. Advocate for strengthened WSUD provisions within the State Planning Policy (Clause 56) and incorporate appropriate policy support within the Boroondara planning scheme (eg the Municipal Strategic Statement / local planning provisions).	
3.5	Partner with key stakeholders, including Melbourne Water, Yarra Riverkeepers and Metropolitan Waste Management Group (MWMG), in projects and programs that **engage local residents and businesses in removing pollutants from our stormwater**. Target behaviours / solutions: • Resident understanding and acceptance of the role of constructed wetlands and raingardens within public open space. • Residential and business use of permeable landscaping options (eg permeable paving, gravel, mulch) in preference to impervious treatments (eg concrete) where feasible. • Litter prevention • Appropriate disposal of waste liquids Note: Recent partnership initiatives include the Lower Yarra Litter Strategy (with MWMG), Yarra River Catchment Crawls (with Yarra Riverkeepers), the 'Choose Tap' campaign (with YVW), and Living for our Future stormwater and raingarden workshops (with Melbourne Water and Sustainable Gardening Australia).	

7.4.4 Key strategies that support flood management activities (Objective 4)

Ref	Key strategies proposed	Benefits
4.1	**Plan and deliver a flood modelling program** to model catchments located within Boroondara and examine Council's main drains and floodway system to develop more precise flood mapping.	
4.2	**Plan and progressively deliver a program of drainage upgrade and renewal works** based on outcomes of updated flood mapping and integrating opportunities for co-benefits (eg landscape amenity and activation, water harvesting and re-use, enhanced biodiversity etc), where feasible.	
4.3	**Develop updated local flood overlays** and associated policy in conjunction with Melbourne Water and incorporate this in the planning scheme.	
	Also refer to strategies 2.2 (delivery of stormwater harvesting), 3.3 (integration of WSUD principles) and 3.4 (adoption of IWM through planning).	

8. Strategy implementation and monitoring

8.1 Implementation

Implementation planning and project delivery will be undertaken over a medium-term time horizon (two to four year) consistent with Council's budget planning timeframes.

The initial implementation plan will include a set of actions for the next two years that will lay the foundation for project prioritisation and planning over the longer-term. With adequate community support, this will enable resourcing of a 'WSUD infrastructure program' to prioritise and progressively invest in significant stormwater management projects that deliver local alternative water, pollutant removal and a wide range of co-benefits. It is important to note that delivery of WSUD infrastructure projects will be subject to annual budget allocation, and Council will proactively seek co-funding from partners wherever possible, particularly from the potential beneficiaries.

A range of strategies will also be progressed within Council's existing operational resources.

8.2 Monitoring and tracking performance

Monitoring involves collection and analysis of data and information to assist timely decision-making, ensure accountability and provide the basis for assessing progress towards achievement of objectives and targets. It will help identify if adjustments need to be made to strategies, resourcing, and program or project design. Resources need to be committed for monitoring so that it becomes an integral part of the program and project cycle.

The 2024 targets will be reviewed pending completion of the feasibility assessment and prioritisation of identified WSUD infrastructure opportunities.

Council indicators

Proposed progress indicators	Monitoring
Council mains water use	Annual inventory of Council's potable water consumption, analysed by facility type and site. High water using facilities will be the focus of sub-metering and periodic monitoring.
Council use of alternative water sources: **1. Capacity of rainwater tanks at Council facilities** **2. Capacity of stormwater storage for reuse** **3. ML used per annum** **4. Usage as % of annual irrigation demand**	Commence data gathering during 2013/14 and establish baseline by 2014/15 for annual monitoring thereafter. Note: the methodology for tracking our ML/annum use will be determined as part of establishing the baseline.
Volume of annual pollutant removal via installed WSUD infrastructure	Modelled baseline (from 2011) plus annual additional pollution removed based on installed WSUD infrastructure (using MUSIC modelling).

Community indicators

Proposed progress indicators	Monitoring
Residential mains water use	Annual calculation of average residential consumption (per person, per day) based on data from Yarra Valley Water.
Percentage of single dwellings with a rainwater tank installed **Proportion of these households with tanks plumbed for internal uses**	Monitor via data from Yarra Valley Water derived from Victorian Rainwater Tank Rebate (Living Victoria Water Rebate Program or equivalent).

Appendix 1
List of existing WSUD treatment systems

System Name	Suburb	Type	Location
Dunlop Street Reserve	Ashburton	Bioretention	Park
Kosciusko Road Park	Balwyn North	Distributed tree pits	Naturestrip
Marquis Street	Ashburton	Distributed tree pits	Shopping strip
Marwal Avenue	Balwyn North	Distributed tree pits	Shopping strip
Kew Residential Services (Subdivision)	Kew	Bioretention	Naturestrip
Kyora Parade Park	Balwyn North	Bioretention	Park
Cascade Reserve	Balwyn North	Bioretention	Park
Deepdene Park	Balwyn North	Bioretention	Car Park
Power Avenue Reserve	Hawthorn	Bioretention	Park
Swinton Avenue	Kew	Bioretention	Naturestrip
Glenferrie Road	Hawthorn	Distributed tree pits	Shopping strip
Balwyn Community Centre	Balwyn	Wetland	Park
Greythorn Park	Balwyn	Wetland	Park
Wallen Road Reserve	Hawthorn	Bioretention	Car Park
Walmer Street	Kew	Bioretention	Park
Irymple Ave and Kilby Road	Kew East	Bioretention	Naturestrip
Winmalee Road	Balwyn	Bioretention	Naturestrip
Hambledon Road	Hawthorn	Bioretention	Scotch college
Eric Raven Reserve	Glen Iris	Bioretention	Park
Willsmere Park	Kew East	Bioretention	Park
Koonung Creek Reserve	Balwyn North	Wetland	Park
Glen Iris Wetland	Glen Iris	Wetland	Park / shopping centre

Appendix 2
Legislative and policy context for Integrated Water Management

This Integrated Water Management Strategy (IWMS) has been informed by existing federal and state strategies and legislation, as well as regional (catchment) planning and policy. The external legislation, strategies and plans that have informed the development of the IWMS are shown in the figure below.

Legislation and policy relevant to integrated water management

National

- National Water Initiative (2004)
- Water for the Future

State

- Victorian River Health Strategy (2002)
- Environmental Protection Act (1970)
- State Environmental Protection Policy (Waters of Victoria) 2003
- Local Government Act (1989)
- Building Act (1993)
- Planning and Environment Act (1987)
- State Planning Policy Framework

Regional

- Melbourne's Water Future Strategy (Vic Govt)
- Melbourne 2030 - Metropolitan Planning Strategy (Vic Govt)
- Better Bays and Waterways Plan (Vic Govt)
- Port Phillip and Westernport Regional Catchment Strategy (PPWCMA)
- A Cleaner Yarra River and Port Phillip Bay Action Plan (Vic Govt)

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