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CITY OF MONASH

INTEGRATED WATER MANAGEMENT PLAN

FINAL (REVISED)

JANUARY 2014

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Integrated Water Management Plan

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EXECUTIVE SUMMARY

The integrated water management plan for the City of Monash documents the following:

- Vision and goals for integrated water management
- Review of existing policy and guidelines, and water sensitive urban design achievements
- Water and pollutant load balance
- Targets and recommendations to guide future strategic policy development and action

Vision and themes for integrated water management

The vision and themes for the integrated water management in the City of Monash, developed from a workshop conducted with Council staff, are

Water is integrated into all Council service areas to ensure a connected and healthy community and environment

This vision is articulated through five themes: social health, ecological health, connected communities, shared prosperity and water sensitive infrastructure

The vision reflects the need to ensure water is considered an integral part of Council's planning and service delivery, and thus helps legitimise the need to support associated structural and non-structural initiatives.

The five themes were drawn from research conducted by Monash University on Melbourne's transition to a water sensitive city. The five themes reflect the key factors influencing integrated water management in Monash, including:

- Amenity and use of active and passive open space areas
- Cost of potable water (e.g. in the delivery and maintenance of Council's active services – sportsgrounds, golf courses, aquatic centres)
- Sustainability of future activity centres and public places (e.g. cost of water and the effect on business; shading, amenity and micro-climate benefits in fostering vibrant places for the community to congregate)
- Protection and enhancement of the waterway health of Dandenong Creek and Gardiners Creek (and the tributaries) for environmental and social needs
- Leading research at Monash University on the transition to a water sensitive city

Existing policy and guidelines

The strategy includes a review of existing policy and the connections of these policies to the themes of integrated water management. The review, based on research on the transition to a water sensitive city and policy analysis (broadly) categorises tools into four areas:

- Policy, legislation, and planning tools
- Finance tools
- Knowledge and information tools
- Networks / systems for organising action

The review will help identify opportunities for collaboration between departments as well as connections to existing or planned actions and budgets.

Some issues identified in the review include:

- Council's policies highlight the five themes of integrated water management as important to its service delivery. Importantly, the vision for Monash 2021 broadly aligns to the themes identified for integrated water management, while the key direction 'taking action' in the current Council Plan directly links to social health, ecological health and water sensitive infrastructure. (*Policy, Legislation and Planning*)
- Council's plans are starting to highlight the link between water and the delivery of its key services. For example, the Economic Development Strategy notes the need to encourage partnerships between water retailers and businesses to improve water efficiency in supporting a sustainable business environment. The Active Monash Strategy stresses the need to harvest water from pavilions for grey water use. (*Policy, Legislation and Planning*)
- Council's environmental policy (e.g. the existing Environmental Sustainability Road Map and this integrated water management strategy) need to be better integrated with and linked to other Council policies (e.g. Monash 2021, the Council Plan, the Health and Wellbeing Plan, the Open Space Strategy, etc). This is important to ensure the plan has a legitimate place in Council's procedures. (*Policy, Legislation and Planning*)
- Council's Environmental Sustainability Road Map (ESRM) commits Council to consider water conservation and effects of poor stormwater quality. A stronger business case could be made by linking these efforts to the themes of integrated water management (e.g. water availability for sportsgrounds and community use). This will help to highlight reduction in water consumption is not always the ultimate outcome if it affects other social needs. (*Policy, Legislation and Planning*)
- Council's 2013-2014 budget could provide greater financial support for integrated water management. Only $200,000 is awarded to actions in the ESRM. This budget will only partly deliver on some of the water-related actions. For example, the backwash facility for Monash Aquatic and Recreation Centre (MARC) is budgeted to cost $377,000. The ESRM budget, even if completely allocated to this project, would be insufficient. (*Finance*)
- Significant budget is allocated to building works (e.g. pavilion upgrades), strategic drainage projects, reserves, and roadworks. Water sensitive infrastructure could be built into the budgets and delivery of these items, particularly if water and the primary service can be linked to another key Council service. The relevant Council

plans may need to be strengthened to support this integration. (*Finance* and *Policy, Legislation and Planning*)

- Council should investigate options to strengthen Council's ability to enforce water sensitive design. Clause 56.07 of the Victorian Planning Provisions is the only instrument that enforces best practice management of stormwater. However, this only applies to sub-divisions. This tool will have limited utility in the City of Monash, where the majority of future development will be multi-unit medium density. Council could use structure plans, the section 173 agreements, or amend the local planning scheme to better support water sensitive design in these development types. (*Policy, Legislation and Planning*)
- Although no harvesting schemes are nominated for construction, Council has started to assess the feasibility of stormwater harvesting schemes. This is a great first step in developing a priority list of projects. *(Knowledge and Information)*
- Knowledge and information is available for the community on efforts in the private and public domain. *(Knowledge and Information)*
- Large potential is available to connect with the community to build awareness, interest and participation in integrated water management. For example, the municipality has a large 'baby boomer' population that as a group are noted as having a high participation rate in volunteering. *(Organisation)*

Water cycle analysis

The water cycle analysis considers the water demands and discharges from the municipality now and into the future.

The current water analysis is shown schematically in Figure 1. The schematic summarises the following:

Potable / mains water	– The municipal demand for potable water is 10,599 ML/yr. Residential demands account for 75% of this demand. Council demand for potable water is the lowest. – 43% of Council's potable water demand is for sportsground irrigation. This includes irrigation of both public golf courses and pavilion water use. – Per person residential demand for potable water is 120 L/day. This is considerably lower than the previous state government target of 155 L/d.
Stormwater and wastewater	– 28,000 ML/yr of stormwater run-off is generated in the municipality; 22,000 ML/yr of stormwater run-off is generated from developed, impervious catchments. – Stormwater volumes are highest off residential areas (due to the high proportion of residential area in the municipality). – Pre-development flows (i.e. if the municipality was 100% pervious / natural) are 10,000 ML/yr; thus developed areas are contributing an

	additional 18,000 ML/yr of stormwater run-off. – Upstream catchments that flow through the City of Monash via Dandenong Creek generate 116,423 ML/yr of stormwater run-off (104,351 ML/yr flows off hardstand areas). – All wastewater is collected and treated outside the municipality boundaries.
Alternative water sources	– Limited data on residential and non-residential use of alternative water sources is available. ABS data is used to estimate the adoption rate of rainwater tanks in residential dwellings. Wesley College (Glen Waverley) harvests rainwater for machinery wash-down, toilet flushing and garden irrigation. – 34% of Council's water demand is met from harvested rainwater (32 ML/yr) and stormwater (61 ML/yr).
Groundwater	- Groundwater bores exist for non-residential and residential use, metered usage totalling 97 ML/yr. - Metered data for use is limited; residential bores are small (and assumed to supply 1.2 ML/year/bore. In 2011/2012, only 7 of 13 non-residential bores were metered. For all metered bores, use of groundwater was less than 30% of the extraction licence.

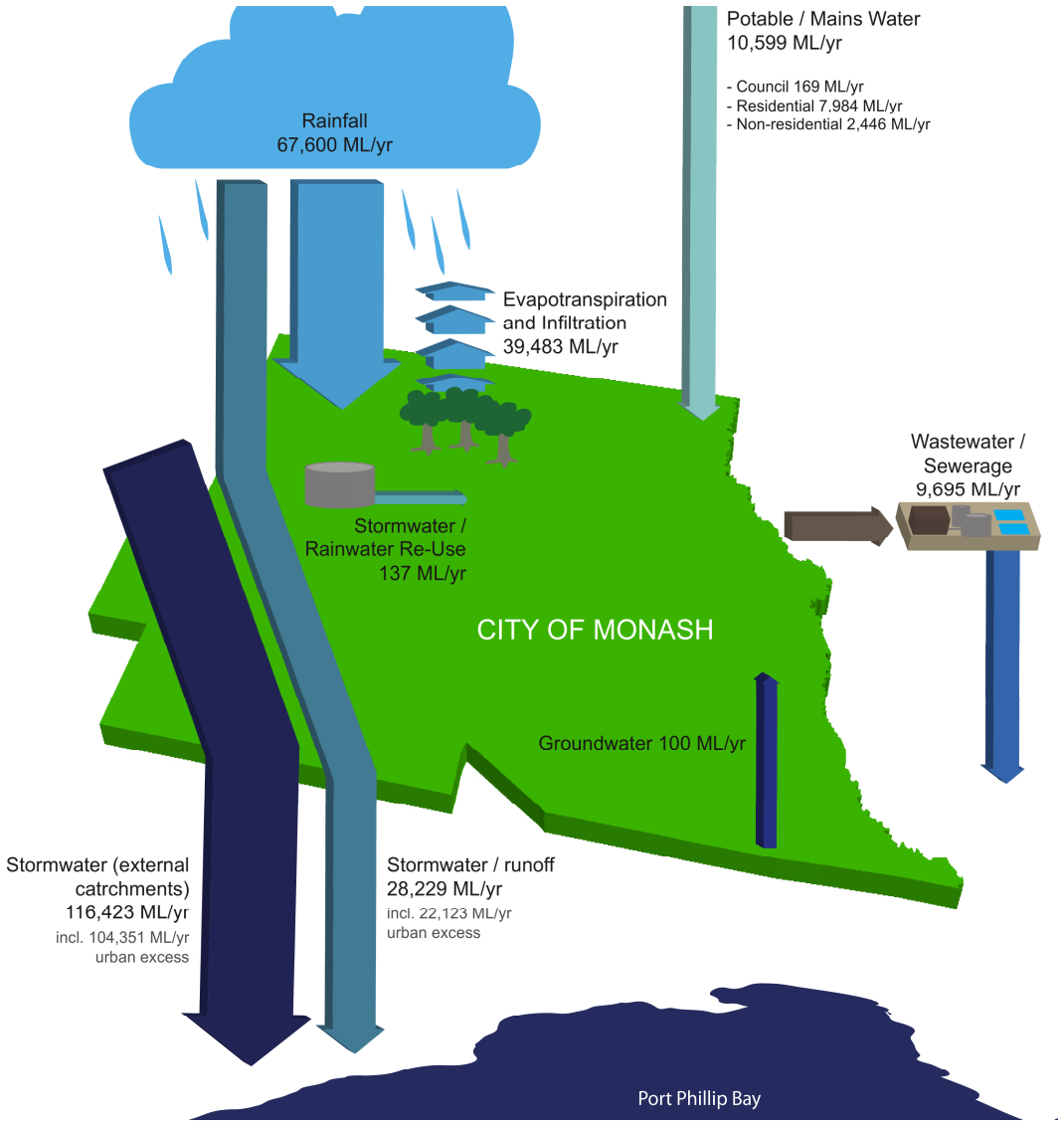

Figure 1: Current water cycle for the City of Monash

The future water balance will be influenced by population growth, business growth and, if pursued, current objectives for the reduction in potable water by Council. Population growth will increase demand for potable water and generation of wastewater volumes. According to the Environmental Sustainability Road Map, Council plan to reduce the use of potable water for sportsground irrigation by 80%: 50% through warm season grasses and 30% through stormwater harvesting.

Stormwater volumes are unlikely to increase significantly as the opportunities to convert pervious to impervious land is limited (most future development will be redevelopment). This volume (28,000 ML/yr) is approximately double the municipality's demand for water. Stormwater harvesting could provide a significant opportunity to reduce the municipality's dependence on centralised mains/drinking water supplies, and can develop Council's resilience in meeting it's other water-related services (e.g. the themes of integrated water management).

Pollutant load analysis

The pollutant load analysis is important to developing an understanding of the best actions to support ecological health in the municipality. The pollutant load analysis was completed for 9 sub-catchments using the industry accepted Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The nine sub-catchments are:

Major catchment	Sub-catchment
Mordialloc Creek Catchment:	Clayton Drain
Dandenong Creek Catchment:	Mile Creek
	Police Road Drain
	Nunawading Outfall
	Dandenong Creek
Yarra River Catchment:	Glen Waverley
	Damper Creek
	Scotchmans Creek
	Gardiners Creek

Consistent with best practice, the pollutant load analysis considers total suspended solids (TSS), total phosphorus (TP) and total nitrogen (TN).The key findings from the analysis are:

- 18,000 ML/yr of additional stormwater run-off (as compared to pre-development) is generated in the municipality. The sub-catchments of Mile Creek, Scotchmans Creek, Gardiners Creek and Dandenong Creek are the greatest contributors to this volume (this reflects the relative sizes of the sub-catchments)
- Residential and road surface types are the most significant sources of total suspended solids and total nitrogen. These surfaces represent at least 60% of the land uses in each sub-catchment.
- Mile Creek, which is 20% commercial, is one of the most significant generators of TSS and TN. However, the overall contribution of commercial land uses to the municipal pollutant load balance is low.

Due to lack of greenfield development opportunities, the future pollutant load balance will reflect the current situation.

Council achievements to date

The City of Monash has implemented 43 water quality improvement structures, including 19 wetlands, 18 bioretention basins / swales and a stormwater retarding basin. In addition, 29 Council facilities have rainwater tanks for toilet flushing, irrigation, or tanker truck access.

The combined pollutant load reductions from these assets are 110,000 kg/yr TSS, 230 kg/yr TP and 2,300 kg/yr TN, which are equivalent to a maximum of 4% reduction in total pollutant loads generated across the municipality.

Targets

Five categories of targets are proposed that will help Council deliver on the vision and themes of integrated water management for the City of Monash. The targets are further

divided into Council, residential and non-residential targets to reflect Council's range of influence across different domains.

The five categories of targets are:

1. Water conservation
2. Potable water substitution
3. Water quality improvement
4. Water sensitive landscapes
5. Tree canopy coverage

Recommendations

A list of recommended actions are given to assist Council achieve the proposed targets. Like the policy review, the targets are divided into structural (i.e. infrastructure) and non-structural initiatives, with non-structural initiatives further defined based on the four tools described earlier (policy, legislation, and planning tools, finance tools, knowledge and information tools, and networks / systems for organising action).

Some of the key recommendations include:

- Implementation of four stormwater harvesting projects to help meet Council's water conservation and potable water substitution target (*structural*)
- Prioritise implementation of the WaterMAP actions for the MARC (*structural*)
- Update Council's Municipal Strategic Statement to support integrated water management in preserving and enhancing the values of the municipality (*policy, legislation, and planning tools*)
- Use the next revision of the ESRM to articulate the major environmental issues relevant to Council and Council's response, as well as the links with other Council policies and directions. The document must provide a basis / context for the integrated water management strategy (*policy, legislation, and planning tools*)
- Develop a Water Atlas of Council's water sensitive urban design projects to provide strategic advice for future projects (*policy, legislation, and planning tools*)
- Council to continue to support the itree program that is mapping existing tree coverage across the municipality (*policy, legislation, and planning tools*)
- Develop a business case to ensure a greater proportion of Council's budget is available for environmental and water-related initiatives (*finance*)
- Continue to organise site tours to promote awareness of integrated water management and confidence within Council of the potential benefits. Ensure these site visits are attended by a large cross-section of Council personnel (*knowledge and information tools*)
- Consider having Council's organisational structure analysed to understand how it supports / constrains integrated water management (*networks / systems for organising action*)

1 Introduction

To assist the City of Monash and its community become water sensitive, E2Designlab has developed an integrated water management strategy for the municipality. A second document, 'Concept designs for integrated water management' supports the strategy by detailing 8 projects identified by Council as important to Council and the City of Monash in implementing integrated water management principles.

Councils across metropolitan Melbourne are increasingly recognising the multiple benefits of water management. No longer is water management considered the domain of engineers. Its management affects the urban landscape of a municipality (e.g. irrigation of street trees and open space areas, which provide amenity and micro-climate benefits), access to active and passive open space (and hence the ability for citizens to live a healthy, active lifestyle), economic appeal (e.g. cost of doing business, cost of accessing water, property values), and the health and amenity of urban waterways (which can affect social and ecological values). These environmental and community services and associated values span across multiple departments of Council.

The multiple and diverse range of benefits achievable through integrated water management are highlighted in the urban water management transition framework developed by Brown and others (2009) at Monash University[1] (Figure 1). The framework describes six different types of urban water management systems that can be broadly divided into (i) centralised management practices only (the water supply, the sewered and the drained city) and (ii) a mix of centralised and decentralised management practices (the waterway, water cycle and water sensitive city).

[1] Brown RR, Keath N & Wong THF (2009), 'Urban water management in cities: historical, current and future regimes' *Water Science and Technology*, 59(5), pp.847-855.

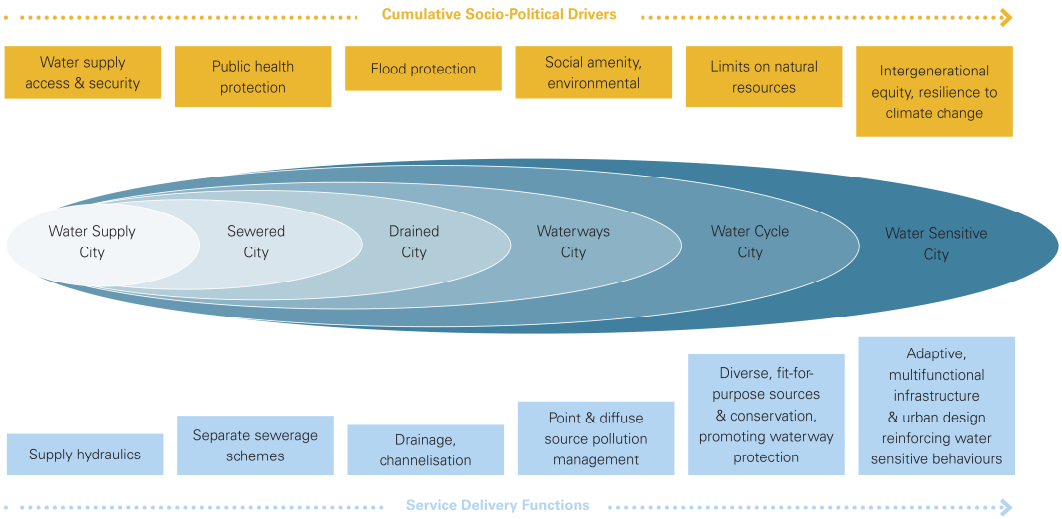

Figure 1: The urban water management transitions framework developed by Brown and others (2009)

A water sensitive city is the ultimate goal on the continuum described by Brown and others, and this vision has been adopted by many councils across Australia. According to the report "Transitioning to Water Sensitive Cities in Australia"[2], a water sensitive city can be characterised into the following three themes:

1. Cities as supply catchments – cities provide a diverse portfolio of urban water sources and delivery options. Through diversity, the city can be resilient and adaptive to changing conditions (natural, e.g. climate change, and anthropogenic, e.g. price increases in centralised water services).
2. Cities providing ecosystem services – waterway health is valued in the city, and water is managed through 'green' infrastructure (such as wetlands and bioretention systems) to protect and enhance downstream ecosystems as well provide visual amenity and biodiversity in the city.
3. Sophisticated and water smart cities - community acceptance and engagement, collaboration, coordination with stakeholders through a diverse range of institutional tools, and the incorporation of the true cost of water management in decision-making.

The social – political drivers influencing these themes (as identified in Figure 1) are present in the City of Monash.

The city is highly urbanised (66% of the land is zoned residential). Consequently, stormwater volumes off hardstand areas are considerably higher than pre-European settlement. The change in hydrology and quality of stormwater has had an adverse effect on

[2] Ison R, Collins K, Bos A, and Iaquinto B (2009), 'Transitioning to Water Sensitive Cities in Australia: A summary of the key findings, issues and actions arising from five national capacity building and leadership workshops' NUWGP/IWC, Monash University, Clayton, available online at http://www.watercentre.org/resources/publications/attachments/Creating%20Water%20Sensitive%20Cities.pdf

the municipality's waterways, for example, scouring and erosion of creek beds, smothering of vegetation, and increased nutrient loads.

The high stormwater volumes, however, also provide a significant source of alternative water that can be used for non-potable water needs. The municipality has 80 active reserves and two public golf courses that require irrigation to sustain their value to the community. Harvesting and treating stormwater generated from the municipality helps reduce Council's reliance on stressed natural potable water sources. Retarding and treating stormwater flows also helps to protect downstream waterways from the impacts described above, thus helping to maintain their amenity and reducing further ecosystem degradation.

Currently Council mainly irrigate with potable water. Access to this water will be affected by cost of centralised water supplies placing strain on Council's budget. (The state government has made a commitment of no future water restrictions, and thus drought will not affect access to water).

Green space and leafy streetscapes are a key value of the municipality. Integrated water management (for example, passive irrigation of street trees through the diversion of stormwater of road ways) can help ensure these landscapes are irrigated as often as possible, and continue to provide shade and amenity even during times of low rainfall and high temperatures. Maintaining this leafy, green character will also help to maintain (and potentially increase) property values in the area.

This document addresses these drivers by analysing the current and future need and generation of water, the likely pollutant loads generated off the municipality's catchments and the policy tools supporting or needed to facilitate integrated water management. Recommendations for change focus on Council's multiple and varied roles in urban water management: a leader in its own action through building and service delivery, and in planning and regulation; an advocator for community action; and a partner in facilitating and supporting action.

Specifically, the aim of the report is to:

- Establish a vision and themes/goals to guide integrated water management initiatives in both Council activities and the non-residential / residential domain
- Analyse the current and future municipal water cycle to understand the needs and opportunities for integrated water management
- Provide background information on the municipal water balance and the impact of urban activities on stormwater quality and quantity and downstream waterways
- Review the effectiveness of current policy tools in supporting integrated water management
- Develop specific, measurable, achievable targets relevant to Council's vision and goals for integrated water management that are linked to key delivery dates
- Recommend structural and non-structural initiatives to help Council and its community achieve the targets developed.

Centralised to integrated water management

A schematic of the urban water cycle is given in Figure A.

The urban water cycle includes centralised potable (mains) water, stormwater (run-off from hard stand surfaces such as roofs, pavements and roads) and generation of wastewater.

These three urban water streams are traditionally managed to achieve a single goal:

- Natural water sources are managed to ensure a secure potable water supply to satisfy urban needs
- Stormwater generated off urban areas is managed (e.g. through retarding basins and pit and pipe networks) to protect urban development from various levels of flooding.
- Wastewater generated from urban activities is managed to protect human health from water borne diseases.

These management goals are satisfied through the use of centralised technologies such as dams and wastewater treatment systems.

Integrated water management (IWM) and water sensitive urban design (WSUD) challenge this linear, siloed approach to urban water management.

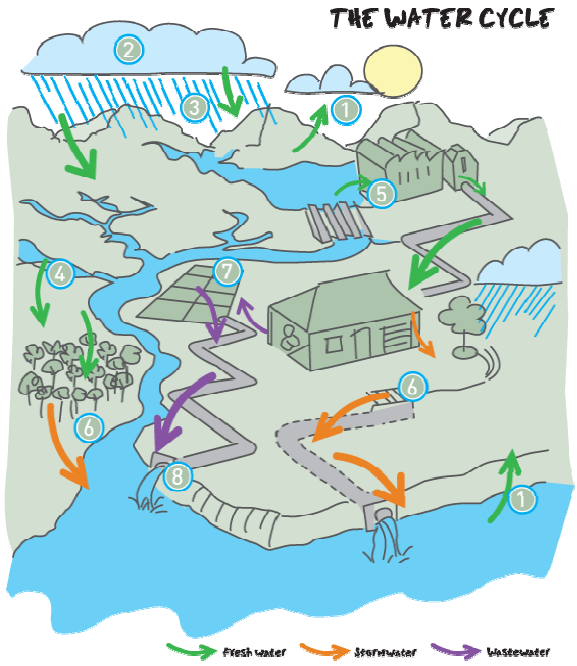

Figure A: The urban water cycle (seqwater 2009)

The traditional approach ignores the upstream and downstream environment. The management of natural systems to provide a secure potable water supply assumes nature's supply of water is infinite and environmental services are subservient to human uses. This assumption has been highlighted as vulnerable to drought (and the introduction of water restrictions) and changes in climate.

Stormwater management practices have evolved to efficiently channel water away from urban areas. Consequently, many creeks and rivers have become an extension of the urban drainage network and lost their biodiversity value.

IWM highlights the opportunities from linking potable water, stormwater and wastewater management. For example, IWM treats stormwater and wastewater as a resource that can supplement urban water needs rather than a waste that degrades natural ecosystems.

IWM promotes the sustainable use of these three water streams to optimise use. It applies to all scales (as recognised in the Melbourne Water Draft Stormwater Strategy (2012)). Integrated management of stormwater has particular benefits to waterway health and associated social values. Retardation and treatment of stormwater protects the health of downstream waterway and harvesting of excess flows can provide a valuable source of non-potable water for irrigation of streetscapes and passive and active open space.

2 Context for integrated water management

2.1 Population and land use in Monash

The City of Monash is located 20 km south east from the central business district of Melbourne and is one of metropolitan Melbourne's most populous municipalities. The current population (2013) is 179,000, and is forecast to increase to 194,000 by 2030[3]. This population growth will affect the municipality's demand for water.

The majority (66%) of Council's land currently accommodates residential use (Figure 2), with single dwellings being the most popular accommodation type (51,000, or 77% of dwelling types)[4]. Commercial and industrial land (12%) is the next largest land use group. This land use is extremely important in supporting business and local jobs (23.3% of residents work within the municipality[5]).

No greenfield land exists in the City of Monash, thus forecast population (and business) growth will be facilitated through redevelopment, primarily in the municipality's activity centres. This densification will mainly affect the municipality's demand on potable water reserves; the impact on stormwater quantity and quality (and consequently downstream waterway health) will be minimal (see section 5 for details).

[3] forecast id (2013), City of Monash population forecasts, available online at http://forecast2.id.com.au/default.aspx?id=102&pg=5000
[4] profile id (2013), City of Monash dwelling type, available online at http://profile.id.com.au/monash/dwellings
[5] economy id (2013), City of Monash workers place of residence by occupation, available online at http://economy.id.com.au/monash/workers-place-of-residence-occupation

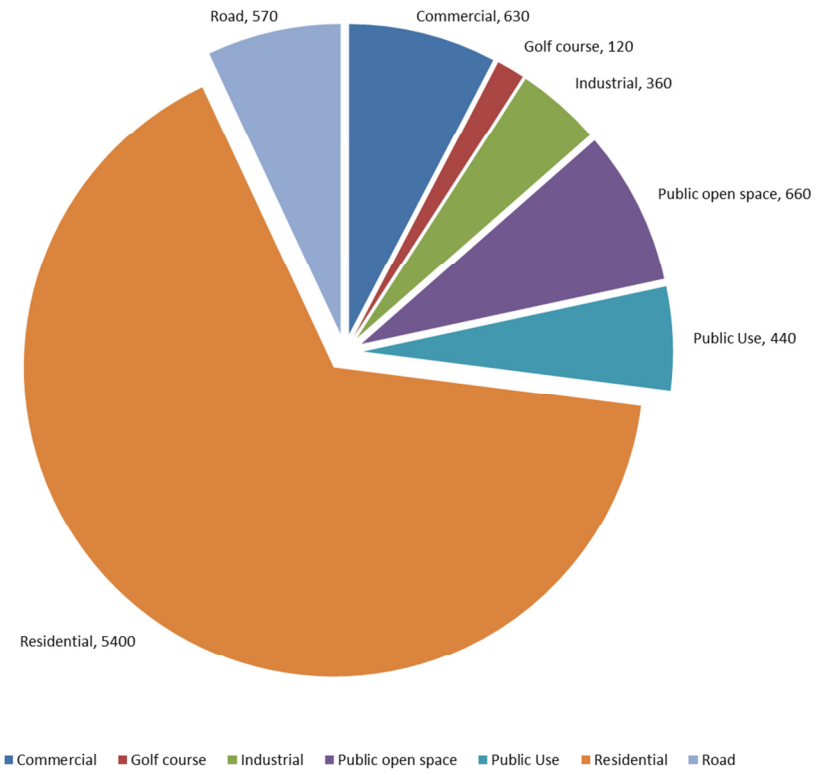

Figure 2: Current land use distribution in the City of Monash

2.2 Catchments and waterway health

The health of urban waterways is impacted by stormwater runoff. The City of Monash has three catchments draining to the Yarra River, Mordialloc Creek and Gardiners Creek (with all eventually discharging to Port Phillip Bay).

Gardiners Creek and Dandenong Creek are the two major waterways in the municipality. Scotchmans Creek and Damper Creek drain to Gardiners Creek, which flows into the Yarra River. Melbourne Water rate Dandenong Creek and Gardiners Creek[6] as having high regional importance. The Index of River Condition (IRC) for each creek is given in Table 1. According to this index, both rivers are in poor condition or less in terms of their aquatic ecosystem health. Other waterways in the municipality (e.g. Mile Creek, Clayton Drain) are highly modified (e.g. concrete channels or piped) and hence have little ecosystem service.

All waterways in the municipality have high social and amenity values. They provide interlinking networks of public open space that are highly valued by the community.

[6] Melbourne Water's description of Gardiners Creek includes Scotchmans and Damper creeks.

Table 1: Index of River Condition for Gardiners Creek and Dandenong Creek (Metro Park)

Parameter	Description	Gardiners Creek	Dandenong Creek (Metro Park)
Hydrology	Flow volume and seasonality of flow	2	2
Physical form	River bank and bed condition, presence of and access to physical habitat, artificial barriers	7	6
Streamside zone	Quality and quantity of streamside vegetation	2	5
Water quality	Key water quality indicators compared against Victorian Government environment protection policy water quality objectives	4	8
Aquatic life	Diversity of macro invertebrates	3	3
Overall health score =		18 (v poor)	23 (poor)

Melbourne Water's 'Port Phillip and Westernport Regional River Health Strategy[7]' sets a 5 year plan to improve the health of both creeks: poor to moderate for Dandenong Creek and very poor to poor for Gardiners Creek. For Dandenong Creek, the Melbourne Water target will be achieved through improved water quality, habitat and stability, and vegetation. Efforts in Gardiners Creek will focus only on improving water quality. Melbourne Water in the strategy also recognises the important social value of both waterways in pursuing these improvements.

To achieve these targets, Melbourne Water's river health program includes water quality improvement measures and revegetation along Dandenong Creek, and weed management and localised bank stabilisation along Gardiners Creek. However, for Dandenong Creek, it is assumed that actions in Monash will be limited to revegetation given the relative high rating for water quality and physical form compared to streamside zone (refer to Table 1). Melbourne Water has a budget of $1.3 million to engage with local council and community groups to help deliver upon this; $2.2 million is allocated for revegetation in Gardiners Creek.

Melbourne Water is responsible for waterway management and do not have control of water quality impacts in the catchment. This is where Council can influence through leadership (in the management of stormwater generated off Council assets), enforcement (for example, through local planning policy) and advocacy (leadership and education) for the uptake water sensitive urban design across the private domain.

[7] Melbourne Water (2012/2013), Port Phillip and Westernport Regional River Health Strategy – Yarra catchment, available online at http://www.melbournewater.com.au/aboutus/reportsandpublications/key-strategies/Documents/Port%20Phillip%20and%20Westernport%20Regional%20River%20Health%20Strategy%20-%20Yarra%20catchment.pdf

Stormwater management and water sensitive urban design focus on decentralised water quality and quantity management. Stormwater quality and quantity management is mandated in the Victorian Planning Provisions for residential sub-divisions (Clause 56.07). The clause references the Environment Protection Authority's (Victoria) 'Urban stormwater best practice environmental management guidelines', which stipulate a 80% reduction in total suspended solids (TSS) and a 45% reduction in both total phosphorus (TP) and total nitrogen (TN). Suspended solids are of particular concern to creeks and rivers: High sediment loads can erode stream banks, smother streams beds, and reduce visibility, which affect the health of aquatic ecosystems and the visual amenity of the stream. Suspended solids are also a conduit for many pollutants, further reducing water quality. Nitrogen is of main concern to large open water bodies, particularly urban lakes and Port Phillip Bay. High nitrogen loads in these environments can encourage extensive plant growth for example, algae, which reduce oxygen levels. This affects both the amenity of the lakes or Bay and the health of aquatic life.

Litter management is also important. Socially, litter in a waterway conjures ideas of neglect and can deter citizens using adjacent open space.

Water sensitive urban design and water quantity management focus on managing the peak flow rate to waterways for a given rainfall event. The EPA best practice guidelines stipulate the 1.5 year ARI for developed catchments is capped at pre-developed levels. More recently, the concept of directly connected imperviousness (DCI) is used to understand the impact of catchment on waterway health and the ability to improve water quality by disconnecting impervious surfaces. DCI is defined as any impervious area that is directly connected, via stormwater pipes or channels, to aquatic receiving waters. Studies by Walsh (2004) indicate a waterway with a catchment DCI greater than 2% will be at least partially degraded. A DCI greater than 5% is likely to indicate a highly degraded waterway. The DCI of waterways in the City of Monash are at least 27%. (Further details on DCI are given in section 5).

2.3 Open space amenity

The City of Monash is proud of its garden city character. It is a core value of the municipality and an important factor in planning. Planning controls established in the 1960's set the framework for a well landscaped municipality across all development types. Planning controls require significant planting of native trees with a crown cover amenable to a soft, green, leafy character[8].

The City of Monash has 660 ha of zoned public open space (Figure 2), which includes approximately 240 ha of passive open space. A lot of this open space adjoins the municipality's waterways (hence the importance of amenity discussed in section 2.2). For

[8] City of Monash (2009), Monash Planning Scheme, Clause 21.03-2

example, Jells Park, which is located within the Dandenong Valley Metropolitan Park, receives approximately 900,000 visitors annually[9].

The Council also provides over 130 playgrounds (including 80 active reserves[10]) and two public golf courses. These active facilities are heavily utilised; with some, as highlighted in Council's Active Reserves Strategy[10], over-utilised for the carrying capacity of the field.

Hence, the streetscape and open space landscapes are important to the character and social fabric of the City of Monash. Water plays and integral role in meeting these expectations. The open space areas require irrigation to sustain current and future amenity, and the carrying capacity will be severely affected if irrigation is restricted. Currently, Council irrigate the majority of their open space areas with potable water. Given the projected rise in potable water, the cost of potable water may place financial constraints on irrigation and the use of sportsgrounds. This has flow on effects to the health and wellbeing of the citizens of the City of Monash.

Street trees also require irrigation. Council currently use harvested stormwater to meet this demand, which provides Council with resilience to imminent, potable water price increases[11].

Maintaining Council's garden character and expansive network of open space is also critical to micro-climate. Urbanisation has been shown to increase the night time temperature of cities, preventing cities from cooling down. This phenomenon, the urban heat island effect, is particularly prominent in summer, exacerbating day time temperatures. Green space provides a cooling environment to counteract the heat absorbed in hard surfaces (i.e. allow heat transfer). Water features (including natural and constructed systems such as water sensitive urban design features) also reduce heat sinks, and are thus important in mitigating the urban heat island effect.

2.4 Summary

This section describes five main contextual drivers for integrated water management in the City of Monash:

1. Population growth will increase demand for potable water by residents, businesses and the community (e.g. through the irrigation of sportsfields to support higher use).
2. Future increases in potable water costs may make impact living and business costs, that have the potential of reducing the social and economic appeal of the municipality. Council's ability to irrigate may also be affected, through restrictions and the cost of accessing potable water.

[9] Parks Victoria (2013), Jells Park, available online at http://parkweb.vic.gov.au/explore/parks/dandenong-valley-parklands/things-to-do/lake-area
[10] City of Monash (2012), City of Monash Active Reserves Strategy
[11] City of Monash (2008), Water Use Management Strategy

3. The municipality is already highly urbanised with little opportunity for greenfield development. Hence, future growth will have minimal impact on current stormwater volumes and quality.
4. The Council has two major waterways of significant community and, in the case of Dandenong Creek, ecosystem value. Council has a role in protecting the social value of these natural assets through stormwater management (infrastructure and planning)
5. The Council provides a significant amount of active open space and takes pride in its reputation as a garden city. Maintaining the value of these two services rely heavily on water availability.

3 Vision and goals for integrated water management in Monash

The integrated water management strategy should be guided by a vision and underlying themes or goals. The vision helps set the overall direction desired, while the themes help articulate the key elements of the vision.

The vision for integrated water management in the City of Monash was developed during a workshop with Council personnel. The themes were based on research completed by Ferguson and others (2011) on 'Melbourne's Transition to a Water Sensitive City: South East Cluster Workshop Series'[12].

The subsequent vision and themes for integrated water management in the City of Monash are:

> *Water is integrated into all Council service areas to ensure a connected and healthy community and environment*
>
> *This vision is articulated through five themes: social health, ecological health, connected communities, shared prosperity and water sensitive infrastructure*

The minutes from this workshop are given in Appendix A. The definitions of the five themes are given in Table 2 and the likely drivers influencing each theme are noted in Figure 2.

Table 2: Five themes guiding Council's vision for integrated water management

Theme	Definition
Social health	A healthy community, where physical and mental well-being is valued, protected and enhanced
Ecological health	A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health
Connected communities	A community that takes responsibility for water through education, empowerment and collaboration
Shared prosperity	Our water systems are equitable and support economic viability and resilience
Water sensitive infrastructure	Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment

[12] Ferguson B, Frantzeskaki N, Skinner R, and Brown R (2012), 'Melbourne's Transition to a Water Sensitive City: South East Cluster Workshop Series' Dutch Research Institute For Transitions, Erasmus University Rotterdam, The Netherlands. Monash Water for Liveability, Monash University, Melbourne, Australia. ISBN 978-1-921912-15-3, available online at http://www.waterforliveability.org.au/wp-content/uploads/SE_Final-Report_FINAL.pdf

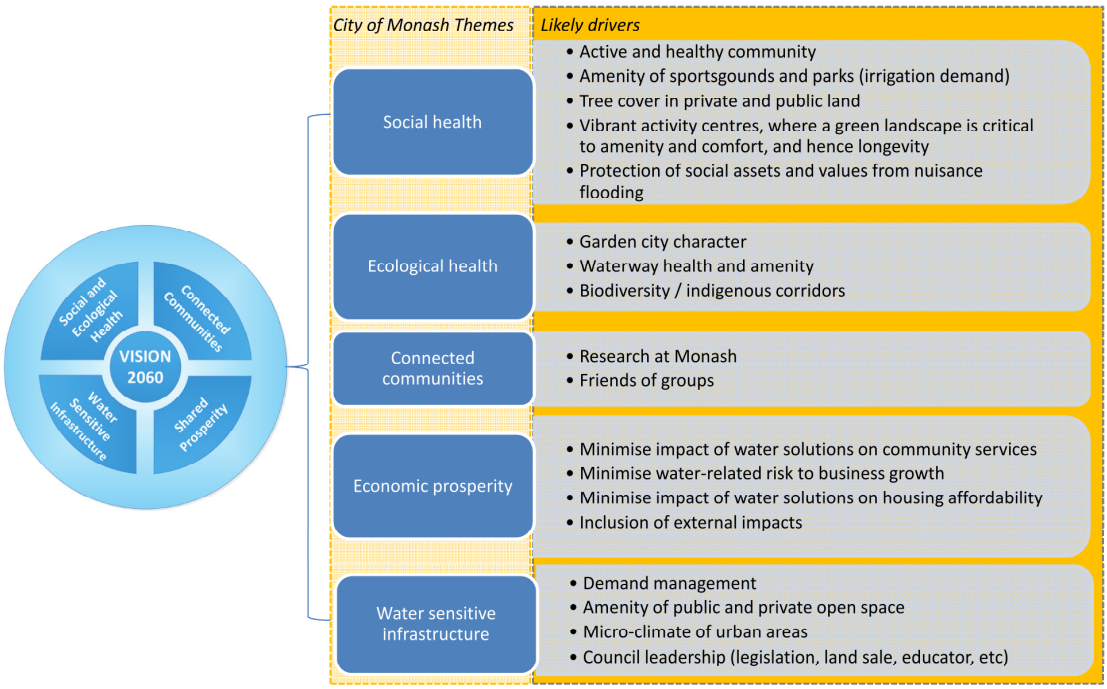

Figure 2: The link between the vision for a water sensitive city developed by Ferguson et al (2012) and the themes identified as important to integrated water management in the City of Monash.

4 Water cycle analysis

An understanding of the municipal water cycle is critical to developing realistic targets and supportive actions for integrated water management. This section documents the current and future water balance for the municipality as well as considerations for alternative water use. Of the context data, population and open space irrigation will have a significant influence on the municipality's water cycle.

4.1 Current water balance

The analysis of the current water cycle is shown schematically in Figure 3 (with details given in Appendix B). The schematic identifies the following key urban water management issues:

Potable / mains water

- The municipal demand for potable water was 10,600 ML/yr. Residential demands account for 75% of this demand. Council demand for potable water is the lowest.
- 43% of Council's potable water demand is for sportsground irrigation. This includes irrigation of both public golf courses and pavilion water use.
- Per person residential demand for potable water is 120 L/day. This is considerably lower than the previous state government target of 155 L/d.

Stormwater and wastewater

- 28,000 ML/yr of stormwater is generated off the municipality; 22,000 ML/yr of stormwater is generated off developed, impervious catchments.
- Stormwater volumes are highest off residential areas (due to the high proportion of residential area in the municipality).
- Pre-development flows (i.e. if the municipality was 100% pervious) are 10,000ML; thus developed areas are contributing an additional 18,000 ML of stormwater (described as the urban excess).
- Upstream catchments that flow through the City of Monash via Dandenong Creek generate 116,423 ML/yr of runoff (of which 104, 351 ML/yr represents the urban excess).
- All wastewater is collected and treated outside the municipality boundaries.

Alternative water sources

– Limited data on residential and non-residential use of alternative water sources is available. Wesley College (Glen Waverley) harvests rainwater for machinery wash-down, toilet flushing and garden irrigation. Residential use of alternative water is limited to rainwater (toilet flushing) and greywater (irrigation). ABS data is used to estimate adoption rate.
– 34% of Council's water demand is met from harvested rainwater (32 ML/yr) and stormwater (61 ML/yr).

Groundwater

- Groundwater bores exist for non-residential and residential use, metered usage totalling 87 ML/yr.
- Metered data for use is limited; residential bores are small (and assumed to supply 1.2ML/year/bore). In 2011/2012, only 7 of 13 non-residential bores were metered. For all metered bores, use of groundwater was less than 30% of the extraction licence.
- Council has one bore with a 10 ML/yr licence at Scammell Reserve.

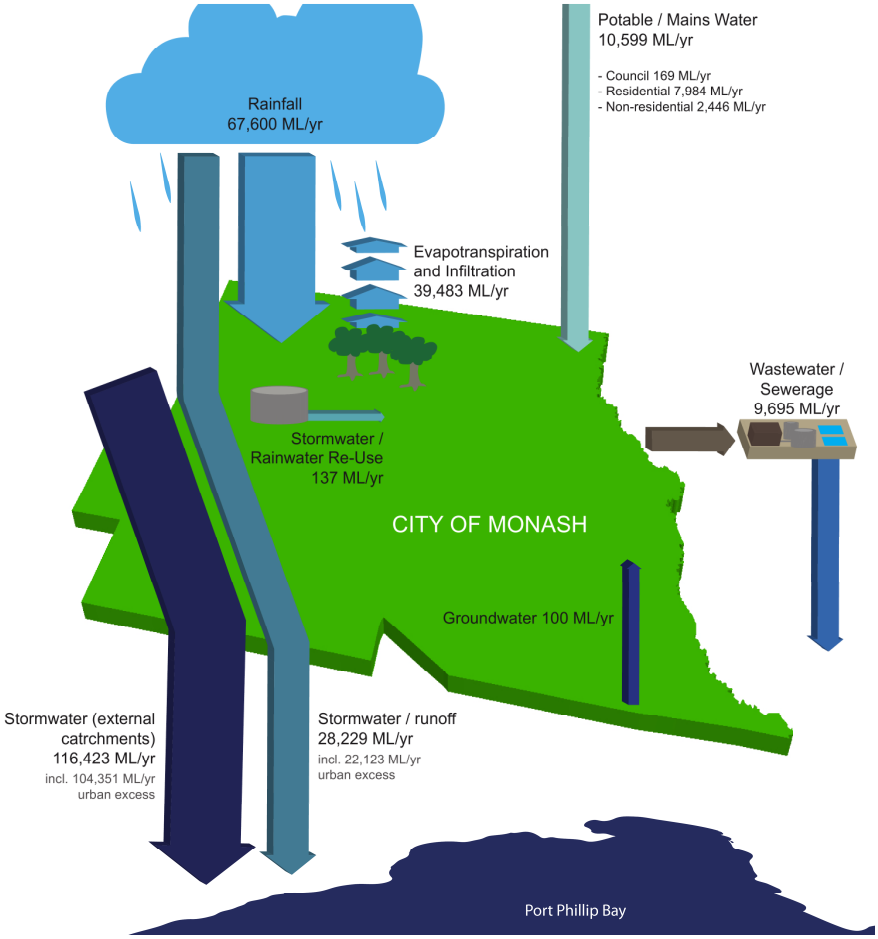

Figure 3: Current water balance for the City of Monash

4.2 Future changes to water balance

The current verse future water balance for the City of Monash is given in Figure 4. A summary of the inputs to the analysis and assumptions is given in Appendix C.

The data displayed in Figure 4 and Appendix C highlights the following:

Future mains water

Overall, mains water use will increase in the municipality by 1,118 ML/yr. This is driven by the forecast population growth and potential increase in Council potable water use (see Appendix C). Although Council's potable water use has significantly decreased since 2002/2003 (416 ML/yr), use in 2012/2013 has risen again (244 ML/yr compared to 169 ML/yr) due primarily to irrigation of recreation areas. Although this is still considerably less than 2002/2003 usage, Council has advised the current potable water conservation target of a 20% reduction in 2002/2003 consumption be sustained for this strategy. This target equates to an annual potable water demand of 330 ML/yr and has been assumed as the future Council demand for potable water.

Harvesting and use of stormwater and rainwater

- Use of harvested rainwater or stormwater is likely to increase by 13 ML/yr by 2030. This is mainly through Council planned initiatives.
- No stormwater harvesting for non-residential or residential demands is assumed.
- Council use of stormwater is limited to sportsground irrigation, which based on Council's Environmental Sustainability Road Map, is likely to provide 30% of demand.
- Although specific opportunities for rainwater harvesting have not been identified, there will be multiple opportunities to include rainwater tanks in the future (for example, as part of the upgrade of sport pavilions, civic buildings, etc).

Groundwater

- The number of bores available in the municipality is exhausted. Although the extraction of groundwater was significantly lower than the licenced maximum, future extraction is not expected to increase with the exception of 10 ML/yr at Wesley College. (The school has a desalination plant, which is forecast to produce an additional 4 ML/yr).
- Harvesting and use of leachate from Reg Harris Reserve is likely. It is estimated that 100% of irrigation demands at Reg Harris Reserve and Scotchmans Run will be met using treated leachate.

Stormwater discharge

- Stormwater volumes will remain approximately the same as greenfield opportunities are limited. (Most future development will be redevelopment).
- Stormwater generated off hard stand areas is approximately double the municipality's demand for water. This provides a significant opportunity for stormwater havresting to supply non-potbale water demands.

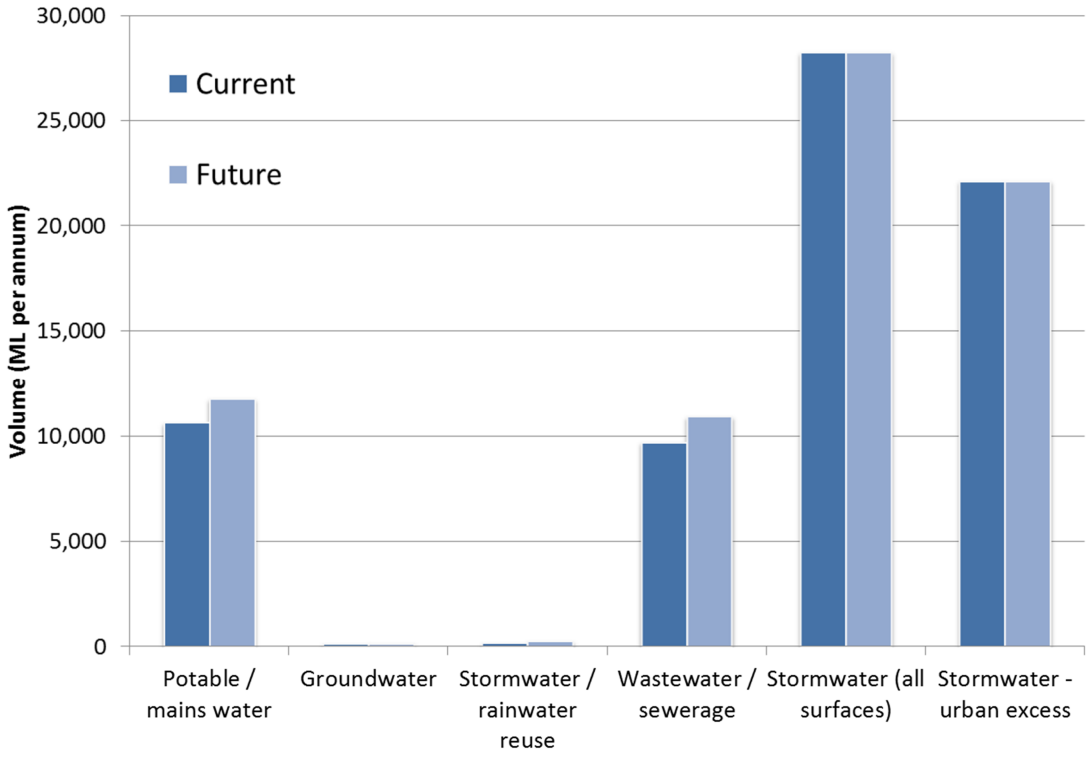

Figure 4: Current verse future water demands, wastewater volumes and stormwater volumes.

4.3 Fit for purpose use of water

To help guide Council reduce their demand on potable water sources, it is important to establish a fit for purpose agenda for available water sources. This agenda helps articulate the opportunities for alternative water use, while also recognising that Council cannot completely remove the need for potable water. The suggested fit for purpose agenda for water use in the City of Monash is given in Table 3.

Table 3: Fit for purpose agenda for water use in Council assets

Water source	Buildings	Sportsgrounds	Open space / streetscapes
Potable water	Main source for drinking water and personal washing Demand is reduced through water efficient fixtures	Used mainly to top-up non-potable water sources (stormwater, rainwater and recycled water)	Not used
Rainwater	Harvested and treated for toilet flushing (if no other alternative supply is available), and irrigation of site landscaping	Used mainly in small open space areas close to rainwater tank (for example, landscape surrounding community buildings)	Roof-run off redirected to streetscape landscape where appropriate
Stormwater	Managed to provide passive irrigation of landscape	Main source, where practical, for irrigation	Stormwater managed in streetscapes to passively irrigate vegetation
Recycled water	Not currently used in the City of Monash	Not currently used in the City of Monash. Sewer mining is possible but less preferable to stormwater harvesting due to cost and energy requirements	Not currently used in the City of Monash
Groundwater	Not used	Used as a supplementary supply and to help meet EPA discharge requirements	Used as a supplementary supply to stormwater

4.4 Demand management

It is premised that water demand management practices support the fit for purpose agenda given in Table 3 and thus reduce the total demand for water.

Council in their Environmental Sustainability Road Map state it will reduce its potable water demand for irrigation by 50% through the conversion to warm seasons grasses. Additionally, the plan states a commitment to include water efficient fixtures in all Council facilities.

Council's demand management strategy should recognise uses have different needs for water. These needs can even vary within a category. For example, a uniform irrigation rate across all recreation areas may not be necessary. Some fields may have lower use, and thus require less irrigation to sustain vegetation and its social value. Warm season grasses and other water efficient practices (e.g. drip irrigation) can also help manage demand for water.

It is not clear how Council currently determines the irrigation application rate across its facilities. It is recommended (as given in section 7) that this be documented and that a hierarchy of application be established. This is likely to reflect the relative use and value of the facility.

4.5 Use of alternative water sources

Stormwater and rainwater are the main alternative non-potable water sources available for Council use.

Council's Facilities Water Management Study provides a preliminary assessment of irrigation demand, stormwater availability and reliability of storage. Additionally, the study recognises the use of the reserve and the timing of capital works in assigning a priority score for harvesting. The most feasible reserves for harvesting according to this ranking system are Central Reserve, Caloola Reserve (East & West Ovals), Princes Highway Reserve (East & West), Mulgrave Reserve (East & West), W A Scammell Reserve, Capital Reserve, Brentwood Reserve, and Waverley's Womens sports centre. An existing drainage system can be intercepted for all of these fields; however, in some cases (3) the drainage is a Melbourne Water asset.

The total water demand for irrigation of these reserves is 24 ML/yr. Reliability of all schemes is estimated at at least 70%, except at Caloola Reserve (East & West Ovals) (36%) and W A Scammell Reserve (56%). A 70% reliability is generally used as a 'rule of thumb' for stormwater harvesting schemes, which would discount Caloola Reserve and W A Scammell Reserve as opportunities. If 70% reliability was assumed of the remaining schemes, 13 ML/yr of stormwater could be provided for irrigation. As all these projects are scheduled for capital works in the next 5 years, this volume could be set as a target for potable water substitution. (Concept designs for Central Reserve and Mulgrave Reserve were developed by E2Designlab to compliment the development of this strategy. The designs are detailed in the report 'Concept designs for integrated water management').

Groundwater and leachate (Reg Harris Reserve) is also a possible alternative water source. The opportunity to use leachate for the irrigation of Oakleigh Golf Course has been investigated as part of a separate investigation conducted by E2Designlab. This study, based on a review of previous feasibility studies highlights 5.5 ML/yr of leachate may be available to supplement the golf course irrigation demand (11 ML/yr).

5 Pollutant load assessment

The land use distribution and associated impervious area affects the pollutant load balance for the municipality. A pollutant load analysis was completed for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN) to quantify the loads generated and highlight the likely priority actions for Council. NOTE: these three pollutants are commonly reported as proxies for the myriad of pollutants typically found in urban stormwater.

For the purpose of pollutant load modelling, the municipality is divided into 9 sub-catchments as follows:

Major catchment	Sub-catchment
Mordialloc Creek Catchment:	Clayton Drain
Dandenong Creek Catchment:	Mile Creek
	Police Road Drain
	Nunawading Outfall
	Dandenong Creek
Yarra River Catchment:	Glen Waverley
	Damper Creek
	Scotchmans Creek
	Gardiners Creek

These sub-catchments are shown in Appendix D.

5.1 Current pollutant load balance

A detailed description of the pollutant load modelling and results is given in Appendix D. The key findings from the analysis are:

- 18,000 ML per annum of additional run-off (as compared to pre-development) is generated off the municipality. The sub-catchments of Mile Creek, Scotchmans Creek, Gardiners Creek and Dandenong Creek are the greatest contributors to this volume (this reflects the relative

Likely actions based on analysis:

- Focus water quality efforts on residential and road areas in all sub-catchments
- Integrate water quality measures with planned road upgrades
- Ensure water quality improvement structures provide additional benefits (e.g. social health, through promoting and supporting the garden character of the municipality or harvesting of stormwater as a supplementary or alternative irrigation supply)

sizes of the sub-catchments) (Table 4)

- Residential and road surface types are the most significant sources of total suspended solids and total nitrogen (Figure 5 and Figure 6). These surfaces represent at least 60% of the land uses in each sub-catchment.
- Mile Creek, which is 20% commercial, is one of the most significant generators of TSS and TN. However, as shown in Figure 5 and 6, the overall contribution of commercial land uses to the municipal pollutant load balance is low.

Table 4: Run-off from pre-developed catchment, current and urban excess

Sub-catchment	Total Outflow (ML/yr)		
	Pre-development	Current	Urban excess
Clayton	800	2,400	1,600
Dandenong	1,500	3,900	2,400
Damper	580	1,300	720
Gardiners	1,500	3,600	2,100
Glen Waverley	440	1,200	760
Mile Creek	2,200	7,600	5,400
Nunawading	600	1,900	1,300
Police Road	360	1,100	740
Scotchmans Creek	2,100	5,400	3,300
TOTAL	10,000	28,000	18,000

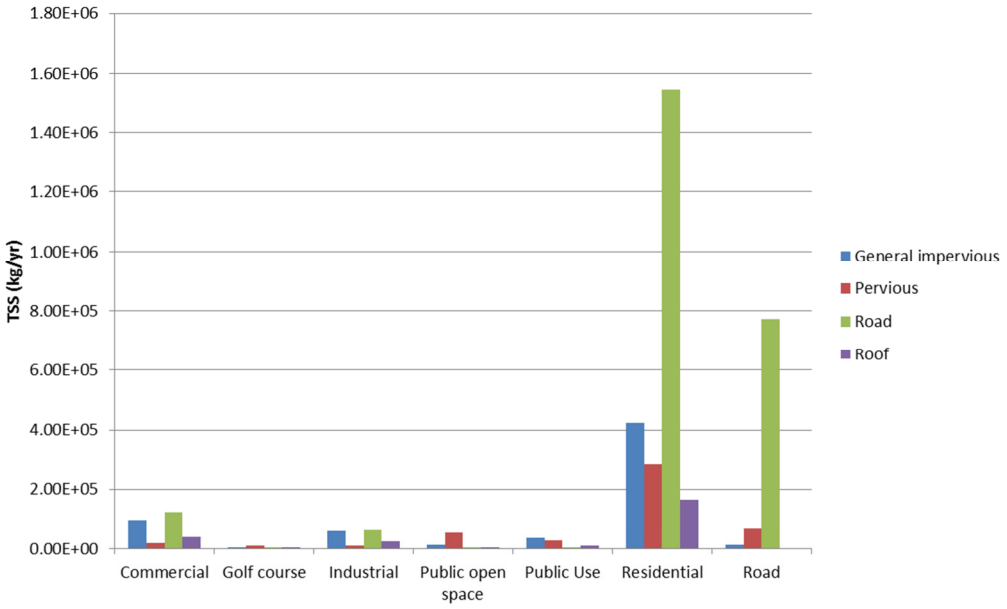

Figure 5: TSS loads generated off various surface types and land uses in the municipality. (KEY: roof – building roof area; road – roadways, pervious – soil and vegetation areas that allow infiltration; general impervious - other impervious surfaces such as car parks and pavements)

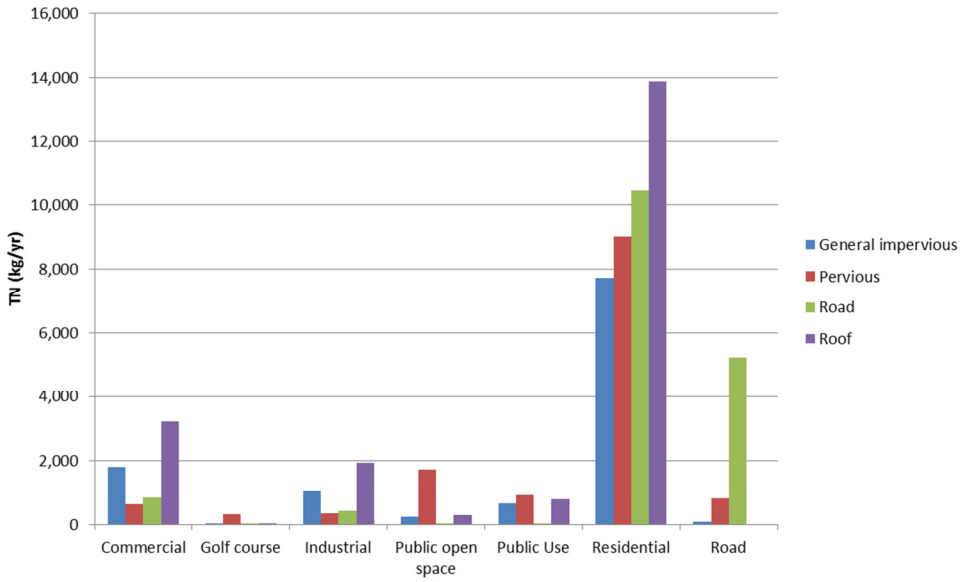

Figure 6: TN loads generated off various surface types and land uses in the municipality. (KEY: roof – building roof area; road – roadways, pervious – soil and vegetation areas that allow infiltration; general impervious - other impervious surfaces such as car parks and pavements)

5.2 Future land use impacts and actions supporting waterway health

Future land use impacts on waterway health are likely to be low due to the highly impervious nature of the municipality. Hence, the future pollutant loads can be assumed equivalent to those presented in section 5.1 for current land use.

5.3 Pollutant loads and waterway health

As described, stormwater pollutant loads and the quantity and pattern of stormwater discharges affect downstream waterway health. Hence, future integrated water management actions to support ecological health can focus on stormwater quality, quantity or both.

5.3.1 Stormwater management

Stormwater quantity impacts can be reduced by disconnecting impervious areas from pit and pipe systems (i.e. the concept of directly connected imperviousness). In the City of Monash, the directly connected imperviousness (DCI) of the 9 sub-catchments range from 27% (Damper Creek) to 52% (Mile Creek). The sub-catchments with the lowest DCI have the lowest proportion of road area, and consequently the lowest rate of TSS and TN pollutant loads.

As described in section 2, significant improvement in waterway health is likely if DCI can be reduced to below 2%. For a highly developed catchment such as Monash, achieving this 2% target will be extremely difficult and impractical.

Rather, efforts should focus on water quality improvements, particularly as water quality also affects amenity of community assets and improves micro-climate. (NOTE: This will also have some impact on stormwater volumes being discharged to the municipal waterways).

5.3.2 Stormwater quality improvements

Council, as part of its responsibility for waterway health protection (as per the SEPP (Waters of Victoria) and the Victorian Planning Provisions), should aim to reduce the pollutant loads from the municipality to best practice (i.e. reduction in TSS, TP and TN by 80%, 45%, and 45%).

A series of investment scenarios were modelled to understand the likely timescale required for Council to meet this best practice pollutant management target. Nitrogen was used as a surrogate for all three pollutants, as reductions in TN are generally the most difficult to achieve.

The starting point for all trajectories includes Council's achievements to date. Council has implemented a large array of water sensitive infrastructure, which are described in section 6. Collectively, these efforts provide a 3% reduction in TN.

Three trajectories are given:

1. A Council investment of $200,000 per annum. This reflects the current Council budget for actions given in the Environmental Sustainability Road Map. The trajectory does not account for investment in water sensitive urban design by the residential and non-residential community
2. A Council investment of $1 million per annum. This equates to approximately 10% of each major item in Council's current budget (as considered potentially relevant to integrated water management), plus the $200,000 specifically identified for actions under the Environmental Sustainability Road Map.
3. Council investment of $1 million per annum plus adoption of best practice stormwater management in all new development (sub-divisions and other development types likely to be included in an amendment to the local planning policy).

The results of the analysis are given in the figure below. The trajectories highlight that with Council's current budget, attainment of best practice TN reduction will take a considerably long time. But with private investment the likely time to achieve best practice targets can be significantly reduced.

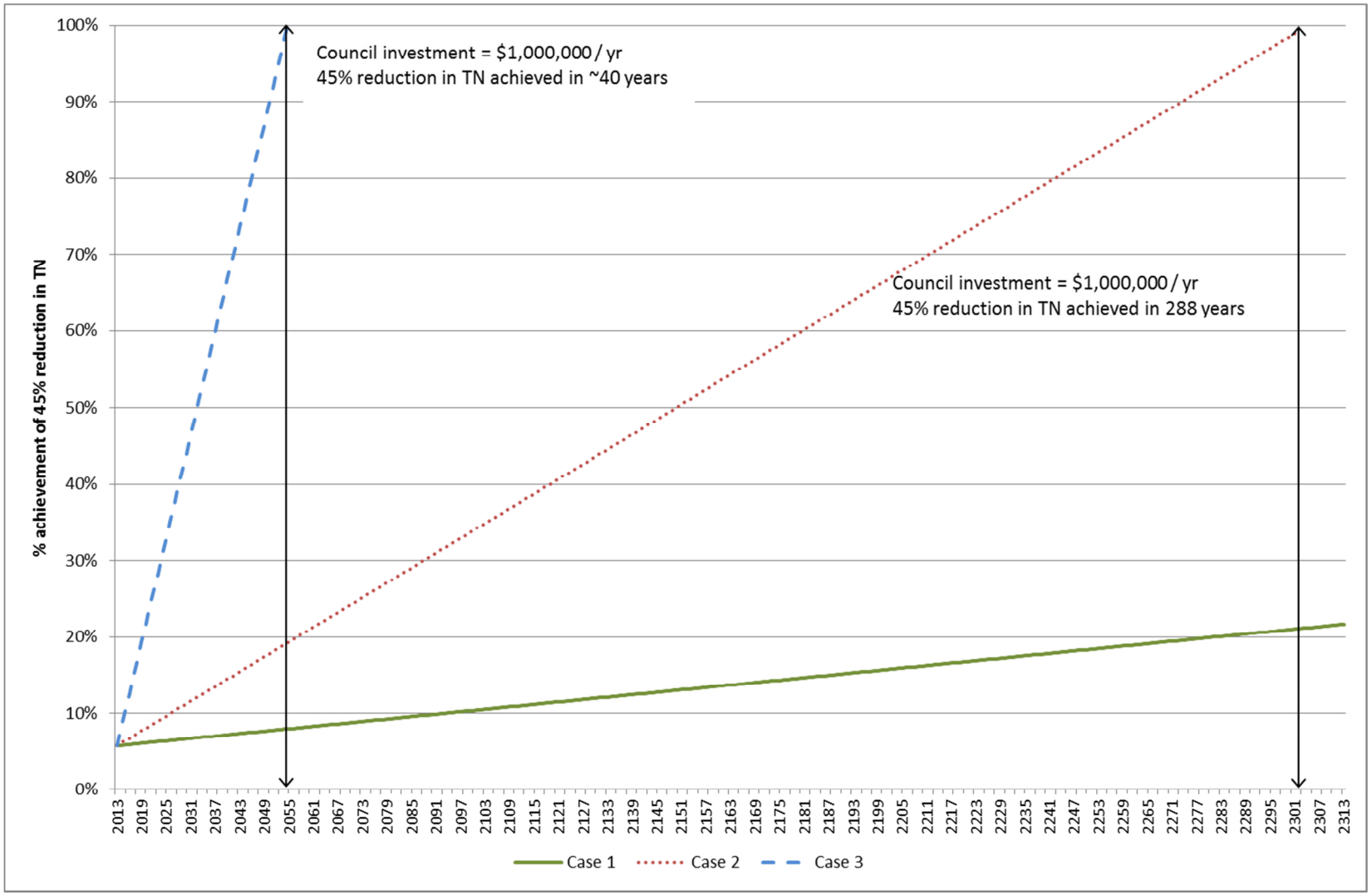

Figure 7: Likely investment trajectory to meet best practice reduction in TN

6 Integrated water management

Integrating water management and achieving Council's vision will require structural and non-structural initiatives.

6.1 Structural and non-structural components of integrated water management

Structural initiatives

A major difference of integrated water management practices compared to traditional centralised approaches is the adoption of decentralised and often 'green', water sensitive technologies. These technologies are critical to ensuring the system is able to deliver on the multiple benefits advocated of a water sensitive city.

Water sensitive technologies are defined as systems that provide amenity and water management services. Water management services relate to flow and quality management. Stormwater flow management is required to protect downstream waterways from erosion. Stormwater quality management protects downstream waterways from high pollutant loads that can degrade waterway health (e.g. high sediment loads and the smothering of vegetation, high nitrogen loads that can lead to algal blooms, particularly in large water bodies such as Port Phillip Bay).

Types of water sensitive technologies include wetlands, bioretention basins, swales and buffers, porous pavements, infiltration systems, and green roof / walls. A description of some of these technologies is given in the following table. Figure 8 illustrates the various scales at which these technologies can be implemented.

Table 5: Typical water sensitive technologies adopted as part of an integrated water management strategy

Technology	Description
Wetlands	Constructed wetlands are densely vegetated waterbodies which operate by stormwater flowing into a defined storage area set by the height of the overflow pipe above a permanent pool of water. Stormwater is filtered horizontally through dense aquatic vegetation. Treatment of stormwater occurs through sedimentation, filtration and adhesion of sediments and biological uptake of nutrients.
Bioretention systems	Bioretention systems (also referred to as raingardens and biofiltration systems) are similar to a regular garden. Stormwater is directed and captured within the bed to promote sedimentation and nutrient removal, as well as retarding the flow of stormwater to waterways. The height of the overflow pipe above the surface of the garden bed sets the volume of stormwater that can be treated. Retardation of flows promoted sedimentation, while the controlled infiltration of stormwater through the dense vegetated garden bed promotes nutrient removal.
Swales and buffers	Swales provide a conveyance function and have a formal discharge point back into the drainage system. Buffers are aligned perpendicular to the direction of flow and rely on infiltration to the underlying soils. Both systems help to protect downstream waterways by disconnecting hard surface areas. They can be grassed or vegetated, depending on broader landscaping needs.
Porous pavements	Porous pavements are an alternative to typical impermeable pavements and promote infiltration, either into the soil or into a storage reservoir below them. They can be made of porous material, modular lattice structures or constructed as block pavements with gaps in between each paver. Infiltration of stormwater through the porous pavement and the underlying sand/gravel media layer reduces runoff volumes and removes sediments, nutrients and other pollutants as water infiltrates to the underlying soils.
Infiltration systems	Infiltration systems are designed to capture stormwater runoff and encourage infiltration into surrounding soils. The trench or sump is typically filled with gravel or course sand. There are also module tank systems on the market that can be installed under trafficable areas such as driveways. Infiltration systems reduce stormwater runoff volumes, protecting downstream waterways from increased flows associated with urban development. On a residential lot it is preferable that runoff is discharged into the system at the surface so that any issues of clogging are identified immediately. Pre-treatment of runoff (using a first flush device for roof runoff or grassed buffer) is required prior to the infiltration trench or sump in areas with shallow groundwater tables, predominantly sandy soils and aquifers with high beneficial uses (i.e. ground water supply systems). (NOTE: these considerations are not applicable to the City of Monash).
Green roofs and walls	Green roofs involve the establishment of vegetation to filter roof runoff and, in some cases, the capture and storage of that roof runoff for reuse. A green wall involves establishing vegetation vertically on the external side of a building. Typically, two types of technologies are used: façade greening or living walls. Façade greening involves climbing plants, secured at the base of the wall. Support structures (e.g. trellis, cables) are used to guide and support the plant. Living walls are modular, with each module containing vegetation. The modules are separated from the wall with a waterproof membrane.

Technology	Description
Rainwater tanks	Rainwater tanks are sealed storages which collect rainwater runoff directly from roofs or other above-ground surfaces for re-use to supply demands such as garden irrigation or toilet flushing.
Stormwater harvesting	Stormwater harvesting is the retardation of stormwater for non-potable use. Systems generally involve a series of structural initiatives to provide treatment and storage. Treatment systems may include those described above, while storage can be provided by formal structural (such as rainwater tanks) or natural systems (aquifers).

Figure 8: Water sensitive design at different urban scales (based on a presentation of the conference paper by Beardmore et al (2012)[13]

[13] Beardmore K, Markwell K, Chatburn C and Breen P (2012), 'How do you create a Water*Smart* Liveable City?', conference proceedings of the Planning Institute of Australia 2012 National Congress, available online at http://www.planning.org.au/documents/item/3980

Non-structural initiatives

Non-structural components of integrated water management facilitate implementation of decentralised and water sensitive technologies.

Non-structural elements, based on the recommendations of the report 'Transitioning to Water Sensitive Cities in Australia'[2] and policy research[14] include:

- Regulation, policy and planning that guide and legitimise action
- Knowledge and information to facilitate awareness of the problem, association with the benefits and skills to act
- Financial implications that either make traditional centralised approaches less appealing, foster innovation in IWM practices, or both
- Systems that organise people and stakeholders into action

6.2 Integrated water management initiatives in the City of Monash

6.2.1 Structural initiatives

The City of Monash has implemented numerous (43) water sensitive technologies, including 19 wetlands, 18 bioretention basins / swales and a stormwater retarding basin. In addition, 29 Council facilities have rainwater tanks for toilet flushing, irrigation, or tanker truck access.

Council currently record the meter readings for rainwater use. The records highlight approximately 33 ML/yr of rainwater is used by Council. This equates to an annual TSS, TP, and TN load reduction of 881 kg, 5 kg and 74 kg, respectively.

The combined impact of these water sensitive design efforts on Council's pollutant load budge is shown in Table 6. NOTE: The effect of these efforts on future pollutant load reductions are described in section 5.

[14] Hood, C 1986, The Tools of Government, Chatham House, New York

Table 6: Achievements to date from the adoption of water sensitive urban design in Monash.

Pollutant	Municipal wide pollutant load	Rainwater tanks	Other WSUD devices	Total savings	% reduction	Best practice target
Total suspended solids (kg/yr)	3,900,000	881	94,513	95,395	2%	80%
Total phosphorus (kg/yr)	8,500	5	182	187	2%	45%
Total nitrogen (kg/yr)	63,000	74	1,624	1,698	3%	45%

Council also has 30 gross pollutant traps (GPT) to trap litter generated from the municipality. Council maintenance varies mainly from monthly to six monthly inspections (one pit is inspected annually). Data collected by Council in 2012 suggests:

- 95% of pits when inspected are 50% full or greater; the pits inspected monthly are always 100% full.
- In at least 70% of cases, the main material collected from the pits is vegetation.
- The maximum percentage of bottles and rubbish collected from a single GPT is reported as 20% and 30%.

Theoretical modelling (e.g. as described in section 5) of litter generation is difficult. Thus, the efficacy of Council's efforts cannot be determined. Although GPTs are an important part of integrated water management, reducing the generation of litter is just as critical. Education is a key component, which is discussed under non-structural initiatives.

Limited information is available on non-Council water sensitive infrastructure. Rainwater tanks are the main initiatives adopted by residents. ABS data shows that in 2011, 27% of Melbourne residential dwellings had a rainwater tank; 30% of which were plumbed to an internal use (toilet). For the City of Monash, this equates to 540 kg TN reduction per year.[15]

As a minimum, Council should encourage (through the non-structural measures described below) that this proportion of single dwellings with rainwater tanks is sustained.

[15] This calculation is based on an assessment of rainwater tanks and pollutant load reductions completed for the City of Moonee Valley 2013.

6.2.2 Non-structural initiatives

A summary of state government and local council non-structural tools that are likely to affect integrated water management is given in Appendix E. The summary also considers how the tool links to the themes of integrated water management described in section 2. This analysis helps to identify gaps in the tools available and subsequent actions.

The main considerations as applicable to the four types of non-structural initiatives are described below. A matrix of the connection of each policy tool and the themes for integrated water management is given in Table 7.

Table 7: Matrix highlighting the connection between selected City of Monash policy tools and themes for integrated water management

Policy tool	Social health	Ecological health	Connected communities	Shared prosperity	Water sensitive infrastructure
Monash 2021	■	■	■	■	■
Council Plan 2013-2017	■	■	▨	▨	■
Municipal Strategic Statement (and local planning policy)		■			
Public health and wellbeing plan (2010-2013)	■		▨	▨	
Environmental Sustainability Road Map	■	■	■		■
Water Use Management Strategy		■			■
Stormwater Management Plan		■	■		■
Flood Management Plan		■			▨
Asset Management Plan		▨		▨	▨
Monash Economic Development Strategy	■		▨	▨	
Draft Walking and Cycling Strategy	■		▨		
Active Reserve Strategy	■			▨	▨
Litter Prevention Strategy	■	■	■		
Monash Baby Boomer Study	■			■	
Indigenous Reserve Corridors Conservation and Management Plan (2000)	▨	■	▨		▨
Sportsground Irrigation Usage Spreadsheet	■		▨		■
C173 agreement		▨			▨
Council fact sheets					■
Council budget	▨	■			■

■ Direct connection ▨ Potential connection

Regulation, policy and planning

Local and state regulation and policy is available to support integrated water management.

At the state level, the Planning and Environment Act (1987) (which led to the development of the state planning policy framework), the State Environmental Protection Policy (Waters of Victoria), the Office of Living Victoria's Melbourne's Water Future, the Water-Supply Demand Strategy 2006-2055, and the Building Act are most relevant.

The Planning and Environment Act (1987) establishes a framework for planning the use, development and protection of land in Victoria. The framework has been established to support specific objectives of planning, including sustainable use of land (objective 4.1.a), protection of natural assets and the maintenance of ecological processes (objective 4.2.b), and to secure a pleasant, efficient and safe working, living and recreational environment.

The framework, the Victorian Planning Provisions, specifically supports integrated water management and the drivers for water sensitive cities. In particular:

Clause 11: Settlement. This clause states that planning must recognise prevention of pollution to land and water, protection of environmentally sensitive areas and natural resources. It also recognises other factors that benefit from integrated water management, for example, economic viability, health and safety, and a high standard of urban design and amenity.

Clauses 12, 13 and 14: These clauses articulate the need to protect catchments, floodplains, sources of drinking water and the health of waterways, bays and coastal ecosystems. Old, traditional stormwater management practices have not delivered on this Clause. Integrated water management aims to address these past management mistakes.

Clause 15: Built Environment and Heritage: Recognises that planning must enhance liveability and amenity of public realm, and protect the attractiveness of towns. Water, as described, in a key tenant of liveability and amenity of our urban environment.

Clause 56.07: Integrated water management: Requires all residential sub-divisions to manage stormwater to best practice (as given in the Environmental Protection Authority's Best Practice Environmental Management Guidelines). It also promotes that water conservation and the use of alternative water sources for non-potable demands.

Clause 56.07 is particularly novel. Victoria is the only Australian state to enforce integrated water management through its state planning scheme. However, the clause only applies to residential sub-divisions, and hence single dwelling, multi-unit developments, major alterations and industrial / commercial developments and sub-divisions are exempt. Some metropolitan councils rely on voluntary adoption schemes such as Sustainable Tools for Environmental Sustainability (STEPS) (residential development) and Sustainable Design Scorecard (SDS) (industrial / commercial development) to encourage the implementation of water sensitive infrastructure in these development types. More recently, some of these councils have proposed changes to their planning scheme to improve their ability to enforce water sensitive design in these exempt development types. Such an amendment to Monash's local planning scheme would be useful in increasing the uptake of water sensitive infrastructure in the private domain.

The State Environmental Protection Policy (SEPP) (Waters of Victoria) is a key instrument to protect and rehabilitate Victoria's surface water environments. It expresses in law the community's expectation for environmental protection. It articulates the uses and values of the freshwater and estuarine environment that government and the community want to protect (termed beneficial uses), and objectives and indicators to support these uses. The SEPP (under Clause 17) clearly identifies the role of Council in ensuring environmental protection. The SEPP recognises the Victorian Planning Provisions (VPP), which as described above require Council to develop local planning policy and strategy to ensure landuse within the municipality does not compromise the beneficial uses identified.

The Office of Living Victoria has started developing a whole of water cycle management strategy for metropolitan Melbourne ('Melbourne's Water Future'). The strategy aims to deliver on numerous initiatives including setting geographical specific targets for water conservation. These targets and the monitoring information generated through this strategy will be valuable to the City of Monash and future iterations of this strategy. However, currently this information is unavailable (it is likely to be released in late 2013).

'Melbourne's Water Future' is likely to supersede the Water Demand Strategy 2006-2055, which was developed to establish means and corresponding targets to save and source water. The targets are guided by 8 objectives, including maintain existing water conservation savings, save more water at home, work and play, and harness alternative water sources. The targets include a residential water saving target of 21.9 GL and a business water saving target of 13 GL by 2015 relative to 1990 figures (280 L/p/d). This equates to a 25% reduction by 2015 (i.e. to 210 L/p/d). (NOTE: As described in section 4, the per capita water consumption rate in the City of Monash is well below this target).

Part 4 of the Building Regulations (2006) and the Building Amendment Act 2011 include the relevant WSUD requirements for all building permits.

Part 4 of the Building Regulations (2006) requires a minimum of 20% of the lot to be pervious. This requirement (regulation 412) has been developed to manage the environmental impacts of urban stormwater. No treatment or best practice standards are referred to.

The Building Amendment Act 2011 refined the definition of the Building Code of Australia to include the National Construction Code Series (Volume 1, 2 and 3). This consequently introduced the requirement for all single dwellings, renovations, alterations and additions to comply with the six star standard. Six star includes a water conservation requirement (the installation of a 2 kL rainwater tanks connected to toilets); however, this can be offset by installing a solar hot water system. Data collected in 2009 by the Building Commission suggests solar hot water systems are preferred. Data was collected from four metropolitan municipalities: Casey, Cardinia, Mornington and Whittlesea. Rainwater tanks were adopted in less than 30% of all cases and in at least 19% of cases, the systems were non-compliant[16]. Data collected by the Australian Bureau of Statistics confirms these trends. In 2011, 27% of dwellings (owned outright) had rainwater tanks. However, only 30% of systems were identified as plumbed to an inside use. This has important implications for Council policy, particularly, how local policy can boost implementation of tanks and encourage systems to be plumbed in to internal uses.

Council's strategic framework for planning is shown schematically in Figure 9. The figure highlights four main documents: Monash 2021, the Council Plan, the Health and Wellbeing Partnership and the Municipal Strategic Statement.

As shown in Table 7, these policy tools either have a direct connection to at least one theme of integrated water management.

Monash 2021 and the Council Plan 2013-2017 broadly recognise the different social –political drivers of a water sensitive city and integrated water management as important to Council's service delivery. The vision for Monash 2021 supports a green, naturally rich city where environmental sustainability is part of business as usual. It also highlights the importance of the municipality's active and open space, the protection of its waterways and collaboration with the community to ensure development is planned and sustainable. The key direction, taking action, in Council's plan specifically supports water sensitive infrastructure. Council's plan,

[16] Sustainable Built Environments 2010, Benchmarking study of residential building performance, available online at http://www.buildingcommission.com.au/resources/documents/5_Star_Benchmarking_study_Report_2010.pdf

however, does not recognise the link between cost of water and business sustainability.

The Municipal Strategic Statement identifies the importance of the environment to the City of Monash: the municipality enjoys good air quality; Scotchmans, Gardiners, Damper and Dandenong Creeks are noted as significant; parkslands along creeks are important open space and recreational areas for the community. The MSS also recognises the impact of urbanisation on waterway health and commits the council to reduce further impacts.

The Health and Wellbeing Plan explicitly mentions environmental sustainability as a key 'health and wellbeing' achievement of the municipality. The Municipal Strategic Statement and the supporting local policies highlight the drivers for integrated water management (e.g. Clause 22;01-3 states the treed character of areas be complemented and preserved).

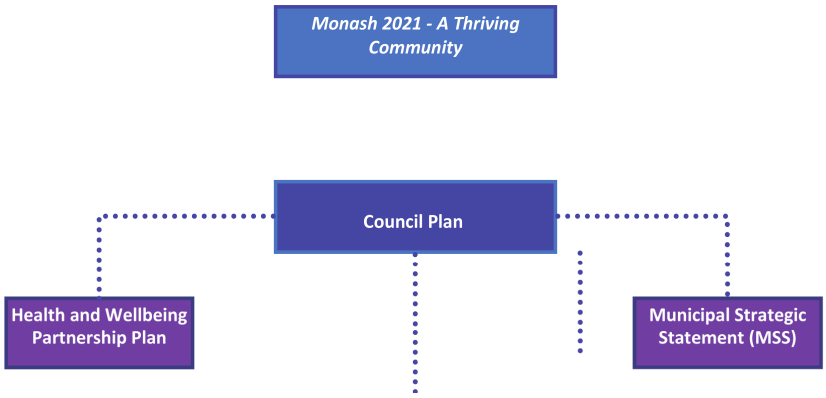

Figure 9: Council's strategic planning framework as given the Council Plan 2013-2017

The Environmental Sustainability Road Map (ESRM) (2011-2015), the Stormwater Management Plan (2002) and the Flood Management Plan (2012) are the main council plans that directly relate to water. Council's ESRM commits Council to consider water conservation and the effects of poor stormwater quality. The Road Map sets a 20% potable water reduction target by 2015, based on 2002/03 consumption, which is an increase on the 15% target set previously in the Water Use Management Strategy 2008 (the document preceding the ESRM). This target was achieved in 2003/2004; 2011/12 Council potable water consumption was 63% lower than 2002/03 consumption (refer to Figure 10). However, although this target now seems redundant, Council has advised that they would like the current water conservation target retained for this integrated water management plan. No target is set in the ESRM or the previous Water Use Management Plan to manage stormwater quality.

The Flood Management Plan (2012) states insufficient drainage capacity in low lying areas as the major factor affecting flood risk in the municipality. 17 hot spots (including 2,550 properties) are identified. Historically, Council's response has been to construct retarding basins and pipe capacity upgrades (funded through a development contribution charge). The FMP, however, states additional retarding basins are required. Like many flood management plans, the recommendations are directed solely at managing stormwater for asset protection. Ideally, the adoption of new retarding basins and other flood management responses should be considered in conjunction with other needs / benefits of water management. For example, underground storage could be constructed within the retarding basins to harvest storm flows and provide an alternative, non-potable water source for the surrounding community (e.g. public open space irrigation). Additionally, lot scale rainwater tanks can provide a flood management role by attenuating flows.

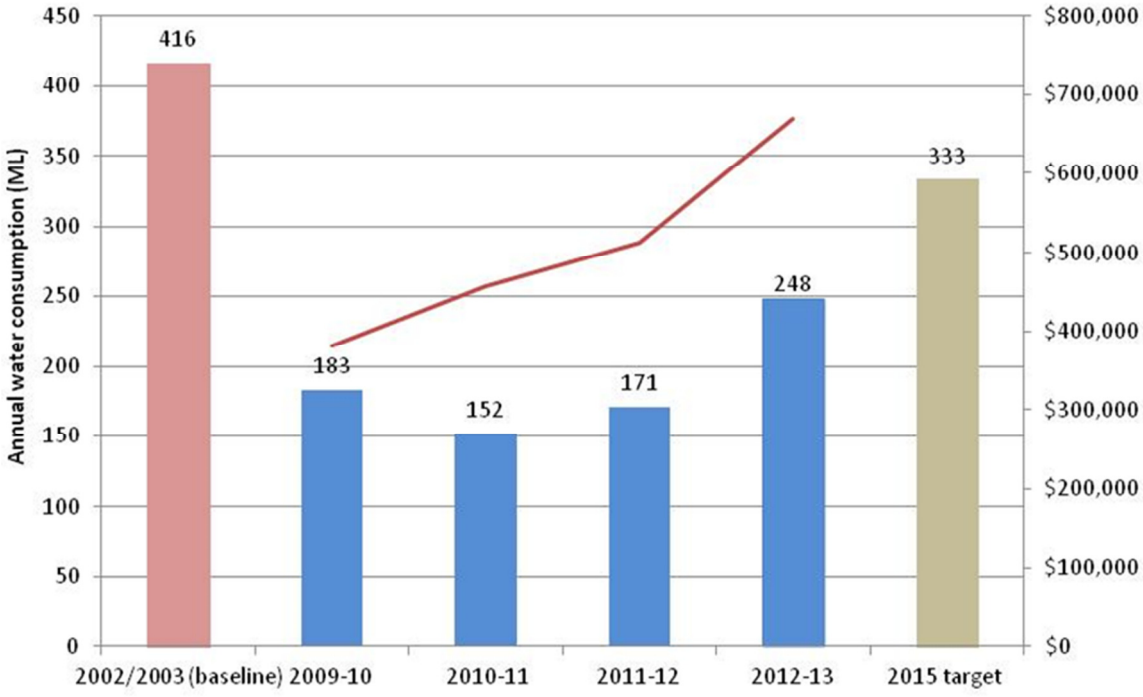

Figure 10: Council water use for the previous four financial years (figure supplied by Council)

The ESRM is supported by Monash 2021 and the Council Plan 2013-2017. A key direction of Monash 2021 is the protection of the municipality's natural environment. The vision of the Council Plan 2013-2017 supports a green and naturally rich city. The MSS, as stated also highlights the importance of the municipality's waterways and the need to protect them from stormwater quality and quantity impacts. The ESRM, however, does not clearly state this link. This is important in highlighting the strategic importance of the ESRM, and the need for other supporting strategies such as an integrated water management strategy.

The ESRM states it will have many social and economic benefits for the community. For water, these are not well defined. To ensure these additional, non-water / non-environmental benefits are realised, it is important for the strategy to clearly articulate these additional benefits and the relevant departments and policies that will need to interact. It is recommended future revisions of the road map make this link.

It is also recommended Council's strategic planning framework (as shown in Figure 9) be revised to include the larger list of policy and plans that relate to Council's key visions / directions. Such a framework would help articulate the relevance of the integrated water management plan, which at the moment is not specifically identified as needed. It is also suggested that Monash 2021 or the Council Plan in future revisions identifies the potential cross over in delivering the key visions / directions. A suggested framework is given in Figure 11. The framework is provided as a guide only, and does not aim to include all Council policy and plans. It has focused on the plans that relate most to integrated water management.

Council's other plans are starting to highlight the link between water and the delivery of its key services. For example, the Economic Development Strategy notes the need to encourage partnerships between water retailers and businesses to improve water efficiency in supporting a sustainable business environment. The Active Monash Strategy stresses the need to harvest water from pavilions for grey water use. However, these initiatives have not been captured in the ESRM. An attempt at showing these connections for the integrated water management strategy is given in Table 8.

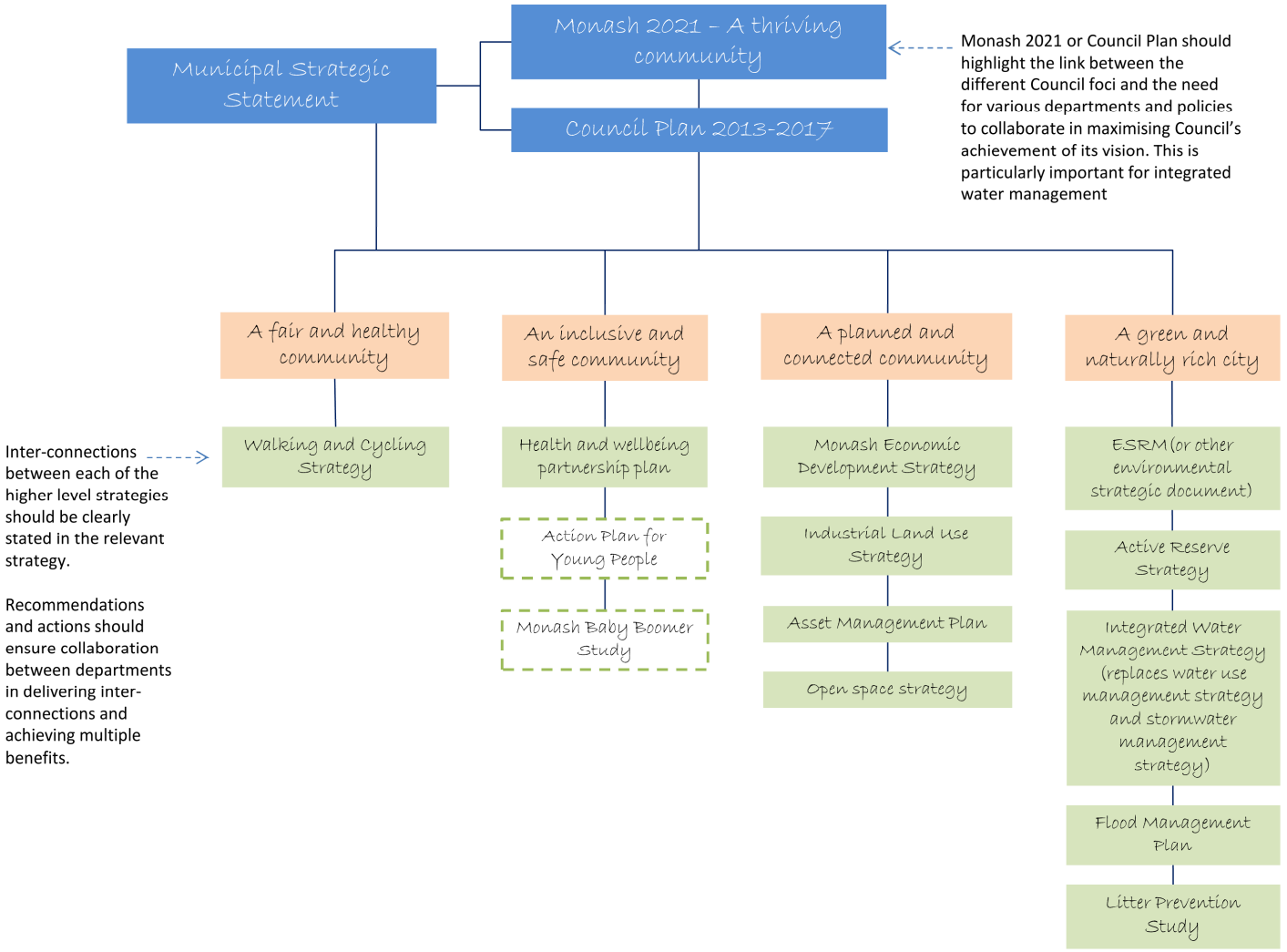

Figure 11: Suggested hierarchy of Council plans and policy to support interaction between Council departments to support the multiple benefits of integrated water management

Table 8: Connection between key Council direction / vision, integrated water management, and other council policy

Council Key Direction / Vision	Potential link to integrated water management	Related policy
An inclusive and safe city	Help ensures landscape of community areas are attractive all year round, In summer, the landscape should provide shade and cooling (i.e. relief from summer temperatures).	Structural plans (e.g. for activity centres)
	Walking tracks that are well vegetated and near water are generally well patronised by the community. Greater patronage also means people feel safe when using these facilities. Stormwater management can help minimise negative impacts on the amenity of waterways. Green, water sensitive, infrastructure along pathways can also help to sustain vegetation (and hence amenity and shade through drier periods).	Walking and cycling strategy
	Sports (particularly team sports) help build a sense of community. Water is key to the availability of these assets. If not irrigated effectively, the amenity and use may be affected, which in turn affects the likelihood of the community becoming involved in active and social activities.	Active reserve strategy
	Integrated water management initiatives are a great way to include and involve community members / groups (e.g. friends of groups). Opportunities to support volunteering should be encouraged to help Council deliver on the strategy actions	Monash Baby Boomer Study Action Plan for Young People
A planned and connected community	Industrial developments can often be devoid of vegetation. It is important that the landscape of these areas retains the garden city character the municipality is proud off. Additionally, industrial and commercial businesses have high impervious fractions and can have high water demands. It is important to consider opportunities for harvesting and use in providing an additional non-potable water source for these businesses (this can provide economic advantages) and managing the downstream impact on waterway health.	Monash Economic Development Strategy Industrial Land Management Strategy
	Many mature trees failed to survive the stress of drought and irrigation restrictions. Alternative water sources and passive irrigation schemes can help increase the reliability of irrigation water to these trees. This	Open space strategy Asset management strategy

Council Key Direction / Vision	Potential link to integrated water management	Related policy
	also helps the amenity of Council's open space areas.	
	Water sensitive urban design practices can help eleviate nuisance flooding, which helps minimise the impact on roads / traffic and properties. Additionally, rainwater tanks can also provide an alternative water source.	Flood management plan Asset management strategy
A fair and healthy community	Active, open spaces are important to all of the community, including the elderly. Walking is a common activity of older people. Shade and amenity will be important to the appeal of these tracks. As stated above, integrated water management can help ensure vegetation has an alternative water source, that helps sustain the plant through warmer, Summer weather.	Walking and cycling strategy
A green and naturally rich city	High quality recreation facilities require a reliable water source. Integrated water management can help provide a portfolio of water sources to ensure the use and value of the facility can be sustained through a range of climate scenarios	Active reserve strategy

Knowledge and education

Knowledge and education tools that support integrated water management include guidelines such as the best practice environmental management guidelines, and the fact sheets provided on Council's website to support community uptake of water sensitive infrastructure.

Monitoring and evaluation data is also very important. The sportsground water usage spreadsheet, the rainwater tank metering, and the GPT litter removal tracking systems are all valuable in demonstrating progress and, in the case of the sportsground water usage spreadsheet, the feasibility of alternative water systems.

External organisations and programs are also valuable sources of knowledge, for example, Clearwater programs and seminars facilitated by the CRC for Water Sensitive Cities.

City of Monash is also home to the CRC for Water Sensitive Cities, which is the leading Australian research group on integrated water management and water sensitive design. Research within the CRC (as well as in other groups at the University of Monash) includes effectiveness and design of biofiltration systems and governance supporting water sensitive cities. City of Monash has started to recognise this resource, collaborating with Monash University in two projects. This type of collaboration should be continued, and could potentially be formalised through a PhD scholarship system.

Financial support

Council produce a budget annually. The 2012-2013 budget provides only $200,000 for environmental actions identified in the Environmental Sustainability Road Map. The Road Map spans all sustainability issues (i.e. waste, energy, water, etc), and thus water-related actions will not necessarily take precedence over other sustainability actions. Additionally, the budget is unlikely to make a significant impact on the actions identified. For example, the MARC backwash facility is estimated to cost $377,000, of which the current budget will only meet 53%.

The majority of Council's budget is for road upgrades, drainage, building works (e.g. sports pavilion upgrades), and management of reserves. Water sensitive infrastructure can potentially be integrated into all of these budget items. To be certain that a proportion of these budgets is available for integrated water management, respective policies should consider the role of water in delivering their service, or the potential for integration across departments to achieve multiple benefits.

Finance for integrated water management can also be accessed through partnership and private funding. For example, Council's Active Reserve Strategy states that where opportunities exist, Council will partner with sporting clubs to fund the development of facilities. The funding of some standard components must be provided by user groups (e.g. 50% of the cost of warm seasons conversions at bowling clubs and synthetic surfaces must be met by the user group).

Additionally, funding can be sought from non-water areas due to the multiple benefits achievable through integrated water management. For example the $6 million streetlife program supports Council to set up trader associations. With Council help, these trader associations can be used to educate the wider trader community on the impact of their business on water issues (e.g. litter, oil in stormwater) and how to change these negative behaviours.

Organisation

A complete review of the organisational structure of Council is beyond the scope of this project. However, based on conversations with Council, the organisational structure is not the most effective for supporting integrated water management. Council could engage with Monash University and the CRC for Water Sensitive Cities to develop a profile of its organisational capacity for supporting integrated water management and the most effective adjustments for encouraging behaviour change and improving implementation.

Organisation also refers to stakeholders. Many stakeholders are involved in water management, particularly when indirect benefits are included. At the state level there is Melbourne Water, the water retailers (South East Water and Yarra Valley Water), the Environmental Protection Authority (EPA), and the Department of Health (DoH). Locally, there are other local councils. Sharing experience between Councils is an extremely effective way of building awareness and capacity in integrated water management. For example, Council engineering personnel have been in contact with the City of Kingston regarding the maintenance considerations for water sensitive infrastructure, and City of Port Phillip on water sensitive infrastructure for passive irrigation. Council should continue to support these informal networks. This could be done through setting key performance criteria for staff related to knowledge and information of water sensitive issues.

Community groups are also valuable partners. The friends of groups in the City of Monash provide regular information sessions on waterway issues, and valuable help in weeding and litter management.

7 Targets and actions

7.1 Targets

A set of targets for integrated water management in the City of Monash have been established to track efforts made by Council and the municipality's residential and non-residential community.

The targets are informed by the current and future municipal water cycle analysis, the pollutant load analysis, and existing policy tools.

The targets are divided into *Council targets*, *residential targets* and *non-residential targets,* which recognises Council's various roles and sphere of influence:

- a leader in its own action through building and service delivery,
- an advocator for community action,
- a partner in facilitating and supporting action, and
- a planner and regulator.

The targets are set for water conservation, potable water substitution, water quality improvement, water sensitive landscapes and tree coverage. Achievement of each target will help Council address all five themes identified as important for integrated water management. The timeframe for achieving all targets is 2018.

The targets developed are summarised in the following table. Included in the table is a qualitative assessment of the likely impact of each target on Council's five goals for integrated water management. Three impact categories are used: direct (solid, orange shading), indirect (orange, stripped shading) and none (no shading).

Table 9: Integrated water management targets to be achieved by 2018 and the relative impact of targets on Councils themes.

Target	Council	Residential	Non-residential	Social health	Ecological health	Connected communities	Shared prosperity	Water sensitive infrastructure
Water conservation	Ensure Council's potable water use does not exceed 330 ML/yr (which is equivalent to current water conservation target given in the ESRM) Target currently achieved	Support residents maintain current potable water consumption rate of 120 L/person/day	None					
Potable water substitution	Decrease potable water use for sportsfield irrigation by 13 ML/yr No use of potable water for street tree irrigation (Target linked to stormwater harvesting program. Refer to section 4.5)	Rainwater tanks installed in 27% of new single dwellings Rainwater tanks installed in 21% of existing dwellings (2012). Encourage connection to indoor use (toilet flushing)	Rainwater tanks installed in 10% of non-residential developments					
Waterway health	3% reduction in TN pollutant loads across Council assets Ensure a 5 weekly street cleaning frequency cycle	1% reduction in TN pollutant loads in new and existing dwellings (Aspirational target: 4% reduction in TN pollutant loads)	None					
Water sensitive landscapes	Encourage the use of stormwater for passive irrigation of street trees in all	Planning permits for new residential developments to require planting of advanced	Planning permits for industrial developments to require detailed					

	relevant capital works projects	trees and drought tolerant species	landscape plans that are water sensitive and include trees that provide shade and amenity					
Tree coverage	Continue Council's target to plant 100,000 trees, shrubs or groundcover per year Develop a city tree canopy management strategy to maintain and enhance tree coverage across all Council assets (i.e. streetscape and open space)							

7.2 Recommended actions

To support the implementation of the targets given in Table 9, a list of recommended actions has been developed. The actions have been developed based on the background information discussed in sections 3 to 6, and an inter-departmental workshop with Council in August 2013.

The actions are divided into structural and non-structural initiatives. Structural initiatives describe the physical infrastructure required to deliver on the desired IWM targets. Non-structural initiatives facilitate the uptake of the technology through knowledge and information, regulation and planning, organisation (e.g. people and roles, networks), and financing.

In addition, the actions have been linked to the themes of integrated water management. Themes, rather than targets, have been referenced as the targets, as shown in Table 9, will deliver on multiple themes.

Table 10 documents the structural actions, while Table 11 to Table 14 documents the non-structural actions.

Table 10: Recommended actions for structural initiatives to support integrated water management in the City of Monash

Action	Priority	Responsibility	Council responsibility[17]	Timeframe	SH	EH	CC	P	WS
Stormwater harvesting: Implement stormwater harvesting program to reduce Council's reliance on potable water for sportsground irrigation. Target one project/year. Link to flood mitigation and open space development program.	High	Council / Melbourne Water / YVW / SEW / OLV		Ongoing					
Capital works program: Ensure opportunities for water sensitive urban design are investigated as part of all relevant new capital works program, particularly road works, buildings, drainage upgrades and open space renewal.	High	Council		Ongoing					
Rainwater tanks (Council): Connect all rainwater tanks on Council owned or managed assets to an indoor demand (e.g. toilet flushing) where practical.	High	Council		Ongoing					
WaterMAP actions: Prioritise the implementation of water conservation measures identified in Council's WaterMAPs. In particular, the backwash facility at MARC.	High	Council		Year 2					
Irrigation demand: Continue to ensure efficient potable water use in parks and sporting amenities, with consideration of climate change response planning through: – Irrigation efficiencies and determining optimal irrigation. – Understanding soil types and soil moisture needs. – Mulching to prevent evaporation. – Planting climate responsive, drought tolerant species. – Linking irrigation demand to other social benefits (e.g use, no. of clubs)	High	Council		Ongoing					
Water efficient fixtures: Continue to install water efficient showerheads, urinals, fixtures and flow regulators across Council assets and dual flush toilets for public toilets.	High	Council		Ongoing					

[17] Council stated in the workshop that this column is important to actions being completed. Council will fill this column in after the submission of the strategy

Action	Priority	Responsibility	Council responsibility[17]	Timeframe	SH	EH	CC	P	WS
Planting: Continue to plant and replant garden beds, where appropriate with low water demand, vegetation (NOTE: although native plants are preferred, exotics should not be discounted completely – they can also have a low water demand)	Low	Council		Ongoing					

Note: SH – social health, EH – ecological health, CC – connected communities, P – shared prosperity, WS – water sensitive infrastructure

Table 11: Recommended actions for regulation, policy and planning to support integrated water management in the City of Monash

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
Municipal strategic statement: Update Council's Municipal Strategic Statement to support integrated water management in preserving and enhancing the values of the municipality. The review should include updates to the local planning policy, including: • Clause 21.06: Update key objectives to include water sensitive objectives. • Clause 21.10: Update key issues and objectives to (i) identify water scarcity as a key issue and (ii) support water conservation and the use of alternative water sources. • Current Clause 21.13: Update policy to require an environmental management plan (currently references the Monash Conservation and Environment Strategy) and clearly articulate the benefits of integrated water management. • Clause 22.04: Reference the EPA Best Practice Environmental Management Guidelines to encourage nutrient load reduction.	High	Council		Year 1					
Council Plan 2013-2017: Future revisions of the Council Plan to articulate the need to (i) update the environmental sustainability road map as Council's strategic environmental management policy and (ii) support strategies such as the integrated water management plan.	High	Council		On-going					
Environmental strategic document: Use the next revision of the Environmental Sustainability Road Map to articulate the major environmental issues relevant to Council and Council's response, as well as the links with other Council policy and directions. The document must provide a basis / context for the integrated water management strategy.	High	Council		Year 2					
Structure plans / precinct plans: Ensure all structure / precinct plans require water	High	Council		Ongoing					

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
sensitive design.									
Stormwater/IWM local planning policy: Consider introducing a local planning policy to mandate the use of STORM[18] or STEPs (Sustainable Tools for Environmental Performance Strategy) in the City of Monash.	Medium	Council / OLV		Year 2					
Interlink Council strategies: Ensure commitment to water sensitive urban design and City of Monash's integrated water management strategy as part of the revision and update of Councils strategies and plans (e.g. open space strategy, sports and recreation related strategy, industrial land management strategy).	Medium	Council		Ongoing					
Water Atlas: Expand Council's current water sensitive urban design GIS layer to provide strategic advice on future opportunities for water sensitive infrastructure. The tool should include WSUD assets and their catchments, footprint, estimates of flow and pollutant load reductions. Additionally, the tool could provide a qualitative assessment of the impact of the project on Council's themes for integrated water management. The tool would also identify where there is double-up of treatment and areas where new projects need to be implemented.	High	Council		Ongoing					
Tree coverage GIS data mapping: Continue to support Council's GIS mapping of street tree coverage and expand program to include open space areas.	High	Council		Ongoing					
Concept plans for water sensitive design: prepare concept designs for a range of water sensitive projects, including: [19]	High	Council		Year 1					

[18] STORM is a tool that can be used to assess whether a WSUD strategy meets best practice pollutant load reductions. The tool is available online at http://storm.melbournewater.com.au/

[19] Some of these concept designs are detailed in the E2Designlab report, 'Concept designs for integrated water management'. The Passive Street Tree Irrigation project is a separate OLV funded initiative.

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
• Passive street tree irrigation using stormwater • Guidance for water sensitive design at Glen Waverley Activity Centre to be included in structure plans and urban design frameworks • Stormwater harvesting for sportsground irrigation at Central Reserve and Mulgrave Reserve • Stormwater harvesting at Oakleigh Golf Course • Retrofit opportunities for stormwater harvesting a Glen Waverley Golf Course • Stormwater diversion for biodiversity habitat • Design advice for WSUD in Atherton Rd redevelopment									
Concept plans for stormwater harvesting: Develop concept plans for the top 10 ranking sportsfields identified in Council's stormwater feasibility study to understand the likely budget and potable water savings, and ensure sufficient detail is available for potential funding submissions. This would also help prioritise projects.	High	Council		Year 3					
Irrigation demand: Update Council's information on irrigation to reflect the wider community benefits of the open space asset (e.g. through the extension of the irrigation index to include an index for public health and public amenity).	High	Council		Ongoing					

Note: SH – social health, EH – ecological health, CC – connected communities, P – shared prosperity, WS – water sensitive infrastructure

Table 12: Recommended actions for finance to support integrated water management in the City of Monash

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
Council Budget: Develop a business case to ensure a greater proportion of Council's budget is available for environmental and water-related initiatives.	High	Council		On-going					
Water sensitive costing: Update Council's Facilities Water Management Study to include a life cycle costing of options. The top 10 options (see Table 3) should be given highest priority for this. This should provide a business case for water sensitive design verse business as usual.	High	Council		Year 3					
Funding: Continue to seek federal and state government funding, for example, Department of Sustainability, Environment, Water, Population and Community's 'National Urban Water and Desalination Planning: Stormwater Harvesting and Reuse Grant'.	High	Council		Ongoing					
Rebate schemes: Continue to encourage uptake of government rebate schemes such as the Living Victoria Water Rebate Program for homes and business by raising awareness via Council's website and local media.	Medium	Council		Ongoing					
Funding opportunities: Identify opportunities to link in with other departments, non-traditional funding sources (such as water retailers, business development and innovation, Australian Sports Foundation), neighbouring Councils and other landholders to apply for funding.	Medium	Council		Ongoing					

Note: SH – social health, EH – ecological health, CC – connected communities, P – shared prosperity, WS – water sensitive infrastructure

Table 13: Recommended actions for knowledge and education to support integrated water management in the City of Monash

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
Internal promotion of water sensitive design: Leverage Council's Green Team to better communicate Council's WSUD policy and initiatives. Establish a website communication board of Council's (or state / national / global) integrated water management / water sensitive design initiatives.	Medium	Council		Ongoing					
Council website: Continue to update Council's Sustainable Living Guide to provide factsheets and links to external information (e.g. green guide)	High	Council		Ongoing					
Tracking benefits: Track and monitor WSUD elements (e.g. EIBC IWM trials site, Council green roof) so water quality achievements can be assessed against the waterway health target. Support Waterwatch.	High	Council		Ongoing					
Water consumption: Council to continue monitoring and reporting water consumption across all its assets	High	Council		Ongoing					
Council capacity for integrated water management: Undertake a gap analysis of Council staff capacity or desired skills in integrated water management (refer to Melbourne Water capacity survey 2013)	High	Council		Year 2					
Hot spots program: Advocate for the establishment of a hot spots program to address illegal waste dumping and sewer connections to stormwater	High	Water authorities		On-going					
Community engagement: Continue to support IWM demonstration days (e.g. building of a bioretention basin), community education and community planting days	Medium	Council		Ongoing					
Organisational awards: Continue to acknowledge Council and community efforts in WSUD through an awards program.	Medium	Council		Ongoing					
Signage: Continue to install both permanent and temporary IWM information	Medium	Council		Ongoing					

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
boards for high profile projects									
Site tours: Continue to organise site tours, etc to promote awareness of integrated water management and confidence in the potential benefits. Ensure maximum departmental representation at IWM site visits.	Medium	Council		Ongoing					
Employee exchange program: Consider an employee exchange program with neighbouring Councils, particularly for maintenance staff. This will provide employees access to practical experience.	Medium	Council		Ongoing					

Note: SH – social health, EH – ecological health, CC – connected communities, P – shared prosperity, WS – water sensitive infrastructure

Table 14: Recommended actions for organisation (networks and associations) to support integrated water management in the City of Monash

Action	Priority	Responsibility	Council responsibility	Timeframe	SH	EH	CC	P	WS
Inter-departmental working group: Foster organisational capacity building by establishing an inter-departmental IWM working group	Medium	Council		Year 3			■		■
Networks with stakeholders: Ensure Council has good, on-going communication with major stakeholders (e.g. Parks Victoria, Office of Living Victoria, VicRoads, Melbourne Water, Yarra Valley Water, South East Water) to help identify opportunities for collaboration.	High	Council		Ongoing			■		■
Internal integration: Continue to foster integration across departments, e.g. through an inter-departmental working group for integrated water management	High	Council		Ongoing			■		■
Trader association / friends of groups: Continue to support friends of groups and other groups such as trade associations in providing educational material that can be distributed more widely.	Medium	Council		Ongoing			■		
Links with Monash University: Continue to support collaboration with universities (e.g. undergraduate / graduate research collaboration). Continue to build partnerships with CRC for Water Sensitive Cities (Monash University).	Medium	Council		Ongoing	▤	▤	■	▤	▤
Project delivery & auditing: Build in-house knowledge and resources around WSUD & IWM to facilitate effective project delivery	Medium	Council		Ongoing	▤	▤			■

Note: SH – social health, EH – ecological health, CC – connected communities, P – shared prosperity, WS – water sensitive infrastructure

Appendix A

Minutes from project workshops

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on (yr)	Reference	Comments
	Environmental Management Co-ordinator (CoM), email correspondence, 29-May-2012	Includes buildings and sportsground irrigation. The majority of sportsgrounds / reserves in the municipality are irrigated using mains water. Potable water is not used for street tree watering. According to Council's Water Use Management Strategy (2008), street trees are watered using harvested rainwater from Scammell Reserve, Glen Waverley North Reserve, Council nursery, Tally Ho Reserve, Southern Reserve and the Glen Waverley Golf Course lake.
	Customer Relationship Manager - Local Government (YVW), email correspondence, 21-May-13 Key Accounts and Billing Team Leader (SEW), email correspondence, 10-May-13	
	Customer Relationship Manager - Local Government (YVW), email correspondence, 21-May-13 Key Accounts and Billing Team Leader (SEW),	

Water stream	Landuse	Current consumption 11/12 (ML/yr)	Reference	Comments
Rainwater use	Council	32	City of Monash 2012, Environmental Sustainability Road Map Environmental Management Co-ordinator (CoM), Council rainwater tank data, email correspondence, 14-May-13	Harvested rainwater is used for toilet flushing, garden irrigation, golf course irrigation, vehicle washbays and street tree watering. Council supplied a list of tanks and data related to capacity, use, and meter readings (where available). If meter readings were not available, assumptions were made re the likely supply. The assumptions used were checked by Council.
	Residential	45	ABS 2011, Water sources and uses, available online at http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4602.2Chapter400October%202011 forecast.id 2013, available online at http://forecast2.id.com.au/Default.aspx?id=102&pg=5230 atlas.id 2013, Social atlas - City of Monash, available online at http://atlas.id.com.au/monash/maps/average-household-size YVW 2011, Yarra Valley Future Water - Residential Water Use Study Volume 1 - Winter 2010, available online at http://www.yvw.com.au/yvw/groups/public/documents/document/yvw1003346.pdf	The calculation assumes: - 27% of existing households have a rainwater tank (ABS data applied to City of Monash) - 8% of households with rainwater tanks are plumbed to internal use (ABS data applied to City of Monash). - Each household has 2.7 pax (atlas.id social atlas) - Harvested rainwater, when plumbed to house, is only used for toilet flushing and the system is 90% reliable. - Toilet flushing demand uses YVW data (19L/p/d).
	Non-residential	0.06	Golf course superintendents association (2011), Welsey rides a new wave, available online at http://www.aprs.com.au/australian-water-management-news/wesley-rides-a-	Only project with information is Wesley College - Glen Waverley campus. The scheme harvests bore water and rainwater. The rainwater tank is connected to a 10,000L tank. Assume the tank turn-over is 6 times per year.

Water stream	Landuse	Current consumption 11/12 (ML/yr)	Reference	Comments
			new-wave	
	Total	**76**		
Stormwater use	Council	61	Urban Design Officer (CoM), WaterMAP - Glen Waverley Golf Course - Progress Report, Council project data supplied to consultant Urban Design Officer (CoM), Sportsground - Actual Use, Council project data supplied to consultant Environmental Management Co-ordinator (CoM), Council rainwater tank data, email correspondence, 14-May-13	Council has two stormwater harvesting schemes: Glen Waverley Golf Course and Mt Waverley Reserve. The Glen Waverley Golf Cours stormwater harvesting scheme, according to the WaterMAP, provides 60,000 kL per annum of water savings (2008/2009 - no data given for 2011/2012). The stormwater harvesting scheme proposed for Mt Waverley Reserve is expected to provide an 80% reduction in potable water use. Current potable water demand at the reserve is 3,610 kL (2011/2012) (data given in Monash spreadsheet "Sportsground - Actual Use"). To date ~900 kL has been harvested.
	Residential	0		Assume all stormwater harvesting schemes in residential domain are for rainwater.
	Non-residential	0		No data available
	Total	**61**		
Recycled water	Council	0		SEW nor YVW supply recycled water to the City of Monash
	Residential	0		As above
	Non-residential	0		As above
	Total	**0**		
Wastewater	Council	47		A 0.9 factor, as per residential dwellings has been applied to Council's potable water and rainwater use (minus use for sportsgrounds).

Water stream	Landuse	Current consumption 11/12 (ML/yr)	Reference	Comments
	Residential	7,208	Customer Relationship Manager - Local Government (YVW), personal correspondence, 21-May-13	YVW do not have specific information on sewerage but have recommended a factor of 0.9 be applied to water usage
	Non-residential	2,421	Commonwealth of Australia 2006, Water efficiency guide: office and public buildings, available online at 'http://www.environment.gov.au/sustainability/government/publications/pubs/water-efficiency-guide.pdf	Typical commercial (office) water use is: - Leakage 28% - Amenities - 37% - Cooling towers - 31% - Retail - 3% - Irrigation - 1% - Other (cleaning, car cleaning) - 2% Hence, 99% of water used in non-residential areas is assumed to go to sewer. This could be high given Council's policy to encourage well landscaped industrial areas.
	Total	**9,695**		
Licensed extractions (bore water)	Council	10	Southern Rural Water 2007, Letter to City of Monash re Groundwater Licence 9030146, dated 13th March 2007	Council has an irrigation licence at Scammell Reserve (10ML). Leachate from Reg Harris is considered under 'other'.
	Residential	27	Business Improvement Officer, Southern Rural Water, email correspondence, 11 June 2013	City of Monash has no licenced metered bores for residential use. 39 non-licenced, unmetered bores exist for domestic and stock use. SRW assume each of these bores has an annual average use of 1.2 ML. It is assumed that 60% of this capacity was used in 2011/2012 (this is the same percent use of non-residential licenced, metered extractions).

Water stream	Landuse	Current consumption 11/12 (ML/yr)	Reference	Comments
	Non-residential	60	As above	Not all licenced bores are metered. The maximum entitlement for licenced bores in the municipality is 493 ML. There are 12 additional un-licenced meter for industrial, dewatering, or irrigation. No information on volume (either maximum extraction or actual use) is available.
	Total	**97**		
Other / Greywater	Council	0.0	Urban Design Officer (CoM), EGProgressReport2011-2012, Council project data supplied to consultant Urban Design Officer (CoM), WaterMAP progress report (MARC), Council project data supplied to consultant URS 2011, Functional design report: Reg Harris leachate desalination plant, report supplied by Council June 2013	Greywater diversion was investigated for Elizabeth Gardens and was found to be too expensive. Backwash facilities - no backwash facilities at Council pools. System was investigated at MARC, but no funding was available. Leachate: According to the functional design report references, the mean irrigation demand of Reg Harris Reserve and Schotchmans Run is 10.9 ML. This application rate has been assumed for 2011/2012. (Reg Harris Reserve nor Scotchmans Run are included in Council's sportsground irrigation spreadsheet).
	Residential	3.0	ABS 2011, Water sources and uses, http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4602.2Chapter400October%202011	ABS data states 28% of households in inner Melbourne use grey / recycled water. It is assumed this water is used for outdoor irrigation only, which is ~60 L/p/d (based on 2005 data). Note this is likely to be high as data is pre- target 155 and water restrictions.
	Non-residential	0	-	No data available
	Total	**3**		

Appendix C

Future water balance

Water stream	Landuse	Future consumption (ML/yr)	Reference	Comments
Mains water	Council	295	Council consumption data (email)	Assumed Council's current target of 20% reduction on 2002/2003 consumption is retained, minus the following exceptions: 1. Council expect a 50% reduction in sportsground irrigation through the conversion of surfaces to low water demand grasses or synthetics (2011 irrigation volume ~40 ML) 2. Rainwater tanks will be installed will lower Council's potable water consumption by 330 kL 3. MARC will achieve a 5% reduction in potable water use as per its WaterMAP. No further reductions will occur past this event 4. Mt Waverley Reserve stormwater harvesting scheme achieves the designed 80% reduction in potable water. Future potable water use does not account for: 1. The likely increase in open space irrigation in the activity centres has not been quantified specifically. Instead it has been included in the overall increase in Council's potable water use due to population growth. 2. Additional increase in water use by the MARC (note: the WaterMap predicts a 9% increase in water use from 2010/2011 to 2011/2012)

Water stream	Landuse	Future consumption (ML/yr)	Reference	Comments
	Residential	8,731	YVW Water Plan 2013-2018 .id 2013, Population forecasts for the City of Monash	YVW's Water Plan (2013-2018) predicts minimal growth in per capita potable water demand. The plan assumes no water restrictions will occur during the next two water plan periods (2013/14 to 2022/23) and the likelihood of any shifts to pre-drought water consumption patterns will be stymied by water efficient fixtures, permament behaviour change, and substantial uptake of rainwater tanks and high costs of potable water. Hence, it is assumed the current per capita water use of 45 kL/yr in the City of Monash will continue.
	Non-residential	2,690	YVW Water Plan 2013-2018	YVW's Water Plan (2013-2018) predicts minimal increase in non-residential demand for potable water. Hence, it is assumed the current use will be sustained. Currently, a 10% increase in current non-residential demand is assumed. It accounts for - Eastern Innovation Business Centre (EIBC) (25 offices, 2 workshops) - Redevelopment of Glen Waverley (principle) activity centres - Redevelopment of major and community activity centres (e.g. Brandon Park)
	Total	**11,717**		
Rainwater use	Council	32	ESRM (2011/2012) WaterMAP (Elizabeth Gardens)	Assumes continued savings from rainwater tanks as per 'current water balance', with the addition of - Notting Hill (tank turn-over = 4) - Chadstone Forest Farm (tank turn-over = 4) - Elizabeth Gardens (assume rainwater tanks provide 5% reduction on 2011/12 usage as planned) No additional rainwater tanks are accounted for. Although the ESRM states Council will continue to install rainwater tanks, and have allocated a budget of $52,500 (within current capital budget)

Water stream	Landuse	Future consumption (ML/yr)	Reference	Comments
	Residential	111	forecast.id 2013, available online at http://forecast2.id.com.au/Default.aspx?id=102&pg=5230	Assumes 27% all new dwellings have a rainwater tank for toilet flushing and the use of all existing rainwater tank water is sustained.
	Non-residential	0.06	Golf course superintendents association (2011), Welsey rides a new wave, available online at http://www.aprs.com.au/australian-water-management-news/wesley-rides-a-new-wave	Only project with information is Wesley College - Glen Waverley campus. The scheme harvests bore water and rainwater. It is assumed the extra 4 ML/yr of water savings expected from the plant will be from rainwater harvesting.
	Total	**302**		
Stormwater use	Council	73	ESRM (2011/2012)	Council (as stated in the ESRM) aims to achieve an 80% reduction in potable water use per reserve by 2016/2017. Given 50% will be achieved through warm season grass / synthetic surfaces, harvesting schemes will provide 30% reduction. This does not include Oakleigh Golf Course.
	Residential	0		Assume rain water is the main residential non-potable water source
	Non-residential	0		Assumed zero. No information available
	Total	**73**		
Recycled water	Council	0		Neither YVW nor SEW plan to deliver a third pipe for recycled water to the City of Monash. NOTE: The City of Monash Water Management Plan 2008 states that recycled water is occasionally purchased from YVW, but does not give a quantity.
	Residential	0		
	Non-residential	0		

Water stream	Landuse	Future consumption (ML/yr)	Reference	Comments
	Total	**0**		
Wastewater	Council	271		Assumed 90% of non-irrigation water is disharged to sewer
	Residential	7,958		Assumed 90% of rainwater and mains water is discharged to the sewer.
	Non-residential	2,664		Assumed 99% of mains water is discharged to the sewer
	Total	**10,892**		
Licensed extractions (bore water)	Council	10		Assume current use is sustained
	Residential	27	City of Monash Local Government Area Hydrogeological Assessment (2009)	As per current use - groundwater report states that all licences available in the area are exhausted. Hence, assume maximum allocation used.
	Non-residential	70	Golf course superintendents association (2011), Welsey rides a new wave, available online at http://www.aprs.com.au/australian-water-management-news/wesley-rides-a-new-wave	Wesley College's desalination plant is forecast to provide 10ML of potable water savings
	Total	**107**		
Other / Greywater	Council	17.2	ESRM (2011/2012)	Council are planning to upgrade the MARC backwash facility, which will provide water savings off 6,200 kL per annum (5 years from 2012) - therefore it is assumed funding will be available.
	Residential	3.4	ABS 2011, Water sources and uses, http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4602.2Chapter400October%202011	Assume 28% of residents use greywater as per the current water balance. Assume Reg Harris leachate is used for irrigation at Reg Harris and Scotchmans Run (~11 ML/yr). Assumed desalination plant is constructed.
	Non-residential	0		No data available
	Total	**21**		

Appendix D

Pollutant load balance

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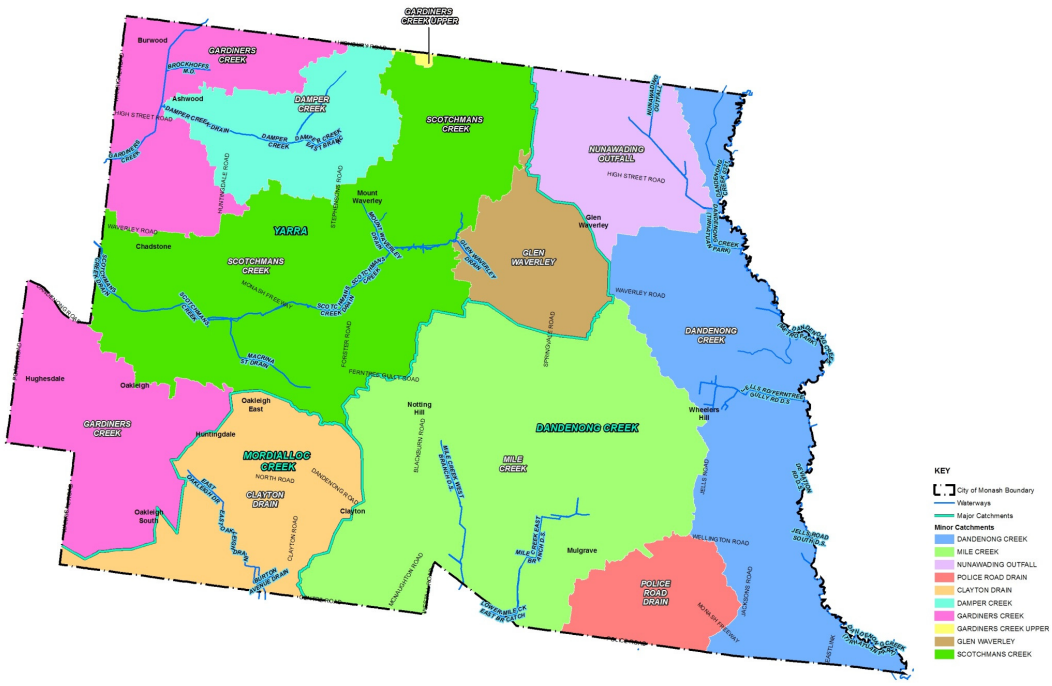

Figure D1: Sub-catchments used in MUSIC modelling

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Pollutant load analysis

A MUSIC model was developed for nine sub-catchments defined for the City of Monash. The model used 6minute rainfall data from the Scoresby rainfall gauge, collected between 1964 and 1973. Figure D2 shows the rainfall bands across the City of Monash. There are two distinct bands that bisect the municipality. The left hand band has an average annual rainfall between 710 and 800 mm. The right hand band has an average annual rainfall between 810 mm and 900 mm. The rainfall data collected at Scoresby was chosen because it approximately equalled the median of these two bands (the average annual rainfall for this period is 828 mm/yr), and the 10 years of

data, which is the ideal minimum for MUSIC modelling, was considered good quality.

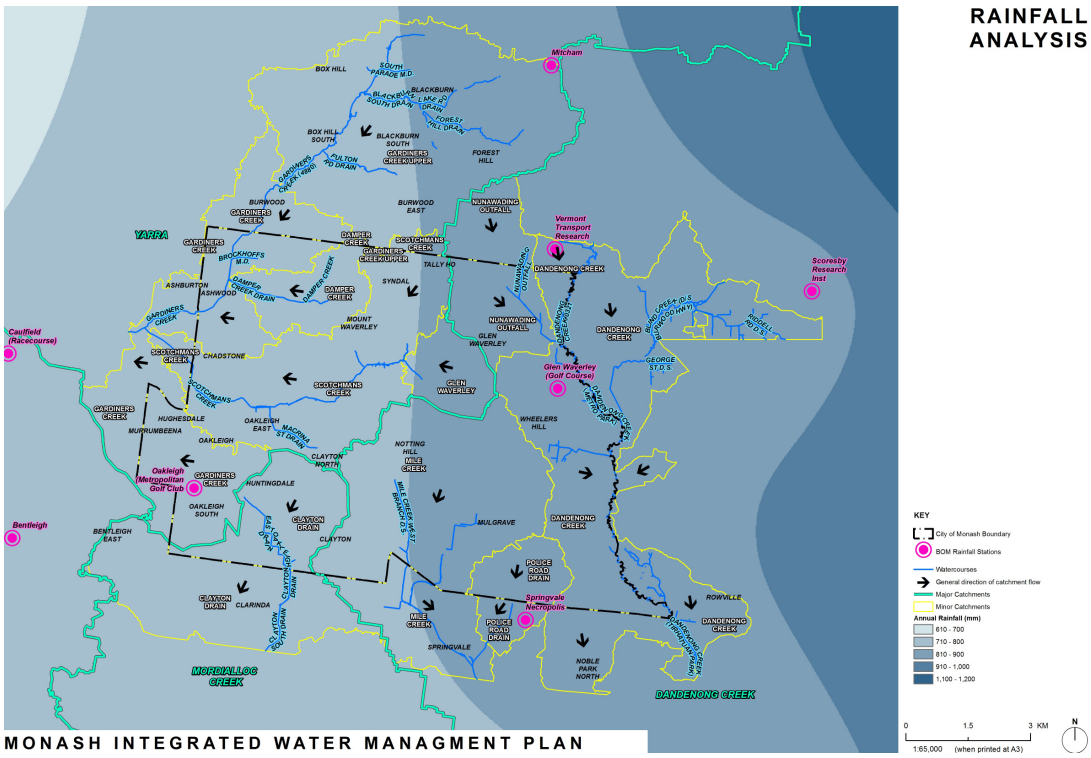

Figure D1: Rainfall bands bisecting the City of Monash

The MUSIC modelling considered four main surface types and 7 land uses. The surface types are defined as:

- Road: Roadways
- Roof: Building roof area
- Pervious: Soil and vegetation areas that allow infiltration
- General impervious: Other impervious surfaces such as car parks and pavements

The land use types were a consolidated list, based on GIS data supplied by Council. The surface types are residential, road, commercial, industrial, public open space, golf course and public use. The area of each land use within each sub-catchment is summarised in Table D1.

Table D1: Land use area within each sub-catchment

Sub-catchment	Area (ha)						
	Commercial	Golf course	Industrial	Public open space	Public Use	Residential	Road
CLAYTON DRAIN	15	28	82	17	64	403	43
DAMPER CREEK	7	0	0	33	37	374	16
DANDENONG CREEK	18	0	0	350	43	752	54
GARDINERS CREEK	42	90	58	56	45	849	36
GLEN WAVERLEY	19	0	17	25	20	266	11
MILE CREEK	370	0	151	50	135	929	177
NUNAWADING OUTFALL	10	0	0	22	17	421	16
POLICE ROAD DRAIN	3	0	27	10	11	228	15
SCOTCHMANS CREEK	147	0	26	102	70	1,228	122

The stormwater generation and pollutant loads calculated by the MUSIC model is influenced by the soil and pollutant load characteristics stipulated for each source node (e.g. Residential, Industrial and the other categories described above). Soil parameters affect the volume of rainfall infiltrated verse run-off. Based on our experience, 10% of baseflow and stormflow was assumed to infiltrate to groundwater. Data on the pollutant load characteristics of different source nodes was sourced from research conducted by Fletcher (2007)[20] and are summarised in Table D2.

[20] Fletcher, T (2007), 'Background study for the revision of Melbourne Water's MUSIC guidelines

Table D2: MUSIC model input parameters for pollutant loads.

Pollutant	Flow	Measure	Urban and industrial (General, Pervious, Road) (U)	Road (Road)	Roof (all land uses) (Roof)
TSS	Base flow	Mean	0.96	0.96	0.96
		Standard deviation	0.401	0.401	0.401
	Stormflow	Mean	1.882	2.431	1.301
		Standard deviation	0.333	0.333	0.333
TP	Base flow	Mean	-0.731	-0.731	-0.731
		Standard deviation	0.36	0.36	0.36
	Stormflow	Mean	-0.68	-0.301	-0.886
		Standard deviation	0.242	0.242	0.242
TN	Base flow	Mean	0.346	0.346	0.346
		Standard deviation	0.309	0.309	0.309
	Stormflow	Mean	0.224	0.342	0.301
		Standard deviation	0.205	0.205	0.225

Appendix E

Non-structural initiatives

Table E1: Regulation and policy potentially supporting integrated water management

Tool	Link to integrated water management themes				
	Social health A healthy community, where physical and mental well-being is valued, protected and enhanced	Ecological health A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health	Connected communities A community that takes responsibility for water through education, empowerment and collaboration	Shared prosperity Our water systems are equitable and support economic viability and resilience	Water sensitive infrastructure Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment
Municipal Strategic Statement		Commits Council to reduce the environmental impact of urban development on water quality. Highlights Council's stewardship in environmental protection and their aim to enhance biodiversity along road and waterway corridors.			
Monash 2021	The vision supports a green, naturally-rich city with high quality recreational facilities, where people have a positive attitude to recycling and being waterwise.	The vision recognises the importance of the municipality's 125 parks and reserves that support indigenous vegetation and form important corridors that provide havens and habitat for native wildlife.	Council works with its community to ensure the city develops and grows is a planned and sustainable way.	Vision supports actions for a 'thriving community'	The vision supports a green, naturally rich city where environmental sustainability is part of business as usual
Council Plan 2013-2018	Two key directions relate to integrated water management and social health: - to ensure the city has inviting places and spaces, for example, through enhanced parks and pathways, and active, vibrant activity centres - achieving a healthy, active Monash community	The key direction, 'taking action for our future' directly supports integrated water management (e.g. protection of natural and built environment)	*The key direction, 'fostering connected communities' does not specifically relate to water, but could easily be expanded to encourage community engagement through water-related issues (e.g. friends of groups, festivals)*	*The key direction, 'taking action for our future' identifies the importance of a resilient community. Although water is not mentioned directly, other plans such as the Economic Development Strategy have made the link between environmental stewardship and economic sustainability.*	The key direction, 'taking action for our future' directly supports integrated water management (e.g. innovation through water sensitive infrastructure)
Public Health and Wellbeing Plan (2010-2013) *(an update of this plan will be available in October 2013)*	Ischaemic Heart Disease continues to be the leading condition across both Victoria and Monash. An inactive lifestyle is a significant factor in the prevalence of these diseases. Environmental sustainability (including water conservation / demand management) identified as a key 'health and wellbeing' achievement of the municipality		Communication critical to encouraging participation and building awareness. E.g. The ACT!VE branding. *This branding could be extended to include water, e.g. water use, demand management strategies, link between use and other goals such as waterway health*	Recreational activity helps citizens feel connected, and it is an Australian ideal that sport is accessible to all. *The price of water and hence its management will affect community access to these facilities*	

Tool	Link to integrated water management themes				
	Social health A healthy community, where physical and mental well-being is valued, protected and enhanced	Ecological health A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health	Connected communities A community that takes responsibility for water through education, empowerment and collaboration	Shared prosperity Our water systems are equitable and support economic viability and resilience	Water sensitive infrastructure Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment
Environmental Sustainability Road Map (2011-2015)	Primary focus of the document is for better environmental management, which will indirectly affect social health. *The document doesn't state what these connections are. Articulating these connections will help clearly define cross-overs between departments and opportunities for collaboration.*	Actions selected to compliment Council's strategic direction. Provides a water conservation target *The document does not state what Council's strategic direction is. It needs to be clear how the strategy links to higher level Council documents and key directions (such as Monash 2021, Council Plan 2013-2018, and the MSS)* *Only a water conservation target is given (this target should include a footnote that it supersedes that of the Water Use Management Strategy). No water quality target is given, despite waterway health noted as a key issue.*		*Water can affect the prosperity of a municipality: e.g. through the cost of living and cost of doing business. This document should highlight this link.*	Document encourages the uptake of Water sensitive urban design in parks, reserves and new facilities. *. The road map does not clearly define what the implementation of water sensitive urban design is aiming to achieve. Being water sensitive entails many objectives, such as the themes and targets established for this strategy. It is important water sensitive urban design features are designed and implemented in a strategic manner and that it is clear what objective/s they are trying to achieve.*
Water Use Management Strategy (2008)		Identifies priority water quality issues (sediment and erosion control, herbicide and pesticide and fertiliser use, gross litter control, and nutrients)			Provides WSUD guidelines for Council operations. Sets a water conservation target of 'reduce corporate water demand by 15% below 2002/2003 usage by 2015'.
Stormwater Management Plan (2002)		Highlights the need to manage stormwater to protect waterway health. Five key priority management areas are identified: road and transport runoff; residential land use (Dandenong Creek catchment); commercial land use (Scotchmans Creek catchment); industrial land use (Monash University); and residential land use (Gardiners and Scotchmans Creek catchments)	Action plan states that educational material (pamphlets and signs), community / landcare groups and stakholder groups (e.g. EPA/Council/Business representatives) are important in changing behaviour		Gross pollutant traps and artificial wetlands are the main structural initiatives promoted. *The stormwater management plan may need to be updated to reflect other water sensitive infrastructure*
Flood Management Plan 2012					The plan identifies Retarding Basins as one mechanism of managing flood issues. *Water sensitive urban design can be incorporated into retarding basins and thus provide an opportunity for harvesting stormwater as an alternative water supply for Council.*
Asset Management Plan: drainage and retarding basins (2004) *Is there an updated version of this?*		Recommends the adoption of assets that protect the health of downstream waterways		Recommends the implementation of stormwater drainage and retarding basins in an equitable, safe and economic efficient manner	*Asset budget does not include WSUD assets*

Tool	Link to integrated water management themes				
	Social health A healthy community, where physical and mental well-being is valued, protected and enhanced	Ecological health A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health	Connected communities A community that takes responsibility for water through education, empowerment and collaboration	Shared prosperity Our water systems are equitable and support economic viability and resilience	Water sensitive infrastructure Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment
Asset management plan: sportsfield playing surfaces & spectator facilities (2007) *Not available at the time of the assessment*					
Monash Local Planning Policy	A strategy of Clause 21.06 is to enhance the structure and function of activity centres by enhancing streetscapes and creating attractive environments that enhance community use of activity centres *Maybe Clause (as part of MSS review needs to make specific mention of water sensitive design (environmentally responsive building design is mentioned)* Management and protection and natural open space, particularly along waterways (Clause 21.10). An objective of the clause is to enhance all open spaces and parklands as significant community assets for both present and future generations of Victorians.	The vision in Clause 21.03 identifies the importance of the 'Garden City' character and the need to maintain and enhance the established canopy treed environment throughout the municipality. The vision covers all land types, including landscape areas in residential, industrial and commercial zones, landscape areas along roads and railway lines, reserves and other open space, and other significant landscapes (as identified in the Vegetation Protection Overlay). (Clause 21.03) The application of the *Land Subject to Inundation Overlay and Special Building Overlay* recognises the environmental service of flooding		Safety, access and appearance are important elements of activity centres, which are the main areas of commercial and residential growth in the municipality. (Clasue 21.06).	
Draft Walking and Cycling Strategy (2013)	Strategy considers opportunities for pathways along waterways and in parks. This promotes active lifestyles		*Educational signs should be included as part of the path network being implemented. The information should inform the community of integrated water management initiatives being undertaken in the area*		
Monash City Council Active Reserve Strategy (no date)	States there is a growing need for Council to ensure all reserves are harvesting water from existing pavilions for grey water use. Provides a summary of the existing and future needs and requirements of clubs, sporting associations and community at sporting facilities			*Council rely predominately on potable water for irrigation. With projected price increases, this will make servicing irrigation needs more expensive, which may affect the ability of Council to financially meet this demand, or the cost to community (i.e. through access fees, poor condition grounds, increased rates).*	Allocates a budget of $40K per annum for adoption of rainwater tanks at existing reserves for grey-water use (assume this means toilets) *Stormwater harvesting options not considered (main focus is on synthetic surfaces)*
Litter Prevention Strategy (2009)	Cigarette butts, dumped rubbish, and street litter identified as the most significant sources of litter affecting amenity of public spaces. Main structural initiatives are litter traps.	Cigarette butts, dumped rubbish, and street litter identified as the most significant sources of litter affecting water way health. Main structural initiatives are litter traps.	Strategy documents education and enforcement measures to manage litter loads.		

Tool	Link to integrated water management themes				
	Social health A healthy community, where physical and mental well-being is valued, protected and enhanced	Ecological health A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health	Connected communities A community that takes responsibility for water through education, empowerment and collaboration	Shared prosperity Our water systems are equitable and support economic viability and resilience	Water sensitive infrastructure Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment
Action Plan for Young People (2009-2012) *Is there an update scheduled?*	Sport and the use of leisure facilities identified as important to the young person population of Monash		Highlights the importance of including youth in decision making to ensure they feel connected and responsive. *The Young Person's Reference Group could be used to discuss water issues and understand the differenr role of the municipality's use in water management (e.g. 'water art' in the activity centres, connection with friends of groups)*		
Monash Baby Boomer Study (2010-2014)	Wellbeing and social connection are two of five major themes important to baby boomers in the City of Monash Physical activities are important to baby boomers (in particular, golf, walking and cycling). Council's ability to provide these services, particularly golf, will be affected by its water management strategy. Meeting friends at shopping centres / activity centres is also part ofthe mental well-being of baby boomers. This relies on activity centres being vibrant and attractive.		Participation and engagement are important to baby boomers, with a high level of volunteering (1 - 9 hours per week for the majority of participants interviewed). *This high enthusiasm (coupled with availability) should be harnessed by providing opportunities for baby boomers to facilitate in delivering the vision of the integrated water management plan.*	The plan identifies a community grants program for people over 50 years old.	

Tool	Link to integrated water management themes				
	Social health A healthy community, where physical and mental well-being is valued, protected and enhanced	Ecological health A healthy and beautiful green landscape that is promoted through protection and promotion of biodiversity and best practice management of waterway health	Connected communities A community that takes responsibility for water through education, empowerment and collaboration	Shared prosperity Our water systems are equitable and support economic viability and resilience	Water sensitive infrastructure Our water systems use resources efficiently to maximise the benefits to the community, the economy and the environment
Monash Economic Development Strategy	Identifies the importance of streetscapes in the vibrancy of activity centres and the consequent support of trade.		*The policy encourages the establishment of active trader associations in activity centres. The role of these associations could be extended to include water sensitive thinking.*	Attraction and investment strategies' is one of four key economic strategic areas. Economic sustainability is also noted as significant, and particular mention is made of water. An action identified under Sustainability is to partner with Yarra Valley Water and South East Water to assist businesses with waste reduction projects. *This action could be linked to the aesthetic of the precinct (e.g. social health), and environmental stewardship (particularly for international companies which may need to report on corporate environmental sustainability)*	
Industrial Land Use Strategy *(awaiting)*					
Public Arts Policy		*Waterway health benefits of integrated water management could be used as a factor in identifying potential priority sites in parks and open spaces*			*Water sensitive infrastructure could be used as a factor in identifying potential priority sites in parks and open spaces*
Public Open Space Review (in progress)					
Indigenous Reserve Corridors Conservation & Management Plan (2000)		Identifies the need to manage land use practices and stormwater to protect endemic fauna and flora of the municipality			Wetlands are suggested as a mechanism for managing stormwater quality issues
Stormwater reuse feasibility study					Stormwater reuse feasibility study
Critical Drains Program *(awaiting)*			? Does this program provide a justification for education of commercial businesses regarding behaviour and stormwater management?		