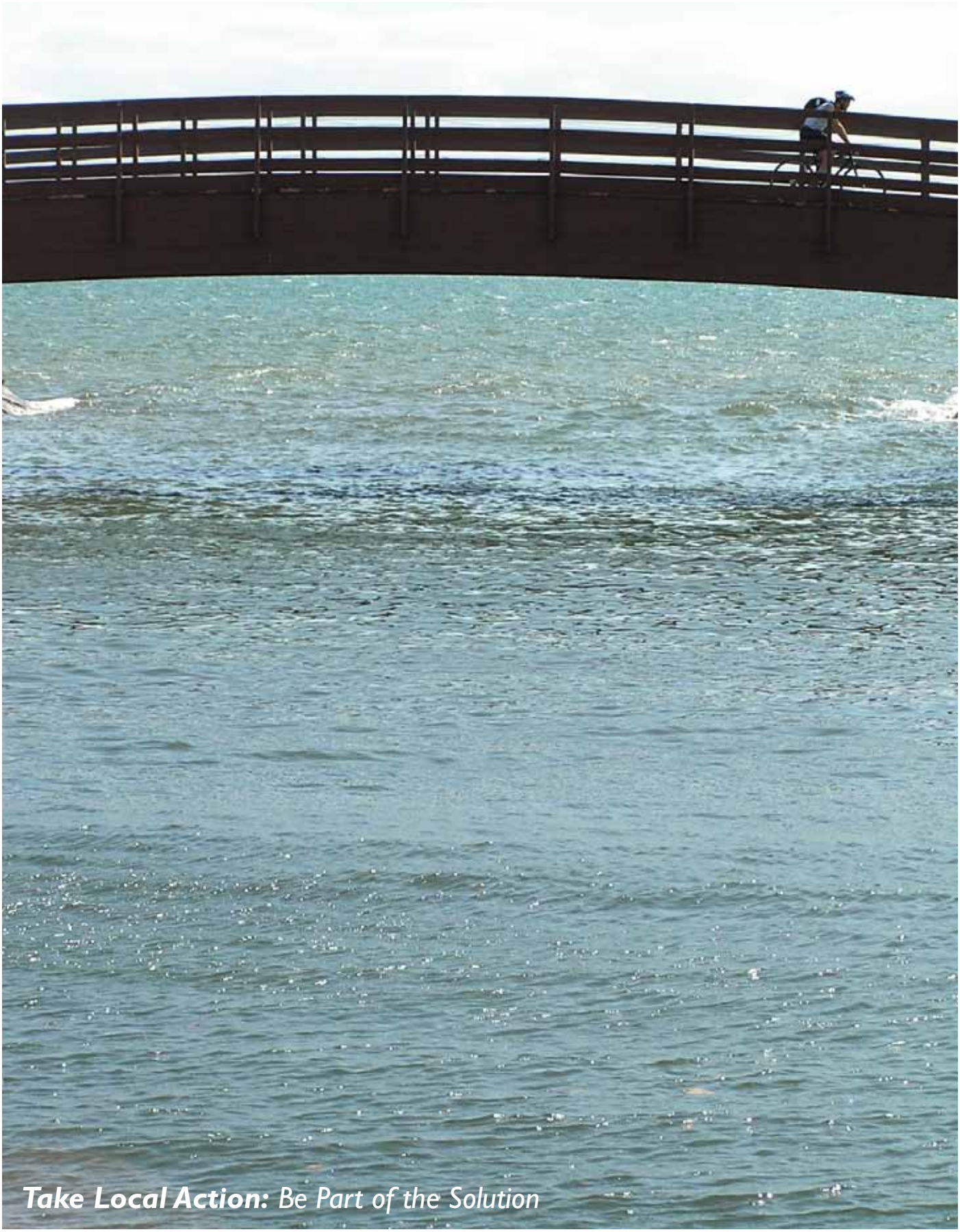
# WATER PLAN

## TOWARD A WATER SENSITIVE CITY



***Take Local Action:*** *Be Part of the Solution*

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Disclaimer
Parts of this document may contain estimates based on assumptions that may be subject to error. Although all care has been taken to verify such estimates readers must not alter their position or refrain from doing so in reliance on them.

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# Mayor's Statement

The Council Plan 2009 - 2013 commits Council to taking real action on climate change and to enhance our city's liveability. This Water Plan is a key component of our plan to meet these commitments. The Water Plan sets 2020 targets and establishes strategies for best practice water management. It looks at ways to increase the use of water sensitive urban design (WSUD) to capture and reuse water – benefiting our parks and streetscapes; and improve our storm water management – benefiting the health of Port Phillip Bay.

The Water Plan highlights that in 2008/09 residential water use placed the greatest demand on mains water supply (71%), followed by commercial (27%) and Council (2%) demands. Although Council's demand represents a relatively small proportion of the city's total water use, we have an important role to play in using water wisely, leading the way in sustainable water management. We will also build strategic alliances and partnerships; advocate for sustainable solutions; and inform and educate the community.

The City of Port Phillip has reduced its water use significantly since 2000 through water restrictions. Unfortunately, this has had an impact on the health of our parks and open spaces. Ongoing water restrictions and changes to the local climate inform our need to transform these water savings into permanent solutions based on efficient, diversified water management.

Our challenge is to implement a sustainable and integrated water management program that saves water, treats municipal pollutants, harvests alternative resources and minimises our impact on our neighbouring councils. To do this we need to create regional partnerships that transcend municipal boundaries. It is critical to continue to work with Melbourne Water, South East Water and other local governments to deliver this strategy. We will also proactively seek federal and state support to assist Council and the community to adapt to the impacts of climate change.

Reducing Council's and the community's use of water, better managing our limited water resources, and supporting and educating our community are Council's ultimate goals. We are committed to preparing the community and our city for a different climatic future.

Frank O'Connor
Mayor, City of Port Phillip

# Executive Summary

The City of Port Phillip has reviewed its water strategy. The Water Plan - Toward a Water Sensitive City sets a new vision for the City of Port Phillip, and Council's approach to transition to a "water sensitive city". The Water Plan sets integrated water management targets for 2020 and outlines five strategies for integrated water management. For Council, the Water Plan is the first significant step in achieving sustainable and integrated water management. The targets and strategies presented in the Water Plan will be reviewed in 2015 as Council assesses and accelerates its implementation efforts.

## Highlights

### What have we achieved to date?

Council has made progress in delivering water conservation and water quality improvement across Council and community assets. Many projects have been implemented as part of the implementation of the Water Management Action Plan 2005, with the following outcomes:

- 71% reduction in mains water use by Council
- 19.4% reduction in mains water use by the community
- 47 ML/yr of stormwater treated through water sensitive urban design
- 14 ML/yr of stormwater harvested through water sensitive urban design.

### Our water and pollutant balance

The Water Plan presents a water and pollutant balance which outlines and quantifies: all water flows throughout the municipality; key stormwater pollutants discharged to Port Phillip Bay; and alternative water sources that can be accessed to meet municipal water needs.

The water and pollutant balance tells us that:

- the municipality uses 8,180 ML/yr of mains water for Council, residential and business use. Most of this is for residential use and a large proportion is discharged as sewage
- 5,100 ML/yr of stormwater is generated across the municipality. Most of this stormwater carries significant pollutant loads, including:
    - 778,000 kg/yr of Total Suspended Solids
    - 1,600 kg/yr of Total Phosphorous
    - 11,400 kg/yr of Total Nitrogen
    - litter, heavy metals, hydrocarbons and other pollutants.
- this stormwater drains directly into Port Phillip Bay, adversely impacting on its ecology and on the tourism and amenity values of Port Phillip's beaches
- Council roads generate a large amount of sediment and solids, and residential and commercial roofs generate a large amount of nitrogen. This should be a key area of focus when planning water sensitive urban design
- there are significant flows from external areas through the municipality of stormwater (20,000 ML/yr) and sewage (46,500 ML/yr)
- there is potential to meet a large amount of potable water demand, particularly for irrigation, with stormwater
- groundwater has limited potential due to salinity levels in most areas.

## Our integrated water management targets

The Water Plan sets new water management targets for 2020 that reflect the water quantity and quality issues relevant to the City of Port Phillip. These are relative to 2000/2001, our base year, and are summarised in Table 1.

*Table 1: Integrated water management targets for 2020 for the City of Port Phillip*

| | |
|---|---|
| Reductions in mains water use | |
| Council | 70% reduction |
| Community | 50% reduction per capita |
| Supply from alternative water sources | |
| Council | 15% of total water use or 50% future projected outdoor water use |
| Stormwater quality reductions in mean annual pollutant loads | |
| Total Suspended Solids | 19% |
| Total Phosphorous | 15% |
| Total Nitrogen | 10% |

These targets will provide a clear focus for Council's water management efforts. Furthermore, these targets can be monitored annually, supporting the tracking of progress toward long-term goals.

## Our integrated water management strategy

To transition to a water sensitive city we view the "city as a catchment". It is a concept that strives to minimise the city's impact and optimise its use of alternative water sources, benefiting both the city and wider catchments.

The Water Plan will achieve its vision through the implementation of five strategies for integrated water management:

- institutionalise water sensitive urban design within Council
- continue to implement water efficiency for parks, gardens and facilities
- increase application of water sensitive urban design in roads, drainage and streetscape works
- implement stormwater harvesting for open space
- facilitate the application of water sensitive urban design by the community.

These efforts will be supported by City of Port Phillip's Water Sensitive Urban Design Guidelines, including a guiding water management hierarchy for projects potentially using potable water.

## Taking action

The Water Plan will be implemented through four key mechanisms:

- an Action Plan, incorporating strategic initiatives, capital and maintenance works, and cross-council, local and regional partnerships. The Action Plan will drive and consolidate action and will be reflected in the implementation plans of each key service unit
- a Capacity Building Program to support Council and the community in delivering water sensitive urban design
- a Communications Program to educate and encourage action across the municipality
- a Monitoring Plan to monitor Council's delivery to targets, track individual project performance, and evaluate the ongoing effectiveness of the Water Plan.

**The Water Plan incorporates the findings and recommendations of an Integrated Water Management Study for the City of Port Phillip, undertaken by EDAW AECOM in 2009.**

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# 1. Introduction

## 1.1 The need for integrated water management

Melbourne's water supply system has traditionally been supported by protected catchments supplying high quality water to nine reservoirs to the north and east of the city. These reservoirs are dependent on rainfall and have been augmented over time as the city has grown. However, after 10 consecutive years of drought, Victoria's river flows and reservoir levels are at all-time lows. Water restrictions have been enforced in dry periods for the last 40 years, and have increased in severity since 2005.

In response to drought and increasing growth, a desalination plant is in development to supply up to 150 billion litres of water to Melbourne and other regional locations. This will meet current urban water requirements. However, as the city continues to grow, with a population of five million forecast for 2026 (DSE, 2008), Melbourne will again need to consider further augmentation of supply.

The significance of climate change on urban water management is an additional concern. As a result of the changing climate and the City of Port Phillip's location on the bay, it is likely that we will experience hotter and drier summers; more intense rainfall events; an increased risk of flooding; more extreme weather events; sea-level rise, coastal inundation and beach erosion (City of Port Phillip, 2007).

Melbourne has reduced its water use significantly through restrictions. However, this has impacted on the health of open-space assets and usable recreational open space. Despite an increased likelihood that restrictions will be lessened, the city needs to find ways to transform the savings achieved through restrictions to permanent solutions based on efficient, diversified water management. The development of such solutions will provide multiple benefits across asset management, environmental protection and community values.

Water quality is similarly vulnerable to threats. Port Phillip Bay is a largely enclosed water body and its ecological health and amenity is impacted by substantial volumes of stormwater carrying pollutants from Melbourne and its surrounds. A study of the bay (CSIRO, 1996) found that nutrient levels were elevated and recommended action to reduce nutrient levels, particularly nitrogen that can lead to algal blooms. The City of Port Phillip is immediately adjacent to Port Phillip Bay and has a strong interest in leading the way in protecting the ecological health of the bay, minimising sediment and nutrient discharge through stormwater as well as litter discharge along its beaches.

To conserve water, protect our local water environment and enhance biodiversity, the sustainable and integrated management of our water resources is required. We must look beyond the regional catchment approach toward localised solutions, and consider stormwater, wastewater and groundwater as sources requiring our management and protection.

*Image: Provided courtesy of Melbourne Water*

Integrated water management is a key climate adaptation measure that can assist Council to:

- deliver more with less
- protect the bay from stormwater pollution
- diversify its water supply options
- manage flooding and benefit from increased stormwater flows arising from climate change.

By managing all aspects of the water cycle – mains water, stormwater, wastewater and groundwater – integrated water management can effectively match available water sources with the most appropriate uses in a fit-for-purpose manner, and reduce demand on external catchments.

It achieves these goals by treating the **"city as a catchment"**, a concept that strives to close the loop on the urban water cycle by minimising the city's impacts and optimising its use of alternative water sources, benefiting both the city and wider catchments.

## 1.2 Aims and objectives of the Water Plan

The Water Plan updates and replaces Council's Water Action Plan 2005 and has been prepared to assist Council implement strategic water actions in line with current best practice integrated water management.

It is a strategic and practical document designed to meet Council and community needs. This includes delivery to Council Plan Strategic Directions and Community Plan Topics related to improved water management.

The objectives of the Water Plan are to:

- review the Local Action Plan 2005 & Council's current approach to water management
- clarify current and future water management challenges and issues of relevance to Council
- provide a water and pollutant balance for the municipality
- outline a vision and principles for integrated water management, including potable water, stormwater, wastewater and groundwater
- set targets for integrated water management across all water sources
- outline an Integrated Water Management Program of Council and community actions, incorporating regional and local partnerships
- outline elements of program support including water project accounting, program monitoring, capacity building and communications planning.

Longer term, the Water Plan will enable Council to develop its own urban water grid. The urban water grid maps the alternative water sources, green infrastructure and community partnerships necessary to become a water sensitive city, and comprises the most appropriate WSUD solutions to respond to municipal water quality and water supply needs. The grid will incorporate stormwater, potable water, wastewater and groundwater management solutions and will be delivered through local and regional partnerships.

### Delivering to Council Plan

The Water Plan will assist Council to implement strategic objectives within Council Plan 2009-2013, including:

- 2.1.2: reduce Council's potable water use
- 2.1.3: facilitate community action in reducing potable water and non renewable energy use
- 2.3.1: improve community understanding and build resilience in responding to the impacts of climate change
- 2.3.2: investigate and manage the impact of climate change on the city's assets and infrastructure
- 4.1.2: maintain and enhance streetscapes for improved amenity, character and sustainability
- 4.2.1: lead in sustainable urban design and development
- 4.3.2: protect, preserve and reinstate local natural environments and open spaces within the city
- 4.3.3: promote increased community action in caring for our environment.

### Delivering to Community Plan

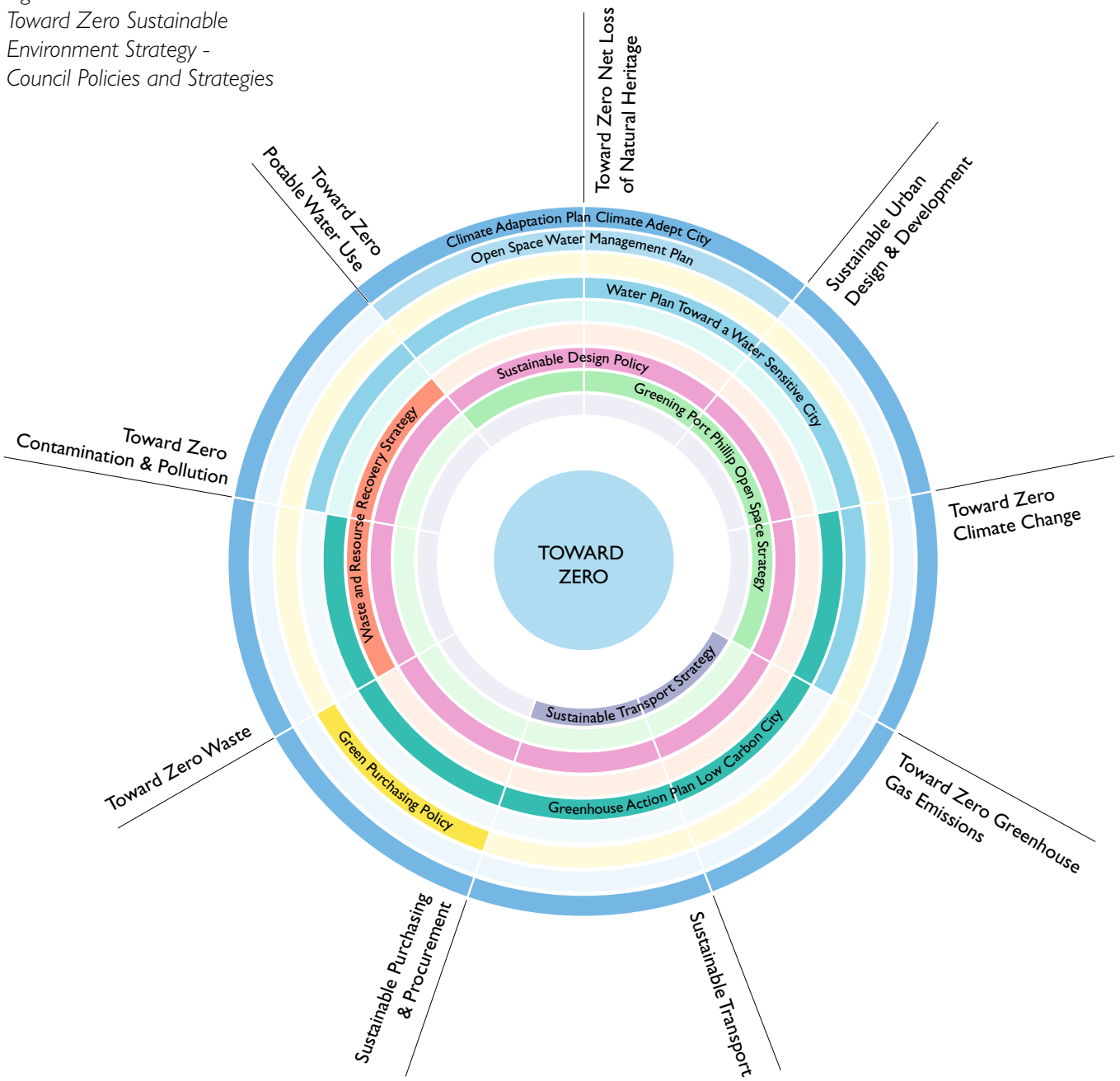
The Water Plan will assist Council to meet the following Community Plan priorities:

- manage water use and reuse, planting and park usage for prolonged drought
- encourage environmentally sustainable design, while advocating for mandatory state controls to reduce greenhouse emissions and water consumption.

## Delivering to Toward Zero

Toward Zero Sustainable Environment Strategy 2007 is Council's overarching environmental strategy, governing the broad direction, action and progress of Council's environmental policies, strategies and actions. It aims to address nine key sustainability challenges, as detailed in Figure 1. The Water Plan will assist Council to target actions to address five of these challenges, namely Toward Zero Potable Water Use, Toward Zero Contamination & Pollution, Sustainable Urban Design & Development, Toward Zero Net Loss of Natural Heritage, and Toward Zero Climate Change.

*Figure 1:*
*Toward Zero Sustainable Environment Strategy - Council Policies and Strategies*



## 1.3 How the plan was prepared

The Water Plan is the outcome of a process commenced in 2008 by Council's Water Taskforce. Following a comprehensive review of the 2005 Water Management Plan, Council commissioned EDAW AECOM to undertake an integrated water management study which included accounting for and modelling of all actions implemented to date. The outcomes are detailed in Section 2.3 and Appendix E.

The integrated water management study concluded by modelling municipal water use and water quality impacts (including a water and pollutant balance), integrated water management targets, and the reductions and investment required to achieve Council objectives. These outcomes are represented within Council's vision for a water sensitive city and the targets and strategies that will support Council action to 2020.

As Council's overarching water management strategy, the Plan does not provide a detailed action plan to 2020. This will be delivered through implementation plans supporting the Water Plan and confirmed annually through Council's capital works program.

*Image: Provided courtesy of Melbourne Water*

# 2. Our Current Approach To Water Management

## 2.1 About the City of Port Phillip

The City of Port Phillip covers 20.62 square kilometres of land adjacent to Port Phillip Bay, including 11 kilometres of beach frontage. As an outfall point for the Port Phillip catchment, and as a popular destination for visitors, a range of internal and external forces impact on the city, its assets and its ability to deliver integrated water management.

This section profiles the City of Port Phillip according to:

- our assets,
- our people,
- our catchment characteristics, and
- our water sources.

### 2.1.1 Our assets

The City of Port Phillip manages a range of assets impacted by or utilising water. These assets are located across the municipality, and include:

- 176 ha of parks and green open space
- 320 ha of roads and 102 ha of footpaths
- 90 facilities, including 35 public amenities
- approximately 55,000 trees, of which 33,000 line major boulevards and streets with the remainder in parks and gardens
- over 250 km of Council drainage.

The City of Port Phillip proactively maintains and renews all assets through its Capital Works and Maintenance Works Programs.

### 2.1.2 Our people

The City of Port Phillip has one of the highest proportions of flats and apartments in metropolitan Melbourne. Lone-person households comprise the largest residential household type at 40%, followed by couples without dependents at 25% and couple families with dependents at almost 15%. 35% are residents aged 25 to 39 years old, our largest age group.

Table 2 summarises predicted population growth across the municipality, and the average annual % change anticipated this year. It provides guidance on potential future increases in residential per capita water use.

*Table 2: Population forecast for 2009, 2012 and 2020*

| Forecast Population | | | | | |
|---|---|---|---|---|---|
| | Forecast Years | | | Change between 2009 and 2020 | |
| | 2009 | 2012 | 2020 | number | average annual % change |
| City of Port Phillip Total | 92,657 | 96,384 | 104,993 | 12,336 | 1.14 |

*(Source: Port Phillip City Council population and household forecasts, forecast.id 2006)*

The population of the City of Port Phillip was estimated at 80,552 in 2000/01. A population of 92,657 is estimated for 2009, an increase of 15% on base year. The population is forecast to grow to 96,384 by 2012 and 104,993 by 2020 (forecast id, 2001). This represents a relative increase of 15%, 207% and 30% over census figures for 2001.

Major growth is anticipated by 2016, with the largest gains expected in key areas of Port Melbourne and along St Kilda Rd. Significant but smaller gains are also expected in St Kilda, South Melbourne and East St Kilda, with more moderate increases in Elwood-Ripponlea and Middle Park-Albert Park.

### 2.1.3 Our catchment

The City of Port Phillip is part of the Yarra catchment to the north and the Elster Creek catchment, an inner urban Melbourne catchment lying adjacent to the south of the Yarra catchment. The City of Port Phillip is low lying, flat, coastal swamp land that has been largely developed since the early days of European settlement. Port Phillip no longer has any natural waterways, with water conveyed to its receiving waters primarily through stormwater drainage. Stormwater from external catchments enters the municipality from Elster Creek and the Byron St, Cowderoy St, Shakespeare Grove and St Kilda Town Hall main drains (EDAW AECOM, 2009).

The three receiving waters associated with the municipality are the Albert Park Lake, Elwood Canal - Elster Creek, and Port Phillip Bay, with the predominant feature the city's extended foreshore and beaches. Governance arrangements and known data related to these receiving waters are described as follows:

- Albert Park Lake covers 45 hectares and is 1-2 metres deep. It is naturally filled with stormwater from surrounding roads, and drains and overflows to Port Phillip Bay via Cowderoy Street Drain. The lake is part of 225 hectares of parkland managed by Parks Victoria. Albert Park's landscape and topography has been artificially modified over time and contains four wetland areas, two vegetation communities and islands that provide habitat for wildlife including wetland and migratory birds. Lake water is high in nutrients and experiences issues with pollution, litter and silt, consequently Parks Victoria undertakes structural pollution control and water quality monitoring. The City of Port Phillip works with Parks Victoria on all issues requiring common management, and currently accesses 2 ML of the lake for irrigation of Council trees and plants.

- Elwood Canal – Elster Creek: Elster Creek is a tributary of Port Phillip Bay, stretching from Bentleigh to Elwood, where it runs into the bay via the Elwood Canal. It is a highly modified creek, with the constructed outlet draining a previously extensive wetland area adjacent to the bay, and development of the floodplain has had a major impact on the health of the creek. Its condition has been informally rated as very poor (Melbourne Water, 2005). The City of Port Phillip works with the City of Bayside to access 1 ML of water from this catchment, taken from Elsternwick Park lake.

- Port Phillip Bay: of the total covering almost 2000 km2, the City's immediate receiving environment incorporates 11 km of beaches, piers and jetties and associated bay waters, providing significant recreational opportunities to visitors and residents.

Figure 2 outlines the hydrological sub-catchments relevant to Port Phillip. There are 20 sub-catchments, 5 of which drain to the Yarra River while the remainder drain directly to the bay or via the lower reaches of Elster Creek. Stormwater enters the bay from 34 Council outfalls, 5 Melbourne Water drains and the Elwood Canal. The Elster Creek catchment is 7,784 ha, almost four times the size of the City of Port Phillip (EDAW AECOM, 2009).

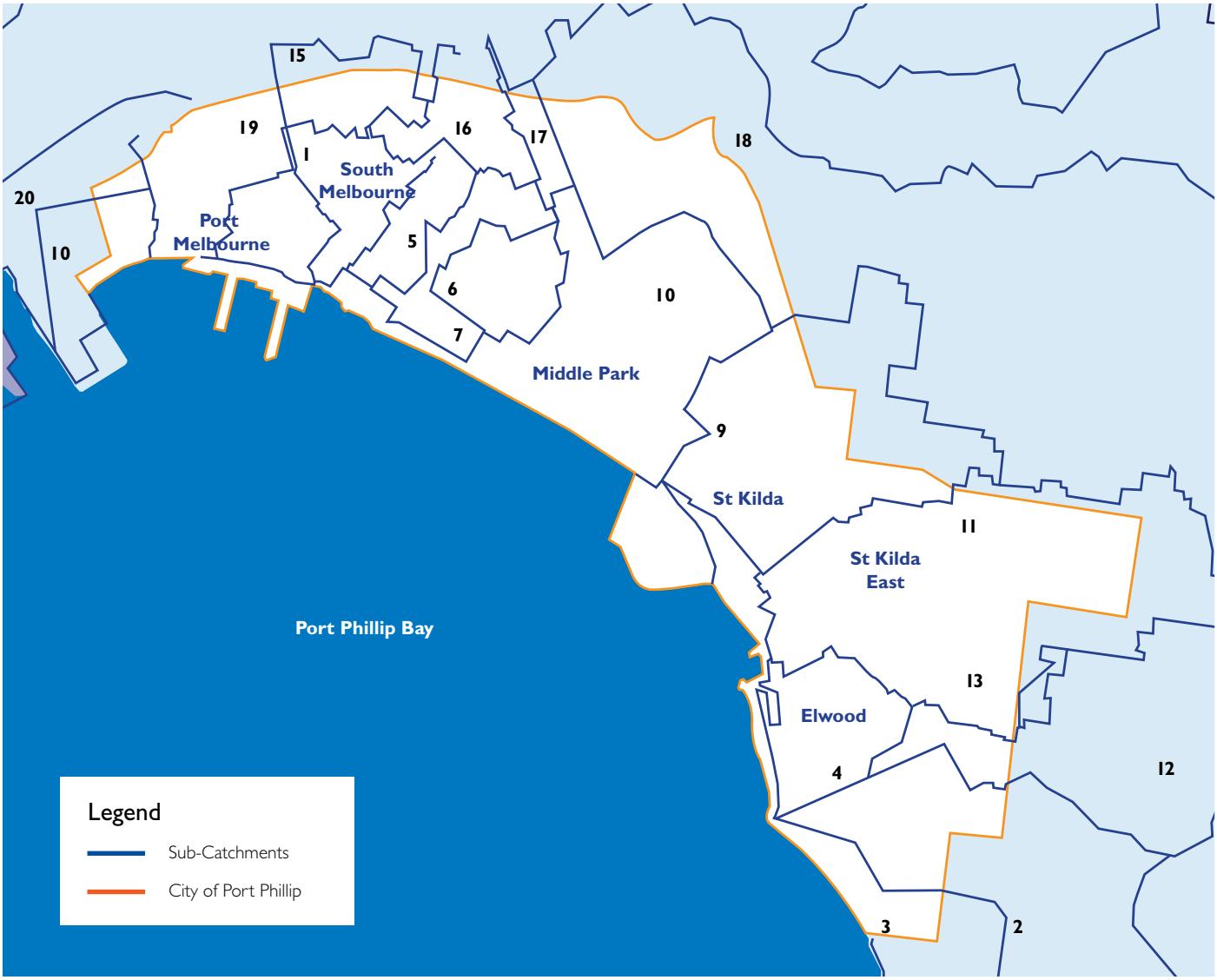



*Figure 2: City of Port Phillip Map with Melbourne Water's hydrological subcatchments (source: City of Port Phillip, 2009)*

| ID | Sub-catchment name | Area (sq km) |
|---|---|---|
| 1 | Princess Street M D | 0.78 |
| 2 | Elsternwick M D | 3.69 |
| 3 | Elwood Diversion Drain | 1.13 |
| 4 | Elwood Canal | 1.05 |
| 5 | Esplanade West M D | 0.52 |
| 6 | Richardson Street M D | 0.73 |
| 7 | Cruikshank Street M D | 0.69 |
| 9 | Cowderoy Street M D | 3.49 |
| 10 | Council Drainage Direct To Bay | 7.34 |

| | | |
|---|---|---|
| 11 | Shakespare Grove M D | 4.42 |
| 12 | Byron Streer M D | 5.17 |
| 13 | St. Kilda Town Hall M D | 0.83 |
| 14 | Yarra River (Mouth To Merri) | 20.84 |
| 15 | Gittus Street M D | 0.75 |
| 16 | Johnson Street M D | 0.68 |
| 17 | Ferrars Street Drain | 0.27 |
| 18 | Hanna Street M D | 4.22 |
| 19 | Rosny Street M D | 1.15 |
| 20 | Council Drainage Direct To Bay | 1.14 |

### 2.1.4 Our water sources

*The City of Port Phillip's urban water grid consists of four key water sources:*

| Potable water | | |
|---|---|---|
| What is it? | Who manages it? | What are the key issues and opportunities? |
| Potable water is currently the principle source of water for Melbourne. It is taken from catchments covering more than 140,000 hectares across nine major storage reservoirs with a capacity of 1,773,000 million litres (Melbourne Water, 2009).<br><br>Melbourne has augmented supply as the city has grown, with its last augmentation the completion of the Thomson Reservoir in 1983.<br><br>Potable water is currently inexpensive as externalities are unaccounted for and the supply system was heavily subsidised by government during establishment. | Melbourne Water looks after Melbourne's water supply catchments.<br><br>South East Water is responsible for the supply and delivery of potable water across the City of Port Phillip. | Potable water is a limited resource, with reduced flow to catchments and increasing urban growth increasing its scarcity. Our catchments are increasingly vulnerable to the impacts of climate change, including limited supply and reduced catchment water quality. After 10 consecutive years of drought, Victoria's river flows and reservoir levels are at all-time lows. Water restrictions have been enforced in dry periods for the last 40 years, with permanent water saving rules introduced in 2005. Furthermore, climate change will continue to reduce runoff due to higher temperatures and lower soil moisture levels.<br><br>Whilst the traditional approach has been to increase the size of our regional catchments, any increase will have significant impacts on the natural environment and biodiversity. A desalination plant is underway to meet Melbourne's increasing water needs.<br><br>It is a primary source of water for Melbourne and its use can be reduced through demand management and use of alternative water sources. |

| Stormwater | | |
|---|---|---|
| What is it? | Who manages it? | What are the key issues and opportunities? |
| Stormwater is the water conveyed by hard surfaces such as roads, buildings and drainage to our waterways and the bay. It is also conveyed through the City of Port Phillip from other upstream sources.<br><br>Stormwater carries pollutants from these hard surfaces, conveying more pollutants and higher flows following storm events.<br><br>Stormwater is an abundant resource that can be treated and captured for reuse. Its use has multiple water cycle benefits, with the flow-on effect of improving the quality of our waterways, reducing stormwater flows to our drainage and conserving mains water.<br><br>Roof runoff is considerably cleaner than other alternative sources of water and requires minimal treatment. | Stormwater is currently not regulated and its use should be considered in partnership with Melbourne Water. | Improving the quality of stormwater entering the bay is important for maintaining an aesthetic and clean recreational environment for visitors and residents, and a sustainable habitat for flora and fauna. Stormwater treatment provides services to the environment, and stormwater harvesting provides increased resilience to climate change<br><br>Stormwater requires treatment to remove pollutants to the environment. Current best practice targets for stormwater quality improvement are outlined within the Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO, 2006) and are as follows:<br><br>• 80% reduction in Total Suspended Solids (grit, tyre/car residue)<br><br>• 45% reduction in Total Phosphorus (fertiliser, detergents, leaf litter, organic matter)<br><br>• 45% reduction in Total Nitrogen (air-borne pollutants, fertiliser, leaf litter, organic matter)<br><br>• 70% reduction in litter.<br><br>Stormwater infrastructure can not always cope with higher flows following storms, increasing the frequency of flooding and renewal, requiring significant redesign to cope with the effects of climate change.<br><br>Decentralised systems requiring minimal infrastructure and maintenance provide local water conservation and ecosystem protection benefits, with appropriate uses including indoor demands such as toilet flushing and/or hot water, and irrigation demands. |

| Wastewater | | |
|---|---|---|
| What is it? | Who manages it? | What are the key issues and opportunities? |
| Wastewater is an abundant water source comprising household, commercial and industrial greywater and blackwater. It is treated at wastewater treatment plants prior to discharge to the environment, but is increasingly being treated to much higher standards for urban reuse through third-pipe systems. Wastewater quality is largely dependent on water users, and the community plays a strong role in maintaining it at a quality that is treatable, through trade waste agreements and responsible disposal of chemicals and other hazardous materials.<br><br>Its use provides multiple water cycle benefits, including water conservation and minimising wastewater discharges to receiving waters. | South East Water manages and maintains the sewerage network, and is involved in any major local wastewater treatment and water recycling schemes.<br><br>Melbourne Water treats most of Melbourne's sewerage and provides recycled water for non-drinking purposes. South East Water is the network manager.<br><br>City of Port Phillip is responsible for ensuring greywater schemes run by households have the appropriate EPA approvals and can be run without major risks to human health. Council also plays a role in providing the relevant planning approvals for more complex blackwater treatment systems, such as sewer mining or small wastewater treatment plants, which must be regulated for health and environmental risks. | As technology improves, wastewater can assist the City of Port Phillip to increase its use of alternative water sources, adding an additional water resource to the urban water grid, and reducing our reliance through reuse and recycling. It needs to be appropriately managed to protect both human health and the contamination of groundwater, stormwater and the bay. Furthermore it requires high energy expenditure to achieve the level of treatment required to meet end use water quality requirements.<br><br>Whilst the City of Port Phillip is not responsible for managing centralised wastewater treatment or the sewer network, it does have a role in enabling decentralised wastewater treatment as a major water user for open space and a responsible authority for community action. |

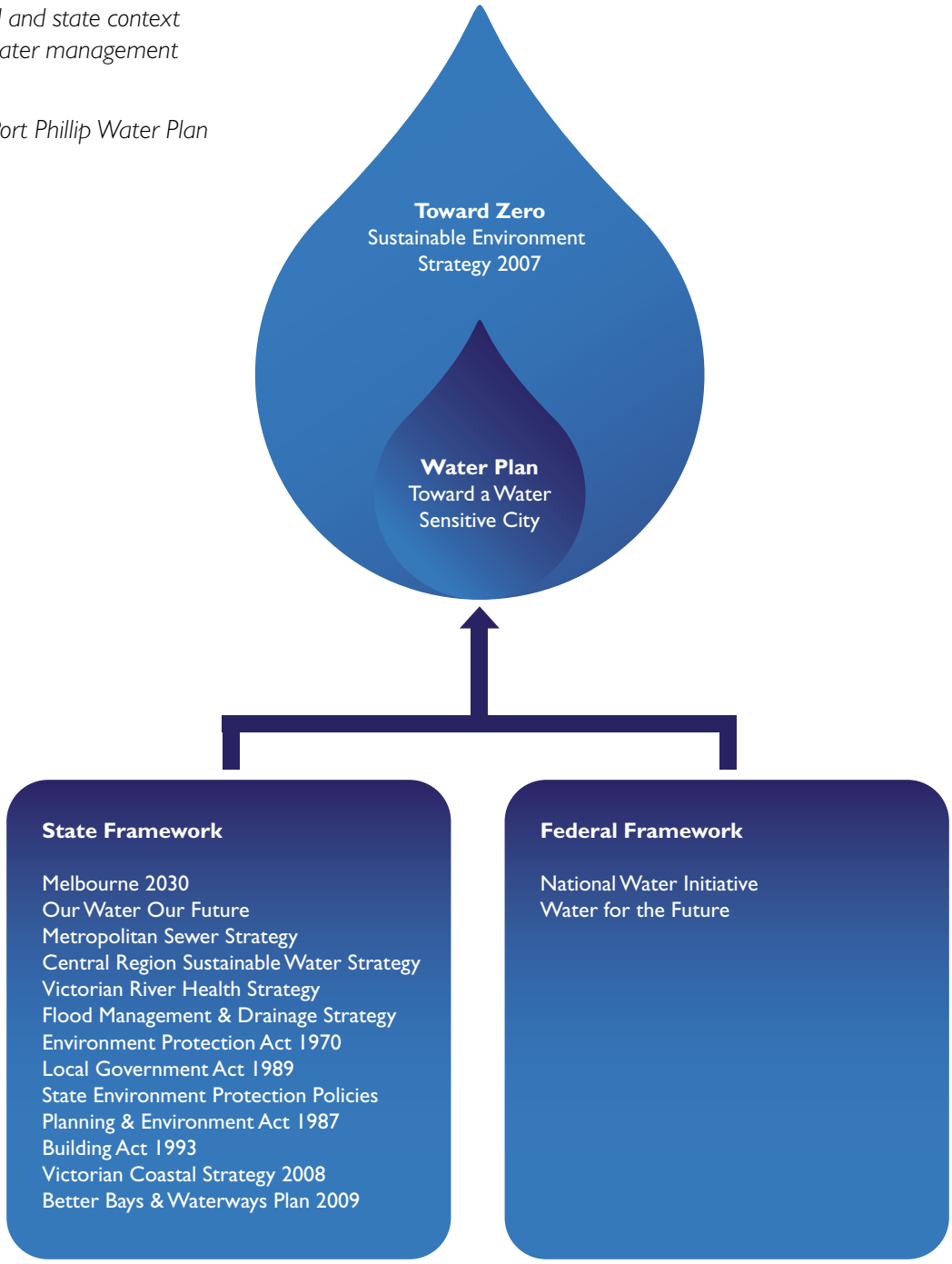
| Groundwater | | |
|---|---|---|
| What is it? | Who manages it? | What are the key issues and opportunities? |
| Groundwater is an important part of the water cycle. Surface water recharges the water table and deeper unconfined aquifers and there is potential for groundwater to be used as a source of water, although its use has been limited to date (EDAW AECOM, 2009).<br><br>The Melbourne Groundwater Map (DSE & Smart Water Fund, 2009) provides an overview of groundwater resources around Melbourne, including the City of Port Phillip. | The Environment Protection Authority is the main body responsible for groundwater quality management in Victoria.<br><br>Groundwater use is managed by Southern Rural Water through a system of permissible volumes, licensing private bore construction and groundwater use. However, its extraction is not metered and there is limited information on groundwater recharge required for sustainable use of the aquifer.<br><br>The City of Port Phillip has shared responsibility for the management of contamination, as encountered in contaminated land. Consequently, where Council land is known to be contaminated, management plans are in place to protect groundwater and users of the space. | Most of the City of Port Phillip is located on unconsolidated quaternary alluvium deposits with a very low storage potential. Soils information indicates that the area surrounding Albert Park Lake and to the east is located on tertiary sands while there is a tertiary basalt area underlying part of South Melbourne. The Fitzroy St area is located on Silurian mudstones, siltstones and sandstones. The potential for groundwater extraction and aquifer storage and recovery (ASR) is therefore considered to be limited across the municipality (EDAW AECOM, 2009).<br><br>Due to the proximity of the city's groundwater aquifer to the bay, ongoing unmonitored extraction can result in increased salinity as water from the bay enters the aquifer. Furthermore, ongoing application of saline groundwater can impact on land and can be ill suited to crops. Groundwater can become polluted from untreated stormwater, burst sewerage, and leaching from landfills.<br><br>The discharge of groundwater to sewer is an emerging issue, as it contributes total dissolved solids to sewer flows conveyed to Melbourne's wastewater treatment plants. These solids have become a significant issue in the treatment and provision of recycled water. Discharges of groundwater to sewer (i.e, through the pumping of groundwater from basements) should be eliminated/reduced where possible. |

## 2.2 The strategic context for water management

There is significant support for integrated water management within local, state and federal legislative frameworks and programs. The Water Plan has been developed within these contexts, which are summarised in Figures 3 and 4.

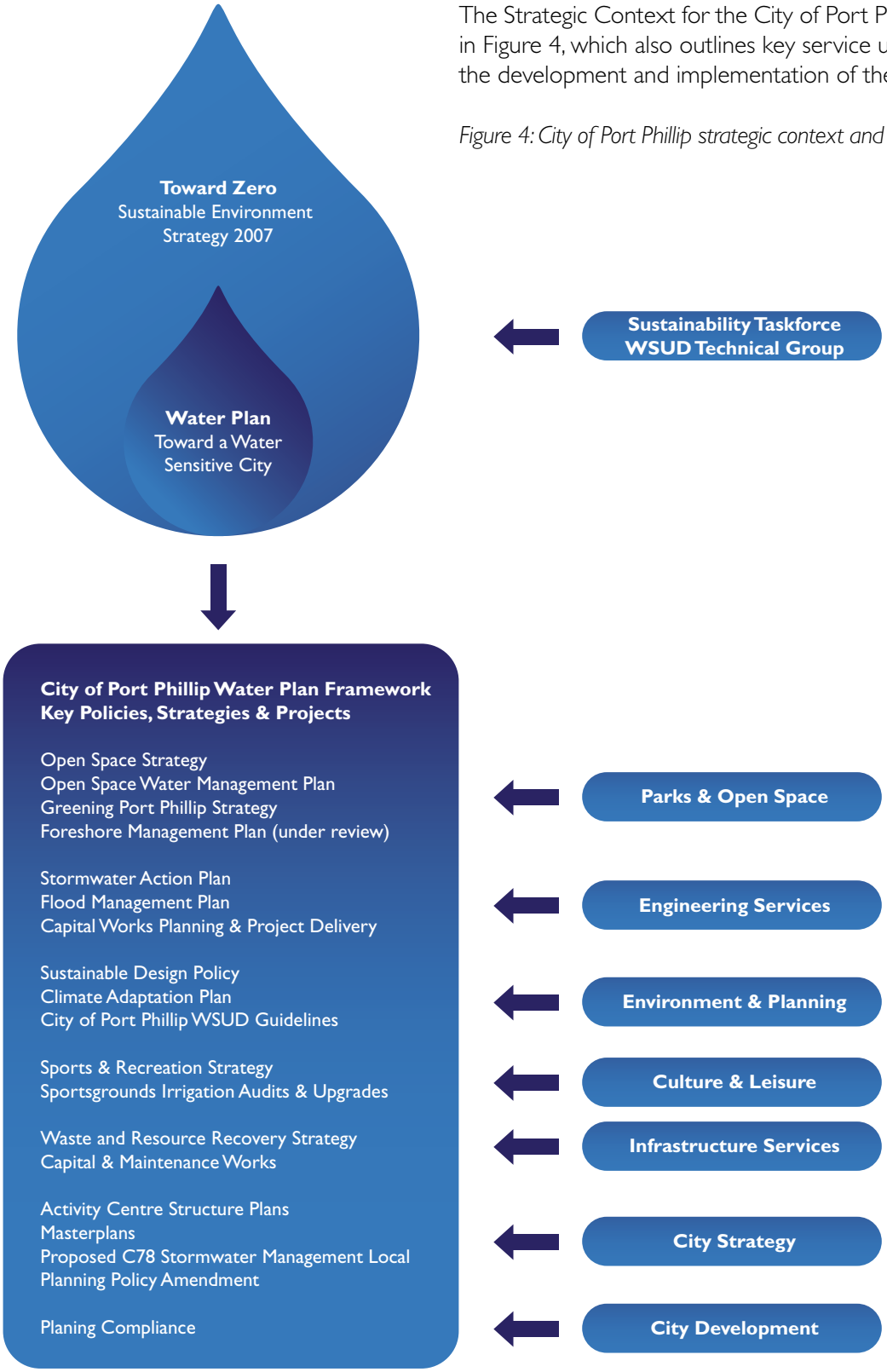
*Figure 3: Federal and state context for integrated water management*

*Source: City of Port Phillip Water Plan (2009 Draft)*



The Strategic Context for the City of Port Phillip is detailed in Figure 4, which also outlines key service units involved in the development and implementation of the Water Plan.

*Figure 4: City of Port Phillip strategic context and key service units*



The Water Plan is further supported by stakeholders delivering significant capacity building and funding programs to Council as follows:

- Melbourne Water Living Rivers Stormwater Program
- South East Water Business Water Conservation Program.

Key organisational stakeholders supporting the development and delivery of this Water Plan are:

- **Sustainability taskforce**, comprising senior management and coordinators from relevant departments across Council. A key purpose of the taskforce is to support the implementation of the Water Plan for the City of Port Phillip. The taskforce meets monthly.
- **WSUD technical group**, comprising Council's most technically skilled officers in WSUD. The technical group provides a referral service to Council staff engaged in delivering WSUD, providing support in the development of business cases, conceptual and functional designs, and project delivery and maintenance.
- **City of Port Phillip staff**: responsible for commissioning, delivering and maintaining projects with WSUD components across a range of key service units, including Place Management, Parks & Open Space, Infrastructure Services and Building Services.
- **City of Port Phillip contractors:** responsible for the construction and delivery of projects impacting on Council's integrated water management.

## 2.3 Key water management achievements 2005-2010

A comprehensive review of the City of Port Phillip's Water Management Action Plan 2005 demonstrates significant achievements across Council and community action. All actions committed to were achieved, with any ongoing action mapped and tracked as part of the current action plan.

The Water Management Action Plan 2005 focused primarily on water conservation across buildings & capital works, parks & open space, strategy & policy, and education. However, significant action has also been delivered in other areas of integrated water management such as water quality improvement through the implementation of water sensitive urban design (WSUD) and Council is continuing to increase its efforts in this area.

The review demonstrates that Council is making progress in working towards integrated water management, and has delivered significantly more outcomes than detailed in the initial plan. Council has gathered data associated with each project to model the benefits, details of which are contained in Appendix E. All projects are tracked in this manner in order to determine Council's progress to targets.

Key achievements and actions from 2005 to 2010 are summarised in Table 3. These achievements place Council in a strong position to escalate its efforts in the implementation of water sensitive urban design.

*Table 3: Key water management achievements 2005-2010*

| Action area | Key actions | Outcome |
|---|---|---|
| Development of environmental strategy | Development of Toward Zero Sustainable Environment Strategy 2007 - the overarching environmental policy and strategic framework for Council and community action | Sets targets for community and Council water conservation, and increased use of water sensitive urban design |
| Implementation of WSUD in public open space | 2005<br>• Howe Parade raingardens<br>2007/08<br>• Development of water conservation display beds at St Kilda Botanic and St Vincent Gardens<br>2008/09<br>• St Kilda Promenade harvesting of stormwater and outdoor water use (fountains/showers) for irrigation<br>• Fitzroy St raingardens<br>• Graham St passive irrigation of nature strips<br>• Lagoon Lane swales<br>• Elwood Foreshore – swale on eastern border of northern carpark for treatment & irrigation of plantings<br>2009/10<br>• Development of Open Space Water Management Plan<br>• Six stormwater harvesting assessments completed for JL Murphy Reserve, Alma Park, Catani Gardens, O'Donnell Gardens, St Kilda Botanical Gardens and Elwood Park/ Elsternwick Park<br>• Completion of concept design of the Elsternwick wetland in partnership with Bayside City Council<br>• Carlisle St raingardens<br>• Coventry St raingardens<br>• St Kilda Rd, Lindsay Avenue & Clarke Reserve passive irrigation of nature strips and trees | Increased amenity of public open space utilising alternative water sources<br><br>Localised water quality improvements to stormwater discharged to bay<br><br>Increased understanding of the potential for larger scale stormwater harvesting for open space |
| Implementation of WSUD in Council facilities | • Depot: placement of 7 rainwater tanks for street sweepers and vehicle cleaning (154kL)<br>• Placement of 120 kL rainwater tanks at St Kilda Town Hall for toilet flushing<br>• South Melbourne Market installation of waterless urinals across all public amenities.<br>2009/10<br>• Implementation of water efficiency retrofits at numerous Council facilities through Council's Building Efficiency Program | Increased water efficiency and use of alternative water sources across our facilities |

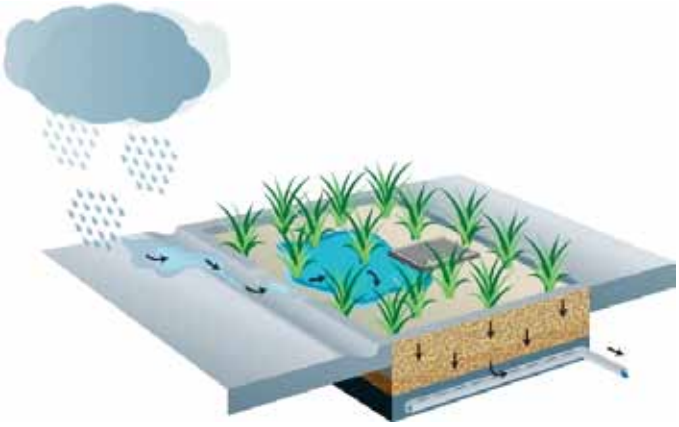
*Table 3: Key water management achievements 2005-2010*

| Action area | Key actions | Outcome |
|---|---|---|
| Implementation of WSUD by the community | Increased voluntary participation in the Sustainable Design Assessment in the Planning Process (SDAPP) program to 40% in 2008/09<br><br>Inner Melbourne Action Plan (IMAP) Action 9.3: Development of a common stormwater management (WSUD) local planning policy amendment and WSUD Guidelines with the Cities of Melbourne, Stonnington and Yarra. In 2009/10 this amendment was approved for exhibition by the Minister of Planning.<br><br>Growing number of private best practice WSUD, including:<br>• K2 Apartments, East St Kilda: rainwater harvesting<br>• Toyota Green, Port Melbourne: raingardens<br><br>Commonwealth funded community water grants for rainwater tanks at schools | Around three times as many planning applications voluntarily participated in SDAPP in 2008 compared to 2005<br><br>Successful ongoing use of the Sustainable Design Scorecard supporting SDAPP<br><br>The development of the proposed Port Phillip C78 Stormwater Management (WSUD) Amendment, with exhibition planned for 2010/11.<br><br>Increasing community efforts in WSUD |
| Open space management | Enhanced irrigation practices and water sensitive management of open space, including:<br>• installation of dripper irrigation lines for mature trees<br>• auditing of all sportsground irrigation systems in 2008/09<br>• auditing of all open space irrigation systems in 2009<br>• implementation of irrigation upgrades at Alma Park, Peanut Farm Reserve, Elwood Park, JL Murphy Reserve and St Vincent Gardens.<br><br>As part of the Inner Melbourne Action Plan:<br>• undertook feasibility of sourcing alternative water sources for five Council parks, including Elwood Park and Alma Park<br>• developed water conservation and reuse toolkit for open space. Includes case studies from IMAP Councils, Parks Victoria and Royal Botanical Gardens | Key contributor to Council' achieving 71% reduction in potable water use in 2008/09 |
| Erosion and sediment control | Street cleaning practices, machinery maintenance<br>• Installation of slurry vacuums on all concrete saws | Improved delivery of services by Council's contractors |

| Action area | Key actions | Outcome |
|---|---|---|
| Informing and educating the community | • South East Water Showerhead Exchange partnership project<br>• Sustainable Living at Home (SLAH) program, including water management component<br>• Enviro Events, including water topic delivered to community since 2004<br>• Annual delivery of Butt Free City Campaign and Port Phillip's "Summer in the City" litter campaign<br>• 2008/09 delivery of state government-affiliated "Don't be a tosser" litter campaign<br>• Ecocentre actively delivering community engagement and outreach programs<br>• 2008/09 and 2009/10 delivery of a Green Business program (also known as VIC 1000) at the South Melbourne Market<br>• Delivery of a range of new community programs incorporating water management, such as Climate Challenge 1000, Enviro Events and Socs & Blocks<br>• Delivery of Council's Climate Conversations and local action planning sessions, focused on facilitating community climate action, including the implementation of WSUD | Over 2468 showerheads exchanged since 2007<br>Improved understanding of water conservation and water quality:<br>• SLAH delivered a total of 10 times<br>• Enviro Events targets over 250 people per annum<br>• successful delivery of all litter campaigns<br>• over 38 businesses engaged in the Green Business Program at the South Melbourne Market<br>• successful delivery of first round of Socs & Blocks program targeting apartment blocks<br>• over 200 community members engaged in Council's Climate Conversations delivered between March and June 2010<br>Increasingly more active community groups |
| Litter management and waterway health | 2009/10<br>• Participated in Lower Yarra Litter Strategy, in partnership with Melbourne Water and the Cities of Melbourne, Yarra and Boroondara | Reduced litter loads and improved local water quality through structural and educational measures, in particular the O'Donnell Gardens Litter Campaign run over the 2009/10 summer. |

## What is water sensitive urban design?

WSUD embraces a range of measures that are designed to avoid or at least minimise the environmental impacts of urbanisation. WSUD includes water efficiency fixtures, rainwater tanks, stormwater treatment systems, stormwater harvesting systems and wastewater treatment systems. WSUD can be integrated into the capital works program through the likes of infrastructure upgrades, streetscape renewal, piping reconfigurations and facility redevelopment, and can be delivered through large scale or smaller, localized treatments. WSUD allows for integrated water management, where issues of water supply and water quality are addressed and embedded into the urban landscape.



*Rainwater tanks*

*Raingardens – Fitzroy St*

## 2.4 Our water and pollutant balance

Integrated water management can only be achieved with a sound knowledge of water sources, their relationships, impacts and threats. A water and pollutant balance helps us to better understand the City of Port Phillip's water cycle, including:

- all water entering and exiting the municipality
- stormwater pollutants generated within the municipality on an annual basis, being discharged to Port Phillip Bay
- alternative water sources that can be accessed to meet municipal water needs.

Our water and pollutant balance is summarised in Figure 4. It is a snapshot in time, capturing our best understanding of these inflows and outflows for 2007/08, and provides insight into different end uses and potential alternative sources that could be matched to corresponding demands. For further details on the development of this balance please refer to Appendix B. For further details on implemented Council and community WSUD projects considered in the preparation of the balance please refer to Appendix D.

### Reading the water balance

*The water balance is separated into Council, residential and commercial demands and different sources of urban runoff and discharge such as stormwater, wastewater and groundwater.*

*The water balance shows how different sources of water are used as they flow towards the bay.*

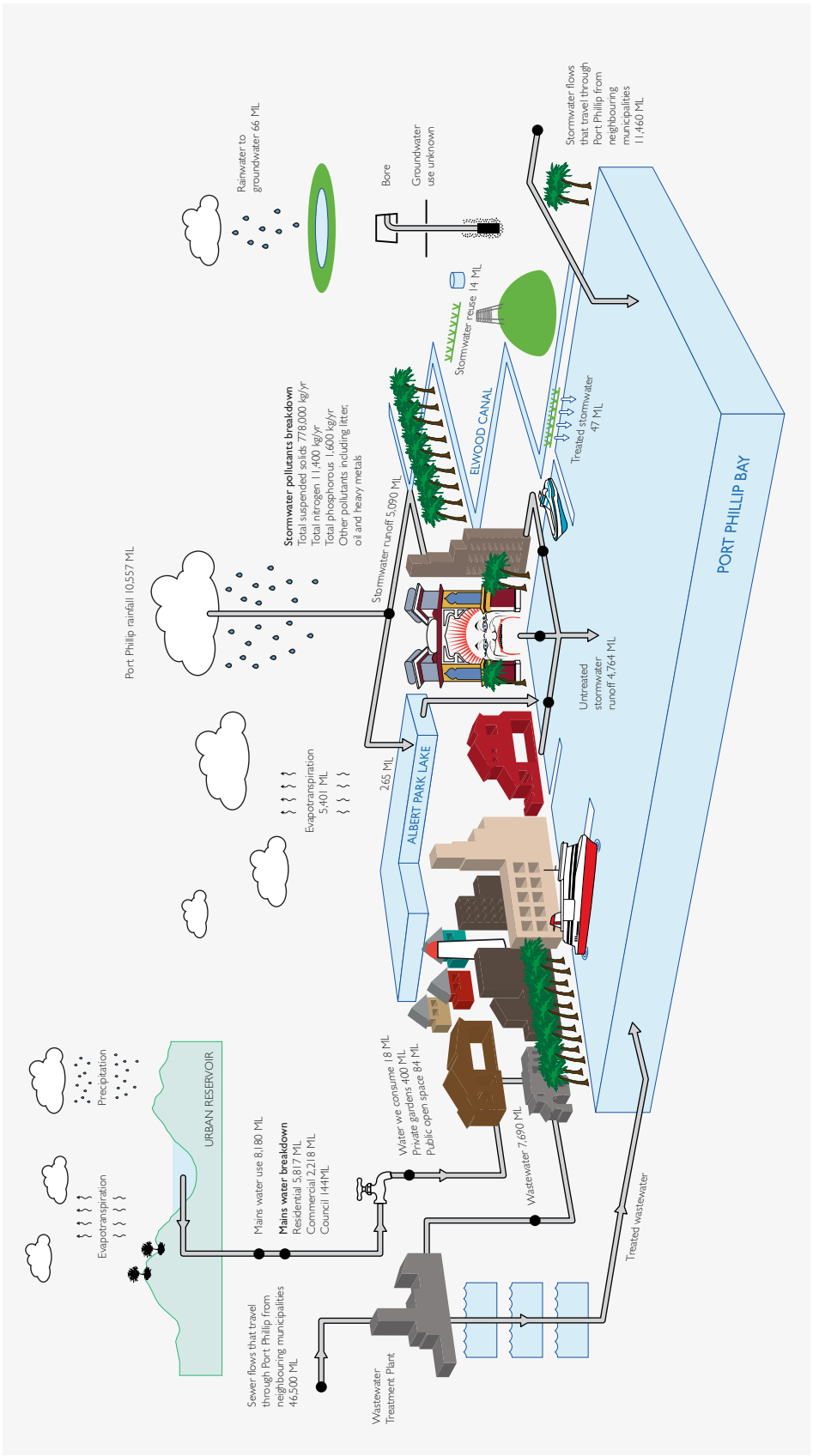



*Figure 5: Water balance for the City of Port Phillip 2007/08*

## The water balance explained…

### How much rain do we get and where does it go?

- Mean annual rainfall across the municipality is 10,557 ML Of this, 5,090 ML is discharged as surface runoff and 5,401 ML is returned to the atmosphere via evapo-transpiration processes, with an additional 500 ML evaporation from Albert Park lake.
- The municipality is highly impervious (61%) and only 66 ML of the annual rainfall flows to groundwater recharge.

### Where do we use our water?

- Mains water consumption can be broken up into Council residential and non-residential use. In 2007/08 residential practices placed the greatest demand on mains water supply (5,817 ML/yr), followed by commercial (2,218 ML/yr) and Council (144 ML/yr) demands. Total municipal consumption was approximately 8,180 ML/year.
- A total of 484 ML/yr of mains water is estimated to be used for outdoor purposes, including 400 ML/yr for residential garden watering and 84 ML/yr for irrigation of public open spaces and sportsfields. It is estimated that very little water is actually consumed, with most water discharged to sewer from toilets, bathrooms, kitchen and laundry in households, and from commercial use. These figures reflect conditions with water restrictions and are much lower than are considered desirable to ensure the long-term health of parks, gardens and sporting fields.
- A more detailed discussion of current Council and community water use follows this summary.

### How much stormwater do we currently harvest?

- It is estimated that we currently harvest approximately 14 ML of stormwater a year through Council and community water sensitive urban design projects. This water is used to irrigate landscape via raingardens, passive irrigation techniques and direct application to trees and open space. Please refer to Appendix D for a more detailed account of these benefits and Appendix E for details on projects contributing to this total.

### How much stormwater do we treat before it is discharged to the bay?

- It is estimated that we currently treat approximately 47 ML of stormwater prior to it reaching the bay. This is undertaken through Council and community water sensitive urban design projects implemented to date. Please refer to Appendix D for a more detailed account of these benefits and Appendix E for details on projects that contribute to this total.
- Stormwater treatment and harvesting measures delivered to 2007/08 have reduced sediment loads by 1.2% and nitrogen loads by 0.5%.

### How much wastewater flows through the municipality?

- The majority of mains water is discharged to sewer as wastewater (7,678 ML/yr), assuming sewage discharge factors appropriate for conditions with water restrictions. It is estimated that these sewage flows are a decrease of 2.3% on 2000/01 levels.
- 46,500 ML of additional wastewater passes through the municipality through the Melbourne sewerage network.

### How much roof runoff is generated by residents, businesses and other private sites?

- A total of 2,466 ML/yr of roof runoff is generated across residential, commercial and other sites providing an abundance of water that could be harvested and used for garden irrigation, toilet flushing, hot water and laundry purposes.

### What alternative sources can we access to meet our needs?

- Rainwater, stormwater and wastewater offer abundant flows that could assist us to meet some of our water needs. Private impervious areas and roads are good sources of runoff that could potentially be harvested to provide a valuable supply. Rainwater is the most accessible water source with stormwater and wastewater access limited by depth of sewer and drainage infrastructure.
- **Rainwater:** 2,227 ML/year or 44% of total annual rainfall discharged to roofs is potentially available for harvesting.
- **Stormwater:** 1,650 ML/year or 32% of total annual rainfall discharged as surface runoff is potentially available for harvesting from Council roads.
- **Wastewater:** A proportion of wastewater flows generated by and passing through the municipality is available to harvest. Greywater is a lower risk source of water that can be used to irrigate gardens or flush toilets.

### What about groundwater?

- Most of the City of Port Phillip is located on unconsolidated quaternary alluvium deposits with a very low storage potential. The city's groundwater is located in an aquifer deemed of lesser significance than other aquifers, consequently volumes are largely unknown.

### 2.4.1 Where do we use our water?

Mains water consumption can be broken up into Council and community (residential and non-residential use). Council and community water use is reviewed to identify current usage patterns and savings made from 2000/2001.

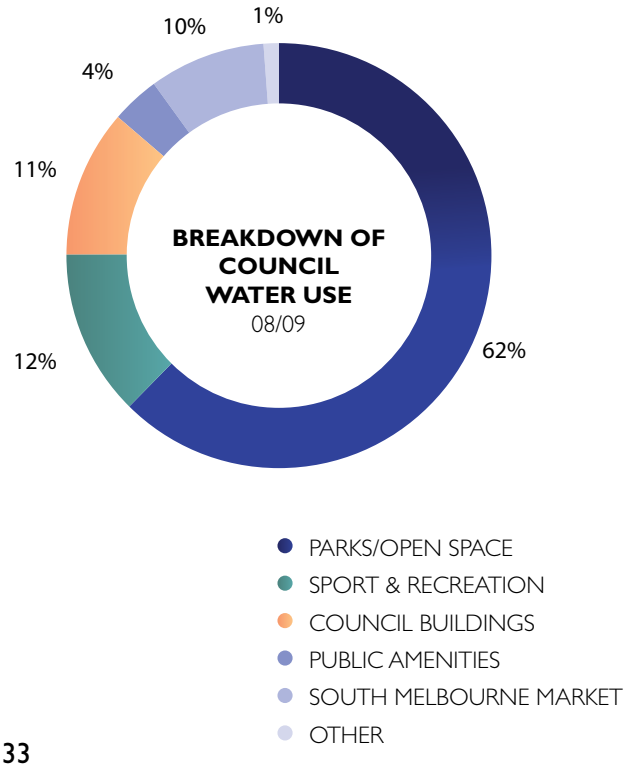
#### 2.4.1.1 Council water use 2000-2009

##### Overview

Council uses water for multiple purposes, including parks and open space, sports & recreation facilities, Council buildings (including aged care facilities, child care centres, community centres, depots, libraries, office accommodation and public housing), public amenities and the South Melbourne Market.

Figure 6 provides a breakdown of Council water use for 2008/09, demonstrating that the largest user of water is parks & open space, representing approximately 60% of Council demand on mains water. Council buildings and South Melbourne Market also have high water demands and these areas provide significant opportunities for water conservation and use of alternative water sources.

*Figure 6: Breakdown of Council water use in 2008/09*




##### Performance

For 2008/09 Council has achieved a 71% reduction in water use. Both the 42% reduction target for 2012 and 70% reduction target for 2020, established in Toward Zero, have already been achieved, primarily in the areas of open space as a result of water restrictions. Furthermore, the 70% saving has been retained for two consecutive years, with a 72% reduction in 2007/08.

It should be noted that these figures reflect conditions with water restrictions and are much lower than are considered desirable to ensure the long-term health of parks, gardens and sportsfields.

A detailed breakdown of total water use from 2000/01 is provided in Appendix A.

##### Analysis and key challenges

Whilst Council has already achieved its potable water reduction targets, savings achieved through water restrictions cannot be considered permanent savings. Water restrictions have impacted on the health of open space which requires more water for sustainability and liveability.

Council's Open Space Water Management Plan (2009) provides an estimate of ideal future irrigation usage based on enhancing the long-term health and sustainability of open space assets. A figure of 155 ML/yr has been estimated for open space, an increase of 62 ML on 2008/09 water use of 93 ML. This projected increase in open space demand (155 ML/year) can be combined with Council's current non-irrigation usage (57 ML/yr) to estimate total Council water demands into the future. On this basis it is anticipated that Council will require 212 ML/yr to meet its needs. With time this figure may need to be readjusted to account for climate change impacts (see section 2.5.2).

Council's ideal irrigation usage can also assist determine the impact of a return to permanent water saving rules. On this basis, an increase of at least 62 ML could be expected. Council will aim to maintain its current potable water savings by delivering this additional demand through the provision of alternative, localised water sources to meet the water budgets required for open space. Savings in areas other than open space and sportsfields will need to continue to ensure Council can continue to meet its 70% target for 2020.

### Why Council doesn't use groundwater

- Groundwater quality is poor in most parts of the municipality due to high salinity levels as a result of a shallow water table (<5m) and generally low-lying land close to sea level. The proximity of the city's groundwater aquifer to the bay means that ongoing unmonitored extraction can result in increased salinity as water from the bay enters the aquifer.
- Furthermore, ongoing application of saline groundwater can impact on land and can be ill suited to crops. An analysis of a sample of monitored bores indicates that salinity levels are in the order of 1,000-3,500 Mg/L across most of the municipality increasing to 3,500-7,000 Mg/L around Port Melbourne. The lower range of salinity levels are considered acceptable for irrigation, however prolonged use may potentially lead to salinity problems or adverse impacts on more sensitive plants. The underlying confined aquifers have similar salinity ranges of 1,000-3,500 Mg/L for the lower aquifer and eastern areas of the upper, increasing to 3,500-7,000 around the Port Melbourne area for the upper aquifer. (EDAW AECOM, 2009)
- Typical chemical properties of the extracted bore water indicates high levels of sodium and chlorides which can be extremely harmful to turf growth, while bore water with a high bicarbonate concentration results in increased water hardness which can impact irrigation systems. At these levels groundwater is considered unsustainable for irrigating turf without desalination or mixing with a less saline water source. (City of Port Phillip, 2009)
- Yields are mostly less than 1 L/s and up to 1-5 L/s in the vicinity of Southbank, which is generally considered to be low for Council irrigation demand. Any use of groundwater requires a comprehensive assessment of the sustainable yield of the aquifer to determine whether it can meet the need of its intended end use without damage to the health and longevity of the aquifer.
- Despite the salinity levels bore water is increasingly being used for garden irrigation (the use of desalination units on bores is becoming increasingly common). From 2003-2007, 416 bores were licensed in the municipality. Many older existing bores may not have licenses and therefore it is difficult to accurately quantify the reliance on bore water across the municipality.
- Council's position is that any consideration of groundwater use should only be undertaken in the context of sustainable yields, salinity levels and asset health. As the recharge across the municipality is estimated at well under 100 ML, the sustainable extraction will be very limited, particularly given unknown current use. Council will continue to support groundwater protection and increased infiltration of clean, treated stormwater.

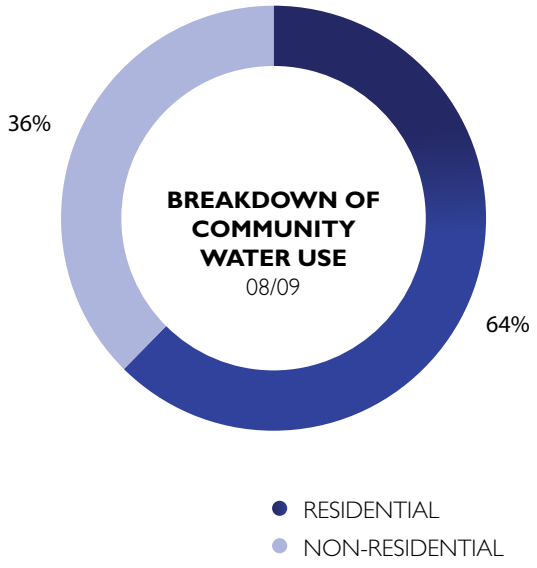
### 2.4.1.2 Community water use 2000-2008

#### Overview

Community water use comprises residential and non-residential (business/industry) use. The breakdown of community water use for 2008/09 is detailed in Figure 7.

Residential use comprises 71% of total community water use and can be broken down into single and multi-unit dwellings. It is estimated that approximately 66% of total residential water use is attributable to apartments and multi-unit dwellings.

*Figure 7: Breakdown of community water use in 2008/09*




*Community use of rainwater, greywater and groundwater is currently not being measured.*

## Performance

Since 2000/01 the community has achieved an ongoing decrease in water use. Figure 8 demonstrates the total and relative reductions that residential and non-residential users have achieved since 2000/2001. These savings can be broken down as follows:

- 19.4% reduction in total community water use from 2000/01, with a 32% reduction in total non-residential water use and a 13% reduction in total residential water use
- 1.5% increase in total community water use from 2007/08, with relative increases of 1.85% in residential water use and 0.7% in non-residential water use
- 31% reduction in average annual water use per household since 2000/01, and a 1.9% reduction on 2007/08
- 41% reduction in average annual water use per business since 2000/01, and a 2.5% reduction on 2007/08.

Figure 8 outlines the average annual community consumption for residential and non-residential water use from 2000-2009. Please refer to Appendix C for further community water use data including a breakdown of community water use by suburb

*Figure 8: Average annual water consumption per property*

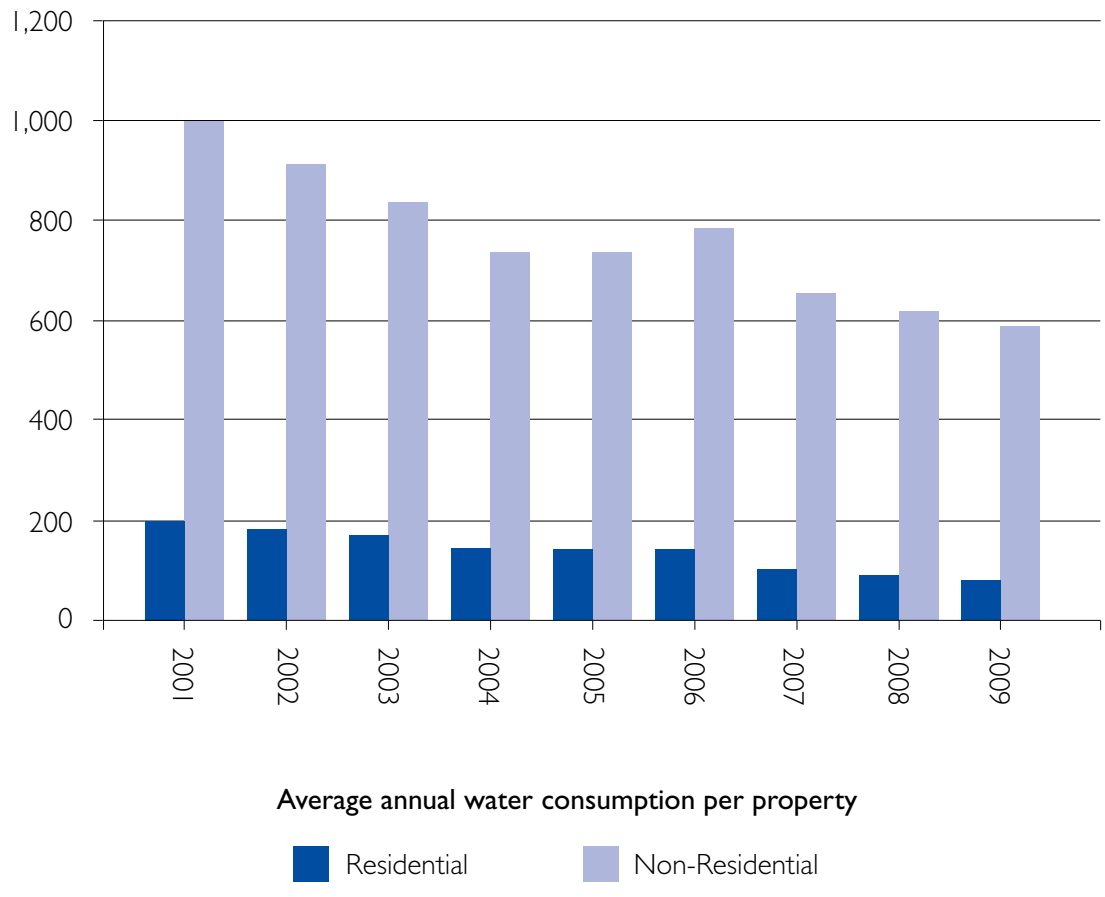


Table 4 outlines the decrease in total water consumption by postcode across the City of Port Phillip for 2008/09 against 2000/01. Most areas show a significant reduction, including Melbourne (St Kilda Rd), St Kilda, St Kilda East, Elwood, South Melbourne, Albert Park, Port Melbourne and Windsor. However, there have been some increases due to urban growth/intensification and Southbank and Ripponlea have experienced a small increase.

*Table 4: Community water savings achieved by postcode in 2008/09 since 2000/01*

| Suburb | ML - Total water use reduction 2008/09 since 2000/01 | % - Total water use reduction since 2000/2001 |
|---|---|---|
| Melbourne (St Kilda Rd) | 408 | -29.3% |
| Southbank | -2 | +13.9% |
| Windsor | 9 | -31.5% |
| St Kilda | 285 | -13.2% |
| St Kilda East | 265 | -21.4% |
| Elwood | 267 | -21.2% |
| Ripponlea | -13 | +16.6% |
| South Melbourne | 50 | -4.1% |
| Albert Park | 302 | -28.3% |
| Port Melbourne | 432 | -23.6% |

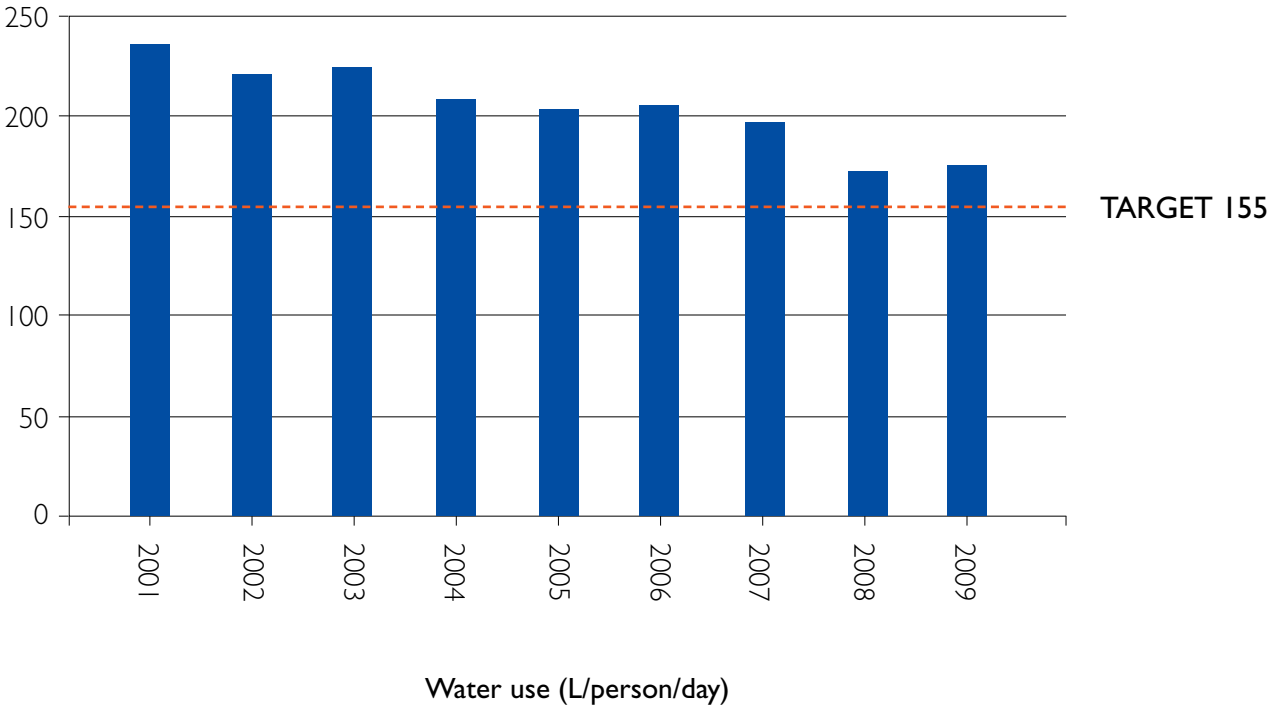
The decreases in non-residential use in Port Melbourne and St Kilda Road are particularly significant given their volumes. It is likely that much of these are permanent savings by business. While percentage changes for Southbank and Ripponlea are large, the sample sizes are small (13 properties in Southbank) and these may not represent trends across the broader area. This indicates that reductions in average use have been offset by growth.

## Are we meeting Target 155?

In 2009, the state government asked the community to reduce its water use to less than 155 L/person/day. The city's residential water use can be assessed on a daily per capita basis to determine our performance to this current target. The results indicate a reduction in water use of 23%, falling from 231 L/person/day to 178 L/person/day, as shown in Figure 9.

This indicates good progress but that there is still some way to go to achieve Target 155. It should be noted that this target may change with a decrease in catchment levels and Council will need to review its progress to state government and Council targets accordingly.

*Figure 9: Progress to Target 155*



### Analysis and key challenges

It is estimated that most of the reductions in residential potable water demand are due to reductions in private irrigation. Therefore, it is likely private irrigation use will increase significantly without water restrictions.

Demand management practices implemented across the residential and commercial sectors are critical to conserving mains water and reducing wastewater flows across the municipality. This will require broader engagement strategies and partnerships with key water bodies such as South East Water and Melbourne Water.

Community conversations to inform Council's draft Council Plan held in February 2009 indicate the community has an interest in the installation of household rainwater tanks and enabling stormwater capture for sportsgrounds, open spaces and trees.

## 2.4.2 Our pollutant balance

### Water quality management

Although Melbourne Water is working to achieve some specific water quality management targets, the responsibility for water quality management is not limited to Melbourne Water and the Environment Protection Authority[1]. The City of Port Phillip has the power to strongly influence water quality through land use control, street and beach cleaning, and renewal and maintenance works. Primary activities of relevance relate to gross pollutant and stormwater infrastructure management, an increasing focus on the removal of diffuse pollution through water sensitive urban design, and sustainable design in the planning process. The City of Port Phillip does not manage or monitor the Albert Park Lake.

Drainage Infrastructure conveys stormwater flows to the bay, catering for the runoff from major and minor storm events. Structural measures are in place to control gross pollutants, however increasing intensity in storm events may result in an increase in pollutants to the bay. Key values requiring protection include receiving waters, the foreshore environment, flora and fauna, use of stormwater as a resource, public health and safety, and recreation and leisure (BMT WBM, 2009).

Diffuse pollution (nutrients, sediments, metals) is becoming increasingly managed by Council through WSUD, and in the past two years, there has been a significant increase in the incorporation of WSUD within Council projects.

Key threats and stormwater management issues specific to the City of Port Phillip are commercial and/or industrial operations, transportation, construction, illegal dumping of rubbish, sewer overflows, discarded syringes, land use change, flooding and external catchment activities (BMT WBM, 2009).

[1] As a caretaker for river health in the Port Phillip and Western Port region, Melbourne Water has responsibility for waterways, drainage and floodplain management, the management of the Environmental Water Reserve, and water quality monitoring. EPA Victoria helps to protect Victoria's water environments through the Environment Protection Act 1970, which provides the basis for protecting our water environments from pollution, and through mechanisms such as environmental laws, policies and regulatory controls.

### How do we impact on local water quality?

The beneficial uses associated with Port Phillip Bay, Elster Creek, the Yarra River and Albert Park Lake are strongly influenced by stormwater discharges to these water bodies. Increased pollutant discharges lead to deterioration in the health of their ecosystems and impact on aesthetic and recreational values. Stormwater pollutant loads have major impacts through:

- Increased nutrients, especially nitrogen and phosphorus, which can lead to eutrophication and the growth of undesirable algae and aquatic weeds, shortages of dissolved oxygen, and blooms of cyanobacteria (which pose a serious health hazard to humans and animals). These problems reduce the ability of water bodies to support recreation and aquatic habitat.
- Increased loads of toxicants, including chemical compounds from pesticides, herbicides, and heavy metals. These compounds can be toxic to some aquatic organisms and can be bio-accumulated, further perpetuating their effect through the food chain.
- Increased loads of suspended solids, or soil and organic particles transported by stormwater to receiving waterways. Suspended solids increase the turbidity of the water, decreasing the penetration of light into the water, and consequently reducing or sometimes completely preventing photosynthesis by aquatic organisms. Nutrients, heavy metals, hydrocarbons and organic chemicals are transported with suspended solids.
- Increased loads of litter, carried by stormwater into our waterways.

### Pollutant balance

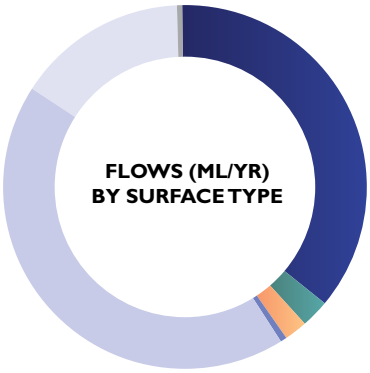
Our pollutant balance tells us that the City of Port Phillip currently generates the following annual pollutant loads to the bay:

- 778,138 kg/year Total Suspended Solids (TSS)
- 11,353 kg/yr Total Nitrogen (TN)
- 1,590 kg/yr Total Phosphorous (TP)
- other pollutants including heavy metals, hydrocarbons and pathogens.

The pollutant balance calculates the flows and pollutant loads generated by our municipality across Council and community roads, roofs, pervious surfaces and other impervious surfaces.

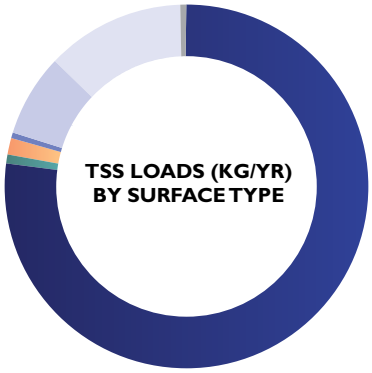
Figure 10 show stormwater flows by surface type and Figures 11-13 show pollutant loads by surface types. Please refer to Appendix D for data supporting these figures.

*Figure 10: Flows (ML/yr) by surface type*



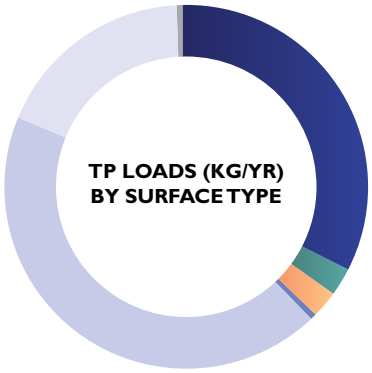

| | |
|---|---|
| 1,650 | COUNCIL ROAD |
| 124 | COUNCIL ROOF |
| 124 | COUNCIL GENERAL IMPERVIOUS |
| 14 | CONCIL PERVIOUS |
| 2,227 | PRIVATE ROOF |
| 933 | PRIVATE GENERAL IMPERVIOUS |
| 16 | PRIVATE PERVIOUS |

*Figure 11: Total Suspended Solids loads (kg/yr) by surface type*



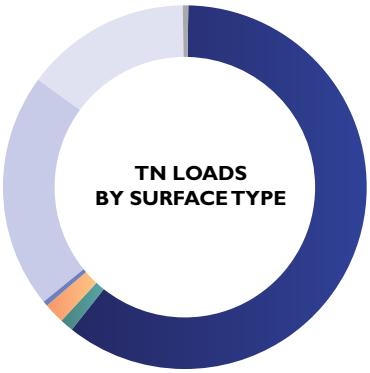

| | |
|---|---|
| 602,000 | COUNCIL ROAD |
| 3,315 | COUNCIL ROOF |
| 12,560 | COUNCIL GENERAL IMPERVIOUS |
| 1,709 | CONCIL PERVIOUS |
| 59,410 | PRIVATE ROOF |
| 97,500 | PRIVATE GENERAL IMPERVIOUS |
| 1,644 | PRIVATE PERVIOUS |

*Figure 12: Total Phosphorous loads (kg/yr) by surface type*




| | |
|---|---|
| 4,070 | COUNCIL ROAD |
| 297 | COUNCIL ROOF |
| 235 | COUNCIL GENERAL IMPERVIOUS |
| 31 | CONCIL PERVIOUS |
| 4,957 | PRIVATE ROOF |
| 1,753 | PRIVATE GENERAL IMPERVIOUS |
| 28 | PRIVATE PERVIOUS |

*Figure 13: Total Nitrogen loads by surface type*




| | |
|---|---|
| 963 | COUNCIL ROAD |
| 19 | COUNCIL ROOF |
| 30 | COUNCIL GENERAL IMPERVIOUS |
| 4 | CONCIL PERVIOUS |
| 338 | PRIVATE ROOF |
| 232 | PRIVATE GENERAL IMPERVIOUS |
| 4 | PRIVATE PERVIOUS |

The pollutant balance shows that road and roof areas generate the greatest volume of runoff and pollutant loads across the municipality.

- **Stormwater flows:** Private roofs contribute the greatest stormwater runoff flows, at 2,227 ML/year or approximately 44%. Roads are the next largest generators at 1,650 ML/year.
- **Total suspended solids:** Roads contribute the greatest suspended sediment loads at 602,000 kg/year or approximately 77%. This is due to the higher concentrations of solids found on these surfaces than found on roofs and other impervious surfaces.
- **Total nitrogen:** Private roof areas contribute the greatest nitrogen loads at 4957 Kg/year or approximately 44%. This is due to the large area of catchment that they represent. Council roads are the next largest generators at 4,070 ML/year.

Another important observation to make is that while 39% of the municipality is pervious, these areas contribute almost negligible stormwater flows and pollutant loads. A simple but effective means of managing stormwater flows and pollutant loads is to preserve and increase pervious areas wherever practical.

### Other local water quality impacts

- Groundwater: Groundwater quality can be impacted by ongoing unmonitored groundwater extraction, which can result in increased salinity due to the proximity of the city's groundwater aquifer to the bay, as water from the bay enters the aquifer. Groundwater can also become polluted from untreated stormwater, burst sewerage and leaching from landfills. Groundwater discharges to sewer should be eliminated or reduced where possible as these act as a point source of total dissolved solids which is currently impacting on the quality of recycled water at Melbourne's wastewater treatment plants.
- Litter: It is estimated that a total of 195 tonnes/year of litter is conveyed by stormwater across impervious surfaces. Primary litter hotspots responsible for these loads are the city's activity centres and foreshore, where entertainment venues, restaurants and open space receive high usage both day and night. Significant expenditure is directed to street and beach cleaning, bin management and in-line litter traps to meet community and environmental needs. Over 2007/08 these measures prevented a significant amount of litter from reaching the bay as follows:
  - 48.7 tonnes from **gross pollutant traps**
  - 3026 tonnes of seaweed from **beach cleaning**
  - 942 tonnes of litter from **street cleaning**
  - 1176 tonnes of litter from approximately **696 bins** across the city.

## 2.5 Future projections

Future projections of water use are impacted by population growth and climate change.

### 2.5.1 Population growth

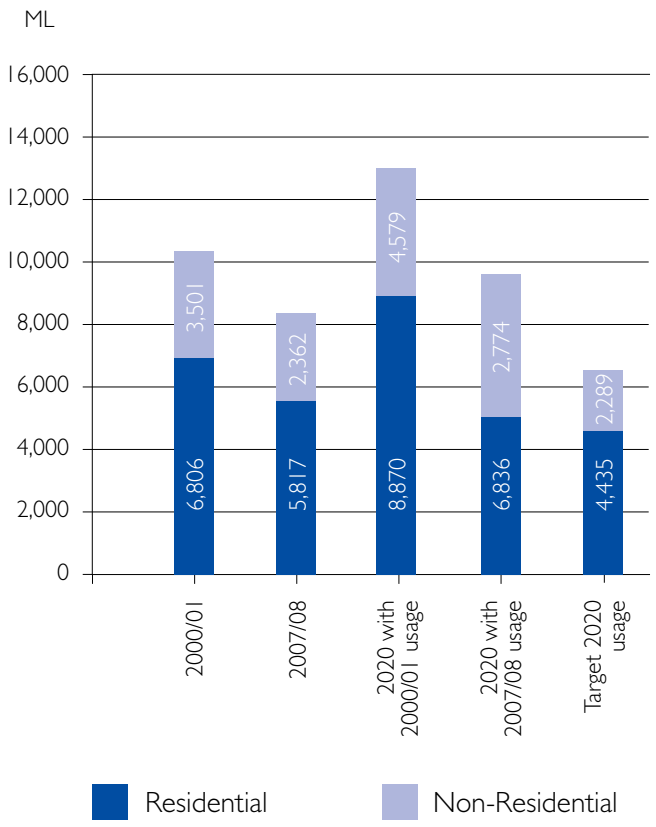
### How much water will the community need?

The City of Port Phillip is growing and evolving as development and urban consolidation occur and this growth will influence the future water balance. With residential water use the largest component of community water use, the greatest challenge will be to retain water savings as population grows. This will be further impacted by a decrease in severity of water restrictions as the desalination plant comes online, and it is likely private irrigation use will increase significantly without water restrictions.

Population growth will lead to an increase in the demand for potable water as well as sewage discharges. Three possible growth scenarios were considered and presented in Figure 14:

1. Growth with a return to water use levels prior to water restrictions (2000/2001 levels)
2. Growth at current per capita water use
3. Growth with targets of 50% reduction in per capita use achieved.

*Figure 14: Potential 2020 water use scenarios*




### Meeting current water saving targets

To meet Target 155 and our 2020 targets for community water use we will need to continue to reduce absolute water use as the population increases to achieve the following:

- Target 155: the state government target of 155 L/person/day requires an additional reduction of 13% on 2008/09 residential per capita water use
- 50% per capita reduction by 2020: the target of 115 L/person/day requires an additional 35% reduction on 2008/09 residential per capita water use
- 50% reduction in average annual water use per household: the target of 88 kL/year requires an additional 28% reduction on 2008/09 levels of water use per household
- 50% reduction in water use per business: the target of 506 kL/year requires an additional 15% reduction on 2008/09 levels of water use per business.

Figure 14 tells us that at current consumption levels population growth will result in a relatively small increase in water use, however a return to levels of use before restrictions will result in a significant increase.

## How much water will Council need?

As drought conditions continue to impact the health of our open space assets, Council must identify means to increase the health, resilience and usability of this space. Furthermore, population growth will place greater demands on open space, increasing the need to maintain our parks, gardens and sportsfields in good condition and health. This will require an increase in water use on open space. Council estimates future irrigation usage at approximately 155 ML/yr; this has been calculated based on the needs of different open space and projected ongoing efficiency gains.

Based on the 2008/2009 non-irrigation use of 57 ML/yr this would increase total Council usage to 212 ML/yr. This is an increase of 62 ML on current water use.

The Water Plan supports these additional water requirements through the use of alternative water sources, primarily rainwater and stormwater. The water balance demonstrates that enough water is available to meet the long-term needs of open space. This will ensure Council can continue to meet its 70% potable water reduction target whilst improving the health and amenity of the municipality.

### 2.5.2 How will climate change impact the municipality?

The best available climate change predictions for the municipality are based on the City of Port Phillip's Climate Change in the City of Port Phillip - An Initial Perspective Report 2007, and the most recent climate change science released by the Intergovernmental Panel on Climate Change (IPCC) and CSIRO (CSIRO and BoM 2007). A summary of key indicators and local climate impacts for the municipality follows:

1. The City of Port Phillip is likely to become drier with increasingly longer dry spells. Total annual rainfall is projected to decrease by 2% by 2020, 4% by 2050 and 15% by 2100. Melbourne is therefore likely to continue experiencing dry spells, drought conditions and water shortages, together with decreasing water quality resulting from decreased streamflow, increased concentrations of pollutants entering the bay and higher ambient bay temperatures.

2. Climate change will increase the duration, intensity and frequency of storm events. It is estimated that storm intensity for a 20-yr event is likely to increase by 5-10% by 2020, 35-45% by 2050, and 70-100% by 2100. With an estimated 61% of the municipality impervious, this will increase in peak flood flows, impacting on the ability of drainage infrastructure to deal with this intense rainfall, resulting in increased stormwater runoff and flooding.

3. Temperature is projected to rise by an estimated 1-1.5% by 2020, 2.5% by 2050, and 3.5-5 % by 2080-2100. As temperature rises, there is also the potential that evaporation will increase, estimated at 3% by 2020. The extreme rise in temperature is anticipated to result in a sharp increase in urban water demand, and lead to a rise in heat-related illnesses and impacts.

Please refer to Appendix F for a more detailed discussion of these impacts.

#### How will this impact the water balance?

- Increases in temperature and evapo-transpiration will increase water needs, leading to an increase in irrigation demand. This can potentially be managed through the use of alternative water sources and drought-tolerant plant selection.

- Increases in rainfall intensity will increase the likelihood and severity of flooding. These increases may have implications for stormwater management, including the sizing of systems for flood control and water quality. This can be managed through the use of WSUD and stormwater treatment and detention.

- Stormwater flow volumes and pollutant loads are expected to decrease by 2020 with flow volumes decreasing by 4.2%, and nutrient loads by less than 5.1%. (EDAW AECOM, 2009)

- The implications of climate change for irrigation are potentially significant. If water restrictions are lifted in future, irrigation may account for as much as 20% of potable water use for the municipality. Furthermore, it is anticipated that irrigation water use will increase by approximately 5% on preferred levels of irrigation without water restrictions. Consideration should be given to measures to mitigate this increase, such as the use of alternative water sources and demand management.

- Climate change is likely to slightly reduce stormwater flows, however it is unlikely these changes will substantially impact on the performance of stormwater treatment measures.

- Alternative water sources developed for irrigation needs should seek to supply a demand that is up to 5% greater than current conditions to ensure future climate resilience to 2020.

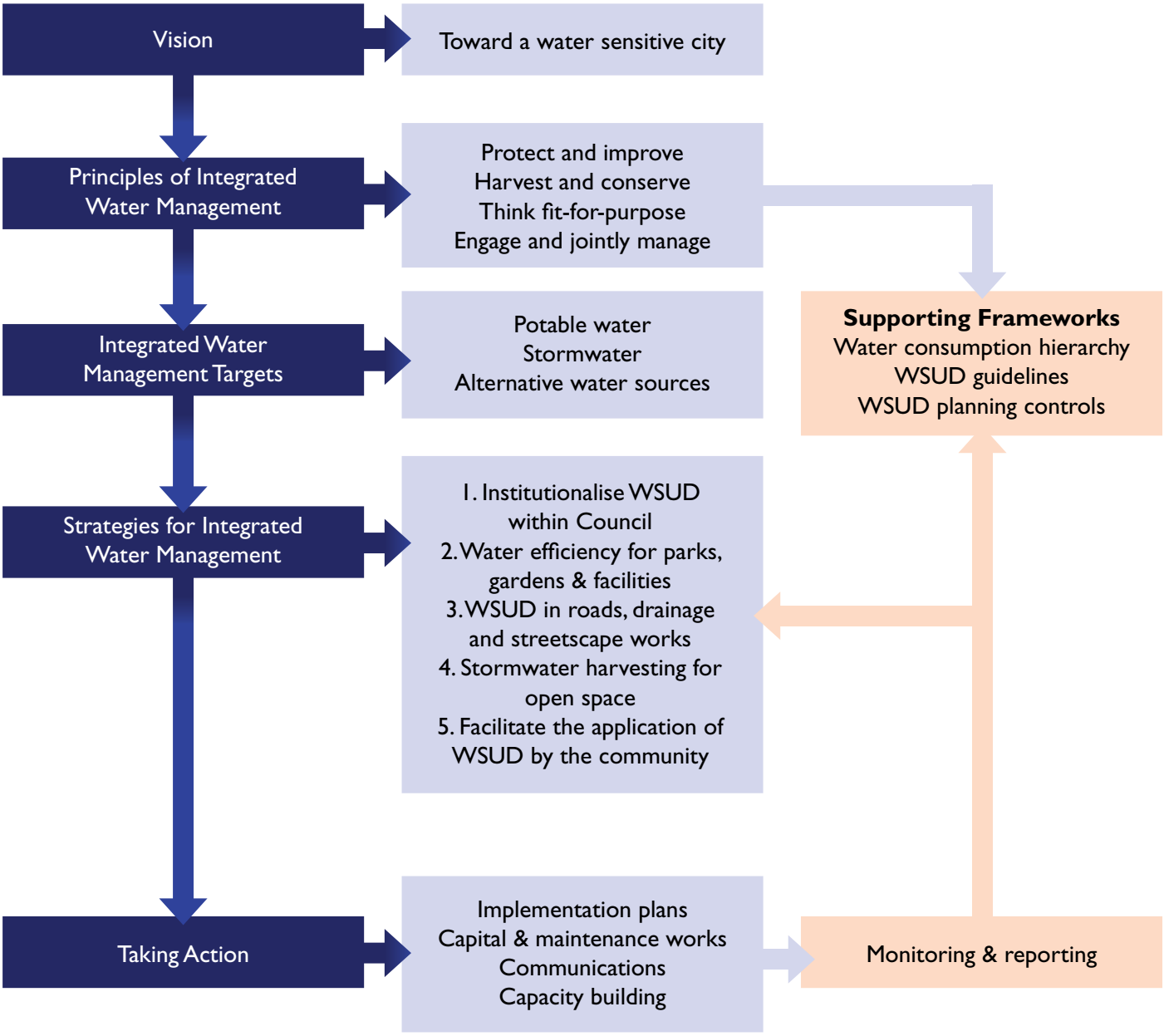
### Will stormwater harvesting schemes and rainwater tanks be affected by climate change?

- The reliability of rainwater tanks could be potentially impacted by a decrease in rainfall (reducing supply) and an increase in irrigation demands. Modelling of a typical residential household with climate-adjusted scenarios identified little change in reliability by 2020, suggesting that rainwater tanks are resilient to short-term climate change impacts. Diversification of water supply is critical in building resilience within the community for adaptation to climate change.
- This is similar to results modelled for a typical stormwater harvesting scheme, with a decrease in reliability of only 1%-2%.
- This is important as it indicates that these systems are resilient to climate change with the impacts on reliability being less than the expected changes in rainfall. These schemes will continue to play an important role in buffering the more vulnerable catchments and mains water supply system against climate change and variability.

# 3. Our Integrated Water Management Strategy

The City of Port Phillip's Integrated Water Management Strategy is summarised in Figure 15. An outline of each of its components follows:

*Figure 15: City of Port Phillip integrated water management strategy*



## 3.1 Vision

The City of Port Phillip supports a "water sensitive city" which reflects an integrated approach to the management of all water sources.

The concept of "water sensitive city" is established in the National Water Initiative (Clause 92), which commits all states and territories to innovation and capacity building to create water sensitive cities.

The characteristics of "water sensitive city" are not stipulated by the National Water Initiative, however Monash University's National Urban Water Governance program has proposed it be underpinned by a commitment to intergenerational equity and resilience to climate change, together with the following principles:

- access to a diversity of water sources (both centralised and decentralised)
- provision of ecosystem services for the built and natural environment
- community engagement (socio-political capital for sustainability).

(Wong and Brown, 2008)

The City of Port Phillip supports a regional process for transitioning to a water sensitive Melbourne, based on participatory community consultation and stakeholder partnerships.

### Council's vision for a water sensitive city

A water sensitive city is an adaptive city that is resilient to low water availability and the impacts of climate change. It is a city that uses many different water sources, not just mains water. It manages its water to meet the needs of the environment, and improve the health of our waterways and open spaces. In this city, we use water sourced locally and actively enjoy its presence in our local neighbourhoods. In this city, we value and understand water and we all play a role in sustainable water management.

### What will a water sensitive City of Port Phillip look like?

A water sensitive City of Port Phillip will articulate these principles into an urban water grid of alternative water sources, green infrastructure and community partnerships, comprising the most appropriate solutions to meet municipal water quality and water supply needs.

- By 2012 the city will have commenced this journey toward increased resilience, institutionalising water sensitive urban design and identifying solutions to the range of water management challenges faced by the municipality. It will continue to perform well to established water targets, with measurable improvements to the usability and sustainability of public open space. Water sensitive urban design will provide additional benefits, including insulating the city's streetscapes and open spaces from the effects of climate change. All water projects will be carbon sensitive and fully manage any health and environmental risks associated with their delivery and ongoing maintenance.
- By 2020, the city will have measurably enhanced community and environmental wellbeing through integrated water management. It will have met its water targets for 2020, with measurable improvements to the liveability of Port Phillip, including flow-on effects in the areas of biodiversity and an enhanced natural environment. Trees and open spaces are in good health and actively used by the community, providing social and health benefits, including food production and respite from the urban heat island effect. Council development is in line with environmental capacity and actively addresses climate risks and enhanced sustainability.

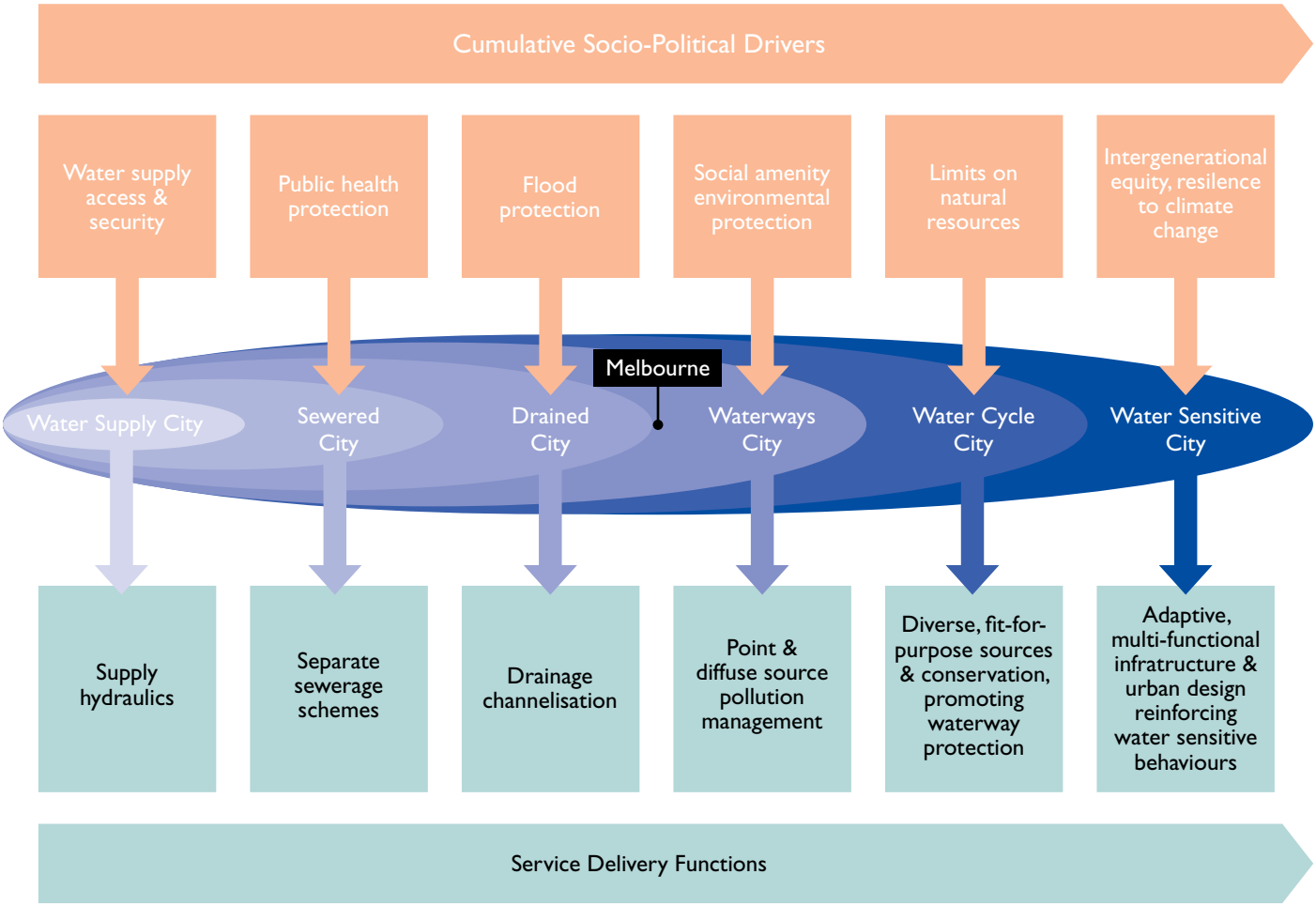
The concept of "city as a catchment" reflects this vision. A water sensitive city will be viewed as a catchment and stormwater and treated wastewater will be viewed as important water sources. Minimal potable water will be imported from, and wastewater exported to, external areas outside the boundaries of the city, instead using water generated by the city in a fit-for-purpose manner.

## Transitioning to a water sensitive city

In the past, potable water supply, stormwater, wastewater and groundwater have traditionally been managed as entirely separate infrastructure. Melbourne has progressed from this situation over time, working its way towards becoming a waterways city.

Figure 16 positions our current state in relation to our long-term vision of becoming a water sensitive city. In our current state, the city demonstrates increased concern for the health of water bodies and for new approaches to the management and delivery of water sources (Brown et al, 2008).

*Figure 16: Urban Water Management Transitions Framework (Brown et al, 2008)*




To meet the challenges ahead a more integrated management of the entire water cycle is required. As local government does not manage all aspects relating to the water cycle, it will be necessary to consider stronger partnerships with those that do, increasing our ability to manage and protect our water sources.

In this journey, it is important for the City of Port Phillip and other local governments also heading in this direction to work closely for greater catchment benefits.

## 3.2 Principles of integrated water management

The vision of a water sensitive city will be supported by the following principles:

- **Protect and improve:** to improve the quality of stormwater and ensure the protection of receiving waters and other environment values
- **Harvest and conserve:** harvest alternative water sources and apply ongoing demand management strategies
- **Think fit for purpose:** match the quality of alternative water sources with the quality required by the end use, to minimise treatment, and ensure supply, storage and users are close together
- **Engage and jointly manage through community partnerships:** including local and regional partners.

These principles will enable integrated water management across the total water cycle, comprising potable water, wastewater, stormwater and groundwater.

Together they emphasise the importance of recognising the city as a catchment, a concept which strives to close the loop on the urban water cycle within the municipal boundary of the City of Port Phillip.

## 3.3 Our integrated water management targets

Council currently has potable water conservation targets but has not previously set targets across other water sources or streams of the urban water cycle. The Water Plan commits Council to broaden current targets beyond potable water across the urban water cycle.

Integrated water management targets allow Council to be accountable to the community in its efforts to protect the local environment, reduce pollutants to the bay and increase local security of supply, and will drive integrated solutions that progress Council's transition to a water sensitive city.

Table 5 outlines Council's integrated water management targets for 2020, which have been set relative to 2000/2001 base-year levels unless indicated otherwise.

*Table 5: Integrated water management targets*

| | | |
|---|---|---|
| **Water conservation** | | |
| **Target description:** Absolute and per capita mains water saved (ML and %) | | |
| **Council** | **Community** | |
| 70% reduction (or 363 ML) by 2020.<br>20% reduction of Council facility water use based on 2007/08. | 50% reduction in annual residential water use per capita by 2020<br>50% reduction in annual non-residential water use per business by 2020 | |
| **Stormwater quality improvement** | | |
| **Target description:** Improvements in stormwater quality, expressed as reductions in Total Suspended Solids (TSS), Total Phosphorous (TP) and Nitrogen (N) against total pollutant loads generated by the municipality. The target is expressed as an annual and 2020 target. | | |
| **Best practice stormwater management target** | | |
| To achieve best practice stormwater management targets for Total Suspended Solids, Nitrogen, Phosphorous and Litter by 2066. | | |
| **Stormwater targets for 2020 and 2066** | | |
| Council target for 2020 | % Annual reduction required | Council target for 2066 |
| Total Suspended Solids: 10,973 kg/year or 19% | 1.5-2% | 80% |
| Total Phosphorous: 18 kg/year or 15% | 1.1-1.6% | 60% |
| Total Nitrogen: 88 kg/yr or 10% | 0.8-1.1% | 45% |
| **Alternative water sources** | | |
| **Target description:** Increase in the use of alternative water sources in absolute terms (ML) and as a percentage of total water consumption. | | |
| **Council** | | |
| 15% of base year water use or 50% of future Council irrigation demand. | | |

**Water conservation explanatory notes:**

- These targets, first set in Toward Zero Environment Strategy 2007, will be retained. The Council target has not been adjusted, as meeting the 70% target has impacted on the health of open space. The community target has not been adjusted, as it is in alignment with state government efforts and reductions are still required to meet this target.
- Council will continue to focus on maintaining savings achieved to date, increasing the liveability and sustainability of open space through the use of alternative water sources.
- A target 20% reduction in Council indoor water use could be achieved through a program to replace all fittings and fixtures within Council facilities with water efficient fittings and fixtures by 2020. It is based on an annual budget of approximately $50,000 and water saving benefits of perhaps 1 ML/yr.
- Council will continue to work with the community to facilitate ongoing water conservation, and good progress is being made with a 31% average reduction in residential water use and a 41% average reduction in non-residential water use. The key challenge will be to continue to reduce total community water use as the residential population increases.
- Water conservation targets for indoor water use can be set as a surrogate for wastewater reduction, as sewage discharges are closely associated with non-irrigation water use. Currently, wastewater savings are achieved mostly through water conservation and efficiency measures rather than water recycling.

**Stormwater quality improvement explanatory notes:**

- These targets are based on percentage reductions in annual pollutant loads relative to typical urban conditions, and are aimed at achieving best practice stormwater quality improvement by 2066. The 2009/2010 capital works plan adopted by Council was evaluated to create a timeline for achieving the stormwater best management practice targets.
- Targets for Total Phosphorus are based on a revised best practice target of 60%, which is expected to be introduced in future. This is based on industry experience and research from the Facility for Advancing Water Biofiltration (FAWB) which indicates that in most cases a reduction in total phosphorus of 60% is achievable when target reductions for total suspended solids and total nitrogen are met with no increase in surface area of a treatment measure. Adopting this revised target means that Council would be exceeding current best practice for phosphorous.
- It should be noted that stormwater quality improvement targets for the community have not been specifically set. The relative contribution expected from the community to these targets is detailed below. These commitments are broadly consistent with the greater contribution of nitrogen loads contributed by community areas:
  - TSS: 400 kg/year or 3.6% of target
  - TP: 2 kg/year or 11% of target
  - TN: 28 kg/year or 32% of target

**Alternative water sources explanatory notes:**

- Alternative water sources encompass rainwater, stormwater, greywater and wastewater.
- Targets for increased use of alternative water sources are based on an ideal water budget for open space prepared as part of the Open Space Water Management Plan. This water budget has been prepared to increase the health, sustainability and liveability of open space, including passive recreational space and sportsgrounds. The water budget indicates that Council must increase its water use to155 ML (an increase of approximately 75% on current use), whilst maintaining its savings in potable water.
- It is proposed that an increase in the use of alternative water sources be a key means to ensuring Council can maintain potable water savings whilst meeting the needs of open space.
- The target is based on meeting 50% of ideal Council irrigation demand or approximately 80 ML.
- Community contributions to an increase in the use of alternative water sources have been calculated based on an assessment of current SDAPP applications, rainwater tanks rebate data, and the potential impacts of the proposed City of Port Phillip C78 stormwater amendment. The assumption is that most private sector applications are for rainwater tanks. The assessment estimates that approximately 0.5% of community water use is currently being delivered through alternative water sources and is a conservative estimate. This figure would increase to 1% with the implementation of C78. 0.5% is roughly equivalent to 150 kL rainwater tanks/year and 1% is roughly equivalent to 375 2kL/ tanks a year.

### What integrated water management targets can't be set at this time?

Targets have not been set for wastewater, groundwater and permeability as at this point there is either insufficient data, tools or expertise to determine targets or measure progress in these areas. These are discussed as follows:

- **Wastewater:** Wastewater reduction is a means to reduce increasing pressure on aging sewage infrastructure and delay or eliminate the need for costly future augmentation works. Reductions in wastewater discharged to sewer are a reflection of reductions in potable water used, and to date are limited to an estimated 2.5% as most savings made through water restrictions have been in the area of outdoor irrigation which is not discharged to sewer. Until significant advances are made in wastewater treatment technology and increasing accessibility for widespread application, it is difficult to set meaningful targets. Secondly, methods for effectively tracking wastewater reduction are not in place. Council will work with South East Water to determine an appropriate process and timeframe around which wastewater targets can be set.

- **Groundwater:** Council does not currently use groundwater for irrigation or other purposes and recognises the importance of conserving and protecting what is a largely unknown resource. The City of Port Phillip's groundwater aquifers are not considered a significant resource due to their moderate-to-high salinity levels and relatively low expected yields in most areas. Consequently there is no data on what constitutes sustainable yields for this aquifer. Until knowledge increases, Council is unable to set quantifiable groundwater targets. Council may nominate salinity levels at which Council is able to consider irrigating open space without impacting on soil and vegetation health. Please refer to section 2.4.1.1 for Council's position on groundwater.

- **Permeability:** Increasing permeability within the municipality is important, to allow for increased infiltration, reduced stormwater flows and flood calming. Increased infiltration of stormwater may potentially lead to groundwater contamination and it is important that infiltrated waters are first appropriately treated. Council will work with Melbourne Water to determine an appropriate process and timeframe around which permeability targets can be set.

- **Stormwater Flows:** As the City of Port Phillip discharges directly to Port Phillip Bay and the lower reaches of the Yarra river and Elster Creek, there is limited value in addressing stormwater flow rates within the municipality.

Targets will be updated as greater expertise is gathered in target setting in the above areas, and as best management practices in stormwater are reviewed.

[2] Council has some knowledge of salinity levels in the municipality based on existing bore data provided by Southern Rural Water (Southern Rural Water, 2009).

## 3.4 Our strategies for integrated water management

Integrated water management targets can be achieved through a range of structural and non-structural measures. These may include WSUD systems and policy initiatives to increase uptake of stormwater treatment and reuse in private developments.

Achieving our targets will require the application of specific strategies in the short to medium term, which can be reviewed over time as technology advances and new approaches emerge:

### 1. Institutionalise water sensitive urban design within Council

- Integrated water management can be achieved through the implementation of WSUD and educational measures. Council's renewal and maintenance program presents an opportunity to institutionalise WSUD across all works. Other areas include the management of construction activities, Council services & contracts, and Council policy and systems.
- This strategy will require a detailed consideration of WSUD in all capital works projects and mechanisms to enhance the scoping, design and delivery of projects. This strategy is supported by Council's water management hierarchy (see section 3.5) to assist determine the most appropriate approach and water source for each water project.

### 2. Continue to implement water efficiency for parks, gardens and facilities

- Continue to implement water efficiency measures across open space and facilities to assist Council to maintain its 70% savings as irrigation demand increases. Deliver a 20% reduction in Council facilities' water use by 2020, through retrofits and maintenance works.
- This strategy will be delivered through Council's Open Space Water Management Plan, Irrigation Upgrade Program and Buildings Efficiency Program.

### 3. Increase application of water sensitive urban design to roads, drainage and streetscape works

- Identify and implement streetscape works including raingardens, bioretention tree pits and passive irrigation in appropriate locations such as roads, nature strips, sunken roundabouts and kerb extensions. These can be implemented within road and drainage reconstruction works, kerb renewals, pedestrian and bike lane works and other projects when upgrades and redevelopment occur.
- On the ground action will aim to demonstrate leadership in treating streetscapes as a catchment, providing water sensitive urban design for stormwater treatment and enhancing amenity and living.
- These works will include complementary gross pollution prevention measures to reduce litter loads discharging to the environment.
- This strategy will be delivered through the identification and implementation of WSUD in roads, drainage and streetscapes, wherever possible, through the annual Capital Works Program.

### 4. Implement stormwater harvesting for open space

- Identify and implement stormwater harvesting schemes to irrigate parks, gardens, sportsfields and new trees, to reduce demand for mains water, provide a reliable supply during times of restrictions, reduce stormwater pollution and provide flood calming benefits. One large harvesting scheme can substantially reduce stormwater pollution while reducing demand for mains water and increasing resilience to climate change.
- On the ground action will aim to demonstrate leadership in treating parks as a catchment, providing large scale WSUD for open space irrigation and where possible reintegrating water into the landscape as a key feature.
- This strategy will be delivered through an annual program of action for priority sites identified for further investigation.

### 5. Facilitate the application of water sensitive urban design by the community

- Redevelopment undertaken across the private domain should require attainment of stormwater best practice targets through application of WSUD. Rainwater and stormwater harvesting and greywater should be encouraged to supplement indoor non-potable water demand such as toilet and laundry water needs. Groundwater should be managed to ensure it is used in a sustainable manner and is not discharged to sewer.

- Policy reform is vital to this strategy. Implementing policy and development controls mandating integrated urban water and best practice stormwater management for all developments is one example. Council's proposed C78 Stormwater Management (WSUD) amendment, if approved, can provide significant support in delivering to these objectives.

- This strategy will be implemented through Council's Community Climate Action Plan incorporating Council's existing SDAPP Program, advocacy and policy reform, and education and outreach programs focused on building community understanding and support for WSUD and good practices in construction management.

- Council has the opportunity to consider additional strategies to accelerate community uptake of WSUD, including incentives within the planning and approvals sector, bulk purchase schemes for rainwater tanks, additional outreach programs and rebate programs.

These strategies will evolve over time to better incorporate the breadth of alternative water sources potentially available to Council. As other sources become easier and more cost effective to access, Council will be able to explore such options more fully. On the ground action will aim to demonstrate leadership in treating the city's precincts as catchments, providing integrated water management across an entire neighbourhood with consideration of other environmental impacts.

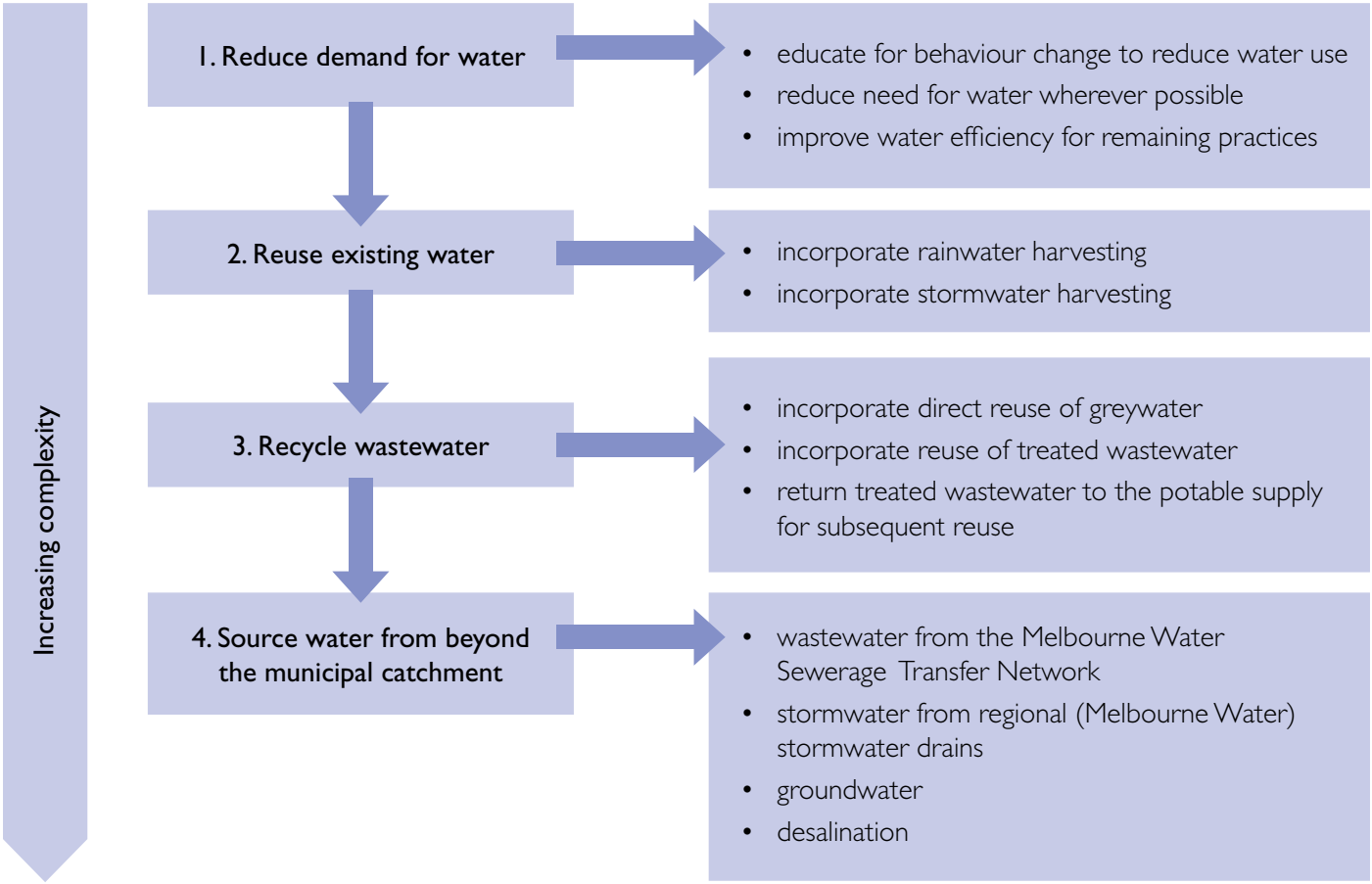
*Water sensitive urban design trees on Carlisle Street*

## 3.5 Water management hierarchy

The Water management hierarchy is a key reference at a conceptual level for Council projects, and guides Council in the implementation of water projects based on the beneficial uses and potential impacts forecast. The hierarchy is provided in Figure 17.

The following options, which increase in complexity down the hierarchy, should be explored to their fullest extent before mains water is used in any Council project or process.

*Figure 17: City of Port Phillip water management hierarchy*




### Reducing our energy impacts

The hierarchy incorporates consideration of the energy costs associated with different options. Council's Water Sensitive Urban Design Guidelines provide further guidance in being carbon sensitive at a more detailed level. Council's carbon sensitive framework measures, reduces and offsets the greenhouse gas emissions from the following aspects of a WSUD project:

- Energy use
- Biodegradation processes
- Embodied energy emissions

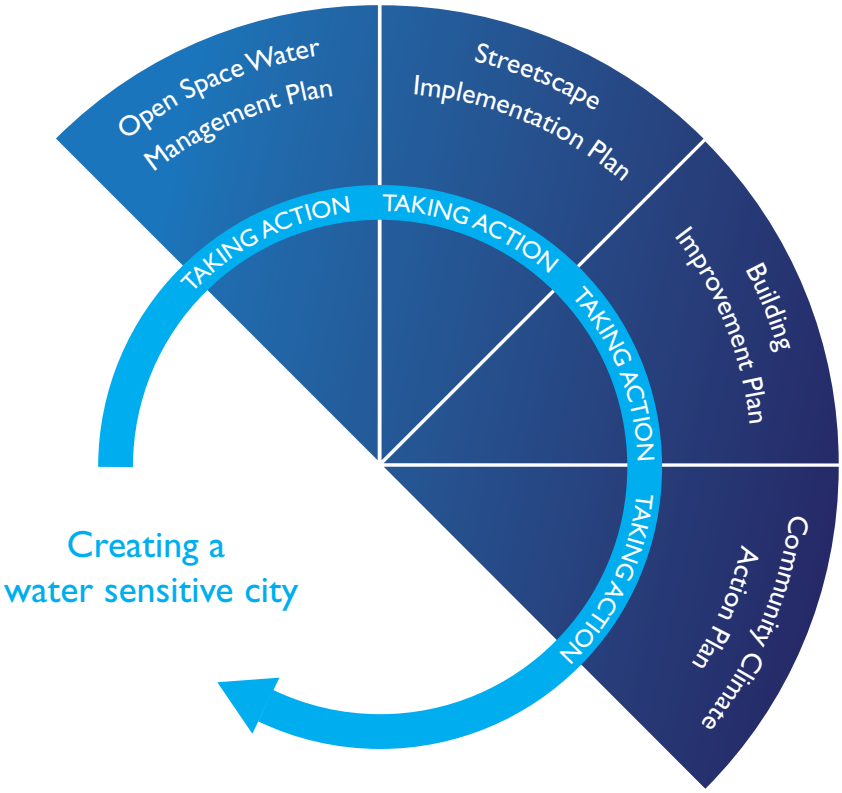
# 4. Taking Action

## 4.1 Implementation framework

### Overview

Each of Council's integrated water management strategies will be translated into specific programs of action meeting multiple water management objectives. These strategies will be delivered through four key implementation plans incorporating strategic initiatives and capital and maintenance works, detailed in Figure 18 below. These implementation plans will summarise all actions being undertaken by key service units within Council as well as through local and regional partnerships.

*Figure 18: Water Plan implementation framework*




Implementation of the Water Plan will be supported by:

- **A Capacity Building Program** to support Council and the community in delivering WSUD.
- **A Communications Program** to educate and encourage action across the municipality.
- **A Monitoring Plan** to monitor Council's delivery to targets, track individual project performance, and evaluate the ongoing effectiveness of the Water Plan.

## 4.2 Action plan overview

Action planning is an ongoing process. Table 6 provides an overview of current action planned for 2010/11 and beyond, acknowledging that the completion of the Streetscape Implementation Plan and Building Improvement Plan will lead to the delivery of additional actions to enable Council to deliver to its targets.

Strategic initiatives will be driven by regional research and action to better understand our water sources, document our environmental impacts and deliver on-the-ground action.

### Developing a localised approach to water sensitive urban design

The most relevant approaches for Council and the community to consider in the short term are:

- **Capture and reuse rainwater locally:** Rainwater tanks enable roof runoff to be captured and reused locally with minimal infrastructure and treatment requirements. Water can potentially be used for toilet flushing, hot water, laundry purposes and garden irrigation. Typically most rainfall is attributed to small but frequent events and these volumes can easily be harvested using small storages to potentially meet a good proportion of residential demands on mains water supply.
- **Passive irrigation:** Mains water can be saved through passive irrigation of raingardens, street tree pits and infiltration to landscaped areas by sourcing runoff from surrounding impervious catchment areas. Council is actively seeking to incorporate passive irrigation within road reconstruction projects.
- **Stormwater treatment and harvesting:** Stormwater treatment and harvesting can provide a good alternative water source to supply the irrigation needs of parks and reduce stormwater flows and associated pollutant loads to downstream receiving waters. Care should be taken in areas where the water table is high and where underlying soils do not allow for adequate infiltration, an important consideration for the City of Port Phillip where proximity to the bay may impact on these factors.

*Image provided courtesy of Melbourne Water*

*Table 6: Water action plan overview 2010/11*

| Strategy | Impact area | Actions | When | Who is leading this action? |
|---|---|---|---|---|
| Institutionalise water sensitive urban design within Council | Council assets | • Standardise preferred designs for WSUD, including raingardens, passive irrigation systems and bioretention street tree pits. This will be undertaken as part of Council's Streetscape Implementation Plan.<br>• Standardise preferred water efficiency fixtures for Council facilities. This will be undertaken as part of Council's Building Improvement Plan.<br>• Develop case studies to support capacity building.<br>• Develop and trial Council's ESD Toolkit to support the integration of sustainability features in all Council projects.<br>• Ongoing participation in Melbourne Water's Living Rivers Stormwater Program, to assist Council to build capacity and deliver on the ground WSUD. | 2010/11 | Sustainable Environment<br>WSUD Technical Group<br>Streetscape Implementation Plan Steering Committee<br>Building Improvement Plan Steering Committee |
| | Planning and development control | • Influence building and construction practices through planning and building controls, focusing on restricting flood prone development, educating the public about erosion and sediment control, and best practice stormwater management.<br>• Enhance enforcement around building and construction practices. | 2010/11 & ongoing | City Development |
| | Council drainage | • Implement Council's Stormwater Action Plan, including permeability mapping, hydraulic modelling and flooding vulnerability assessments. | Ongoing | Engineering Services |
| | Contracts management | • Incorporate water related reporting requirements and integrate green purchasing requirements into Council contracts. | 2010/11 | Green Purchasing Working Group |
| | Groundwater infiltration | • Ongoing management of Council's known contaminated sites. | Ongoing | Across Council |

| Strategy | Impact area | Actions | When | Who is leading this action? |
|---|---|---|---|---|
| Continue to implement water efficiency for parks, gardens and facilities | Council parks, gardens and sportsfields | • Increase the liveability and sustainability of open space through the implementation of the Open Space Water Management Plan. Key areas of focus will be to increase tree health, identify alternative water sources for open space, and increase water efficiency across open space assets.<br>• Implement irrigation upgrades at Elwood Park, Peanut Farm and St Vincent Gardens (stage 2) in 2010/11. This project is also supported by state government funding.<br>• Implement WaterMaps for all high water using sites (over 10 ML/year) and voluntary WaterMaps for sites using between 5-10 ML/year to demonstrate how these sites will use water more efficiently in the future. | 2010/11 & ongoing | Parks and Open Space |
| | Council facilities | • Implement Council's Building Improvement Plan, including an annual efficiency and retrofit program to progressively retrofit facilities for water and energy saving.<br>• Continue to deliver water sensitive infrastructure maintenance and refurbishment services to Council buildings, enhancing these through the cyclical annual maintenance program.<br>• Installation of rainwater tanks at South Melbourne Market. | 2010/11 | Building Improvement Plan Steering Committee<br><br>South Melbourne Market |
| Increase application of water sensitive urban design to roads, drainage and streetscape works | Council streetscapes, including nature/ median strips | • Deliver an annual program of action to effectively incorporate WSUD into the ongoing implementation and management of drainage, roads and streetscape capital and maintenance works. Actions will be determined as part of the development of Council's Streetscape Implementation Plan.<br>• Delivery of projects incorporating WSUD and passive irrigation through Council's road rehabilitation and capital works programs.<br>• Investigate the feasibility of incorporating WSUD into the Elwood Foreshore redevelopment. A preliminary design has been prepared for evaluation. | 2010/11 | Across Council<br><br>Streetscape Implementation Plan Steering Committee |

*Table 6: Water action plan overview 2010/11*

| Strategy | Impact area | Actions | When | Who is leading this action? |
|---|---|---|---|---|
| Implement stormwater harvesting for open space | Council parks, gardens and sportsfields | • Implement Council's Open Space Water Management Plan, including a capital program to deliver stormwater harvesting projects to open space.<br>• Progress a detailed design for Elwood Park to harvest water from the City of Bayside's Elsternwick Park.<br>• Undertake a detailed design of stormwater harvesting for O'Donnell Gardens.<br>• Seek funding opportunities for stormwater harvesting as these emerge. | 2010/11 & ongoing | Parks and Open Space |
| | Council assets, including beaches and receiving waters | • Address litter management through the implementation of the Waste and Resource Recovery Strategy. Key areas of focus include street and beach cleaning; bin placement, maintenance and cleaning; maintenance and monitoring of dumped rubbish and litter hotspots; increased public place recycling; enforcement; education programs and signage.<br>• Continue to address gross pollution management and identified litter hotspots through structural and non-structural measures, from bins and pollutant traps to a strong program of public education and state and national campaigns, including Summer in the City and others.<br>• Monthly reporting on tonnes of litter collected from stormwater pits, litter baskets, and beaches, and street conditions monitored via the citizens monitoring group. | 2010/11 & ongoing | Infrastructure Services |
| Facilitate the application of water sensitive urban design by the community | Community engagement | • Support internal and external stakeholders in the delivery of stormwater quality education and engagement programs, particularly around projects in planning.<br>• Delivery of Council's Climate Conversations and local action planning sessions, focused on facilitating community climate action, including the implementation of water sensitive urban design. | 2010/11 & ongoing | Sustainable Environment |

| Strategy | Impact area | Actions | When | Who is leading this action? |
|---|---|---|---|---|
| Facilitate the application of water sensitive urban design by the community | Alternative water sources | • Develop and communicate rainwater and stormwater harvesting information for residents and business, linked in with partner programs such as Melbourne Water's Downpipe Disconnections Program and South East Water Rainwater Tank program. | 2010/11 & ongoing | Sustainable Environment |
| | Planning Controls for WSUD | • Influence the uptake of water sensitive urban design in the community, primarily through the Sustainable Design in the Planning Process.<br>• Public exhibition of the proposed C78 Stormwater Management (WSUD) amendment and ongoing efforts to incorporate the amendment into the local planning scheme. This action is being undertaken in partnership with the cities of Melbourne, Stonington and Yarra. | 2010/11 & ongoing | Strategic Planning |
| | Residential water use | • Support water efficient homes through Council programs, such as Challenge to Change and Socs and Blocks (a pilot program for sustainability in apartment blocks), as well as partnership programs such as the South East Water showerhead exchange. | 2010/11 | Sustainable Environment |
| | Non-residential water use | • Support water efficient businesses through Council programs, such as Enviro Events, and partnership programs such as the South East Water S155 business support program, fire sprinkler efficiency program, waterless woks program, cooling towers water efficiency program amongst others.<br>• Development of a Green Business program for delivery in 2011/12. | 2010/11 & ongoing | Sustainable Environment<br><br>Economic Development |

*Table 6: Water action plan overview 2010/11*

| Strategy | Impact area | Actions | When | Who is leading this action? |
|---|---|---|---|---|
| Facilitate the application of water sensitive urban design by the community | Stormwater treatment | • Support the implementation of programs targeting stormwater pollution, such as Melbourne Water's 10,000 raingardens program and litter programs.<br>• Installation of a demonstration raingarden at a Council community facility. | 2010/11 | Sustainable Environment |
| | Groundwater | • Work with South East Water to ensure groundwater is not discharged to sewer. | 2010/11 | Sustainable Environment |
| Other actions | Targets | • Work with key stakeholders to advance the development of targets in wastewater, permeability and groundwater. | 2010/11 & ongoing | Sustainable Environment |
| | Catchment action | • Work with partners within the local catchment for improved water management outcomes. Partners include Melbourne Water, the Inner Melbourne Action Plan group of councils, the Association of Bayside Municipalities and other regional practitioner groups.<br>• Develop an appropriate program of action to improve the health of the Elwood Canal. Partners include Melbourne Water, local community members, schools, the Ecocentre and others. | 2010/11 & ongoing | Sustainable Environment |

## 4.3 Building capacity to implement WSUD

The aim of Council's Capacity Building Program is to ensure that Council staff and contractors develop the necessary skills to implement the Water Plan.

A Capacity Building Program and calendar of events will support each service unit in the delivery of water management projects. As WSUD is a rapidly evolving field, the capacity building program will be updated regularly.

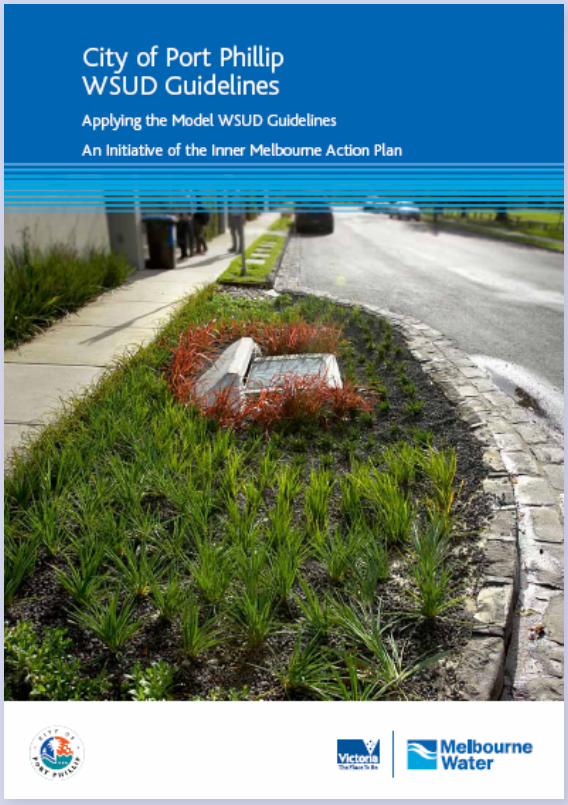
The Capacity Building Program is strongly based on Council's main technical resource, the WSUD Guidelines and on project-based workshops to support project delivery. Clearwater is a key bridging organisation supported by Melbourne Water to provide significant capacity building assistance with its ongoing program of training and resources, providing Council with more technical skills where required.

### Water Sensitive Urban Design Guidelines

The Water Sensitive Urban Design (WSUD) Guidelines inform Council staff, developers and residents on how to apply WSUD principles to urban developments or local water reuse projects. The guidelines provide information, strategic advice and practical tips through the following structure:

- Part 1: Policy commitment and principles of WSUD
- Part 2: How to implement WSUD through a project management framework, including risk management, climate change impacts, construction and maintenance
- Part 3: Local case studies of innovative and practical WSUD
- Part 4: Fact Sheets covering the elements of WSUD and treatment technologies

The WSUD Guidelines will be amended and altered as technologies, knowledge and practices increase.



## 4.4 Communicating progress

An internal communications plan will be implemented to achieve the following objectives:

- increase staff general awareness of the Water Program and relevant targets
- educate staff involved in the delivery or maintenance of WSUD
- communicate Council learning
- promote and support the WSUD referrals process (WSUD Technical Group)
- promote Council success
- support staff involved in the delivery of the external communications plan.

An external communications plan will be implemented with the primary objectives to:

- increase community general awareness of Council's Water Program, actions and relevant targets
- educate the community about integrated water management
- increase community awareness of what they can do to contribute to targets
- increase the uptake of WSUD by the community
- promote Council leadership.

Relevant supporting materials include:

- **City of Port Phillip WSUD Guidelines (2009):** a technical document for Council and the community to assist with the implementation of WSUD. All technical updates to this document will be managed by Melbourne Water.
- **Case studies:** the City of Port Phillip will showcase its integrated water management program to Council and the community through case studies of on-the-ground implementation of Water Sensitive Urban Design. These will be integrated into the WSUD Guidelines over time, with internal workshops to support the learning process.
- **Environment E-hub**: Council's primary community online education tool, to complement the materials and approach of Council' behaviour change programs, whilst reaching out to a larger section of the community. www.enviroehub.com.au
- **Council intranet and internet pages.**

## 4.5 Monitoring and reporting

### Overview

The delivery of Council's implementation plans will be reviewed on a six-monthly basis followed by an annual review of overall delivery of the Water Plan. This review will be presented to Council's interdepartmental Sustainability Taskforce and reported to Council through relevant channels such as the Toward Zero Annual Environment Report, Community Plan Report and individual department plans. All adopted integrated water management targets will be reviewed in 2014.

### Our annual water account

The City of Port Phillip's water account is a key mechanism for tracking Council's delivery to targets. Through project tracking, it captures and summarises the annual and cumulative net environmental benefits of Council's projects on the municipality. The annual water account will be reported to Council each year as follows:

- total water saved (ML)
- total stormwater quality improvement achieved (estimated pollutant reductions KG/year)
- total alternative water sources used (ML)
- total percentage of catchment treated by WSUD
- cumulative results achieved since base year.

The water account will be based on the estimated water cycle benefits of all WSUD projects delivered by Council, capturing a range of information, including project location, catchment type, area treated (m2), tank size, stormwater flow and pollutants reduced, financial costs and benefits.

There are many ways in which Council can measure and monitor improvements in integrated water management. To complement the annual water account, efforts will be made across Council to track relevant indicators such as open space irrigation efficiency, measurable improvements to tree health across the municipality, and community perceptions of Council's transition towards sustainability.

### Monitoring project performance and maintenance regimes

The City of Port Phillip aims to monitor the performance of on-the-ground WSUD through the following approaches:

- tracking estimated water cycle benefits of all projects, incorporating WSUD. Tools such as MUSIC and STORM will be utilised to model benefits
- assessing functional performance of WSUD through the asset maintenance process.

Improving business cases to reflect strong conceptual visions of WSUD, standardising preferred designs for WSUD, and ensuring projects are delivered as designed and in accordance with best practice will be critical to measuring Council's progress in this area.

Progress in this area will be measured qualitatively across Project Design, Project Delivery and Project Maintenance to provide a picture of Council's increasing capacity to deliver WSUD across the entire project lifecycle.

[3] City of Port Phillip's annual water account does not include water quality monitoring as it is expensive and does not necessarily produce statistically reliable estimates of water quality contaminant loads (BMT WBM, 2009). Given the size of the bay and the range of impacts it receives, it is not feasible to use marine water quality as an indicator of Council's progress in this area. Reductions in pollutant loads will act as an indicator of local improvements to the bay.

## 4.6. Key implementation considerations

### 4.6.1. Local, regional and community partnerships

The Water Plan is strongly based on cross-Council, local and regional partnerships. In some instances Council is a conduit for the environmental retrofit and education programs best managed by external stakeholders. In other instances Council can deliver better on-the-ground outcomes through a stakeholder partnership approach.

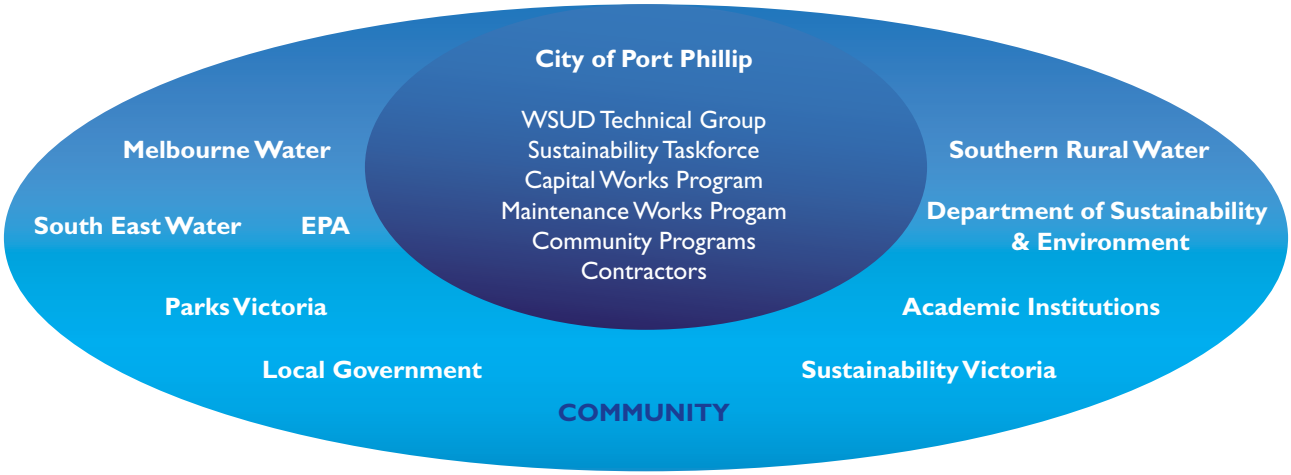
Key stakeholder partnership opportunities worth noting are:

- **Melbourne Water,** through its Living Rivers Stormwater program
- **South East Water,** through its S155 water conservation business and community support programs
- **Southern Region Integrated Water Management Strategy**, a partnership project between Melbourne Water, South East Water and Southern Rural Water
- **National Water Initiative Cities as a Catchment Research Program**, focused on research into the characteristics of a water sensitive city, of which City of Port Phillip is a project partner
- **Inner Melbourne Action Plan**, an alliance of local government comprising the Cities of Melbourne, Port Phillip, Stonnington and Yarra. This alliance has progressed significant action in integrated water management (refer Appendix A)
- **Association of Bayside Municipalities**, comprising 10 Councils with coastal frontage to Port Phillip Bay concerned with improving the overall management of the coastal environment, with climate change adaptation and water quality improvement of key interest
- **Other local government and partners within the Elster Creek catchment**, namely the Cities of Bayside, Glen Eira and Kingston, as well as Parks Victoria and Port of Melbourne Corporation
- **EcoCentre**, a not-for-profit community-managed environment group, supported by the City of Port Phillip. The EcoCentre provides a base for community groups involved in a range of activities, including water conservation and water quality improvement
- **Practitioners networks**, including the Inner Urban WSUD Practitioners Network, with the participation of Melbourne Water, and the Southern Region Stormwater Group, with the participation of South East Water.

Council will continue to seek to be a part of additional alliances where this will assist achieve the Water Plan's objectives.

### Delivering the Water Plan

*Figure 19: Delivering the Water Plan through local, regional and community partnerships*



### Building more resilient communities for the future

Residents and businesses are important contributors to delivering to our integrated water management targets. Council will work closely with the community to facilitate action in the following areas:

- Educating the community about water quality, including sediment and erosion control, litter management, nutrients and other stormwater pollutants
- Building community understanding and support for WSUD, the role it can play in water quality improvement and how the community can implement water quality improvement works
- Increasing the implementation of water efficiency measures through the delivery of community education and outreach programs
- Increasing the uptake of rainwater tanks by households, primarily through the Sustainable Design in the Planning Process and the proposed Port Phillip C78 WSUD amendment
- Promoting water conservation and water quality programs delivered by Council stakeholders, including South East Water, Melbourne Water, and others
- Increasing the uptake of WSUD in the development community, primarily through the Sustainable Design in the Planning Process and the proposed Port Phillip C78 WSUD amendment
- Identifying and responding to emerging water management needs across different business and residential sectors
- Partnering in ongoing care for maintenance similar to the "Adopt a Tree" program
- Gaining community ownership for WSUD projects undertaken on allotments and in streetscapes, open spaces and neighbourhoods.

Effective community engagement is critical as it motivates community participation in the delivery of WSUD and integrated urban water management solutions at the local or catchment-wide scale.

City of Port Phillip recognises that partnerships and collaboration on sustainability issues is essential. Empowering the community to take action is a key part of creating a city and region with the smallest possible ecological footprint.

### 4.6.2 How will the Water Plan be funded?

In the past two years, there has been a significant increase in the incorporation of WSUD within Council projects. Delivering to the strategies, targets and actions in this plan will require Council to further escalate these efforts and allocate specific resources to WSUD projects across all proposed implementation plans. As Council has set 2066 as its target year for achieving best practice integrated water management, this investment is calculated against the next 56 years. It is expected that the required investment for WSUD will become a "business as usual" component of the capital and maintenance works program over time.

To enable a transition to a water sensitive city over the next ten years, Council will need to invest an average annual figure of $1.6 million, or 5.6% of its present capital works program of $28,450,000, to the implementation of water sensitive urban design measures across the municipality. This can be allocated as follows:

- 4.6% of Council's present capital works program (approximately $1.3 million) to delivering to alternative water sources and stormwater management targets
- 1% of Council's present capital works program (approximately $285,000) to delivering water conservation targets.

In the initial stages, this investment may be implemented in a staged, progressive manner as Council escalates its efforts in delivering WSUD. In following years this investment would need to be adjusted so that targets for 2020 are achieved as planned. It is expected that the required investment will become a business as usual component of the capital and maintenance works program over time.

This funding commitment is also representative of the funding commitment made towards additional benefits such as reduced operational costs, improved amenity of parks and recreational facilities and streetscapes, flooding control and securing alternative water sources. A significant proportion of this funding will contribute to enhancing the health of Council's trees, and will allow Council to increase planted areas within the urban landscape.

It is estimated that an additional $750,000 would need to be invested across the private domain each year to address community impacts, increasing over time once the proposed Port Phillip C78 Stormwater Management (WSUD) planning scheme amendment is integrated into the local planning scheme.

Adopting this WSUD investment into capital works projects will achieve best practice stormwater management targets by 2066.

### How much does WSUD actually cost?

On the ground implementation of WSUD requires careful consideration of the urban water cycle very early in the design phase, which then allows for the integration of water management objectives into an overall project design. The design and construction of WSUD elements carry costs which can be substantially reduced by incorporating WSUD into existing Council projects early in the design phase. For example, the cost of a raingarden may not necessarily be much greater than the cost of conventional landscaping. However, raingardens provide additional benefits of passive irrigation to reduce irrigation requirements and improved stormwater treatment.

The WSUD Guidelines (see section 4.3) provide some guidance on costs associated with WSUD which can be utilised to forecast design and construct costs associated with different measures. The costs of these projects would likely be absorbed within the existing roads and drainage works budgets.

However, inadequate life cycle costing information and tools currently exist to support the implementation of WSUD projects. This has been identified at a national level as a key area for further development, to support practitioners delivering these projects. In the interim, Council must gather and consolidate the range of data associated with all proposed projects' social, financial and environmental costs and benefits, to facilitate the assessments required in project selection and delivery.

# Appendices

# APPENDIX A
## COUNCIL & COMMUNITY WATER PROFILES

### Council water consumption data

#### Overview

The City of Port Phillip tracks Council water consumption through Utility Tracker, a tool developed by Sustainability Victoria to capture water use across a range of categories as follows:

- **parks & open space**: parks, gardens, playgrounds, median strips & nature strips
- **sports & recreation facilities**: clubs, pavilions
- **Council buildings**: aged care facilities, child care centres, community centres, depots, libraries, office accommodation and public housing
- **public amenities**
- **major sites**: South Melbourne Market
- **other**: carparks, miscellaneous.

Data is provided by South East Water quarterly and has been collected since 1998/1999. Council has nominated 2000/01 as the base year as previous years contain significant anomalies. Please refer to Table 7 for a detailed breakdown of Council water use.

*Table 7: Water use by facility type (ML)*

| Financial Year | Parks / open space | Sports & recreation facilities | Council buildings | Public amenities | South Melbourne Market | Other | Total |
|---|---|---|---|---|---|---|---|
| 2000/2001 | 368 | 46 | 36 | 44 | 17 | 7 | 518 |
| 2001/2002 | 225 | 49 | 33 | 35 | 15 | 3 | 360 |
| 2002/2003 | 328 | 52 | 32 | 39 | 14 | 2 | 467 |
| 2003/2004 | 191 | 36 | 25 | 16 | 14 | 2 | 283 |
| 2004/2005 | 198 | 37 | 26 | 18 | 19 | 3 | 300 |
| 2005/2006 | 207 | 44 | 23 | 21 | 18 | 2 | 314 |
| 2006/2007 | 104 | 26 | 20 | 9 | 15 | 3 | 177 |
| 2007/2008 | 84 | 18 | 18 | 6 | 15 | 3 | 144 |
| 2008/2009 | 93 | 19 | 17 | 5 | 14 | 2 | 150 |
| % Reduction | 75% | 60% | 54% | 88% | 16% | 70% | 71.0% |
| Target Reduction 2012 | | | | | | | 42% |

## Community water consumption data

The community water consumption inventory identifies the water used by the residential and non-residential sector in the municipality. Data has been provided by South East Water since 1999/2000. Council has nominated 2000/01 as the base year as a result of anomalies in the initial datasets.

The following tables and figures detail:

- total community water consumption (ML)
- average annual consumption per property (kL)
- community water consumption by postcode (ML).

*Table 8: Total community water consumption (ML)*

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| Residential (ML) | 6,806 | 6,753 | 6,893 | 6,511 | 6,506 | 6,742 | 6,275 | 5,817 | 5,925 |
| Non-Residential (ML) | 3,501 | 3,145 | 2,983 | 2,711 | 2,679 | 2,899 | 2,605 | 2,362 | 2,378 |
| Total (ML) | 10,307 | 9,898 | 9,876 | 9,222 | 9,185 | 9,641 | 8,880 | 8,180 | 8,303 |

*Figure 20: Total community water consumption 2000/01-2008/09*

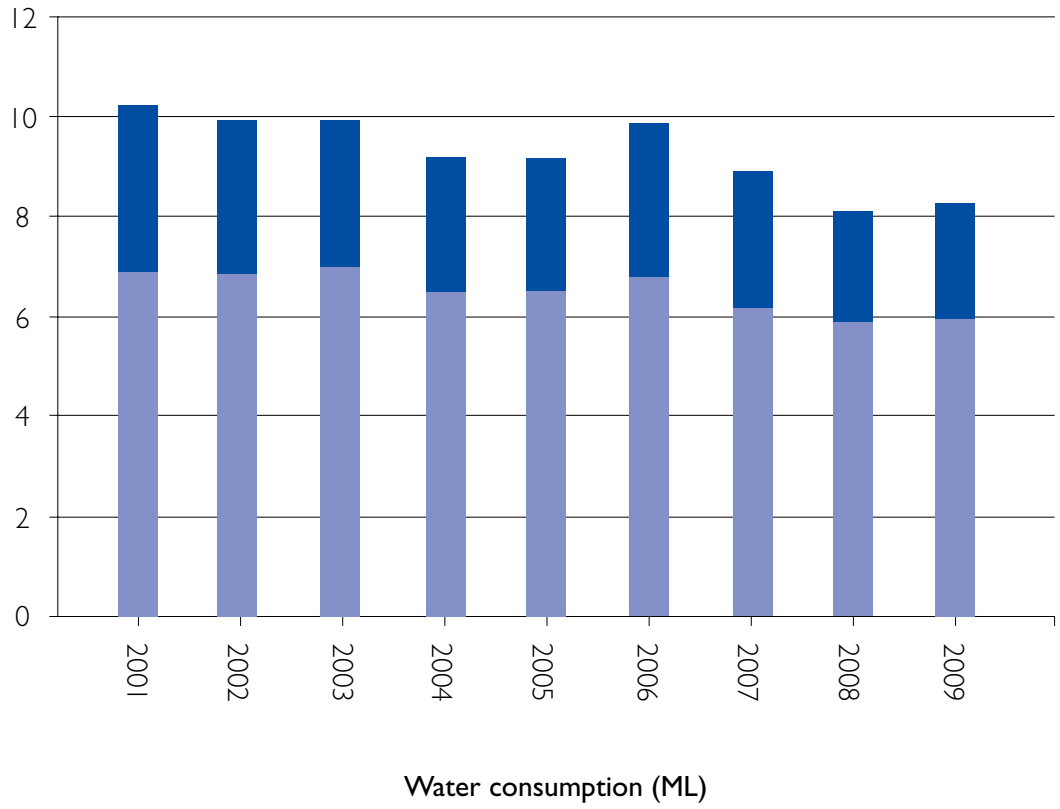


*Table 9: Average annual consumption per residential property and business (kL)*

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|
| Residential (KL) | 6,806 | 6,753 | 6,893 | 6,511 | 6,506 | 6,742 | 6,275 | 5,817 | 5,925 |
| Non-Residential (KL) | 3,501 | 3,145 | 2,983 | 2,711 | 2,679 | 2,899 | 2,605 | 2,362 | 2,378 |
| Total (KL) | 10,307 | 9,898 | 9,876 | 9,222 | 9,185 | 9,641 | 8,880 | 8,180 | 8,303 |

*Figure 21: Average annual consumption per residential property (kL)*

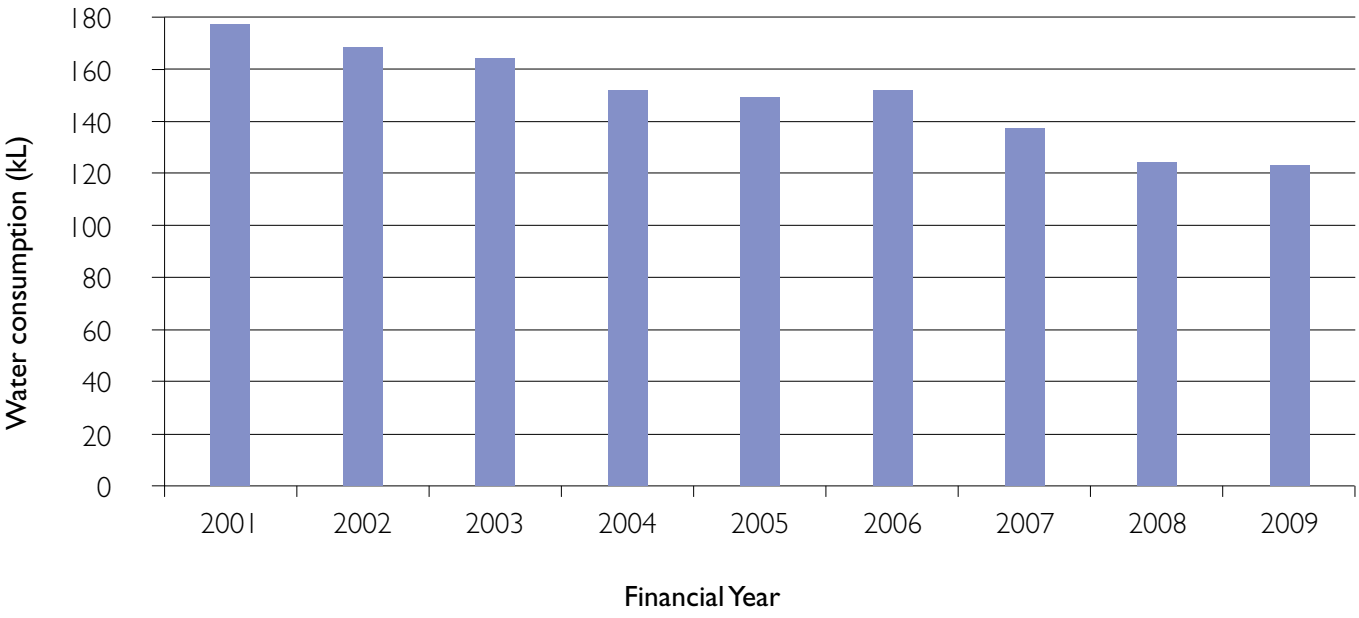



*Figure 22: Average annual consumption per business (kL)*

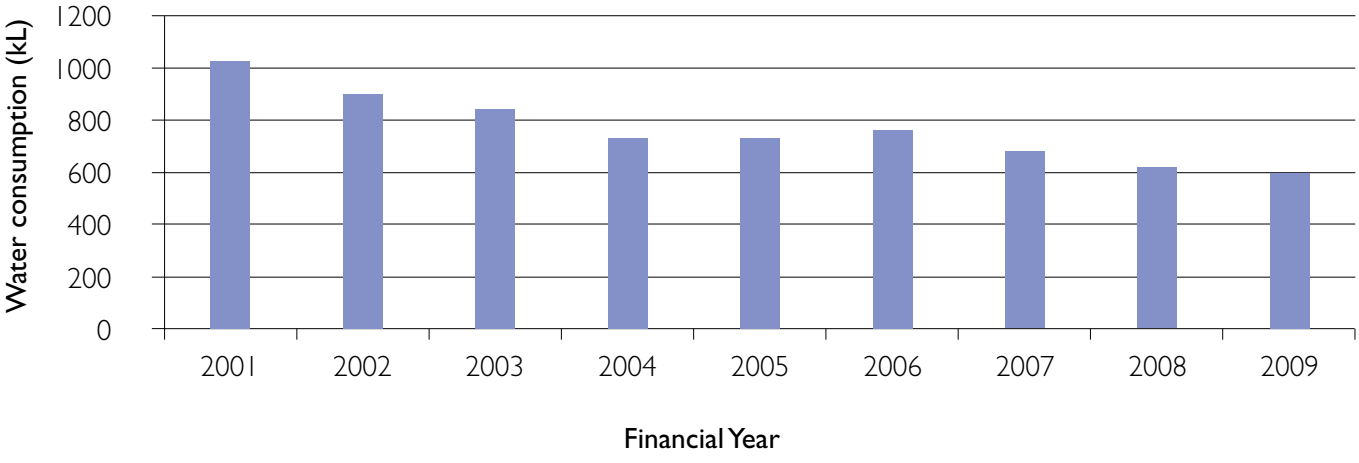
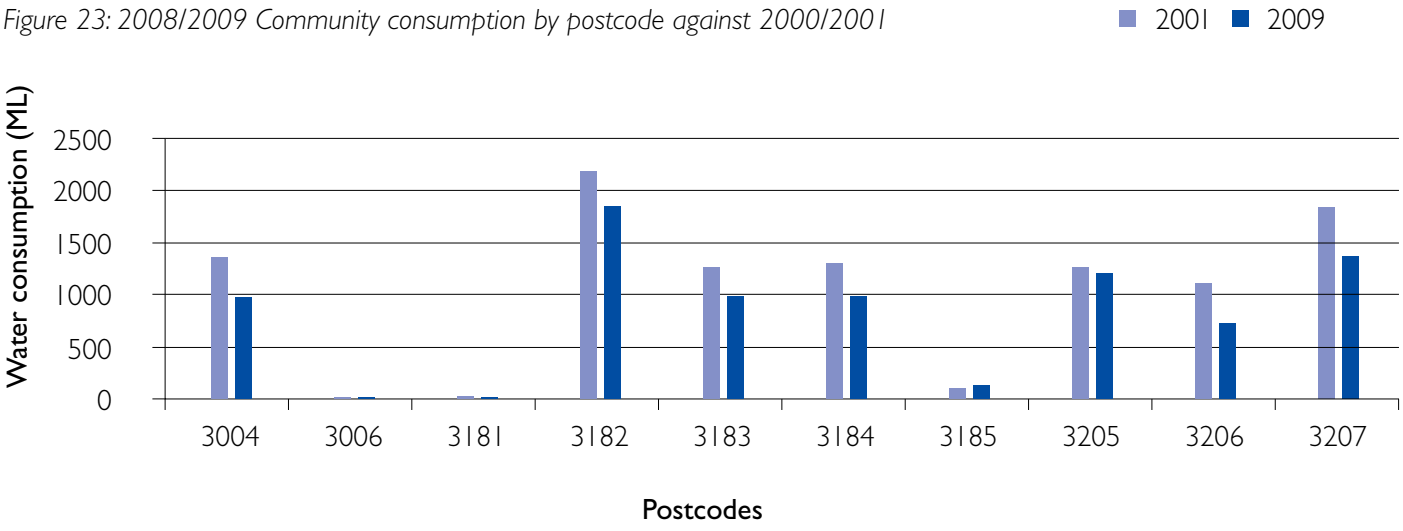


*Table 10: Community water consumption by postcode (ML)*

| SUBURB | POSTCODE | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Melbourne (St Kilda Rd) | 3004 | 1,393 | 1,236 | 1,162 | 1,089 | 1,124 | 1,204 | 1,174 | 988 | 985 |
| Southbank | 3006 | 13 | 12 | 5 | 10 | 11 | 12 | 13 | 13 | 14 |
| Windsor | 3181 | 28 | 28 | 27 | 26 | 24 | 23 | 26 | 18 | 19 |
| St Kilda | 3182 | 2,158 | 2,150 | 2,193 | 2,052 | 2,022 | 2,116 | 2,003 | 1,846 | 1,873 |
| St Kilda East | 3183 | 1,242 | 1,210 | 1,206 | 1,144 | 1,122 | 1,155 | 1,087 | 1,076 | 976 |
| Elwood | 3184 | 1,261 | 1,220 | 1,240 | 1,141 | 1,117 | 1,157 | 1,065 | 968 | 994 |
| Ripponlea | 3185 | 80 | 78 | 78 | 76 | 76 | 78 | 73 | 10 | 93 |
| South Melbourne | 3205 | 1,234 | 1,235 | 1,218 | 1,112 | 1,092 | 1,177 | 1,060 | 1,094 | 1,184 |
| Albert Park | 3206 | 1,067 | 1,009 | 1,024 | 914 | 906 | 929 | 838 | 746 | 765 |
| Port Melbourne | 3207 | 1,831 | 1,722 | 1,723 | 1,658 | 1,690 | 1,790 | 1,540 | 1,422 | 1,399 |
| Total | | 10,307 | 9,898 | 9,876 | 9,222 | 9,185 | 9,641 | 8,880 | 8,180 | 8,303 |

*Figure 23: 2008/2009 Community consumption by postcode against 2000/2001*



# APPENDIX B
# INTEGRATED WATER MANAGEMENT STUDY

## Overview

In 2009, the City of Port Phillip commissioned EDAW AECOM to undertake an integrated water management study for the municipality. The aim of the project was to provide insight into the best way forward for Council to strategically integrate sustainable water management practices into the planning, design and capital works process across the municipality.

More specifically, the study provided support in the following three areas:

- At a strategic level, assist Council to establish a framework that sets out underlying philosophy and guiding principles for a water sensitive city
- At a planning level, identify new targets for integrated water management, translate targets to measurable flow volume reductions and pollutant load reductions, and quantify a current water balance and pollutant balance for the City of Port Phillip
- At an implementation level, outline a process for achieving targets over time.

The water balance and pollutant budgets contained in the Water Plan are a result of this work and will form the basis for future modelling and target setting in this area.

## Review of Council's previous Water Plan

A comprehensive review of the 2005 Water Management Plan was undertaken by Council as part of the preparation of the Water Plan. The integrated water management study further progressed this review by accounting for and modelling all actions implemented. The outcomes are detailed in section 2.3 and Appendix E.

## Water and pollutant balance methodology

The water and pollutant balances were calculated as follows:

- Potable water use is calculated based on data provided by South East Water for 2000/01 to 2007/08. A baseline of 2000/2001 has been adopted by Council

- Wastewater generation within the municipality was estimated from potable use using assumed sewage discharge factors. Typically, this would be around 0.7 for residential areas in Melbourne due to irrigation, while for commercial/industrial it would be higher (perhaps 0.9) but can be highly variable). Due to the introduction of water restrictions, irrigation use has declined dramatically, resulting in changes to sewage discharge factors as less water is "consumed", particularly for irrigation. This variability is reflected in the modelling. There is still considerable uncertainty in these figures as irrigation use and current sewage flows were both unknown and had to be estimated

- Rainfall and evapo-transpiration data for the Melbourne Regional Office gauge (86071) was used for modelling. A recent rainfall data set consisting of 10 years of data was selected for analysis July 1996 – June 2006. This takes into account dryer conditions than the long-term average and is considered to be a reasonable representation of likely future conditions, given expected climate change and a trend towards less rainfall

- Stormwater flows are estimated using land use, ownership (Council, private), drainage sub-catchments and imperviousness based on an imperviousness GIS layer supplied by Melbourne Water. Land use was analysed as per current town planning zones, and then aggregated to five land use categories: Residential, Commercial/Industrial, Road, Open Space and Other

- MUSIC Models for the whole municipality and individual subcatchments were set up using a standard set of nodes allowing for full representation of different land uses, surface types and ownership. Fletcher (2007) pollutant concentrations were adopted for storm flows for general impervious, road and roof surface types.

The MUSIC default soil parameters were adopted for modelling. This approach was considered reasonable as flows from pervious areas were minor relative to impervious flows (estimated at less than 1%). While modified parameters are recommended for Melbourne in the MUSIC manual, recent research has indicated that the defaults (for Brisbane) are likely to be more realistic (Dotto, 2009).

## Target-setting methodology

Targets for Council have been set based on a detailed analysis of:

- Council's past delivery of WSUD (Appendix F) and current commitment to WSUD as reflected in Council's capital works program for 2009/2010

- Future considerations that will facilitate the implementation of WSUD, including capital and maintenance works, technological advances in WSUD, and increasing private sector efforts.

Targets for the private sector have been set based on:

- Current implementation of SDAPP program

- Anticipated impacts of the implementation of the proposed WSUD amendment C78.

Appendices E-F contain important background data used in developing the water and pollutant balances as well as in target setting. WSUD and potable water conservation projects were assessed based on available information. MUSIC modelling of most projects was undertaken to determine reductions in stormwater pollutant loads and potential potable water conservation. The level of information varied with areas and demands estimated for some projects while for others detailed information was available.

# APPENDIX C
## STORMWATER POLLUTANT BUDGETS

*Table 11: Stormwater pollutant budget by land use for the City of Port Phillip (Melbourne 1996-2006 rainfall data and Fletcher (2007) storm flow concentration parameters)*

| | City of Port Phillip managed assets | | | Private ownership | | | |
|---|---|---|---|---|---|---|---|
| | Roads | Public open space | Other | Private residential | Business/ Industrial | Other | Total |
| Area (ha) | 437 | 67 | 350 | 802 | 292 | 98 | 2,046 |
| Flow (ML/yr) | 1,652 | 203 | 59 | 1,998 | 964 | 214 | 5,088 |
| Total Suspended Solids (kg/yr) | 602,438 | 12,961 | 4,185 | 90,180 | 54,501 | 13,873 | 778,138 |
| Total Phosphorus (kg/yr) | 964 | 40 | 12 | 349 | 182 | 43 | 1,590 |
| Total Nitrogen (kg/yr) | 4,074 | 419 | 122 | 4,275 | 2,023 | 440 | 11,353 |
| Gross Pollutants (kg/yr) | 63,600 | 7,820 | 1,792 | 76,500 | 37,100 | 8,180 | 194,992 |

*Table 12: Stormwater pollutant budget by surface type for the City of Port Phillip (Melbourne 1996-2006 rainfall data and Fletcher (2007) storm flow concentration parameters)*

| | City of Port Phillip Council managed assets | | | | Private ownership | | | |
|---|---|---|---|---|---|---|---|---|
| | Road | Roof | General impervious | Pervious | Roof | General impervious | Pervious | Total |
| Area (ha) | 394 | 30 | 73 | 357 | 531 | 223 | 439 | 2,046 |
| Flow (ML/yr) | 1,650 | 124 | 124 | 14 | 2,227 | 933 | 16 | 5,088 |
| Total Suspended Solids (kg/yr) | 602,000 | 3,315 | 12,560 | 1,709 | 59,410 | 97,500 | 1,644 | 778,138 |
| Total Phosphorus (kg/yr) | 963 | 19 | 30 | 4 | 338 | 232 | 4 | 1,590 |
| Total Nitrogen (kg/yr) | 4,070 | 279 | 235 | 31 | 4,957 | 1,753 | 28 | 11,353 |
| Gross Pollutants (kg/yr) | 63,600 | 4,806 | 4,806 | 0 | 85,790 | 35,990 | 0 | 194,992 |

# APPENDIX D
## FLOW MANAGEMENT BENEFITS AND POLLUTANT LOAD REDUCTIONS FOR THE CITY OF PORT PHILLIP

*Table 13: Flow management benefits achieved across the City of Port Phillip*

| Water stream | Land ownership | Baseline (2000/2001) volume used or generated (ML/yr) | Volume reduction (ML/yr) | Current % reduction |
|---|---|---|---|---|
| Mains water supply | Council | 518 | 374 | 72.2% |
| | Residential | 6,806 | 989 | 14.5% |
| | Comm/Ind | 2,983 | 765 | 25.6% |
| | Total | 10,307 | 2,128 | 20.6% |
| Stormwater | Council | 1,866 | 5 | 0.3% |
| | Residential | 1,999 | 1 | 0.1% |
| | Comm/Ind | 964 | 7 | 0.7% |
| | Other | 258 | 0 | 0.0% |
| | Total | 4,828 | 13 | 0.3% |
| Wastewater | Council | 124 | 67 | 53.7% |
| | Residential | 4,901 | -567 | -11.6% |
| | Comm/Ind | 2,834 | 682 | 24.1% |
| | Total | 7,859 | 181 | 2.3% |

*Table 14: Pollutant load reductions achieved across the City of Port Phillip*

| Pollutant | | Baseline load (kg/yr) | Load reduction (kg/yr) | % Reduction to date |
|---|---|---|---|---|
| TSS | Council | 619,584 | 6549 | 1.1% |
| | Residential | 90,180 | 1426 | 1.6% |
| | Commercial Industrial | 54,501 | 693 | 1.3% |
| | Other | 13,873 | - | 0.0% |
| | Total | 778,138 | 8668 | 1.1% |
| TP | Council | 1,016 | 9 | 0.9% |
| | Residential | 349 | 2 | 0.7% |
| | Commercial Industrial | 182 | 2 | 0.9% |
| | Other | 43 | - | 0.0% |
| | Total | 1,590 | 13 | 0.8% |
| TN | Council | 4,615 | 31 | 0.7% |
| | Residential | 4,275 | 12 | 0.3% |
| | Commercial Industrial | 2,023 | 16 | 0.8% |
| | Other | 440 | - | 0.0% |
| | Total | 11,353 | 59 | 0.5% |

# APPENDIX E
## WSUD PROJECTS IMPLEMENTED UP TO 2008/09


78

*Table 15: WSUD projects 0708*

| Action ID | Type | Action name (Location) | WSUD system type | Projected benefits (kL/yr) | | | | Stormwater pollutant load reductions (kg/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mains water conserved | Alternative water source used | Wastewater flow reduction | Stormwater flow reduction | TSS | TP | TN | Litter (t/yr) |
| **Council actions** | | | | | | | | | | | |
| **Parks & streetscapes** | | | | | | | | | | | |
| 1 | ST | Howe Parade, Port Melbourne | Bioretention | 0 | 0 | 0 | 0 | 1,486 | 1.97 | 5.9 | 170 |
| 2 | AWS | J.L. Murphy Reserve | Xtracta (WRX) Water Treatment Plant | 4,000 | 4,000 | NA | 4,000 | 1,460 | 2.35 | 9.9 | 155 |
| 3 | DM | Irrigation practices | Open space management | 40,000 | 0 | 0 | 0 | 0 | 0.00 | 0.0 | 0 |
| 4 | ST | Installation of GPTS | Gross pollutant traps | NA | NA | NA | NA | 0 | 0.00 | 0.0 | 49 |
| 5 | DM | Garden City Reserve tanks | Tanks | 56 | 56 | 0 | 56 | 2 | 0.01 | 0.1 | 2 |
| 6 | DM | Murphy reserve subsurface irrigation | Tanks | NA | NA | NA | NA | NA | NA | NA | NA |
| **Facilities** | | | | | | | | | | | |
| 1 | AWS | Depot/Transfer Station water harvesting | Tanks | 528 | 528 | 0 | 528 | 14 | 0.08 | 1.2 | 23 |
| 2 | AWS | St Kilda Town Hall | Rainwater tanks | 30 | 30 | 0 | 30 | 1 | 0.00 | 0.1 | 38 |
| 3 | AWS | Garbage Truck washdown | High pressure washer | 1,320 | 0 | 1,320 | 0 | 0 | 0.00 | 0.0 | 0 |
| 4 | DM | St Kilda Town Hall | Fire sprinkler water captured | 18 | 0 | 0 | 0 | 0 | 0.00 | 0.0 | 0 |
| **Sub-Total** | | | | **45,934** | **4,614** | **1,320** | **4,614** | **2,963** | **4.41** | **17.1** | **436** |

| Action ID | Type | Action name (Location) | WSUD system type | Projected benefits (kL/yr) | | | | Stormwater pollutant load reductions (kg/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mains water conserved | Alternative water source used | Wastewater flow reduction | Stormwater flow reduction | TSS | TP | TN | Litter (t/yr) |
| Council actions | | | | | | | | | | | |
| Community actions | | | | | | | | | | | |
| Business | | | | | | | | | | | |
| 1 | AWS | Christian Brothers College Rainwater harvest | Tanks/pond | 88 | 0 | 0 | 88 | 9 | 0.02 | 0.5 | 24 |
| 2 | AWS | Middle Park, St Kilda Park, St Columba's and St Kilda Primary Schools | Tanks/pond | 1,495 | 1,495 | 0 | 1,490 | 39 | 0.22 | 3.3 | 57 |
| 3 | ST | Toyota Green - Fisherman's Bend | Swale and bioretention | NA | NA | NA | 0 | 507 | 0.66 | 1.0 | 64 |
| **Sub-Total** | | | | **1,583** | **1,495** | **0** | **1,578** | **555** | **0.90** | **4.8** | **145** |
| Residential | | | | | | | | | | | |
| 1 | AWS | K2 Apartments St Kilda | Rainwater Tank Greywater treatment Stormwater treatment | 5,272 | 3,285 | 3,285 | 550 | 16 | 0.08 | 1.3 | 26 |
| 2 | DM | Showerhead Exchange program | Showerheads | 17,736 | NA | 15,962 | NA | NA | NA | NA | NA |
| 3 | AWS | Inkerman Oasis | Wetland, Greywater treatment, MBR tanks, UV disinfection | 3,000 | 3,000 | 3,000 | 890 | 1,410 | 2.39 | 10.9 | 308 |
| **Sub-Total** | | | | **26,008** | **6,285** | **22,247** | **1,440** | **1,426** | **2.47** | **12.2** | **334** |
| **Total** | | | | **73,524** | **12,394** | **23,567** | **7,632** | **4,943** | **7.79** | **34.1** | **915** |

*Table 16: WSUD projects 0809*

| Action ID | Type | Action name (Location) | WSUD system type | Projected benefits (kL/yr) | | | | Stormwater pollutant load reductions (kg/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mains water conserved | Alternative water source used | Wastewater flow reduction | Stormwater flow reduction | TSS | TP | TN | Litter (t/yr) |
| Council actions | | | | | | | | | | | |
| Parks & streetscapes | | | | | | | | | | | |
| 1 | ST | St Kilda Promenade | Tanks, passive irrigation | NA | NA | NA | 0 | 0 | 0.00 | 0.0 | 0 |
| 2 | ST | Foreshore connections - Fitzroy St | Raingarden | 0 | 0 | NA | 0 | 741 | 0.97 | 2.9 | 84 |
| 3 | ST | Carlisle St, St Kilda | Tree pit | 0 | 0 | NA | 0 | 311 | 0.41 | 1.2 | 36 |
| 4 | AWS | Lindsay Avenue, Elwood | Strip drains, customised pits & slotted pipes, passive and active irrigation | 10 | 10 | NA | 10 | 1,072 | 1.46 | 3.8 | 129 |
| 5 | AWS | Graham St, Albert park | Strip drains | 20 | 20 | NA | 20 | 848 | 1.14 | 3.2 | 97 |
| 6 | ST | Lagoon Lane | Swale | NA | NA | NA | 0 | 43 | 0.06 | 0.1 | 5 |
| 7 | AWS | Alma Park | Rainwater tanks | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.0 | 0 |
| 8 | ST | Elwood Carpark Stage 1 | Swale | 0 | 0 | NA | 0 | 555 | 0.71 | 1.0 | 63 |

| Action ID | Type | Action name (Location) | WSUD system type | Projected benefits (kL/yr) | | | | Stormwater pollutant load reductions (kg/yr) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mains water conserved | Alternative water source used | Wastewater flow reduction | Stormwater flow reduction | TSS | TP | TN | Litter (t/yr) |
| **Facilities** | | | | | | | | | | | |
| 1 | DM | South Melbourne Market | Waterless urinals | 310 | NA | 279 | NA | NA | NA | NA | NA |
| 2 | DM | South Melbourne Market | Waterless urinals | 1,385 | NA | 1,247 | NA | NA | NA | NA | NA |
| 3 | DM | South Melbourne Market | High pressure units | 655 | NA | 655 | NA | NA | NA | NA | NA |
| 4 | DM | Elwood Carpark facilities rainwater tanks | Tanks | 0 | 0 | 0 | 614 | 16 | 0.09 | 1.4 | 27 |
| **Sub-Total** | | | | **2,380** | **30** | **2,181** | **644** | **3,587** | **4.85** | **13.5** | **441** |
| **Community actions** | | | | | | | | | | | |
| **Business** | | | | | | | | | | | |
| 1 | AWS | Sustainable design referrals | Rainwater tank is predominant WSUD measure | 5,000 | 5,000 | 0 | 5,000 | 138 | 0.77 | 11.2 | 606 |
| **Sub-Total** | | | | **5,000** | **5,000** | **0** | **5,000** | **138** | **0.77** | **11.2** | **606** |
| Residential | | | | | | | | | | | |
| 1 | DM | Showerhead Exchange program | Showerheads | 4,424 | NA | 3,982 | NA | NA | NA | NA | NA |
| Sub-Total | | | | 4,424 | 0 | 3,982 | 0 | 0 | 0.00 | 0.0 | 0 |
| Total | | | | 11,804 | 5,030 | 6,163 | 5,644 | 3,725 | 6 | 25 | 1,047 |

# APPENDIX F
## CLIMATE CHANGE PREDICTIONS

The best available climate change predictions for the municipality are based on the City of Port Phillip's Climate Change in the City of Port Phillip - An Initial Perspective Report (Port Phillip, 2007a), and the most recent climate change science released by the IPCC and CSIRO (CSIRO and BoM 2007). As science improves, so will the analysis of potential impacts. A summary of key indicators and local climate impacts for the municipality follows:

1. The City of Port Phillip is likely to become drier with increasingly longer dry spells. Total annual rainfall is projected to decrease by 2% by 2020, 4% by 2050 and 15% by 2100. The last 10 years have recorded annual rainfall of over 100 mm below the Melbourne average, and CSIRO estimate this will continue to decrease annually. Melbourne is therefore likely to continue experiencing dry spells, drought conditions and water shortages, together with decreasing water quality resulting from decreased streamflow, increased concentrations of pollutants entering the bay and higher ambient bay temperatures.
2. Climate change will increase the duration, intensity and frequency of storm events with the following storm intensity estimations likely for the city: 5-10% increase in intensity of a 20-yr event by 2020, 35-45% increase in intensity of a 20-yr event by 2050, and 70-100% increase in intensity of a 20-yr event by 2100. With an estimated 61% of the municipality impervious, this increase will impact on the ability of drainage infrastructure to deal with this intense rainfall, resulting in increased stormwater runoff and flooding. Coupled with sea level rise and extreme weather events, this runoff can cause significant damage to infrastructure, property and natural habitats, particularly on the coast and in low-lying areas.
3. Temperature is projected to rise by an estimated 1-1.5% by 2020, 2.5% by 2050, and 3.5-5 % by 2080-2100. As temperature rises, there is also the potential that evaporation will increase, estimated at 3% by 2020. The extreme rise in temperature is anticipated to result in a sharp increase in urban water demand, and lead to a rise in heat-related illnesses and impacts.

*Table 17: City of Port Phillip summary of local climate impacts*

| Climate change indicator | Local climate impacts | | |
|---|---|---|---|
| | 2020-2025 | 2050 | 2075-2100 |
| Total rainfall decrease (%) | 2% by 2020 | 4% by 2050 | 15% by 2100 |
| Increase in storm intensity (% increase in 20 yr event) | 5-10% by 2020 | 35-45% by 2050 | 70-100% by 2100 |
| Temperature increase (%) | 1-1.5% by 2020 | 2.5% by 2050 | 3.5-5% by 2080-2100 |
| Sea level rise (cm) | 4.5cm by 2020 | 13.5cm by 2050 | 28.5cm by 2100 |
| Increased drought conditions (drought months) | 15-20% by 2025 | 25-30% by 2050 | 40-50% by 2075 |

Integrated water management in this context will result in an increased ability to adapt to and manage both water-scarce and water-abundant conditions, protecting water quality, managing damaging stormwater flows, and finding new ways to meet water demand.

# Glossary

| | |
|---|---|
| **Aquifer storage and recovery** | A system of water storage where surface water, typically stormwater or treated wastewater, is pumped into an aquifer (underground layer of rock that can hold water), and extracted for use at a later. |
| **Bioretention systems** | These are another name for rain gardens (see below). |
| **Blackwater** | Water polluted with high levels of organic material, such as food, animal or human waste. In a domestic situation, blackwater is any stream of wastewater that contains toilet waste. |
| **BOM** | Bureau of Meteorology |
| **C78 Amendment** | The proposed C78 Stormwater Management (WSUD) Amendment has been developed based on a common stormwater management local planning policy prepared by the Inner Melbourne Action Plan Action 9.3. |
| **Catchment** | The area of land drained by a creek or river system, or a place set aside for collecting water which runs off the surface of the land. Catchments provide the source of water for the reservoirs that collect our drinking water. Most of Melbourne's catchments are "protected": that is, they are fenced to keep out people and domestic animals and minimise the potential of pollution. |
| **City as a catchment** | "City as a catchment" describes a catchment-based approach to urban areas that attempts to close the loop on the urban water cycle. |
| **CSIRO** | Commonwealth Science and Industrial Research Organisation – the national science agency of Australia. |
| **Demand management** | Demand management is an approach to reducing the consumption of water by reducing demand for it. Demand management includes educating people about how to save water, promoting the use of household and industrial appliances that use water more economically, such as dual-flush toilets, and putting a price on water that reminds people of its true value. (Source MW). |
| **Greywater** | Greywater is wastewater from the kitchen, laundry and bathroom (but not the toilet). It usually contains soap, detergents and fats. |
| **Gross pollutant trap** | A gross pollutant trap (GPT) is a structure used to trap large pieces of debris (>5mm) transported through the stormwater system. |
| **ICLEI** | International Council for Local Environment Initiatives. The ICLEI Water Campaign is a milestone-based capacity building program for local government. There are 5 Milestones within the ICLEI Water Campaign™. The Milestones serve as a progressive benchmark as to how well local governments achieve their objectives and goals for water conservation and water quality management for Council and the community. |
| **Impervious** | Impermeable, does not allow water to drain through. |

| | |
|---|---|
| **Integrated water management** | Where the collection, treatment and storage of stormwater and wastewater is embedded into the urban landscape to address issues of water supply and quality in urban areas. |
| **IPCC** | Intergovernmental Panel for Climate Change. |
| **IWM** | See Integrated Water Management. |
| **Mean annual rainfall** | The arithmetically averaged total amount of rain recorded during a calendar year. |
| **Megalitre (ML)** | 1,000,000 litres. |
| **MUSIC** | MUSIC is the acronym used for the Model for Urban Stormwater Improvement Conceptualisation software developed by the Cooperative Research Centre for Catchment Hydrology to model urban stormwater management schemes. |
| **Nutrients** | Nutrients are organic substances such as nitrogen or phosphorous in a water. |
| **Potable water** | Potable water is water suitable for drinking or ingestion purposes. It is assigned as potable on the basis of water quality standards. It is provided to householders through a reticulated (piped) water distribution network. |
| **Pervious** | Permeable to water, as in pervious paving which allows water to permeate the surface. |
| **Raingarden** | Raingardens are constructed vegetation systems such as swales that filter polluted stormwater through a vegetated filter media layer. Water is treated, purified and released so it can flow downstream into waterways or into storage for reuse. Raingardens can often provide a habitat for flora and fauna. Raingardens are also referred to as bioretention systems. |
| **Rainwater** | Rainwater includes roof runoff and is generally stored in rainwater tanks. |
| **Recycled water** | Recycled water is taken from any waste (effluent) stream and treated to a level suitable for further use, where it is used safely and sustainably for beneficial purposes. This is a general term that can include reclaimed water. |
| **Sewage** | Sewage (also called "wastewater") is the human waste material that passes through a sewerage system. Sewage is much more than what gets flushed down the toilet. It also includes everything that goes down the kitchen, laundry and bathroom sinks as well as trade waste from industrial and commercial premises. |
| **Sewerage system** | Sewerage is the system of pipes and pumps that transports wastewater. |
| **Stormwater** | Stormwater is rainfall runoff from all types of surfaces. Stormwater is generated predominately in urban catchments from impervious surfaces such as roads and pavements |

| | |
|---|---|
| **Suspended solids** | Suspended solids refer to small solid particles which remain in suspension in water as a colloid or due to the motion of the water. It is used as one indicator of water quality. Particles can be removed by sedimentation or filtration. |
| **Water balance** | A water balance is a mass balance accounting for water entering, accumulating and exiting a system. It includes rainwater, potable mains water, evapo-transpiration and infiltration, wastewater and stormwater. |
| **Wastewater** | Wastewater is water which has been used for a specific purpose and is no longer required or suitable for that purpose. It comprises blackwater, greywater, as well as industrial and commercial wastewater and trade waste. |
| **Water account** | The account kept by the retailer to track water consumption by a single meter, and to allocate consumption and service costs to the user. |
| **Water Sensitive Urban Design (WSUD)** | WSUD embraces a range of measures that are designed to avoid, or at least minimise, the environmental impacts of urbanisation. WSUD recognises all water streams in the urban water cycle as a resource. Rainwater (collected from the roof), stormwater (collected from all impervious surfaces), potable mains water (drinking water), greywater (water from the bathroom taps, shower, and laundry) and blackwater (toilet and kitchen) possess an inherent value. |
| **Water reuse** | Water reuse is the beneficial use of recycled water that has been treated for reuse on a site. |
| **Urban water grid** | The urban water grid maps the alternative water sources, green infrastructure and community partnerships necessary to become a water sensitive city. It comprises the most appropriate WSUD solutions to respond to municipal water quality and water supply needs, and incorporates stormwater, potable water, wastewater and groundwater management solutions.. |

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## FOR MORE INFORMATION

To learn more about water, other Council environmental plans, or action you can take to make your lifestyle, home or business, and your neighbourhood more water sensitive, visit www.enviroehub.com.au

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