Practice Note #5

VEGETATED DRAINAGE DEVICES

Water Smart design is the effective planning, design and building of homes, subdivisions, suburbs, towns and cities that are sensitive to the ecological needs of the waterways that are impacted by them.

Water Smart developments aim to mimic natural processes which reconnect neighbourhoods with local waterways and improve visual amenity and quality of life, make better use of all water within our urban areas, seek to protect the ecological health of urban waterways from the potential negative impacts of urban development, and to add value to our water and waterway management activities.

Each Practice Note in this series is designed to give greater detail and specific advice on different aspects of Water Smart developments and devices. The Practice Notes provide reviews of the main design features, advice on installation and maintenance issues, include diagrams and pictures to assist with implementation, and reference useful websites to assist with further research into Water Smart developments.

This Practice Note explains the various types of vegetated drainage measures that can be used to manage stormwater runnoff at homes and in medium size developments.

WHAT IS A VEGETATED DRAINAGE MEASURE?

Vegetated drainage measures are designed to detain, filter and treat stormwater runoff on individual properties or in larger scale developments. Vegetated drainage measures are a naturally efficient and cost effective Water Smart measure that can easily be included in the treatment train process (see Practice Note 1 for an explanation of treatment trains). Vegetated drainage measures provide a number of benefits to development design and the environment including:

- Slowing stormwater runoff, trapping sediment and providing bio-filtration treatment on site
- Assisting your development to meet water quality targets imposed by State Government and Councils, and satisfy other specific conditions placed on development applications
- Reducing environmental impacts through reduced stormwater runoff, reduced erosion, and improved water quality
- Reducing public infrastructure and maintenance requirements for managing stormwater flows resulting in less cost to the community
- Creating improved visual amenity
- Assisting in the reduction of the "heat island effect" created by land clearing and heavily built environments such as cities and residential suburbs. This is achieved through increased vegetation cover which promotes evapotranspiration and shading resulting in reduced air temperatures.

VEGETATED DRAINAGE MEASURES

There are a number of different types of vegetated drainage measures explained in this Practice Note. The basic principle in all these involves the conveyance of stormwater runoff over and through vegetation such as grass and shrubs prior to discharging to a formalised drainage system. This process acts to slow and detain stormwater runoff and provide natural treatment. Enhanced design features can be added which permits infiltration of stormwater through filter media which greatly improves the water quality.

Following is a summary of two commonly used vegetated drainage measures, namely swales and rain gardens, which can easily be incorporated around the home. Plants are an essential component of vegetated drainage measures. Native species, preferably local to the area, should be used. Refer to the planting guide at the end of this document (see **Table 2**) and contact you local nursery for further information.

Design, construction and maintenance information for swales and rainwater gardens is provided later in this Practice Note.

Source: Ku-ring-gai Council

Source: Hunter Councils

Source: City of Kingston

Source: Port Stephens Council

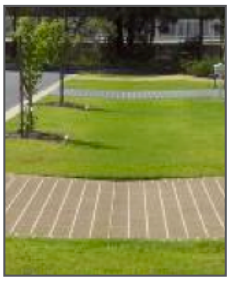
Figure 1: various vegetated drainage features that detain, filter and treat stormwater runoff.

Swales and buffer strips

Swales are shallow channels used to convey stormwater and are typically lined with vegetation such as grasses and/or shrubs. Buffer strips are vegetated strips often incorporated with swales, which encourage sheet flow and filtration of stormwater. **Figure 2** shows some examples of vegetated swales.

Source: Port Stephens

Source: STORM Consulting



Source: Wyong Council

Figure 2: Examples of vegetated swales

Rain gardens

Rain gardens can be used to control and treat roof water, rainwater tank overflows and runoff from paving. They are designed to fit into small areas such as back yards and landscaped gardens. What makes rain gardens unique is a special soil filter media and reliance on plants which treat the stormwater. **Figure 3** shows two examples of in-ground rain gardens.

Figure 3: Two examples of inground rain gardens

Other vegetated drainage measures

Other vegetated drainage measures that are available include: constructed wetlands; soak areas and green roofs. These measures have various benefits and a wide range of applications and they can also be incorporated in a residential setting.

A brief explanation of each follows. Please refer to Useful Websites for additional information.

Figure 4: Examples of small to medium size constructed wetlands

Constructed wetlands: are shallow, permanent water bodies that contain aquatic plants with an engineered outlet structure. **Figure 4** illustrates two examples of constructed wetlands. This Water Smart measure has superior water quality potential, although they tend to require a greater land area than other measures such as rain gardens and infiltration devices. Constructed wetlands have been in use for many decades, have a proven track record in operation and maintenance, and are often used as an aesthetic feature of urban sub-divisions.

Soak Areas: Many sites contain natural depressions or low points containing species that indicate temporary bogginess (for example, sedges, swamp grasses, frogs, water dragons and dragonflies). Consider utilising such sites within the system rather than altering existing drainage patterns, thereby promoting retention of natural drainage features and valuable habitat. An example of a shallow depression with native vegetation is shown in **Figure 5**.

Figure 5: Example of a Soak area (Image source: City of Fitchburg)

Green Roofs: A green roof is defined as any planted open space that is detached from the earth by a building or other structure. Green roofs promote evapotranspiration and help to reduce stormwater runoff from roof areas. Green roofs and green walls are common features in the newly developed concept of Water Sensitive Cities. They are aesthetically pleasing, provide habitat, improve insulation and enhance air quality and can even be used to grow fruit and vegetables. Examples of green roofs are shown in **Figure 6**.

Figure 6: Green roofs in a commercial and urban setting

SWALES AND BUFFER STRIPS

Swales are used in the place of 'kerb and gutter' systems and concrete drains to filter and direct stormwater into downstream Water Smart measures and trunk drainage systems.

Location

Swales can be used instead of pipes or street kerb and gutter. Swales and buffer strips are typically integrated with landscape features such as garden beds, alongside paving and driveway/road edges. Some examples of larger swales are illustrated in **Figure 7**; however they can just as easily be included in small areas and garden beds around the home. **Figure 8** provides examples of buffer strips. Flat or steep sites are not appropriate for swales – see Design section for further information.

Design

The most important consideration for swale design is the slope. Typically swales are designed with a longitudinal slope of 1% to 4%. Slopes less than 1% will result in either stagnation or minimal flow. Slopes greater than 4% will not slow stormwater flows and result in erosion of the soil and vegetation. Other important design features to note:

- Swale design should be based on conveying a certain size flow; typically this is the smaller but more frequent rainfall events. This keeps the swale size small (i.e. width and depth of flow), though it will result in overflow during larger storm events.
- Long swales provide greater treatment due to increased stormwater detention time.
- When installing large swale systems (>10m in length), it is recommended to install a subsoil drainage pipe beneath the swale with a gravel surround. This is especially necessary for flatter swales of 1-2% slope so as to reduce sogginess.
- Select appropriate vegetation to be planted in the swale. The type of vegetation used e.g. grass, shrubs or trees, will greatly influence the capacity of the swale to convey stormwater. The denser and larger the vegetation used the less capacity available to convey water.
- Swale outlets should be connected to the drainage system whether that is a grated inlet pit, channel, waterway or other Water Smart Measure.
- Buffer strips used adjacent to car parks and larger hard stand areas should have an area of approximately 10% of the pavement area that drains to it.

Figure 9 shows a typical swale detail. Larger swales should have moderate side slopes (as opposed to steep) to permit easier maintenance and mowing (if grass).

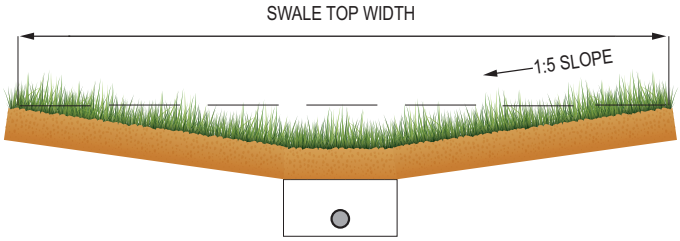


Figure 9: Typical swale cross section with sub-soil pipe.

Figure 7: Key parts of a typical domestic rainwater system.

Vegetated swale at Fern Bay seaside village, Port Stephens (note grass buffer along road kerb edge)

Newly constructed road-side grass swale in Port Stephens. Note: jute mat is used for erosion control during plant establishment.

Figure 8: Roadside swale. (Source: Dr Scott Arthur).

Buffer strips provide a pre-treatment of stormwater runoff prior to entering a formalised drainage system like a swale or channel. Buffer strips rely on shallow flows (generally not exceeding the height of the grass or vegetation), which are evenly distributed along their edge in the form of sheet flow. A typical swale edge detail is provided in **Figure 10**.

Even flow is encouraged over the buffer strip by using a flush pavement edge or by adopting regular breaks in a kerb edge as shown in **Figure 11**.

Vegetation and soil

Swales can be lined with grass or larger vegetation such as taller sedges, shrubs and even trees. Native vegetation should be used wherever possible and preferably indigenous. When designing swales, consider the following:

- Shrubs and sedges, when planted from tube stock, should be placed at a density of 8-10 per m^2.
- Use jute or other organic mats and sediment fences to provide sediment control whilst the vegetation is establishing. See useful websites at the end of this practice note.
- Use imported topsoils, or stockpiled topsoil from the site in the top 200mm of the swale to encourage plant growth. Please note any soils used from the site may require treatment for dormant weed seed.

Refer to the planting guide at the end of this document (***Table 2***) and contact you local nursery for further information.

Maintenance

During the plant and grass establishment phase, swales will require routine monitoring and possibly maintenance. Common maintenance activities that are likely to occur on a regular basis (annually) include:

- Re-instatement of native plants
- Removal of weeds which can choke the swale and drainage structures and prevent healthy native plant growth
- Repair of erosion spots and removal of accumulated sediment build up
- Removal of gross pollutants such as plastics bags, bottles and general litter (this is more applicable to commercial and public facilities).

Where swales have been installed to manage flows of a specific magnitude, then management of vegetation may be required i.e. maintain shrub growth to a certain height and bulk. Overgrown vegetation can choke swales and substantially reduce their flow capacity resulting in localised nuisance flooding.

Munmorah State recreation Area, Central Coast

Figure 11: Drainage in car park. (Above top, Source: M.Wierzbicki) (Above Source: Auckland Council).

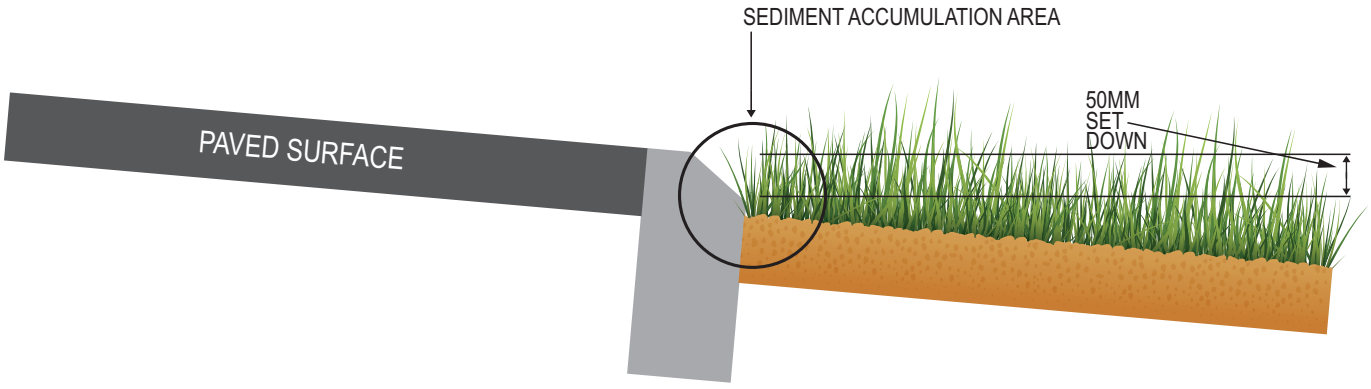


Figure 10: Typical cross section of a buffer strip

RAIN GARDENS

Rain gardens are used to slow and filter stormwater runoff from roofs, rain-water tank overflows and pavement areas like driveways, footpaths and courtyards. Large areas like car parks and roads will generate more runoff which can be managed by larger rain gardens which are called bio-retention basins.

Specific plants and drainage filter media is required in order to filter and treat the stormwater in rain gardens, and this forms a key component of their design.
There are three basic styles of rain gardens, which are summarised below and shown in **Figure 12**:

- Planter boxes (above ground)
- In-ground structures that are lined
- In-ground structures that encourage infiltration

(Source: Ku-ring-gai Council)

(Source: Melbourne Water)

Figure 12: Exampes of an in-ground raingarden and an above-ground raingarden planter box

Location

Rain gardens can be located within individual lots or in the streetscape and they are suitable for residential, industrial and commercial applications. Rain gardens require a small footprint compared to other stormwater treatment measures and can be easily integrated into landscape features. **Figure 13** gives some examples of rain gardens used in various situations.

Rain garden car park Brisbane City Hall. (Source: Nevue Ngan Associates).

Rain garden car park Brisbane City Hall. (Source: Nevue Ngan Associates).

Rain garden in ground. (Source: CRJA landscape architects).

Figure 13: Raingardens used in various situations

Design

A number of key design considerations exist when determining how to select and install a rain garden. **Figure 14** shows the basic components of a rain garden which are further discussed in this section.

Size

The size of a rain garden is directly related to the size of the area draining to the device. The surface area of a rain garden is generally sized at 2% of the area draining to it. This assumes a filter media depth of 0.3m, if the depth is more or less than this, then the surface area should be reduced or increased accordingly.

Lining

Rain gardens are commonly lined to prevent infiltration of water into the surrounding soil. Builders plastic or other such impermeable membranes are generally used. Lining is an important consideration especially when rain gardens are located near buildings and other structures likes roads. The lining prevents saturation of the surrounding soil which can be a problem especially when shrink/swell clays are present. The dos and don'ts for managing infiltration are further explained in Water Smart Practice Note No.3 – Infiltration Devices.

Infiltration

When installing rain gardens into sandy or free draining soils, or away from structures such as buildings and foundations, infiltration to surrounding soils is appropriate. In this instance the subsurface collection drain (shown as "perforated pipe" in **Figure 14**), can be omitted although the overflow structure is still required. Infiltration rain gardens are not appropriate in densely developed residential areas such as inner city suburbs or unit developments.

Plumbing

Rain gardens should include an overflow mechanism, to ensure ponding only occurs for a few hours after rain. This enables smaller but more frequent rainfall events to be treated, and minimises potential for mosquito habitats through prolonged ponding of water. The overflow must be connected to the site drainage system. See ***Figure 15*** for an example of overflow outlet structures.

It is recommended that a plumber install the rain garden pipe system, including inlets from roof and paved areas, sub surface drainage, outlet and overflow structures.

Figure 15: Rain garden overflow. (Source: Andrew Haliburton).

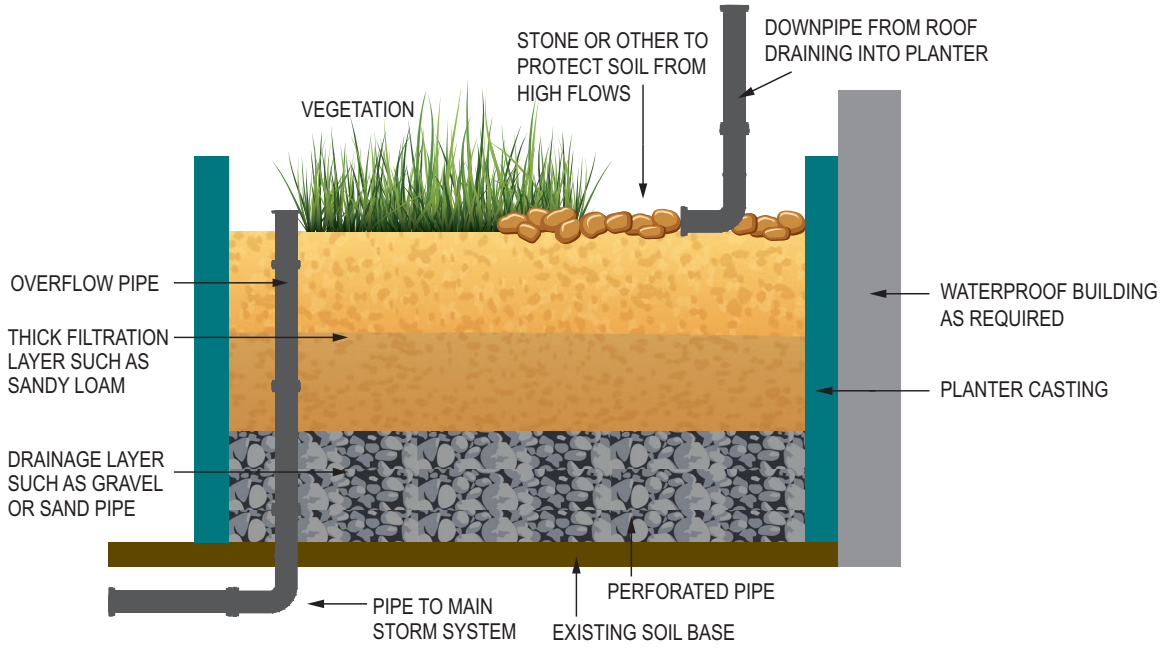


Figure 14: Design components of a rain garden (adapted from Melbourne Water)

Subsurface drainage

Lined rain gardens require the installation of a perforated or slotted pipe underneath the filter media, this enables the collection and removal of filtered stormwater. This subsurface drainage pipe should be connected via gravity flow to the site stormwater system. ***Figure 16*** shows an example of a PVC perforated pipe prior to placement of drainage layer and filter media.

Slotted pipe used for subsurface drainage

Rain garden during construction with subsurface pipe in the base. (source: Ku-ring-gai Council)

Figure 16: Rain garden subsurface drainage

Rain garden filter layers

The various filter and drainage layers are a crucial component of every rain garden. Careful selection and installation of the granular material is required to ensure the device does not clog and fail. The following three types of backfill material are used:

- *Filter Media:* allows infiltration of water but also has a minor organic component to support plant growth. Organic matter may take the form of finely screened compost or chicken manure etc. There are some commercially available products that meet this requirement (see Useful Websites at the end of this Section) or otherwise a mix of 4 parts white washed sand and 1 part topsoil can be used.
- *Transition layer:* beneath the filter media, coarse washed river or beach sand should be laid.
- *Drainage layer:* surrounds the perforated pipe and consists of clean gravel with no fine material (use between 7mm and 10mm stone size).

The filter and drainage material should be applied in layers as shown in **Figure 17**. Indicative depths for each layer are also noted in this Figure. Note: there is no need for filter fabric to separate these layers.

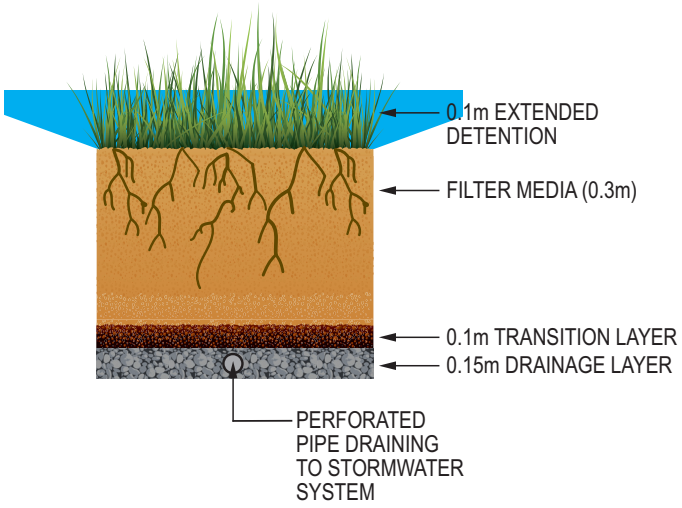


Figure 17: rain garden filter and drainage layers (adapted from Wyong Council)

Planting

Vegetation utilised in a rain garden permits soil aeration, which reduces clogging, and also provides a surface for bio-film growth which greatly enhances the treatment effectiveness. Therefore plants are an essential component of the system. As rain gardens are free draining and hold little water, the use of native drought tolerant shrubs, sedges and grasses is required. Choose species that:

- are perennial rather than annual species
- have spreading root systems rather than a deep fibrous root system

When selecting appropriate plants seek the advice of your local nursery and use the planting guide provided at the end of this Practice Note – **Table 4.**

Plants should be installed at a density of 8 plants per square metre and tube stock should be used. This is recommended to assist in the establishment of the rain garden. An example of suitable plant stock and planting a rain garden are shown in **Figure 18**. A surface layer such as mulch or stones is recommended to help retain moisture and stabilise the surface layer.

Figure 18: Mature tube stock for rain garden planting (left) and planting a rain garden in Sydney (right).

Materials list

What you need to build a rain garden.

An in-ground rain garden of 3m^2 size, measuring 2m long x 1m wide x 0.5m depth, will require the following materials listed in Table 1 (this example is for a sealed rain garden which requires lining). These items can be purchased from a hardware and/or landscape supplier;

RAIN GARDEN MATERIALS	QUANTITY
90mm diameter slotted drainage pipe (Ag Pipe)	2 l/m
90mm diameter uPVC pipe	2 l/m (depends on connection and discharge point)
90mm diameter uPVC 90 degree bend or 2x 45 degree bends	Remove accumulated sediment (sludge). Clean out if necessary.
PVC grate 90mm finishing collar	1
PVC 90mm diameter domed pipe grate	1
PVC 90mm tee	1
PVC 90mm cap	1
PVC liner (builders plastic)	6 m^2
PVC tape	2 rolls
7mm or 10mm screenings for drainage layer at base	0.3 m^3
Filter media (mix together)	
- washed sand	0.6 m^3
- finely screened compost or topsoil	0.2 m^3
Gravel mulch (stones preferably or heavy mulch)	0.15 m^3
Hardwood sleepers (class 1) or similar for rain garden surround	6 l/m
Native plants - 150mm pots (use more than 2 or more pant species)	20

Table 1: Materials and quantities for a 3 m^2 in-ground rain garden (adapted from Melbourne Water).

l/m = lineal metres
m² = square metres
m³ = cubic metres
mm = millimetres

Mantenance

Ongoing maintenance of rain gardens is essential but it is easy as explained below.

Maintaining healthy plant growth is vital to ensure the filter media remains un-clogged and good treatment of stormwater continues throughout the rain garden's life. Maintenance can be divided into routine and periodic activities. Routine maintenance is recommended every 6-12mths and includes the following;

- Weeds need to be removed
- Replacing dead plants with new native stock
- Occasional watering, possibly only during prolonged dry periods (this is expected to be minimal if the correct plants are selected)

Periodic maintenance tasks that maybe required very 2-5yrs include;

- Inspect inflow and overflow pipe connections for blockages from debris and plant matter
- Remove sediment and organic debris from rain garden

If slow draining of the rain garden occurs (i.e. water ponding for more than 2 days) than it is likely the filter media has become blocked due to surface compaction or clogging with sediment. In this instance the surface layer, filter media and plants will require replacement. This may be required once very 10-15 years, though it greatly depends if adequate routine maintenance is undertaken.

PLANT SELECTION

Table 2 below provides a general guide to indigenous plant species which suit different vegetated drainage measures. It is recommended that you consult with a nursery to select the most appropriate species local to your area.

Further information on plant selection and tips for planting are provided in Practice Note 6 – Water Smart Gardening.

Table 2: Planting Guide for various vegetated drainage measures.

PLANT SPECIES	PLANT TYPE	DESCRIPTION	SOAK AREA	RAIN GARDEN	FILTER STRIP	GRASS SWALE	CON-TOUR BANK	GREEN ROOF
Pigface *Carpobrotus glaucescens*	Ground Cover	Leaves - succulent and triangular Flowers - bright pink and yellow Flowering time - much of the year						x
Violet-leaved Goodenia *Goodenia hederacea*	Ground Cover	Leaves - dark green above silvery below Flowers - yellow Flowering time - spring-summer						x
Guinea Flower *Hibbertia pedunculata*	Ground Cover	Leaves - shiny dark green Flowers -yellow Flowering time - spring					x	x
Prickly Spider Flower *Grevillea juniperina*	Ground Cover to shrub	Leaves - Stiff and needle–like Flowers - yellow-green or red Flowering time - spring			x		x	x
Tussock Grass *Poa labillardieri*	Grass	Leaves - long, narrow and grey Flowers - plum-like heads on stems			x	x	x	x
Green Coastal Tussock Grass *Poa poiformis*	Grass	Leaves - Fine green and arching Flowers - purplish grey Flowering time - summer			x	x	x	x
Kangaroo Grass *Themeda australis*	Grass	Leaves - narrow soft linear leaves turning maroon in winter			x	x	x	x
Tussock Rush *Juncus usitatus*	Grass	Leaves - reduced to sheaths at the base of the stems. Flowers - pale	x	x				
Jointed Twigrush *Baumea articulata*	Grass	Leaves - wide shiny mid green stems tapering to a tip	x					
Twigrush *Baumea rubiginosa*	Grass	Leaves - compressed and slightly twisted	x					
Fringed Wattle *Acacia fimbriata 'Dwarf form'*	Shrub	Leaves - thin and edged fringed with tiny hairs Flowers - fragrant globular lemon yellow Flowering time - winter to spring		x	x		x	x
Myrtle Wattle *Acacia myrtifolia*	Shrub	Leaves - tough, thick and dark green Flowers - globular and cream in colour Flowering time - late winter			x		x	x
Harpin Banksia *Banksia spinulosa*	Shrub	Leaves - narrow to oblong and toothed Flowers - cylindrical and orange/yellow in colour Flowering time - winter			x		x	x
Fringe Myrtle *Calytrix tetragona*	Shrub	Leaves - tiny and bright green Flowers - star-like and white to pink in colour Flowering time - spring to summer					x	
Pink Spider Flower *Grevillea sericea*	Shrub	Leaves - stiff, pointed ends and silver below Flowers - spider-like and pink in colour Flowering time - winter to summer					x	
Austral Indigo *Indigofera australis*	Shrub	Leaves - blue green Flowers - purple pea flowers Flowering time - spring					x	x
Prickly Tea-tree *Leptospermum juniperinum*	Shrub	Leaves - prickly forming soft dense thickets Flowers - white Flowering time - spring to summer			x		x	x
Toothed Daisy Bush *Olearia tomentosa*	Shrub	Leaves - pale and hairy Flowers - white or mauve Flowering time - spring			x		x	x
Thyme Honey-myrtle *Melaleuca thymifolia*	Shrub	Leaves - small and crowded on stem Flowers - violet to purple Flowering time - spring	x	x				
Heath Myrtle *Baeckea imbricata*	Shrub	Leaves - small and rounded leaves Flowers - white to pink Flowering time - spring to summer	x	x				
Swamp Baeckea *Baeckea linifolia*	Shrub	Leaves - narrow needle-like Flowers - white Flowering time - spring to summer	x					

USEFUL WEBSITES & GUIDES

Design & General Information:

Simple and concise explanation of WSUD and infiltration – go to Treatment Measures in the following Melbourne Water website link: http://wsud.melbournewater.com.au/

Information on rain gardens and swales, including short videos, see Melbourne Water's website: http://raingardens.melbournewater.com.au/

Rain garden and Infiltration Trench construction: Little Stringy Bark Creek – keeping Stormwater in the Catchment. http://www.youtube.com/watch?v=AYJNcky_4fw. Source – Melbourne Water.

WSUD Planning and Design in the Sydney Region—Guidelines, tools, resources and picture library www.wsud.org

Sydney Conservatorium of Music – green roof, article in SMH: http://www.smh.com.au/news/environment/green-roofs-growing-in-popularity/2008/09/16/1221330837223.html

Constructed Wetland information: wikipedia.org and design: http://www.melbournewater.com.au/content/library/wsud/melbourne_water_wetland_design_guide.pdf and http://www.environment.gov.au/water/publications/urban/water-sensitive-design-national-guide.html

DVD presentation by Landcom on vegetated drainage measures such as bio retention (rain gardens) and constructed wetlands: http://www.landcom.com.au/videoPlayer.aspx?media=/downloads/uploaded/landcom_trimmed_1d11.flv&TB_iframe=true&height=403&width=471&TB_video=true

Technical Information:

Information on a range vegetated drainage measures: National Guidelines for Evaluating Water Sensitive Urban Design— Appendices: http://www.environment.gov.au/water/publications/urban/water-sensitive-design-national-guide.html

WSUD Design—Technical Guidelines for Western Sydney: www.wsud.org/tools-resources/

WSUD Design—Technical Design Guidelines for South East Queensland". www.waterbydesign.com.au/

Rain garden filter media specification prepared by Faculty of Advanced Water Bio filtration, Monash University. Download Adopted Guidelines from http://www.monash.edu.au/fawb/publications/index.html

Other:

Sustainable Gardening Australia - useful tips on sustainable gardening, landscaping, and composting, find a landscape gardener. www.sgaonline.org.au/

Nursery and Gardening Industry Australia: Publications and Resources: http://www.ngia.com.au/Category?Action=View&Category_id=122

REFERENCES

Archer, J., Le Hunt, R., & Hodges, J., (1993). The Water Efficient Garden: a practical and innovative guide, from planning through to established gardens. Random House, Milsons Point NSW.

BMT WBM Pty Ltd (2009). Evaluating Options for Water Sensitive Urban Design – A national guide. ted drainage measures: National Guidelines for Evaluating Water Sensitive Urban Design — Report and Appendices: http://www.environment.gov.au/water/publications/urban/water-sensitive-design-national-guide.html

Handrek, K. (2001). Gardening Down-under: A guide to healthier soils and plants. CSIRO Landlinks Press, Collingwood Vic.

Hunter New England NSW Health (2005). Living with Mosquitoes in the Lower Hunter and Mid-North Coast Regions: http://www.hnehealth.nsw.gov.au/__data/assets/pdf_file/0020/63470/Living_With_Mosquitoes_-_2nd_Edition_-_DECEMBER_2009.pdf

Melbourne Water - Healthy Waterways. http://raingardens.melbournewater.com.au/

Van Dok, Wendy. (2004). The water-efficient garden: a guide to sustainable landscaping in Australia. Glen Waverley, Vic.

Walsh, K, (1995). Water-Saving Gardening: waterwise plants and practices in Australia. Reed Books, Chatswood NSW.

Sainty G.R., Jacobs S.W.L (2033). Waterplants in Australia—A Field Guide. Sainty and Associates Pty Ltd.

DEVELOPED BY

A project delivered by the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS): a program of the Environment Division of Hunter Councils Inc.

This project has been assisted by the NSW Government through its Environmental Trust.

HCCREMS MEMBER COUNCILS

Address for Correspondence:
Environment Division
Hunter Councils Inc.
PO Box 3137
THORNTON NSW 2322
Phone: (02) 4978 4020
Fax: (02) 4966 0588
Email: execassist@huntercouncils.com.au