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Water Cycle Management - navigating the ebbs & flows

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Overview of the Session

- What are your goals?
- Why are you here?
- IWM background and benefits

LUNCH 12:30

- IWM tools and technology
- Case studies
- Resources

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What's next

- The Saturday dates planned for sessions for semester 2 (80.10.13. commencing at 9:30)
- **Session 2** Aug 20 – Andrew Allen – Manningham – Catchment water management and case study visits
- **Session 3** Sep 10 – Advanced water tech, futurism, irrigation and aquaponics. Stormwater Engineering – Knox – Site Visit to Dobsons Creek IWM
- **Session 4** Oct 8 – City stormwater management – Micah Pendergast Stormwater Regional Coordinator – West Melbourne Water

Intro to WSUD what we will learn about

- https://www.youtube.com/watch?v=wfOqMj-hXVc&index=7&list=PLqacRwhlhmOwKdRnmtIVEsRnBPQ0ph4eu

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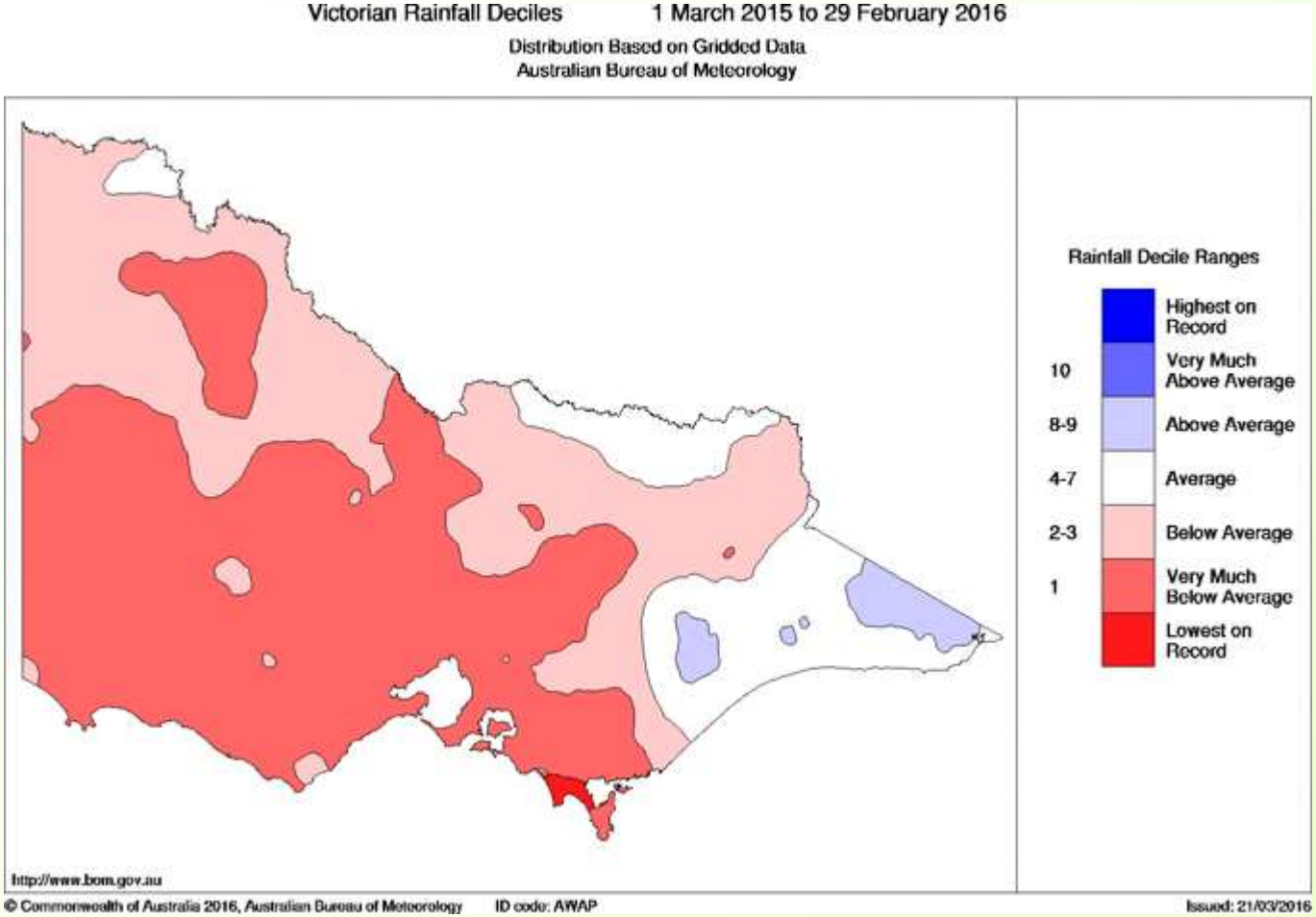
The last year



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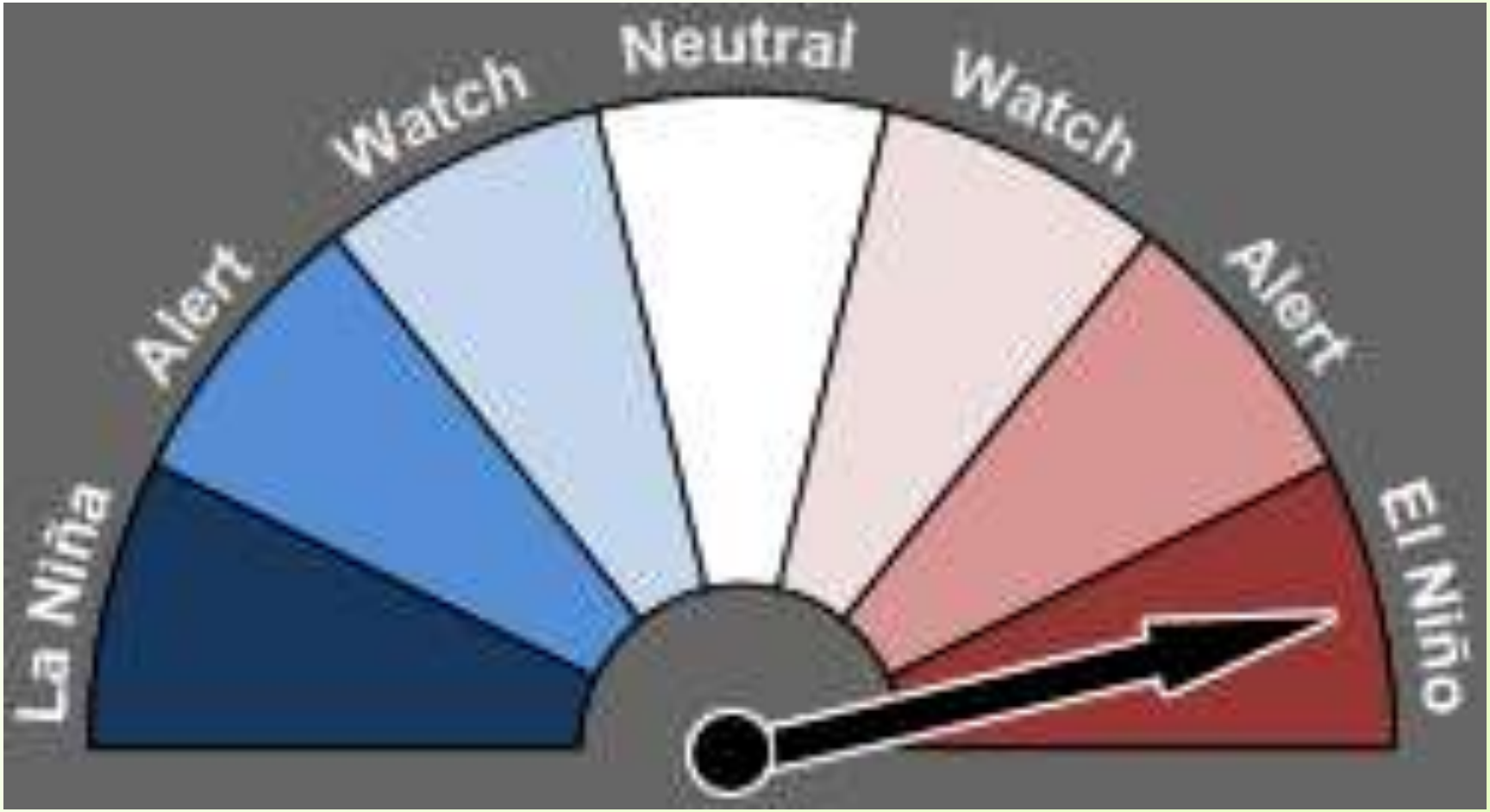
A good time to plan Water Cycle Management?



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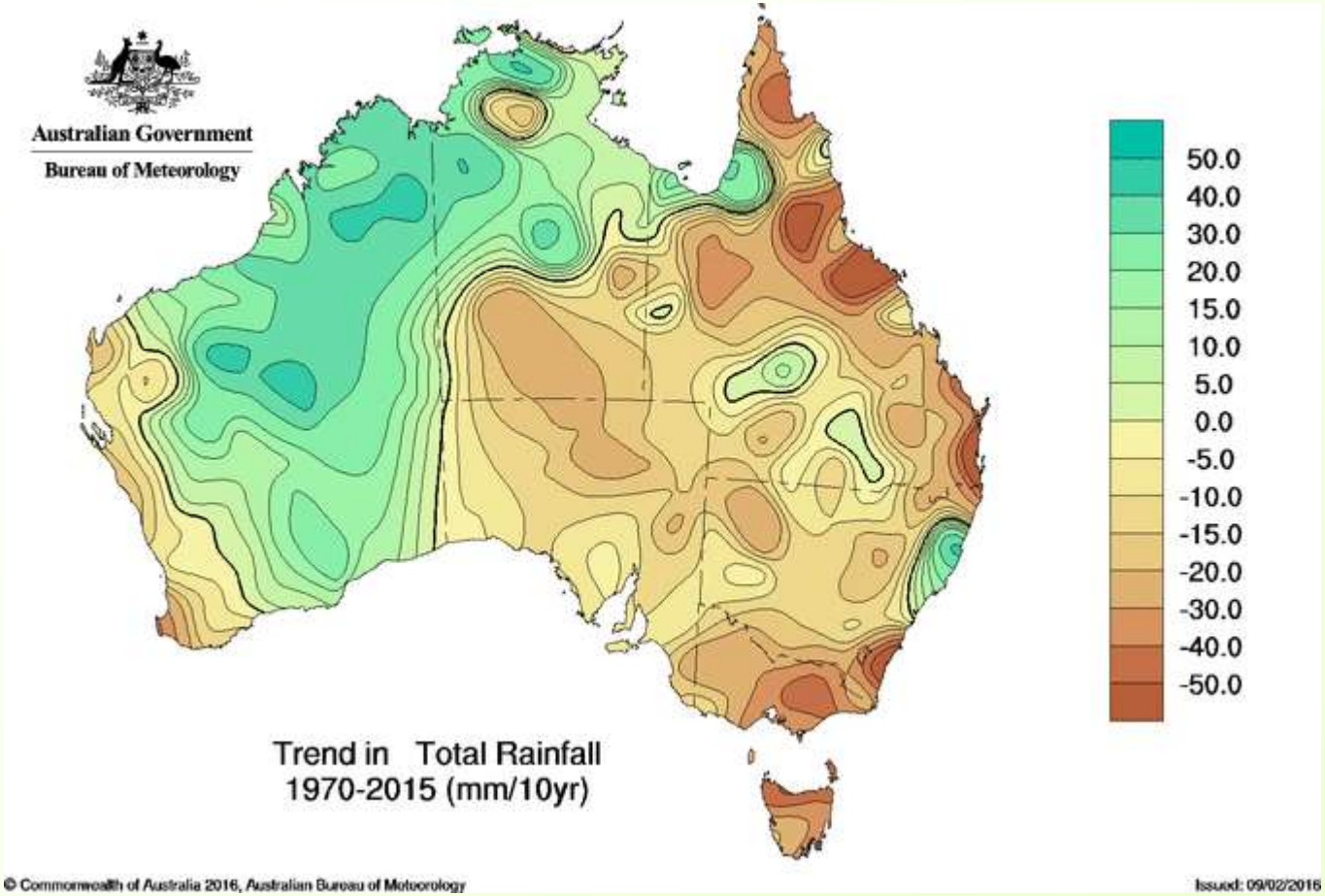
35 Year Trend



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Balancing Multiple Goals

Environmental Managment

- https://www.youtube.com/watch?v=hF1dUbSPuUA
- Killing the Ganges – how not to do environmental management

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Water Cycle Planning

Capture and store water

Use Water Efficiently

Treat and Recycle

Envisioning WSUD

- https://www.youtube.com/watch?v=6KFqEmcLXk8&list=PLqacRwhlhmOwKdRnmtIVEsRnBPQ0ph4eu
- Tony Wong

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Where to start

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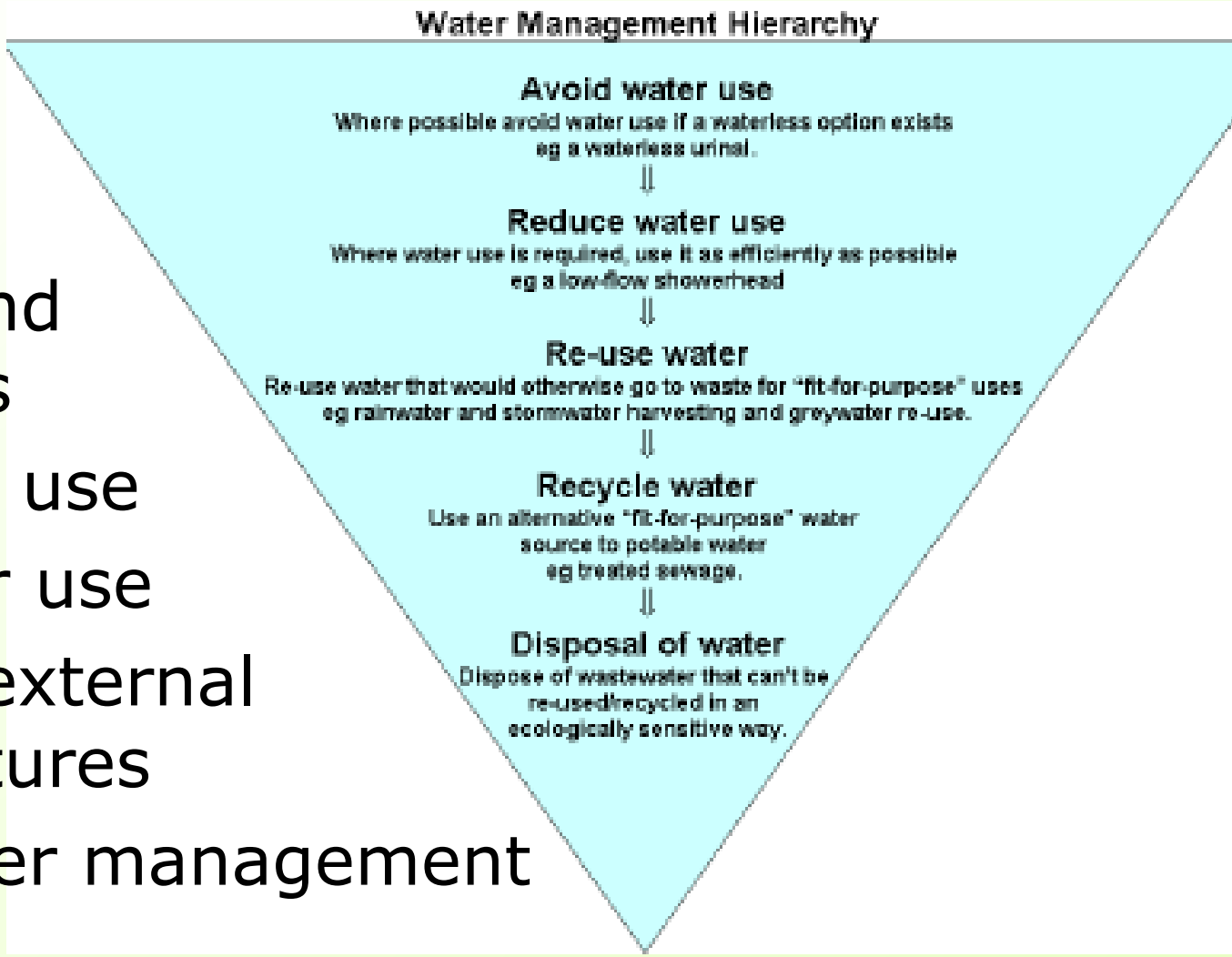
What do I do first?

- Water efficient fixtures and appliances
- Rainwater use
- Greywater use
- Minimise external water features
- Stormwater management



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Building Water Audit

- Water / stormwater / rainwater balance tools
  - In-site Water
  - Green Star Water Calc
  - BESS
  - Custom report from Water Auditor

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Why is water efficiency important?

- The average Melbourne household of four people uses approximately 240,000 litres of drinking water each year (one-tenth the size of an olympic swimming pool)
- 90% of that water does not need to be drinking quality.

Source: www.ci.adelanto.ca.us

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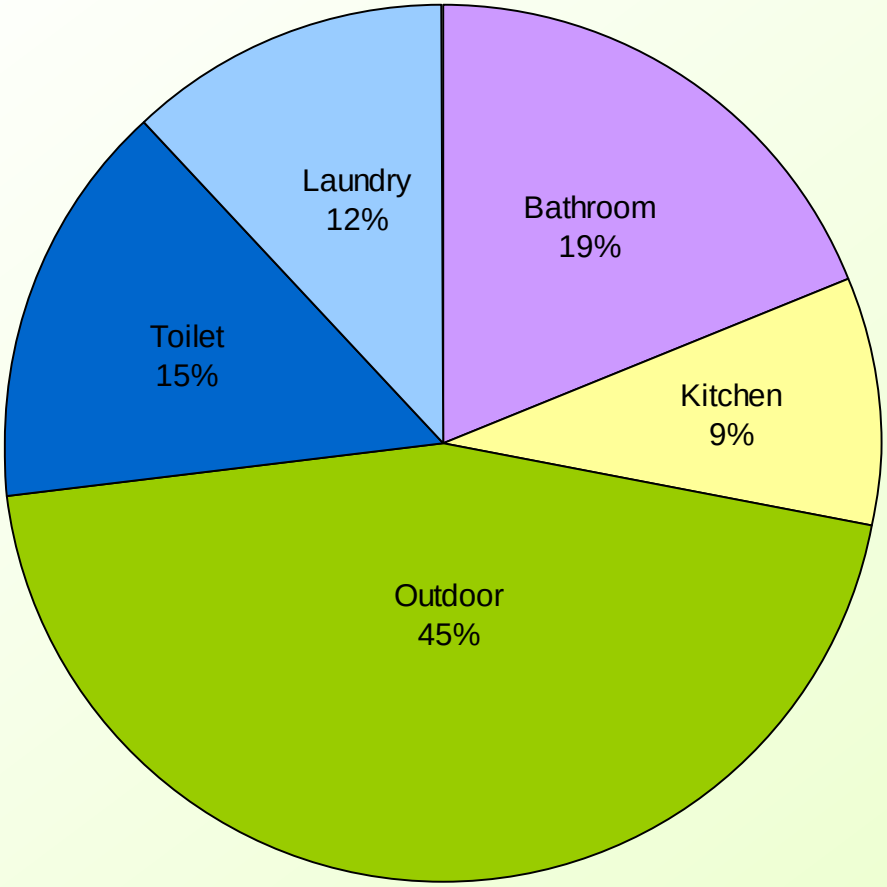
Residential Water Use



Source: ABS 2004 – Environmental Issues and Trends

greenspark consulting

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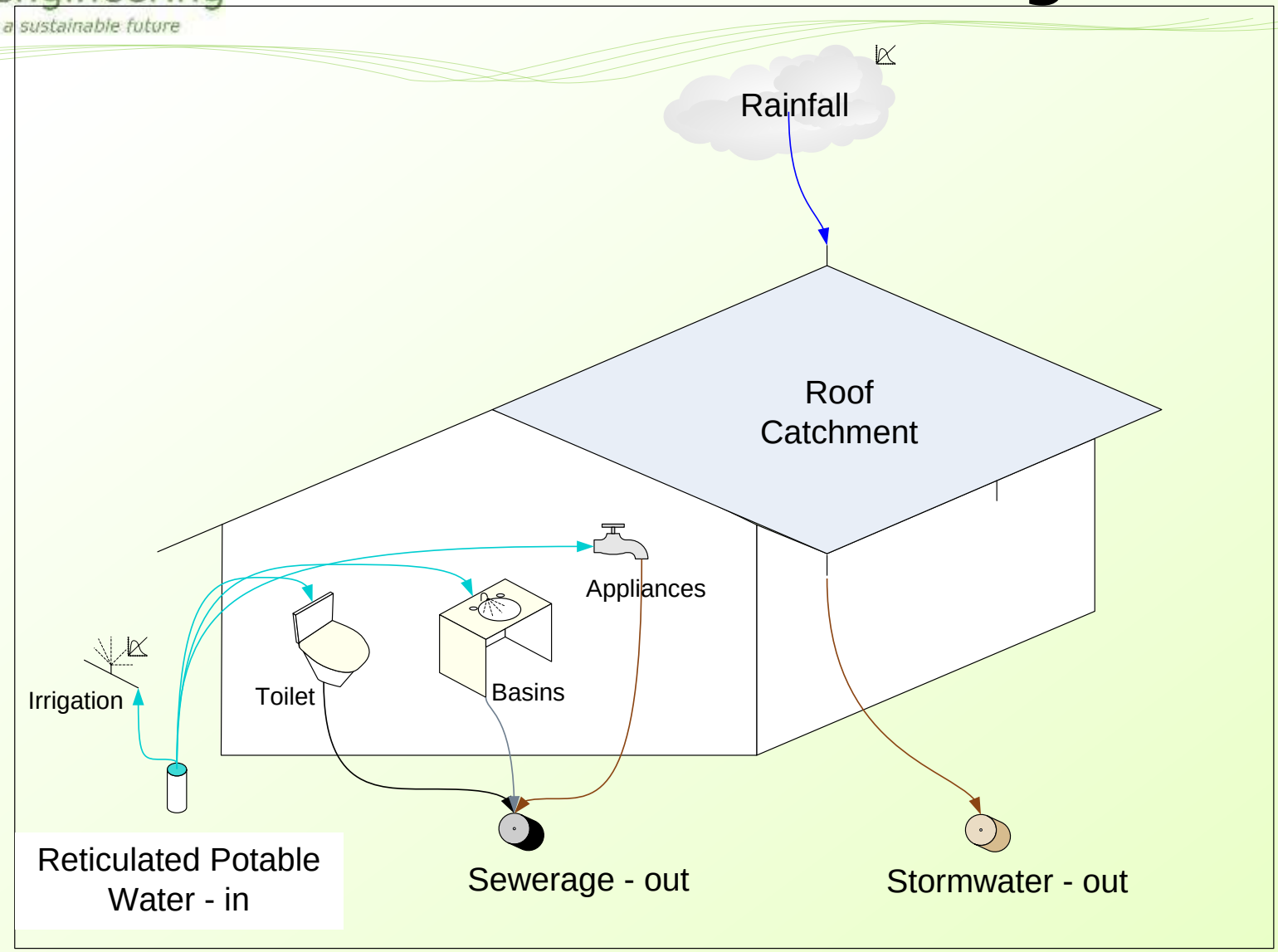
Traditional buildings



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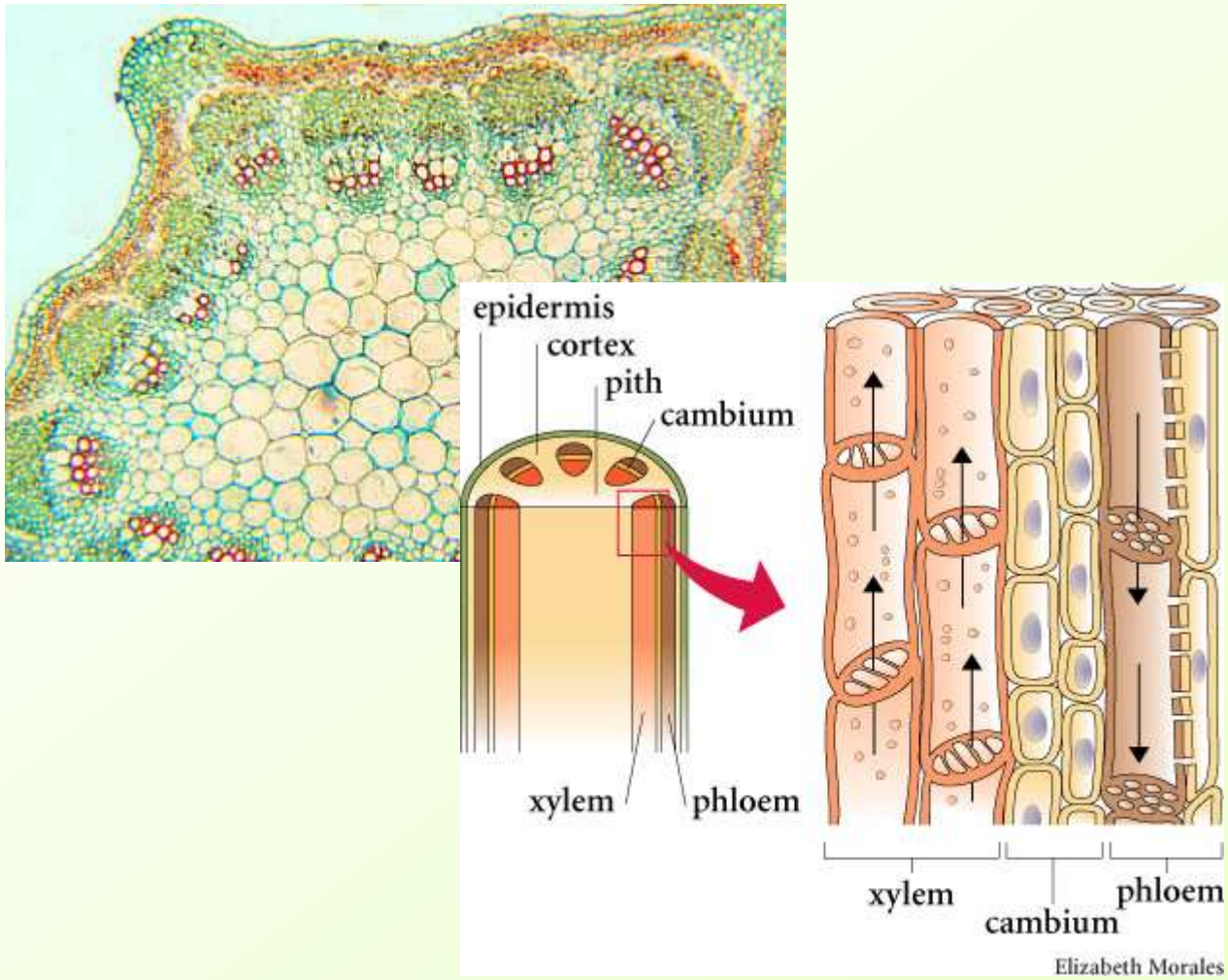
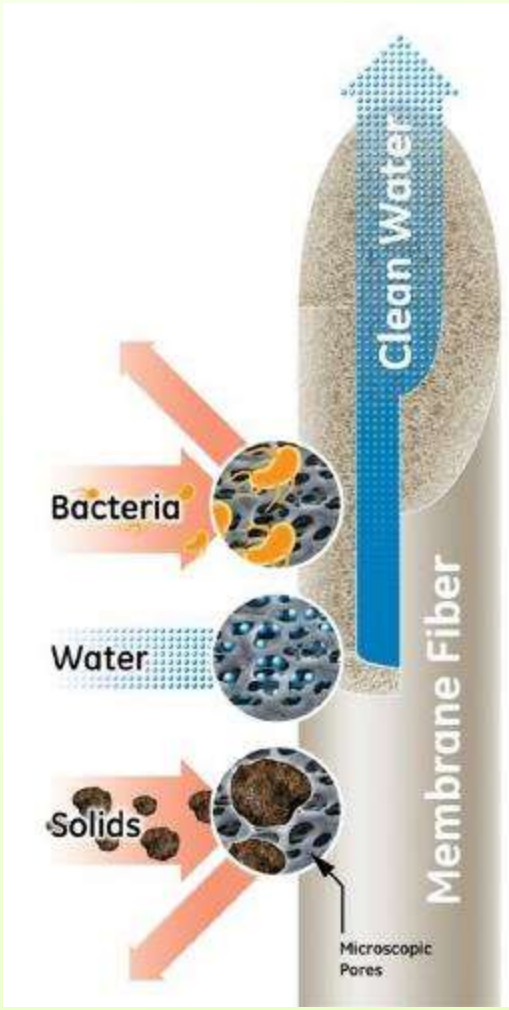
Natural Systems – Store and purify





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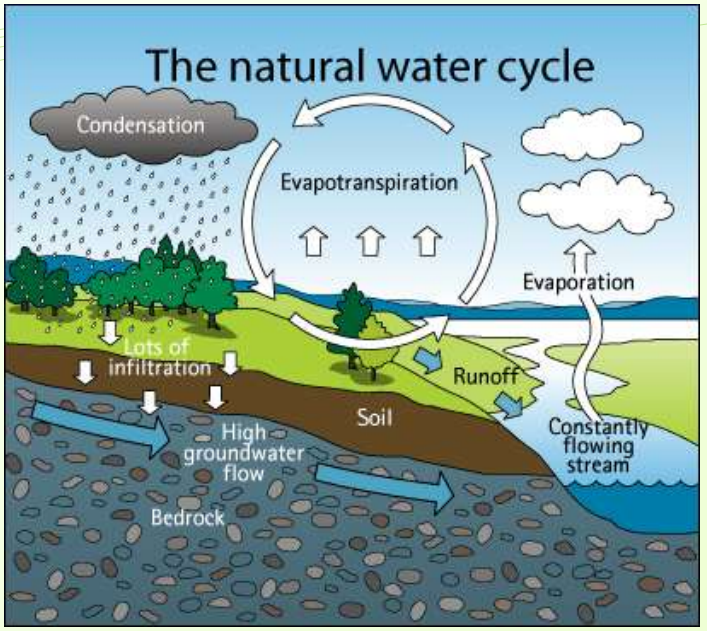
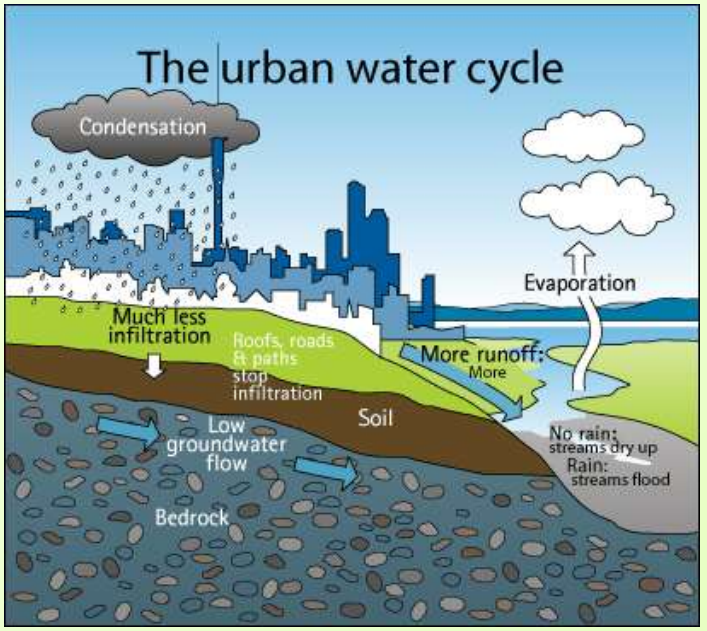
Definitions

- **Rainwater**- is water that has fallen as rain containing little dissolved mineral matter.
- **Greywater**- is wastewater generated from domestic activities such as laundry and bathing which can be recycled for on-site use such as toilet flushing or irrigation.
- **Blackwater** – is wastewater generated from toilet sytems which can be recycled for some non-potable uses if heavily treated
- **Stormwater**- is water generated from rain or snowmelts that falls on impervious surfaces and enters the stormwater system.





Source: www.blueplanet.nsw.edu.au

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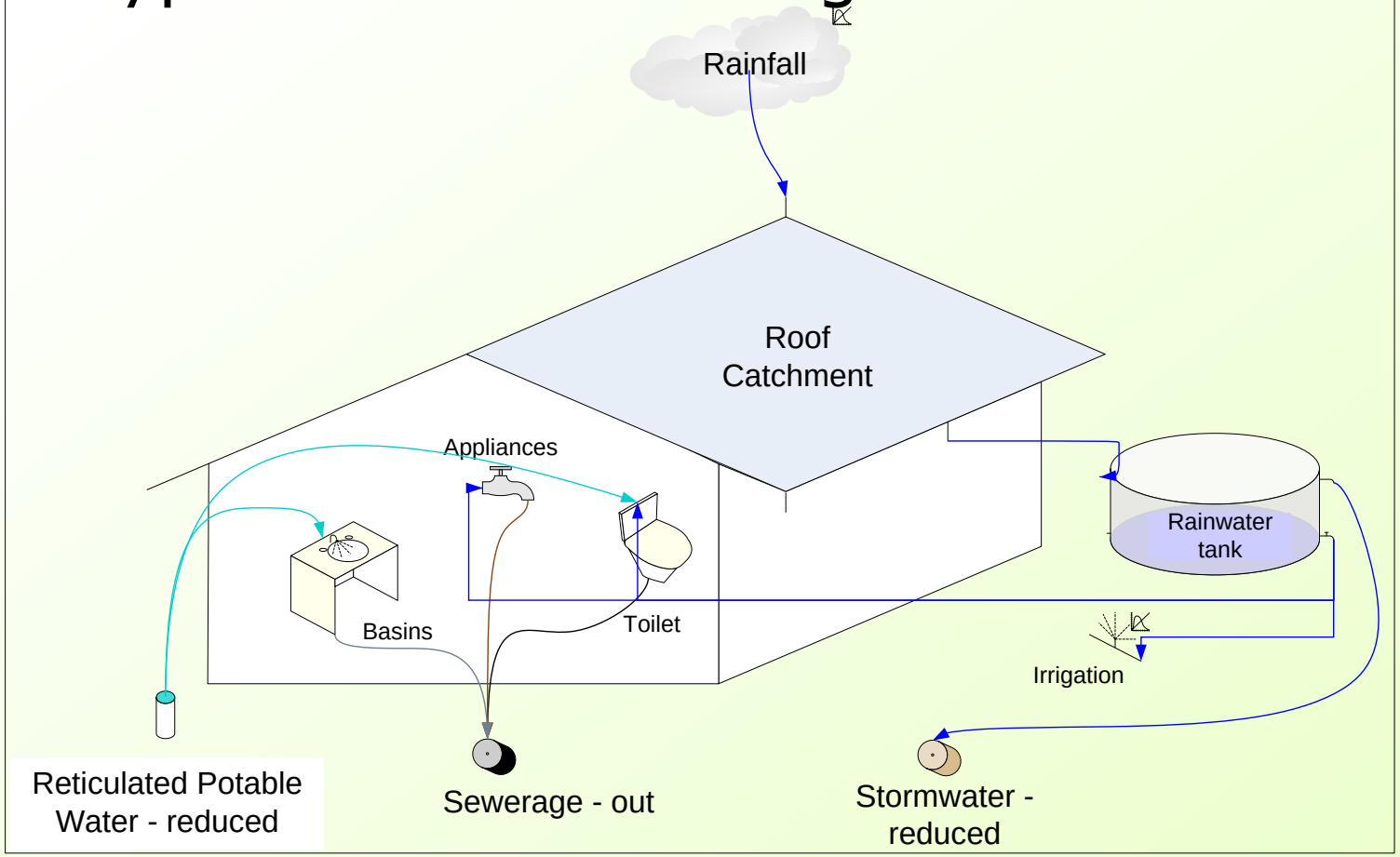
Rainwater + efficiency

- Typical 4 Star Building



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Water efficient fixtures

Water efficient fixtures and appliances are the easiest measure to reduce water consumption:

- Benchmarked through WELS (water efficiency labels and standards)
- Water efficient taps and shower roses
- Dual flush toilets or waterless urinals
- High star rated dishwashers and washing machines
- Efficient garden watering systems that minimise waste and evaporation

Water Tanks

- Reuse
  - Toilet flushing
  - Irrigation
  - Car washing
  - Cooling towers
- Detention
  - Minimises additional detention infrastructure requirement

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Rainwater Use

The collection of rainwater allows for the conservation of precious potable water resources by using tank water for toilet flushing, garden irrigation and hot water throughout homes.

Source – en.wikipedia.org

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Rainwater Collection

Types of rain water tanks






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Rainwater Use

Careful assessment of rainwater availability and demand should take into account:

- What will the rainwater be used for?
- How big is the roof, or other catchment areas, that can feed the tank?
- How many people live in household?
- How big is the garden?
- What size tank will meet the demand and
- Where can it be located?

Source - www.paulmorganarchitects.com/

There are a number of online tank sizing applications such as ATA's tankulator (which is inaccurate) or In-Site water

Water efficient fixtures

Discuss for 3 minutes:

1. How far is going too far?
2. Is it far enough?
3. Should we enforce 4 minute showers?

Source – www.rogersellers.com

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Your Turn

- Green Star Water Calculator design and as-built
- BESS (max 3 users)
- STEPS and SDS (being retired)

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Water Sensitive Urban Design
in the Planning Process

Knox City Council

Whitehall Terrace - Ferntree Gully

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Regulatory Contexts

- Plumbing Code as part of National Construction Code
- Not much efficiency regulation
- *Urban Stormwater Best Practice Guidelines,* CSIRO, 1999.

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WSUD Topics

- Why do we need to consider it?
- WSUD methods
- Council Statutory Planning requirements
- Assessment tools

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Stormwater Management

Melbourne's continued urbanisation has increased impervious surfaces, resulting in the majority of rain falling in urban areas being converted to run off, or stormwater.

Stormwater can be managed through:

- Rainwater tanks (covered previously)
- Porous paving
- Raingardens
- Drought tolerant landscaping

Water Sensitive Urban Design (WSUD) can capture, treat and reuse stormwater, improving the quality of water entering our waterways and conserving drinking water.

Source – sustainablemelbourne.com

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Stormwater Management

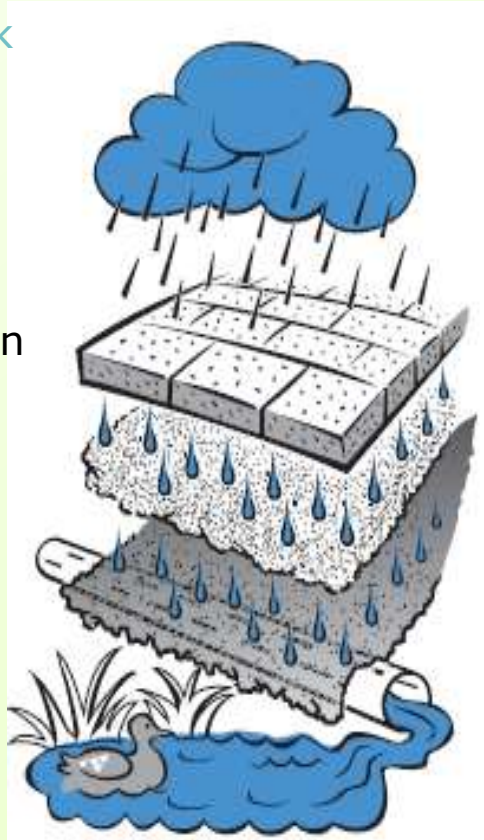
Porous Paving allows rainwater to pass through the pavers and soak into the ground, unlike standard concrete or block pavers.

Using porous pavers affects:

- An increase in groundwater recharge by allowing the water to soak through the soil
- Improvement in stormwater quality by filtering and reducing pollutant loads
- A reduction in high flows during peak rain events that can cause stream erosion and habitat scouring
- The likelihood of flooded surfaces

Source – southcoastenergychallenge.com.au

Source – greenanswers.com



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Stormwater Management

- Raingardens are designed to capture, filter and reduce the flow rate of stormwater from roofs or hard surfaces
- Raingardens are an easy way to reduce pollutant loads in stormwater while providing attractive landscaping
- Effectiveness is increased further when linked to a rainwater tank

Source - raingardens.melbournewater.com.au

How to build a raingarden video

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Why consider it?

- Stormwater pollution is the biggest threat to our urban rivers, creeks and bays
- Each year about 500 billion litres of water containing litter and other harmful pollutants such as heavy metals, oil, organic matter and excess nutrients enters our rivers, creeks and bays via stormwater drains
- Excess nutrients cause vigorous growth of algae, which leads to reduced oxygen levels in water – threatening animals & plants

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Why consider it?

Citarum waterway - Indonesia

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Buildings: Pollutants

- Gross Pollutants (litter & organic material)
- Excess Nutrients - Nitrogen (N)
  - Phosphorus (P)
- Total Suspended Solids (TSS)
- Oils and Grease
- Other Hydrocarbons and Chemicals
- Heavy Metals, pH imbalance, etc.....

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1 in 100 year Rainfall Events

- **Flash-flooding**
- March 2011 - 26 millimetres of rain in Melbourne in less an hour

Clockwise from left:
South Melbourne; Chapel St; North Melbourne

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A Challenge?

- Stormwater pollution becomes a bigger challenge the more Melbourne grows.
- More roads, concrete, roofs and paving where a natural environment used to be.
- The amount of water able to soak into the ground is reduced, so more water runs into stormwater drains.

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An Opportunity

- Stormwater harvesting reduces volume and speed of flow - reducing the amount of water and pollution reaching our waterways.
- Stormwater offers an alternative water source for domestic and industrial use.
- Water rates on the rise This is an opportunity to save.

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Water Sensitive Urban Design (WSUD)

Treating Stormwater

- Protecting Natural Systems
- Reducing Peak Flows
- Removing Litter and Pollutants
- Add value & minimise drainage costs

Koolamara Waters

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WSUD Methods

- **Primary Treatment**
  - Gross Pollutant Traps
  - Filtration
- **Secondary**
  - Grassed Swales
  - Buffer strips
  - Infiltration
  - Green Roofs
- **Tertiary**
  - Raingardens
  - Bioswales
  - Wetlands
  - Detention Basins
- **Diversion**
  - Water Tanks

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Bioretention

- Captures and filters water through a biological or porous medium to remove nutrients and other pollutants
- Raingardens, bioswales, trenches, etc.

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Raingardens

- Diverse install methods suitable for all developments
- Size approx. 2-5% of treatment area
- Treat directly from downpipes, paved areas, driveways etc.

In-Ground

Above Ground

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Raingardens

Pathway, road & car-park treatment

Arboretum Carpark - Dorset Rd, Ferntree Gully

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Raingardens

Knox Council Civic Centre - Burwood Highway, Wantirna South

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Bio filtration

- In depth

https://www.youtube.com/watch?v=GzqCU_ga7wc&index=5&list=PLqacRwhlhmOwKdRnmtIVEsRnBPQ0ph4eu

- Guidelines:

http://www.melbournewater.com.au/raingardens

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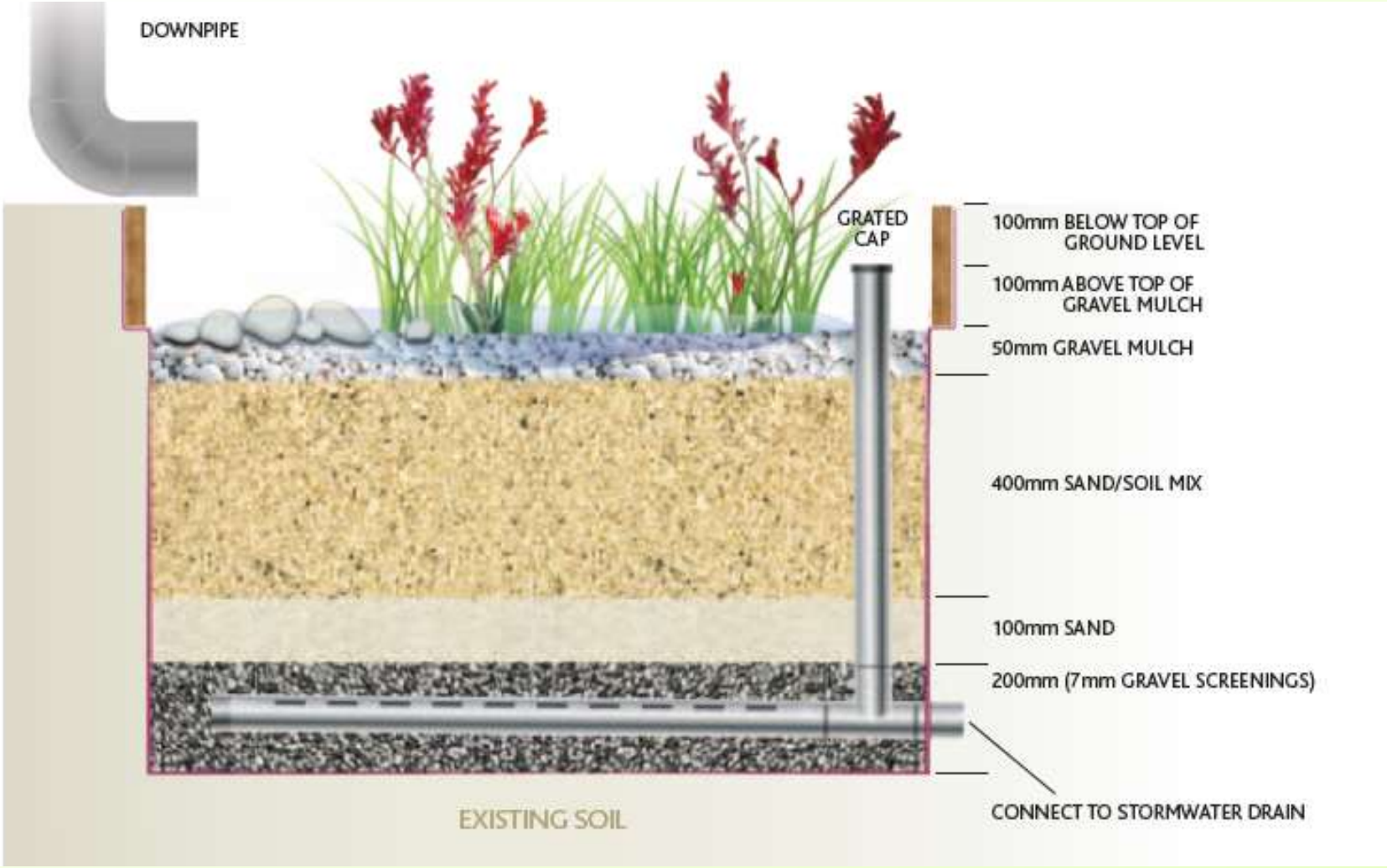
Raingardens

Construction



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Swales & BioSwales

- A channel conveying water from one point to another.
- Facilitates infiltration into soil.
- Removes pollutants & sediment.

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Landscaping

Drought tolerant landscaping is an excellent way to save water in the garden. This can include plant selection, mulch, maintaining healthy soil and installing an efficient watering system.

Source: www.californiagardens.com

Source: www.yelp.com

Did you know the average Victorian family uses 20% of their drinking water in the garden?

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Porous Paving

- Miminise hard surface area
- Concrete pavers, ashphalt
- High pressure hose to clean
- Cost similar or less than traditional pavement

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Porous Paving

Sydney Olympic Park

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Wetlands and buffer zones

- drainage system directs all roof water into the wetland in the forecourt

NAB Head Office – Docklands, VIC

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Storm water management benefits

Water security issues mean that efficient use of water is economically and environmentally beneficial. It can:

- Reduce costly demand on infrastructure upgrades
- Secure a water supply not subject to restrictions

Source: www.dcwc.com.au/cms-projects/ppp-s/victorian-desalination-project.phps

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Why is water management important?

It can also:

- Discharge less sewage into rivers and the ocean
- Improve the health and amenity of our waterways
- Reduce risk of flooding

Source - http://www.epa.vic.gov.au/your-environment/water/stormwater

My Country by Dorothea McKellar

- Community sector – Councils & Water Authority expectations:

- I love a sunburnt country, a land of sweeping plains,
  Of ragged mountain ranges, of droughts and flooding rains.
- I love her far horizons, I love her jewel-sea,
  Her beauty and her terror- the wide brown land for me!

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Statutory Planning Requirements

- Knox City Council Municipal Strategic Statement (MSS) – Objective 6:
  - Reduce the impact of urban stormwater run-off on creeks, rivers, bays and other receiving waters and their surrounds, both within and outside the City.
  - Ensure new development contributes to the ongoing improvement of stormwater management and the quality of stormwater runoff, and reduces pollution in local waterways.
  - Ensure all new developments and redevelopments minimise the amount of impervious surfaces on a site.
  - (plus additional...)
- Victoria Planning Provision - Clause 56.07
  - states that urban stormwater management systems for all new (greenfield) residential subdivisions are to be designed and managed to meet the current Best Practice Environmental Management (BPEM) objectives..

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Statutory Planning Requirements

- Knox - Sustainable Design in the Planning Process
  - Residential: 3+ Dwellings
  - Industrial/Commercial: 500m^2+ Gross Floor Area
- Required to achieve Urban Stormwater Best Practice Environmental Management targets (BPEM)
  - 80% retention of Suspended Solids (TSS)
  - 45% retention of Phosphorus (TP)
  - 45% retention of Nitrogen (TN)
  - 70% reduction of litter

*BPEM targets aim to achieve objectives of the *State Environment Protection Policy (SEPP) - Waters of Victoria* statutory policy under section 16 of the *Environment Protection Act (1970)*

> Corresponding to a score of 100% in Melbourne Water's online STORM tool

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WSUD Assessment Tools

STORM (Stormwater Treatment Objective - Relative Measure)

www.storm.melbournewater.com.au

- Developed by Melbourne Water
- Residential & Industrial/Commercial sites up to 1 hectare
- Quantifies WSUD treatment measures into a percentage compared against BPEM targets

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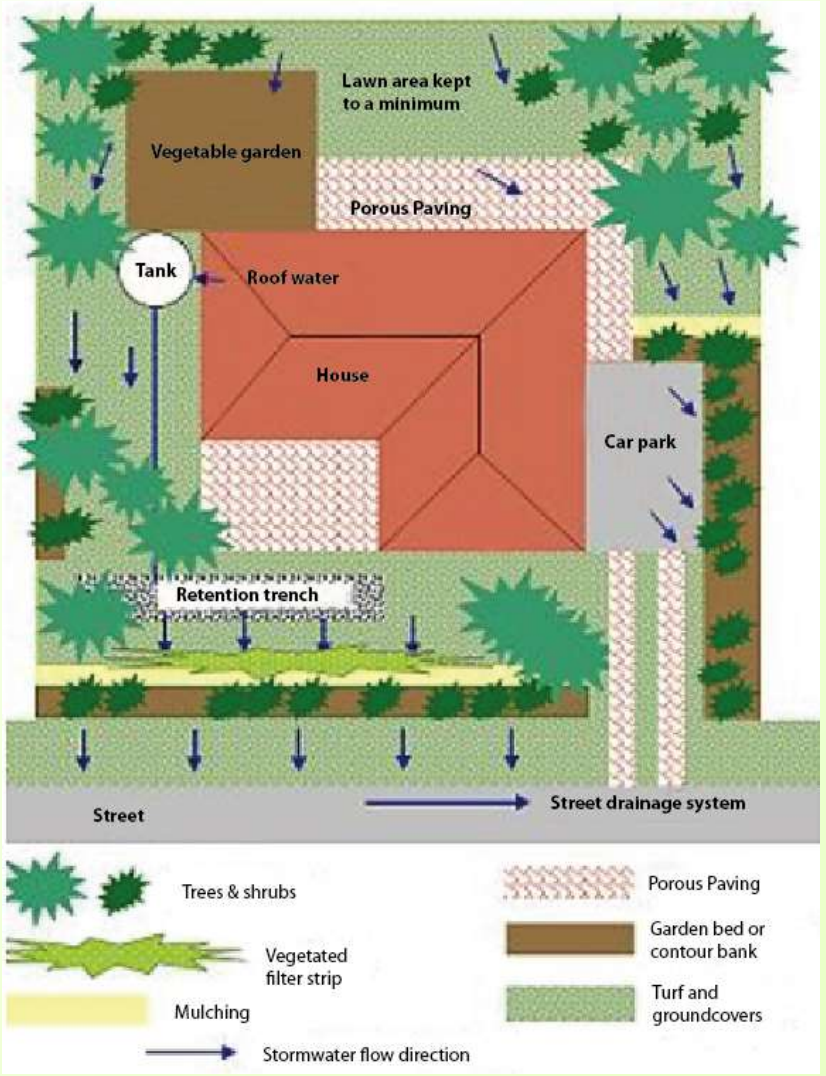
Assessment Tools - STORM

Sample - Residential

- Impervious Areas
- Proposed treatment methods

ie.

- Roof to tank: 250m^2
- Untreated roof: 50m^2
- Drive to raingarden: 100m^2
- Remaining untreated: 50m^2



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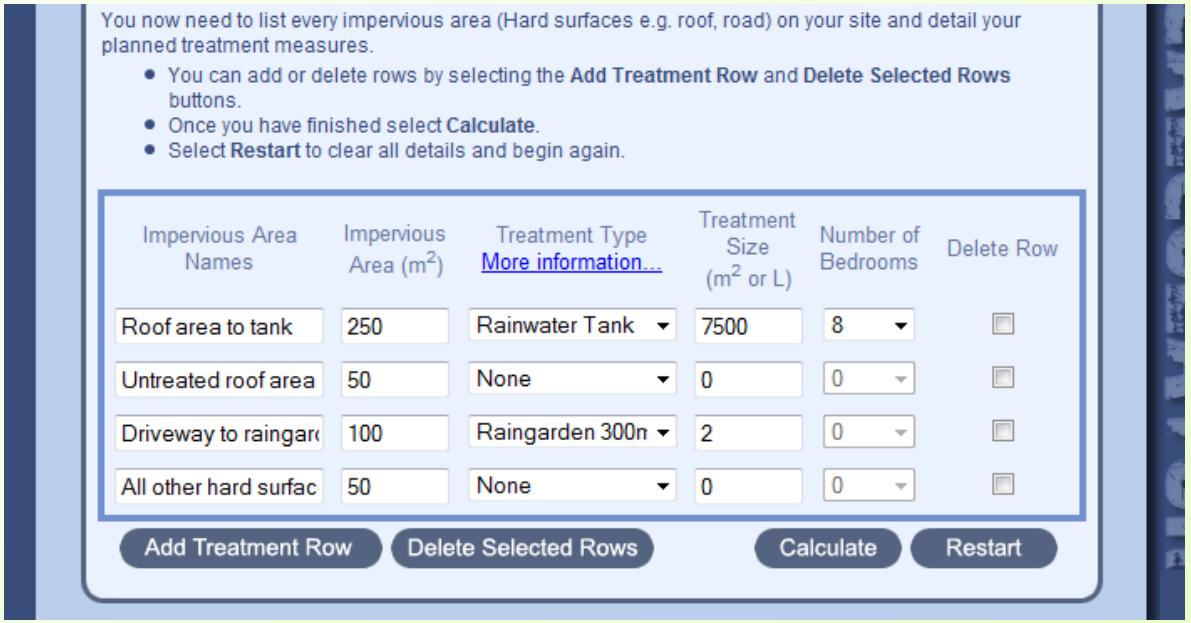
Assessment Tools - STORM

- Enter details of **all** impervious (hard) surfaces in the development and the corresponding WSUD treatment type for each



- Important to include untreated surfaces for an accurate score

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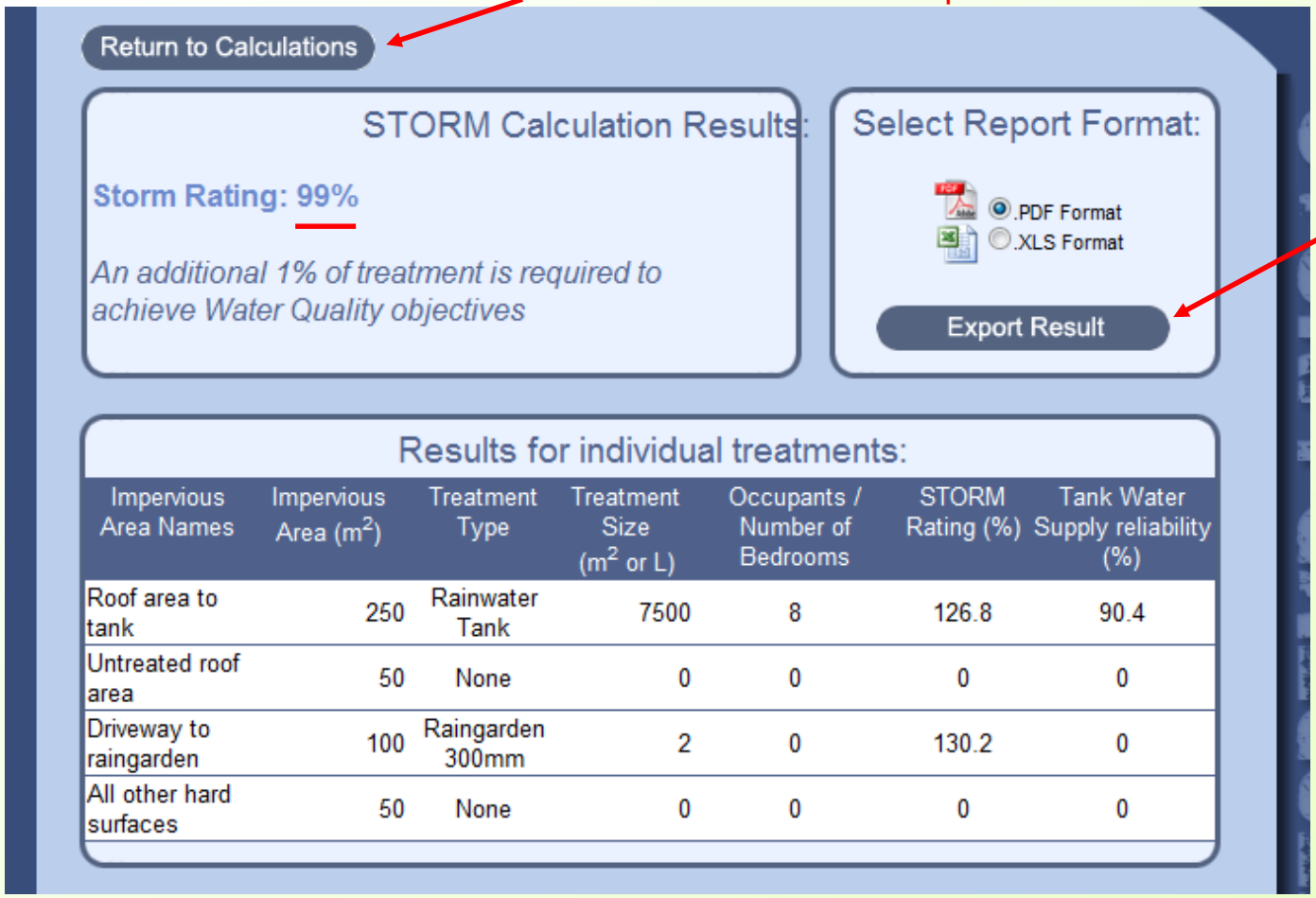
STORM

- Aiming for a score of 100% - representing Best Practice Performance



Impervious Area Names	Impervious Area (m^2)	Treatment Type	Treatment Size (m^2 or L)	Occupants / Number of Bedrooms	STORM Rating (%)	Tank Water Supply reliability (%)
Roof area to tank	250	Rainwater Tank	7500	8	126.8	90.4
Untreated roof area	50	None	0	0	0	0
Driveway to raingarden	100	Raingarden 300mm	2	0	130.2	0
All other hard surfaces	50	None	0	0	0	0

Assessment Tools - STORM

- Treatment Types
  - Rainwater tank
  - Rain gardens
  - Swales
  - Ponds
  - Wetlands
  - Infiltration systems
  - Buffers

- To improve score:
  - Increase rainwater tank size (& roof area draining to tank).
  - Install Raingardens to treat downpipe flow or carpark/driveway runoff.
  - Minimise total hard surface area by using permeable paving for driveways.
- Assumptions
  - STORM assumes rainwater tanks are connected to toilets for sanitary flushing.

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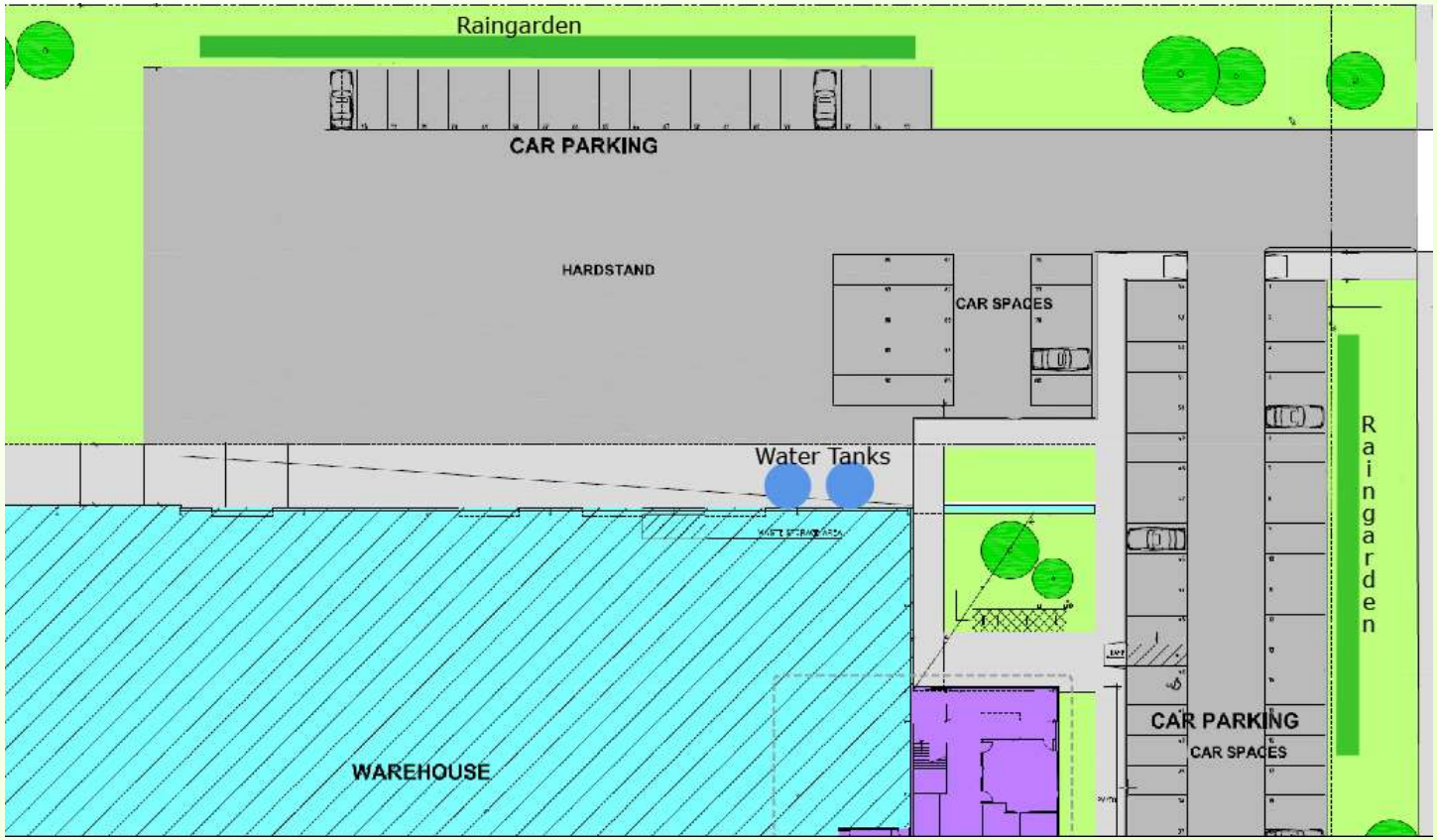
STORM

Sample – Industrial

- Site Area: 4,000m^2
- # Occupants: 40
- Roof draining to 50kL tanks: 1500m^2
- Untreated roof: 500m^2
- Hardstand to 50m^2 raingarden (300mm deep): 1,000m^2
- Untreated hardstand: 150m^2



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Assessment Tools - MUSIC

MUSIC (Model for Stormwater Improvement Conceptualisation)

- A conceptual design tool – for large or complex developments.
- Demonstrate performance of stormwater quality improvement systems.
- Proprietary Software by eWater CRC.

music

(www.ewater.com.au)

eWater CRC

- Approx $5,000 single PC license

- Training available through Monash University & eWater

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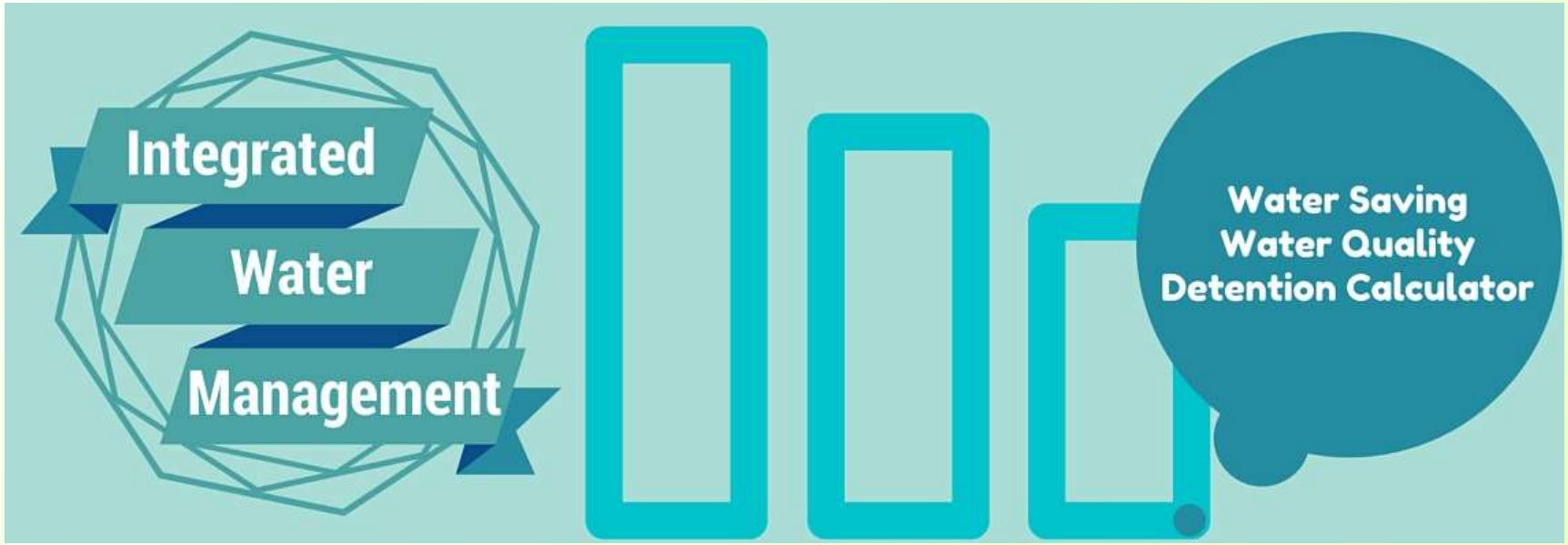
http://insitewater.net/

- Use to calculate water savings
- Water tank sizing



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Recommendations

Consider WSUD <u>early</u> in the planning phase:

- Identify land use capabilities of the site
- Allow greater flexibility of possible treatment options.
- Include WSUD treatment features in first round design documentation to expedite permit approval process.
- Integrate WSUD into landscape design.
- Reduces overall size & cost of drainage infrastructure.

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More water References

- www.storm.melbournewater.com.au
- www.raingardens.melbournewater.com.au
- www.publish.csiro.au
- www.epa.vic.gov.au/water/stormwater

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With the Cattle – Banjo Patterson

The drought is down on field and flock,
The river-bed is dry;
And we must shift the starving stock
Before the cattle die.
We muster up with weary hearts
At breaking of the day,
And turn our heads to foreign parts,
To take the stock away.
And it's hunt 'em up and dog 'em,
And it's get the whip and flog 'em,
For it's weary work is droving when they're dying every day;
By stock-routes bare and eaten,
On dusty roads and beaten,
With half a chance to save their lives we take the stock away.

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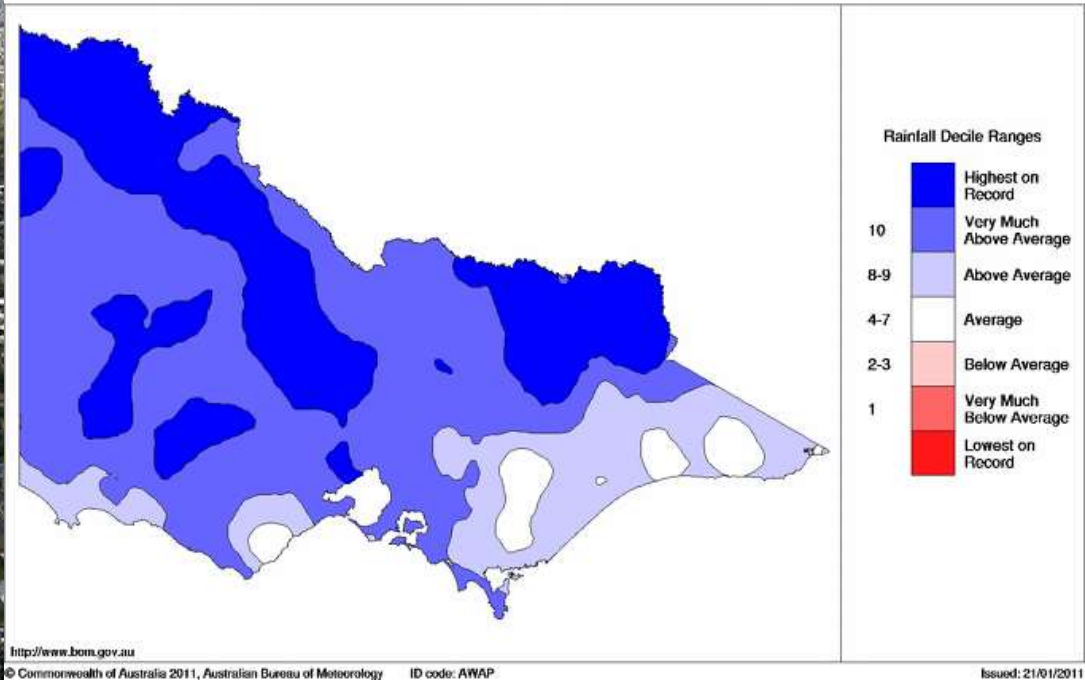
STORMWATER flood management

Victorian Rainfall Deciles 1 October to 31 December 2010

Distribution Based on Gridded Data
Product of the National Climate Centre



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A flooded building site

How M'Ginnis Went Missing – Banjo Paterson

Let us cease our idle chatter,
    Let the tears bedew our cheek,
For a man from Tallangatta
    Has been missing for a week.
Where the roaring flooded Murray
    Covered all the lower land,
There he started in a hurry,
    With a bottle in his hand.

And his fate is hid for ever,
    But the public seem to think
That he slumbered by the river,
    'Neath the influence of drink.
And they scarcely seem to wonder
    That the river, wide and deep,
Never woke him with its thunder,
    Never stirred him in his sleep.

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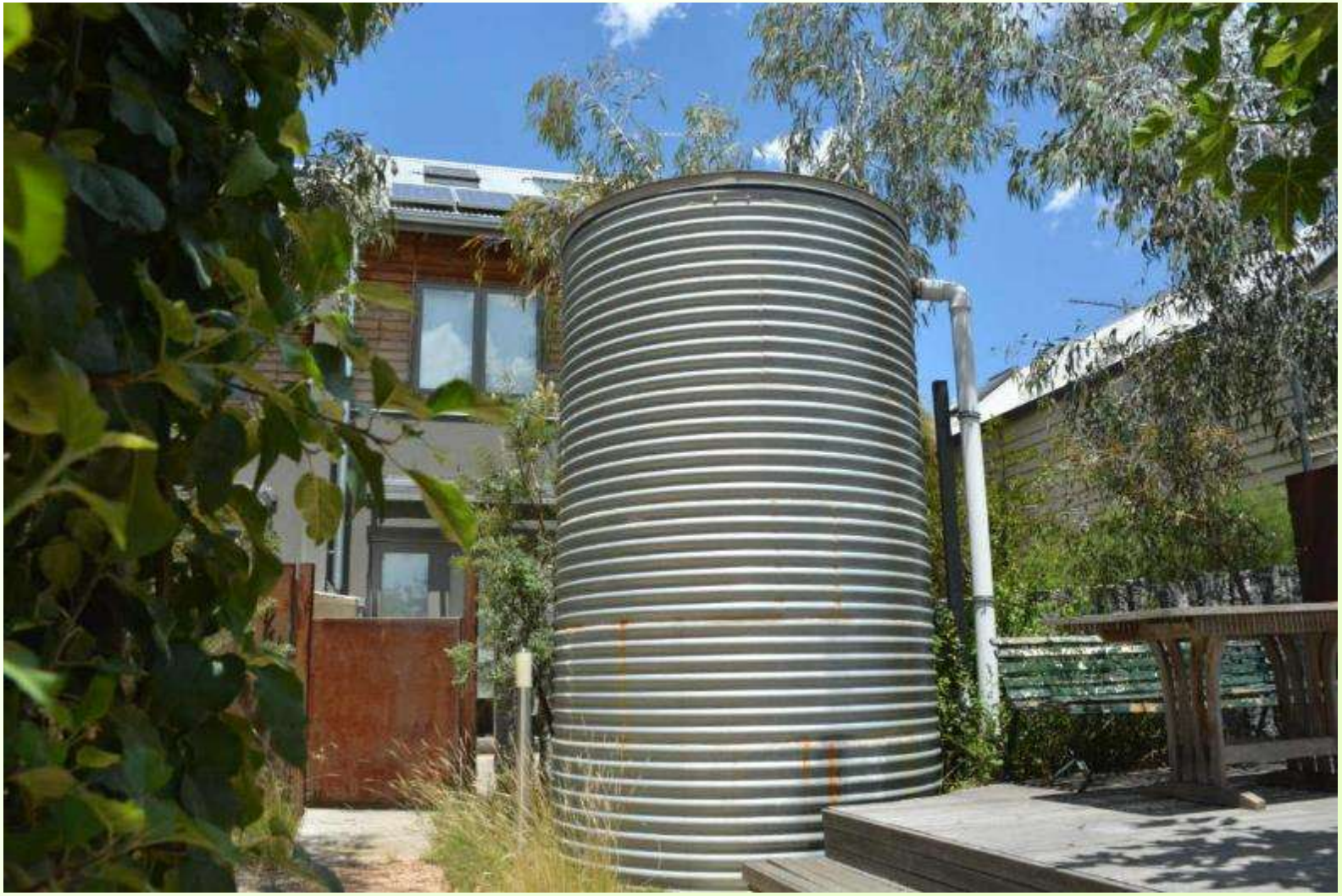
Proactive Management



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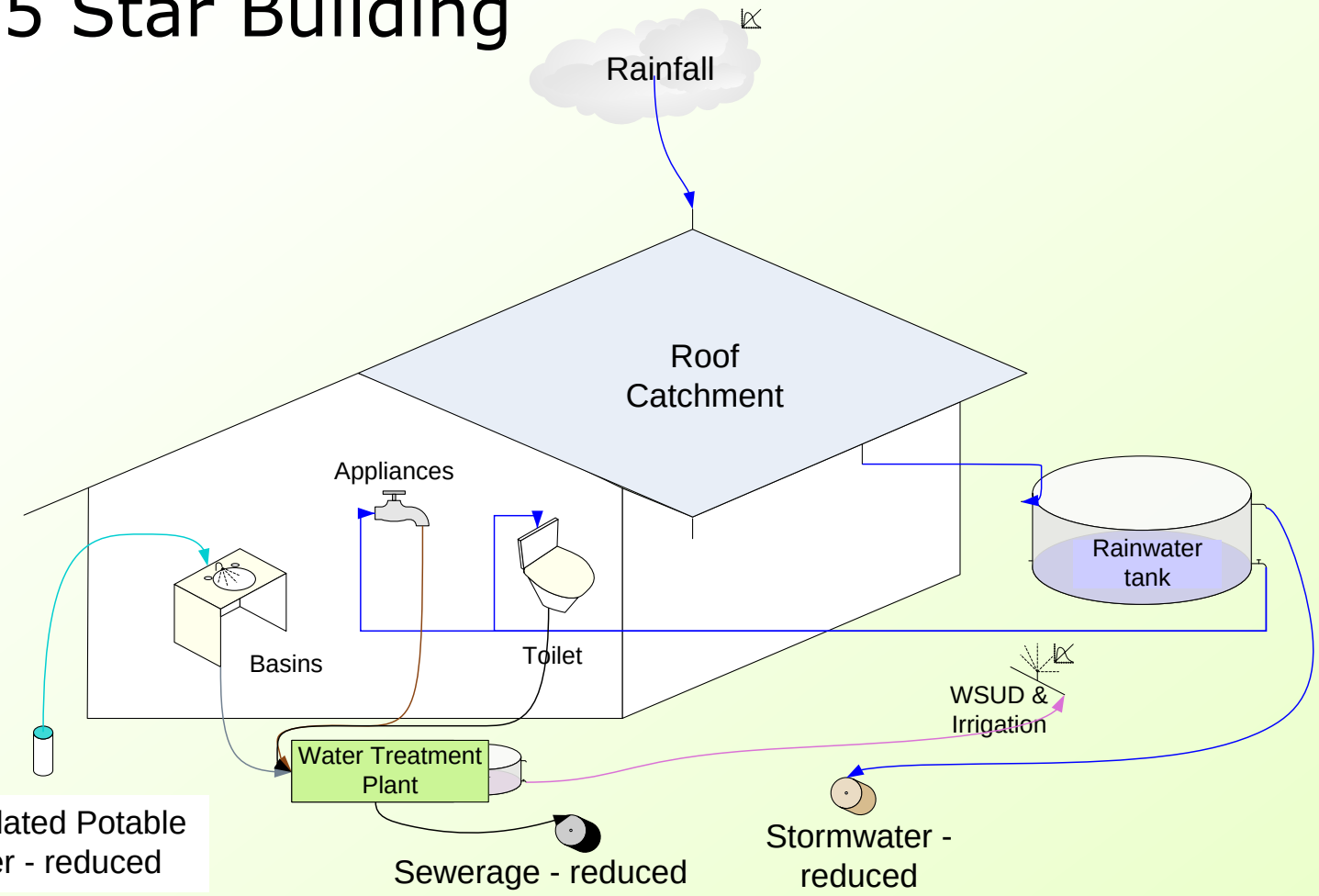
- 5 Star Building



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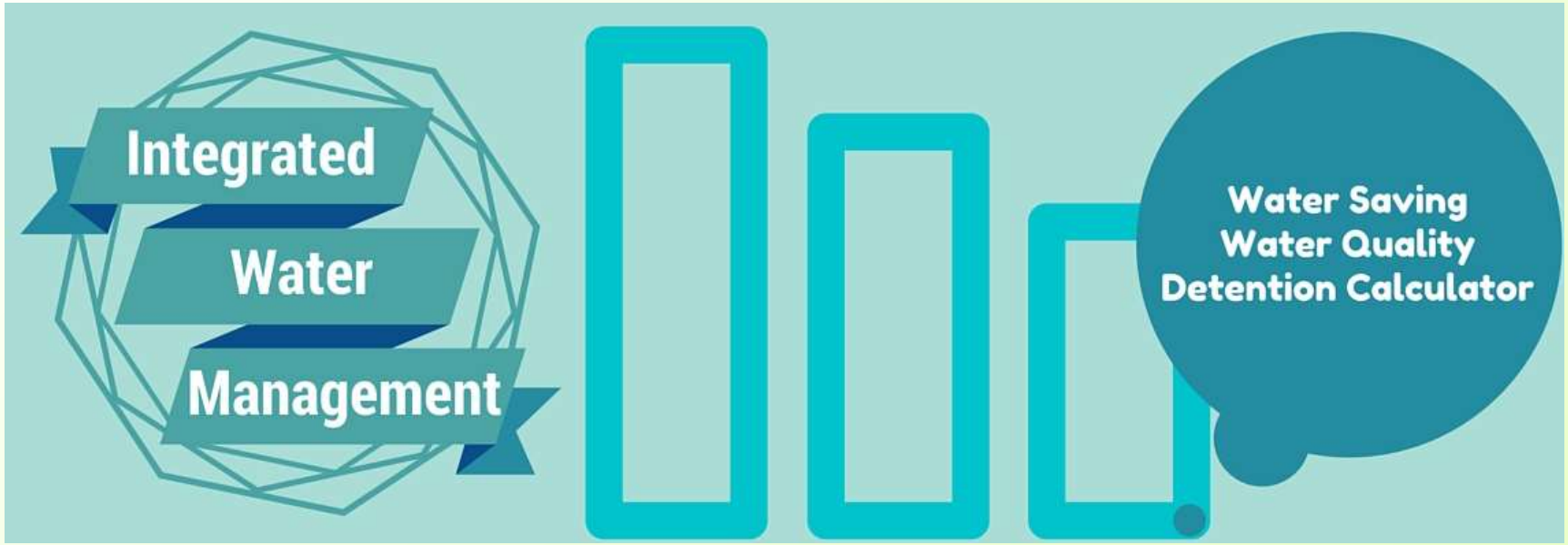
http://insitewater.net/

- Use to calculate water savings
- Water tank sizing



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Week 2

Session 2 Aug 20 – Andrew Allen – Manningham – Catchment water management and case study visits

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Site Visit

- We'll be heading to MC2 (Manningham Community Hub building) located at 699 Doncaster Road- there should be ample parking on the weekend and the site is easily accessed from the city by bus (907 to Mitcham, can catch from Lonsdale Street).

- And being in Doncaster Hill we can talk more generally about the role of planning and sustainable buildings.

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Site VISIT

We should be able to see:

- Raingardens
- Aesthetic wetland
- Integrated treatment and On Site Detention
- Tree pit
- Examples of passive irrigation
- ZAMWSUD (low maintenance Water Sensitive Urban Design)
- Tri-generation
- Multi use community building
- Stormwater harvesting

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What's next

- The Saturday dates planned for sessions for semester 2 (80.10.13. commencing at 9:30)
- **Session 2** Aug 20 – Andrew Allen – Manningham – Catchment water management and case study visits
- **Session 3** Sep 10 – Advanced water tech, futurism, irrigation and aquaponics. Stormwater Engineering – Knox – Site Visit to Dobsons Creek IWM
- **Session 4** Oct 8 – City stormwater management – Micah Pendergast Stormwater Regional Coordinator – West Melbourne Water

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Week 3

Session 3 Sep 10 – Advanced water tech, futurism, irrigation and aquaponics. Stormwater Engineering – Knox – Site Visit to Dobsons Creek IWM

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Wicks Reserve, Wicks Rd
The Basin VIC 3154

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Wicks Reserve

- Raingardens and swales
- Community use of WSUD space
- Habitat creation for Riparian Species like this southern brown frog

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Boronia Park Retarding Basin (RB)

Cnr Park Crescent and Dorset Rd, Boronia, Melways 64 K10

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Boronia Park Retarding Basin

- Flood retention
- Community use space - design effort focused on social inclusion, where design features meet the need for community interaction, participation, engagement and community cohesion
- Habitat Creation

Tim Neville Arboretum and Dobson Park Oval
98 – 106 Dorset Rd, Ferntree Gully, Melways 73 K1

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Tim Neville Arboretum and Dobson Park Oval

- Stormwater Harvesting
- Water Quality Improvement
- Flood retention
- Habitat Creation
- Community use

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Bio-mimicry

- Create Abundance through biomimicry
- Recycle water to get lush gardens!

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Green Roofs and walls

- http://www.growinggreenguide.org/technical-guide/

Burnley Biodiversity Green Roof

- http://www.growinggreenguide.org/victorian-case-studies/burnley-biodiversity-green-roof/

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Where can we not use them?

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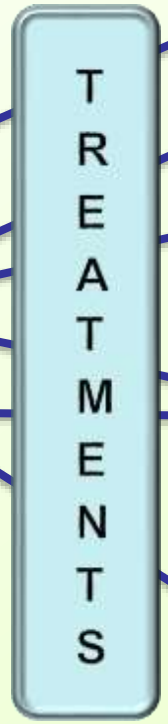
More Water Saving Opportunities

- Efficiency
- Potable Water
- Rainwater
- Greywater
- Stormwater



- Taps
- Hot Water
- Toilets
- Washing Machine
- Irrigation Water
- WSUD

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Greywater Use

Greywater can replace mains water for toilet flushing and garden watering. Untreated it must be used within 24 hours and can only be used within the property.

Greywater can be used through manual or mechanical diverter hoses that take water directly from washing machines, baths and showers to a tank or garden.

Source – greenletter.org

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Rainwater and Greywater Use

	Water end use	Rainwater	Greywater
Least Sensitive	Landscape irrigation	Yes	Yes
	Toilet flushing	Yes	Yes, but treated
	Edible garden irrigation	Yes	Yes, but treated
	Car washing	Yes	Yes, but treated
	Washing machine	Yes	Yes, but treated
	Dishwasher	Yes	No
	Swimming pool	Yes	No
	Showers	Yes	No
Most Sensitive	Drinking and cooking	Yes, however only recommended where no reticulated drinking water is available.	No

Source – IMAP Stormwater Management fact sheet

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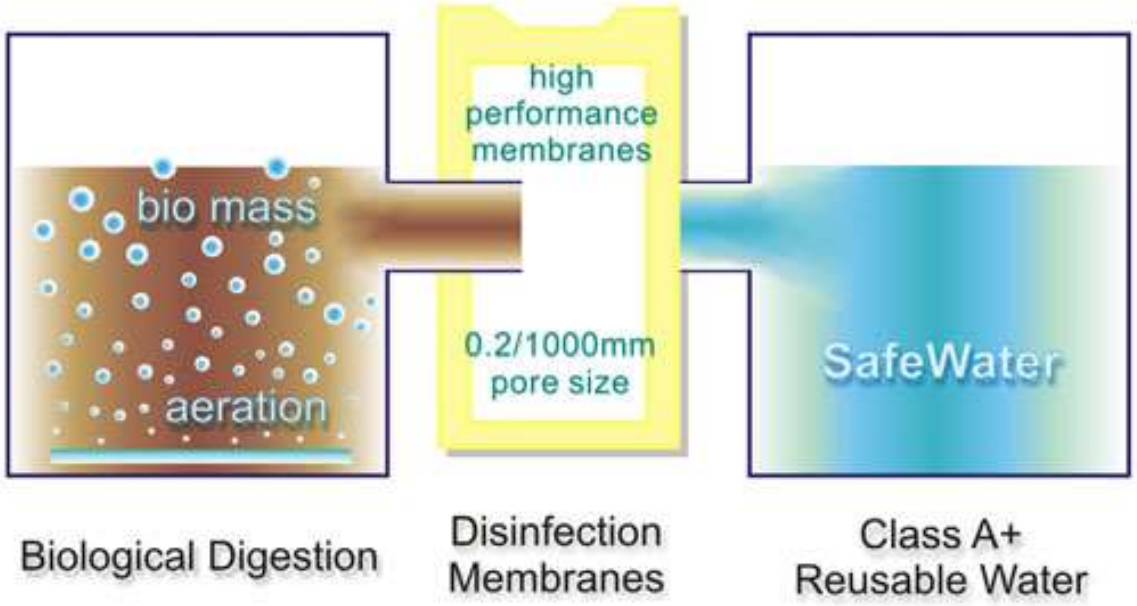
User Health Risk Management

- Human health risk assessments – perceptions vs. science
- A+ system and the 10/30/10 standard



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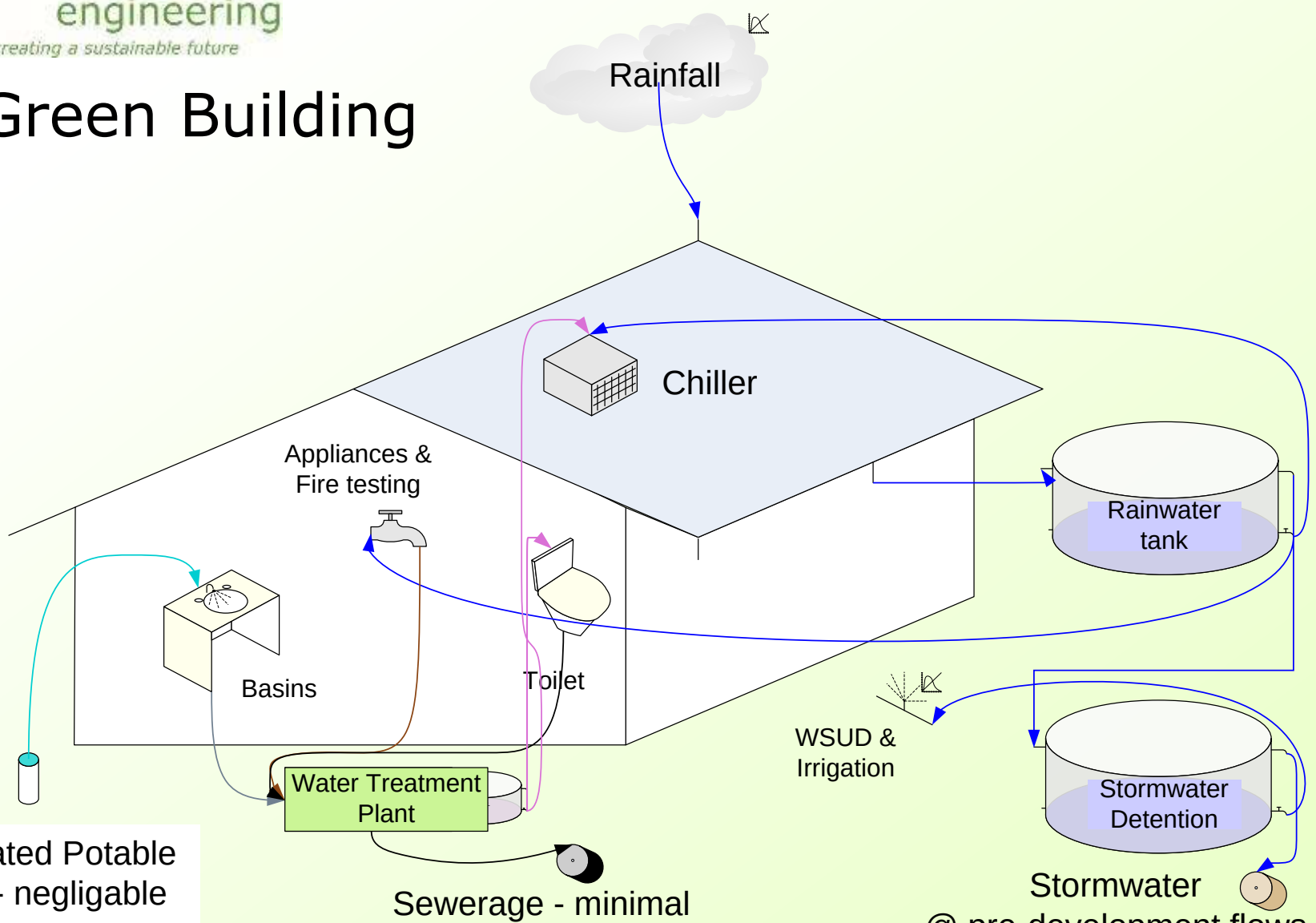
- Green Building



In case we have time

- https://www.youtube.com/watch?v=99jkZ-6vvvE
- Around the world – Bangladesh and climate change
- Thoughts for musing in the shower – dystopian water management in coastal cities - best viewed by drones
- Write a poem to read out in the next session

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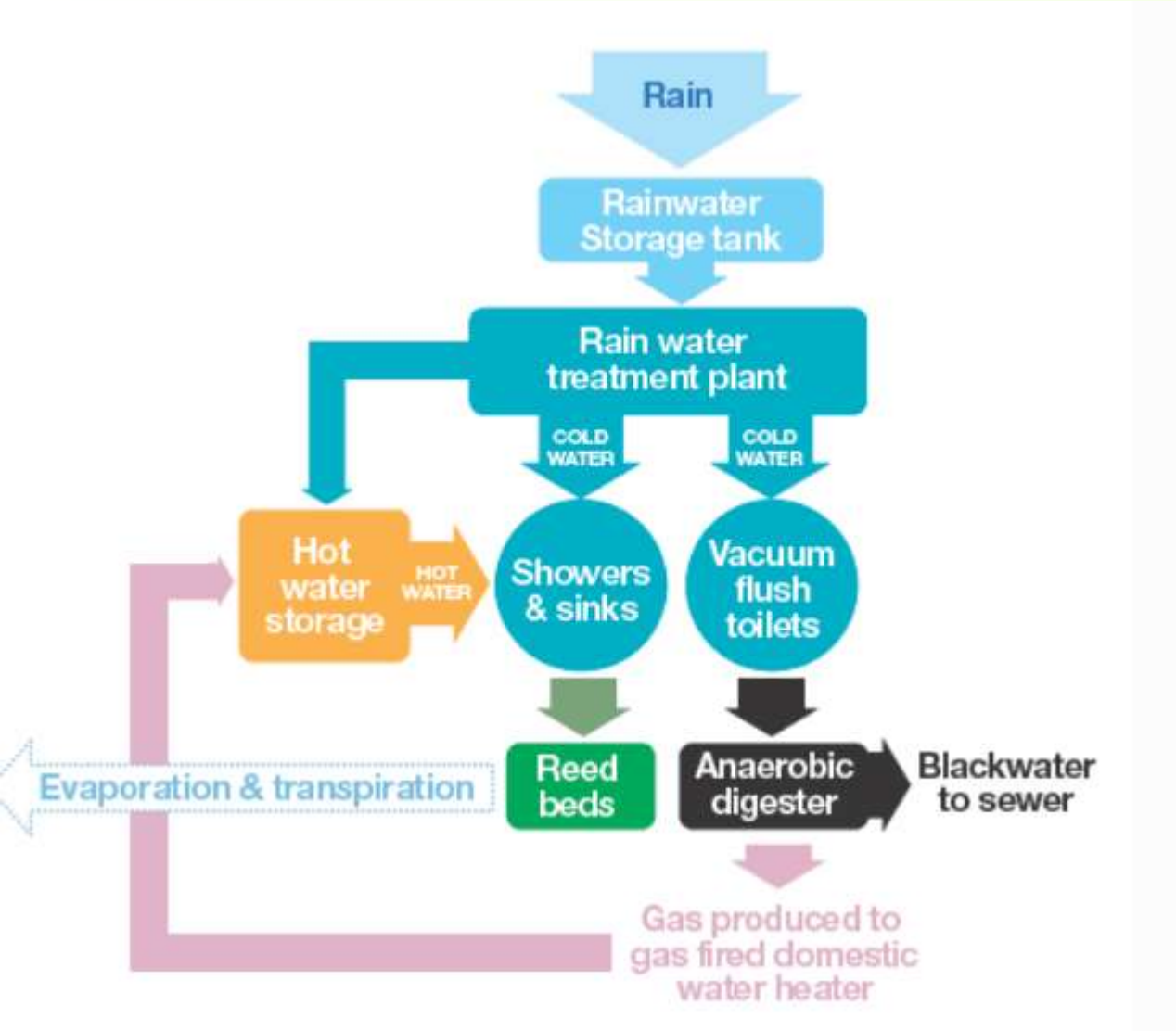

- Source: Umo-Lai

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Green Roof and living edge

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ANZ Centre, Docklands

- Rainwater Harvesting
- Blackwater Recycling
- Recycled water used for irrigation and cooling towers

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Exercise – Water Plan

- List all water uses in a building
- List the lowest safe water quality to be used
- List the water saving opportunity
- List what equipment / service may be required

Water Use	Required Quality	Saving opportunity	Equipment / Service required

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DIY Help

- Green Star Performance www.gbca.org.au/green-star/green-star-performance/
- WELS efficiency rating scheme http://www.waterrating.gov.au/
- NABERS water benchmarking (use the home and/or hotel calculators and guides for Aged Care) http://www.nabers.gov.au/

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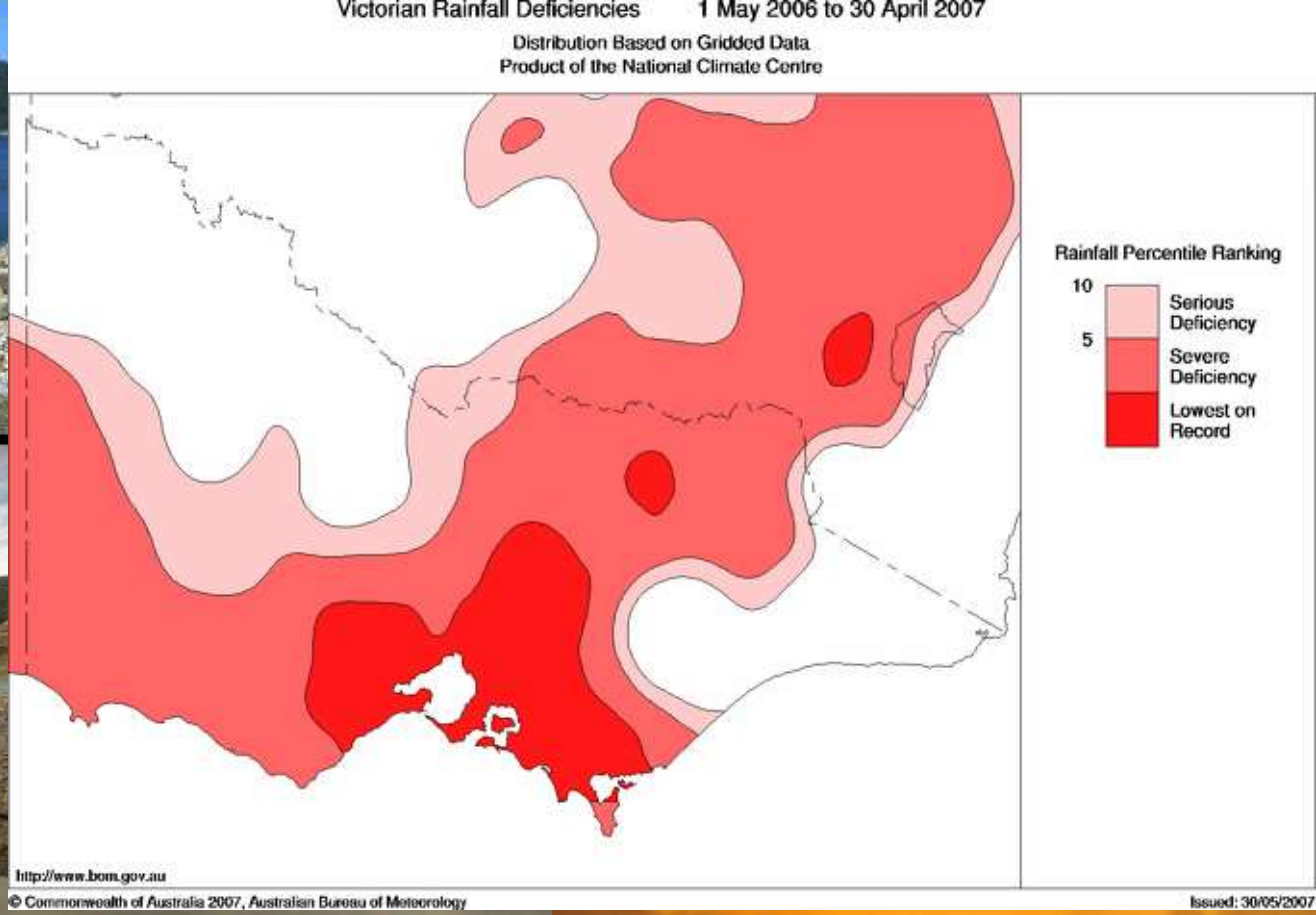
Case Study – Melbourne Airport

- Get a plan


Thomson Dam
1997


Thomson Dam
2008


Victorian Rainfall Deficiencies 1 May 2006 to 30 April 2007
Distribution Based on Gridded Data
Product of the National Climate Centre
Rainfall Percentile Ranking
10
5
Serious Deficiency
Severe Deficiency
Lowest on Record
http://www.bom.gov.au
© Commonwealth of Australia 2007, Australian Bureau of Meteorology
Issued: 30/05/2007

Have you met IOD

https://www.youtube.com/watch?list=PLbKuJrA7Vp7naJL31deES8QAV5E0q6U_H&v=J6hOVatamYs

- El-Nino's lesser know accomplice

- Also meet ENSO

https://www.youtube.com/watch?v=si2BhMVGB8I

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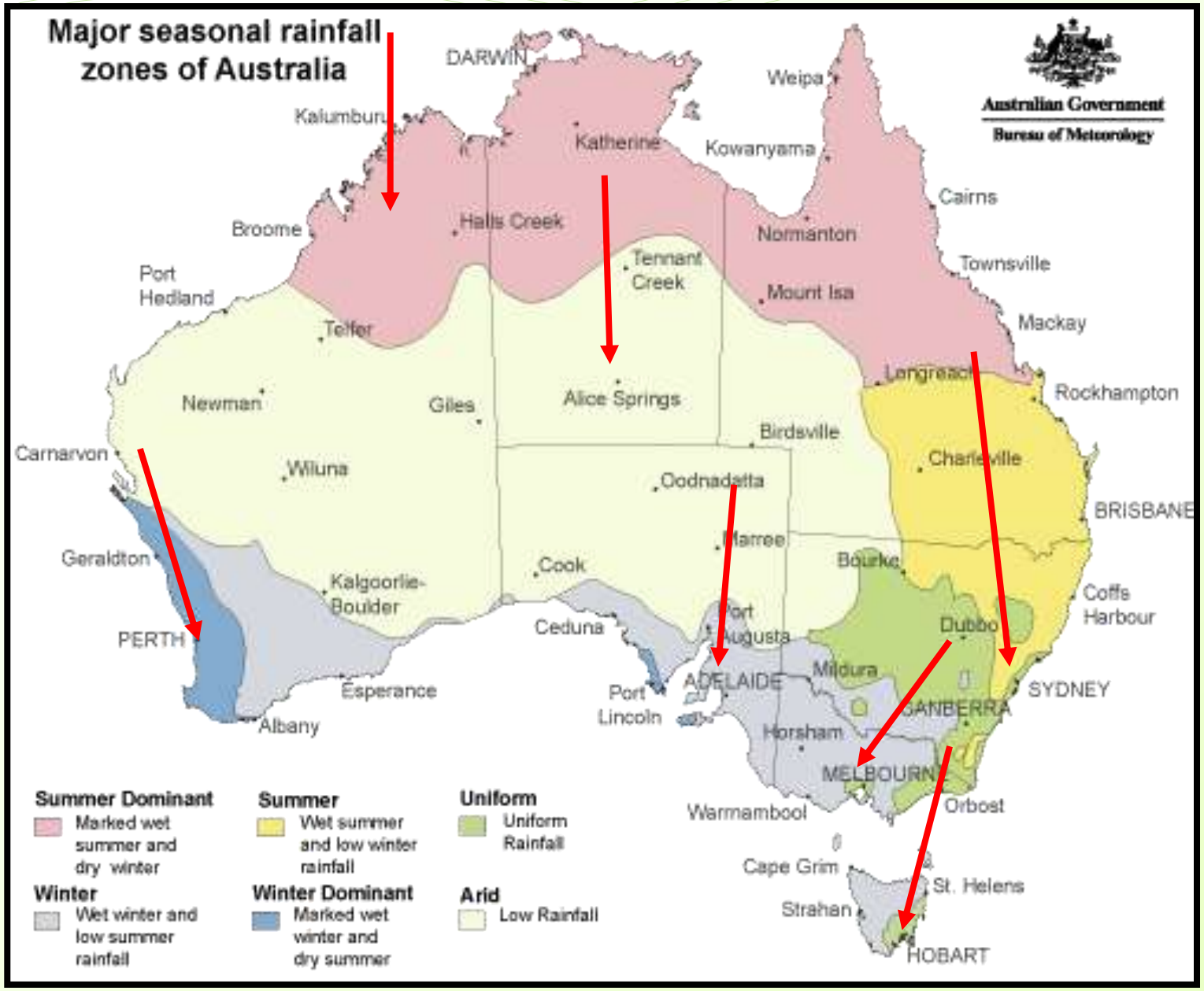
Climate Trends



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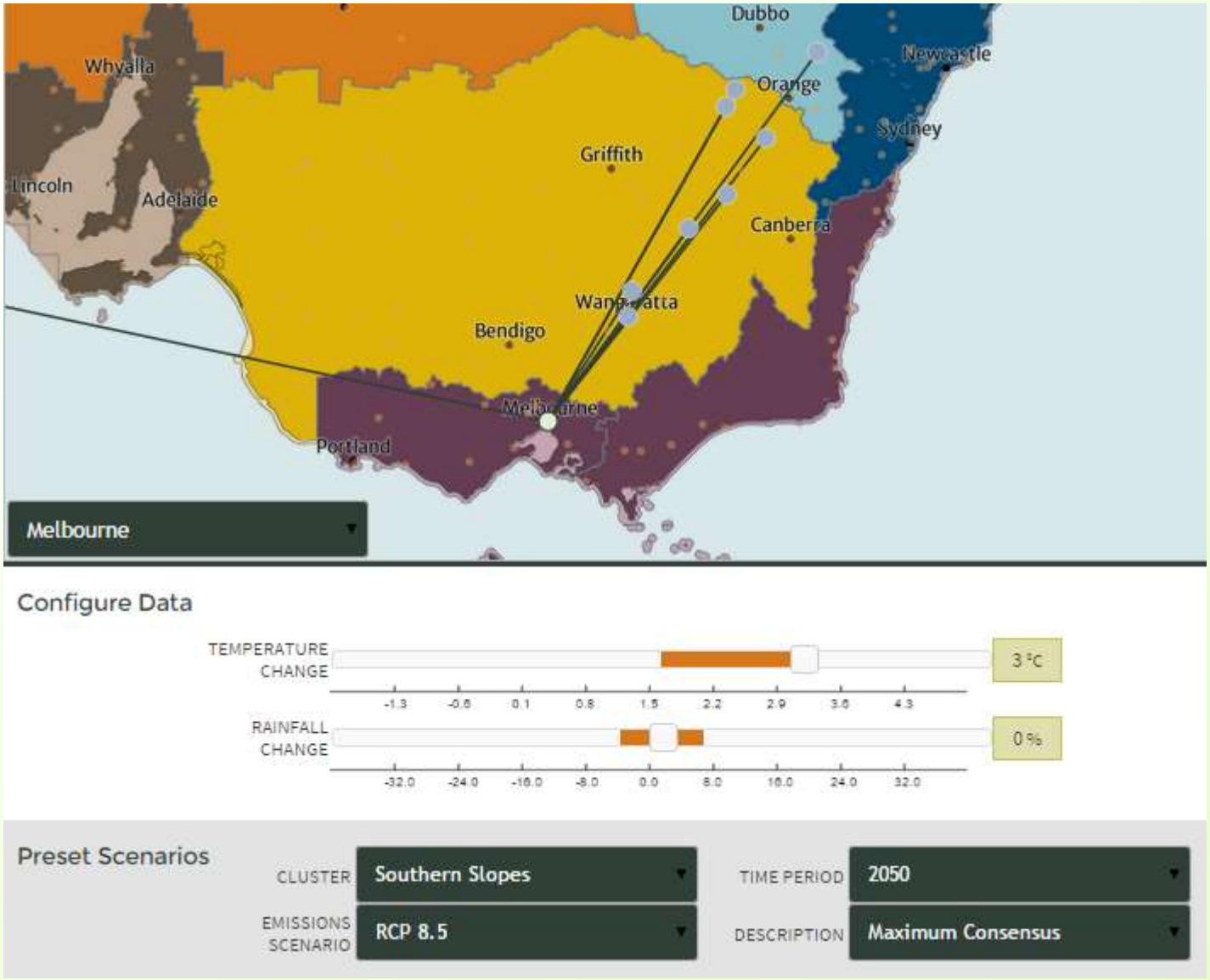
Climate Analogues

Climate Analogues:

Cootamundra, Wangaratta, Corowa,

Wagga Wagga, Parkes, Forbes, Esperance, Mudgee, Cowra



Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website, cited 02/10/2015

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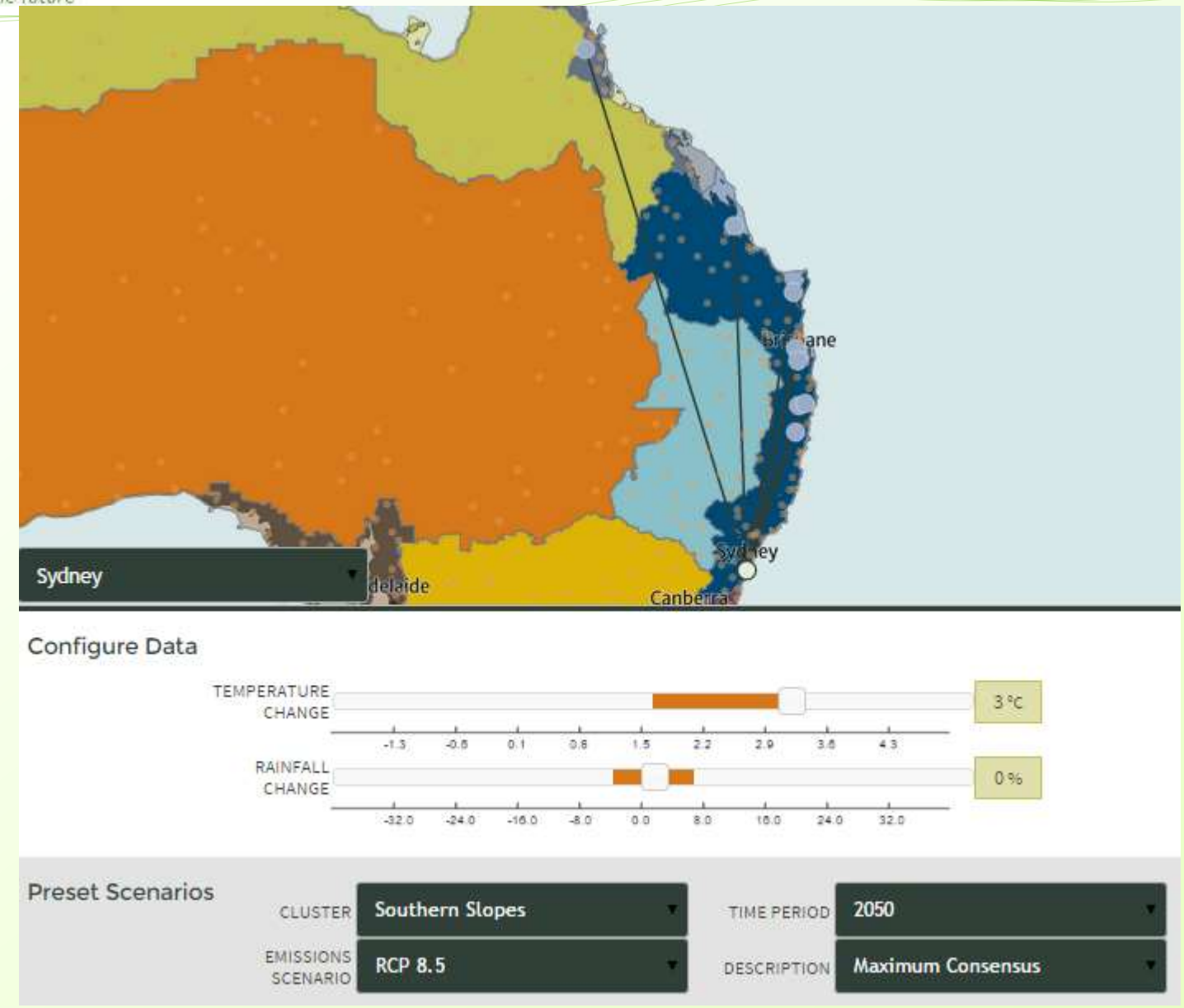
Climate Analogues

Climate Analogues:

Caboolture, Brisbane, Yeppoon, Atherton, Grafton, Casino, Hervey Bay, Lismore



Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website, cited 02/10/2015

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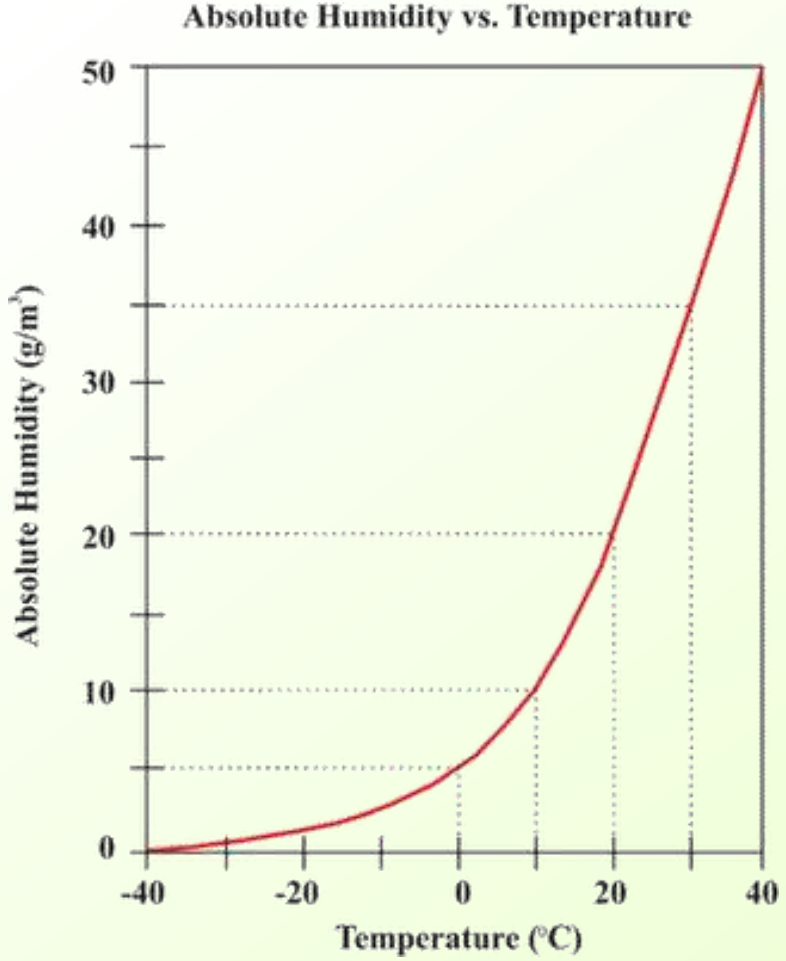
Rainfall vs Temperature



The effects of climate change could cost the world between 5% and 20% of gross domestic product.

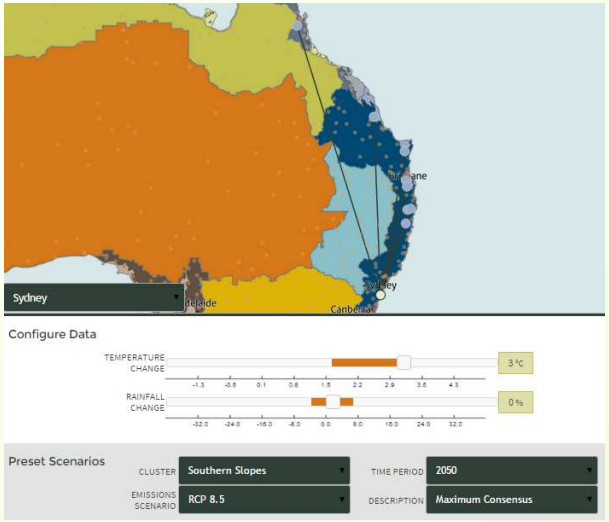
The Stern Review on the Impact of Global Warming on the Economy

The 2010-2011 *floods cost* the Australian economy at least A$10 billion (0.6% GDP)

Climate Analogues

Climate Analogues:

Caboolture, Brisbane, Yeppoon, Atherton, Grafton, Casino, Hervey Bay, Lismore



Your Turn – Google CSIRO Climate Analogues

http://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-analogues/analogues-explorer/

Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website, cited 02/10/2015

With the Cattle – Banjo Patterson

The days are done of heat and drought
    Upon the stricken plain;
The wind has shifted right about,
    And brought the welcome rain;
The river runs with sullen roar,
    All flecked with yellow foam,
And we must take the road once more,
    To bring the cattle home.
        And it's 'Lads! we'll raise a chorus,
        There's a pleasant trip before us.'
And the horses bound beneath us as we start them down the track;
        And the drovers canter, singing,
        Through the sweet green grasses springing,
Towards the far-off mountain-land, to bring the cattle back.

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Resources	Description	Address
Your Home	Comprehensive guide to design	www.yourhome.gov.au
Stormwater Treatment Objective Relative Measure (STORM) Calculator	Simplified analysis of storm water treatment methods	http://storm.melbournewater.com.au
Model for Urban Stormwater Improvement Conceptualisation (MUSIC)	Designed to help visualise storm water solutions	http://www.toolkit.net.au/music
Water Efficient Labelling Scheme (WELS)	Allows comparison of different water fixtures	www.waterrating.gov.au
Save Water	Water use tips, programs, tutorials and tools	www.savewater.com.au
Environment Protection Authority	Reducing Stormwater pollution from construction sites	www.epa.vic.gov.au
Dept. of Environment and Primary Industries	Govt. initiatives, water advice for the home business and on the land	http://www.water.vic.gov.au/
Alternative Technology Association	Tankulator- tank size calulator	www.tankulator.ata.org.au

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Advanced water treatment tech

So, What's the process?

PRIMARY TREATMENT

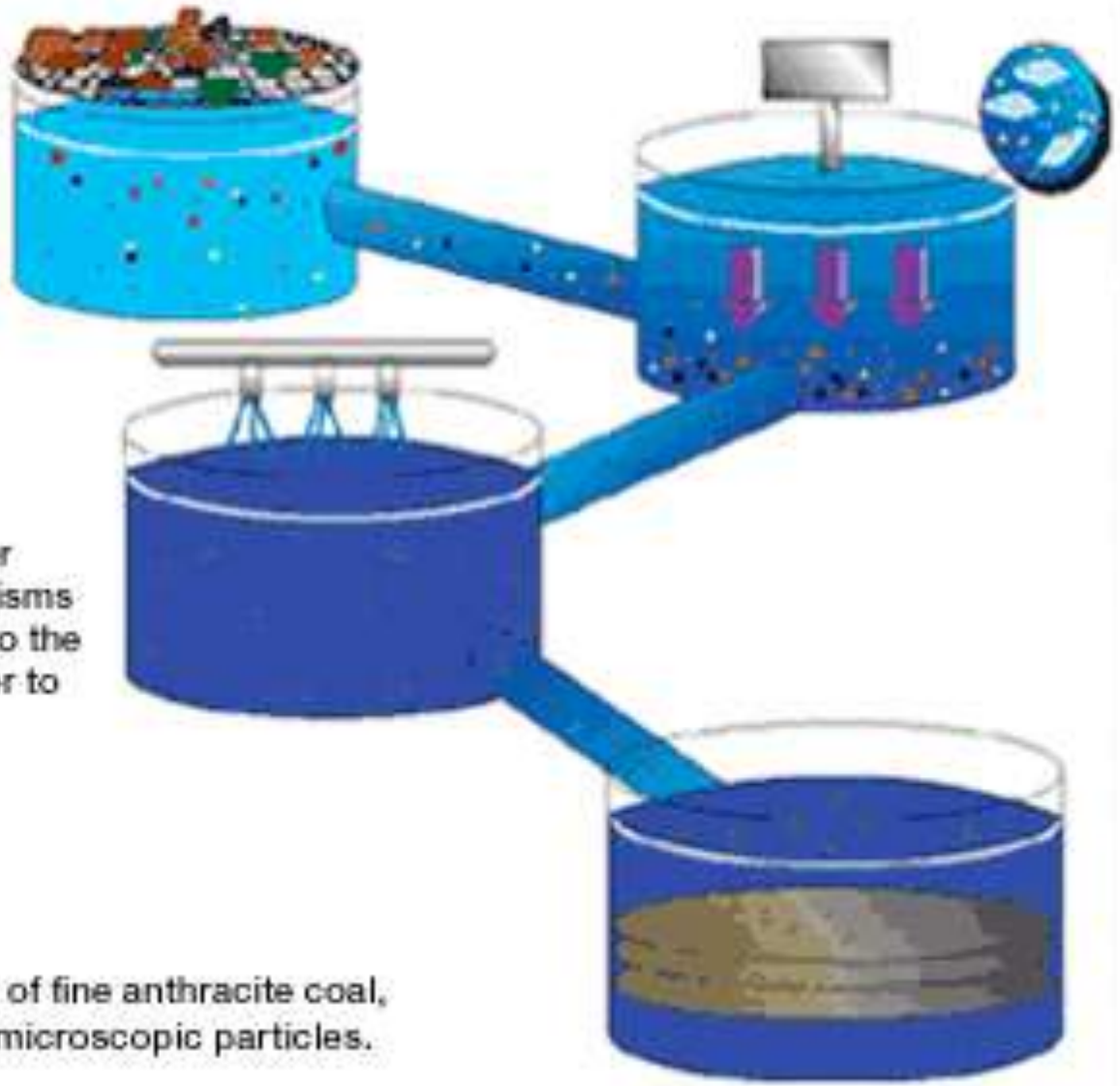
Solids are removed from the water.

SECONDARY TREATMENT

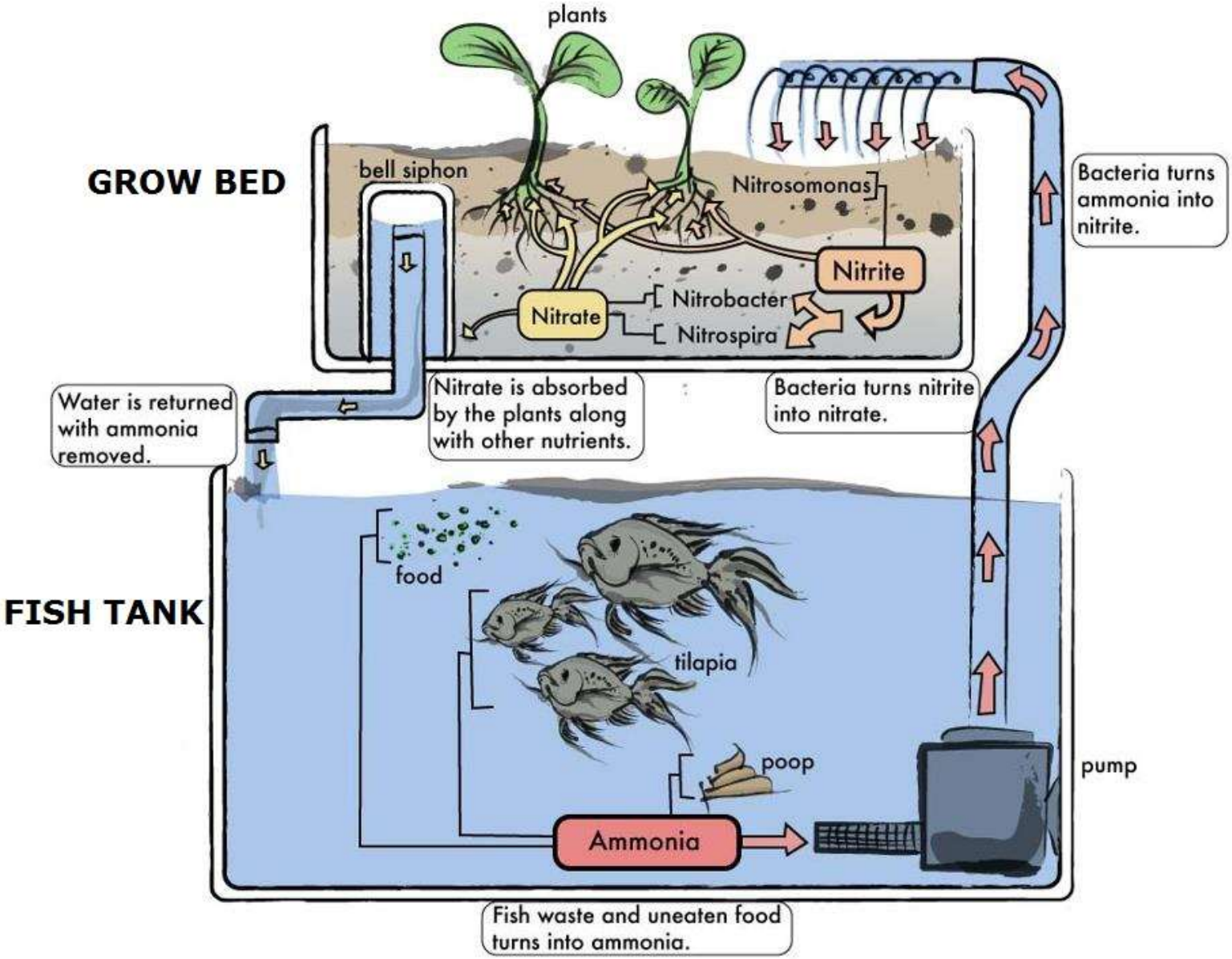
Dirt-loving microorganisms are added, which eat smaller particles. Once these organisms get full and heavy, they fall to the bottom leaving cleaner water to rise to the surface.

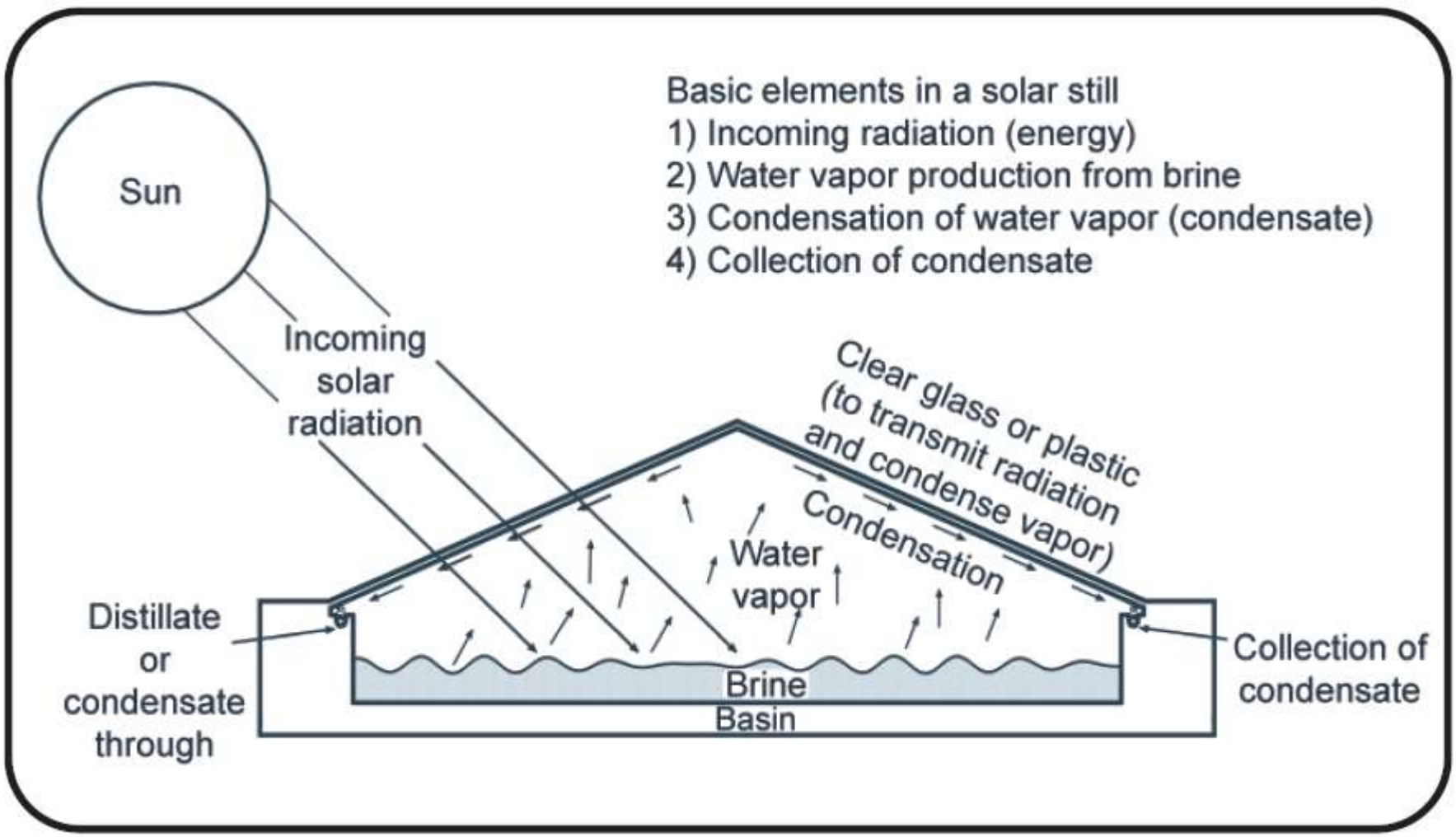
TERTIARY TREATMENT

Water moves through layers of fine anthracite coal, sand and gravel which trap microscopic particles.



Aquaponics and irrigation




Basic elements in a solar still
1) Incoming radiation (energy)
2) Water vapor production from brine
3) Condensation of water vapor (condensate)
4) Collection of condensate
Sun
Incoming
solar
radiation
Clear glass or plastic
(to transmit radiation
and condense vapor)
Condensation
Water
vapor
Distillate
or
condensate
through
Brine
Basin
Collection of
condensate

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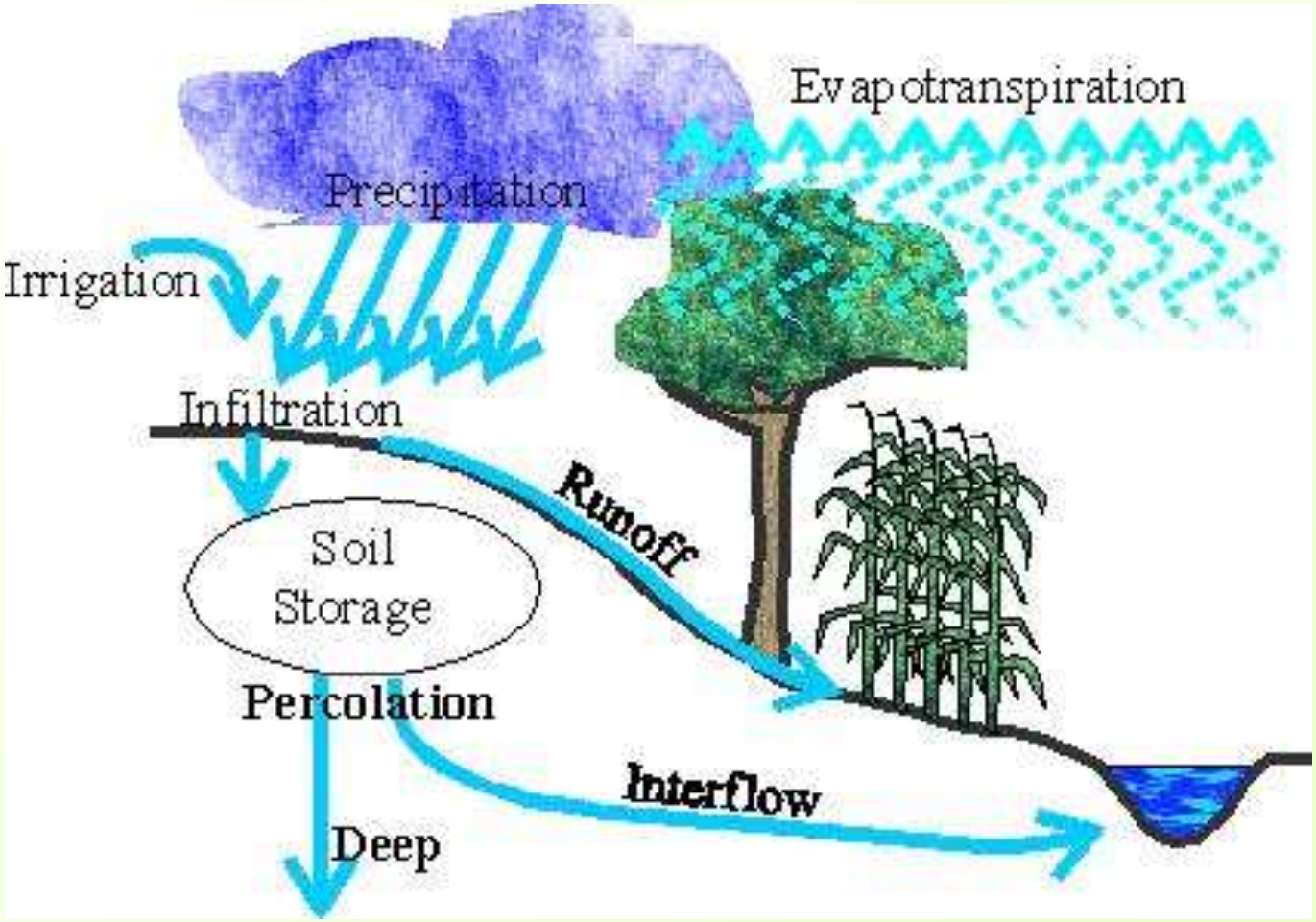
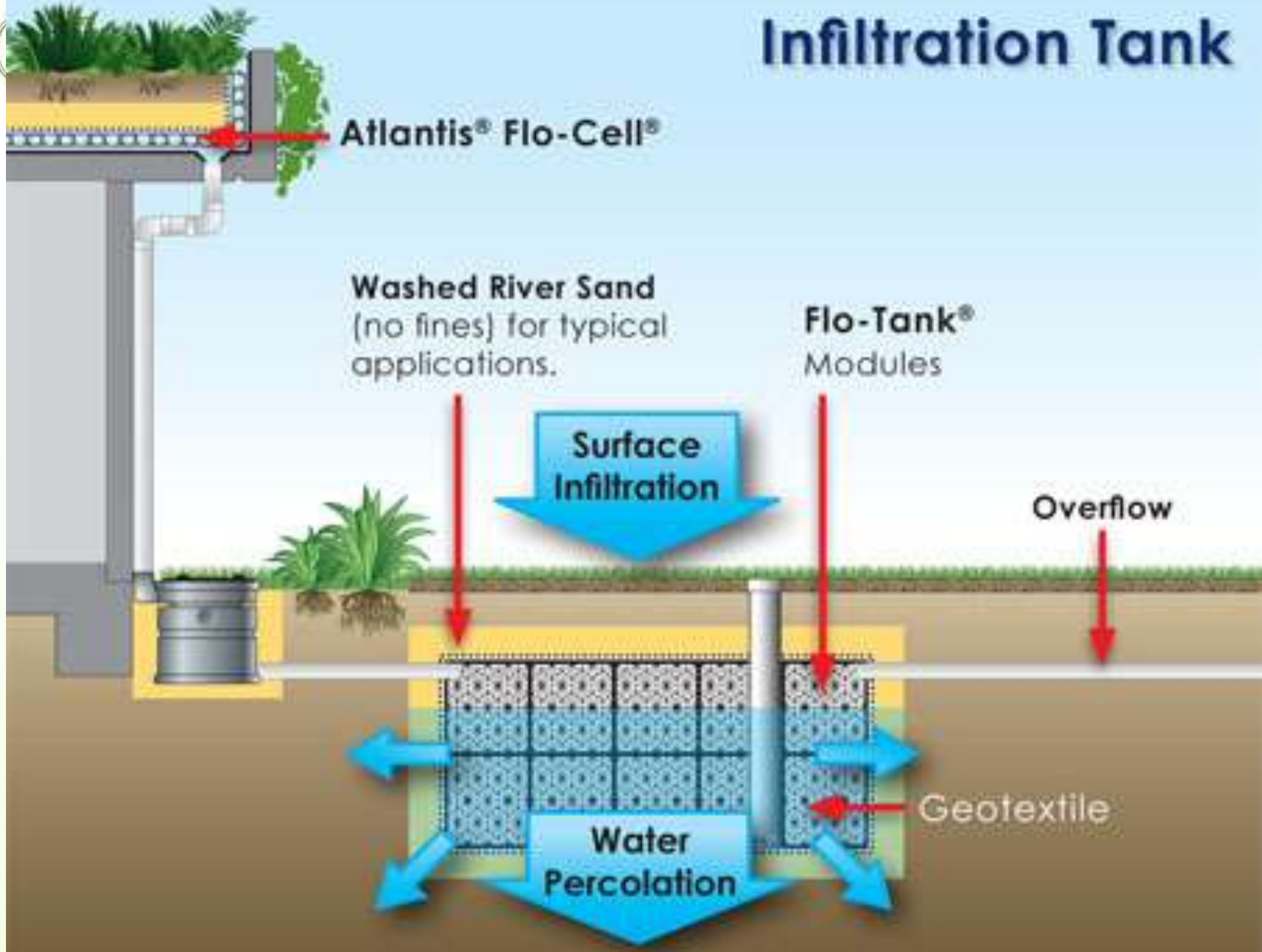
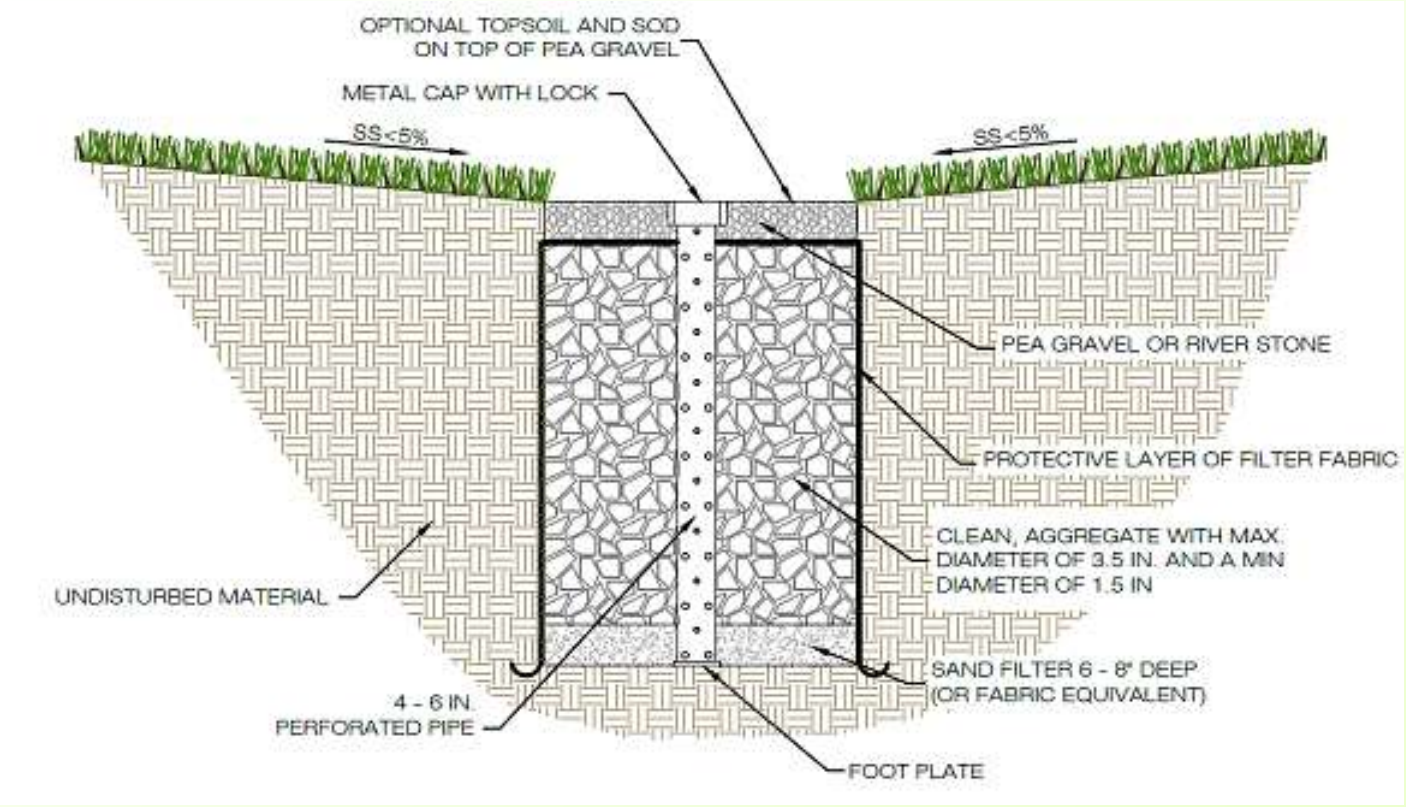
STORMWATER flood management


Detention Tank (Attenuation)
Note: Atlantis does not endorse detention systems. Detention systems discharge "recyclable" water into existing stormwater systems where the water is contaminated causing heavy pollution downstream.
Atlantis®
Flo-Tank™
Modules
Discharge
Control Pit
Filtration
Unit
Washed
River Sand
(no fines)
Maxi
Mesh
Geotextile
Plastic liner required in certain areas only
Orifice Plate

Infiltration




Infiltration Tank
Atlantis® Flo-Cell®
Washed River Sand
(no fines) for typical
applications.
Flo-Tank®
Modules
Surface
Infiltration
Overflow
Geotextile
Water
Percolation


OPTIONAL TOPSOIL AND SOD
ON TOP OF PEA GRAVEL
METAL CAP WITH LOCK
SS<5%
SS<5%
PEA GRAVEL OR RIVER STONE
PROTECTIVE LAYER OF FILTER FABRIC
CLEAN, AGGREGATE WITH MAX.
DIAMETER OF 3.5 IN. AND A MIN
DIAMETER OF 1.5 IN
UNDISTURBED MATERIAL
SAND FILTER 6 - 8" DEEP
(OR FABRIC EQUIVALENT)
4 - 6 IN.
PERFORATED PIPE
FOOT PLATE

Detention

- Local stormwater authorities / Councils usually require one of the following:
  - a specified minimum site storage requirement (SSR) and permissible site discharge (PSD) relative to either the site area, land use, or the change in impervious area; OR
  - a permissible site discharge for the specified design storm frequency with no minimum storage volume specified; OR
  - a requirement not to exceed pre-development peak discharge rates for a range of design storm frequencies.

  This calculator caters to the above requests by calculating PSD and SSR for the applicant, or by allowing the applicant to enter these requirements from the Council manually.

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What's next

- **Session 4** Oct 8 – City stormwater management – Micah Pendergast Stormwater Regional Coordinator – West Melbourne Water

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Wicks Reserve, Wicks Rd
The Basin VIC 3154

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Boronia Park Retarding Basin (RB)

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98 – 106 Dorset Rd, Ferntree Gully, Melways 73 K1

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Week 4

Session 4 Oct 8 – City stormwater management – Micah Pendergast Stormwater Regional Coordinator – West Melbourne Water

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Melbourne Water 990 Latrobe

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Catchment scale WSUD

- https://www.youtube.com/watch?v=ErNoIvKYbsk&list=PLqacRwhlhmOwKdRnmtIVEsRnBPQ0ph4eu&index=4
- Lynbrook case study

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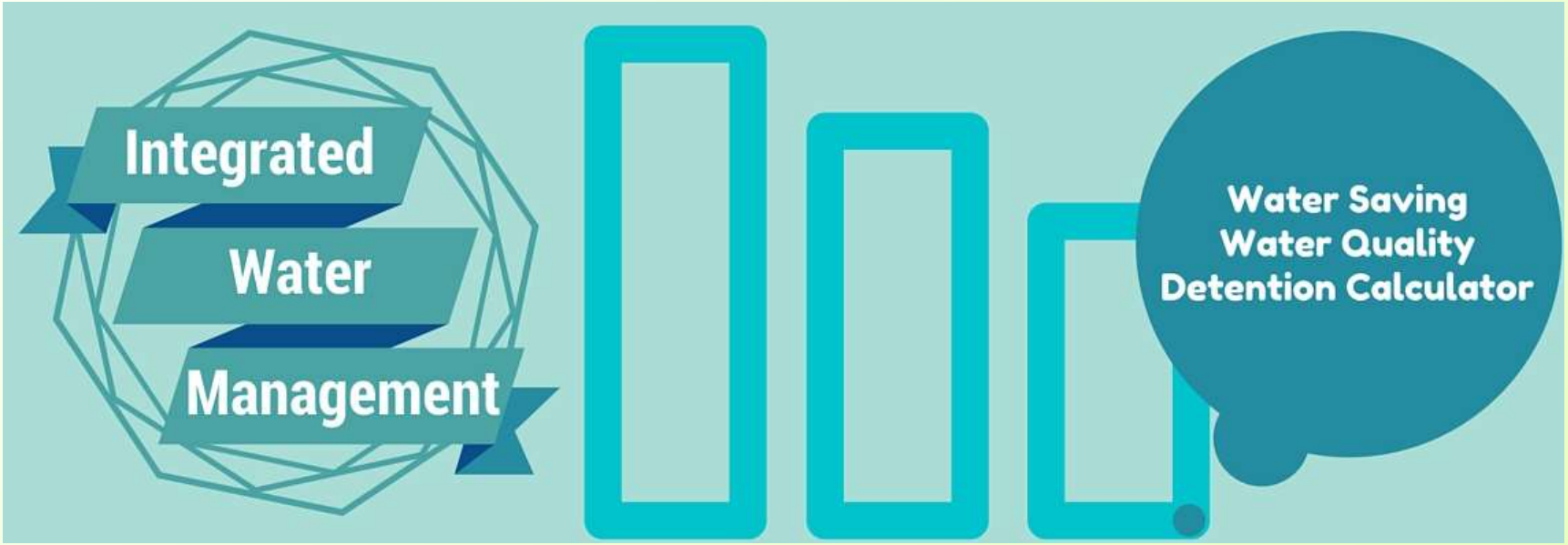
http://insitewater.net/

- Use to calculate water savings
- Water tank sizing
- Detention / retention tank sizing



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Key areas metrics duplicated below

Unit 1 (front) Areas	
Lower floor	61 m2
Upper floor	74 m2
Garage	24.5 m2
POS	27 m2
Unit 2 Areas	
Lower floor	64.5 m2
Upper floor	58 m2
Garage	25 m2
POS	42 m2
Unit 3 (rear) Aas	
Lower floor	88.5 m2
Garage	25 m2
POS	55 m2
Whole site Areas	
Total	697 m2
Built up	319 m2
Permeable	209.5 m2

- Design and size your own IWM system for the following case study lot.

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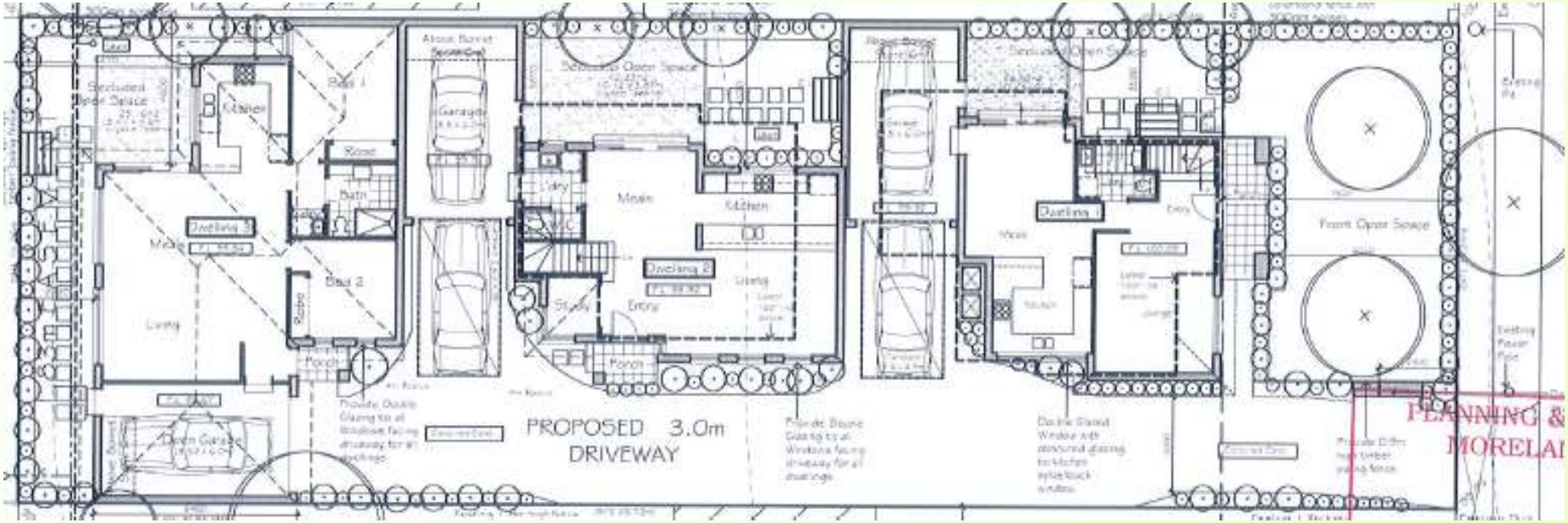
Ground floor



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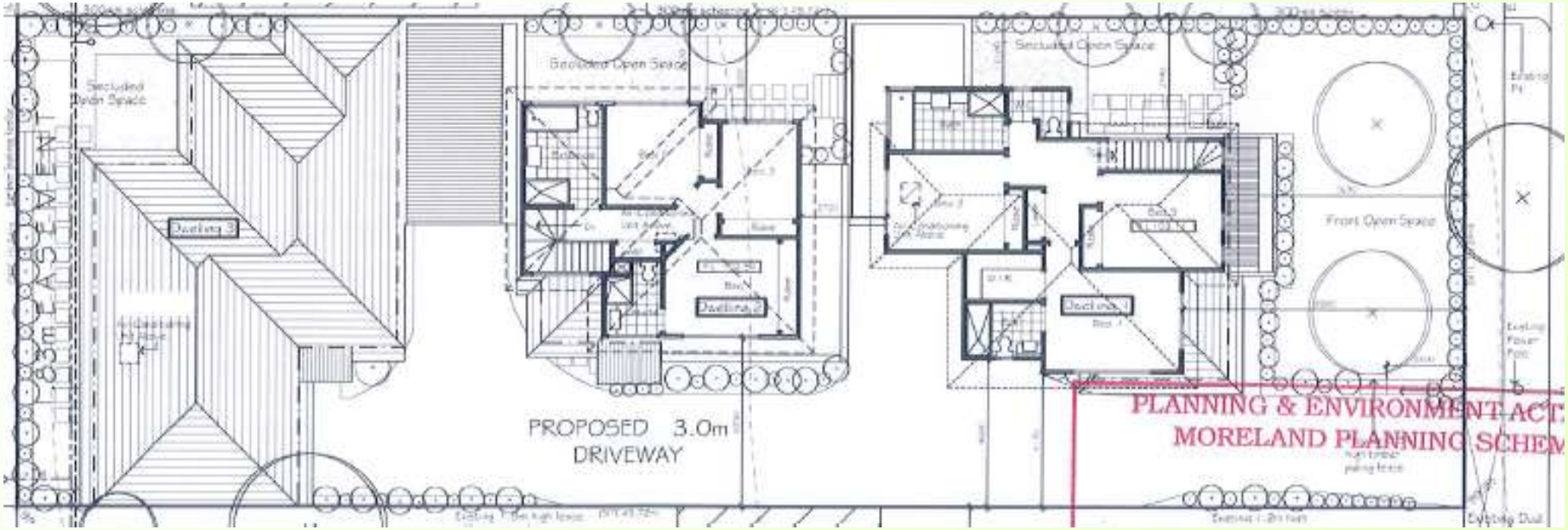
First floor



N

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Elevations

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Elevations

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Your diagrams