

## **PLANNING FOR WATER SENSITIVE URBAN DESIGN IN THE DARWIN REGION – TOOLS TO FACILITATE SUSTAINABLE URBAN DEVELOPMENT**

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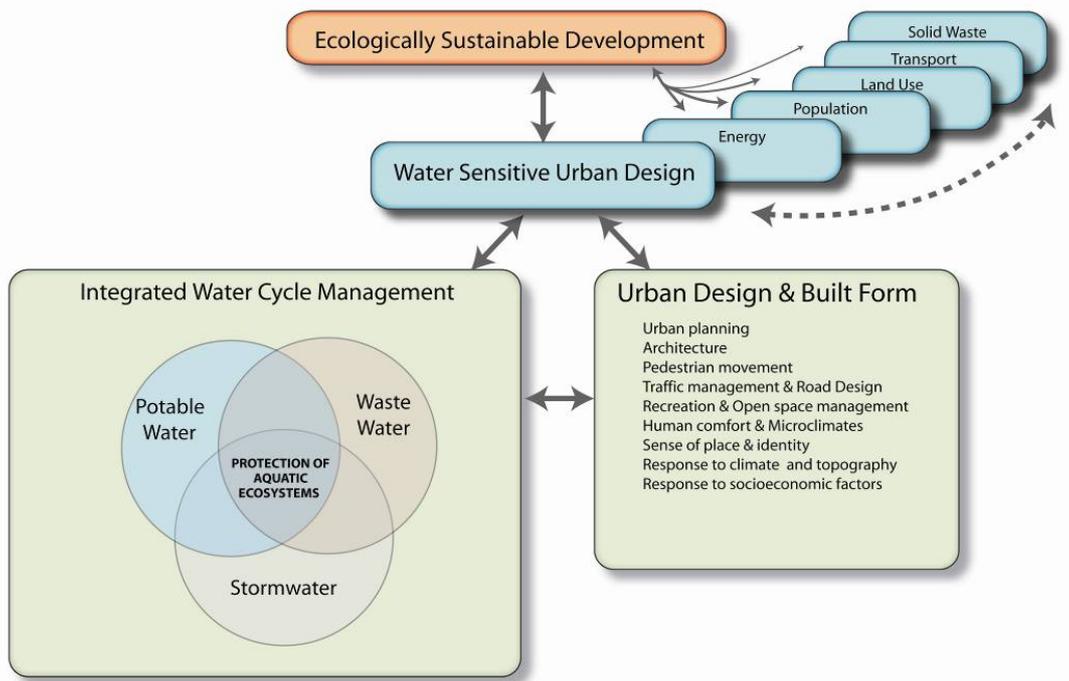
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*Darwin Harbour is a unique natural resource, providing significant social amenity and environmental values. The Harbour is the ultimate receiving environment for all stormwater and wastewater discharge from Darwin and Palmerston urban areas. With strong population growth predicted over the next few decades, Darwin Harbour faces significant potential impacts. In order to manage the impacts of new development on Darwin Harbour, the Territory Government is seeking to implement Water Sensitive Urban Design (WSUD) within all new greenfield developments. WSUD is becoming common practice in southern Australia, but there are significant challenges to implementing this approach in Australia's northern regions. To successfully implement WSUD, three key supporting elements are required: a robust planning framework, including clear objectives built in to policy and legislation; a comprehensive enabling framework, including appropriate guidelines and tools for the development industry and local councils; and capacity building and communication amongst government, industry practitioners, developers and the broader community. This paper will describe how each of these three elements are being developed for the Darwin Region, and discuss the challenges to bringing all three elements together into a coherent strategy.*

### **INTRODUCTION**

Water Sensitive Urban Design (WSUD) represents a new paradigm in the planning and design of urban development that aims to minimise impacts on the natural water cycle and protect the health of aquatic ecosystems. WSUD promotes the integration of the urban water streams, namely stormwater, water supply, wastewater and groundwater, so as to deliver sustainable water cycle solutions.

Additionally, WSUD aims to integrate these urban water cycle solutions into the planning and design of the layout, streetscapes, buildings and landscapes of an urban development, towards an overall goal of ecologically sustainable development (ESD), as illustrated in Figure 1. Further description of the philosophy and implementation of WSUD is provided in Australian Runoff Quality (Engineers Australia, 2006).



**Figure 1 Relationship between water sensitive urban design, ecologically sustainable development and integrated water cycle management**

**WSUD in Darwin**

The aquatic environment of the Darwin Harbour contains a wealth of cultural, environmental, recreation, social and economic uses and values for the community of Darwin (Northern Territory Government, 2005). The Harbour is the ultimate receiving environment for all stormwater and wastewater discharges from catchments around the harbour such as Darwin and Palmerston urban areas. Recent research has identified that although the harbour is considered to be in close to pristine condition with good water quality, the impacts of urban stormwater runoff and wastewater discharges are evident (Padovan 2003). Furthermore current predictions for 2050 are that the Darwin Harbour region will experience strong population growth and the associated development will have significant impacts on Darwin Harbour.

In order to manage the impacts to Darwin Harbour, particularly from new development and re-development, the Northern Territory (NT) Government has identified that the implementation of water cycle management measures in new development zones is critical, and has embarked on a project to complete a WSUD Strategy for Darwin Harbour. The project is being supported by funding from the Australian Government Department of the Environment, Water, Heritage and the Arts.

## **WSUD IMPLEMENTATION**

WSUD is focused on achieving the following principles:

- Protection and enhancement of natural water systems (including creeks and rivers).
- Treating urban stormwater to meet water quality objectives for reuse and/or discharge to receiving waters.
- Matching the natural water runoff regime as closely as possible (where appropriate).
- Reducing potable water demand through water efficient fittings and appliances, rainwater harvesting and wastewater reuse.
- Minimising wastewater generation and treatment of wastewater to a standard suitable for effluent reuse opportunities.
- Integrating stormwater management into the landscape, creating multiple use corridors that maximise the visual and recreational amenity of urban development.

There are both technical and non-technical issues associated with the implementation of WSUD. Experience in southern Australia has revealed that the successful implementation of WSUD requires three key elements:

- A robust policy and planning framework.
- A comprehensive enabling framework including technical guidelines and tools.
- Capacity building.

The following sections describe how these three elements are being addressed in the Darwin region.

### **POLICY AND PLANNING FRAMEWORK**

A policy and planning framework for WSUD translates scientific understanding on the impacts of urban development into clear and practical objectives and targets which can be integrated into policy and legislation. Objectives should be clear and consistent, and relate to ecosystem protection outcomes that can be readily achieved using best practice design approaches. Objectives should be backed by quantifiable targets, built into mandatory planning controls. This will allow the Northern Territory (NT) Government and local authorities to assess new developments in terms of their ability to meet WSUD objectives.

#### **Development of objectives and targets**

Three underpinning principles have been put forward for the development of stormwater quality objectives and targets (Healthy Waterways, 2007). These are also relevant to other WSUD principles. Objectives and targets should be:

- *Locally relevant* - the design objectives must, to the extent possible, be derived using locally relevant information on urban stormwater pollution generation rates and stormwater quality treatment measure performance
- *Practical* - the design objectives must be achievable with more than one design solution, and

- *Best Practice* - the design objectives must result in the adoption of the most effective and efficient forms of contemporary 'best practice' designed stormwater quality treatment infrastructure sized to operate at their respective limit of economic performance (i.e. beyond which any further increase in treatment size will not result in any appreciable increase in treatment performance).

A set of WSUD objectives and targets that fulfil the above criteria are proposed for the Darwin region. These targets relate to both potable water conservation and stormwater quality and are shown in Table 1.

**Table 1: Preliminary WSUD Objectives for Darwin Harbour**

<b>WSUD Objective</b>	<b>Performance Measure/Target</b>
Potable Water Conservation	No quantitative potable water conservation objective has been specified, however a 20% water conservation target is considered technically feasible and is suggested as an interim target
Stormwater Quality	Stormwater discharged from development areas to be treated in accordance with best practice: <ul style="list-style-type: none"> <li>• 80% reduction in the mean annual load of Total Suspended Solids (TSS)</li> <li>• 60% reduction in the mean annual load of Total Phosphorus (TP)</li> <li>• 45% reduction in the mean annual load of Total Nitrogen (TN)</li> <li>• 90% reduction in the mean annual load of Gross Pollutants</li> </ul>

### **Inclusion into the Planning Framework**

The major goal of the WSUD Strategy for Darwin Harbour is the adoption of WSUD in all new subdivision development in the region. For this goal to be realised, the WSUD Strategy should be consistent with and work within the context of the existing administrative and legislative framework, and should complement existing policies and programmes relating to stormwater management, catchment management and receiving waterways in the region.

WSUD needs to be supported in the Darwin Region through appropriate policy and a strong position within the planning framework. The policy and planning framework for WSUD should:

- Provide leadership from the NT Government to support the adoption of WSUD
- Include clearly stated WSUD design objectives and targets
- Inform and guide strategic land use planning (i.e. structure planning and master planning), infrastructure planning and development assessment decision making

The major goal of the WSUD Strategy for Darwin Harbour is the adoption of WSUD in all new subdivision development in the region. This is currently occurring through the masterplanning process adopted by DPI for suburbs such

as Bellamack, Johnston and Zuccoli. To consolidate this approach a key requirement is to include WSUD within the *NT Planning Act* and *NT Planning Scheme*. It is proposed that provisions on WSUD principles be incorporated within the *NT Planning Act* and *NT Planning Scheme*, while WSUD objectives and supporting information are presented as WSUD Guidelines supporting the NT planning framework, similar to the Community Safety Design Guide. This would act as a basis for amendments to the local government subdivision guidelines to include specific WSUD requirements including quantitative targets.

## **ENABLING FRAMEWORK**

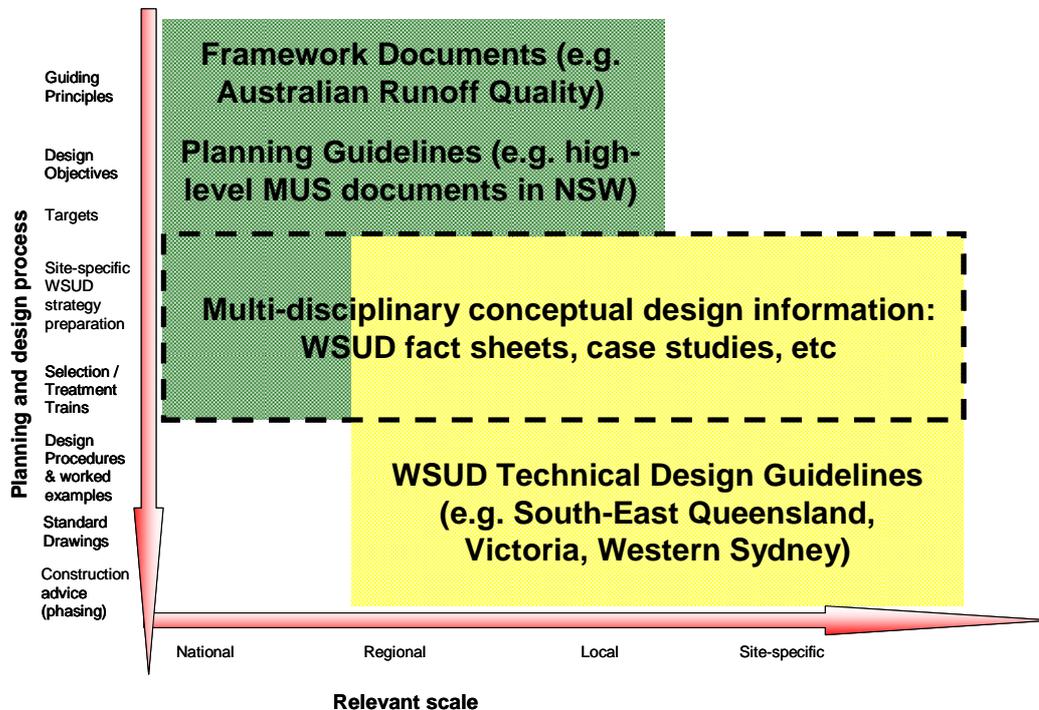
Practical examples of WSUD in the wet-dry tropics in general and Darwin in particular are minimal. While there is a relatively strong framework of both policy and technical guidelines available in south eastern Australia to support the implementation of WSUD, these are not directly relevant in the Darwin context due to the unique challenges of climate and seasonal rainfall distribution.

A key requirement to enable the widespread uptake of WSUD practices within Darwin is supporting information to translate principles, objectives and targets into sustainable and appropriate water management elements for new development. Ideally this would be in the form of practical WSUD guides that are of direct relevance to the local context and which will enhance the knowledge, ability and confidence of developers, builders, planners and local development assessment and council staff in WSUD planning, design, implementation and ongoing operation.

There are a range of WSUD support documents that have been prepared in Australia at national, state, regional and local levels to support the implementation of WSUD. With the wide range of documents available, Figure 2 organises this information into four basic types, according to the scale and the stage of the planning and design process at which they are relevant:

1. **Framework documents**, which provide high-level information on the principles and practice of WSUD. An example is *Australian Runoff Quality* (Engineers Australia, 2006)
2. **Planning Guidelines**, which offer high-level advice on management and strategic issues, including WSUD objectives and targets. An example is the NSW *Managing Urban Stormwater* series of documents (published by DECC)
3. **Multi-disciplinary conceptual design information**, such as fact sheets, case studies, etc., which distil technical design information into a format that is readily understood by a broad non-technical audience. An example is the series of “Water by Design” Fact Sheets published by the SEQ Healthy Waterways Partnership
4. **WSUD Technical Design Guidelines**, which offer guidance on the detailed design of WSUD elements including stormwater treatment systems. For example, both Melbourne Water and the SEQ Healthy

Waterways Partnership have published in-depth Technical Design Guidelines.

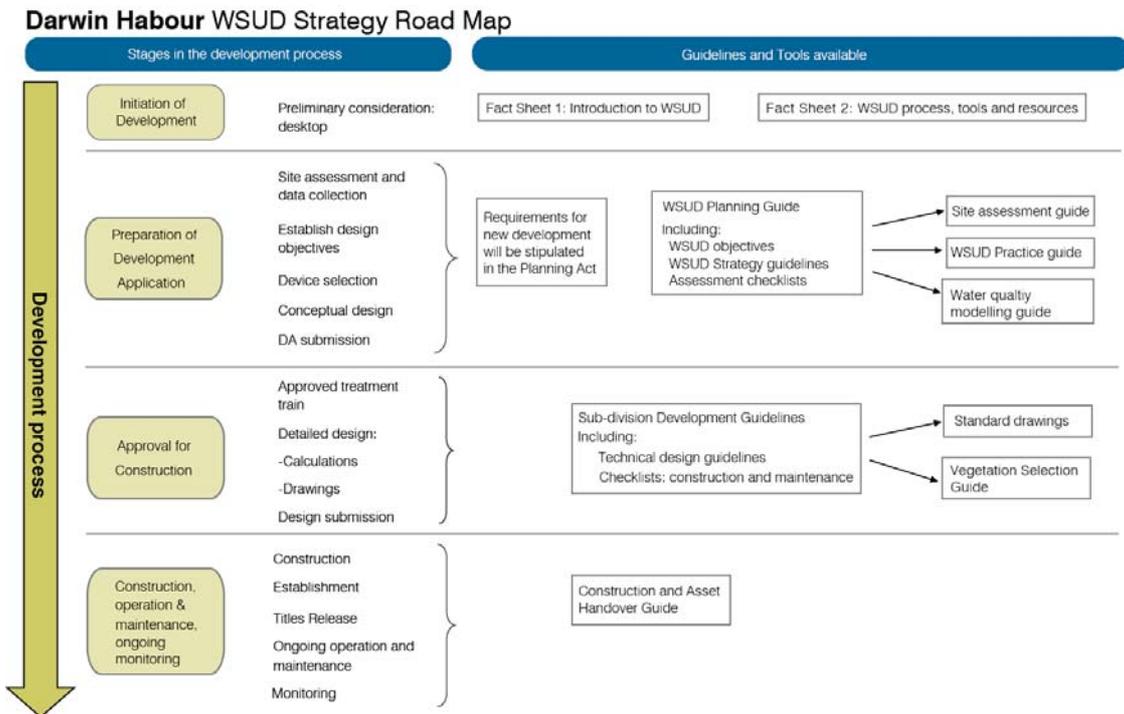


**Figure 2: Hierarchy of technical information available to support WSUD**

Consistent with the above framework, the following WSUD guidelines and tools are being developed for the Darwin Region:

- Two fact sheets:
  - An Introductory fact sheet on WSUD
  - A fact sheet outlining the set of tools and resources available
- A *WSUD Planning Guide* - for developers, consultants, councils, the DCA and DPI on how to implement WSUD through the development process.
- A *Site Assessment Guide* - describes the key site assessment tasks which should inform the development of a WSUD strategy for a new subdivision.
- A *WSUD Practice Guide* - to assist in the selection, sizing and conceptual design of potable water conservation and stormwater quality treatment measures as part of a WSUD strategy for a new subdivision.
- A *Water Quality Modelling Guide* - outlining how to undertake stormwater quality modelling to size and design WSUD measures.
- *Sub-division Development Guidelines* - detailed technical design guidelines for the Darwin region.
- *Standard Drawings* – typical stormwater treatment measures.
- A *Vegetation Selection Guide* – to assist designers choose appropriate species for vegetated stormwater treatment systems.

Figure 3 shows how these documents relate to each other and to the development process.



Showcase WSUD projects, which highlight practical examples of WSUD are being implemented by the NT Government in their major release areas including Bellamack. These demonstrations are being developed to address issues such as climatic and rainfall issues identified above, as well as ensuring that industry concerns are addressed.

### CAPACITY BUILDING

Capacity building is important to ensure that the WSUD Strategy for Darwin Harbour can be implemented by local practitioners. An assessment of barriers and opportunities for WSUD in Darwin found that the capacity building needs are different to those found in southern regions. In particular, the following local barriers were identified:

- With a small population, a well flushed harbour and an abundance of wet season rain, the perception is that there is no apparent need for WSUD. This is despite research showing that the impacts of urban stormwater runoff and wastewater discharges are evident, and issues of water scarcity are becoming apparent which will be exacerbated by increasing population.
- There is a need to define what WSUD is and what it means for Darwin.
- There is a perception that WSUD will not work in Darwin due to the extreme wet season rainfall and prolonged dry season dry spell.
- Issues with water ponding and mosquito breeding.

Capacity building initiatives for the Darwin region need to be tailored to address these issues. A series of meetings with key stakeholders throughout 2008 has helped to define their current knowledge, skills and needs around water management. A series of formalised workshops and training sessions are proposed to disseminate information amongst the key stakeholders as well as a broader audience. This will include

- Training of local and NT government staff.
- Industry training for practitioners of WSUD, primarily those responsible for the implementation of WSUD, including government engineers and ecologists, consultants and utility companies.

The training will form an important element of the dissemination and roll-out of the implementation guidelines and tools. A training program will be developed to ensure knowledge transfer and application of the WSUD objectives, guidelines and tools. The training workshops will be interactive with participants, involving problem based learning, through training modules, whereby the implementation strategies suggested can be trialled by participants.

## **CONCLUSION**

Implementation of WSUD in the Darwin region has the potential to protect Darwin Harbour from the negative impacts associated with urban development, protecting its environmental and socioeconomic values. However for a WSUD approach to be successful it requires a paradigm shift in the planning and design of new developments. To bring about this change, the WSUD Strategy for Darwin Harbour has involved the development of clear, quantifiable and locally relevant WSUD objectives and targets, a framework of guidelines and tools, tailored for local practitioners, and will also include a capacity building program tailored to local needs.

## **REFERENCES**

Engineers Australia 2006 *Australian Runoff Quality: A guide to Water Sensitive Urban Design* Engineers Australia, National Committee for Water Engineering.

Healthy Waterways Partnership 2007 "Developing design objectives for urban development in South East Queensland" Version 2 - 8 November 2007.

Northern Territory Government (2005) "The Health of the Aquatic Environment in the Darwin Harbour Region", Department of Natural Resources, Environment and the Arts.

Padovan, A 2003 "*Darwin Harbour water and sediment quality*" Darwin Harbour Regional Plan of Management, Proceedings of the Darwin Harbour Public Presentations - February 2003.