Green Cities - Water Recycling

Rooftop Garden, Changi Gen Hospital

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Green Cities - Water Recycling

Vertical Farming

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Green Cities - Water Recycling

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Vertical Farming

Green Cities - Water Recycling

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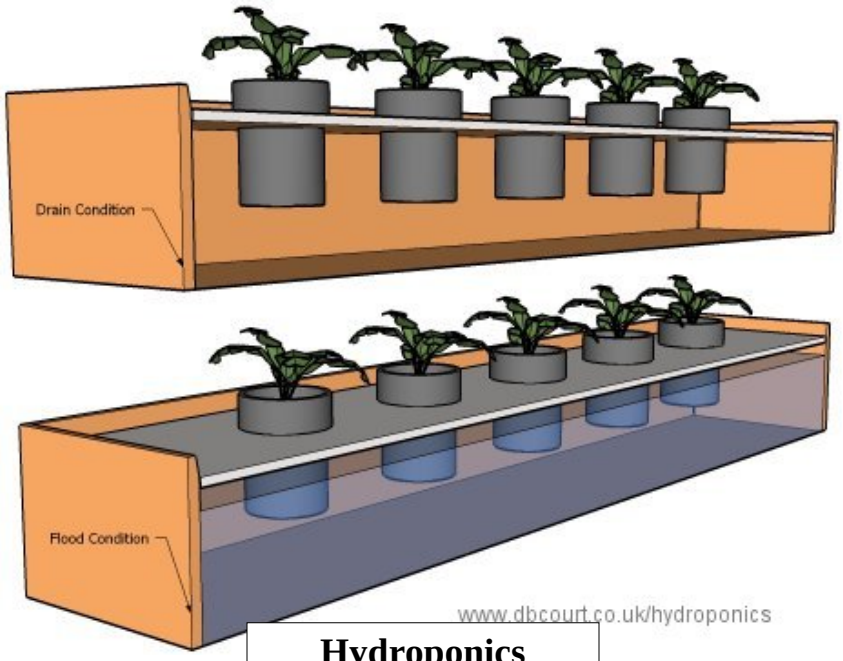
Hydroponics

Green Cities - Water Recycling



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Hydroponics

Green Cities - Water Recycling

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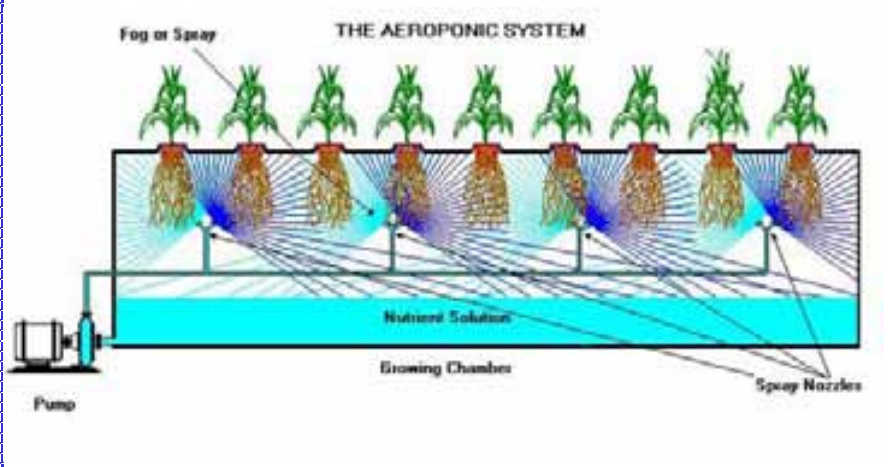
Hydroponics

Green Cities - Water Recycling



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Aeroponics

Green Cities - Water Recycling

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Aeroponics

Green Cities - Water Recycling

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Cities

Dealing with the Problem

1) Cities → Green Cities
   - Create smallest possible ecological footprint
     - Urban agriculture → reduce distance from field to fork
     - Renewable sources of energy → wind turbines, solar panels, biogas

Green Cities - Water Recycling

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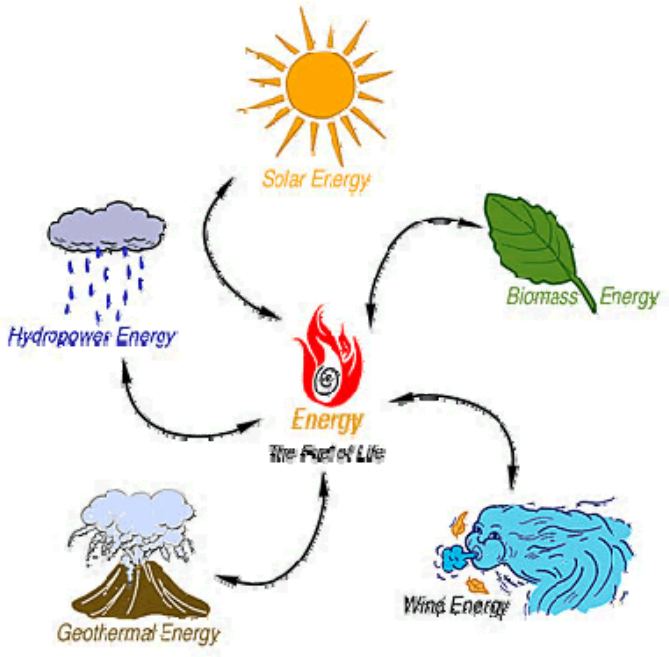

Green Cities - Water Recycling

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Domestic Solar Heater

Green Cities - Water Recycling

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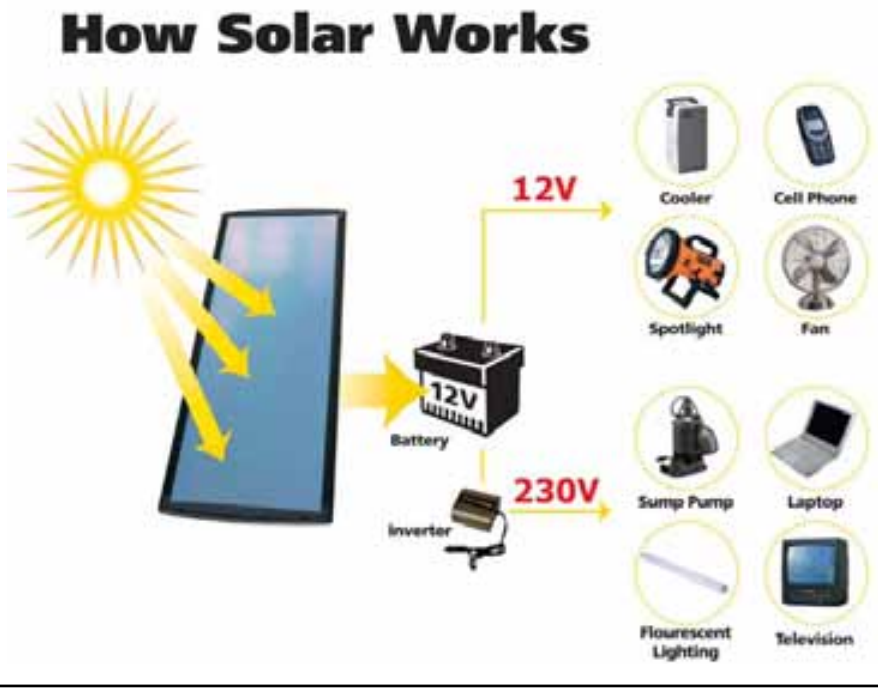

Green Cities - Water Recycling

Hilton Garden Inn, Indianapolis
18 Nos 225 watt → 1,700 kWh/month

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Green Cities - Water Recycling

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Green Cities - Water Recycling

Bahrain World Trade Centre

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Green Cities - Water Recycling

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Green Cities - Water Recycling

Cities

Dealing with the Problem

1) **Cities → Green Cities**
   - **Create smallest possible ecological footprint**
     - **Urban agriculture → reduce distance from field to fork**
     - **Renewable sources of energy → wind turbines, solar panels, biogas**
     - **Water conservation**

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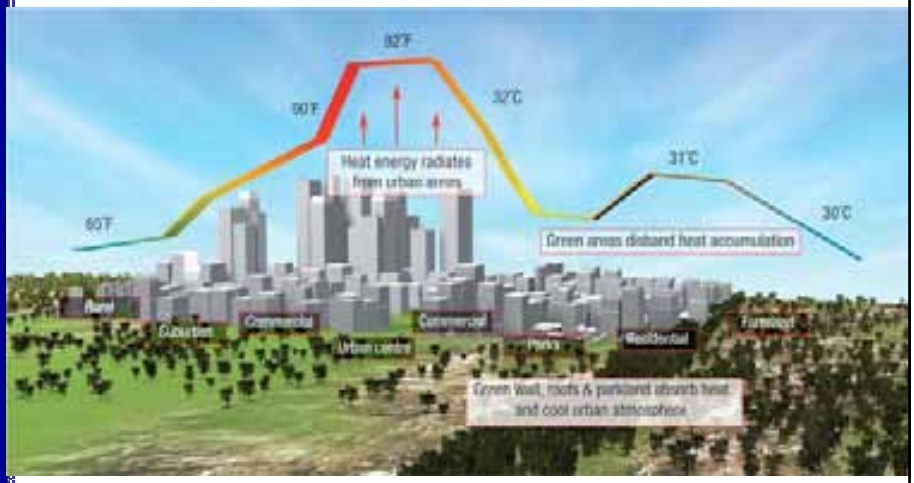
Cities

Dealing with the Problem

1) Cities → Green Cities
   - Create smallest possible ecological footprint
     - Improve pubic transport to reduce energy needs and emissions
     - Greening the city → trees, green spaces, water features → reduce urban temperature / heat island



Urban Heat Island Effect

Trees act as nature's air conditioner by cooling the surrounding air in 2 ways :
→ Provide shade
→ Cool themselves and surroundings through evapo-transpiration

Everybody wants to park under the trees

Green Cities - Water Recycling

Typical carpark - contributing to urban heat island

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Love for palm trees???

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Angsana tree provides good shade

Green Cities - Water Recycling
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Cities

Dealing with the Problem

1) Cities → Green Cities
   - Create smallest possible ecological footprint
     - Green roofs

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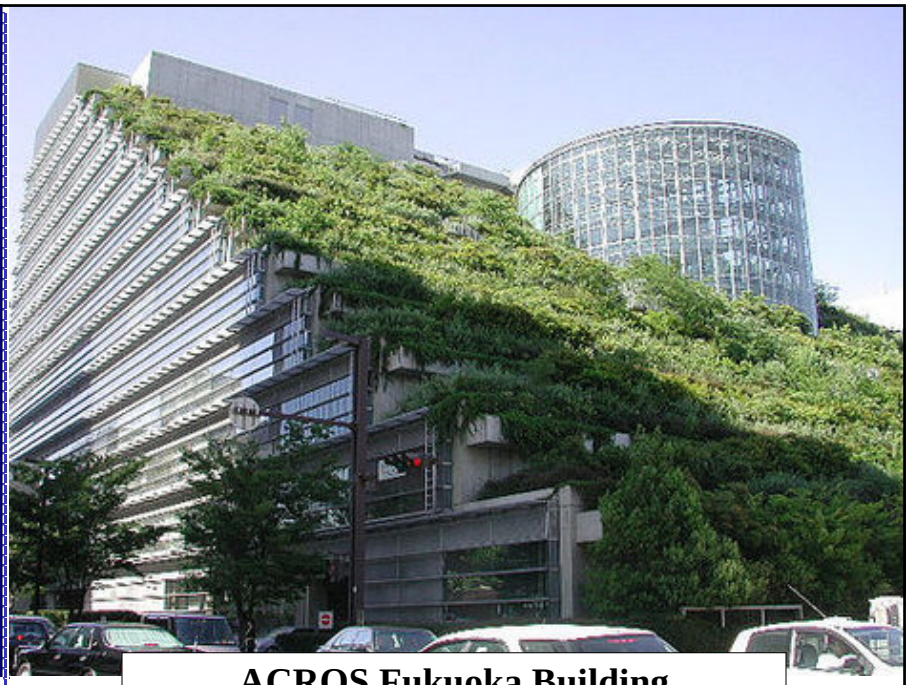

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ACROS Fukuoka Building

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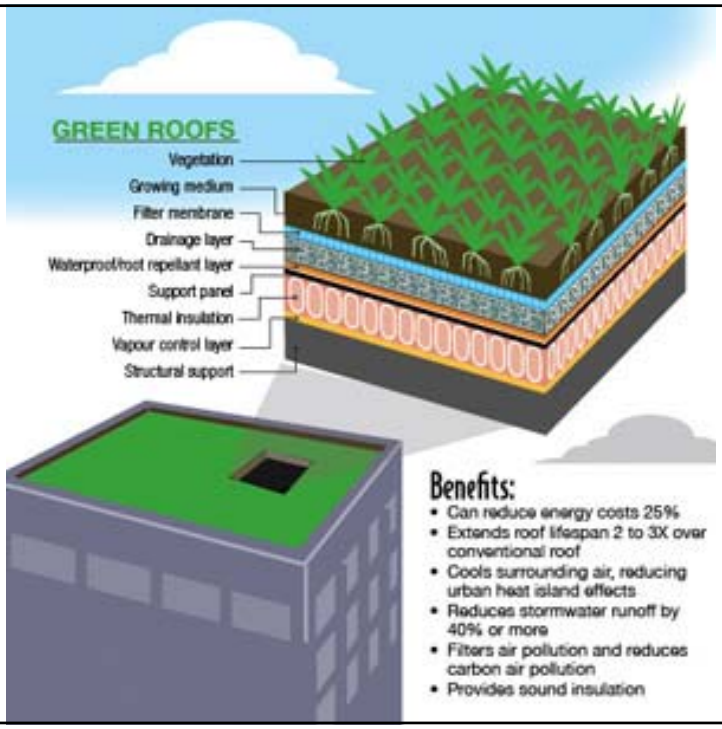

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Kuala Lumpur City Centre


Bringing Nature Back to
Kuala Lumpur City Centre

Cities

Dealing with the Problem

1) Cities → Green Cities
   - Create smallest possible ecological footprint
     - Green roofs
     - Zero / low (nett) energy buildings
     - Green buildings
     - Sustainable drainage

Green Cities - Water Recycling

Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
   - Buildings constructed <u>completely</u> with environmentally benign materials, components and systems
   - Can operate without <u>any</u> adverse environmental impact

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Green Cities - Water Recycling

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
   - Rely completely on renewable energy sources for its energy requirements
   - When useful life is over → can be deconstructed with all its materials, components and systems reused or recycled

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
   - Unfortunately we do not have as yet a building that is completely sustainable

Green Cities - Water Recycling

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
3) Green Buildings
   - Buildings that are environmentally friendly and resource-efficient
   - Must be energy efficient → Zero / low (nett) energy

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PTM Building → ZEO

Bangunan PTM ZEO pelopor binaan bangunan jimat tenaga

ZEO → Zero Energy Office

Green Cities - Water Recycling

Cities

Dealing with the Problem

1) **Cities → Green Cities**
2) **Sustainable Buildings**
3) **Green Buildings**
   - **Non-wasteful and non-polluting**
   - **Highly flexible and adaptable for long term functionality**
   - **Economical to operate and maintain**

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Green Cities - Water Recycling

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
3) Green Buildings
   - Supportive of the productivity and well-being of the occupants
   - 2010 Budget → incentives provided
   - Green Building Index, GBI

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
3) Green Buildings
4) Changing from Supply Management → Demand Management

Cities

4) Changing from Supply Management → Demand Management
   - Supply Management → Supply driven
   - Problem arise → eg too many cars
   - Solution → have projects to solve problem eg build more roads
   - Costly method (but good for some)
   - Not sustainable → resources limited while problem will continue

Cities

4) Changing from Supply Management → Demand Management
   - Demand Management → Manage the demand / need
   - Problem arise → eg too many cars
   - Solution → examine source of problem
   - Control problem at source → eg improve public transport, deter use of private cars (tolls, parking, etc)

Green Cities - Water Recycling

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Cities

Dealing with the Problem

1) Cities → Green Cities
2) Sustainable Buildings
3) Green Buildings
4) Changing from Supply Management → Demand Management
5) Dealing with the Water Problem?

Green Cities - Water Recycling

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Outline of Presentation

I. Man → A Social Animal
II. Man and Water
III. Impact of Cities (Urbanisation)
IV. Dealing with the Problem
V. Water Recycling
VI. Conclusion

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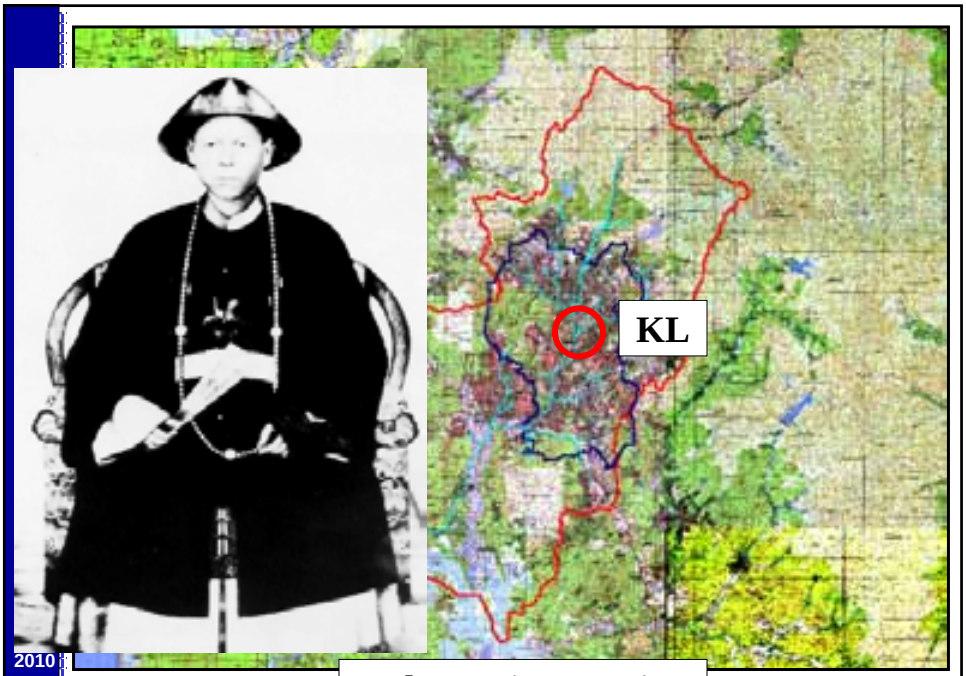
Cities

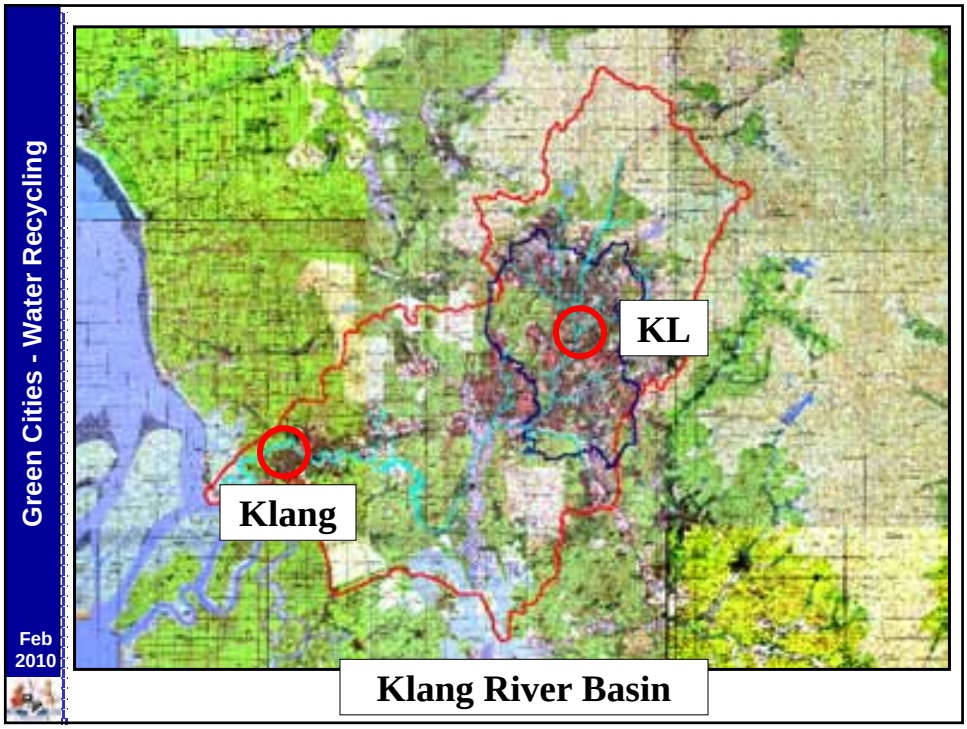
Dealing with the Water Problem

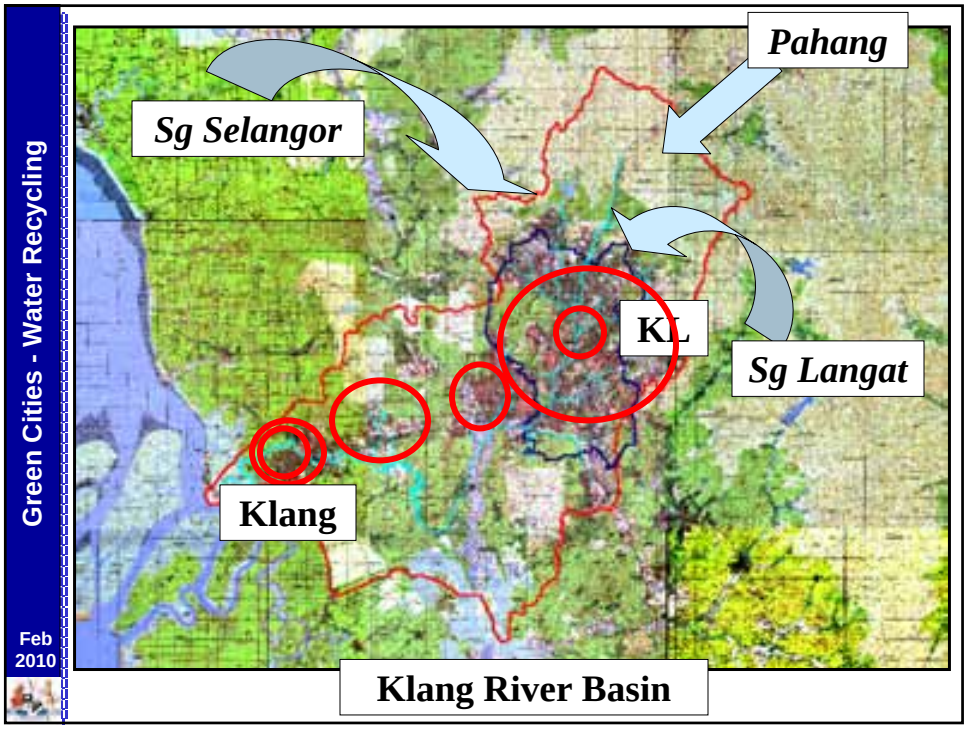
1) Understand the Problem
   - Cities → affect water quality (pollution) and quantity (shortage and floods)
   - Traditional solutions not sustainable
   - eg. Water supply



2010

Klang River Basin


Green Cities - Water Recycling
KL
Klang
Feb 2010
Klang River Basin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Pahang
Sg Selangor
KL
Sg Langat
Klang
Feb 2010
Klang River Basin

Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) Understand the Problem
   - Cities → affect water quality (pollution) and quantity (shortage and floods)
   - Traditional solutions not sustainable
   - Water supply
   - eg. Floods

Green Cities - Water Recycling

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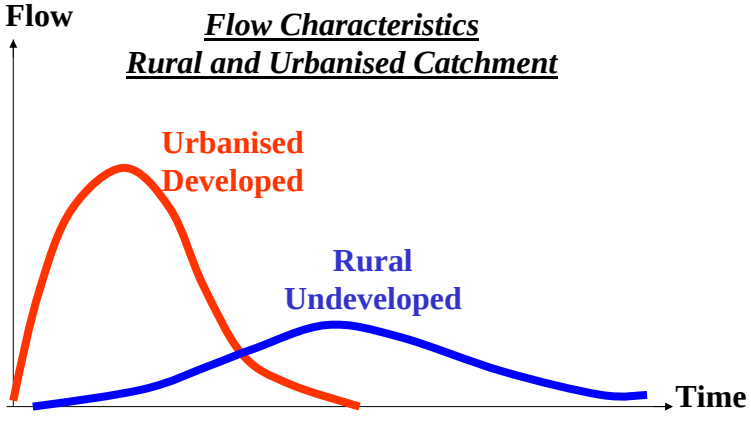
Traditional Solution - Floods

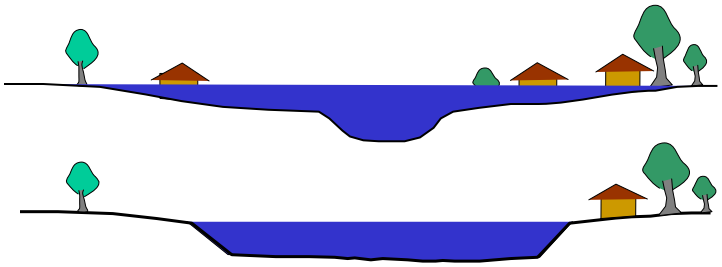
- ⇧ *increase urbanisation*
- ⇧ *runoff generated*



Green Cities - Water Recycling

Traditional Solution - Floods

- ⇧ *increase urbanisation*
- ⇧ *runoff generated*
- *Leads to flash floods*
- *Solve through engineering works*



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Green Cities - Water Recycling

Traditional Solution - Floods

- ⇧ *increase urbanisation*
- ⇧ *runoff generated*
- *Leads to flash floods*
- *Solve through engineering works*
- *Cycle repeated with more urbanisation*
- *Not Sustainable*

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Cities

Dealing with the Water Problem

1) Understand the Problem
   - Cities → affect water quality (pollution) and quantity (shortage and floods)
   - Traditional solutions not sustainable
   - Water supply
   - Floods
   - Solve through Demand Management → control problem at source

EARTH MATTERS 5

Managing demand for water

'Manage demand to ensure better supply'

IPOH, Tues. — To ensure adequate water supply here for the year 2000 and beyond, the Government must move towards managing the demand for water as opposed to managing the supply.

Department of Irrigation and Drainage director-general Keizrul Abdullah said this was a long-term measure to manage the country's water resources by adjusting development to suit the amount of water available.

He said all this while the Government had been increasing the supply of water to meet needs and this had worked well in ensuring adequate water supply.

"But with rapid development and an increase in population, more water is being used. We must therefore look at the solution from another angle," he said after delivering a keynote address at the Humid Tropics 1998 Conference here today.

The three-day conference is jointly organised by Universiti Sains Malaysia (Tronoh) and the Perak Government.

It will be officially opened by Menteri Besar Tan Sri Ramli Ngah Talib tomorrow.

Themed "The Challenge of Sustainable Development", the conference is aimed at bringing together researchers and practitioners from various fields to report on best water resources and hydrological practices and for the transfer of technology between fellow participants.

Keizrul said the demand management approach was to reduce the demand for water for the same output, which would ensure a continuous supply in the future.

Green Cities - Water Recycling

Cities

Dealing with the Water Problem

1) **Understand the Problem**

2) **Sustainability**

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Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
   - **Water → scarce natural resource**
   - **Water finds its own level**
   - **Need a holistic approach**
     - **Concept of River Basin**

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River Basin

- **Geographical area determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus**

Green Cities - Water Recycling

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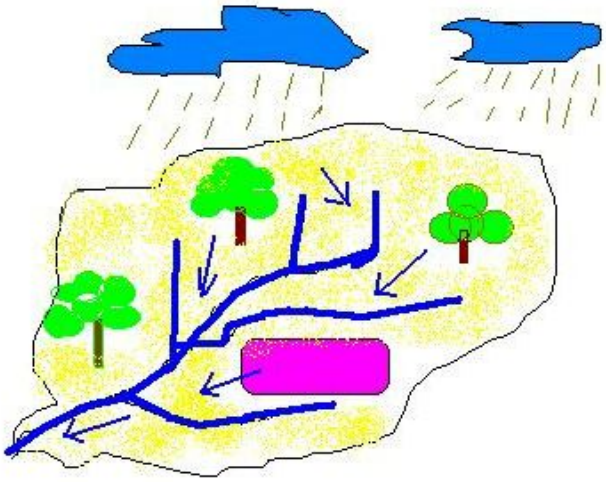
A River Basin



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Planning to be on the basis of physical (hydrological) and not political/administrative boundaries

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Keep to carrying capacity (ability to supply water continuously) of rivers and aquifers

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Green Cities - Water Recycling

Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs**

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**

- **Reduce → use less water**

Green Cities - Water Recycling

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New Straits Times

City Life

Selangor consumers told to cut water use

Using 50 litres less can save 100 million litres a day, says Exco member

By Suzanne Dulip

Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) Understand the Problem

2) Sustainability

3) 3Rs → <u>Reduce</u>, Reuse, Recycle

- <u>Reduce</u> → use less water
- Water efficient/savings devices, eg toilet

Green Cities - Water Recycling

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Green Cities - Water Recycling

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Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**
   - **Reduce → use less water**
   - **Water efficient/savings devices, eg toilet**
   - **Rainfall harvesting → for watering lawn, etc to reduce potable water use**

Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**
   - **Reuse → discarded water used again**
   - **Water for washing rice grains can be used to water plants**

Green Cities - Water Recycling

Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**
   - **Recycle → discarded water treated and used again**
   - **Generally not for potable use**

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ESDAY January 30 2001 THE STAR

S'pore to turn sewage into water

SINGAPORE: The island republic launched a programme yesterday to recycle sewage to meet some of its water needs, the Ministry of Environment said.

The recycled sewage, called "Newater," is expected to provide 15% of Singapore's water supply in 10 years' time, a ministry statement said.

The Newater recycling programme is part of Singapore's new sewage tunnel system. Tunnelling work on the pro-

Green Cities - Water Recycling

Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**
   - **Recycle → discarded water treated and used again**
   - **Generally not for potable use**
   - **Energy is needed in treatment process**

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Green Cities - Water Recycling

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Cities

Dealing with the Water Problem

1) **Understand the Problem**
2) **Sustainability**
3) **3Rs → Reduce, Reuse, Recycle**
4) **Stormwater Management → Controlling the Problem at Source → MSMA (Manual Saliran Mesra Alam)**

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Control at Source

Green Cities - Water Recycling

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Control at Source

Reduce run-off through

- **Storage**
- **Increasing Infiltration**
- **Decreasing Velocities**

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Control at Source

Reduce run-off through

- **Storage**
- **Increasing Infiltration**
- **Decreasing Velocities**

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Control at Source

- **Storage**
  - **Detention Ponds**

Green Cities - Water Recycling

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Detention/ Storage ponds

Control at Source

- **Storage**
  - **Detention Ponds**
    - **Ponds can be used as source of water to recycle in an emergency**
    - **Ponds can also be used for recreation**

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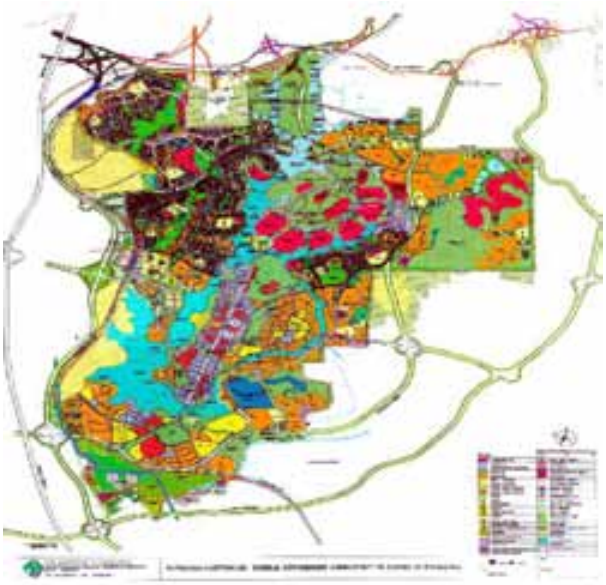

Putrajaya Lake functions as storage/ retention/recreation

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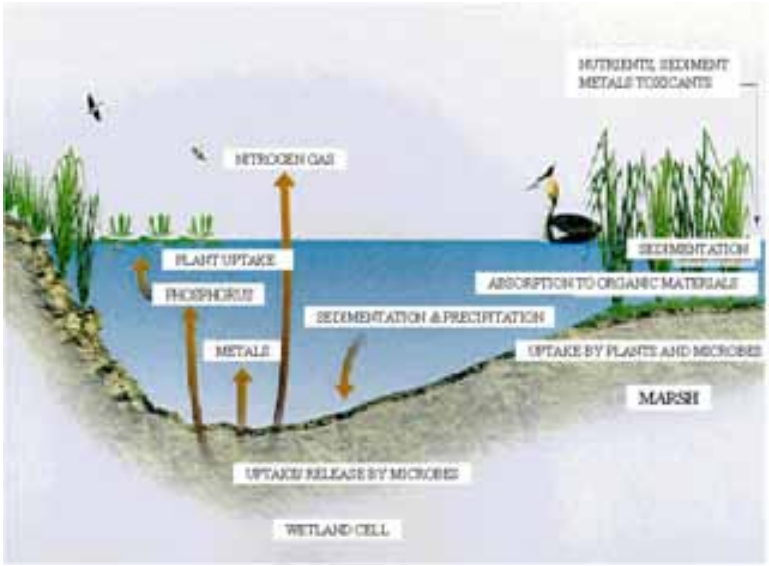

PutrajayaWetlands functions as Pre-Biological Treatment

Control at Source

- **Storage**
  - **Detention Ponds**
  - **Rainfall harvesting**

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Traditional Rainfall Harvesting

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Control at Source

- **Storage**
  - **Detention Pond**
  - **Rainfall Harvesting**
  - **Modular tanks underground**

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Underground Tanks

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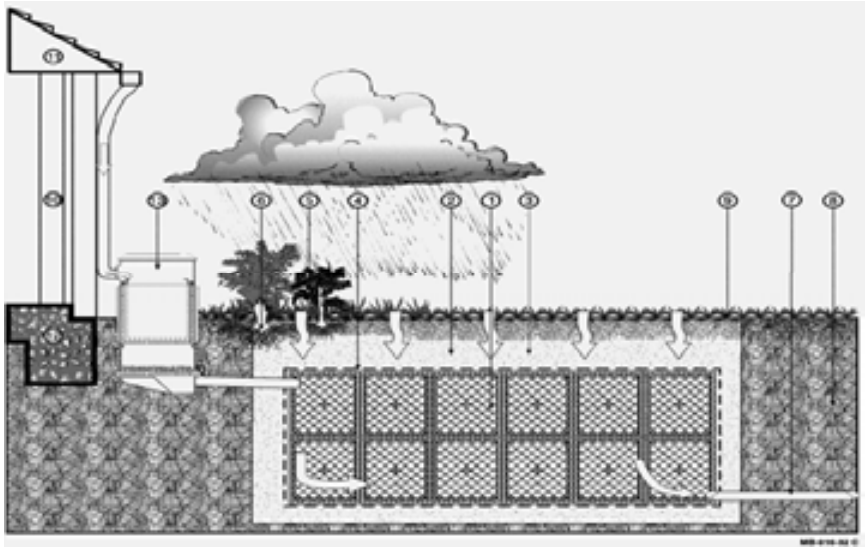
Modular Tank



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Storage tanks in house

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Control at Source

Reduce run-off through

- **Storage**
- **Increasing Infiltration**
- **Decreasing Velocities**

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Control at Source

- **Storage**
- **Increase Infiltration**
  - **Infiltration/Gravel Drains**

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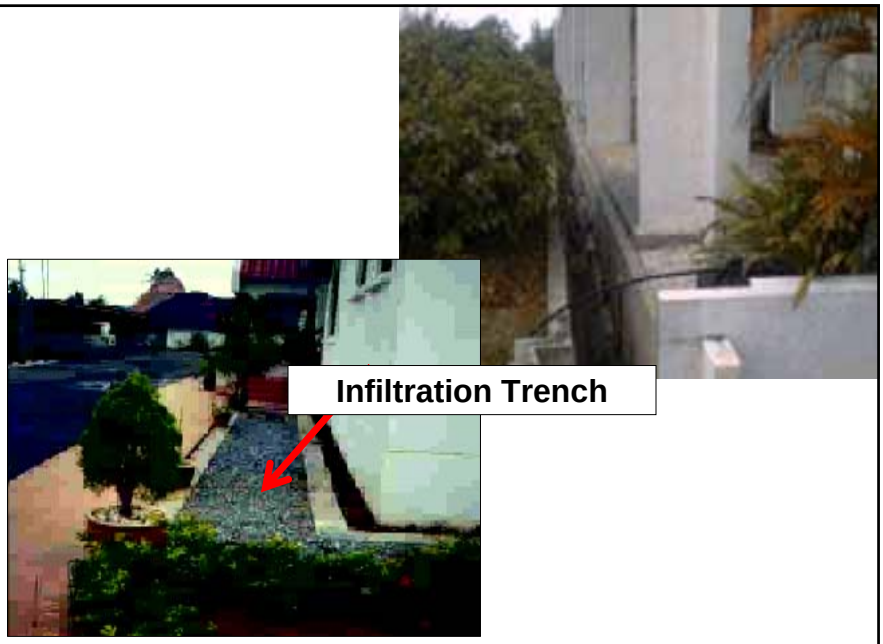

Infiltration System at housing perimeter

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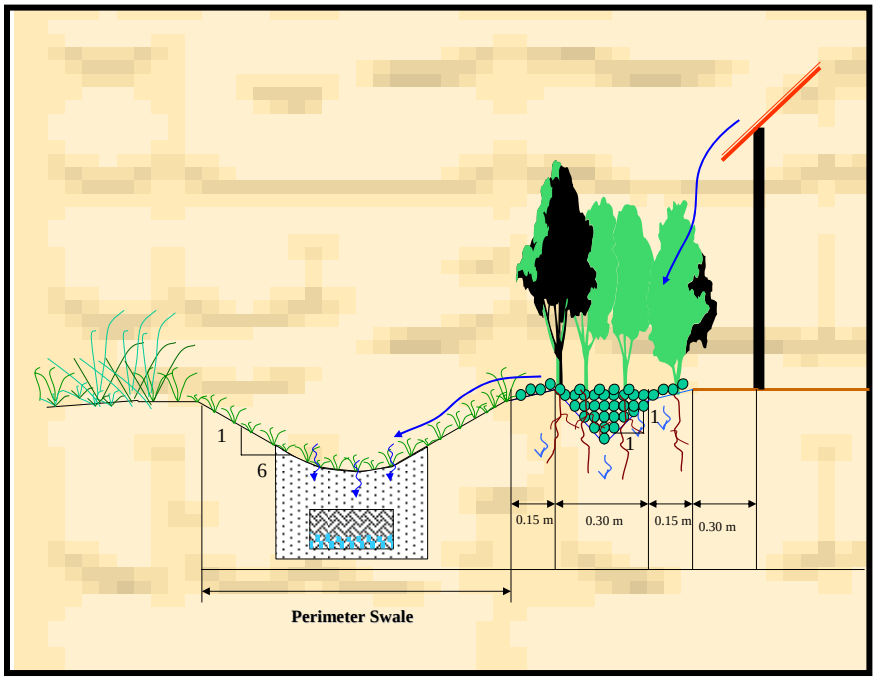

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Green Cities - Water Recycling

Control at Source

- **Storage**
- **Increase the infiltration rate**
  - **Infiltration/Gravel Drain**
  - **Pervious Road Pavement**

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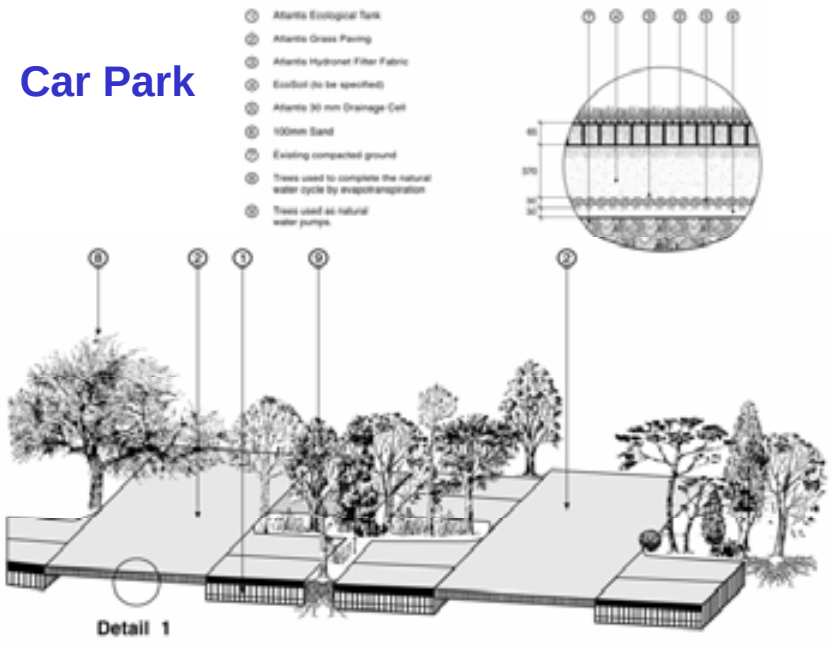
Car Park



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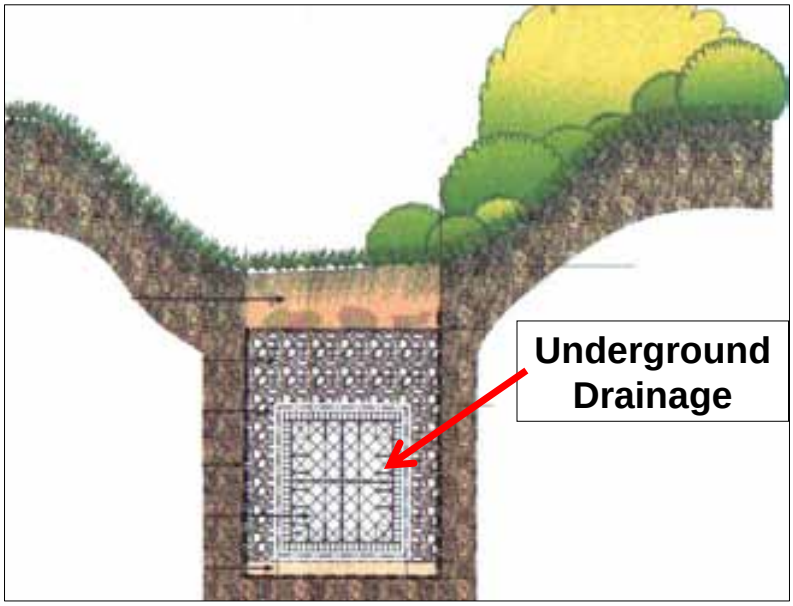
Control at Source

- **Storage**
- **Increase the Infiltration rate**
  - **Infiltration/Gravel Drain**
  - **Pervious Road Pavement**
  - **Underground Drainage (buried drains)**

Green Cities - Water Recycling



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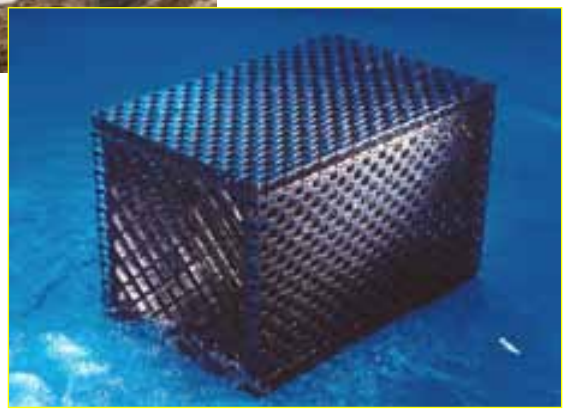

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Control at Source

- **Storage**
- **Increase the Infiltration rate**
  - **Infiltration/Gravel Drain**
  - **Pervious Road Pavement**
  - **Underground Drainage**
  - **Improves Water Quality**

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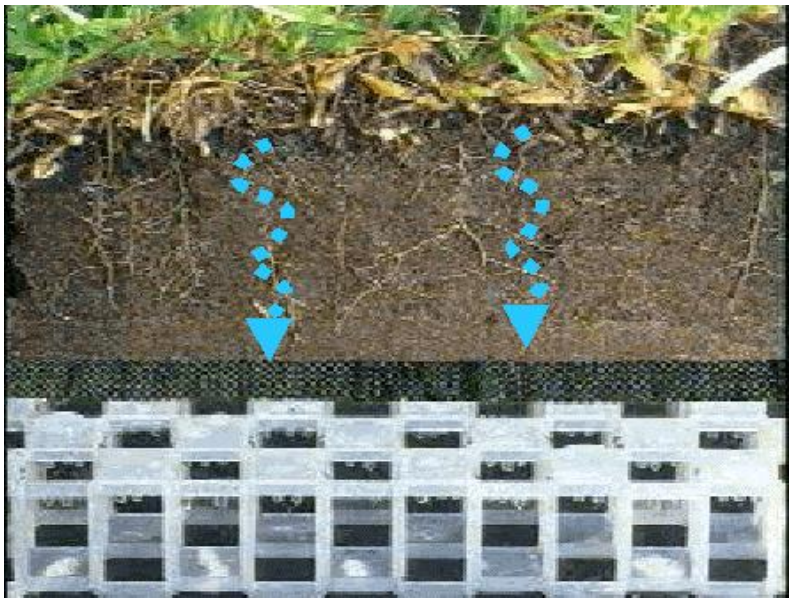

Purification of Runoff

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Control at Source

Reduce run-off through

- **Storage**
- **Increasing Infiltration**
- **Decreasing Velocities**

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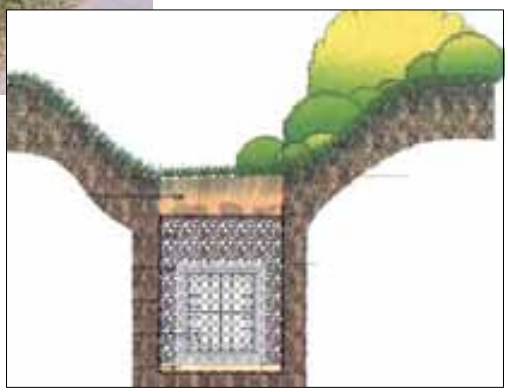
Swale



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Green Cities - Water Recycling

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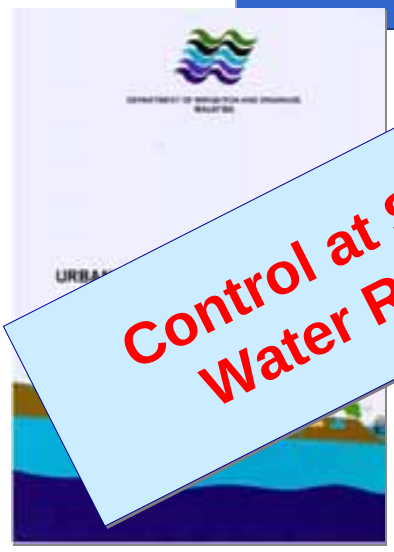
STORMWATER MANAGEMENT MANUAL



- Ex… …rol …d

Control at Source → Water Recycling

… Examples of World-wide best practices

Outline of Presentation

I. Man → A Social Animal

II. Man and Water

III. Impact of Cities (Urbanisation)

IV. Dealing with the Problem

V. Water Recycling

VI. Conclusion

Conclusion

- As cities expand → water problems (both quantity and quality) will increase
- Project-driven measures of water supply and flood mitigation not sustainable
- Need to change from Supply Management (project driven) → Demand Management (control at source)
- MSMA → handle both quantity and quality issues