Raingardening

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1) Planet Earth – Is water scarce?

- From a global perspective water isn't scarce 70% of the surface of the globe is water.
- But 96% of this is salt water in the oceans; 4% fresh water. Of this 2% is locked away in glaciers, snow and ice; just over 1% is locked away deep down in aquifers.
- Less than half of 1% is water that available and accessible to living organisms and plants on land.
- Found in rivers, lakes, creeks, streams and soil - part the of water cycle and supports all life on land.

2) Water Cycle

- Water has a natural cycle, it's transient and constantly moves but never leaves.
- The water we have now is the same water from thousands of years ago. There is no new water.
- The Issue with climate change is the change in where the water is in this cycle; this affects our weather and our ability to grow food, maintain gardens and have strong biodiversity in our spaces.
- The amount of water made available will change because the amount plants transpire, the amount that evaporates and the amount that condensates will all change.

3) Australia – The Driest Continent on Earth

- Australia is the driest country on the planet and has experienced 1.7 degrees of warming in the last 170 years. Australia is warming quicker because of its large landmass.
- Predictions for Australia is a warming of 2.7 - 3 degrees before climate change levels off.
- The expectations for Melbourne – longer and more volatile summers in the long term, with more intense heat events and more often, with days of over 50 degrees becoming common.
- More large unpredictable rain events – so stormwater is going to be a challenge, but overall less rain.
- The weather we are experiencing today was created by our actions 30 years ago, so our actions today will influencing the weather in about 30 year's time. There are Huge lag times with Climate Change.

4) Water in the Urban Environment – The Stormwater Problem

- In many Australian cities the volume of stormwater runoff is equal to the total amount of potable water consumed. With an estimated 50% being used for "lower-quality" purposes such as irrigation.
- In a pre-urban (forest) environment, there are high levels of transpiration and evaporation, with excess rainfall infiltrating the soil and slowly percolating into groundwater base flow. This water makes its way slowly into creeks and streams.
- As urbanization progresses natural landscapes are compacted and the number of hard surfaces, such as buildings, roads, footpaths and other sealed surfaces increases. Instead of infiltrating the soil rainwater flows directly into our waterways via the stormwater network increasing erosion and harm to our natural aquatic ecosystems.
- Stormwater runoff in developed areas is a large source of pollution entering waterways
    - Some common pollutants entering our waterways via stormwater are:
        - Chemicals – pesticides, herbicides, fertilizers, oil, heavy metals etc.
        - Litter – plastic bags, bottles, food wrappers etc.
        - Natural waste – food, leaves, garden clippings, animal waste etc.
        - Air pollution that has settled on the ground
        - Shampoos and washing detergents.
- Stormwater can be a valuable resource. Well-managed stormwater can replace potable water for household uses where high-quality water is not required, such as garden watering. An expanded garden improves habitat for native wildlife and can make the area surrounding the house cooler in summer. Using stormwater can save potable water and decrease water bills. It can also have broader environmental benefits, including:
    - reduced flooding
    - cleaner rivers, lakes and beaches that are safer for swimming
    - a healthier environment for plants and animals.

5) Slow the Flow

Slow the Flow is a message promoted by Australian water authorities to encourage a more natural way of managing stormwater.

Instead of rushing rainwater straight into pipes and drains, *Slow the Flow* focuses on **slowing, spreading, and soaking water into the landscape**, especially during heavy rain. This reflects best-practice stormwater management in Australia, which aims to reduce fast, high-volume runoff that can cause downstream flooding, erosion, and pollution.

By slowing stormwater down, we can:

- reduce **local flooding**
- improve **water quality**
- limit **erosion** in creeks and waterways

When water moves more slowly, it has time to **infiltrate the soil or return gradually to waterways**, easing pressure on drainage systems and supporting healthier urban environments

"slow it, soak it, use it"

6) What is a Raingarden

- Raingardens are specially prepared gardens designed to capture, slow, and filter rain run-off from roofs, driveways, patios and other hard surfaces, therefore helping to protect our streams and rivers from stormwater pollutants
- Also known as bioretention systems because they use soil, plants and naturally occurring microbes to filter and treat stormwater.
- Installing a rain garden on your property can be an easy way to reduce pollutant loads in stormwater while also improving water retention on your property.
- Raingardens:
    - Help the home gardener by keeping rainwater on site longer so it is available to plants and to the soil.
    - Also have a positive impact on the health of urban waterways by slowing stormwater entering the stormwater system. By the time the water does enter the stormwater system it has slowed down dramatically and is cleaner.
    - Turns "boggy" areas into attractive wildlife habitats.

7) How Raingardens Work

- Raingardens work by:
    - Allowing water to collect and settle on the garden surface
    - Allowing water to soak through the plants and soil (filter media), trapping rubbish and sediment on the surface
    - The soil and plant roots work together to naturally filter the water.
- They typically consist of:
    - A 200-500mm space above the media for water to collect and settle for up to a few hours.
    - Soil such as loamy sand for filtration that drains quickly and does not release nutrients into the stormwater
    - Gravel for drainage
    - And plants that can tolerate periods without rain. If there is no rain the rain garden won't get water either, therefore drought tolerant plants that can tolerate waterlogging are important.
    - A slotted drainage pipe beneath the soil to direct the filtered rainwater away
    - An overflow pipe on the surface to prevent flooding
- raingardens can be:
    - Any shape or size

        - They can be designed to fit your garden and follow the natural flow of water on your property.
    - In-ground or above-ground. The choice depends on your space, soil type, and what works best for your site.
        - In-ground raingardens can be either:
            - Infiltration raingardens
                - These let water soak directly into the ground.
                - They should be located at least 5 meters away from buildings such as houses, sheds or garages.
                - They work best in sandy or loamy soils.
            - Lined raingardens
                - These hold and filter stormwater for a short time before releasing it through a pipe into the stormwater system. This option is useful where infiltration isn't suitable.
                - Built with special soil mixes
    - Constructed using a variety of media
        - Most raingardens use a sandy loam that allows water to drain quickly while still supporting healthy plants.
    - Planted with a variety of plants
        - Plants are chosen to suit local conditions, cope with wet and dry periods, and create an attractive garden feature.

8) Types of Raingardens

- Infiltration raingarden
    - A gravel filled trench designed to receive stormwater directly from a diverted downpipe, water tank overflow, or runoff from surrounding hard surfaces.
    - Features layers of soil for filtration, gravel for drainage and drought tolerant plants that can tolerate periods of waterlogging.
    - Facilitate stormwater infiltrating the surrounding native soils
    - Best for areas with well-draining soils
    - Intended to reduce stormwater volume
- In-Ground raingarden
    - Used when infiltration into the surrounding soil is not possible or safe
    - Typically feature a lined, constructed soil bed, gravel layer and drainage pipe to direct filtered water into the stormwater system
- Planter Box or Above Ground Raingarden
    - Elevated or contained planters designed to capture, filter and treat stormwater runoff from downpipes or water tank overflows before releasing it into the stormwater system
    - For areas where in-ground planting is not practicable
    - Function as small, raised versions of the in-ground raingarden.
    - Can be designed with a base reservoir (similar to a wicking bed) to allow plants to draw water up as needed.
    - Consist of a sturdy container (often timber, plastic, or concrete) with layers of media, a submergible water zone and drainage pipes.
- Swales
    - Unlike raingardens that are designed to capture and filter or absorb water in place, swales are linear, sloping channels designed to move and slow water down.
    - Are best used for larger directed flows
    - Uses vegetation and soil to filter pollutants
    - Can be positioned to collect stormwater from hard surfaces
    - Help reduce the amount of stormwater entering rivers and creeks

9) Creating a Raingarden

- Four stages to create and sustain a Rain Garden
  - Plan
  - Build
  - Plant
  - Maintain
- **PLAN**
  - **Check:**
    - Check with your local council for any stormwater regulations in your area
    - Check the location of existing utilities (Before You Dig Australia https://www.byda.com.au/ previously known as Dial Before You Dig), this will affect where you can build your raingarden.
    - Raingardens should also not be built over or close to septic systems or other underground service.
  - **Observe:**
    - Observe how water moves in your garden
    - Decide how water will flow to the rain garden
  - **Choose:**
    - Choose the location for your raingarden, this is best in a location that:
      - Will not be used for another purpose
      - Is close as possible to the water source – downpipe, rainwater tank overflow, paved area etc. ensuring adequate distance from your house or other structures, this may depend on the depth of your foundations – a minimum distance of 3-5m is often recommended
      - Avoid building your rain garden underneath large trees to avoid damaging the root system and making more work for yourself.
      - Allows for the overflow to safely direct water away from the house or neighboring properties
      - Water flows naturally towards
  - **Stormwater & Site Safety:**
    - Determine the depth of the existing stormwater pipes to ensure correct connection
    - Identify a safe location for overflow from the raingarden
    - A Certified plumber must be used for stormwater connections and modifications

  note: if you are working on or near a slope greater than 10% a professional should be consulted to avoid creating instability in the landscape
  - **Soil and Drainage:**
    - Assess the soil drainage rate where your rain garden will be located, this is especially important for in-ground raingardens.
    - Identify a safe place to direct overflow from the raingarden
  - **Size and Shape:**
    - Choose the size and shape of your raingarden
      - Ensure your raingarden is large enough to manage the amount of stormwater it will likely receive.
      - Generally, the raingarden should be approximately 2% of the run-off area. For example, if you plan to capture water from the downpipe from a roof measuring 100m^2 your rain garden should be approximately 2m^2.
    - Ensure the location you have chosen is large enough for your planned raingarden.
- **BUILD**

The best time to build a raingarden is in Autumn, while it can be done in other seasons it is best to avoid overly wet or dry weather as it can lead to further compaction and erosion respectively.

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If you are building an inground style raingarden (including inground and infiltration raingardens or swales) the area should be dug with a gentle slope away from houses or other permanent structures.
The base of the raingarden should be above the surrounding groundwater level
The raingarden should be designed to capture gentle rainfall with runoff from heavy storms able to bypass the raingarden into the drainage system.

- **Inground Raingarden**
  - Mark out the location of your rain garden (using stakes, ground paint, and/ or other tools)
  - Excavate the raingarden with a gentle slope towards the stormwater outlet (where the water will leave your raingarden)
  - Line the raingarden with a UV safe liner, if multiple sheets are needed overlap them by 200mm and seal with a suitable water safe tape
  - Line the bottom with 7mm screenings (gravel)
  - Lay a 90mm diameter slotted drainage pipe horizontally along the center of the raingarden base, cap one end and have your plumber connect the other end to the properties existing stormwater.
  - Connect a vertical (upright) 90mm diameter overflow pipe into the slotted drainage pipe using an elbow and seal (the top of the overflow pipe should sit approx.. 100mm above the gravel mulch and 100mm below the surrounding ground level. Make sure the top of the overflow pipe has a cover on it to prevent debris and materials falling in.
  - Create a path for water to enter the rain garden (e.g. extend the downpipe spout, or run an underground pipe or swale) and a rock-lined entry for water into the rain garden
  - Shape or level the bottom of your rain garden making sure not to compact it
  - Use an appropriate raingarden soil mix or incorporate compost into your existing soil
  - When adding the soil mix make sure to leave space below the overflow for ponding
- **Infiltration Raingarden**
  - Dig a shallow, flat-bottomed depression ensuring the base is above the groundwater level
  - Create a gentle slope for water to enter.
  - Install an overflow (e.g. a shallow, gravel-lined trench) to allow heavy storm runoff to exit via the stormwater without flooding the area
  - Add a layer of gravel at the bottom for drainage
  - Top with 300-600mm of a sandy loam media.
- **Above Ground/ Planter Box Raingarden**
  - Can be created out of any material as long as it is strong enough to hold soil and wont leech chemicals into the soil/ water. You can use old water tanks/ troughs, wine barrels, or build your own using hardwood.
  - Line planter box (bottom and sides) with a PVC liner, if multiple sheets used overlap by 200mm and seal with PVC tape. Lining is only necessary if container isn't already waterproof (water tanks, troughs etc may hold water on there own)
  - Place the 7mm screenings (crushed gravel) to a depth of 50mm.
  - Level screenings to create a gentle slope towards the stormwater outlet (where water will exit the planter)
  - Place a 90mm diameter slotted drain pipe horizontally along the centre of the planter box atop the screenings (have a licenced plumber connect the drainage pipe to the properties stormwater).
  - Connect the vertical 90mm diameter overflow pipe into the slotted drainage pipe using a 90degree t pipe. The top of the overflow pipe should be 100mm above the gravel mulch and 100mm below the top edge of the planter box.
  - Put a temporary cap ontop of the overflow pipe to avoid debris blocking the pipe
  - Add the rest of the screenings to a depth of 150mm on top the drainage pipe.

- Add 100mm of washed sand over the screenings
- Add sandy soil mix to a depth of 400mm
- Redirect downpipe or water tank overflow into the raingarden using pipe bends where required. Add plants.

- **PLANT**
  - Prioritize planting in Autumn where practicable as it gives plants a chance to establish before hot dry weather.
  - Use a variety of small trees, shrubs, groundcovers and grasses
  - Select plants suitable for the three planting zones within your rain garden and around the perimeter
    - **Top – Dry/ Upper bank**
      - Sits highest in the garden
      - Soil drains quickly
      - Rarely inundated
      - Experiences long dry periods between rain
      - Best for drought-tolerant plants
    - **Mid – Damp/ Mid Zone/ terrace**
      - Most versatile planting area
      - Regularly moist
      - Temporarily inundated
      - drains within 24-48 hours
      - Shallower than the bottom of the basin or swale
    - **Bottom – Wet/ Inundated base**
      - Lowest part of the garden
      - Collects water and temporary ponding
      - Holds water the longest after rain
      - Planted with sedges, rushes and water-loving plants

    Rain-garden plants must tolerate both wet feet after rain and dry conditions between rainfall events. If plants cannot handle both, they are not suitable for raingardens.
  - Cover exposed soil with mulch to minimize erosion
  - Provide water to establish plants
- **MAINTAIN**
  - Keep the inlet and overflow clear of debris and protected with rocks
  - Avoid the use of fertilizers, pesticides and herbicides
  - Weed the area regularly, especially in the first year when the plants are getting established
  - Water new plants until they are established, once established a well-designed raingarden should rarely need watering once mature.
  - Add more mulch as needed

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Plant Choice

- Consider Indigenous Plants as they are suited to the local soil and climate. Often require less water once established

Category	Botanical name	Common name	Rain-garden zone suitability
Shrubs	*Acacia verticillata*	Prickly moses	Dry / Upper bank
	Baeckea virgata 'Clarence River'	Weeping baeckea	Damp / Mid zone
	Callistemon viminalis 'Better John'	Bottlebrush 'Better John'	Damp / Mid zone - Wet / Bottom Zone
	Callistemon viminalis 'Slim'	Bottlebrush 'Slim'	Damp / Mid zone - Wet / Bottom Zone
	Correa nummulariifolia	Roundleaf correa	Dry / Upper bank
	Daviesia leptophylla	Narrow-leaf bitter-pea	Dry / Upper bank
	Goodenia ovata	Hop goodenia	Damp / Mid zone
	Goodia lotifolia	Golden tip	Damp / Mid zone
	Hakea ulicina	Furze hakea	Dry / Upper bank
	Melaleuca incana	Grey honey-myrtle	Damp / Mid zone
	Olearia myrsinoides	Silky daisy-bush	Dry/ Top zone - Damp / Mid zone
	Prostanthera lasianthos	Victorian Christmas bush	Damp / Mid zone
Grasses and Sedges	*Austrostipa* sp.	Spear-grass	Dry / Upper bank
	Carex breviculmis	Short-stem sedge	Dry/ Top zone - Damp / Mid zone
	Deyeuxia quadriseta	Reed bent-grass	Damp / Mid zone - Wet / Bottom Zone
	Dianella longifolia	Pale flax-lily	Dry/ Top zone - Damp / Mid zone
	Dianella revoluta	Black-anther flax-lily	Dry/ Top zone
	Dichelachne micrantha	Short-hair plume-grass	Dry/ Top zone - Damp / Mid zone
	Ficinia nodosa	Knobby club-rush	Damp / Mid zone - Wet / Bottom Zone
	Themeda triandra	Kangaroo grass	Dry/ Top zone - Damp / Mid zone
	Lomandra filiformis	Wattle mat-rush	Dry/ Top zone - Damp / Mid zone
	Lomandra longifolia	Spiny-headed mat-rush	Dry/ Top zone - Damp / Mid zone
	Poa labillardierei	Tussock grass	Dry/ Top zone - Damp / Mid zone
	Rytidosperma racemosum	Clustered wallaby-grass	Dry/ Top zone - Damp / Mid zone
	Tetrarrhena juncea	Forest Wire-grass	Damp/ Mid zone
Wildflowers	*Arthropodium milleflorum*	Pale Vanilla Lily	Dry/ Top zone - Wet / Bottom Zone
	Chrysocephallum semipapposum	Clustered Everlasting	Dry/ Top zone - Wet / Bottom Zone
	Microtis unifolia	Common Onion-orchid	Dry/ Top zone - Wet / Bottom Zone
	Patersonia fragilis	Short Purple-flag	Damp / Mid zone
	Patersonia occidentalis	Long purple-flag	Dry/ Top zone - Damp / Mid zone

Category	Botanical name	Common name	Rain-garden zone suitability
	Stylidium graminifolium	Grass Triggerplant	Dry / Upper bank
	Tetratheca ciliata	Pink-bells	Dry/ Top zone - Damp / Mid zone
	Viola betonicifolia	Showy Violet	Dry/ Top zone - Wet / Bottom Zone
	Wahlenbergia sp.	Bluebells	Dry/ Top zone - Wet / Bottom Zone
Bog Plants	*Alisma plantago-aquatica*	Water plantain	Wet / Bottom zone
	Carex appressa	Tall sedge	Damp / Mid zone - Wet / Bottom Zone
	Centella cordifolia	Swamp pennywort	Wet / Bottom zone
	Crassula helmsii	Swamp stonecrop / swamp crassula	Wet / Bottom zone
	Empodisma minus	Spreading rope-rush	Wet / Bottom zone
	Goodenia humilis	Swamp goodenia	Wet / Bottom zone
	Juncus flavidus	Yellow rush	Damp / Mid zone - Wet / Bottom Zone
	Persicaria praetermissa	Spotted knotweed	Wet / Bottom zone

Summary

- Understand how water moves through natural and urban environments
- Recognise the impacts of climate change on rainfall and stormwater
- Value stormwater as a resource, not a waste
- Apply the “slow the flow” approach to water management
- Understand what rain gardens are and how they work
- Capture, slow and filter runoff from roofs and hard surfaces
- Reduce flooding and improve urban water quality
- Choose appropriate rain garden types for different sites
- Design rain gardens with location, size and soil in mind
- Select plants suited to wet and dry conditions
- Support healthier waterways, landscapes and communities

Useful Links:

Good Life Permaculture swale pathways: https://goodlifepermaculture.com.au/swale-pathways/
SGA Raingardens: https://www.sgaonline.org.au/raingardens/
Tankulator tank size calculator: https://renew.org.au/resources/tankulator/
Renew water conservation, collection and reuse: https://renew.org.au/resources/how-we-can-help/water/
Melbourne Water raingarden instruction sheets: https://www.melbournewater.com.au/water-and-environment/saving-water/raingardens
Clearwater Infiltration Garden Fact Sheet: https://www.clearwatervic.com.au/user-data/c56-toolkit/Infiltration_Raingarden_Fact_Sheet_0.pdf