South African Landscapers’ Institute & Rand Water’s

GUIDE TO WATER WISE LANDSCAPING

2017
Servest with its biodiversity consulting partners Local Biodiversity Council have garnered a consistent reputation – ‘working with the power of nature’ – one of self-sustainability, financial efficiency and accountability by providing you with a service that is accredited by Ecocert Biodiversity Certification. With over 20 years of scientific and professional, environmental experience is underpinned by what we refer to as ‘functional restoration,’ a holistic, efficient and cost effective model that solves the problems surrounding excess water consumption, additive usage, storm water management, erosion, waste management and habitat destruction.
The future of Water Wise landscaping

Drought, a word that has appeared more frequently in our conversations of late. To ignore the reality about the changes to our climate would be like shooting ourselves in the foot.

Water and the availability of water is the heartbeat of climate change. Understanding, respecting and preserving this resource is of vital importance because it affects our planning, it affects our ability run our business and business operations, which all have major financial implications. Not to mention our environment, ecosystems and ultimately all life on earth is dependent on this resource for survival. All water resources used in and to maintain landscapes must therefore be used sparingly and with utmost care.

Acknowledging this, Rand Water and SALI have collaborated to produce this Guide to Water Wise Landscaping which will take you on a journey to understand some of the complexities associated with supplying potable drinking water and how climate change could affect this supply in the future.

We then go on to elaborate on practical water wise principles that can be implemented to help reduce water use (from any source) in the landscape. By adapting landscapes to reduce their need on water, the landscaping industry can make a substantial contribution to reducing demand on water resources.

SALI together with Rand Water has for the first time modified the criteria for the SALI Awards of Excellence to include a Water Wise element in each category of the awards. This shift in mind-set creates a platform to celebrate different types of landscapes for the value they add in various water conservation principles. Finally the latter part of the guide showcases this.

With such achievements in one of the worst droughts faced by South Africans, we hope that this guide will inspire anyone who engages in a landscaped environment to appreciate it and to be Water Wise.

Meagan Donnelly & Leslie Hoy

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This publication is a joint venture between Rand Water and the South African Landscapers’ Institute (SALI) 2017.

Cover: Water Wise and eco-friendly landscaping. Designed and implemented by DDS Landscaping, the project known as Veld Garden, Robertson received the Trophy for the Best Environmental Landscape Work at the 2017 South African Landscaper’s Institute Awards of Excellence.

“In this 7 590 square metre garden overlooking a game farm, DDS Landscaping has managed to achieve the brief of the client ‘to rehabilitate the surrounding veld into the garden’. In an area of the Little Karoo that is renowned for its poor soil and huge variations in climatic conditions, these obstacles have been overcome by the correct use of plants and their suitability for the site.

The speed in which the plants have grown can only attest to the high degree of soil preparation done prior to planting. Proper soil preparation addresses two main issues. The first deals with ensuring the adequate supply of nutrients that will allow your plants to grow. The second pertains to creating a soil structure that allows your plants to properly obtain and uptake those nutrients.

DDS Landscaping had to contend with game grazing newly planted grass plugs as well as finding out that the planting of certain grass species before the winter months was not successful.

It is only through lessons like this that are learnt and corrected a contractor can learn and implement corrective changes to enhance the sustainability of the garden design. The planting palette makes use of interesting Eragrostis and Helichrysum species that are not traditionally used on landscape sites”. - SALI National Judge.
Guide to Water Wise Landscaping

Footprint of supply

Rand Water is at the forefront of supplying potable water to over 16 million people.

Water has always been a scarce resource on the Witwatersrand as the goldfields of Johannesburg were established 70km from the nearest river in 1886. To this day, Johannesburg remains the only major city in the world that is not built on a river or lake.

Supplying potable water to Gauteng evolved over many years.
- On 8 May 1903, The Rand Water Board was officially established by the Rand Water Board Incorporation Ordinance No. 32 of May 1903 to supply water to Johannesburg.
- The 1903 Rand Water Board included members of the Johannesburg Town Council, The Chamber of Mines, and other existing local authorities in the Witwatersrand.
- To augment the supply of water from the early boreholes and reservoirs, Rand Water embarked on large water engineering projects.
- In 1914, the Board adopted the Vaal Development Scheme (1914–1924), which involved the construction of the Vaal Barrage and the provision of purification and pumping works in Vereeniging.
- This was followed by the building of the Zwartkopjes Pumping Station and Vaal Dam (1938) and Zuikerbosch Pumping Station (1949).
- The Tugela-Vaal scheme (1974) fed water into the Vaal River via an inter-basin transfer of water from the Tugela River in KwaZulu-Natal. Water continues to be released into the Vaal River system from the Sterkfontein Dam via the Nuwejaar Spruit and Wilge River.

Water from Lesotho
- The Lesotho Highlands Water Project (LHWP) also transfers water to the Vaal Dam.
- The project comprises six dams and three pumping stations. It diverts the flow of the Orange River via tunnels through the Maluti Mountains, channelling the water to the Eastern Free State, and then on to the Vaal Dam.
- Phase I of the LHWP was completed in 1998. Phase II is scheduled for completion in 2025.

Water footprint
- Today Rand Water provides bulk potable water to a service area of over 20 000km².
- The ‘Rand Water Gauteng’ supply footprint ranges from Rustenburg and Carletonville in the North West Province to Sasolburg and Heilbron in the Free State. ‘Rand Water Mpumalanga’ operates as far east as Bushbuckridge, with water supplied from various sources in Mpumalanga supplying over 1 million people.
- More than 15 million people live in the ‘Rand Water Gauteng’ footprint and over half of South Africa’s economic activity takes place within it.
- Rand Water is the largest bulk water utility in Africa and is one of the largest in the world.

What is potable water?
Potable water is water from natural sources that has undergone costly purification processes to render it safe to drink. Delivered through a complex system of pipes and reservoirs, it is often referred to as municipal water.

“Water conservation is destined to be an inevitable part of everyday life”.
- Leslie Hoy, Rand Water
Water Wise living

In our water-stressed country, a Water Wise campaign to value water and use it wisely has been essential.

How has Rand Water been involved in promoting Water Wise concepts?

- During the drought of 1994, Rand Water launched a Horticultural Forum as part of their campaign to highlight the importance of Water Wise landscapes and low water landscaping.
- The aim was to promote processes which assisted in the development of low water landscapes that use water effectively and efficiently.
- In 1995, Rand Water initiated a water conservation campaign using ‘Manzi’ the mascot.
- In 1997, the Water Wise brand was launched.
- During the next two decades, Rand Water launched numerous Water Wise campaigns aimed at increasing awareness of the need to value water and to use it wisely.
- Campaigns over the years have included Water Wise guides to landscaping and golf courses, plants for bees and butterflies, developing food gardens, firescaping your property, removing waterholic invasive species, zoning your garden, water features, wetlands and many more.
- The Three Drop Water Wise Guide divides plant species into low, medium and high water users. It is especially useful for developing hydro-zoned landscapes.
- Water Wise has increased its education footprint to include, amongst others, school and community vegetable gardens, rural community education and a Water Wise campaign to businesses, industry, the public (of all LSM levels) as well as to all sectors of the green industries.
- Following international trends, the Environmental Management Services of Rand Water has become increasingly interested in quantifying the amount of potable water used in landscapes.
- This pioneering work is a valuable foundation to Water Wise landscaping campaign.
- Water Wise landscapes and landscape design are honoured by Rand Water through trophies presented at garden centre shows and in the green industries over many years.

Water Wise in action

Rand Water have developed four educational Water Wise demonstration gardens.
- Water Wise House at Rand Water’s Vereening Purification Station is used purely for school group education (2003).

For more information about the campaign visit www.randwater.co.za and click on the Water Wise logo.

A history of honouring water wise landscape design


2013: Life Landscapes for Alexander Forbes, Sandton.

2014: Cape Contours for the Mitchell's Plain Hospital, Cape Town.

2015: Life Landscapes for Roobergkraans Private Game Lodge, Bela Bela.

2016: Life Landscapes and Real Green (Joint Venture) for Sun City.
Water and climate change

Landscaping for climate change

Green buildings are increasingly incorporating a range of living walls and roofs.

Water is the primary medium through which climate change impacts will be felt by humans and the environment.

Whilst governments grapple with the climate change commitments arising from the Kyoto Protocol (1997) and Paris Agreement (2016), local organisations are developing monitoring tools and quality assurance platforms for the new low carbon economy.

For landscapers, the climate change movement to reduce energy in green buildings, quantify water use in landscaping and develop landscapes that are in harmony with nature is gathering. The most notable responses locally can be seen in three ways.

Quantifying water use in landscapes

Landscapers are tapping into apps, calculators and resources to offer clients the option to scientifically monitor the amount of water used in landscape projects.

There are a range of water scoring solutions for doing this supplied by Water Footprint, Carbon Disclosure Project, Audubon International and Green Building Council of South Africa (GBCSA). The efficient use of water on the green building site accounts for just over 15% of the scoring in the GBCSA ‘Green Star’ rating system.

Installing living walls

Vertical gardens or biowalls can be grown on just about any type of wall, with or without the use of...
 Water and climate change

soil. They can be placed both on outdoor and indoor walls.

Indoor vertical walls decorate atriums such as award winning examples at Netcare Pinehaven (2016 Gold Medal) Atrium on 5th (2016 Gold Medal) or Rosebank Corner which received a Double Gold Medal Award in the 2017 South African Landscapers’ Institute Awards.

Outdoor living walls are used as ecological signage as used at the Entertainment Centre, Sun City or cover entire buildings such as The Grand in Rivonia, Johannesburg. Most recently, the planting of climbers in containers at all levels of a multi-storey car parkade at the certified ‘4 Green Star’ green building - 4 Stan Road, Sandown, Sandton - is likely to evolve into a multi-storey bird and eco-friendly living wall.

Creating living roofs

Most of the award winning roof gardens make use of Water Wise endemic grasses and succulents.

Heimo Schulzer Gardens’ living roof garden in Higgovale, Cape Town was honoured with a Double Gold Award in the 2017 SALI Awards.

Other examples include the treed roof of the parking area at Nelson Mandela Square in Sandton, Grace Hotel in Rosebank, Life Sciences Faculty, University of the Western Cape, library of Stellenbosch University, and roofs of all the guest rooms at the boutique hotel, Forum Homini, Cradle of Humankind, west of Johannesburg.

Why are living roofs so successful?

Planted up with Water Wise endemic flora in a thin layer of soil medium on the roof of a building, living roofs beautify our environment by:

• Assisting a building to blend into their environment;
• Stabilising the climate in a building;
• Reducing heating and cooling costs;
• Reducing storm water run-off;
• Filtering pollutants and carbon dioxide, out of the air;
• Increasing wildlife habitat in built-up urban areas.

My favourite roof garden

Botanist, landscaper and author, Marijke Honig was honoured for her exceptional contribution to landscaping in 2016. An expert in indigenous plants and the ecology of fynbos, Marijke’s favourite roof garden is one her team designed for the Department of Environmental Affairs and Planning in Dorp Street, Cape Town.

Reflecting the endemic biomes of the Western Cape, the roof garden is designed as a Water Wise educational space. With a soil depth of 30cm, the team packed a lot of biodiversity into a small roof garden.

Source:
Expect intense weather

What does intense weather mean for the landscaping industry?

Crisis in Cape Town

- In 2008, the City of Cape Town predicted future shortages of potable water.
- By early 2017, the worst water crisis in living memory had hit the City of Cape Town.
- Fuelled by three winters of below-average rainfall, the city went to Level 4 water restrictions on 1 June 2017.
- Level 4 restrictions:
  - Prohibit the use of municipal drinking water for gardens, landscaping, water features or filling up swimming pools.
  - Golf courses, sports facilities, parks, schools and learning institutions are not allowed to establish new landscaping or sports fields, except if irrigated only with non-potable water.
  - Flushing toilets with non-potable water (e.g. greywater or rainwater) is encouraged.
  - Residents are encouraged to use no more than 100 litres/person/day.
- It is estimated that several years of good winter rainfall will be needed to reverse the crisis.

What does intense weather mean for the landscaping industry?

- There will be more ‘drier dry spells’ and ‘wetter wet spells’ resulting in intense floods and intense droughts.
- The arrival of intense floods may relieve water shortages, but floods will damage bridges and result in more water-borne diseases.
- Rivers, lakes and dams will be impacted mainly by increasing variability in rainfall.
- The western side of South Africa will become drier, impacting on agriculture. The eastern side will have longer spells of drought. Both sides however will experience heavy rains when they do occur.
- It is predicted that there will be an increased number of people without access to sufficient fresh water. This will worsen food shortages.
- Overall, water supplies will diminish in quantity and quality.

Urban water efficiency

In anticipation of projected growth and water shortages, cities across South Africa have passed by-laws to promote best practice. A City of Cape Town by-law (2006) states:

- No watering of residential gardens between 10h00 and 16h00.
- Hosepipes must be fitted with automatic self-closing devise.
- No automatic top-up systems fed from a potable (drinking) water source may be used to supply swimming pools and ponds.
- No person may hose down a hard-surface or paved area using potable water, without getting prior written notice from Council.
- Potable water may not be used to damp building sand and other building materials to stop them from being blown away.
- The maximum flow rate from a tap installed in a wash hand basin may not exceed 6 litres per minute.
- Toilet cisterns may not exceed 9.5 litres in capacity.
- No automatic cistern or tipping tank may be used for flushing a urinal.
- Major water users (using more than 3 650Kl per annum), excluding multiple dwellers’ units, must conduct an annual water audit.
- Commercial car wash industries must recycle a minimum of 50% of the water used in their operations.
- No person supplied with water in terms of this by-law may sell such water without written permission or special agreement.
The drought of 2015/2016 is one of the biggest drought events in living memory*, says Professor Bob Scholes, Wits Global Change and Sustainability Research Institute (Cape Argus, 9 March 2016).

What is the definition of drought? “If a specific area in South Africa receives less than 75 percent of its normal rainfall, we consider that area to be experiencing a meteorological drought” says Elsa de Jager, South African Weather Service. “It can be safely assumed that a shortfall of 20% from normal rainfall will cause crop and water shortfalls in many regions, accompanied by social and economic hardship”, she says.

According to the South African Weather Service:
- South Africa received the lowest rainfall between January and December 2015 since the recording of rainfall began in 1904.
- Since 1904, rainfall in all nine provinces has averaged 608mm a year. During 2015, South Africa received an average of 403mm (66 percent of the annual average).
- Previously, the lowest rainfall received in a year was in 1945 when South Africa received 437mm (72% of annual average).

### Planting for drought
Water Wise landscaping is all about choosing drought-resistant plants that are indigenous to regions with extremely low rainfalls.

Look out for these characteristics which render plants extremely water-efficient.

- **Sturdy internal structures.** Strong internal skeleton which supports the leaf, prevents wilting and enables them to survive for longer periods without water. Examples: streiltzia, restios.
- **Leaf size and shape.** Small or needle-like leaves that minimise the surface area from which water is lost by evaporation. Example: ericas, most acacias (Senegalia spp.), rosemary, origanum and thyme.
- **Grey foliage.** Grey or blue-green leaves reflects the sun’s rays away from the plant, thereby keeping the plant cooler, reducing transpiration. Examples: arctotis, honey flower (Melianthus major), cancer bush (Sutherlandia frutescens).
- **Hairy leaves.** Hairs surrounding the stomata slow down air movement past the stomata, thereby reducing water loss. Examples: silver tree (Leucadendron argentum), beach salvia (Salvia africana-lutescens), Buddleja spp.
- **Succulent leaves.** Water is stored in thick fleshy leaves to be available when necessary. Examples: crassulas, aloes, echveraria, vygies.
- **Closing leaves.** Leaves that close when water-stressed, reducing the number of stomata exposed to sunlight to reduce transpiration. Examples: Acacia spp., Jerusalem sage (Phlomis fruticosa), rock rose (Cistus spp.).
- **Waxy cuticle.** A waxy leaf coating helps to prevent moisture loss. Examples: Euonymus spp., Kalanchoe spp., wild fig (Ficus spp.).
- **Reduced size and number of leaves.** Some plants reduce moisture loss by dispensing with leaves. Examples: karee (Rhus lancea), Acacia spp., buffalo thorn (Ziziphus mucronata).
- **Plants with lighter colours on the undersides of their leaves.** When stressed, they turn the lighter side upwards to reflect the sun away. Examples: gazania, wild olive, Buddleja spp.
- **Volatile oils in the stomata.** An extra protection against water loss, they reduces water transpiration from the leaves. Examples: rosemary, lavender, thyme, sage, oreganum.

Nearly 91% of South Africa falls within the United Nations’ definition of dry lands. These are extraordinarily dry areas where rainfall is low and evaporation rates high.
ABOUT US
Vezimvelo Horticulture is a young, dynamic and proudly South African landscaping and horticultural company based in Cape Town and a level 1 BBBEE service provider. Mr Ian Vusi Tshabalala, current MD and founder established Vezimvelo in January 2012, and has a passion for landscaping, horticulture and conservation. Vezimvelo has the horticultural knowledge, experience, technical ability and financial stability to not only meet your requirements, but also surpass your expectations. It is increasingly becoming difficult for companies to absorb the costs incurred from failures or lack of maintenance. At Vezimvelo Horticulture we offer a full service with regards to landscaping.

SERVICES
• Consultation, Design and implementation of gardens
• Landscape and garden maintenance to the highest standards
• Indoor garden design
• Irrigation design (manual & automatic), installation and maintenance
• Environmental rehabilitation
• Turf construction and maintenance
• Earthworks and Paving solutions
• Project management
• Tree surgery, Plot/site clearing
• Alien vegetation eradication/consultancy

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Cape Town
Water Wise landscaping is an approach to landscaping which applies eight basic principles of water conservation. Existing, transformed or traditional manicured landscapes can also be altered to make them Water Wise. The best time to convert an existing landscape to one that is Water Wise is when it needs a revamp. If building alterations are to be carried out, this is also a good time to reassess the landscaping. For many landscapers, Water Wise landscaping is inextricably linked to the planting of regionally indigenous plants. Adapted to the prevailing conditions, and once established, an endemic Water Wise garden not only reduces your water footprint, but also contributes to environmental conservation.

South Africa has over 23 000 indigenous plants. “If you live in a bushveld environment, it makes sense to establish a bushveld landscape” says Ernst van Jaarsveld, a past curator of the succulent collection at Kirstenbosch National Botanical Gardens. “If you are designing in the Western Cape create a strandveld-fynbos landscape. If you are landscaping on the Highveld, use the glorious indigenous grasses of the area in your project”, says van Jaarsveld.

### Eight Water Wise principles

Whether you choose to plant with local plants or not, there are eight basic principles to Water Wise landscaping:

1. **Plan and design** for water conservation and beauty from the start. Design principles include scale, balance, interest, harmony and continuity. Less obvious, but important design elements include creating shaded areas to help preserve moisture in the soil, planning windbreaks to prevent wind drying out the soil or designing a wetland as a reservoir for harvested rainwater.

2. **Zone the landscape into different hydro zones** (high, medium, low and no water) and group plants according to their water usage.
   - Make the low water usage zone as large as possible. Thereafter, determine how much and how often to water through the seasons.
   - **Create practical turf areas** of manageable sizes and shapes, and select appropriate grass types such as hybrids of *Cynodon dactylon* and *Cynodon transvaalensis* varieties rather than kikuyu. Shapes must be easy to water using appropriate sprinklers.
   - **Use soil amendments** such as compost, manure and water retentive polymers. To this end, use mulches, especially in high and moderate watering zones.
   - **Irrigate efficiently** with properly designed systems, and by applying the right amount of water at the right time. It is important to use separate stations for each distinct hydro zone and consider drip irrigation as an efficient water management system.
   - **Harvest rainwater and reuse water**. Install a rainwater tank to capture harvested water off a roof, channel water directly from downpipes or divert storm water into a pond. Terracing sloping ground to create level areas of soil is a way to harvest rainwater with each terrace and prevent soil erosion.
   - **Remove invasive species**. There are 379 listed invasive plants many of which are known to consume large quantities of water and destroy habitats. Remove them from your landscape.
   - **Maintain a landscape** by not only mowing, pruning and fertilising correctly, but also by planning new plantings and habitats that could dramatically increase the bird and butterfly habitats.
Design and planning

Water Wise design involves simple design and management practices that take advantage of natural site features and minimize negative impacts on the water cycle.

**Tip 1: Design in hydro zones**

An important design principle in a Water Wise landscape is to group plants with similar water requirements together, in different areas. Slowly transform an existing garden into hydro zones or plan a new garden from scratch with hydro zones.

- Map out where the hydro zones will be in your landscape, taking into account the water needs of existing trees and large shrubs.
- Make the low water usage, 1-drop zone, cover 30-60% of the landscape, the medium water usage 2-drop zone cover 20-40%, and the high water usage 3-drop zone as small as possible covering only 10-20% of the landscape.
- Reduce lawn areas. Replace with permeable paving, gravel or low water usage, 1-drop ground covers. Design the irrigation system with suitable technology to match each hydro zone.

**Tip 2: Site hydro zones for convenience**

- Place high water usage zones close to the house where colourful annuals can be grouped for impact and watering will be easier during dry spells.
- Situate the low water usage zones around the perimeter.

**Tip 3: Prepare your soil**

Soil preparation is the key to a Water Wise landscape.

- Compost. Raising the organic matter in soil will increase the moisture retention in the soil.
- Mulch. Place a thick layer of organic mulch such as compost, grass cuttings, pine needles, chopped bark, peach pits, straw manure or autumn leaves across the soil. As they break down, they enrich the soil. Replace organic mulches regularly. Inorganic mulches such as gravel, pebbles and stone chips also help to retain moisture in the soil.

**Tip 4: Capture the rain**

- Plan to capture rainwater by designing channels, berms, water features, rain tanks and permeable paving into your design.
- Identify the source of fallen rain water (roof, gutters, paving or the street).
- Decide where the rain water must go (rain tank, wetland, seasonal bog or water feature).
- Design features (berms, swales, wetlands, dry river beds or paving) to direct rain water.
- Plan to retain the water on your property by installing permeable paving, terraces or wetlands. Site a rain water tank near gutters to collect water from the roof.

**Tip 5: Make use of containers**

- Containers lose less water than the soil and can be watered with harvested rain water.
- High water usage, 3-drop plants can be planted in containers near a patio or entrance.
- To reduce water loss, group patio container plants together. The foliage creates a canopy to help shade the soil and keep it cool.
- Fill containers with potting soil that drains well and is high in organic matter.
- Add water-retaining polymer granules to the potting soil.
- Larger pots are better at water use than smaller pots.
Planting in zones

Group plants with similar water requirements in different zones of your landscape.

Water-wise hydro zoning encompasses planting and landscaping concepts. Ultimately, the aim is for gardeners to learn the water needs of different plants and group them in zones in the garden.

No-water zone
- Make this hydro zone 10-30% of the landscape.
- Plants in this zone come from areas with less than 300mm of rainfall per year.
- Lay permeable rather than non-permeable paving where-ever possible in this zone.
- Established local indigenous trees, shrubs and succulent species will thrive in this zone.

1-drop plant zone - Low water usage
- 1-drop plants originate from regions with between 300-500mm rainfall per year.
- Make this hydro zone the largest, covering from 30-80% of the landscape.
- All succulents are ‘one drop’ plants and need no extra water.

2-drop plant zone - Moderate water usage
- 2-drop plants originate in regions with between 500-750mm rainfall per year.
- Keep this hydro zone relatively small, covering 20-40% of the landscape.
- Once established, they do not need watering, except during very hot dry spells.

3-drop plant zone - High water usage
- 3-drop plants originate in regions with between 750mm and 1000mm rainfall per year.
- Keep this hydro zone as small as possible, covering 10-20% of the landscape.
- Once established they need regular watering throughout the year.

Water Wise guide to plants

| Zone | Plants
|------|--------------------------------------------------|
| 1-drop plants | Pelargonium (Pelargonium peltatum), Pink gaura (gaura lindheimeri), Plectranthus ‘Mona Lavender’, Red hot poker (Kniphofia uvella), Silver arctotis (Arctotis venusta), Stalked bulbine (Bulbine frutescens), Trailing ice plant (Lampranthus spectabilis)
| 2-drop plants | Groundcovers (Lambs ear (Stachys byzantina), Snow-in-summer (Cerastium tomentosum), Sour fig (Carpobrotus deliciousus), Vigies (Mesembryanthemum spp.)), Climbers (Star jasmine (Trachylospermum jasminoides)
| 3-drop plants | 3-drop plants (Agapanthus (Agapanthus praecox), Asparagus fern (Prostasparagus densiflorus), Blue statics (Limonium perezii), Cape thatching reed (Chondropetalum tectorum), Daylilies (Hemerocallis cultivars), Fairy crassula (Crassula multica), Gazania (Gazania uniflora), Hen & chicken (Chlorophytum comosus), Honey marguerite (Euryops virgineus), Kingfisher daisy (Felicia amelloides), Red hot poker (Kniphofia praecox), Wild garlic (Trubagha violacea), Wild iris (Dietes grandiflora), Black-eyed Susan (Thunbergia alata), Brazilian jasmine (Mandevilla sanderi), Climatics, Climbing roses, Carpet geranium (Geranium incanum), Erigeron daisy (Erigeron karvinskianus), Mondo grass (Ophiopogon japonicus), Flowering cherry trees (Prunus spp.), Japanese maple (Acer palmatum), Swamp cypress (Taxodium distichum), White pear (Apodytes dimidiata), Azalea, Tree fuchsia (Halleria lucida), Baby’s tears (Soleirolia soleirolii), Failing stars (Crocosmia aurea), White arum (Zantedeschia aethiopica)

Leslie Hoy (Rand Water) developed the 3-drop system to guide the choice of correct plants for each of the three hydro zones by analysing extensive databases.

Group these 2-drop plants together:

| Climbers | Black-eyed Susan (Thunbergia alata), Brazilian jasmine (Mandevilla sanderi)
| Shrubs | Climatics, Climbing roses, Carpet geranium (Geranium incanum), Erigeron daisy (Erigeron karvinskianus), Mondo grass (Ophiopogon japonicus), Flowering cherry trees (Prunus spp.), Japanese maple (Acer palmatum), Swamp cypress (Taxodium distichum), White pear (Apodytes dimidiata), Azalea, Tree fuchsia (Halleria lucida)
| Perennials | Baby’s tears (Soleirolia soleirolii), Failing stars (Crocosmia aurea), White arum (Zantedeschia aethiopica)

The key design principle of a Water Wise landscape is to group plants with similar water requirements in the same area.

Water Wise guide to plants

| 1-drop plants | Group these 1-drop plants together:
| Trees | Baobab (Adansonia digitata), Camel thorn (Acacia erioloba), Common cabbage tree (Cussonia paniculata), Hook thorn (Acacia caffra), Monkey thorn (Acacia galpinii), Pompon tree (Dais cotinifolia), Tree aloe (Aloe bainesii), Wild olive (Olea europaea subsp. africana)
| Shrubs | Aloe (all species), Bougainvillea, Cape Honeysuckle (Tecomania capensis), Gold dust plant (Aucuba japonica), Lavender (Lavandula angustifolia), Lion’s ear (Leonotus leonurus), Rosemary (Rosmarinus officinalis), Sacred bamboo (Nandina domestica), White bauhinia (Bauhinia natalensis), Wormwood (Artemisia afra)
| Perennials | Cone flower (Echinacea purpurea), Heartleaf iceplant (Aptenia cordifolia), Honeysuckle (Lonicera nitida)

| 2-drop plants | Group these 2-drop plants together:
| Trees | Boerbean (Schotia brachypetala), Buffalo thorn (Ziziphus mucronata), Bushwillow (Combretum zeyheri), Coastal silver oak (Brachylaena discolor), Coral tree (Erythrina lysistemon), Highbred cabbage tree (Cussonia spicata), Kei apple (Dovyalis caffra), Lavender tree (Heteropxis natalensis)
| Shrubs | Baby’s tears (Soleirolia soleirolii), Failing stars (Crocosmia aurea), White arum (Zantedeschia aethiopica)
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| Perennials | Cone flower (Echinacea purpurea), Heartleaf iceplant (Aptenia cordifolia), Honeysuckle (Lonicera nitida)
Discover how plants can improve water conservation on golf courses.

Best management practices for water conservation can be described as the combination of proper plant selection and cultural maintenance practices that provide adequate turf quality for the game of golf. Plant choice is critical for the out of play areas (low water usage plants), the fairways (medium water usage areas), as well as greens and tees (high water usage areas).

- **Use low water turf grasses.** Select and install drought-resistant turf grass. Use species adapted to the rainfall of the local area. For example, replace waterholic kikuyu with Cynodon varieties which are best adapted to the local environmental conditions and need less water. Cynodon varieties were chosen for the Leopard Creek Country Club practice facility by Golf Data and the Eye of Africa Golf Course by Servest. Cynodon dactylon was also used at Blair Atholl golf course in 2012. The course uses 700 000 - 1 million litres a day, whereas kikuyu over the equivalent fairway area would need 2-2.5 million litres a day.¹

- **Increase the size of natural vegetation areas.** Embark on a programme to plant up all out-of-play areas with low water usage plants. This includes the clubhouse and parking areas. Reduce the quantity of turf grass on a course by increasing the size of natural vegetation areas. Links-style golf courses use the Water Wise principle of hydro zoning.
  
  The Atlantic Beach Golf Club situated on the West Coast at Melkbosstrand near Cape Town is not only a link-style golf club that was designed around the endangered fynbos vegetation, but the tees and fairways are planted up with indigenous Cynodon transvaalensis ‘Gulf Green’.

- **Remove invasive species.** Replace waterholic invasive trees with indigenous trees from the region. Superb examples of golf courses who have succeeded in a monumental endeavour to remove over 600 tonnes of invasive biomass from their courses are Mossel Bay Golf Course and Plettenberg Bay Country Club.

- **Establish planted buffer zones.** Maintain herbicide, fungicide, pesticide and fertiliser-free buffer zones around all surface water, including wetlands and dams. Transition zones grasses that receive no fertilisers act as buffer or filter strips to remove nutrients from excess fertilisation in run-off before it reaches the water source. Buffer zones also help to reduce the chance of pesticide drift, run-off and leaching into sensitive wetland areas. A 15m wide buffer zone alongside watercourses or other bodies of water is recommended as a minimum width.²

- **Use plants to clean water.** A golf course can be a green lung that cleans water moving through the site. It can also offer habitats for wildlife and plant species. River Club Golf Club in Sandton successfully planted up and maintain Phragmites australis and Typha capensis alongside a dam on the course. The plants provide nesting sites for the red bishop and help to filter the water as it passes through the dams and watercourses on the River Club course.

Sources:

¹ Rand Water Water Wise Guide to Golf Courses, 2013. www.randwater.co.za

Improve turf irrigation

Five tips and tools needed for improving turf irrigation on a golf course.

A typical golf course irrigation system is likely to have in excess of 500 irrigation heads, kilometres of in-ground wiring, a network of underground pipes, a powerful pumping station, and a control system that enables turf managers to control when, where, and how much water is applied.

Five tips

Consider these five tips for enhancing the irrigation programme on a golf course.

1. **Track your water use.** You can’t manage what you can’t measure. This holds true for any golf course wishing to embark on a Water Wise programme. Fit a magnetic or inductive water meter that accurately measures water use to your pumping station. Download a water use report template (http://www.usga.org/course-care/water-resource-center/water-management-plans.html) and track water use by day, month and year. Once you have the data, evaluate the efficiency of your water use on different turf species, at different times of the day or in different weather.

2. **Reduce soil compaction.** “Soil compaction is the enemy of an efficient water conservation plan on golf course fairways and roughs”, says Patrick O’Brian. Compaction destroys soil structure, impairs rooting, and increases surface water runoff because soil is less able to accept water. Consequently, compacted soils require more irrigation. Studies by Dr. Robert Carrow at the University of Georgia have shown that aerating with heavy-duty slicing tines or blades significantly reduces soil compaction creating more channels for air and water movement. In high traffic areas, lay pathways for golf carts to avoid compaction.

3. **Use wetting agents.** Wetting agents conserve water by improving water penetration into the soil so that irrigation water is used more efficiently. Research by Dr Sowmya Mitra at California State Polytechnic University demonstrated reduced water usage when wetting agents were injected into irrigation lines.

4. **Use soil moisture sensors.** “In-ground, wireless soil moisture sensors are a great way for golf facilities to better monitor soil moisture and extend intervals between irrigation events”, says O’Brien. Soil moisture sensors more accurately report soil moisture status compared to visual examination. Sensors measure the volumetric water content of the soil. They can be used to stretch the intervals between irrigation and can assist in scheduling a Water Wise irrigation programme with greater confidence and accuracy. Irrigation controllers linked to off-site weather equipment will also assist in reducing unnecessary watering.

5. **Raise and level irrigation heads.** Correcting low, crooked, sinking or tilted sprinkler heads will improve irrigation uniformity coverage and help make the best use of water. Irrigation heads sink for a variety of reasons, including soil settling, traffic by mowers, thatch build up or top-dressing programmes. The trajectory of a water stream emitted by a low sprinkler head is disrupted when it strikes turf grass next to the head. As the stream of water breaks apart, turf nearest the sprinkler becoming too wet and the turf farther away becoming too dry. Proper sprinkler head setup and spacing ensures the best delivery and use of water.

Sources:

A healthy soil retains water. Improve your soil quality by adding organic matter such as compost which will improve the moisture and nutrient holding capacity of the soil. Compost also provides food for earthworms, which improves soil aeration and water penetration. Earthworms can consume their own body weight in organic matter, daily. Their castings (excreta) are rich in nitrates and available forms of potassium, phosphorous, calcium and magnesium.

In small areas, mix polymers into the soil. Both organic and inorganic polymers act like small sponges in the soil. They swell up with water ten times their size when moisture is applied to the soil and slowly release the moisture to the soil.

Covering healthy soil with a layer of mulch is an essential aspect of Water Wise landscaping. Mulching dramatically reduces water loss from the soil due to evaporation, so that less frequent watering is required. Which mulch to choose and the depth of the applied mulch depends on the landscape theme, availability of various mulches and the local climate.

Mulch is any substance that can be placed on the surface of the soil around plants in order to keep moisture in the soil. Mulch is one of the quickest, easiest and most cost-effective ways to save water in your garden. There are three types of mulch that you can explore.

### Why is mulch important?
- It insulates the soil helping to provide a buffer from heat and cold temperatures.
- It retains water helping to keep the roots moist.
- It keeps weeds out to help prevent root competition.

### Three types of mulch
- Organic mulches. These come from plant and animal sources and are the best sort of mulch because, as they break down, they enrich the soil. Examples are compost, fruit pips, nut shells, bark nuggets, wood chips and autumn leaves. Organic mulches need to be topped up regularly.
- Inorganic mulches. These are substances or materials that do not break down and enrich the soil, but help keep moisture in the soil. Examples are gravel, pebbles, stone chips and pavers. As they can store heat they need to be used judiciously; they are most suitable in shady areas.
- Living mulches. Ground covering plants serve the exact same purpose as other types of mulch, and may be preferable for aesthetic reasons. Low water usage ground covers are the best choice and include any 1 Drop Water Wise species.

### How thick should mulch be?

#### For loamy soils:
- **Organic**
  - Wood chips 50-100mm
  - Sawdust 20-75mm
  - Shredded bark 50-100mm
  - Chunk bark 50-120mm
  - Pine needles 20-75mm
  - Leaves 20-100mm
  - Lawn clippings 20mm at a time
  - Straw 50-120mm
  - Straw manure 50-100mm
  - Compost 50-100mm
- **Inorganic**
  - Gravel 20-75mm
  - Crushed stone 20-75mm
  - Sand 20-50mm

### Seven benefits of mulch
- Mulch reduces soil temperature, so less water is lost to evaporation.
- It promotes good root growth by retaining moisture in the root zone.
- It suppresses water-consuming weed growth by keeping out the light.
- Mulch provides winter protection for plants in cold climates, preventing frost damage to roots.
- It reduces exposure to wind, which results in less moisture loss through evaporation.
- It controls erosion by softening the impact of falling water and slowing it down so that it can soak into the soil before running off.
- As the mulch decomposes it becomes an excellent source of food for the bacteria and organisms living in the soil, enhancing the soil quality.
Why choose organic mulch?

- Organic mulch eventually breaks down and improves the quality and water-holding capacity of soil near the surface.
- Mulched soils do not need digging, as micro-organisms and earthworms do all the work.
- Partially decomposed compost makes excellent organic mulch and is particularly appropriate and cost effective for businesses where the establishment of a compost heap made from kitchen and garden waste is viable.

Tips for organic mulch use

Do you want to know how to use mulch?
- Organic mulches must at least be 5-8cm thick for normal soil and 8-12cm for a sandy soil. With clay soils 2-4cm is sufficient under normal conditions.
- During dry or cold periods the level of mulch needs to be thicker than during wet periods to protect plant roots.
- As organic mulches break down in the decay process, they need to be replenished. Compost decomposes in two to four months, whereas bark chips last about two years before being broken down.
- In spring, after the last frost, it may be necessary to pull mulch back from emerging plants, especially small perennials.
- When applying organic mulch, make sure that it does not touch the stem or trunk of the plants.

Calculate how much mulch to buy

For a 10cm deep mulch, 25 x 30dm bags of mulch will cover 7.5m, one bag will cover 0.3m.
For a 7.5cm deep mulch, 25 x 30dm bags of mulch will cover 9m, one bag will cover 0.36m.
For a 5cm deep mulch, 25 x 30dm bags of mulch will cover 15m, one bag will cover 0.6m.
For a 2.5cm deep mulch, 25 x 30dm bags of mulch will cover 30m, one bag will cover 1.2m.

To calculate how many cubic metres of mulch you need:
- Measure the area in metres: Thus: $3 \times 3 = 9$ m² (A)
- Calculate what depth of mulch you want in cm? 5 cm
- Divide cm by 100 to get measurement in metres: Thus: 0.05 metres (B)
- Multiply A by B: Thus: $\frac{9 \times 0.05}{\frac{5}{100}} = \frac{0.45}{\frac{5}{100}} = \frac{0.45 \times 100}{5} = 9$ cubic metres (C)
- This last measurement C is the number of cubic metres you need.
- If you buy mulch in 30dm bags, 33 bags = 1 cubic metre of mulch.

“The combination of the landscape fabric and the mulch stops the light getting to the soil and slows or stops germination and growth of weeds.”
Rain Bird proudly celebrates 80 years of irrigation innovation.

In 1933, we invented the first impact sprinkler. But we didn’t stop there. For eighty years, we’ve been developing new and innovative products that water more intelligently. From the 1800™ series to XFS subsurface dripline and HE-VAN nozzles, Rain Bird’s award-winning products have not only kept landscapes green, they’ve also helped revolutionize an industry. Our work is far from over. Call on your local Rain Bird distributor and see the newest Rain Bird products that will make 2017 one of our most groundbreaking years ever.

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Rain Bird® XFS Subsurface Dripline
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2011 Irrigation Show
Best New Product, Turf/Landscape

Not just inventing.
Reinventing.
That’s intelligent.

Horizontal Action Impact Drive Sprinkler 1933
“Installing low pressure drippers in drip irrigation, means not only less water consumption, but less energy use” – Professor Amos Winter, MIT, USA.

Efficient irrigation

Designing efficient irrigation

Tips for designing Water Wise irrigation and choosing the right system.

A Water Wise irrigation system is a complex network of pipes, sprinklers, valves, controllers, electric control wiring, filters, pumps and accessories. Designing it correctly is critical to success”. Landscape Irrigation Association (LIA) of South Africa.

Every Water Wise irrigation project goes through five phases: design, product choice, installation, commissioning and maintenance. Start by appreciating the importance of Water Wise design and choosing the right irrigation system.

Design tips

- Plant your irrigation to suit the landscape hydro zones of the design.
- Choose an appropriate system for the watering requirements of plants. Turf areas are irrigated differently from shrub borders.
- Choose the plants to be irrigated. Design emitters around the drip line of trees where the roots are, rather than next to the trunk.
- Design an irrigation system that takes into account future growth to avoid any shadowing or blocking effects as plants mature.
- Consider areas of prolonged shade, high wear and tear or areas subject to digging or mechanical disturbance.
- Evaluate the site’s soil type, topography and microclimatic influences. South and east exposures need less frequent watering than north and west exposures.
- Identify slopes on the plan to aid choices of pumps and piping in the system design. Slopes need to be irrigated more slowly than flat surfaces.
- Quantify the water quality, flow capacity and pressure per hour from your water source.
- Develop a detailed drawing showing the position of dripline or sprayline piping, mainline piping, solenoid valves, emitters, sprinklers, storage tanks, water sources and pumps.
- When designing consider aspects such as distribution uniformity and irrigation efficiency.
- Never programme to water beyond field capacity, otherwise nutrients will be leached from the root zone, plants will develop shallow root growth and you will get fungal infections.
- Plan to capture and reuse water runoff. Capture storm water runoff in ponds and pump it back into the system where it can be reused for the next cycle of irrigation.
- Link a rain sensor to the automatic controller to ensure that irrigation will automatically switch off during rainy periods.

System choice

- Controllers: For Water Wise irrigation choose a computerised irrigation controller as it will help you to sustainably quantify water used. Link the controller to a rain sensors, soil moisture sensors and a weather station either by wireless radio (wifi) or electrical cables.
- From a Water Wise perspective, drip irrigation is preferable to sprinklers and lawn pop up systems. Why?
  - Delivers water directly into the soil. Micro sprinklers lose water droplets to wind and evaporation.
  - Can reduce water consumption by as much as 60 percent (MIT, 2017)
  - Emits 1.6 litres of water per hour, whereas a sprinkler system emits 2-7 litres per minute.
  - Is particularly good for mulched areas because it does not wash away the mulch.
  - Never wets foliage, reducing the threat of fungal attack to plants.
  - Can get into awkwardly shaped and narrow areas. Conventional sprinklers waste water by over-lapping spray circles.
  - Is slowly becoming cheaper on account of the availability of low pressure emitters.

Source:

Drip irrigation remains the most Water Wise of all irrigation systems.


“SALI. South African Landscape Institute.”

“WaterWise SANDWATER.”
Grow Your Own Indigenous lawn

Save Water – plant MayFord drought resistant indigenous lawn seed

For Full Sun, plant MayFord Princess

• Very latest indigenous, water wise, creeping cynodon hybrid
• Survives on half the water Kikuyu requires and up to 29% less than other cynodon varieties

For Shade areas, plant MayFord LM (Berea)

• Shade and heat tolerant indigenous, water wise, creeping LM
• Survives on 3 hours of direct sunlight per day and recovers from drought and heat stress by means of its creeping growth habit
Managing water efficiently

How to manage existing irrigation systems according to Water Wise principles.

Managing an existing irrigation system that has already been installed and commissioned is a challenge for all water managers. First, initiate irrigation practices that save water on the site. Secondly, install meters on main lines and quantify how much water the landscape is using. Only when you know what water you use on site, can you plan for the future.

Seventeen irrigation tips to help you manage irrigation more efficiently.

- Avoid ‘setting and forgetting’ an irrigation controller. Adjust them as conditions change through seasons and climate.
- Check your irrigation system for overall coverage and distribution uniformity. Irrigating paved areas results in considerable water waste.
- Monitor sprinkler heads for any misalignment and adjust the sprinkler heads if necessary.
- Water only as frequently as your plants need it, but no more than each specific hydro zone. Each hydro zone has its own water requirements and requires a different watering schedule.
- Water less frequently but more deeply. This encourages deep root growth that sustains the plant during dry periods.
- If water from a sprinkler system puddles instead of sinking into the soil, change the programme to deliver the required amount of water in two sessions rather than one session.
- Water-train trees and shrubs. By gradually changing from frequent shallow watering to less frequent but deeper watering schedule, permanent plants can be ‘trained’ to need less water.
- Water in the early morning or late afternoon to reduce water loss to evaporation in alignment with any water bylaws.
- Adjust the irrigation programme according to the season. Plants need less water during the cool winter season than during the hot summer months.
- Make use of a landscape water-use model to determine the site’s proposed water use. For more information, email waterwise@randwater.co.za.
- If the sky is cloudy, irrigation can be reduced by as much as 50%.
- Avoid irrigating during windy weather as high winds blow away water delivered by sprinklers and evaporation rates are high.
- If you do not have a rain sensor, turn off the system if rain is irrigating the landscape sufficiently.
- Check all water connections in the irrigation system at least twice a year for leaks.
- Replace all worn washers in taps on site.
- Consider converting overhead sprinklers to drip irrigation. This is the most effective way to provide water directly to the root zone.
- Install water meters to quantify the water usage on site.

Lowering the costs of drip irrigation

“Drip irrigation can reduce water consumption by as much as 60 percent”, says Amos Winter, assistant professor of mechanical engineering, at Massachusetts Institute of Technology (MIT), USA.

Dippers in most drip irrigation systems are designed to operate at a pressure of 1 bar. The main cost of drip irrigation lies in the pump and power system needed to maintain this pressure. Winter says, “This fact laid the foundation for the MIT research project: Could we make drippers that operate on much lower pressures, and thus cut the pumping power and the capital costs?”

The result of MIT’s research was unveiled in April 2017. A new design of pressure-compensating drippers operate as low as 0.1 bar – one-tenth of the pressure of commercial systems. The new dripper technology halves both the power required to pump water through the drippers and the capital cost of an off-grid solar-driven drip system.


“A weekly Water Wise irrigation schedule should include different cycles per week for all hydro zones, as well as station run times for all four seasons”

— John Gordon, LIA.
Harvest rainwater

Make the maximum use of rainwater to irrigate a landscape

Make maximum use of rainwater to irrigate a landscape. Channel rainwater into your landscape by developing berms, swales, terraces or dry river beds. Harvest rainwater from a roof to store in water tanks for later use.

**Tip 1: How to channel rainwater**

Plan to capture rainwater by channeling it from where it comes (roof, gutters, hard paving or the street) to where it is needed.

There are various techniques for channelling water:
- Permeable paving. Slow down runoff by avoiding impermeable paving. Gravel, pebbles, permeable pavers planted up with groundcovers will allow water to percolate slowly through the soil and into the local ground water stores (aquifers).
- Channels, gullies or dry river beds will direct water safely down slopes towards a wetland, water feature or soak zone, rain garden or bioretention pond.
- A swale is a shallow soak zone or marshy depression between ridges that will slow water moving down a sloping site. A swale collects runoff rainwater and can be the basis of a wetland or pond area.
- Berms at the lower edge of a slightly sloping lawn area will harvest water for the lawn. Very slight concrete berms on a solid surface driveway can direct runoff away from the road into an adjacent border or lawn area.
- Swales and berms in lawn area must be shaped to allow for easy mowing.
- Terracing sloping ground is a Water Wise technique that prevents soil erosion, slows water down and allows water to soak into the soil. A multi-level terrace makes an attractive landscape feature.

**Tip 2: Harvest rainwater from roofs**

Rainwater harvesting involves the collection and storage of rainwater from the roof.

How do you harvest rainwater?
- Start by ensuring that your rooftop is suitable for rainwater harvesting.
- Corrugated iron or metal rooftops are best for harvesting rainwater, followed by tiled and concrete rooftops.
- Unfortunately, thatched roofs are not suitable for practical rainwater harvesting.
- Gutters assist in effectively channelling rainwater to downsputs leading to water tanks or rain barrels.
- Leaf filters, tank mesh and flush diverters provide prefiltration of rainwater.

**How much rainwater can I collect from a roof?**
Firstly you need to know:
- Your roof surface area;
- Mean annual rainfall for your area;
- Every one square metre of roof generates 1 litre of water from 1mm of rainfall.

**How to do the calculations?**
- Assume your roof area is 3m x 5m = 15m².
- Check the rainfall in your area. Johannesburg receives 650mm per year.
- Calculate the area x volume: 15m² x 650mm = 9750 litres a year.

**How to determine the size of the tank you need?**
- Get assessed by a rainwater harvesting professional.
- However, a general estimation suggests the following:
  - Volume/Year x consumption coefficient (0.049)
  - Equates to: 9750 x 0.049 = 477 litre tank.

**What equipment is needed?**
Remember for your rain water harvesting system to work efficiently you need prefiltration equipment (filters, meshes, screens), a storage tank (situated above or below ground in 1000l, 2500l, 5000l and 10 000l sizes), as well as piping, taps and a pump (if necessary).
Wetlands purify water
• Wetlands ‘clean’ and take up pollutants from water by the process of phytoremediation.
• The diverse bacterial communities and particular plants in a wetland benefit from the high nutrient load of polluted water.
• Wetlands also biodegrade nutrient-laden industrial effluents.

What size wetland is required to purify grey water for a household? Grey water is understood to include water from baths, sinks, dishwashers and washing machines. Research suggests a wetland the size of 5m x 5m is needed for a family of four.

Nature’s water sponges
• Preserving a natural wetland or constructing a new wetland in an urban or industrial landscape helps to compensate for the loss of natural wetlands.
• Golf courses develop wetlands around dams that supply water for irrigating turfed areas.
• Industrial and commercial landscapers are following this water-friendly trend by developing wetlands appropriate to the size of the landscape.
• A well-designed wetland can become a focal point in a landscape. Many plants like the moist soil of a bog area. Some, such as sedge (Cyperus spp.), scarlet river lily (Hesperantha coccinea) and white arum (Zantedeschia aethiopica), grow with their roots in the waterlogged soils at the edge of a wetland.

Develop a wetland
• Wetlands provide a designated area for water storage.
• In a watercourse system, wetlands can decrease the impact of flooding.
• During development, spoil from excavation can be used to build up areas and create depressions for wetlands.

Place a wetland
• Any area experiencing periodic wetness or drainage problems is a prime location for a wetland.
• Small ditches, existing ponds or old ponds can be converted into wetland areas.
• A primary drainage outlet that leads from the golf course into a natural water body can also be an ideal location to position a wetland to provide some final runoff treatment.
• Eroding channel banks on small drainage ways can also be targeted for wetlands.

Developing a wetland in a residential estate
Vula Environmental Services developed a wetland for Onverwacht Village, Somerset West.

“Water pollution is a universal problem in urban areas, and one of the most critical services provided by these wetlands is improving water quality”,
– Dr Donovan C. Kotze, Mondi Wetlands Project.
Water and invasive species

The impact of invasives

What are the impacts of invasive species on our soil and water resources?

There are 379 listed invasive terrestrial plant species in South Africa. They are divided into four categories under the National Environmental Management: Biodiversity (Act no. 10 of 2004) Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Among the listed invaders are serious waterholics such as eucalyptus, pine and wattle.

How much water do we lose?
Numerous studies have been conducted in South Africa to measure the amount of water taken up by invasive alien plants. Scientists estimate that:

- Invasive alien plants have invaded an estimated 19 million hectares in South Africa.
- The current loss of usable water to alien invasive plants is estimated to be 695 million cubic metres, or the equivalent of 4% of the total registered water use.
- Catchments in the Western Cape lose up to 31% of mean annual runoff to invasive plants.
- It is predicted that if invasive plants are left uncontrolled, water losses could increase to over 2,720 million cubic metres or 16% of registered water use across South Africa.

Changing soil chemistry
Invasive plants impact the nutrient recycling and chemical composition of soil. Left over extended periods, the soil composition can change drastically so that indigenous vegetation may no longer be able to re-establish once the invaders are cleared. Studies on:

- Invasive Acacia trees such as Acacia cyclops, A. dealbata, A. longifolia, A. mearnsii, A. saligna and A. melanoxylon have been shown to impact on the release of nitrogen and other chemical elements that change the structure of soil chemistry. With Acacia saligna, increased nitrogen was also leached into groundwater.
- Exotic Australian Acacia trees which are serious invaders in the Western Cape’s fynbos biome are altering the soil composition to the detriment of indigenous fynbos plants.
- Eucalyptus trees such as Eucalyptus camaldulensis have soluble phenols in their leaf litter which can affect acidity and nitrification processes. The leaves also have waxy cuticles and tannins which can alter water chemistry, thereby leading to the demise of fish and other organisms in the water.

Water use by invasive plants
How exactly do invasive alien plants deplete water?

- In fynbos and grasslands, vegetation is often made up of small reeds, sedges, grasses and small shrubs. Grasses in particular have a small surface leaf ratio compared to many invasive trees and shrubs. Because of the small surface area in natural vegetation, evaporation from indigenous vegetation is much less than that of exotic trees and shrubs.
- Another important factor contributing to high rates of evaporation is the height of the plants. Plants which are low to the ground such as grasses and fynbos are less prone to the effect of wind, which in tall trees, has a much greater effect on evaporation from the leaf surface. This follows a similar principal of taking a wet towel and laying it flat on the ground, which will take much longer to dry than if it was elevated off the ground where it will dry faster.
- Grasses and fynbos plants also have short root systems, whereas exotic invasive trees have deep root systems which can travel further and absorb much more water.

Sources:

“Invasive species are a huge threat to our water supply and currently use 4% of available water in our catchment areas”.
– Dr Guy Preston, Department of Environmental Affairs.
Physical removal, herbicide application and biological control are three methods used to remove and control unwanted invasive alien plants.

**Physical removal**

Methods of physically removing invasive species from new habitats include:

- **Hand-pulling**: This is best done with small emerging plants and herbaceous weeds and ideally when the soil of soft and moist. Destroying the plant before it has the chance of producing seed is important.
- **Uprooting**: Slightly larger herbaceous plants and small shrubs can be uprooted. This may entail the use of a leverage tool to dislodge the root system or a garden fork to loosen the surrounding soil.
- **Slashing or hacking**: Herbaceous plants or shrubs and small trees with a diameter less than 50mm can be chopped or hacked down using loppers or an axe or metal slasher. This should be followed by herbicide application to prevent regrowth.
- **Felling**: Large trees can be felled using a saw or chainsaw. Be very careful when felling large trees and make sure it won’t fall onto buildings or a car.
- **Ring-barking**: This entails removing all the bark and cambium across a 30cm band around the stem and at a height of no more than 50cm above ground.
- **Strip-barking**: This entails stripping off all the bark from waist level to just below the surface of the soil.
- **Frilling**: A ring of cuts is made near the base of a stem and herbicide applied into the cuts.

**Chemical control**

Chemical control involves the use of registered herbicides to kill the target weed. All herbicides have to be registered and their use is controlled by law. Read the label carefully, follow the instructions and wear the appropriate safety clothing when applying an herbicide.

There are basically three methods of applying herbicide:

- Foliar or leaf application: The herbicide is sprayed onto the leaves and stems and ideally suited to small herbaceous plants and small shrubs.
- Stem application: Basal stem application is where herbicide is applied to the basal stem of standing trees.
- Stump application: Once the tree is felled, herbicide is applied to the outer ring of the freshly cut surface just inside the bark.

**Biological control**

Biological control involves introducing an invasive alien plant’s natural enemies (for example insects or fungi) to its new habitat with the aim of removing the plant’s competitive advantage or killing it completely.

- The South African biocontrol sector employs 77 personnel in research, 31 personnel in mass-rearing activities, 16 biodiversity officers and managers, as well as 17 people in two field implementation teams.
- Ninety-seven species of agents have been released on 60 weed species.
- Since 2013, nineteen species have been cleared for release against 13 weeds.

“In South Africa, biological control contributes significantly to the control of 34 of the 60 invasive alien plant species on which biological control agents are established”, says Dr Costa Zachariades, Agricultural Research Council, Cedara, KwaZulu-Natal. “Thirteen of these target species are considered to be under complete control, with no need for any other control intervention.”
Maintaining Water Wise landscapes

Great tips for maintenance checks and selling improvements to a customer.

Maintaining landscapes

Great tips for maintenance checks and selling improvements to a customer.

- Monitor sprinkler heads for any misalignment and adjust.
- Replace all old worn washers.

Make improvements

How do you help customers decide to make improvements?

- Develop a professional trust with clients.
- Be proactive and provide that information to your customer.
- Consider bringing in a third-party consultant, such as a Water Wise specialist.
- Talk to the customer to identify where mutual needs can be satisfied through water management.
- Would they consider landscape changes (turf removal) in an effort to reduce water consumption?
- Are they interested in purchasing rain or soil sensors?
- Are they interested in installing a weather-based controller?
- Are they concerned about their water costs or the cost of water in relationship to the cost of landscape maintenance?

Proposing upgrades

- Problem + Solution = Result
- Identify areas that need improvement, such as system inefficiencies, controller scheduling, machinery upgrades, high water use colour bags or indigenous plants to perk up a landscape.
- Show potential water savings and return on investment as a result of implementing the recommendations.
- Identify a problem and what a solution will mean for the client, and then work on a solution.
- Analyse the site and quantify the solution.
- Educate the customer about findings.
- Provide recommendations in order of importance.
- Create a solution incorporating the customer's budget and aesthetics.

Irrigation maintenance

- Check the irrigation controller.
  - Check the date and time on the controller and reset if necessary.
  - Replace the battery back-up if necessary.
  - Activate the valves. If a valve is not operating, diagnose with a volt/Ohm meter. Greater than 50 Ohms usually indicates a short.
  - Regulations require that a qualified electrician be on site to check power problems.
- Flush the irrigation system.
  - Remove the end cap or sprinkler head that is farthest away from valve.
  - Turn on the valve for 30 seconds or until the water runs clear.
  - Turn off the valve and replace end cap or sprinkler head.
  - Clean the individual sprinkler screens.
  - Flush all driplines.
- Full system check-up.
  - Activate the valve.
  - Look, listen, and feel. Walk the station and adjust spray patterns and check for leaks, breaks, and leaky valves.
  - Flag all troubled areas.
  - Repeat with all valves.
  - Fix all flagged areas.

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aintenance is a skill in its own right. Maintenance management should include the following:
- Weed and pest control;
- Mulch and compost;
- Fertiliser (less more frequently than more);
- Pruning and cutting;
- Watering times;
- Irrigation maintenance including season adjustments;
- Maintaining the landscape as per the original design intention;
- Removing invasive alien plants.

And often, the irrigation delivery system is the real water waster, rather than the plants, themselves. On average, 20% to 40% of water applied to lawns and groundcovers is wasted due to high rates of application, system leaks, low or tilted heads, broken sprinklers, unmatched sprinklers, incorrect water pressure or sprinkler spacing. Now is the time to check your irrigation system.

Situated in the Kogelberg Biosphere Reserve, Arabella Country Club uses local indigenous plants in all landscaping and rough area.

Francistown Stadium. Monitor sprinkler heads for any misalignment and adjust.

Lebone II, College of the Royal Bafokeng, drains all its grey and black water to a sewage treatment plant on site. The final treated-effluent is used as landscape irrigation water.

Source:
1. Keeping plants alive under drought or water restrictions, by Janet Hartin et al, University of California, 2015.
2. Qualified water-efficient landscaper manual: City of Santa Rosa Utilities Department (Water-Use Efficiency), 2012.

"It does not take a truck load of parts to offer an efficient maintenance service. A selection of key items will handle 90% of all situations" – John Gordon, LIA.