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Water sensitive urban design

Water sensitive movement networks and transport hubs

Summary

This fact sheet highlights opportunities for the delivery of water sensitive urban design outcomes in movement networks and transport hubs. It is intended to be used by transport planners to help identify suitable options for inclusion in transport and development projects, to optimise the delivery of multiple outcomes such as improved public amenity and ecological health, reduced energy use and greenhouse gas emissions and other outcomes that contribute to the wellbeing of Western Australians.

Introduction

Water sensitive urban design (WSUD) promotes the sustainable use, re use and management of water in all landscapes across our built and natural environments. The delivery of WSUD results in efficient, safe and healthy natural and engineered water systems. It is strongly linked to green infrastructure - the network of green spaces and water systems, like parks, streets and waterways, that improves community mental and physical health and makes our urban places liveable. This green network is increasingly being recognised for its critical role in enhancing the pedestrian, cycling and vehicular movement networks of our cities and spaces.

WSUD in a transport context

The WA transport portfolio's Strategic Direction includes six objectives to help drive and shape the achievement of its Vision. These objectives, shown in Figure 1, are consistent with the objectives of WSUD and Integrated Water Management

Customer focussed We keep the customer at the centre of service delivery and decision making	**Sustainable transport systems** We deliver integrated, safe, efficient transport solutions	**Innovative solutions** We innovate to optimise our service delivery and infrastructure
Planning and prioritisation We plan holistically for a growing State	**Optimising investment** We maximise the benefits of every transport dollar	**Collaborative culture** We embrace collaboration to achieve better outcomes

Figure 1: Transport Portfolio 2018-19 Strategic Direction

Applying WSUD principles and approaches to the development or retrofit of movement networks and transport hubs will result in multiple benefits, including:

- improved liveability around the network through increased shade, reduced urban heat, provision of additional landscape features, improved visual amenity and increased access to the natural environment;
- increased bitumen life from shade provided by trees;
- increased walking, cycling and use of public transport due to improved liveability, thus increasing cost-effectiveness of infrastructure investment, reducing congestion on roads, and reducing emissions from cars contributing to climate change;
- Improved catchment hydrology and decreased infrastructure costs due to reduced need for piped solutions;
- increased water available for use within the transport hub or by the surrounding community (via rainwater collection, or increased local infiltration to the superficial aquifer); and
- reduced impacts on or potential improvements to the health of sensitive environments, particularly in relation to the extensive impermeable areas and poor stormwater quality usually associated with transport corridors and hubs.

Opportunities

By recognising the role WSUD can play in supporting other State, regional or local objectives and promoting collaboration between those responsible for planning, design and managing our infrastructure and other relevant stakeholders, we can maximise the potential for WSUD to support multiple objectives.

Improved integration of WSUD into transport projects should aim to improve liveability and the quality of the environment. Although the main interaction of transport projects with the water cycle is management of stormwater, other opportunities exist to install and operate efficient water use systems and create localised sources of water for uses such as toilet flushing, washing of buses, trains and platforms or irrigation through collection of rainwater, or harvesting and treating stormwater or wastewater.

Water sensitive solutions for movement networks and transport hubs

Some WSUD systems are more suitable for inclusion within a transport network than others due to their design features or maintenance requirements which may not fit within the constraints of traditional corridors and/or transport hubs. Some of the more suitable WSUD solutions include:

- biofilters, raingardens and passively watered street trees (see below) – can be designed at a range of scales and shapes and are therefore flexible in their design and location. They also provide urban cooling, increased amenity and noise reduction;

- vegetated swales (figure 2 & 3) – primarily due to their linear form which makes them ideally located along transport corridors;
- permeable pavement (figure 4 & 5) – generally suitable for light traffic areas such as roadside rest areas, carparks, depots, and pedestrian thoroughfares;
- water harvesting and reuse – including from roofs, shade structures, stormwater systems and local wastewater management systems. The level of treatment should be appropriate for the distribution and use of the water source and consideration must be given to seasonal rainfall patterns, seasonal demands and storage options; and
- water efficient fixtures and fittings in buildings and for irrigation that could incorporate smart technology and weather and moisture sensors.

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WSUD in movement networks (paths, roads and rail)

Linear corridors, such as those associated with footpaths, cycle paths, roads and rail lines, have the potential to impact catchment flow paths. To address this and improve delivery of WSUD approaches, projects for linear infrastructure should:

- maintain catchment flow paths where possible, including through use of overland flow (where safety criteria can be met), retaining waterway alignments, installing bridges and using culverts that are designed to provide for fauna movement and minimise visual impacts;
- protect important infrastructure (rail lines, significant distributor roads) from flooding and inundation – raise infrastructure where necessary (except in floodways);
- minimise impervious area - let the water infiltrate at-source (e.g. minimise continuous kerbing where possible) and use vegetated flow paths to improve water quality, improve amenity, provide habitat and protect receiving environments;
- direct flood flows to waterways, wetlands or the coast via vegetated overland flowpaths, which help to maintain ecological water flows and minimise the risks associated with over-reliance on large on-site systems;
- protect waterways and conservation-value wetlands by providing sufficient foreshore areas and wetland buffers; and
- provide critical ecological links and urban cooling by planning corridors with sufficient width for green infrastructure. Maintain existing vegetation and trees where possible and plant more where it is safe to do so.

Figure 2: Car park biofilter and roadside swale

Figure 3: Roadside swale for treatment of stormwater

Figure 4: Permeable pavement types

WSUD in transport hubs (buildings and spaces)

Transport hubs, such as rail/bus stations and transit-oriented development precincts, also provide significant opportunity for integrating WSUD solutions. These include:

- incorporating green infrastructure into buildings (green roofs, green walls, green facades) and streetscapes (street trees and vegetation that receives stormwater) to improve amenity, reduce urban heat and improve environmental quality;
- using pervious paving and disconnecting impervious surfaces to reduce stormwater flows;
- harvesting rainwater from roofs or shade structures to be used in toilets or for washdown of platforms;
- harvesting stormwater from impervious surfaces (e.g. carparks and plazas) and treating/storing in constructed wetlands or groundwater aquifers for irrigation (subject to necessary approvals);
- upgrading existing drainage systems and reserves to form multi-purpose public open spaces and green corridors, which can provide better outcomes than excessive on-site storage requirements; and
- treating and reusing greywater or wastewater, which can reduce the need for new or upgraded infrastructure and provide an additional water source.

Figure 5: Disconnecting hard surfaces (grates and permeable pavement) reduces stormwater flows

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Project planning and implementation

Early planning and collaboration with key stakeholders is critical to assess the feasibility of implementing WSUD systems in transport projects. An early commitment to using sustainability rating tools will also improve project performance. Application of WSUD solutions should be appropriate to site conditions and the development/project context.

Design considerations

Key factors to consider when applying WSUD to transport projects are:

- Sensitivity of the adjacent environment – pristine environments, threatened species/ecosystems, or public drinking water catchments may require water leaving the project to be of a higher quality compared to pre-development.
- Landform and geology – land topography and soil types of the site will determine which WSUD systems are best suited to the project site (e.g. direct infiltration may be more suitable in sandy soils than for clay soils).
- Changing climate – ensure solutions consider changes in rainfall patterns, bushfire risk and heat.
- Imperviousness – understand the change in permeability resulting from the project, and the additional runoff requiring management compared to pre-development.
- Space and layout –availability for appropriately sized WSUD systems, including linear corridors (roads/footpaths/railway lines) and hubs (train & bus stations/car parks/airports)
- Project-specific objectives – stakeholder's requirements and outcomes (e.g. providing a source of irrigation water as well as encouraging public transport use and managing flooding)
- Safety – understanding safety issues when incorporating WSUD for asset users and maintenance staff.
- Maintainability – the capacity of the final asset owner to maintain the WSUD systems.
- Cost-benefit – whole-of-life cost (capital and operational cost) of incorporating different WSUD systems into a project versus multiple benefits.
- Legislative or policy obligations – any Local, State or Federal planning or legislative instruments, or any internal or external policy or practice requirements (e.g. Green Building Council Green Star rating).

Case study: Northlink

NorthLink WA, a $1.02 billion road project led by Main Roads WA connecting Morley and Muchea, demonstrated the benefits of applying a WSUD approach to the management of stormwater. The project vision included a desire to maximise sustainability though economic, social and environmental responsibility.

The emphasis on sustainability was cemented early in the project though the requirement to achieve an Excellent Infrastructure Sustainability rating from the Infrastructure Sustainability Council of Australia (ISCA) in the Request for Proposal.

The project team demonstrated a strong culture for improved project outcomes. Key WSUD strategies included water sensitive stormwater management and water conservation and efficiency. The drainage strategy incorporated strings of drainage basins planted to mimic the natural wetland chains in the area. The project resulted in a net gain in the area of native vegetation through the planting of over 3 million trees and more than 1000kg of native seeds. The NorthLink WA Southern Section achieved a 24% reduction in water use through innovative materials selection and use of drought tolerant plant species which designed out the need for reticulation in most areas. It also achieved a 10% reduction in the cost of pit and pipe drainage systems and associated fencing (nearly $700,000 saving) through infiltration at source, which also resulted in smaller basins.

The NorthLink WA Southern Section achieved the highest ISCA design rating score in WA (93). It also won the IS Impact Award (projects > $20million) and Outstanding Achievement Award from ISCA in 2017.

References

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CRC for Water Sensitive Cities

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www.newwaterways.org.au
info@newwaterways.org.au

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