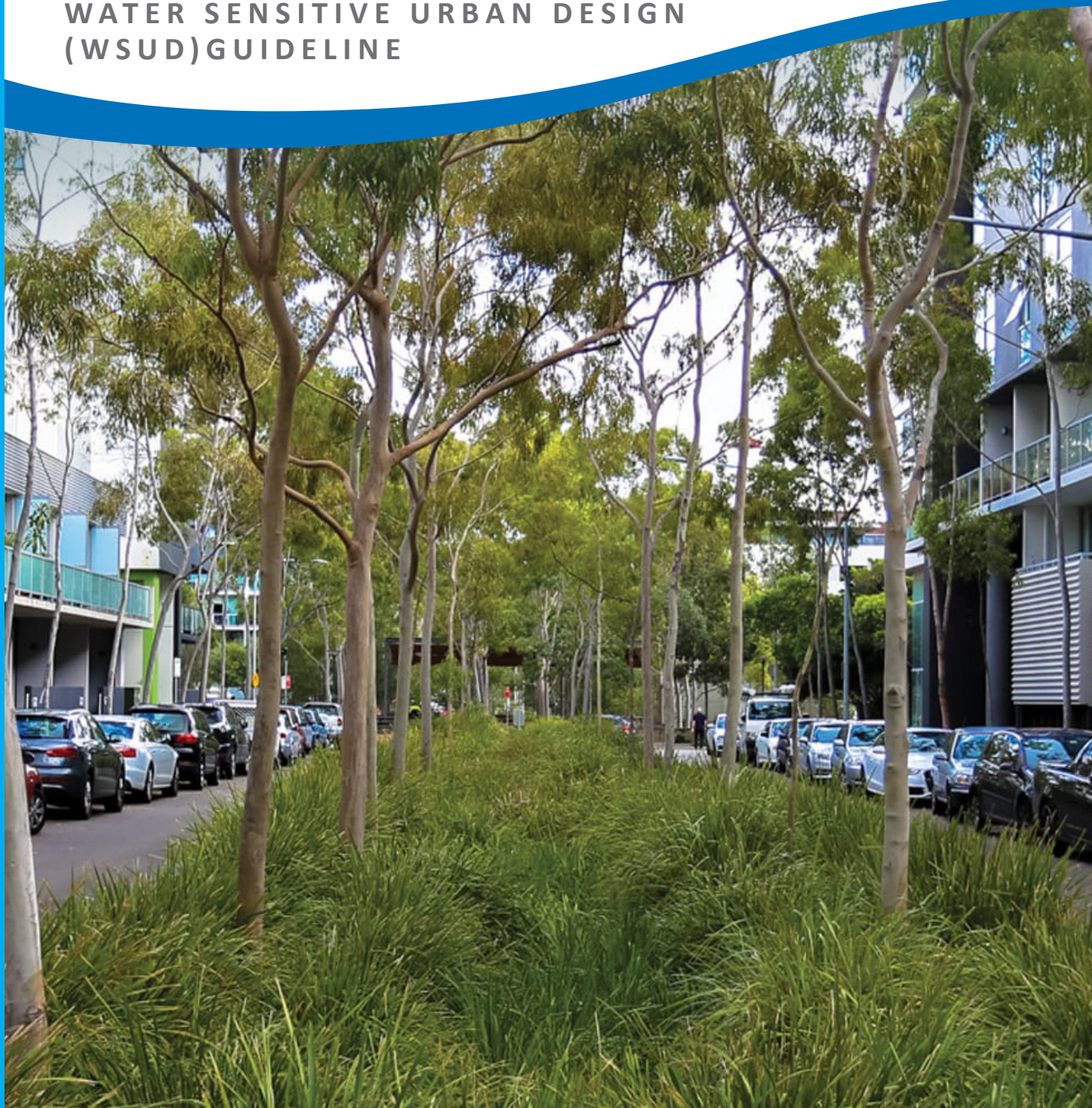


COFFS HARBOUR CITY COUNCIL



WATER SENSITIVE URBAN DESIGN (WSUD) GUIDELINE



Adopted by Council 25 June 2009

Revision September 2018



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1.0 INTRODUCTION

Urban development changes the dynamics of water within our catchments. Under natural conditions, a large amount of rainfall soaks into the ground to replenish groundwater and provide a source of water for plants. Once impervious or hard surfaces such as roads and roofs are introduced to a catchment the opportunities for infiltration are greatly reduced. This results in more runoff into our creeks and rivers, carrying litter, nutrients and sediments and increasing soil and in-stream erosion.

Water Sensitive Urban Design (WSUD) integrates land and water planning and management into urban design. WSUD is based on the idea that urban development must address the sustainability of water and minimise impacts on the water environment.

In Coffs Harbour, urban stormwater is one of the major impacts to our waterways and the Solitary Islands Marine Park. An important part of WSUD is applying best practice stormwater management, which helps to maintain, protect and improve the health of our waterways. This guideline addresses the stormwater management aspect of WSUD.

1.1 RELATIONSHIPS TO OTHER DOCUMENTS AND LEGISLATION

This guideline is consistent with many of the principles of the Commonwealth's Water Initiatives and the general state-wide approach to WSUD.

This guideline is consistent with the provisions of Coffs Harbour Local Environmental Plan (2013), Coffs Harbour Development Control Plan (DCP) 2015, State Environmental Planning Policies, and relevant policies adopted by Council.

Note: The Hearnese Lake/Sandy Beach DCP takes precedent over this guideline in relation to WSUD treatment types required of development occurring in this areas (until such time as this land is subject to the provisions of Coffs Harbour LEP 2013).

1.2 WSUD PRINCIPLES

This guideline aims to:

- Improve the quality of stormwater runoff from development
- Reduce runoff and peak flows resulting from development
- Integrate stormwater management into the landscape to improve public open space and the recreational and visual amenity of the community;

The principles of WSUD can be adopted at a lot, precinct and/or regional scale.

WSUD opportunities include:

- detaining, rather than rapidly conveying stormwater
- capturing and using rainwater and stormwater as alternative water sources
- using landscaping in our streets to filter water
- water-efficient landscaping
- protecting water-related environmental, recreational, and cultural values.

1.3 BASIX

BASIX (Building Sustainability Index) sets targets for water and energy savings in all developments and requires up to 40% reduction in potable water consumption. BASIX is focused on water efficiency rather than stormwater management and does not rule out the need to achieve the performance criteria in this guideline.

2.0 DEVELOPMENT TO WHICH THIS GUIDELINE APPLIES

Development Types

This guideline applies to the following development types:

- a. Subdivision of land with three or more resulting lots.
- b. Residential accommodation comprising three or more dwellings.
- c. Commercial and industrial development where:
 - i. new development comprises a total impervious area greater than 600m²; or
 - ii. alterations and additions to existing development comprises an increase in the site impervious area by more than 300m² AND results in a total impervious area greater than 600m² (see Note 3).
- d. Tourist development where:
 - i. new development comprises a total impervious area greater than 900m²; or
 - ii. alterations and additions to existing development comprises an increase in the site impervious area by more than 450m² AND results in a total impervious area greater than 900m² (see Note 3).
- e. Public administration buildings where:
 - i. new development comprises a total impervious area greater than 600m²; or
 - ii. alterations and additions to existing development comprises an increase in the site impervious area by more than 300m² AND results in a total impervious area greater than 600m² (see Note 3).
- f. Car parks (where not ancillary to other development to which this guideline applies) with a total impervious area greater than 600m².

Notes:

1. The requirements (a) to (f) do not apply to development of lots within a subdivision which comprises an approved stormwater management plan that achieves the performance criteria in this guideline. However, the performance criteria may be applied if the development of a lot significantly differs from the assumptions in the stormwater management plan.
2. Impervious area includes roofs and hardstand areas.
3. The performance criteria in Section 3 only apply to the alterations / additions - NOT the existing development.

3.0 PERFORMANCE CRITERIA

All development to which this guideline applies must comply with the principles, targets and detention requirements as detailed in 3.1 to 3.3.

Erosion and sediment control will be in accordance with requirements of Coffs Harbour DCP 2015.

3.1 WSUD PRINCIPLES

- Implement 'best practice' stormwater management techniques.
- Maintain natural drainage patterns.
- Maintain watercourses in their natural form, ie. watercourses should not be piped or channelled.
- Maintain adequate and intact vegetation buffers around waterways and sensitive areas, as per DCP requirements.

3.2 POLLUTANT REDUCTION TARGETS

Minimum reductions in average annual pollutant loads from a development site (comparing untreated developed case versus developed treated case) are:

- 80% reduction in total suspended solids (TSS)
- 60% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)
- 90% reduction in gross pollutants (size >5mm)

The pollutant reduction targets provided above do not apply to rural and large lot residential development (refer to requirements provided in 3.2.2 below).

3.2.1 MUSIC Modelling

MUSIC modeling undertaken to support development applications is to include 'split catchments' for source nodes, not 'lumped catchments'.

3.2.2 Rural and large lot residential development

Rural and large lot residential development does not need to comply with the pollutant reduction targets provided above.

Design and implementation of the following measures is generally considered acceptable, however each application will be addressed on a case-by-case basis.

- Road reserves may comprise turfed or planted swale drainage subject to Council approval. Drainage easements (where appropriate) will need to be incorporated in the design.
- On-lot measures may comprise rainwater tanks and dispersal of runoff (sheet flow) from impervious areas over grassed/planted areas. Dispersal is to include appropriate sediment and erosion control measures.
- Other methods as approved by Council.



3.2.3 Deemed to Comply Solutions

Development considered to be minor in scale by Council may apply the South East Queensland deemed to comply scenarios as summarised below. Further details can be found in the guideline Water by Design's Deemed to Comply Solutions – Stormwater Quality Management (South East Queensland) (2010).

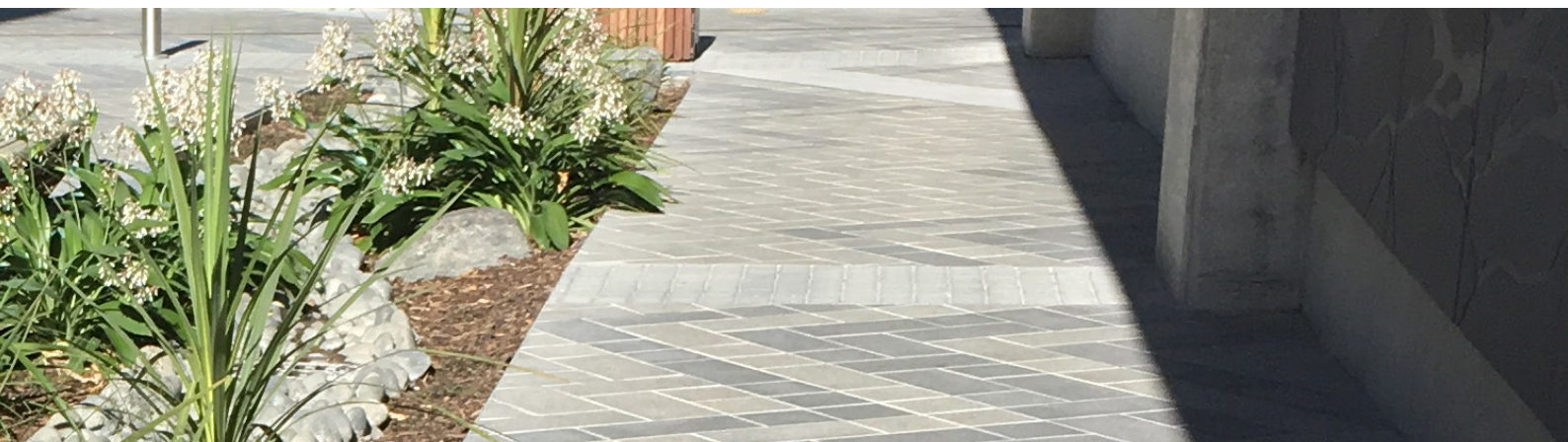
Table 1: Deemed to Comply development scenarios

LANDUSE	DEVELOPMENT SCENARIO	SCALE Site area
Residential	Residential greater than 2 lots up to 20 lots	N/A
	Residential greater than 2 dwellings (townhouse style up to 2 storeys)	≤ 12,500 m ²
	Residential high density multiple dwelling apartments (flats, high rise)	≤ 12,500 m ²
Commercial and / or Industrial	Commercial and / or industrial	≤ 12,500 m ²
Public building development	Public Building development	≤ 12,500 m ²

3.3 Detention Requirements

Discharges should generally be maintained at pre-development levels. To achieve this objective, development to which this Guideline applies must comply with detention criteria in:

- *Coffs Harbour City Council's Handbook of Stormwater Drainage Design*; or where this does not apply;
- Clause 12 (retardation / detention basins) in the *Northern Rivers Local Government Handbook of Stormwater Drainage Design*.



4.0 DESIGN REQUIREMENTS

4.1 LOCATION OF WSUD ASSETS

WSUD systems should be designed to seamlessly integrate with the local landscape or act as a prominent landscape feature where appropriate.

WSUD systems should generally be located:

- within the development property in a readily accessible location;
- offline from natural waterways; and
- outside any riparian zones and buffers required by Coffs Harbour DCP 2015.

Exceptions to the above will be considered on a case-by-case basis.

4.2 PROPRIETARY WSUD DEVICES

Use of proprietary devices will be considered on a case-by-case basis.

4.3 VEGETATED WSUD SYSTEMS SUCH AS SWALES AND BIORETENTION BASINS

4.3.1 General Design Requirements

Council's preference is to follow design guidelines published by Water by Design or other contemporary guidelines.

4.3.2 Landscape Requirements

Where WSUD is providing dual purpose to meet landscaping requirements, the landscaping controls within Coffs Harbour DCP 2015 must be addressed as part of the proposal.

Species selection and planting layout for vegetated WSUD assets is to preferably be undertaken by a suitably qualified Landscape Architect / Designer. Where a Landscape Architect / Designer's services are not used, the suggested planting species provided in Table 2 are to be utilized.

Table 2: Suggested plant species

CONTEXT	MINIMUM NUMBER OF PLANT SPECIES
Small scale urban	For bioretention filter area < 50m ² one of the following species: Shara™ <i>Lomandra fluviatilis</i> Evergreen Baby™ <i>Lomandra labill.</i>
	For bioretention filter area 50 - 100m ² : One to two species from the list provided in Appendix A
	For bioretention filter area > 100m ² : In the order of three to four species from the list provided in Appendix A
Medium-Large scale urban	In the order of four to six species from the list provided in Appendix A
Bushland	In consultation with Council

5.0 WSUD ASSET OWNERSHIP, TRANSFER PROCESS AND BONDING

5.1 OWNERSHIP OF WSUD ASSETS

WSUD assets and associated land may be either dedicated to Council or owned and managed by a private party. The latter may include Torrens title subdivisions with a Community Title lot that incorporates the WSUD assets and public roadworks.

5.1.1 Dedication of WSUD assets and associated land to Council

Proposals to dedicate WSUD assets and associated land to Council are to be resolved at the Development Application stage and must satisfy the requirements of Council's Dedication of Land Policy.

5.1.2 Privately owned WSUD assets

WSUD assets can be owned by a body corporate, property owner, or other private party. Privately owned WSUD assets are to be maintained by the property owners in accordance with the approved operation and maintenance plans.

5.2 ASSET TRANSFER PROCESS AND BONDING

The following process is largely based on *Transferring Ownership of Vegetated Stormwater Assets (Version 1)* (Water By Design, 2012).

5.2.1 Bioretention systems and other vegetated stormwater assets – transfer to Council

The following relates specifically to the transfer of bioretention systems as they make up the majority of WSUD assets. It also provides a general guide for other vegetated stormwater assets. Any departures from this process would be assessed on merit as part of the development application.

For the case of a bioretention unit serving multiple subdivision stages, the following criteria relate to ultimate development of all contributing stages.

Specific requirements relating to the following process are to be addressed at the Construction Certificate stage.

Subdivision Construction stage:

- Construct 'essential' elements of bioretention system and operate as a sedimentation basin until: 80% of subdivision is developed or for 4 years (whichever comes first). 'Essential' elements can be negotiated at Construction Certificate stage (i.e. construct the earthworks, profiling and hydraulic structures but it may include or exclude the drainage layers and media).
- Provide a maintenance bond for the 'essential' elements of the bioretention system.
- Provide a stormwater asset bond for the landscaping and the uncompleted components of the bioretention system. The stormwater asset bond will be 150% of the total cost of construction, establishment and maintenance of the landscaping and 150% of the cost of construction of the uncompleted civil components. Maintenance requirements will be based on the approved Operation and Maintenance Schedule.

Post-Subdivision Construction:

When 80% of allotment-building phase is complete or after 4 years following Practical Completion of the subdivision (whichever comes first):

- Remove allotment-building phase sediment protective measures from the bioretention system (where relevant).
- Install / construct any uncompleted works.
- Mulch, plant and establish the bioretention system vegetation.

Practical completion inspection of the landscaping and the remaining components of the bioretention system will be undertaken once the above three items are complete AND vegetation has established for at least one growing season (6 - 12 months).

Off-maintenance or final compliance inspection will be

undertaken 12 months after Practical Completion of the landscaping.

5.2.2 Proprietary systems – transfer to Council

The following provides an indicative process for the use of proprietary systems (e.g.. cartridge filter systems):

Subdivision Construction stage:

- For subdivisions: cartridge filters are not to be installed until 80% of allotment-building phase is complete or for 4 years following Practical Completion of the subdivision (whichever comes first).
- On single-lot development (e.g. multiple dwelling development): cartridge filters are not to be installed until the majority of the building/civil works are complete.
- Civil components that form part of the proprietary system (chambers and pipes) may be constructed during the above stages and either operate as part of a sediment capture system or kept off-line.
- Provide maintenance bond for the constructed components.
- Provide stormwater asset bond for the uncompleted components (e.g.. cartridge filters). The stormwater asset bond will be 120% of the cost of supply, installation/construction of the uncompleted components.

Post-Construction stage:

Practical completion inspection for a subdivision system will be undertaken once all the following items are achieved:

- 80% of subdivision is developed or after 4 years following Practical Completion of the subdivision (whichever comes first); and
- Allotment-building phase sediment protective measures have been removed from the proprietary system (where relevant).
- Installation / construction of any uncompleted works.

Off-maintenance or final compliance inspection will be undertaken 12 months after Practical Completion.

5.2.3 Private WSUD Assets

For WSUD assets that remain in private ownership, the following process is to be followed:

- During the construction stage, protection of the system is to be undertaken as described above for assets transferred to Council.
- Prior to the issue of an Occupation Certificate or Subdivision Certificate, a certificate from a suitably qualified inspector is to be issued to the Principal Certifying Authority to the effect that the system has been installed and complies with the approved design.

6.0 DEVELOPMENT APPLICATION AND CONSTRUCTION REQUIREMENTS

Table 3 lists the information required by Council at the various stages of development.

Table 3: Information required by Council

STAGE	INFORMATION REQUIRED / MATTERS TO BE RESOLVED	
Development Application (DA)	Concept WSUD/Stormwater Management Plan	✓
	Dedication of WSUD assets and associated land to Council	✓
	MUSIC Model in electronic format (see * note below) For staged developments provide results of entire project and individual stages as separate data.	✓
	Proprietary devices: sufficient detail to demonstrate suitability and effectiveness	✓
Civil Works Construction Certificate	Stormwater Management Plan - detailed	✓
	Revised MUSIC model in electronic format if proposal has changed from DA stage (see * note below)	✓
	Landscape plan which identifies any WSUD specific planting	✓
	Proprietary devices - technical specifications, proprietary operation and maintenance manuals and sufficient detail supporting devices efficacy claims	✓
	Operation and Maintenance Plan for each component of the system.	✓
	Strata / Community Title (draft) Plans where required reflecting Operation and Maintenance Plan.	✓
Building Certificate	Inspection compliance certificate for WSUD system	✓
During construction	Certification of bioretention filter media specifications (comply with FAWB) - supply a min. of 14 days prior to installation	✓
	In-situ saturated hydraulic conductivity testing (by independent test and certified)	✓
	WAE plans and Operation and Maintenance Plan if amend	✓

* Not applicable for Deemed To Comply Solutions

7.0 CONSTRUCTION AND ESTABLISHMENT

Construction and establishment of vegetated WSUD assets (eg. bioretention basins) should follow the protocols in Water by Design's Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (2010) or any superseding guidelines.

8.0 OPERATION AND MAINTENANCE

Suggested guidelines for the development of operation and maintenance plans for vegetated WSUD assets:

- *Water by Design's Maintaining Vegetated Stormwater Assets* (2012)
- *Adoption Guidelines for Stormwater Biofiltration Systems* (Payne et al, 2015).

9.0 REFERENCES

Coffs Harbour City Council (2000) *Urban Stormwater Management Plan*

John Wilson and Partners Pty Ltd (2006) *Coffs Harbour Water Integrated Water Cycle Management Concept Study*

Payne, E.G.I., Hatt, B.E., Deletic, A., Dobbie, M.F., McCarthy, D.T. and Chandrasena, G.I., (2015). *Adoption Guidelines for Stormwater Biofiltration Systems*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Water by Design, (2010). *Deemed to Comply Solutions – Stormwater Quality Management (South East Queensland)*. South East Queensland Healthy Waterways Partnership. Brisbane.

Water by Design, (2010). *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*, South East Queensland Healthy Waterways Partnership, Brisbane.

Water by Design (2012). *Maintaining Vegetated Stormwater Assets (Version 1)*. Healthy Waterways Ltd. Brisbane.

APPENDIX A LANDSCAPING SPECIES FOR WSUD SYSTEMS

Core functional bioretention plant species – WSUD plant species require the following features:

- They are able to tolerate short periods of inundation punctuated by longer dry periods. For bioretention systems these dry periods may be reasonably severe due to the free draining nature

(low water holding capacity) of bioretention filter media

- Generally have spreading rather than clumped growth form
- Perennial rather than annual
- Have deep fibrous root systems

SPECIES NAME	COMMON NAME	TYPE	HEIGHT (mm)	COMMENTS
Groundcovers – bioretention systems				
<i>Bacopa monnieri</i>	bacopa	prostrate	100	Not suitable for sandy soils with low water holding capacity
<i>Baumea teretifolia</i>		tufted	300-1000	Not suitable for sandy soils with low water holding capacity
<i>Carex appressa</i> * #	Tall sedge	Groundcover – tufted	1000	Not suitable for sandy soil with low water holding capacity
<i>Carex gaudichaudiana</i>	Tufted sedge	tufted	600	Not suitable for sandy soils with low water holding capacity
<i>Carex pumila</i>	Coastal sedge	tufted	250	Salt tolerant
<i>Cymbopogon refractus</i>	Barbed wire grass	tufted	300	
<i>Cynodon dactylon</i>	couch	turf	50-150	Mowing required to achieve smaller heights
<i>Cyperus polystachyos</i>	Bunchy sedge	tufted	600	
<i>Dianella caerulea</i>	Blue flax lily	tufted	600	
<i>Ficinia (Isolepis) nodosa</i> * #	Knobby club sedge	Groundcover – tufted sedge	600	Salt tolerant sandy conditions
<i>Gahnia aspera</i>	Saw sedge	tufted	1000	Not suitable for sandy soils with low water holding capacity
<i>Gahnia sieberiana</i> #	Red-fruit saw-sedge	Groundcover – tufted sedge	1500-3000	
<i>Imperata cylindrica</i> #	Blady grass	Groundcover – tufted grass	500	
<i>Juncus amabilis</i> *	South west NSW		500-1100	Grows in damp places
<i>Juncus flavidus</i> *	Mid west NSW		250-900	
<i>Juncus kraussii</i>	Sea rush	tufted	600-2300	Salt tolerant
<i>Juncus usitatus</i>	Common rush	tufted	500	Not suitable for sandy soils with low water holding capacity
<i>Lepidosperma laterale</i> #	Variable sword sedge	Groundcover – tufted sedge	500-1000	Shade tolerant
<i>Lomandra confertifolia</i>	Mat rush	tufted	400	Shade tolerant
<i>Lomandra fluviatilis</i>	Shara™	tufted	500	
<i>Lomandra hystrix</i> #	Green mat rush	Groundcover – tufted herb	1000	Shade tolerant - Not suitable for sandy soil with low water holding capacity
<i>Lomandra labill.</i>	Evergreen Baby™	tufted	400	
<i>Lomandra longifolia</i> #	Spiny headed mat rush	Groundcover – tufted herb	1000	Shade tolerant
<i>Pennisetum alopecuroides</i> #	Swamp foxtail grass West of range NSW	Groundcover – tufted grass	1000	Shade tolerant, this plant is not invasive
<i>Poa labillardieri</i> #	Common tussock grass	Groundcover – tufted grass	450	
<i>Sporobolus virginicus</i>	Marine couch	turf	To 400	Salt tolerant
<i>Themeda australis</i> #	Kangaroo grass	Groundcover – tufted grass	300-500	

SPECIES NAME	COMMON NAME	TYPE	HEIGHT (mm)	COMMENTS
Groundcovers – wetland system				
<i>Baumea articulata</i>	Jointed twig rush	Wetland DM / M	1000-2000 (6-8/m ²)	Slow growth plant solo
<i>Baumea juncea</i>	Bare twig rush	Wetland SM / T	300-1000 (8-10/m ²)	Slow establishment
<i>Baumea rubiginosa</i>	Soft twig rush	Wetland M / M	300-1000 (6-8/m ²)	Can be slow to establish
<i>Carex appressa</i>	Tall sedge	Wetland EM / M	500-1200 (4-8/m ²)	High surface area
<i>Carex breviculmis</i>	Short stem sedge	Wetland B / T	To 150 (6-8/m ²)	Very adaptable
<i>Carex inversa</i>	Knob sedge	Wetland EM / M	100-300 (8-10/m ²)	Rapid establishment
<i>Carex pumila</i>	Coastal sedge	Wetland B / T	100-250 (8-10/m ²)	Salt tolerant, drought tolerant
<i>Ficinia nodosa</i> (<i>Isolepis nodosa</i>)	Knobby club rush	Wetland SM / M	500-1500 (6-8/m ²)	
<i>Gahnia clarkei</i>	Tall saw sedge	Wetland B / T	1500-2500 (4-6/m ²)	Plant solo
<i>Gahnia siberiana</i>	Red fruited saw sedge	Wetland B / T	1500-3000 (4-6/m ²)	Aesthetic
<i>Juncus usitatus</i>	Common rush	Wetland SM / M	300-1200 (8-10/m ²)	Rapid growth
<i>Lepidosperma laterale</i>	Variable sword sedge	Wetland EM / M	400-900 (6-8/m ²)	Shade tolerant
<i>Lomandra filiformis</i>	Wattle mat rush	Wetland B / T	150-500 (6-8/m ²)	Shade tolerant when established
<i>Lomandra longifolia</i>	Spiny headed mat rush	Wetland B / T	500-1000 (4-6/m ²)	Shade tolerant
Small tree / shrub – bioretention systems			HEIGHT (m)	
<i>Breynia oblongifolia</i>	False coffee bush	shrub	1-2	
<i>Callistemon salignus</i>	White bottlebrush	tree	2-15	Full sun to semi shade
<i>Callistemon sieberi</i> #	River bottlebrush	shrub	3-10	Requires moist conditions during establishment but tolerates dry periods once established
<i>Banksia robur</i> #	Swamp banksia Kempsey - wollongong	small tree	1-1.5	Moist soils on coastal sand and peat soils
<i>Elaeocarpus obovatus</i>	Hard quandong	tree	5-30	
<i>Goodenia ovate</i> *	Hoop goodenia South east NSW	Shrub	2	
<i>Hardenbergia violacea</i>	Purple coral pea	shrub	1-3	Scrambling or prostrate, full sun to light shade
<i>Jacksonia scoparia</i>	dogwood	shrub	1-3	Sunny position
<i>Leptospermum liversidgei</i> #	Olive tea tree	shrub	1-3	Moist soil sunny position
<i>Leptospermum polygalifolium</i>	Wild may	Shrub	1-4	Sunny position
<i>Lomatia silaefolia</i>	Crinkle bush	shrub	1-2	Partial sun or shade
<i>Melaleuca ericifolia</i> *	Swamp paperbark South from Hastings river	Shrub / small tree	Up to 8	
<i>Melaleuca linariifolia</i> #	Flax-leaved paperbark	Small tree	5-10	adaptable over a wide range of climates and will tolerate less than perfect drainage. In nature it is often found in areas which suffer periodic inundation**
<i>Melaleuca viridiflora</i> #	Broad leaved tea tree Northern tropical australia	Small tree	3-10	adaptable to a wide range of soils and conditions but does particularly well on heavy clays which are waterlogged in the wet.**
Small tree / shrub – wetland system			HEIGHT (m)	
<i>Callistemon salignus</i>	White bottlebrush	Wetland B / tree	2-15 (1/m ²)	Moist sandy and alluvial soils, full sun to semi shade
<i>Callistemon sieberi</i>	River bottlebrush	Wetland B / shrub	3-10 (1/m ²)	Very wet to moist conditions in heavy clay soils, tolerates dry conditions once established
<i>Leptospermum liversidgei</i>	Olive tea tree	Wetland B / shrub	1-3 (2-4/m ²)	Moist soil, sunny position

SPECIES NAME	COMMON NAME	TYPE	HEIGHT (m)	COMMENTS
Large tree				
<i>Casuarina cunninghamiana</i> #	River she oak	Tree	10-35	
<i>Casuarina glauca</i> #	Swamp oak	Tree		
<i>Lophostemon confertus</i>	Brush box	tree	10-30	
<i>Lophostemon suaveolens</i> #	Swamp mahogany	Tree	5-25	Sunny position
<i>Melaleuca bracteata</i> #	Black tea tree North from macleay river	Tree	5-15	Sunny position
<i>Melaleuca nodosa</i>	Prickly leafed paperbark	tree	2-7	Sunny position
<i>Melaleuca quinquenervia</i> #	Broad leaved paperbark	Tree	8-25	
<i>Melaleuca sieberi</i>	Small leafed paperbark	tree	2-5	
Large tree - wetland system				
<i>Casuarina cunninghamiana</i>	River she oak	Wetland B / tree	10-35 (<1/m2)	
<i>Elaeocarpus obovatus</i>	Hard quandong	Wetland B / tree	5-30 (<1/m2)	Moist soils, tolerates water logged soils hardy and fast growing
<i>Lophostemon confertus</i>	Brush box	Wetland B / tree	10-30 (<1/m2)	Moist deep alluvial clay soils or moist sandy soils
<i>Lophostemon suaveolens</i>	Swamp box	Wetland B / tree	5-25 (<1/m2)	Moist sandy soils
<i>Melaleuca nodosa</i>	Prickly leafed paperbark	Wetland B / tree	2-7 (2-4/m2)	Deep sand s and moist sandy soils
<i>Melaleuca quinquenervia</i>	Broad leaved paper bark	Wetland B / tree	8-25 (<1/m2)	Very moist soils and alluvial soils, tolerates inundation
<i>Melaleuca sieberi</i>	Small leafed paper bark	Wetland B / tree	2-10 (<1/m2)	Moist sandy or poorly drained soils

List compiled from Gold Coast and Brisbane City Council plant selection detail.

Black highlighted are species endemic within North Coast NSW.

Species marked with * are identified by FAWB as having effective nutrient removal.

Species marked with # are SEQ WBD core functional plant species.

** <http://anpsa.org.au>

ZONE		DEPTH (m)	FORM	
P	Pool	1.5-0.5	S	Submerged macrophytes
DM	Deep marsh	0.5-0.35	M	Emergent macrophytes
M	Marsh	0.5-0.2	G	Groundcover
SM	Shallow marsh	0.2-0	T	tufted
EM	Ephemeral marsh	0 - +0.2		
B	Batters	+0.2 - +0.5		



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