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MOVING TOWARDS SUSTAINABLE STORMWATER MANAGEMENT IN THE NEW GROWTH AREAS OF MELBOURNE – ACHIEVING RESULTS BY PARTNERSHIPS, POLICIES AND PERSUASION

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Abstract

Melbourne Water is a statutory corporation fully owned by the State Government of Victoria, and is a water resources manager, providing water, sewerage and recycled water services to retail water businesses and waterways and drainage services to the greater Melbourne community. It is a significant business, managing approximately $8 billion in water supply, sewerage and drainage assets. Its drainage and waterway assets include more than 8,400 kilometres of waterways, 123 wetlands and 77 urban lakes.

The Victorian Government, in its Our Water Our Future action plan, designated Melbourne Water as caretaker of river health with responsibility for waterways, drainage and floodplain management. This requires Melbourne Water to demonstrate leadership in stormwater management, protecting the health of the region's rivers and providing an integrated overview of all activities impacting on river health. A key task for Melbourne Water is to reduce the impacts of stormwater runoff on the bays and waterways around Melbourne, especially on Port Phillip Bay.

Melbourne Water's Development Planning team is responsible for managing the drainage, floodplain, waterway health and stormwater quality issues in new growth areas around Melbourne. This team works with key stakeholders – including developers, local government, the Growth Areas Authority, retail water authorities and the community to plan and build the required assets and infrastructure.

As part of the move towards more integrated water management, the past few years has seen a greater focus on what additional water and waterway benefits can be provided in these new growth areas – including stormwater harvesting opportunities and infrastructure for the use of recycled water from treatment plants, as well as greater use of biofilters, wetlands and river health rehabilitation programs.

The Paper looks at Melbourne Water's work in the new growth areas under the broad headings of partnerships, policies and persuasion.

The partnerships component discusses the work being done with a broad range of industry, government and community partners to plan and deliver a range of integrated and innovative stormwater solutions. Examples include the Glen Iris wetlands project – working with the Stockland developers and the City of Boroondara – and the Bayview Rise Estate – working with Villawood developers. Other partnership projects with local government and with Melbourne's retail water authorities are also examined and discussed.

The policies part of the Paper looks at what stormwater outcomes are being achieved by the current legislation and policy tools including the Integrated Water sections in the Victorian Planning Provisions.

The persuasion section of the Paper examines the outcomes being achieved by Melbourne Water in encouraging and assisting a range of stakeholders to develop sustainable stormwater solutions. Examples include working with "Clearwater" on developing training and education packages to encourage integrated stormwater outcomes, and being involved in university research programs in relation to stormwater to further encourage innovation.

The Paper also discusses Melbourne Water's significant role in the major new infrastructure projects that are being built to service these new growth areas, including freeways, arterial roads, railway line upgrades and water supply delivery pipelines, especially where such infrastructure can impact upon a Melbourne Water natural or built asset. The application of Water Sensitive Road Design (WSRD) is being achieved in many of these infrastructure projects. Major projects discussed in the Paper include the Eastlink road project, the Monash freeway upgrade, the Deer Park bypass and the Western Highway realignment at Melton.

The work being done in these three key areas of partnerships, policies and persuasion is presented in context of the broader challenge for Melbourne Water to work towards creating a "water smart city" for Melbourne.

1.0 Background

Melbourne Water is a statutory corporation fully owned by the State Government of Victoria, Australia, and is a water resources manager, providing water, sewerage and recycled water services to retail water businesses and waterways and drainage services to the greater Melbourne community. It is a significant business, managing approximately $8 billion in water supply, sewerage and drainage assets. Its drainage and waterway assets include more than 8,400 kilometres of waterways, 123 wetlands and 77 urban lakes (Corbett, 2010a).

In Melbourne, water and wastewater services are provided by a single wholesaler, Melbourne Water, and also by three metropolitan retail water businesses, City West Water, Yarra Valley Water and South East Water. Melbourne Water also provides waterways and drainage management services in the Port Phillip and Western Port region. The 38 local councils in Melbourne Water's area provide for management of the local drainage network including drains and waterways (generally catchments less than 60 hectares) (Halcrow Pacific, 2009).

The Victorian Government, in its *Our Water Our Future* action plan (Government of Victoria, 2004), designated Melbourne Water as caretaker of river health with responsibility for waterways, drainage and floodplain management, across the whole of the Port Phillip and Western Port region. This requires Melbourne Water to demonstrate leadership in stormwater management, protecting the health of the region's rivers and providing an integrated overview of all activities impacting on river health. A key task for Melbourne Water is to reduce the impacts of stormwater runoff on the bays and waterways around Melbourne, particularly on Port Phillip Bay.

Melbourne Water serves an area of around 12,000 square kilometres. This includes the entire suburban area of Melbourne, with a population of four million people, (Colebatch and Lahey 2009), is Australia's second most populous city, and has been named the world's "third most liveable city" for the last few years (Colebatch 2010).

Like many cities around the world, Melbourne is currently having to deal with the issues of population growth and climate change. In July 2010, the Victorian Parliament ratified Planning Amendment VC68, paving the way for the further expansion of Melbourne's urban growth boundary. This announcement (Department of Planning and Community Development 2010) that Melbourne's Growth Boundary will expand to accommodate a further estimated 284,000 dwellings, which (together with the establishment of a further 316,000 dwellings in established areas of Melbourne) will increase the city's population to over five million before 2030[1], has a number of social, economic and environmental implications for Melbourne. Amongst

[1] The recent announcement on the expansion of the Urban Growth Boundary follows on from the release by the Victorian Government in December 2008 of two integrated policy statements that provide a long term

these environmental considerations is the impact of urbanisation on the health of Melbourne's waterways. A key issue for Melbourne Water is to ensure that best practice stormwater management is utilised to minimise the impacts of new development on its waterways.

2.0 Stormwater as a problem

Stormwater management is a key issue to be addressed in the move towards a sustainable water future. Mitigating the impact of the additional stormwater generated in the new growth areas of Melbourne is a key challenge for Melbourne Water, especially in relation to its role as the waterways manager for the greater Melbourne area.

Stormwater is a problem and a challenge to manage because it is polluted with a cocktail of sediments and chemicals; it flows at the wrong times (big, frequent flushes every time it rains, and not enough flow when it is dry); and perhaps the most difficult problem is that there is too much of it (University of Melbourne 2009). The problems caused to freshwater ecosystems by stormwater runoff in urban environments are a result of stormwater management policies that emphasize expedient removal of stormwater from communities for the protection of human health and property, but place a low priority on ecosystem preservation (Roy *et al* 2008). In relation to Melbourne Water's area, stormwater is discharged into the environment at more than 1,000 locations across Melbourne, of which nearly 400 discharge directly into Port Phillip Bay; and stormwater is the greatest source of pollutants to the Bay (Morrison, 2008, Ewert *et al* 2009).

Similarly the Victorian Commissioner for Environmental Sustainability has commented that *"urban stormwater is the most significant source of pollution to Melbourne's rivers, creeks and wetlands. Stormwater contains elevated levels of sediment, nitrogen and phosphorus, as well as other contaminants such as metals, hydrocarbons and pathogens. Rapid, direct transport of these pollutants by the drainage system amplifies the pressure placed on receiving waters"* (McPhail, 2008).

3.0 Stormwater management in relation to Water Sensitive Urban Design, Integrated Water Management and Water Sensitive Cities

Melbourne Water's vision is *"working together to ensure a sustainable water future"*[2]. A key part of achieving this vision will be implementing more sustainable forms of urban water management and integrating the urban water management cycle. This is being implemented at a time when there is a growing move worldwide towards more appropriate and sustainable water management. Achieving sustainable stormwater management is a key part of this transition towards a sustainable water future and, in the case of Melbourne,

plan for managing Melbourne's growth: "Melbourne 2030: a planning update – Melbourne @ 5 Million" (accessible at http://www.dse.vic.gov.au/
and "The Victorian Transport Plan" (accessible at http://www.transport.vic.gov.au/web23/home.nsf
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[2] Melbourne Water's full vision, as stated in its Strategic Framework (2009) is "We will ensure a 'sustainable water future' in which our water supply is secure and high quality, our waterways and bays are healthy, biodiversity is improved and stormwater and treated wastewater is recycled or beneficially used. Service delivery is based on efficient resource use and by 2018 we will achieve zero net greenhouse gas emissions and meet all our energy needs from renewable sources. We will achieve our vision through continuing to adopt innovative approaches to asset and resource management and working collaboratively with all our stakeholders." Framework document available at http://www.melbournewater.com.au

to a water sensitive city. As Taylor (2008) has commented, numerous terms have been coined to describe the application of this new paradigm of sustainable water management including water sensitive urban design (WSUD) and integrated urban water management.

The development of the WSUD approach has been well described elsewhere, eg Wong (2004) The key principles of WSUD adopted by Melbourne Water are those in the "Urban Stormwater - Best Practice Environmental Management Guidelines" and are *"to protect natural systems, integrate stormwater treatment into the landscape, protect water quality, reduce runoff and peak flows, and add value while minimising development costs"* (Victorian Stormwater Committee 1999).

The progression towards achieving integrated water management, including WSUD, is now being considered as part of the overall move towards water sensitive cities. The concept of the water sensitive city has evolved from the principles of WSUD. It is a goal of the Australian Government's National Water Initiative (Council of Australian Governments 2004).

As the Monash University Centre for Water Sensitive Cities (2010) has noted, *"through the practice of Water Sensitive Urban Design, the planning and design of a "Water Sensitive City" responds to issues of water conservation and water security, risk of flooding, degradation of urban waterways and rising temperatures, in a way that enhances the livability of our cities and towns"*.

As part of the move towards a water sensitive city, Melbourne Water has attempted to implement WSUD through a range of programs and initiatives, and this Paper looks at the approaches being taken by Melbourne Water in the areas of Partnerships, Policies and Persuasion.

4.0 Planning for development in the new growth areas of Melbourne

In Victoria, the Growth Areas Authority is the State Government organisation that oversees planning and infrastructure coordination in Melbourne's five designated growth areas, being Casey-Cardinia, Hume, Melton-Caroline Springs, Whittlesea and Wyndham.

The Growth Areas Authority prepares master plans for whole communities (usually between 10,000 and 30,000 people) known as Precinct Structure Plans, and advises the Minister for Planning on their approval. Precinct Structure Plans are created to set the blueprint for development and investment in infrastructure that will occur over many years; they guide development and the need for integrated planning at an early stage in the process. Melbourne Water works with the Growth Areas Authority to ensure that water management, especially drainage, stormwater, flooding and waterway issues, are addressed in Precinct Structure Plans.

Melbourne Water's Development Planning team is responsible for managing the drainage, floodplain, waterway health and stormwater quality issues in new growth areas around Melbourne. This team works with key stakeholders – including developers, local government, the Growth Areas Authority, retail water authorities and the community to plan and build the required assets and infrastructure. The Development Planning team works as part of Melbourne Water's Waterways Group, one of the eight business groups in the Melbourne Water Corporation.

Operating under the *Water Act 1989 (Vic.)*, the Development Planning team in Melbourne Water provides, manages and operates stormwater infrastructure connecting into its waterways. It also develops and implements plans and actions to bring new drainage systems into operation, and to improve stormwater quality in drainage systems.

Melbourne Water develops and implements plans known as "Development Services Schemes" for future urban development areas which aim to protect the natural environment and provide a safe level of flood protection for new urban communities. Currently there are around 140 such Schemes in place around Melbourne. The primary focus is to prepare cost effective plans for servicing urban growth, taking into account a number of elements including orderly planning and equitable cost sharing.

Traditionally, Development Services Schemes have focussed on ensuring that the right infrastructure will be in pace to provide drainage, flood protection, and healthy waterways. Whilst these three issues are still vitally important, it is also becoming increasingly important for Development Services Schemes to also make provision for aspects of integrated water management, especially stormwater harvesting.

Accordingly, as part of the move towards more integrated water management, the past few years has seen a greater focus on what additional water and waterway benefits can be provided in these new growth areas – including stormwater harvesting opportunities and infrastructure for the use of recycled water from treatment plants, as well as greater use of biofilters, wetlands and river health rehabilitation programs. Examples of these initiatives are given in the Partnerships section in this paper.

5.0 Partnerships

The partnerships component discusses the work being done with a broad range of water industry, development industry, government and community partners to plan and deliver a range of integrated and innovative stormwater solutions.

A key part of the partnerships approach has been the role of demonstration projects. Melbourne Water believes that demonstration projects play an important role in helping the water industry and its partners "see how new things can be done". As Farrelly *et al* (2009) have noted, *"practitioners consider demonstration projects as an important learning tool for the urban water sector. Such projects build sectoral confidence in the feasibility and performance of technological innovations and help reveal how such innovations challenge and/or fit within the current rules and regulations, often termed the 'invisible processes'."*

5.1 Lynbrook

A key initial demonstration project was the Lynbrook development approximately 35 kilometres south east of Melbourne in the city's then major growth corridor, constructed between 1999 and 2000. The estate is an 800 lot development, of 55 hectares, that incorporated WSUD principles adopted at the streetscape and sub-catchment scale. The Urban and Regional Land Corporation (URLC) (now VicUrban), as the estate developer, was an enthusiastic party in the design and implementation of this project. Several early stages of the Estate were designed with a conventional stormwater system. Lynbrook was subsequently chosen by the URLC for a WSUD trial after an approach by Melbourne Water to set up a demonstration project. Three stages of the development were initially approved by the City of Casey as part of the demonstration project.[3] Lynbrook

[3] Brown and Clarke (2007) offer a relevant comment on the approvals process for this project: "It is worth noting that the final innovative design plans were rejected by the local government authority which viewed the stormwater management strategy as too risky – it was perceived not to conform to the Council drainage standard. Melbourne Water then negotiated with Council and eventually "got Council over the line by underwriting the hydraulic design", and by guaranteeing to replace the WSUD infrastructure with a conventional approach (for example, kerbs and channels) if it did not perform as designed."

Estate was the first residential development in Melbourne to fully integrate some principles of WSUD (Brown and Clarke 2007).[4]

The costs of implementing a WSUD stormwater management scheme at Lynbrook were compared with a conventionally designed stormwater drainage system. The comparison shows a cost increase of 5% in the drainage component of the development. As the drainage works component represents only 10% of the overall land development cost, the incorporation of WSUD into the stormwater management system only increased the total development budget by approximately 0.5%.

As Keath and Brown (2008) have commented, one of the key features of the Lynbrook project was the risk management: *"a developer agreed to provide land and one of the government water corporations underwrote the risk for the implementation of a series of innovative stormwater quality treatment technologies promising to rebuild with traditional infrastructure if the project failed. The project was also underpinned by an integrated and adaptive learning model whereby the project was extensively monitored and scientifically assessed by a local university which considered the multi-faceted spheres of project implementation including technical performance, economic effects, policy tools and the social context, feeding research findings into the project development process on an ongoing basis. This provided important knowledge for future co-management initiatives with the public. The project went on to become an internationally recognised example of water sensitive urban design."*

In the development of WSUD in Victoria, Lynbrook played a very important role as a key demonstration project. As Farrelly and Davis (2009) concluded: *"Overall, Lynbrook Estate successfully demonstrates the application of an innovative, stormwater treatment train in Melbourne. Despite encountering a number of challenges, the Lynbrook Estate project has played an essential role in the transition towards the institutionalisation of WSUD elements in some areas of policy and legislation in Victoria"*.

5.2 Glen Iris wetlands project

The $3.6 million Glen Iris Wetlands project, completed in 2009, is a partnership project between Melbourne Water, the City of Boroondara, and Stockland (developers of the adjacent residential and retail development, Tooronga Village). Melbourne Water was the largest financial contributor to the project, funding over $2 million of the project's cost.

Melbourne Water saw this as a very important project as opportunities to improve the quality of stormwater in established urban areas in Melbourne are very limited.

The wetlands are located on the site of the former Glen Iris and Tooronga Bowls Club site, and are fed by stormwater from Melbourne Water's Rix Street Drain, which drains an urban catchment area of about 90 hectares. The wetlands are located beside the Gardiners Creek shared path, which is one of Melbourne's busiest bicycle routes and contribute to the social and environmental amenity of the area.

[4] At Lynbrook, roof and road runoff from the site is conveyed through a system of roadside swales and median strip bioretention systems. Following treatment, stormwater is discharged to a constructed wetland system, which in turn discharges to an ornamental lake. The monitoring results showed that, compared with a conventional design, nitrogen loads have been reduced by 60 per cent, phosphorus 80 per cent and suspended solids 90 per cent.

Each year, it is anticipated that the Glen Iris Wetlands (including the sediment pond) will remove 18.5 tonnes of sediment, 150 kg of nitrogen and 8 tonnes of gross pollutants. The wetlands are also a source of water for irrigating the local reserve adjacent to the wetlands. Water is diverted from the wetland into an underground storage facility that holds 350,000 litres. The stormwater is treated to Class A standard before use.

Melbourne Water believes that the example of the Glen Iris wetlands shows how successful stormwater quality improvement projects can be retrofitted via a partnership approach to achieve community outcomes.

5.3 The VicUrban development at Officer

VicUrban, the Victorian Government's land development agency, is developing a 340 hectare site at Officer, south east of Melbourne, in the Shire of Cardinia. This will provide homes for around 15,000 people and will contain a number of innovative, sustainable aspects especially in relation to water and energy. This development is part of the Cities as Water Supply Catchments program at Monash University. It is also one of 16 projects selected world-wide by the Clinton Climate Initiative Program[5], due to its focus on clean energy technologies and other innovations.

In terms of Melbourne Water's water sensitive urban design program, it is proposed to use part of the development (the area covered in the Gum Scrub Creek catchment) as a pilot for implementation of Directly Connected Impervious targets. This aims to control the volume and frequency of stormwater runoff entering the waterway. To achieve these targets, developers will need to adopt a range of stormwater initiatives. These are likely to be implemented at a range of spatial scales, including the household level, the subdivision level and the estate level. Melbourne Water has currently engaged a consultant to prepare a Development Services Scheme for the Gum Scrub Creek site to incorporate the above initiatives.

5.4 The Werribee Employment Precinct

The Werribee Employment Precinct is a 925 hectare area of undeveloped Government owned land, located at Werribee some 25 kilometres south west of the Melbourne CBD. It is currently being planned for development as Australia's first eco-city that will achieve new standards in transport, energy, water and resources efficiency, and accelerate the adoption of higher standards throughout Victoria. The overall integrated water cycle management for the site is planned to include stormwater and rainwater harvesting, aquifer storage and recovery, water efficient appliances and gardens and wastewater reuse from a treatment plant located on the site.

This project is being coordinated by the Victorian Department of Planning and Community Development. Melbourne Water is currently preparing a Development Services Scheme for the site which will set the framework for the inclusion of the above mentioned innovative water management features.

5.5 The Merrifield development at Kalkallo

[5] The Clinton Climate Initiative program, working as part of the William J. Clinton Foundation, supports the development of large-scale urban projects that demonstrate how cities can grow in ways that are "climate positive." Climate Positive real estate developments will strive to reduce the amount of on-site CO2 emissions to below zero. More information at http://www.clintonfoundation.org/what-we-do/clinton-climate-initiative/

The Merrifield development at Kalkallo is situated 50 kilometres to the north of Melbourne CBD, and covers approximately 900 hectares in a key future growth region. The site is proposed to be developed for employment, mixed use and residential land uses.

An integrated approach to water supply, drainage and sewerage services is proposed by undertaking a strategy that includes stormwater harvesting, wastewater treatment and recycling options for the site. This ongoing project may ultimately provide ground breaking integrated applications in Victoria for fully integrated water management in a Greenfield Development.

Supported by the land owners (the Merrifield Corporation), led by Yarra Valley Water, and supported by Melbourne Water and the City of Hume, the project will involve capturing and treating stormwater from a 160 hectare catchment area within commercial land. In the future, it is hoped that the treated water may supplement the drinking water supply across the Merrifield development and Melbourne's growing northern corridor. The project received $9.6 million funding under the first round of the Federal Government's "Water for the Future - National Urban Water and Desalination Fund" in November 2009.

Stormwater will be treated to drinking water standard and, in the project's first stage, used to supplement the development's recycled water supply. Eventually, it is proposed that this water could supplement the potable water supply, when rigorous monitoring and data collection demonstrates that it is safe to do so, and if government policy supports such an initiative.

The stormwater will be collected via traditional stormwater drains. It will then be treated in a series of architecturally-designed wetlands along the Hume Highway frontage of Merrifield, including settling ponds and wetlands and then stored in a large dam. The wetlands will incorporate best-practice sustainability design principles which will manage the quality and quantity of stormwater collected from the area. From there the water will pass through a state-of-the-art treatment plant which will produce a drinking water quality end product.

The Kalkallo Stormwater Harvesting and Reuse Project is set to be a project of international significance, showcasing how urban water infrastructure can be designed differently to deliver a more resilient water solution. The project will demonstrate how a new development can be built to:

- reduce the net volume of imported water by up to 90 per cent;
- decrease the urban runoff into the local streams by 45 per cent above existing requirements;
- decrease the nutrient discharged into the local streams by 25 per cent above existing best practice;
- recover the upfront capital and ongoing operational costs within a 25 year period.

The surrounding landscape design at Merrifield will provide a community focal point to visually communicate the highlights and benefits of the wetlands and natural systems for the treatment of urban stormwater.

The implementation of this project follows on from the development in 2008 of the "Kalkallo Integrated Water Management Plan", prepared by Yarra Valley Water, Melbourne Water and the City of Hume; this Plan highlighted the need for the development of an alternative water supply program for the area due to the economic and environmental costs of traditional water supply being provided to this area.[6]

[6] These issues included that potable water would need to be pumped a total of three times from the nearest reservoir (Greenvale) to the Kalkallo site; this would involve pumping over a 20 kilometre distance with a static lift of 176 metres; that the existing water supply network currently terminated five kilometres short of Kalkallo and would need a major upgrade to service the development; that there would be a 10 fold increase in stormwater flows to the local waterways from a conventional treatment of stormwater on the site, and that

Yarra Valley Water has commented that some of the lessons learned from the project's planning include that stormwater harvesting project planning needs to start at the development master-planning stage otherwise it is too late; that early engagement with the Developer is required to validate methodology and level of commitment, and that early engagement of other key stakeholders is also a necessity (Elliot, 2010).

5.6 The Eastlink project

Melbourne Water also has a significant role in the major new infrastructure projects that are being built to service these new growth areas, including freeways, arterial roads, railway line upgrades and water supply delivery pipelines, especially where such infrastructure can impact upon a Melbourne Water natural or built asset.

The application of Water Sensitive Road Design (WSRD) is being achieved in many of these infrastructure projects. A recent example is the Eastlink project in Melbourne's East. Completed in 2008, Eastlink is a $2.5 billion road construction project that built 45 km of new roadway in Melbourne's eastern suburbs and included 1.6 km of tunnels under the Mullum Mullum valley, involved the construction of 103 structures including 88 bridges, required seven million cubic metres of earthworks, the laying of more than one million tonnes of asphalt, and the planting of 3.5 million plants.

For Melbourne Water, some of the key issues were ensuring that this massive construction project did not cause siltation and pollution impacts on waterways, that the design of the infrastructure took into account the short and long term requirements of the waterways that it impacted with, and that the design produced a roadway that would minimise its ongoing impact on the waterways. In relation to the waterway crossings, and waterway realignment works, Melbourne Water was involved in the design process, especially in relation to river health and floodplain management outcomes.

In relation to minimising the ongoing impact, Eastlink is the first major road project in Australia to have all of the runoff from its one million tonnes of asphalt impervious areas filtered through water quality treatment measures before reaching a waterway. The water quality treatment measures for Eastlink included biofilters, swales and wetlands that were constructed for this project. Modelling was done to ensure that these water quality treatment measures would treat all the runoff to best practice standards. In addition, the construction of Eastlink included spill basins, each with the capacity to store up to 50,000 litres of potential pollutants eg fuel or fire fighting foam from a vehicle accident, rather than have these pollutants find their way directly into nearby waterways. These pollutants are captured and then pumped out and removed from site.

A range of other infrastructure projects are currently in the planning or construction phase around Melbourne currently, including the $760 million Peninsula Link project, where Melbourne Water is working to achieve the same water sensitive road design results as it did with Eastlink.

5.7 The value of demonstration projects

the project could provide up to one megalitre of treated storm water a day (at full development) for use by the precinct, and that the proposed stormwater treatment would give a level of treatment (in terms of reducing Nitrogen, Phosphorus and sediment impacts on waterways) far in excess of current legal requirements.

Whilst demonstration projects can play an important role in showing how new approaches to innovative stormwater management can be implemented, it is less clear to what extent demonstration projects can assist in "mainstreaming" these new approaches. The dominant risk-based management approach in the urban water sector has been identified as a key factor in limiting experimentation and innovation, for example see Farrelly *et al* (2009), who concluded that for demonstration projects to assist in the transition to new ways of water management, a number of changes are required:

- Cultural change in the water sector needs to be an explicit policy focus in promoting value in experimentation and learning using best practice social learning principles.

- Politicians, policy makers, implementers, scientists, and communities need to feel confident they are supported in their learning endeavours.

- Policy makers need to explicitly invest in demonstration projects as social learning experiments (as a policy instrument), that is reflective of the adaptive governance approach required for sustainable urban water management.

- the co-development of risk sharing mechanisms to support inter-sectoral innovations among the government, civil society and the private sector is also required.

- the urban water sector needs to include research and development (science) partners in learning projects, to assist in identifying new solutions to ensure ongoing protection of public health, supply security and flood control and mitigation, but that can also deliver on environmental protection and resource efficiencies.

Clearly the above concerns present a number of challenges to the water sector, including Melbourne Water, in relation to how ensuring that the lessons from demonstration projects are maximised and are then utilised. Mention has already been made of Melbourne Water's commitment in its Vision statement to "continuing to adopt innovative approaches to asset and resource management". Such a commitment needs to ensure that it not only addresses the above concerns, but also provides leadership on how this can be done, in order to ensure that such demonstration projects do assist in the transition to new ways of water management. For Melbourne Water, the issue of "capacity building" from demonstration projects, especially with local government, developers and consultants is also a key issue to be further addressed.

6.0 Policy initiatives

The Policies part of this Paper looks at what stormwater outcomes are being achieved by the current legislation and policy tools including the Integrated Water sections in the Victorian Planning Provisions.

A key challenge for Melbourne Water has been to ensure that the impacts new development has on waterways and the bays are minimised, and that an appropriate regulatory regime is in place to ensure that these impacts are assessed and appropriately addressed. In Victoria, this has primarily been achieved through the introduction of new planning regulations (Corbett, D, 2010b).

Clause 56.07 was introduced into the Victoria Planning Provisions on 9 October 2006 and forms the Integrated Water Management provisions relating to residential subdivision. This clause aims at managing water more responsibly and sustainably, and is vital in protecting the health of our waterways and bays by reducing pollutants and excessive flows. The Clause requires that all new subdivisions of greater than two lots must treat stormwater onsite to the best practice standard, as defined in the Urban Stormwater Best Practice Environmental Management Guidelines (Victorian Stormwater Committee, 1999). To help Councils do this, a

Melbourne Water Stormwater Officer is available to Councils to help improve processes and systems relating to Clause 56.07 implementation. In addition, Melbourne Water in conjunction with its training partner provider "Clearwater", has developed an Implementation Toolkit to assist Councils with these planning provisions.

Clause 56.07 attempts to mandate the implementation of water sensitive urban design. As the Victorian Environment Protection Authority has noted in relation to Clause 56.07: "in particular, the urban run-off management objectives (Clause 56.07-4) address urban stormwater, and will contribute to improved stormwater water quality and assist in achieving the objectives of *State Environment Protection Policy (SEPP) - Waters of Victoria)*. The standards to be met include performance objectives set out in the Urban Stormwater Best Practice Environmental Management Guidelines. These standards can be met by incorporating water sensitive urban design (WSUD) elements as part of the drainage system".

The relevant objectives of Clause 56.07 in relation to urban run-off are: to minimise damage to properties and inconvenience to residents from urban run-off; to ensure that the street operates adequately during major storm events and provides for public safety, and to minimise increases in stormwater run-off and protect the environmental values and physical characteristics of receiving waters from degradation by urban run-off. Clause 56.07 mandates the treatment of stormwater to achieve best practice objectives for all residential subdivisions. To assist in achieving these objectives, the Best Practice Environmental Management Guidelines for Urban Stormwater describes the level of stormwater treatment necessary to comply with these regulatory requirements; the pollutant performance objectives required are:

- Suspended solids 80% reduction from typical urban load;
- Total phosphorus 45% reduction from typical urban load;
- Total nitrogen 45% reduction from typical urban load;
- Litter 70% reduction from typical urban load.

As mentioned above, Melbourne Water's area includes 38 local government areas, and given the important role that Councils play in managing stormwater in their communities, achieving success with Councils has always been seen as critical for the sustainable stormwater program. As part of its Living Rivers Stormwater Program, Melbourne Water is also working to build the capacity of local government and inform relevant stakeholders and processes, and to assist in the successful implementation of Clause 56.07 of the Victoria Planning Provisions.

Clause 56.07 introduced a requirement for stormwater quality treatment at-source for the subdivision of a land development site, with the acknowledgment that the "end-of-pipe" approaches such as regional wetlands may not provide as much protection to local waterways as distributed treatments.

With Clause 56 having been introduced some four years ago, it is now timely to reflect on the success to date of this policy. Whilst there has undoubtedly been considerable success in that many projects have been implemented in accordance with the objectives of Clause 56.07, some challenging issues remain. One of these is the issue of ongoing asset management. As mentioned above, Melbourne Water's long standing policy is that local government manages drainage systems and assets in catchments of less than 60 hectares; this means that Councils become the asset owners and maintainers of drainage assets created in these areas, and this can include biofilters, swales, raingardens, and wetlands. Some of the 38 Councils in Melbourne Water's area have concerns with managing these non-traditional assets.

Provision of assistance from Melbourne Water to Councils to enable them to better manage these non-traditional assets will need to continue. Across the 38 Councils, there is still clearly variability in commitment and capacity to WSUD, as Morrison (2008) concluded from his research in this area. There is some anecdotal

evidence that the appreciation of wetlands as community assets is increasing, ie that many residents enjoy having a wetland in their community for its social, aesthetic and recreational values. Marketing of many new estates often highlights the wetland features of an estate.

However there are also still issues with acceptance of WSUD by some land developers. Some developers have concerns with the amount of land that they have to give up for these assets, whereas in their opinion there are other solutions that would require less land. An example would be where Melbourne Water requires land to be provided from developers for a flood retardation basin – the water quality infrastructure required could either be a wetland built inside the retarding basin (and therefore requiring no additional land take, or a distributed system of swales and biofilters that is dispersed throughout the streets of the development and may result in additional land take.

7.0 The importance of Persuasion

The Persuasion section of the Paper examines the outcomes being achieved by Melbourne Water in encouraging and assisting a range of stakeholders to develop sustainable stormwater solutions.

For Melbourne Water, a key part of the move to encourage a range of organisations to take up sustainable stormwater management, has been to ensure the provision of a wide range of relevant training and education programs. This has been important due to the technical nature of parts of the WSUD approach, such as the use of computer models like MUSIC (Model for Urban Stormwater Improvement Conceptualisation), a conceptual design tool that estimates both stormwater pollutant generation and the performance of stormwater treatment measures.[7]

The training programs that Melbourne Water has seen as instrumental for implementing WSUD have largely been delivered by "Clearwater". The Clearwater program was established in 2002 as part of the Victorian Stormwater Action Program; Melbourne Water commenced funding the program in 2006 and Clearwater is now housed in Melbourne Water. Clearwater operates as an information exchange and also develops and implements education and training programs for industry, Councils and Government agencies to help deliver best practice stormwater management and WSUD. Its aim is to help accelerate the uptake of sustainable urban water management.[8]

Having access to, and input in to, key research programs is a key part of Melbourne Water's approach to sustainable stormwater management. This involves activities including setting up partnerships and research collaborations, and the provision of funding. Work by Melbourne Water to date has been with a number of organisations including the Cities as Water Supply Catchments research program at Monash University[9], the Department of Resource Management and Geography at the University of Melbourne, the National Urban

[7] More information on MUSIC is available at http://www.toolkit.net.au/Tools/MUSIC/features

[8] Clearwater website at http://www.clearwater.asn.au/index.cfm

[9] The Cities as Water Supply Catchments research program at Monash University is part of the Centre for Water Sensitive Cities. This Centre consolidates all of Monash University's research and development efforts in advancing water sensitive cities, and brings together Monash University's Facility for Advancing Water Biofiltration and the National Urban Water Governance Program, along with other researchers, all involved in driving and accelerating the development of water sensitive cities. More information at: http://www.watersensitivecitiescentre.org/

Water Governance Program at Monash University, and the Facility for Advancing Water Biofiltration at Monash University.

The results and findings provided by these university research programs are then used as a key persuasion "tool" by Melbourne Water, to further encourage innovation and uptake of appropriate stormwater management. An example is the Little Stringybark Creek project, which is the subject of a presentation at this conference.[10]

8.0 Conclusion

As a city experiencing considerable growth, and also dealing with climate change, Melbourne has a clear need to move towards more integrated water management. As part of addressing the challenge of moving towards sustainable and integrated stormwater management in the new growth areas around Melbourne, Melbourne Water has implemented programs under the broad headings of Partnerships, Policies and Persuasion. This Paper has looked at examples from each of these three areas to show that there is progress being made in the way that stormwater is being managed, and that the outcomes are providing not just waterway benefits (in terms of mitigating the impacts of stormwater quantity and quality) but in also providing a source of water for arrange of "fit-for-purpose" uses. It is encouraging to see that stormwater is now being more formally considered as a key part of the integrated urban water management cycle, and that there is now a much stronger "push" on innovative, integrated and sustainable stormwater management. But much remains to be done to truly "mainstream" the integration and use of stormwater. The learnings from the demonstration projects need to be fully realised. The "partnerships, policies and persuasion" approach needs to ensure that it is bringing about the transition to new ways of integrated stormwater management. The journey continues.

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