

WHY PLANT WATER SMART GARDENS?

Water Smart gardens are becoming increasingly popular and necessary due to the benefits gained by reducing the impact of development on the natural environment. Water Smart Gardens are primarily used to achieve either of the following objectives:

- Reduce water consumption (and therefore costs)
- Provide vegetation to naturally filter and treat stormwater runoff (see Practice Note 5)

Other benefits derived from incorporating Water Smart Gardens into your home or development are:

- reduced need for fertilisers and nutrients which have a detrimental impact on bushland and waterways
- reduce the "heat-island effect" which is created by urban areas that are dominated by concrete and asphalt with little or no vegetation (vegetation promotes evapotranspiration and a return to the natural water cycle).
- enhance the natural habitat for local fauna such as insects, worms, birds etc
- provide aesthetically pleasing environments

This Practice Note provides guidance on designing a Water Smart garden, selecting appropriate plant and turf, and tips on ground preparation and planting.

GARDEN DESIGN

Water Smart Gardening and BASIX
(www.basix.nsw.gov.au)

Water Smart developments should include an area of native garden in order to gain a credit in the State's Water & Energy Rating System BASIX (see Practice Note 1). Indigenous or low water use species reduce the water demand of gardens included in the development. The location of the native garden and type of plants must be shown on Development Application and Construction Certificate Plans.

Integrated landscaping

For your development to truly be Water Smart, your gardens should be designed and integrated into the overall site plan. Locating gardens near impervious surfaces, such as driveways and footpaths, will enable the garden to receive valuable stormwater runoff. The garden can also act to treat runoff by detaining and filtering the flow. Gardens should be planned to ensure appropriate plant species are selected to take advantage of any natural landforms and conditions (such as shaded areas, deeper soils, and natural depressions that may hold water). Where ever possible, plants should be grouped by their required watering schedule, as this will assist with utilising the natural water regime, water retention aspects of the soils, and reduce ongoing garden maintenance. Below are examples of plants that require different levels of watering to survive:

- High water requirements: lawns, leafy vegetables, soft-fruit trees, exotic shrubs like azaleas and camellias, flowering herbaceous annuals and many bulbs
- Medium water requirements: hardy vegetables like pumpkins and potatoes, hardy fruit trees and vines like nut trees and grapes, many herbs, some exotic shrubs, most grey-leaved or tomentose (hairy) plants, roses and daisies
- Low water requirements: most Australian natives including banksias, grevilleas, hakeas, wattles and eucalypts. Succulents and cacti and some exotic ornamentals such as bougainvillea also fall within this category.

It is recommended that a variety of plants be utilised throughout the garden areas to protect against plant die off caused by drought, plant specific disease or pests. Select hardy specimens from various genera but with similar horticultural, watering and soil fertility requirements, unless a formal avenue of a single species is required for a landscape theme or style.

Wind and sun protection

Gardens often need to be protected from harsh winds and full sun to reduce moisture loss from leaves and soil and damage to plants from the harsh Australian sun. To ensure your garden areas are Water Smart, carefully consider plant selection and planting location before establishing the gardens.

A multi-rowed windbreak, planted in staggered heights, can offer downwind protection equivalent to about seven times the height of the plants. Garden placement should take advantage of any existing landforms offering wind protection, such as locating garden beds on the downwind side of any existing rows of trees or landform rises.

Locate trees to provide seasonal shade to garden areas, outdoor entertaining areas and to north and west facing walls of the house. Deciduous trees allow winter sun to penetrate whilst helping to break wind flow with their network of branches. Evergreen trees need to be more strategically placed so that they do not cast deep shade on living areas of the house and garden.

Where the development does not have sufficient room to plant trees for a sun and wind screen, consider installing a lattice work fence which can support climbing plant. This screen will provide weather protection and privacy from prying eyes. Note that in certain circumstances, a fence may need planning approval (depending on location, scale, and construction requirements) so check with your local council prior to commencing work.

Always consider the effects of light and heat reflection off building walls (especially North and West facing walls that will capture much of the sun's heat) when planning the location and plant species to be used in gardens.

Minimising lawn area

Lawn areas are traditionally regarded as the perfect Australian garden, enabling endless games of backyard cricket for the children. However large grassed areas also require significantly more water, fertiliser and maintenance per unit area to maintain healthy growth when compared to garden beds or treed areas. In addition, lawn areas require significantly more on-going maintenance (lawn mowing) than other garden types. The emphasis now is to reduce lawn areas and this is encouraged through the BASIX rating system where credit is given for including water wise planting in the development. Rationalising the size and design of lawn areas will result in significant reductions in water use.

Options include:

- Replace lawn areas with vegetable patches, garden beds, screen planting, or a shade tree and garden bench
- Locate lawns closer to the house for more efficient watering from rainwater tanks.
- Choose other groundcovers and low-growing shrubs to create feature areas
- Use other porous surfaces for high traffic areas and/or entertaining areas, such as mulch, gravel or permeable paving units
- Alter maintenance practices to encourage deeper root growth (reduced mowing frequency, higher blade height, less frequent but deeper watering)
- Use grass species that are slow growing and require little water to remain green. Check with your local supplier for native and introduced grasses that suit local conditions

If you need to retain an area of lawn, **Table 1** provides details on the most water efficient grass varieties for your particular conditions.

Other grasses that are also suitable and are possibly more indigenous to your area include:

- Axonopus affinis (Carpet Grass)
- Digitaria didactyla (Blue Couch)
- Microlaena stipoides var. stipoides (Lawn grass) – Australian native
- Paspalum vaginatum (Saltwater Couch),
- Sporobolus virginicus (Marine Couch) – Australian native
- Zoysia macrantha (Prickly Couch).

GRASS VARIETY	DISEASE	WEAR	SHADE	FROST	DROUGHT TOLERANCE	WATER EFFICIENCY
GREEN COUCH (CYNODON DACTYLON)	3	3	1	2	2	5
KIKUYU	3	5	1	4	5	4
SIR WALTER	4	4	5	3	4	4
PALMETTO ST AUGUSTINE BUFFALO	4	4	5	5	4	4
SAPPHIRE SOFT LEAF BUFFALO	4	5	5	5	4	4
EMPIRE ZOYSIA	4	5	3	5	5	5
1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good and 5 = Excellent						

Table 1: A list of water efficient grass varieties (Source: Bram Nicholson and Associates and Millers Turf, 2007)

Table 2 provides details on a variety of readily available low maintenance ground covers suitable for the coast and ranges of NSW, that can replace conventional lawns.

Table 2: Low maintenance groundcovers that can be used to replace lawns

NAME	DESCRIPTION	LOCATION	SOIL	SUN	WATERING	MOWING	USE	ESTABLISHMENT
<i>Dyrrama flavius</i>	Australian native turf	Dry or boggy conditions	Any	Full sun to part shade	Drought tolerant	None or very little	Can filter grey water	Turf rolls available. Needs watering in the first 3-6 weeks.
Natehre's green <i>Sporobdus virginicus</i>	Prostrate fine leaf native grass	Dry or boggy conditions, handles heat and light frost	Many (prefers sandy)	Full sun to part shade	Drought tolerant	Few times per year	High traffic. Can filter grey water	Propagate from small tube or plant division
Fog Fruit <i>Phyla nodiflora</i> <i>Lippia</i> ,	1-3c, high creeper, up to 2m wide. 2cm lilac flower most of the year	Tropical, subtropical and temperate regions. Frost resistant	Tolerates waterlogging and salt spray	Full sun to part shade	Some during warmer months	None	High traffic	Propagate from rooted runners or plant division
Kidney Weed <i>Dichondra repens</i>	Rapid growing, 1-2cm high 1m wide. Small green-yellow flower in Spring	4 Moist areas. Does not tolerate cold climates	Well drained soil	Sun or shade	None / low	A few times a year	Takes mild traffic; recover well after waer: good around edges / strips	Propagate from plant division, seed (purchase from native plant nurseries) or tube stock. Can be invasive – don't plant near less vigorous plants
Swamp mazus <i>Mazus pumilio</i>	Forms dense mat 1m wide. Small white – violet flowers in Spring	Frost resistant	Tolerates moist boggy soils	Sun or partial shade	Survives on rainfall if in correct position	None or few	Tolerates foot traffic in moist, shaded areas	Propagate from plant division or plants – purchased from native nursery
Lawn chamomile <i>Chamaemelum nobile</i> <i>Treneague'</i>	Non-flowering 5-10cm high	Warm and cold climate	Most soil types	Moderate sun	Very low water needs once established	When necessary	Good companion plant. Use as a tea, shampoo and fertiliser	Propagate from plant division, seeds or plants. Needs considerable weeding while establishing.
Penyroyal <i>Mentha pulegium</i> var. <i>'Decumbens'</i>	2-3cm high, spreads 70cm/yr. Red-purple flowers in Summer, fragrant when stepped on	Grows in warm and cold climate	Grows in all soil types, preferring moist area	Full sun to part shade	Only in extreme heat. Not drought tolerant	None	Suited to high traffic	Propagate from runners (cut stem pieces that have rooted and replant), plant division, seeds or plants – purchase from herb nursery
Corsican Mint <i>Mentha requenii</i>	3-6cm high green cushion, hardy, tiny flowers early Summer, fragrant when stepped on	Suited to grow among stones in a path	Well drained, mildly enriched and moist soil	Full sun or light shade	Low water needs	none	Can stand some traffic	Propagate from plants (set in early Spring) or plant division (in Spring)
Wild Thyme <i>Thymus Serpyllum</i>	3-12cm high carpet, aromatic leaves, rosy to white flowers	Grows in warm and cold climates	Suited to dry, well drained soil as well as damp clay	Full sun	None to low	Withstands mowing but not usually needed	Suited to occasional trampling. Herb that can be used to for tea	Propagate from seeds, or cuttings. Plant in Spring, 20-20cm apart. Apply manure or compost in Autumn and Spring
Creeping boobialla <i>Myoporum parvifolium</i> <i>'prostrate form'</i>	4cm high. 1-2m wide. Small white or pink flowers in Spring - Summer	Ideal for coastal areas. Frost hardy. Salt tolerant	Any soil with good drainage	Full sun	Drought tolerant	None required	Good for weed suppression	Propagate from plants (from native nurseries) or from tip cuttings (harder areas of the plant stem)

PLANT SELECTION

Choosing water efficient plants for your garden requires identifying species that are best suited to your site's soil and microclimatic conditions. Below are some ideas on how to identify appropriate plant species:

- Exploring your neighbourhood noting the plants that seem to thrive in neighbour's gardens
- Street trees planted by councils, are a good guide, as they are often selected due to their low water requirements
- Visit the Savewater® Plant Selector (www.savewater.com.au) for low and moderate water use plants suitable for coastal areas of NSW
- Utilise plant guide books specific to your local area (a number are listed at the end of this Practice Note)
- Visit your local nursery, as they will be able to advise on appropriate species for your location and needs
- Talk to your local council as many councils offer residents discounts on purchase of native plants

Although it is always preferable to utilise Australian native plants, some exotic plants from the Mediterranean region, California and Southern Africa are able to survive on limited water and a range of soil conditions similar to those found in Australia. Confirm the suitability of these species with your nursery or local Landcare group to ensure they are not classed as noxious weeds. When purchasing plants from a nursery, check that any trees have self-supporting trunks

- Ensure plants are not root bound before purchasing, i.e. excessive root growth, particularly where the roots have become highly matted around the base and sides of the pot
- Ensure plants have healthy green leaves before purchasing, rather than yellow or blotchy ones that may indicate mineral deficiencies or other problems.
- Use tube stock rather than large pot plants which will result in faster plant establishment and better survival rates



SOIL PREPARATION

Prior to planting, it is important to ensure the soil is properly prepared to ensure it enables air and water flow, has organic matter present and is the appropriate consistency and pH.

Preparation activities are dependent on the type of soil at your site. There are three main soil types; Sandy soils, clay soils or loamy soils.

- **Sandy soil** - Sandy soils drain rapidly and dry out quickly in dry conditions. Depending on the plant species to be used, it may be necessary to mix a wetting agent into the soil to aid with moisture remaining in the soil and not draining away. Also adding a compost or organic material will aid with plant establishment. Screened garden compost or chicken fertiliser can be used.
- **Clay soil** - Clay soils hold the most water and are dense soils, making them unsuitable for many plant species. In some instances it may be necessary to dig in larger soil particles to clay soils to improve aeration and improve water flow. Products such as gypsum or lime can be added to clay soils to break down the soil structure which will aid in planting.
- **Loamy soil** - Loamy soils contain high levels of organic matter and are comprised of a mixture of both coarse and fine particles, making them ideal for plant growth.

As a 'rule of thumb' ensure a top soil depth of at least 150mm prior to applying turf and at least 400mm for garden beds. **Table 3** lists common soil preparation options that may be suitable for use in your garden.

SOIL ISSUE / PROBLEM	SOIL PREPARATION SOLUTION
Heavily compacted soil	Mechanical aeration (rotary hoe, ripper, etc) to break up soil. Consider the addition of coarse particles or organic matter at this stage to reduce the chance of re-compaction
Acid Sulphate soil	Check with your local council to see if your development is sited on acid sulphate soils. Lime can be added to neutralise acid sulphate soils, or seek specialist advice on remediation options for larger areas.
Saline soils	Soil additives such as gypsum are useful for counteracting saline or sodic soils. Always test the soil to determine the correct application rate.
Clay Soils	Establishment of hardy, deep rooted trees which will draw water from low down and assist in breaking up soils.
'Dead soil'	Till soil and add organic matter (potting mix, compost or equivalent) to introduce organic matter and microbes to improve soil health, improve water infiltration and retention and ability to support plant life.
Dry soil	Dig in wetting agents or water storing crystals to assist in moisture retention (these provide a reservoir of moisture for plant roots during dry periods). Add organic matter to encourage microbial and worm activity which aids in moisture retention.

Table 3: Soil types and preparation solutions

PLANTING

To encourage plant establishment and reduce the risk of die back when planting, follow the guidance below:

- Ensure there is an adequate depth of drained soil for the stock size to be used
- Do not plant if the air temperature is over 35°C
- Do not plant if the soil is water-logged
- Ensure planting holes are twice the width of the plant and at least the depth of the root ball when planting shrubs or trees
- Ensure planting holes are at least 500mm in diameter and at least the depth of the root column, when planting tube stock
- Ensure the sides of the hole are rough rather than smooth, as this will promote root growth
- Place remaining excavated soil as a mound around the edge of the root ball to create a watering well to assist with water retention
- Cover the soil surface with mulch and water each plant well directly after planting



Top image: (source Melbourne Water)

Bottom image: Volunteer planting. (Source: Million Trees.)

MULCHING

The use of mulch has been proven to reduce evaporation of soil moisture, suppress weed germination, and stabilise soil temperature, necessary for the creation of a healthy garden. To ensure your garden receives the benefits of mulching and is Water Smart, follow these guidelines:

- Apply 75-100 mm of organic mulch over the surface as a mulch blanket for massed plantings, ensuring mulch is not placed within 150mm of trunks and stems (to prevent rot)
- Use mulch with a mixture of textures to ensure water freely passes through
- Where available use a mulched product with a combination of chipped bark and leaves as these products will decompose at different rates, and supply a variety of minerals and nutrients over time
- Do not apply fresh organic products directly to the soil (such as sawdust, woodchips and pine bark) as these products extract nitrogen from the soil (nitrogen drawdown), causing plants to sicken and die
- If you must use a fresh organic mulch, either compost the material before use, or add fertiliser (manure or blood and bone) before application to retain adequate nitrogen levels
- When planting on steep slopes, where mulching is difficult, utilise a 100% organic matting (jute), to provide the effect of mulching and assist trees and shrubs to be established
- Inorganic mulch can be used, but does not add humus and nutrients to the soil. Use crushed rock, gravel and brick, silicon chip, coarse river sand, scoria or river pebbles to complement landscape themes or where loose materials may be blown away. Avoid blue metal as this can alter soil pH. Use to a depth of about 50 mm to allow water penetration
- Avoid using mulch in areas where it is likely to be washed away by surface flow during heavy rain
- Mulch should be topped up annually

HARDENING OFF PLANTS

Seedlings that are grown either indoors or in a greenhouse will need a period to adjust and acclimatise to outdoor conditions, prior to planting in the garden. This transition period is called "hardening off".

Hardening off gradually exposes the tender plants to wind, sun and rain and toughens them up by thickening the cuticle on the leaves so that the leaves lose less water, preventing transplant shock. The process of

hardening off your plants depends on the age of plants, species type and climate conditions, so there is no firm guide, but the process of hardening off should follow the rough guide described below:

- A week or two before you intend to set plants out in your garden, stop fertilising and reduce the amount of water they receive. Give plants just enough water so they don't wilt
- Take your plants outside for a short time. Give the plants a half hour of filtered sunlight (under an open-branched tree or similar) during the warmest part of the day. If the weather is windy, put the plants in a spot where they're sheltered
- Gradually increase the amount of time the plants are outside and the intensity of the light that they're exposed to. By day seven, the plants should be outside all day. Move the plants into progressively sunnier locations during the week so they get used to their future condition in the ground. However, make sure that you bring the plants in every night
- Plant as per the previous advice

ON-GOING PLANT CARE

To ensure your Water Smart garden thrives and provides all the benefits discussed, it is necessary to maintain the plants and ensure they are receiving enough water, trimmed to promote growth and free from weeds. Following is guidance on how to effectively maintain your Water Smart gardens.

Watering

All new plantings should receive regular watering to assist with survival. The rule of thumb is:

- Water once per week for the first three months
- Water once per fortnight for the next six months
- Water at least once per month for the next six months

Ensure you adjust these frequencies to suit local soil, climatic and weather conditions.

Efficient watering is achieved by:

- Watering slowly to encourage deep root penetration, but do not saturate the sub-soil layer as this can cause leaves to wilt
- Water according to soil moisture and plant needs rather than to a fixed schedule. Test the soil 50 mm below the mulch to see if it is dry before watering
- Divide garden beds into sections and alternate between them at watering times, allowing deep soaking on each occasion

- Minimise evaporation by watering in the early morning or late after-noon. Apply water to the roots rather than the foliage, as some plants are susceptible to pest and fungal diseases if left with damp leaves, especially overnight
- Avoid watering in windy conditions as much water is lost to spray drift
- If using a handheld hose, use a trigger-operated nozzle to control flow whilst moving between plants
- If using an irrigation system, install an underground or surface drip system to make sure the water reaches the soil below the mulch (see next section for further discussion on Irrigation)
- Give lawn areas a good soaking rather than frequent shallow waterings. During prolonged dry periods it may be necessary to water every third day to the equivalent of 15 mm of rain

Water Smart irrigation

When designing your Water Smart garden, determine if you will need to install an irrigation system, remembering that with the correct plant selection and use of stormwater run-off from paved areas may reduce or eliminate the need for supplementary irrigation, which is the goal of a Water Smart garden.

If it is determined that irrigation is appropriate, the following guidance should be followed to ensure the system utilised is as efficient as possible.

- Match the irrigation system's design and specifications to the site conditions (water source, water quality, soil type, soil depth, moisture infiltration rates, evapotranspiration rates, frequency and intensity of rainfall, slope, plant choice and layout). Consult an irrigation specialist for a tailor-made efficient system
- Refit an existing system with the most efficient low-flow fittings (jets, sprays and nozzles, etc.). Fix any leaks from joiners, hoses and pipes. Rationalise system layout, adjusted to suit the changing requirements of plants as they mature (generally reduced water demand)
- Connect each garden area to separate valves to create hydro-zones. Plants grouped with similar water needs are precision-watered to their needs
- Water according to the weather and plant needs, not to a fixed time schedule. Consider installing soil moisture indicators as a guide and allow the sensors to override any automated system
- Reduce the frequency of watering so that plants become less reliant on irrigation. Monitor plants individually and replace systematic watering with manual watering of stressed plants
- Install drip systems for sparsely distributed plants and underground or surface leak systems for dense garden beds as they are the most efficient irrigators
- With spray systems, avoid overlap-ping areas or directing it onto paths and driveways

- Ensure that water is directed to the roots as much as possible
- Routinely inspect irrigation systems for blockages, leaks or worn parts

The costs and maintenance of an efficient irrigation system should be measured against the benefits. Consider re-designing and replacing with plants that have less demand for constant supplementary water.

Weed Removal

Regularly control weeds to reduce competition for both soil moisture and nutrients. Hand-pull or hoe weeds when they are young. Remove weeds before they set seed for the next generation.

Avoid herbicide application wherever possible. If persistent woody weeds do not respond to manual or organic methods, cleanly cut near the stem base stem and paint with herbicide on the fresh wound. Use herbicides only in accordance with the manufacturer's instructions.

Pruning

Minimise pruning as soft growth is more prone to drying out in hot winds and, if not hardened by the end of the growing season, plants can be damaged in the colder months.

Grassed areas

Avoid excessive fertiliser application on grassed areas as this stimulates leaf growth, increasing moisture loss and nutrient-enriched run-off. It also requires more frequent mowing.

To increase water penetration into grassed areas and reduce water loss through evaporation, use a lawn aerator (or a garden fork) to create small diameter holes over the lawn surface.

After Rain

Avoid walking or driving over wet ground as heavy soils are easily compacted when wet. Soil compaction significantly reduces infiltration rates.

Check for soil erosion and repair erosion points before they magnify. Identify the cause and undertake corrective measures (redirect drainage, disperse flow and reduce velocity). Check for sediment build-up in vegetated filter strips, drainage swales, soak areas and ponds. Collect sediment and stabilise in areas that are less prone to erosion.

USEFUL WEBSITES

Australian web site dedicated to promoting better water conservation. Includes an online plant selector for various climatic regions of Australia: www.savewater.com.au

Garden design, plant selection and watering information for the Hunter Region can be found on Hunter Water's website — see Save Water In the Garden www.hunterwater.com.au/Save-Water/

Hunter Water savewater!® gardens. Drought tolerant plant lists for Backyard Gardens, Cottage Gardens, Formal Gardens, <http://www.hunterwater.com.au/Resources/Documents/drought-tolerant-plant-list.pdf>

Fact Sheets on native plants and gardening in Hunter & Central Coast Region: <http://www.cen.org.au/resources/educationalresources/factsheets.html>

Providing an alternative in native plants: <http://www.aabr.org.au/images/stories/resources/planting/GrowMeInstead.pdf>

Sydney Water In your garden' program with details on efficient watering, garden design, plant selection: <http://www.sydneywater.com.au/Water4Life/Inyourgarden/>

Water Commission Project —: [http://www.ap.urscorp.com/watertool/\(X\(1\)S\(2qcatu22eqcugb55p3kjwfp\)\)/Resources.aspx](http://www.ap.urscorp.com/watertool/(X(1)S(2qcatu22eqcugb55p3kjwfp))/Resources.aspx)

Muswellbrook Shire — general tips for Saving water in the garden. <http://www.muswellbrook.nsw.gov.au/Council-services/Environment/My-environment/Save-water-garden.htm>

NSW plant identification and database for native and introduced species <http://plantnet.rbgsyd.nsw.gov.au/>

Information on native plant prepared by The ABC— Gardening Australia. <http://www.abc.net.au/gardening/factsheets/native.htm>

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

Tips on sustainable garden and water use: <http://www.livingthing.net.au/RC/pp/ACFGreenHomeNSW.pdf>

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

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