



Green Cities - Water Recycling

Feb 2010



Vertical Farming

This image shows a vertical farming system. It consists of several white, multi-tiered racks. Each tier has a row of green leafy plants growing out of it. The plants are densely packed and appear to be in a controlled environment. The racks are arranged in a row, and the plants are growing in a nutrient-rich medium. The overall appearance is that of a modern, space-efficient agricultural system.

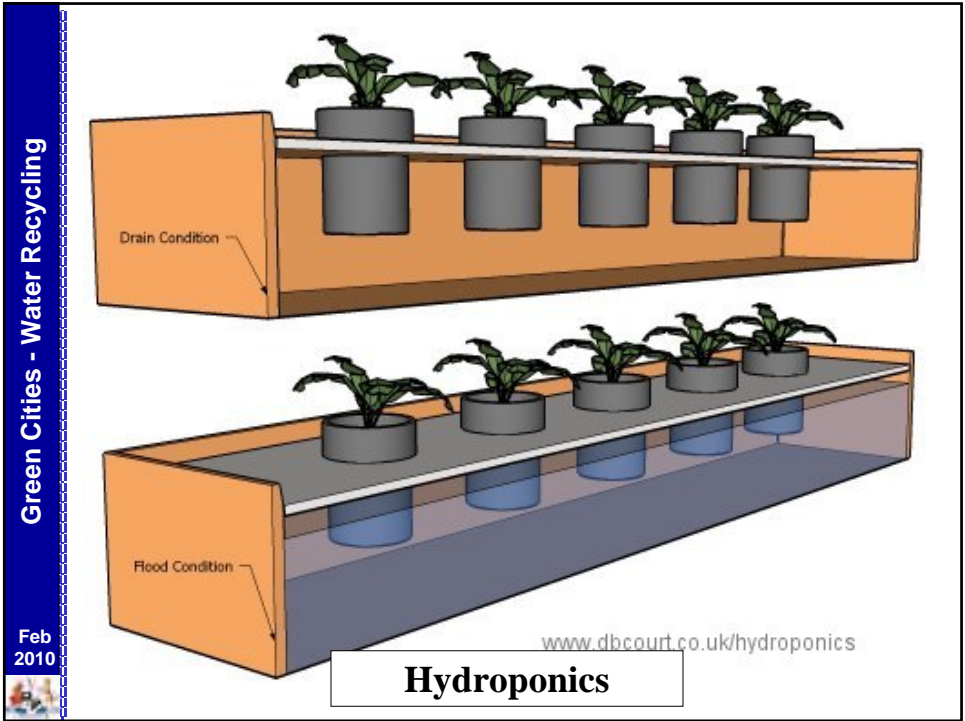
Green Cities - Water Recycling

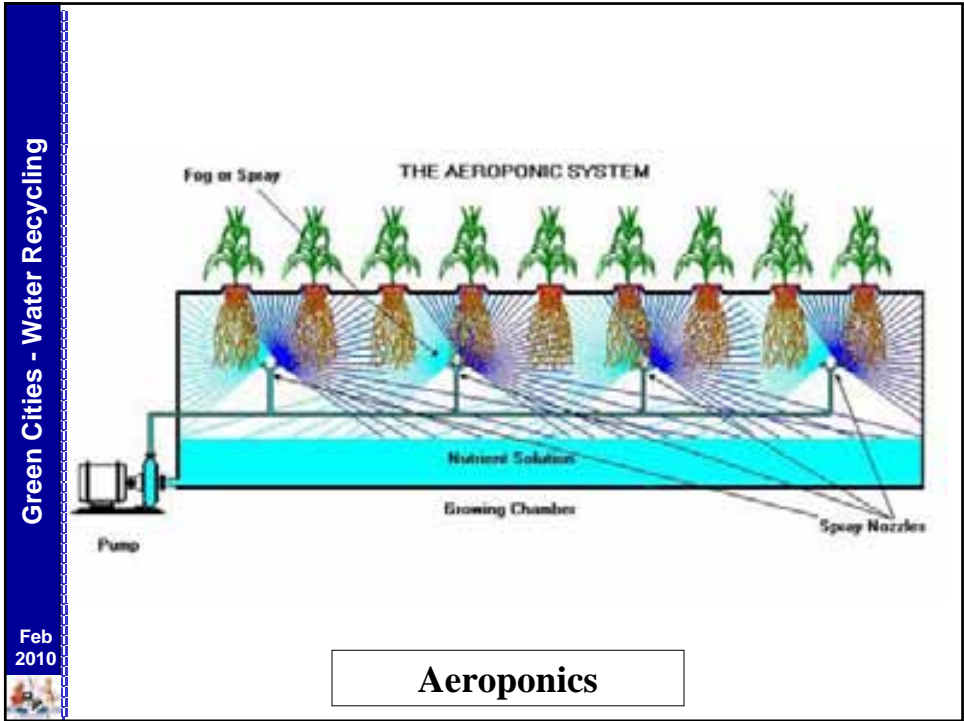
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Hydroponics

This image shows a hydroponic system. It features a row of white, rectangular containers, each holding a green leafy plant. The containers are connected to a network of black tubes and hoses, which are part of a water delivery system. The plants are growing in a nutrient-rich solution. The system is designed to be efficient and space-saving, allowing for high-density planting. The number '2' is visible on one of the containers.





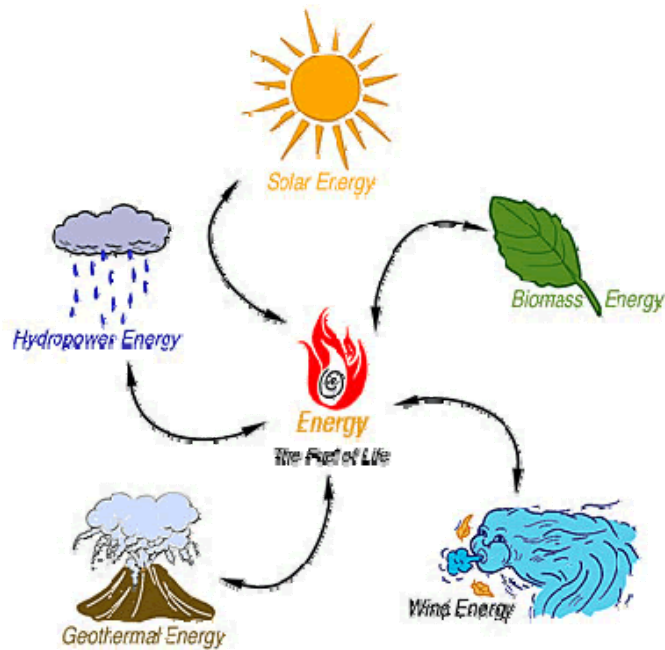


Cities

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





Domestic Solar Heater

How Solar Works





Green Cities - Water Recycling

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



Green Cities - Water Recycling

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Green Cities - Water Recycling



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Bahrain World Trade Centre

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
- Water conservation

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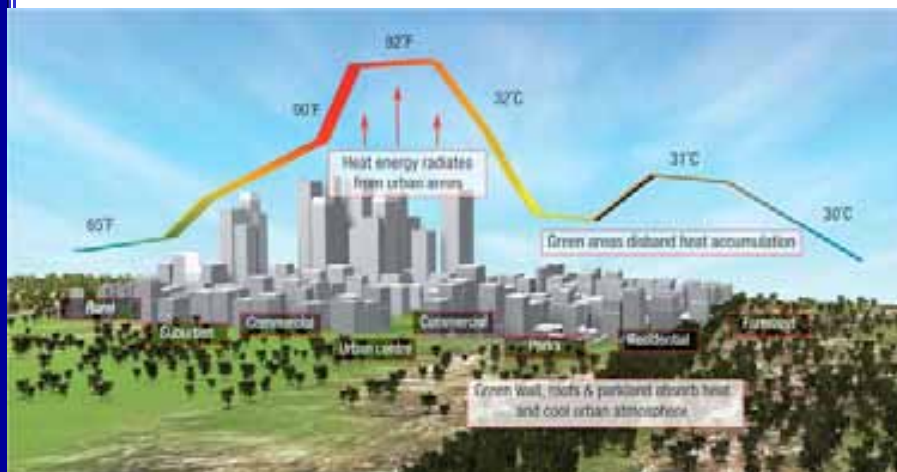


Cities

Dealing with the Problem

1) Cities → Green Cities

- Create smallest possible ecological footprint
- Improve public 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



Typical carpark - contributing to urban heat island

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Love for palm trees???

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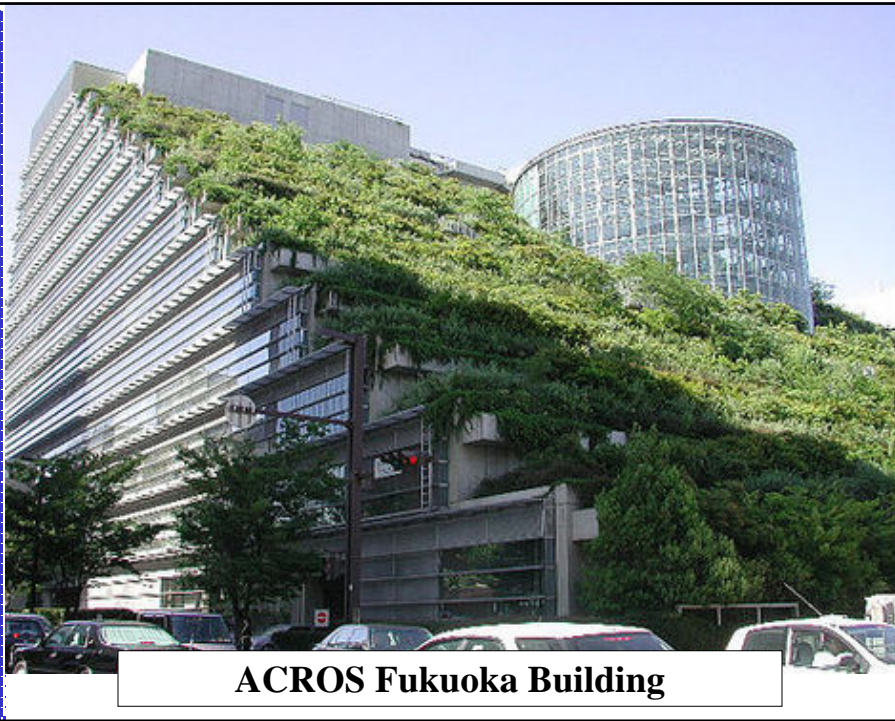
Angsana tree provides good shade

Cities

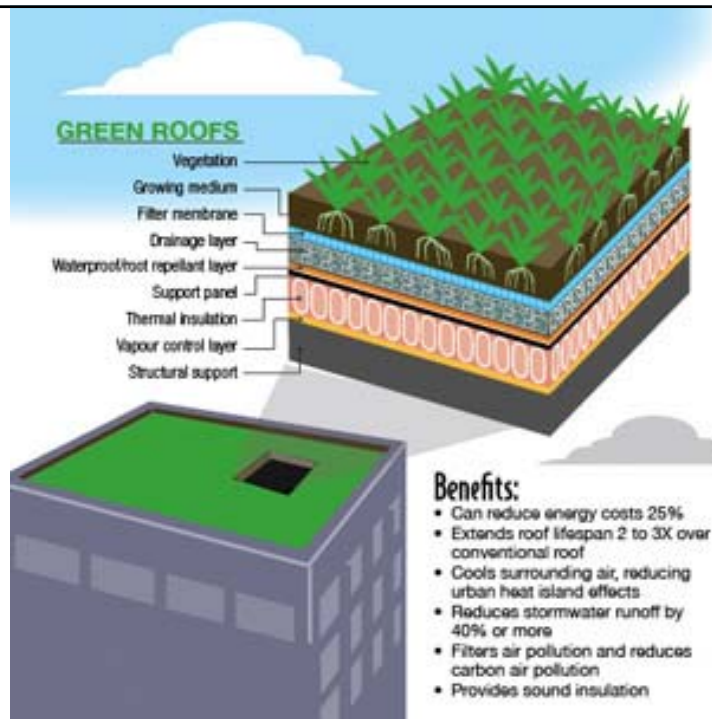
Dealing with the Problem

1) Cities → Green Cities

- Create smallest possible ecological footprint
- Green roofs



ACROS Fukuoka Building



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



Cities

Dealing with the Problem

1) Cities → Green Cities

2) Sustainable Buildings

- Buildings constructed completely with environmentally benign materials, components and systems
- Can operate without any adverse environmental impact



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



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



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



PTM Building → ZEO



ZEO → Zero Energy Office

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**



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**



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)**



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?



Outline of Presentation

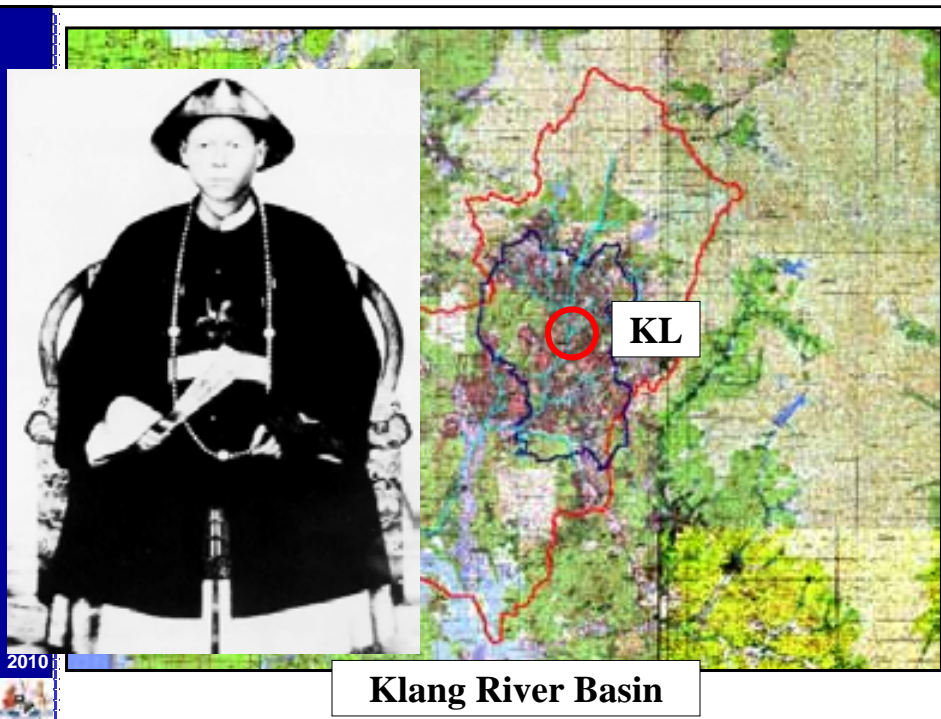
- I. Man → A Social Animal
- II. Man and Water
- III. Impact of Cities (Urbanisation)
- IV. Dealing with the Problem
- V. Water Recycling**
- VI. Conclusion

Cities

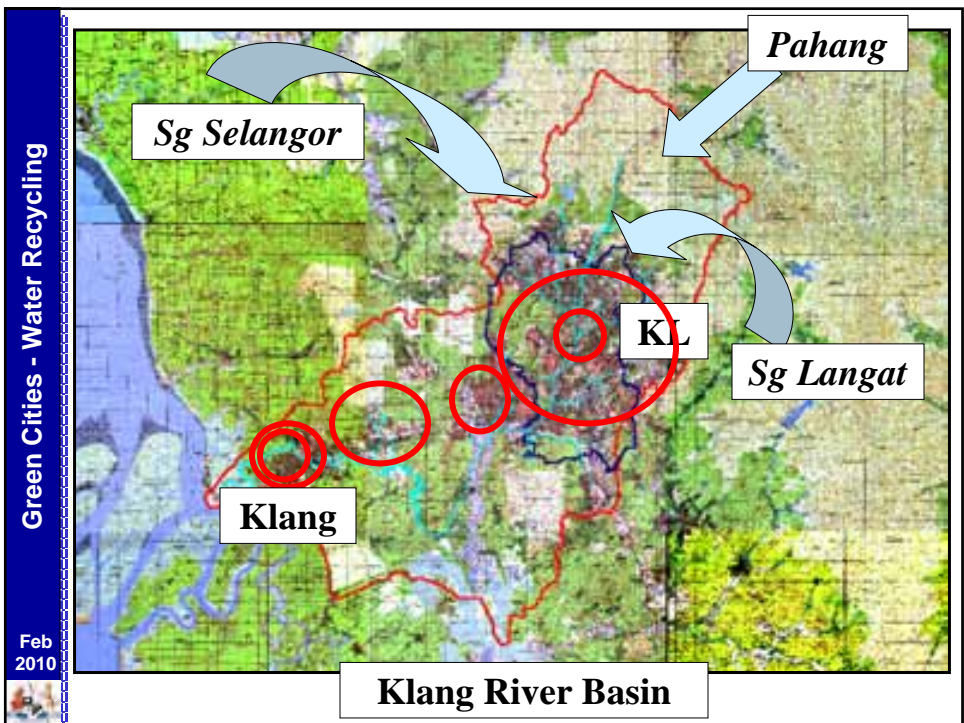
Dealing with the Water Problem

1) Understand the Problem

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



Klang River Basin





Cities

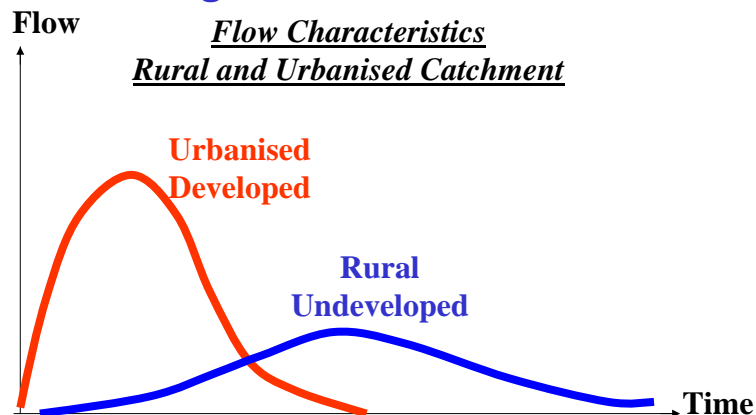
Dealing with the Water Problem

1) Understand the Problem

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

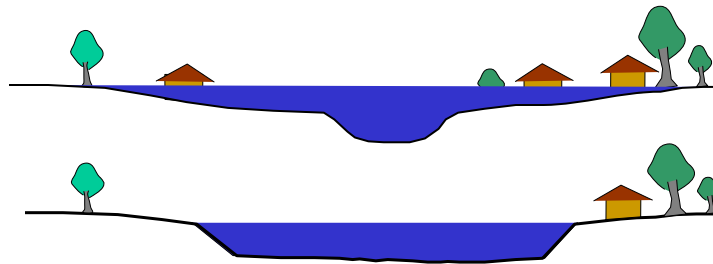
Traditional Solution - Floods

- ↑ increase urbanisation
- ↑ runoff generated



Traditional Solution - Floods

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



Traditional Solution - Floods

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



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



'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 key-

note 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.

Cities

Dealing with the Water Problem

- 1) Understand the Problem
- 2) Sustainability



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

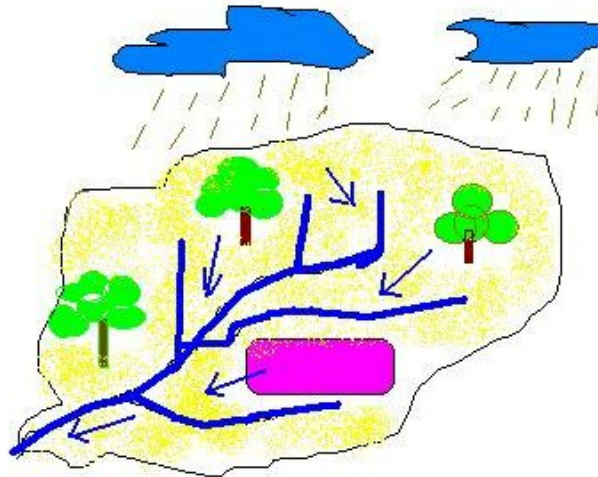


River Basin

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



A River Basin



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



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

Cities

Dealing with the Water Problem

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





Cities

Dealing with the Water Problem

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



Cities

Dealing with the Water Problem

- 1) Understand the Problem
- 2) Sustainability
- 3) 3Rs → Reduce, Reuse, Recycle
 - Reduce → use less water

New Straits Times

City Life

FRIDAY, MARCH 18, 2010

Editor: Mohd Ariyan Othman Tel: 25584405 Email: citylife@nsp.com.sg

Kuala Lumpur: Tan Boon Ming Sdn Bhd TBM

Selangor consumers told to cut water use

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

By Suriani Dalip (surdal@nsp.com.my)

The Selangor Government wants each consumer to cut down on water consumption by 50 litres (which is equivalent to two and a half jugs of water) a day with immediate effect.

Today, water treatment facilities in Selangor are producing 2.1 billion litres of water a day.

State Infrastructure, Communications and Public Service and Utilities Commission chairman Derek Wood stated during a meeting held in terms of

water, a consumer would save five and one-eighth litres a day on the water bill.

He said there have been some two million water users in the State.

"With this reduction, we can conserve about 100 million litres of water a day. And this conservation will save about RM2.00 in water bills in total."

He said this is required after visiting the Sungai Selangor water treatment plant (Sungai Selangor) in Kuala Lumpur, and several areas which had been used as sources to fill the almost

Selangor Selangor due to the existing dry spell.

According to the Selangor Waterworks Department deputy director V. Subramaniam, Sungai Selangor (SPLASH) has had several water treatment plants in Petaling Jaya, Klang, Shah Alam and Telukok, Seremban, and Telok Anson.

Wood said the dry spell, which started last month, had caused drops in water levels at the various reservoirs and five dams in the State.

City Council chairman

the maximum water level of the river was 10 metres.

He said the normal level was 50 metres. The drop signals water to be put out of reservoirs in Selangor and Kuala Lumpur.

He said in order to increase the water level at the Sungai Selangor (SPLASH) had been pumping water into the river from some of the dams taken over by Selangor Selangor. The operation started on Feb 25.

"About 75 million litres of water is being pumped daily. This will continue until early next month when the water level increases again. It is expected to last," he said.

The Selangor Government will hold an event in each district to encourage water conservation.

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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

Green Cities - Water Recycling

City
New Straits Times

Bright Future for Jinteng
Value-Add recycling launch

Advice to use water-saving toilet cisterns

Builders urged to implement ruling in advance

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10 litres → 6 litres

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Green Cities - Water Recycling

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2-Buttons Cistern



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





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



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



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-

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





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)



Control at Source



Control at Source

Reduce run-off through

- Storage
- Increasing Infiltration
- Decreasing Velocities



Control at Source

Reduce run-off through

- Storage
- Increasing Infiltration
- Decreasing Velocities

Control at Source

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

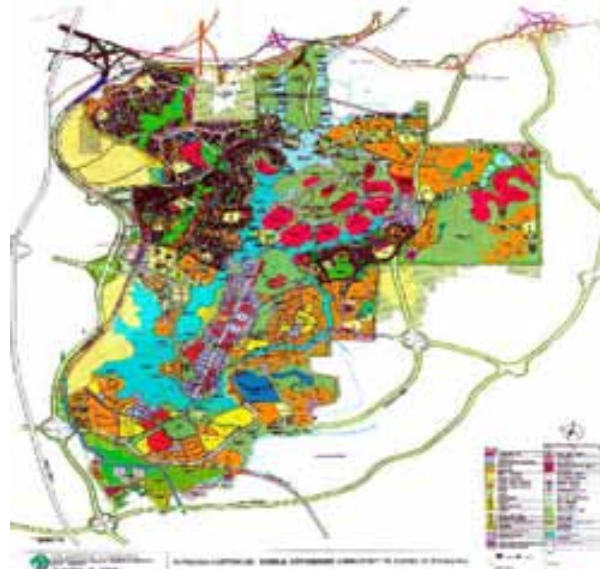


**Detention/
Storage ponds**

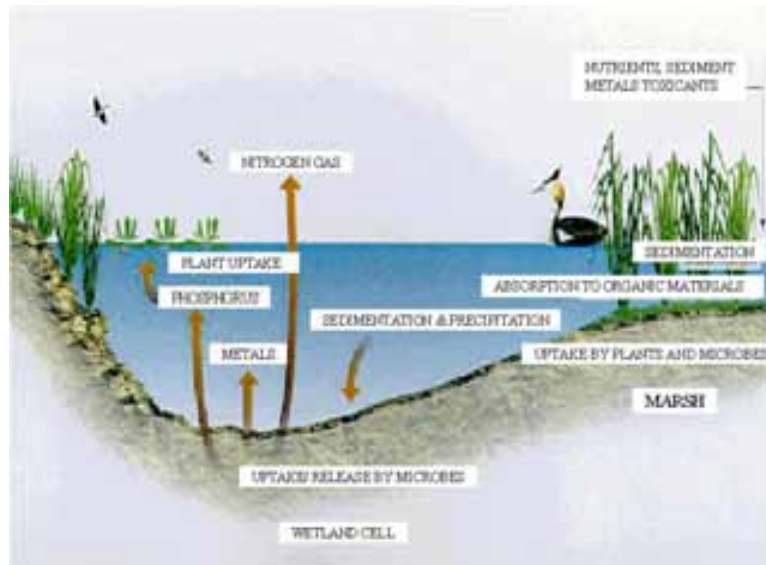


Control at Source

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



**Putrajaya Lake functions as storage/
retention/recreation**



Putrajaya Wetlands functions as Pre-Biological Treatment

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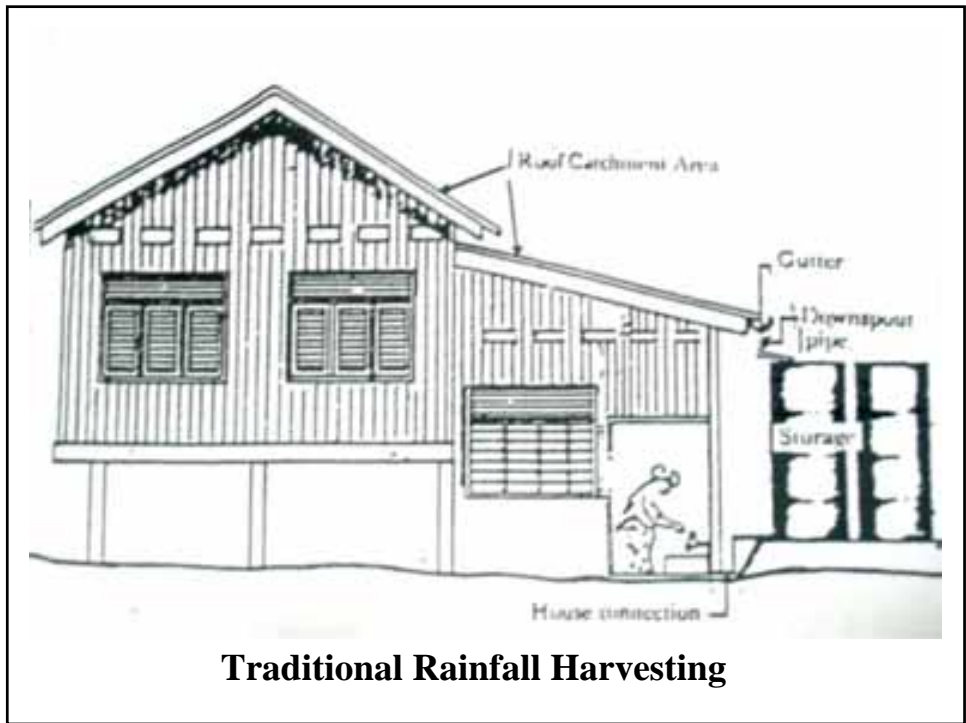


Control at Source

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

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Traditional Rainfall Harvesting






Control at Source

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

Green Cities - Water Recycling

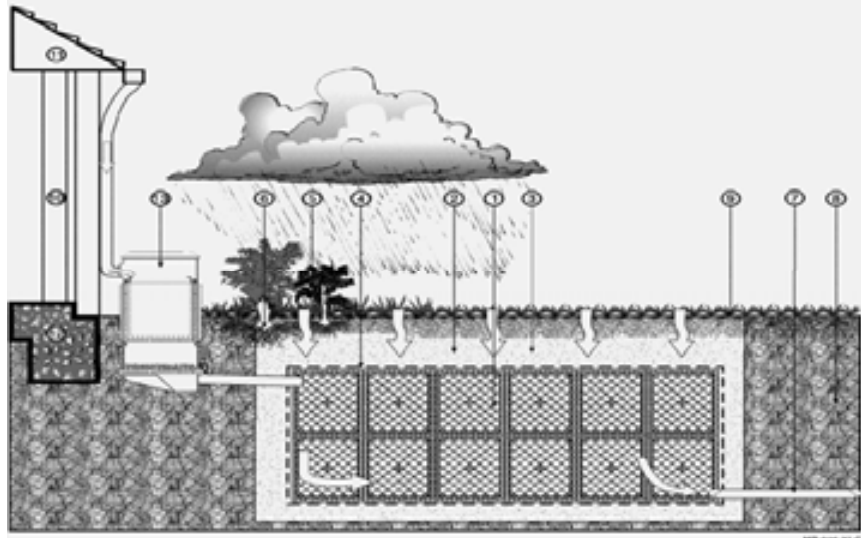
Underground Tanks



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Green Cities - Water Recycling

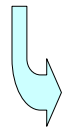
Modular Tank



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Storage tanks in house



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Control at Source

Reduce run-off through

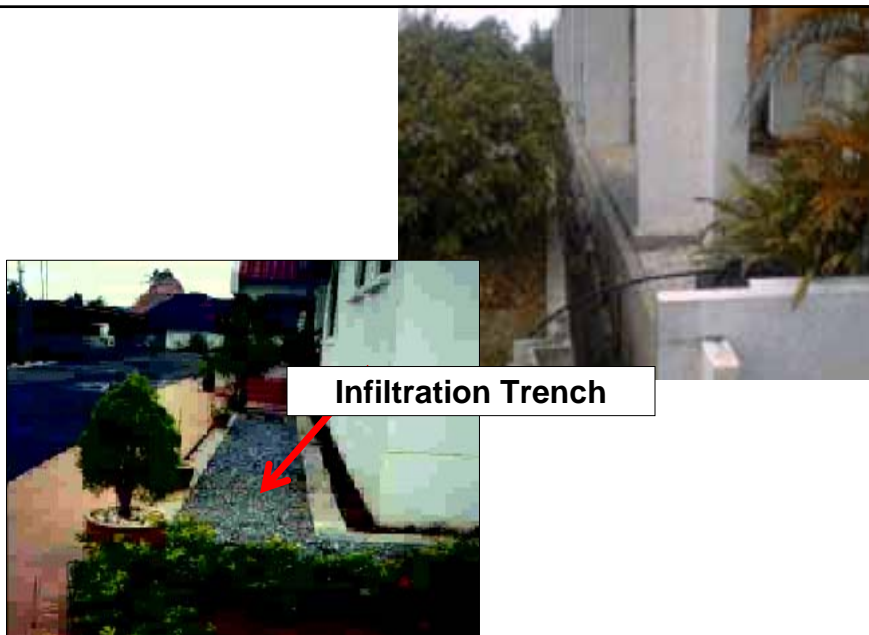
- **Storage**
- **Increasing Infiltration**
- **Decreasing Velocities**

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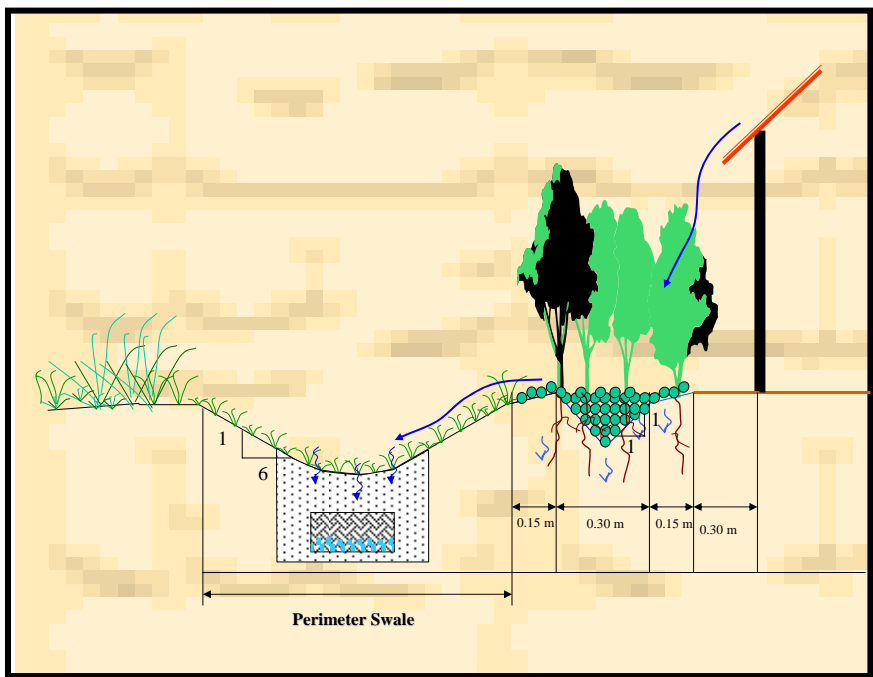


Control at Source

- Storage
- Increase Infiltration
 - Infiltration/Gravel Drains

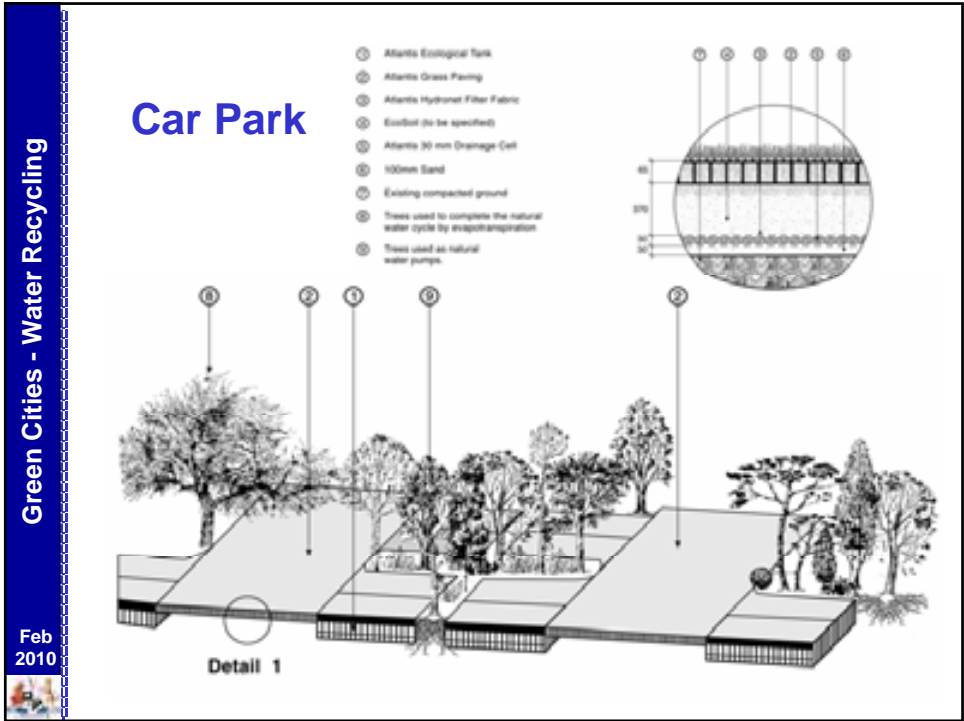


Infiltration System at housing
perimeter



Control at Source

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



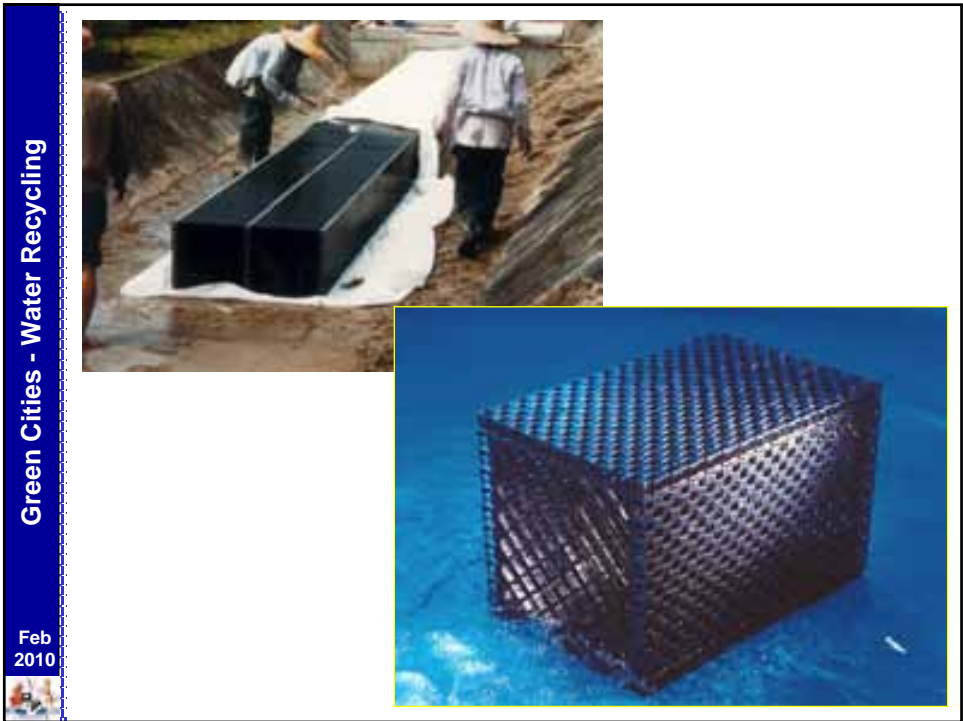
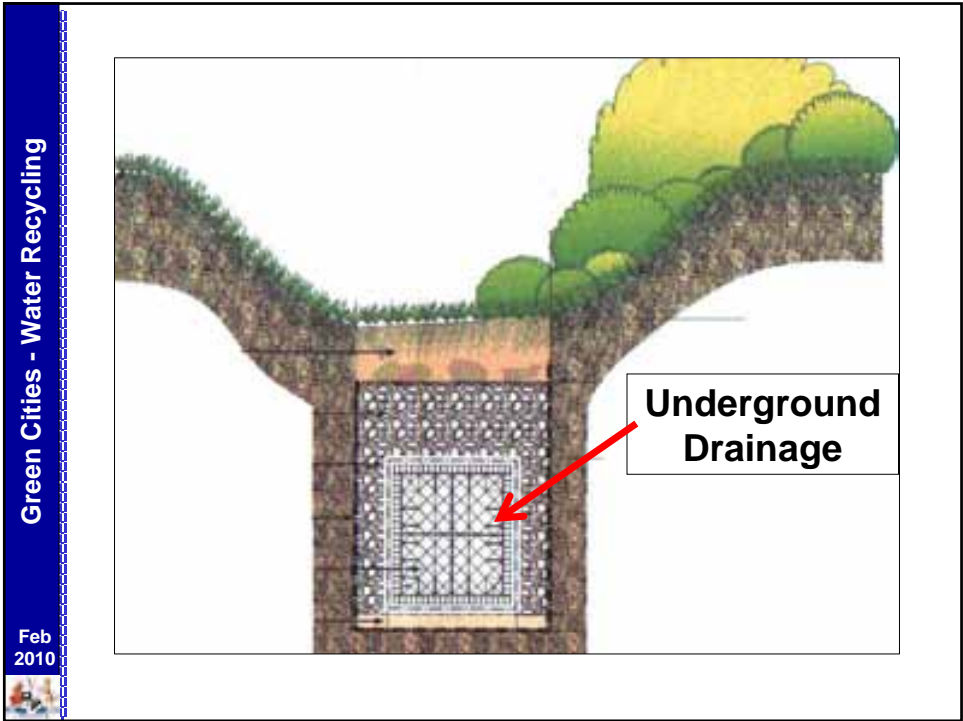


Green Cities - Water Recycling

Control at Source

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

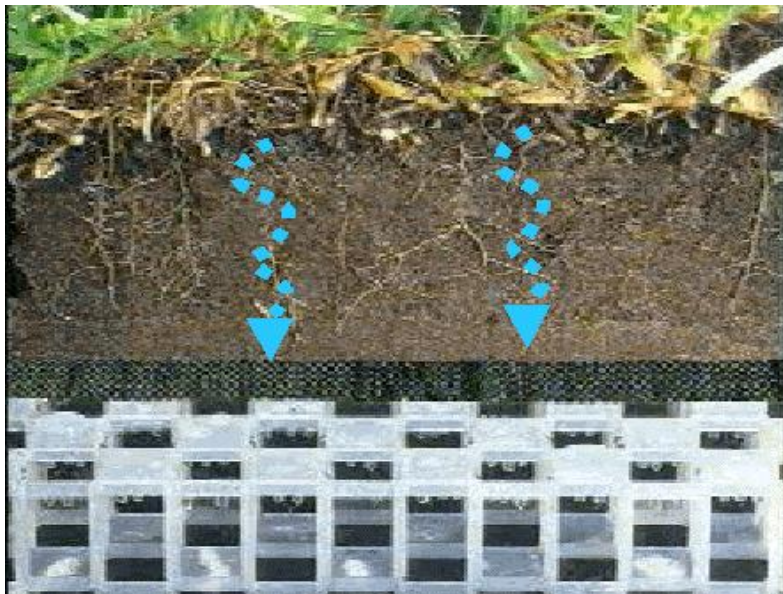
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Control at Source

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



Purification of Runoff

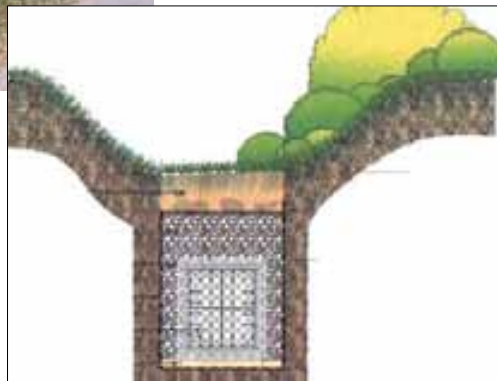
Control at Source

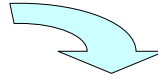
Reduce run-off through

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

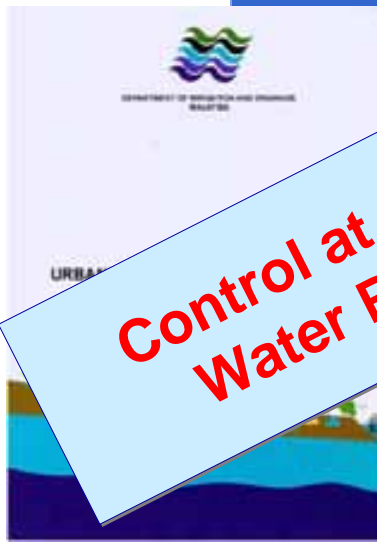


Swale





STORMWATER MANAGEMENT MANUAL



■ Examples of Control and

**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

