Interim Reference Guideline for the *South East Queensland Concept Design Guidelines for WSUD*

The Interim Reference Guideline has been produced for WSUD practitioners in Sydney to enable the local usage of the *South East Queensland (SEQ) Concept Design Guidelines for WSUD*.

This Interim Reference Guideline does not replace the *SEQ Concept Design Guidelines for WSUD*, but identifies Queensland references and proposes Sydney specific alternatives. The main issues *relevant to Sydney* are outlined as follows and are detailed in the following pages:

1. Design objectives for WSUD in Sydney – identification of appropriate WSUD objectives for Sydney.

2. Drivers for WSUD in Sydney – identification of appropriate WSUD drivers for Sydney

3. Specific issues for consideration when applying the *SEQ Conceptual Design Guidelines for WSUD*.

4. Case Studies – two Sydney relevant retrofit case studies are presented:
    a. Pirrama Park, City of Sydney (Water Police site) (Urban Core) – example of open space planning, streetscape layout, waterscapes as art, stormwater harvesting and reuse, GPT, scales of bioretention,
    b. Granville CBD, Parramatta (Urban Core / Suburban) – example of city centre improvement, upgrading working with Landscape designers, planners, to deliver streetscape layout, scales of bioretention.

Content contained herein will be updated as required to ensure the information is in accordance with NSW Government Policy.

Background

The *SEQ Concept Design Guidelines for WSUD* seeks to assist multi-disciplinary teams conceptualise and develop design solutions that integrate best practice sustainable urban water management within the urban form.

The focus of the document is on greenfield development and large infill redevelopment scenarios. While there is limited information on the application of Water Sensitive Urban Design (WSUD) in retrofit situations, the design principles and approach outlined in this document can be utilised by WSUD practitioners in Sydney for their own projects.

Who Should Use this Guideline in Sydney?

This guideline provides valuable guidance for the following practitioners:

- WSUD designers,
- Council staff implementing WSUD,
- Engineers,
- Landscape Architects,
- Planners.

1. WSUD Design Objectives for Sydney

Page 7 of the *SEQ Conceptual Design Guidelines for WSUD* identifies design objectives for water conservation and stormwater management. These objectives are based on Queensland legislation and are appropriate for development in that State. Water conservation and stormwater management objectives appropriate for Sydney are outlined below.

Design objectives are critical at the outset of a project to establish the water management outcomes of the project. The objectives define design criteria to which the system will operate once functional. The design process identifies at which stage these objectives should be applied, are outlined in Section 2 of the *SEQ Conceptual Design Guidelines for WSUD*.

Water Conservation Objectives

Water conservation seeks to reduce the demand for potable mains water (drinking water), with the added benefit of reducing wastewater volumes. The NSW Government's BASIX Scheme requires all new residential developments to incorporate water savings measures (http://www.basix.nsw.gov.au). There are, however, no such requirements for other development types (e.g. commercial, retail, industrial etc.), or open space.

Water Conservation	

Objectives	• Buildings not affected by BASIX that are installing any water use fittings must demonstrate minimum standards defined by the Water Efficiency Labelling and Standards (WELS) Scheme. Minimum WELS ratings are 4 star dual-flush toilets, 3 star showerheads, 4 star taps (for all taps other than bath outlets and garden taps) and 3 star urinals. Water efficient washing machines and dishwashers are to be used wherever possible.
	• Installation of dual reticulation for toilet flushing, laundry, irrigation and potentially cooling towers in large redevelopment areas.
	• Buildings not affected by BASIX must install rainwater tanks to meet a portion of supply (XX%) such as outdoor use, toilets, laundry or hot water.
	• Where cooling towers are used, they are:
	  ○ To be connected to a conductivity meter to ensure optimum circulation before discharge;
	  ○ To include a water meter connected to a building energy and water metering system to monitor water usage; and
	  ○ To employ alternative water sources for cooling towers where practical.
	• Water use within Public Open Space is to be minimised by improved soils, passive irrigation and integration of vegetated stormwater treatment system within the Public Open Space.
	• Water use within Public Open Space including irrigation, street cleaning, public amenities is to be supplied from alternative sources to meet 80% of non-potable demand.

Application	These objectives can be applied to all development types not addressed by BASIX. This includes council projects such as road and footpath upgrades, open space redesign and town centre redevelopments. The objectives can be adopted by councils as water conservation provisions within their Development Control Plan.
References / Further Information	Landcom WSUD Guideline (2009). http://www.landcom.com.au/whats-new/publications-reports/water-sensitive-urban-design.aspx

Stormwater Management Objectives

Design objectives for stormwater management have been derived from Landcom's WSUD Policy as well as stormwater planning provisions typically adopted by councils in Sydney within their Development Control Plan. Should the NSW Government release different or contrary objectives, this document will be updated immediately to reflect Government policy.

The suite of stormwater management design objectives incorporate:

- Stormwater quality – protection of waterways by limiting the quantity of key pollutants discharged to stormwater from urban development. It is based on a reduction in the loads of sediment, phosphorus, nitrogen and litter in stormwater runoff from an urban development compared to untreated runoff from a comparable landuse.
- Flow Management – Due to the increase in impervious area (eg roads, roofs, pavements etc.) in urban catchments, urban development increases the frequency, duration, peak flows and volume of stormwater runoff. Pipe and constructed channel drainage systems deliver flows more rapidly to receiving waters, and concentrate flows at a single point. An important consequence of these effects is the potential for increased erosion of natural waterways downstream of urban areas. Flow management objectives have been identified to minimise the impact of urban development on stream morphology.
- Catchments above wetlands – natural wetlands are particularly susceptible to the impacts of urban stormwater flow regimes upon their wetting and drying cycles. For catchments above natural wetlands, consideration needs to be given to addressing the hydrologic change associated with catchment urbanisation beyond typical flow management strategies.

Stormwater Quality	
Objective	Reduction compared to untreated stormwater from the same development type, of: • 90% of the post development mean annual load of total gross pollutant loads (greater than 5 mm); • 85% of the post development mean annual load of total suspended solids; • 65% of the post development mean annual load of total phosphorus; • 45% of the post development mean annual load of total nitrogen.
Background	Urban development increases the pollution load entering receiving environments. Stormwater quality controls have been derived through the modelling of numerous combinations of urban development types and stormwater management / WSUD strategies at various locations. They reflect a cost-effective level of stormwater treatment, that is considered to be technically feasible in terms of the land-take (or footprint) of stormwater/WSUD measures likely to be required for compliance.
Application	Stormwater quality objectives are typically applied to larger developments and council developments / retrofits to ensure that proponents have the ability to implement WSUD systems and councils can review Developments Applications submitted. Examples of development types which these objectives typically apply to, include: ○ Medium and high density residential; ○ Commercial and industrial development or additions to commercial and industrial land, where the impervious area of new or additional driveways, vehicle parking areas or vehicle manoeuvring areas, either individually or in total exceeds 150m^2; ○ All subdivisions of 6 or more lots and/or an area of greater than 2,500m^2, whichever is less; ○ All development types with ten or more carparks, either covered or uncovered.
Demonstrating Compliance	Stormwater quality elements are to be sized using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). Modelling parameters for the determination of the size and configuration of WSUD elements must be undertaken in MUSIC and in accordance with the Draft *"NSW Water Sensitive Urban Design MUSIC Modelling Guidelines"*.
References / Further Information	○ Landcom WSUD Policy (2009). http://www.landcom.com.au/whats-new/publications-reports/water-sensitive-urban-design.aspx ○ Botany Bay Coastal Catchment Initiative Water Sensitive Urban Design LEP and DCP Guide / Template ○ Draft NSW Water Sensitive Urban Design MUSIC Modelling Guidelines.

Flow Management	
Objective	• Maintain 1.5 year ARI peak discharge to pre-development magnitude, • Stream Erosion Index = 2.0
Background	Flow regimes are considered to be equally, if not more important than water quality in determining the level of ecosystem health of streams and wetlands in urban areas. These aspects are reflected in the NSW Government's River Flow Objectives typically nominated for urban catchments in NSW: ▪ Maintain wetland and floodplain inundation, ▪ Maintain natural flow variability, ▪ Maintain natural rates of change in water levels.
Application	The flow management target is applicable to Greenfield sites or wherever there is a natural stream downstream of a development. Flow management targets are not appropriate for a piped drainage system or stream (of fourth order or higher) flowing to ocean, estuary, lake or lagoon. The Stream Erosion Index has been identified by the Department of Planning's Growth Centres Commission as the flow target set for developments in north-west and south-west Sydney. These flow targets are defined as the ratio of the post development duration of stormwater flows greater than the "stream-forming flow" to the duration of flows greater than the "stream-forming flow" for the catchment under pre-development, natural conditions. At other sites, flow management objectives should be considered on a case-by-case basis.
Demonstrating Compliance	Guidance is being developed by the NSW Government and the Sydney Metropolitan Catchment Management Authority on modelling parameters for the flow management targets. This guidance will be released as available.
References / Further Information	○ Landcom WSUD Policy (2009). http://www.landcom.com.au/whats-new/publications-reports/water-sensitive-urban-design.aspx ○ Botany Bay Coastal Catchment Initiative Water Sensitive Urban Design LEP and DCP Guide / Template

Wetland Hydrology	
Objective	To be determined based on the type of wetland. Please see the Hunter Councils document *WSUD Solutions for Catchments above Wetlands (2007)* and website http://www.huntercouncils.com.au/environment/products/publications.html.
Background	Natural wetlands' wetting and drying cycles are particularly susceptible to the impacts of urban stormwater flow regimes. For catchments above natural wetlands, it may be necessary to address in more detail, the hydrologic change associated with catchment urbanisation beyond typical flow attenuation strategies. The hydrological regime of wetlands determines the depth, frequency, duration and temporal pattern of flooding and drying and therefore influences the physical, chemical and biological characteristics of the wetland substratum. An investigation undertaken by the Hunter Councils Group has recommended the adoption of flow management objectives for minimising the impacts of catchment urbanisation upon wetlands, based on the definition of the wetland inundation and drying characteristics of different wetland types. Flow duration frequency curves representing maximum flow and minimum flow conditions are considered to provide the principal hydrologic index for wetland flooding and drying respectively.
Application	Specialist advice should be sought on determining the wetland type as well as the appropriate hydrologic objectives and how the objectives may be obtained. Please see *WSUD Solutions for Catchments above Wetlands (2007)* for further information on the derivation and application of these objectives.
Demonstrating Compliance	*WSUD Solutions for Catchments above Wetlands (2007).*
References / Further Information	*WSUD Solutions for Catchments above Wetlands (2007),* available from Hunter Councils http://www.huntercouncils.com.au/environment/products/publications.html

2. Divers for WSUD in Sydney

Page 6 of the *SEQ Conceptual Design Guidelines for WSUD* identifies drivers for WSUD in South East Queensland. These drivers include key socio-economic and environmental impacts in Morten Bay, which are directly attributable to stormwater pollution.

While stormwater pollution loads in Sydney are similar to South East Queensland, the specific impacts of stormwater pollution may not be as evident as in Morten Bay. This does not suggest a diminished impact on Sydney's receiving environments from stormwater pollution. Key drivers for WSUD include reducing stormwater pollution and the negative impact of stormwater on receiving environments, as well as benefits to urban environments from implementing WSUD. Each of these drivers are outlined in the following sections.

Impacts of Stormwater

There is a direct link between urban development and waterway health. On average, there are approximately 100 rainfall events in an average year. Under natural conditions, this rainfall would typically cause stormwater runoff in up to ten of these events. The remaining water would infiltrate naturally into the ground. Urbanisation disrupts this natural cycle, and increases the number of rainfall events that generate stormwater because of an increase in imperviousness, leading to a range of impacts including:

- Increased nutrient export increases nutrient concentration in receiving waters, promoting excessive plant growth. Reduced channel capacity and an increased likelihood of stream erosion;
- Increased sediment loads which smother aquatic habitats and increase turbidity. Increased turbidity in turn causes a reduction in light penetration and therefore a reduction in plant photosynthesis;
- Increased contaminants and toxic materials including heavy metals, hydrocarbons and pesticides;
- Increased litter and debris reducing oxygen levels and degrading the aesthetic and beneficial uses of the water environments;
- Changes to flow patterns including decreased stream low flow volumes, increased peak flow rate and volume, increased flooding risks, loss of riparian vegetation, undermines streambank stability and stream degradation;
- Changing the morphology of creeks and rivers, leading to degradation and loss of aquatic habitat and therefore reduced biodiversity;
- Changes to groundwater levels and potential impacts on soil conditions, including increased salinity; and
- Importation of exotic plants and weeds, which results in the loss of native riparian and aquatic vegetation through.

Such impacts can be reduced through source control and distributed stormwater systems, which can be implemented through WSUD.

For further information about the opportunities provided by better stormwater management and its harvesting and reuse at source provides, please refer to the outputs from the Cities as Water Supply Catchments Research Program.

Stormwater Impacts on Sydney Receiving Environments

- Seagrasses - Nutrient enrichment and high level of suspended solids from urban runoff threaten seagrass beds. The nutrients facilitate algal blooms which reduce light availability to seagrasses. Suspended sediment also blocks light, which is essential for photosynthesis. The loss or reduction in the extent of seagrass beds is a major concern for many species including commercially and recreationally important species that rely on them for food and habitat. Seagrass communities also help stabilise sediments, reduce erosion and improve water quality so their loss has further negative impacts on aquatic communities.
- Bushland - Urban developments that drain to areas of natural bushland can lead to significant erosion. The erosion hazard associated with such discharges is a function primarily of soil erodibility, slope and

flow velocities. The resulting deposition of nutrient rich sediment provides an ideal environment for the proliferation of weed species. Urban development proposals, which drain to areas of natural bushland should incorporate WSUD and stormwater treatment elements aimed at preventing or minimising erosion at or downstream of the discharge point. Stormwater treatment measures likely to minimise the discharge of weed propagules into bushland areas (through filtration provided by bioretention, for example) should be encouraged.

Benefits of implementing WSUD

Benefits of implementing WSUD include:

- Introducing vegetated water treatment systems into the landscape can influence micro-climates and reduce the urban heat island effect. Trees can reduce asphalt temperatures by over 10°C;
- Vegetated treatment systems provide green infrastructure and green links to improve the look, function and recreational value of our cities;
- Road upgrades and/or traffic calming, which include WSUD features and can reduce stormwater loadings;
- Increased property values as a result of quality of the aquatic ecosystem and the amenity they provide to the population;
- Stormwater and wastewater reuse for council infrastructure such as sports ovals provide insurance against water scarcity and water restrictions; and
- Reduced need for rehabilitation and maintenance of waterways.

3. Key Sydney issues for consideration when applying the *SEQ Conceptual Design Guidelines for WSUD*

While most of the information in the *SEQ WSUD Concept Design Guideline* can be readily applied by practitioners in Sydney, there are several specific references, which either relate directly to the Queensland context or publications. The following tables relate to sections within the document and having identified Queensland specific references, provide relevant and appropriate NSW guidance:

Section 2: Project Teams and the *Conceptual Design Guidelines for WSUD*

The following table reproduces the key steps in the WSUD conceptual design process (Section 2 of the *SEQ Conceptual Design Guidelines for WSUD*), and identifies relevant and appropriate WSUD references for Sydney:

Task	Key Activities
Task 1- Understand the most recent WSUD policy and regulations	Review the most recent State and local government policy including: ▪ State Environmental Planning Policy: The BASIX Scheme ▪ State Environmental Planning Policy: Growth Centres Commission (and associated Development Codes) ▪ Other State Environmental Planning Policies ▪ Regional Environmental Planning Policies ▪ Landcom WSUD Policy ▪ Local council WSUD LEP ▪ Local council WSUD DCP Provisions / WSUD policy
Task 2 – Identify regionally and locally significant ecosystems and understand the sites' context in relation to the protection and or enhancement of these ecosystems. Particularly riparian and wetland ecosystems associated with waterway corridors.	NSW Office of Water – Riparian policies http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/Controlled-activities/default.aspx Endangered Ecological Community (EEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the *NSW Threatened Species Conservation Act 1995* (TSC Act).
Task 3 – Identify environmental values and water quality objectives for key receiving waters within and downstream of the development.	NSW Water Quality and River Flow Objectives for NSW Waterways http://www.environment.nsw.gov.au/ieo/index.htm
Task 4 – Establish the ecological condition and management requirements of key receiving environments within and downstream of the site.	As per *SEQ WSUD Concept Design Guideline*
Task 5 – Establish the site's existing and regional context.	As per *SEQ WSUD Concept Design Guideline*
Task 6 – Understand the regional and local integrated water cycle infrastructure context.	Sydney Water regional recycled water planning http://www.sydneywater.com.au/Water4Life/recyclingandreuse/
Task 7 – Understand the current and future flooding risk on and downstream of the site.	Local councils Floodplain Management Planning
Task 8 – Understand the site terrain and soils.	As per *SEQ WSUD Concept Design Guideline*
Task 9 – Prepare a preliminary WSUD Opportunities constraints overlay.	As per *SEQ WSUD Concept Design Guideline*
Task 10 – Determine water conservation objectives.	See *Section 1: Water Conservation Objectives* of this document
Task 11 – Determine wastewater minimisation objectives.	As per *SEQ WSUD Concept Design Guideline*

Task	Key Activities
Task 12 – Determine stormwater management objectives.	See *Section 1: Stormwater Quality Objectives* of this document
Task 13 – Confirm the WSUD objectives within local council.	As per *SEQ WSUD Concept Design Guideline*
Task 14 – Integrate the conceptual design process.	As per *SEQ WSUD Concept Design Guideline*
Task 15 – Undertake detailed site analysis.	As per *SEQ WSUD Concept Design Guideline*
Task 16 – Undertake quantitative modelling.	As per *SEQ WSUD Concept Design Guideline*
Task 17 – Prepare final conceptual site layout.	WSUD Strategy submitted as a component of the Development Application.

Section 3: WSUD Strategies

The WSUD Strategies section of the *SEQ WSUD Concept Design Guideline* provides additional information on how to incorporate WSUD in the conceptual design process. Relevant Sydney information is addressed in the following table:

<table>
<tr><th>Issue</th><th>Sydney Response</th></tr>
<tr><td>Page 20 – Water Conservation</td><td>Water conservation in Sydney is directed by the BASIX Scheme, which requires reduction of 40% of the potable (drinking) mains water consumed by new residential dwellings. Targets for non-residential dwellings are stated within the WSUD Reference Guideline in Section 1. These targets should be used in place of Figure 8.
Information on the BASIX Scheme http://www.basix.nsw.gov.au/information/index.jsp

Much of the information on water conservation within the SEQ Concept Design Guideline is based on Landcom's WSUD Policy - http://www.landcom.com.au/downloads/uploaded/Wastewater%20reuse%20technology%20report_links2_d960_de33.pdf</td></tr>
<tr><td>Page 22 / 23 – Water Conservation</td><td>The NSW Building Sustainability Index (BASIX) SEPP establishes a potable water conservation target of 40% for residential development, which is typically achievable through efficiency gains by utilising water efficient appliances in conjunction with the installation of a rainwater tank. The permissible water reuse options under the BASIX tool for water sourced from alternative sources are summarised in Table 1. Table 1 also acts as a guide to how different sources of water can be used to substitute typical demands.

Water reuse options allowable under the BASIX Scheme
<table>
<tr><th>Source</th><th>Garden</th><th>Toilet</th><th>Laundry</th><th>Hot</th><th>Drinking</th></tr>
<tr><td>Potable water (mains)</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Roofwater</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Stormwater</td><td>√</td><td>√</td><td>√</td><td>x</td><td>x</td></tr>
<tr><td>Treated greywater</td><td>√</td><td>√</td><td>√</td><td>x</td><td>x</td></tr>
<tr><td>Diverted greywater</td><td>√</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Reticulated recycled water</td><td>√</td><td>√</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Mixed source (i.e. rain, grey, and stormwater)</td><td>√</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td colspan="6">Reuse option: √ = permissible x = not permissible</td></tr>
</table></td></tr>
</table>

Issue	Sydney Response
Page 23 – Wastewater Minimisation	In Sydney, there are no wastewater minimisation targets. Rather wastewater minimisation is indirectly linked to reductions achieved through water conservation. Water recycling is provided in new residential areas of: ▪ Rouse Hill Recycled Water Area; ▪ Sydney Olympic Park and Newington (Sydney Olympic Park Authority); ▪ The Hoxton Park new release area, in Liverpool and Campbelltown LGA's; ▪ Ropes Crossing, near St Marys; ▪ As part of Metropolitan Water Plan other areas Sydney's north-west and south-west growth corridors will be provided with recycled water. Future major supplies of recycled water is also provided in two recycled water grids through the City as follows: ▪ Liverpool to Ashfield pipeline; ▪ The Rosehill/Camellia Recycled Water Scheme will provide high-quality recycled water from a new plant at Fairfield to major industrial customers and a racecourse in Western Sydney. Sewer mining operations include a connection to Sydney Water Corporation's sewer to extract wastewater, and wastewater treatment. Approval for any sewer mining systems must include: ▪ a system for distributing recycled water; ▪ a connection to Sydney Water's sewerage system to discharge approved residuals; ▪ a system to manage any other by-products produced in the facility. Refer - http://www.sydneywater.com.au/Water4Life/recyclingandreuse/RecyclingAndReuseInAction/SewerMining.cfm There are various types of treatment technologies available to treat wastewater obtained from sewer mining. Wastewater treatment will generate: • recycled water suitable for a particular use; • grit and screenings; • other residuals, including a more concentrated version of the extracted sewage, which may contain treatment additives. For further information see Landcom's *Wastewater Reuse In The Urban Environment: Selection Of Technologies,* at http://www.landcom.com.au/downloads/uploaded/Wastewater%20reuse%20technology%20report_links2_d960_de33.pdf
Page 24 – Stormwater Management	There are no finalised NSW State Government stormwater quality targets. Rather the targets in *Section 1: Stormwater Quality Objectives* of this document should be used as an interim measure and until such time as Targets are announced. Further details on stormwater quality elements can be found in the following documents: o South East Queensland, WSUD Technical Design Manual; o WSUD Program's Tools and Resources Database available at http://www.wsud.org/tools-resources/
Page 30 – Stormwater Management Construction and Establishment	The WSUD Program has developed further guidance on the application and usage of the South East Queensland Construction and Establishment Guideline. This document is available at http://www.wsud.org/tools-resources/

Section 5: Best Management Practices

Section 5 of the *SEQ WSUD Concept Design Guideline* identifies Best Management Practices, which form the treatment elements of the WSUD toolkit. These twelve practices range from demand management through to stormwater treatment. For each of the 12 BMPs there are two relevant issues, where Sydney appropriate information has been identified, namely:

- *Considerations when incorporating WSUD element into concept design – Statutory Compliance Requirements,*
- *BMP Risk Considerations – Poor Design.*

The references of these statements are outlined in the following table:

Best Management Practice	Reference (Page)	SEQ Guidance	Sydney Response
BMP 01: Demand Management	Page 56 – Statutory Compliance Requirements	QDC MP 4.2 establishes minimum water saving targets to be developed for all new type 1 buildings. The Queensland Govt must be consulted for all non-Type 1 buildings.	See *Section 1: Water Conservation Objectives* of this document
	Page 57 – Poor Design	Queensland Dept. of Natural Resources and Water	Sydney Water Water Right Tool http://www.ap.urscorp.com/watertool/
BMP 02: Roofwater Harvesting	Page 58 – Statutory Compliance Requirements	Roofwater harvesting assists meeting QDC MP 4.2, and can be used in new commercial and industrial buildings QDC MP 4.3.	See *Section 1: Water Conservation Objectives* of this document
	Page 58 – Statutory Compliance Requirements	The Qld Plumbing and Drainage Act	Sydney Water Guidelines for rainwater tanks http://www.sydneywater.com.au/Publications/FactSheets/RainwaterTanksGuidelines.pdf
BMP 03: Stormwater Harvesting	Page 61 – Statutory Compliance Requirements	Australian Guidelines for Water recycling: Managing Health and Environmental Risks (Phase 2)	Sydney Water Stormwater Harvesting guidelines http://www.sydneywater.com.au/OurSystemsAndOperations/StormwaterManagement/PDF/Stormwater_harvesting_brochure.pdf#Page=1 DECCW – Managing Urban Stormwater: Harvesting and Reuse http://www.environment.nsw.gov.au/stormwater/publications.htm
	Page 62 – Poor Design	Stormwater Harvesting Technical Guidelines (SEQ HWP 2009b)	
BMP 04: Wastewater Treatment for Reuse	Page 65 – Statutory Compliance Requirement	Relevant State and National Guidance.	NSW Health http://www.health.nsw.gov.au/PublicHealth/environment/water/wastewater.asp Sydney Water recycled water strategy http://www.sydneywater.com.au/Water4Life/recyclingandreuse/ Landcom Guidelines http://www.landcom.com.au/downloads/uploaded/Wastewater%20reuse%20technology%20report_links2_d960_de33.pdf
	Page 65 – Poor Design	Water reuse in the urban environment: Selection of Technologies (Landcom 2006)	

Best Management Practice	Reference (Page)	SEQ Guidance	Sydney Response
BMP 05: Gross Pollutant Capture Devices	Page *68* – Statutory Compliance Requirement	*SEQ Regional Plan Implementation Guidelines No7: WSUD* establishes minimum reduction of gross pollutants at 90%	See *Section 1: Stormwater Management Objectives* of this document
BMP 06: Sediment Basins	Page *70* – Statutory Compliance Requirement	*SEQ Regional Plan Implementation Guidelines No7: WSUD* establishes minimum reduction of: ▪ 80% total suspended solids ▪ 60% total phosphorus ▪ 80% total nitrogen	See *Section 1: Stormwater Management Objectives* of this document. Reduction compared to untreated stormwater from the same development type, of: • 90% of the post development mean annual load of total gross pollutant loads (greater than 5 mm); • 85% of the post development mean annual load of total suspended solids; • 65% of the post development mean annual load of total phosphorus; • 45% of the post development mean annual load of total nitrogen.
BMP 07: Grass Swales	Page 72 – Statutory Compliance Requirement		
BMP 08: Sand Filters	Page 74 – Statutory Compliance Requirement		
BMP 09: Bioretention Systems	Page 77 – Statutory Compliance Requirement		
BMP 10: Constructed Wetlands	Page 80 – Statutory Compliance Requirement		
BMP 06: Sediment Basins	Page *70* – Poor Design	WSUD Technical Guidelines for SEQ (2006)	The WSUD Program has developed further guidance on the application and usage of the WSUD Technical Guidelines for SEQ. This document is available at http://www.wsud.org/tools-resources/
BMP 07: Grass Swales	Page 72 – Poor Design		
BMP 08: Sand Filters	Page 74 – Poor Design		
BMP 09: Bioretention Systems	Page 77 – Poor Design		
BMP 10: Constructed Wetlands	Page 80 – Poor Design		

4a. Case Study 1: Pirrama Park, Sydney

Project Characteristics

- Project Type: Retrofit;
- Landuse: Open Space adjacent to high density;
- Site Area: 1.8ha site;
- LGA: City of Sydney;
- Project Team Composition:
  - Landscape Architect,
  - Civil Engineer,
  - Ecological Engineer.

Project Overview

Pirrama Park is a 1.8 hectare site at the northern end of Harris Street Pyrmont that was once the home of the NSW Water Police. City of Sydney purchased and connected the site to adjacent parkland along the Pyrmont Peninsula, facilitating a continuous foreshore path around the City.

City of Sydney purchased the site in 2005, and developed a masterplan for the site defining key elements of the Park. The masterplan sought to build on the site's past history with sandstone elements reflecting the former quarries once situated on the site; the new promenade marking the original shoreline, and native vegetation seeking to restore biodiversity to the peninsula. The site's name, Pirrama Park, references its original occupants: the Pirrama people.

The Park was designed by Aspect Studios, with the water elements delivered by Ecological Engineering (Sydney). Aspect Studios suggest that the "*design provides multiple new paths and a waterfront promenade around the Pyrmont foreshore, an important link in the 14km network of open space extending from Glebe to Rushcutters Bay. It re-instates the direct historic relationship between Harris Street and the Harbour and creates a new public square at the water's edge.*"

WSUD Objectives

Being a park, the main focus for the site was to identify a source of irrigation water while treating the stormwater runoff from the impervious elements of the site to best practice standards. The WSUD objectives adopted for the site were:

- Treat urban stormwater from the impervious areas of the site to best practice standards, namely:
  - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS).
  - 65% reduction in the post development mean annual load of Total Phosphorus (TP).
  - 45% reduction in the post development mean annual load of Total Nitrogen (TN).
- Public open space irrigation was supplied from treated stormwater to meet 80% of the site's estimated future water use demand.

Site Characteristics

Pirrama Park is predominately flat, however there is a central spine in the park that exposes a 1.5m retaining wall. The area surrounding the park includes a sheer 10m cliff to the east, which includes high density residential dwellings on Pyrmont Point, and a 10 hectare amphitheatre catchment to the south surrounding Harris Street.

WSUD Solution

The WSUD solution sought to treat the local and external catchments to best practice standards and utilise the treated stormwater as a source of irrigation water. Within the park redevelopment, road and carpark runoff is treated through street tree bioretention systems and bioretention raingardens in the parking bays.

The eastern external catchment on top of the cliff is directed to the central bioretention spine, and the southern Harris Street Catchment is diverted from the stormwater drain in Harris Street, to a gross pollutant

trap and into a bioretention system along the southern edge of the park. The large bioretention system drains to a 300kL tank, which is used for irrigating the Park.

Best Planning Practices Employed

The WSUD Best Planning Practices (BPP) employed in the project include:

- BPP 2 WSUD on flat sites – External catchments situated above the site are used to drive the bioretention systems by gravity. Within the site, stormwater is directed to surcharge pits, which overflow into the bioretention systems. The treated stormwater drains directly to the Harbour;
- BPP 3: Multiple Use Public Open Spaces – Pirrama Park incorporates a suite of 15 bioretention systems, and terrestrial biodiversity, along with highly utilised playground equipment and café;
- BPP 4: Street Layout and Streetscapes – Both the carpark areas and street re-developed through the project were designed to incorporate a range of stormwater treatment elements. Careful consideration of road grades as well as location of drainage pits complement the bioretention systems so that all stormwater from the site is treated;
- BPP 7: Waterscapes as Public Art – The public play area includes a children's playground, including interactive water pathways and a sand pit incorporating sandstone in remembrance of the sandstone quarry which was once based at the site. Public art is also included in a series of features on the southern portion of the site.

Public Art incorporated into Pirrama Park

Best Management Practices Employed

The WSUD Best Management Practices (BMP) employed in the project include:

- BMP 3: Stormwater Harvesting – Treated stormwater harvesting from the site is collected in a 300kL underground storage tank in the northern part of the site. The treated stormwater meets 80% of the irrigation demand of the park;
- BMP 5: Gross Pollutant Traps (GPT) – Low stormwater flows are diverted from the main stormwater trunk drain in Harris Street into a gross pollutant trap. Flows from the GPT are conveyed to the bioretention system at the base of the sandstone wall on the southern end of the Park. Flows from this bioretention system discharge to the underground stormwater storage system;
- BMP 9: Bioretention Systems – There are a series of bioretention systems which treat stormwater from both the immediate and adjacent catchments. The road areas that were realigned as part of the works include bioretention street trees on the northern kerb of Pirrama Road at the southern end of the park. The car parks on the eastern side of the park are treated through a series of ten bioretention systems interspersed through the car parks.



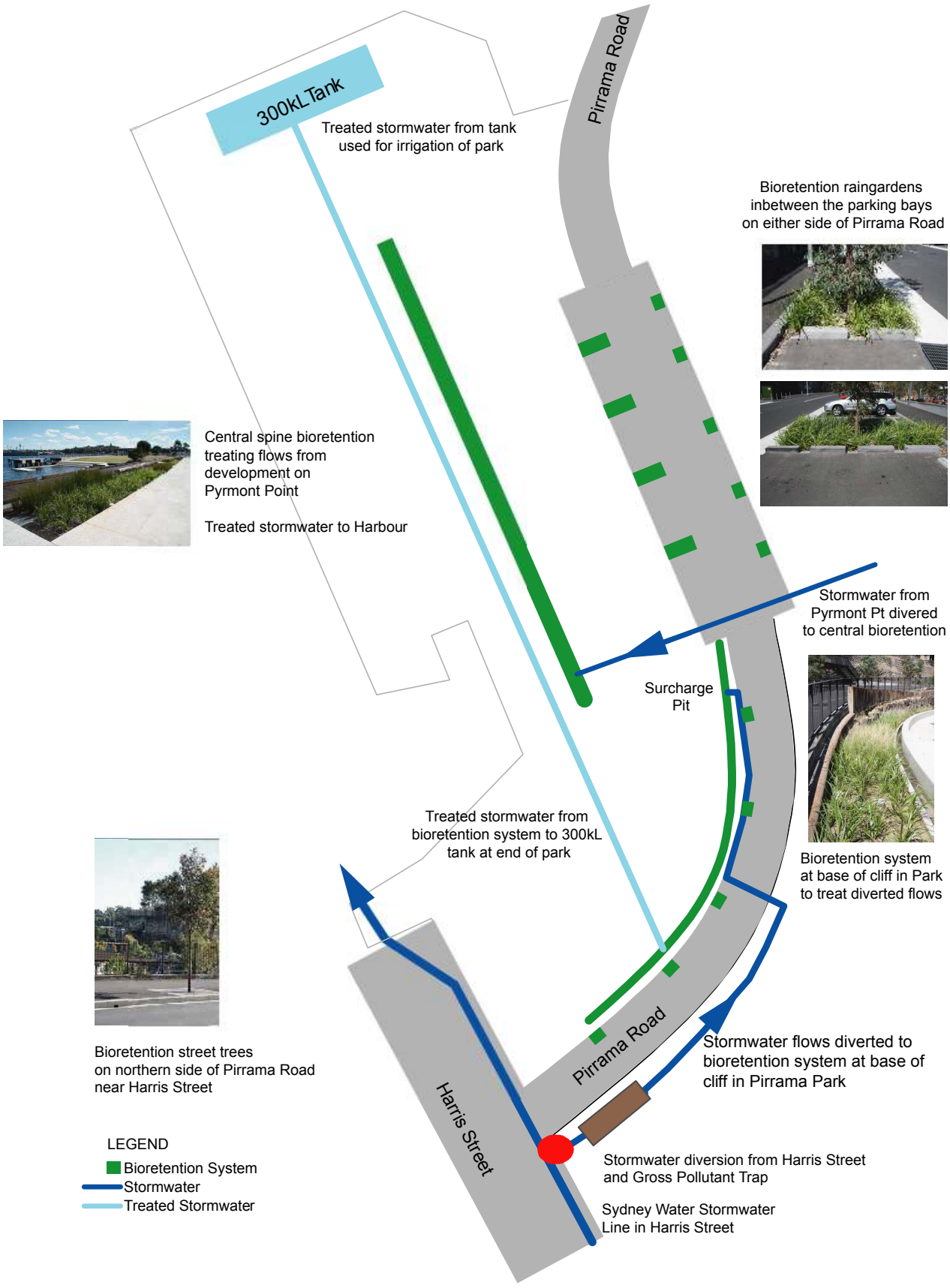

WSUD Elements (Clockwise from top left) – Street tree in Pirrama Road, central spine bioretention system, bioretention system at base of cliff on southern end of park, carpark bioretention systems.

Successes

The site has won numerous awards including:

- 2009 CCAA Public Domain Awards, Winner of Precincts State Winner NSW, Winner Best Overall Project
- 2009 The Parks and Leisure Australia Awards of Excellence (NSW), Certificate of Recognition In collaboration with Fiona Robbe Landscape Architects / Play Space category
- 2007 AILA NSW Planning Award for Excellence

Pirrama Park stormwater treatment and reuse scheme



4b. Case Study 2: South Street, Granville

Project Characteristics

- Project Type: Retrofit of Granville Town Centre;
- Landuse: Strip Shopping Mall;
- Site Area: 7,000m^2 site;
- LGA: Parramatta City;
- Project Team Composition:
  - Landscape Architect;
  - Civil Engineer;
  - Ecological Engineer.

Project Overview

Granville Town Centre is located on South Street Granville to the south of Granville train station. The town centre is situated along the 350m South Street, which includes a range of shopfronts along its length. Parramatta City Council has an ongoing series of works to improve the Town Centre including streetscape upgrades, a community hubs, town square, improved pedestrian linkages and improved facilities. The work is being undertaken to embed sustainability into Council activities.

WSUD Objectives

The WSUD objectives adopted for the site are to improve urban stormwater outcomes and seek to passively irrigate the street trees within the open space areas:

- To treat urban stormwater from the impervious areas of the site to best practice standards. Namely:
  - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);
  - 65% reduction in the post development mean annual load of Total Phosphorus (TP);
  - 45% reduction in the post development mean annual load of Total Nitrogen (TN).
- Water use within Public Open Space to be minimised by improved soils, passive irrigation and integration of vegetated stormwater treatment system into POS.

Site Characteristics

South Street, Granville is being upgraded to incorporate a bioretention median as well as a series of street tree pits (as shown in the figures below). The system is under construction in 2010. The medians have been designed so that flows from the high (western) side of South Street flows into the system via kerb cuts as shown in the top right image of the Figure below. Stormwater flows from the eastern portion of the Street, flow into a series of street-tree bioretention systems shown in the lower two images in the Figure below.

WSUD Solution

The WSUD solution has been led by the landscape design team within Council.

Best Planning Practices Employed

The WSUD Best Planning Practices (BPP) employed in the project include:

- BPP 4: Street Layout and Streetscapes – South Street has undergone a major retrofit as a result of the project with a central median put in place to calm traffic and add to the amenity of the precinct.

Best Management Practices Employed

The Best Management Practices employed in the project include:

- BMP 9: Bioretention Systems – The Upgrade of South Street includes both a bioretention median and street trees. The bioretention median takes stormwater flows from the western portion of the road, which has been graded to flow to that system. The median acts as a level change with the lower eastern side of South Street flowing to a series of bioretention street trees located in the road in between car parking spaces.

South Street, Granville WSUD elements (clockwise from top left) – centre media bioretention, inlet to median bioretention, street-tree pit, and street-tree pit showing overflow.