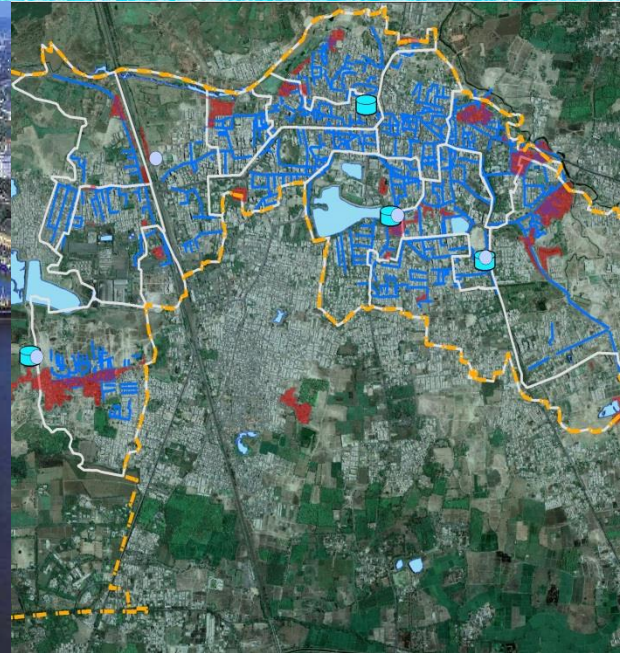


# Cities, Water and Urban Planning

## From challenges to emerging opportunities

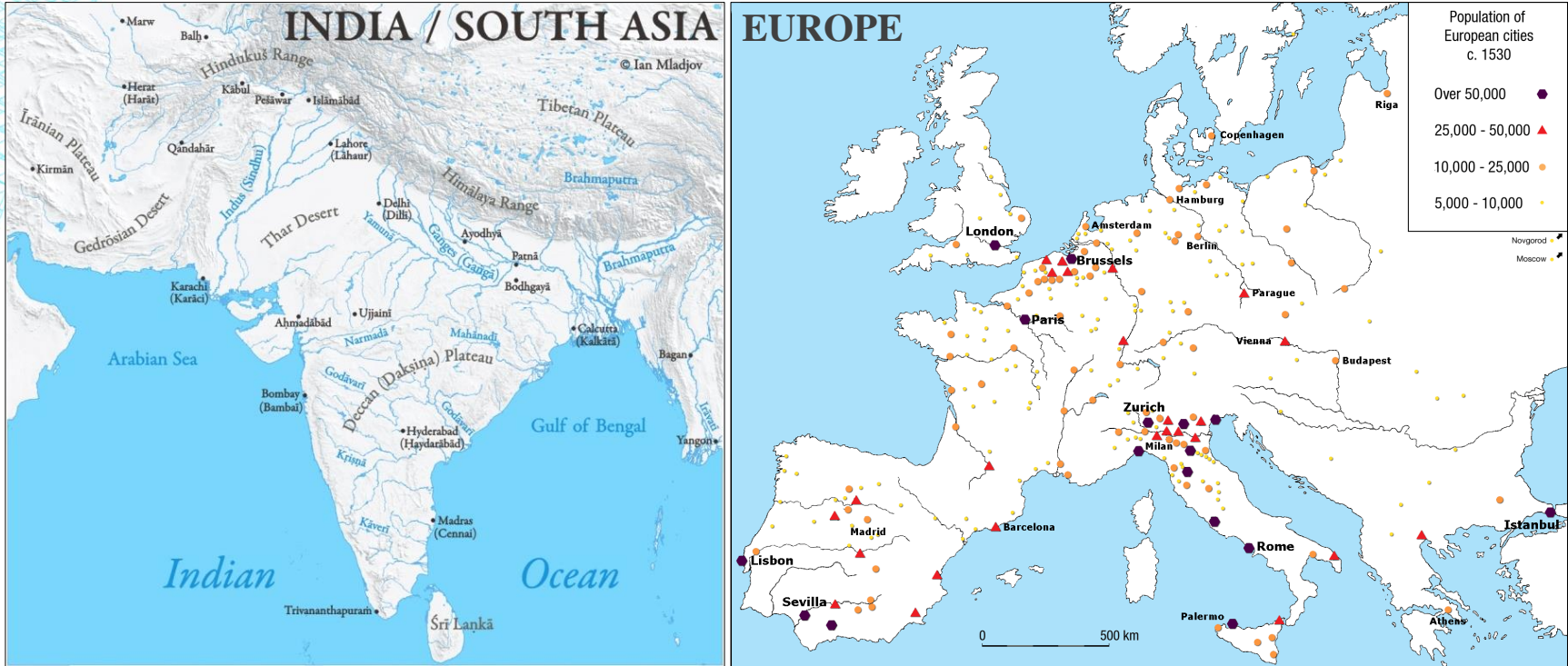
Prof. Meera Mehta, CEPT University, INDIA

50<sup>th</sup> ISCOCARP International Planning Congress, Gydnia, September 2014.



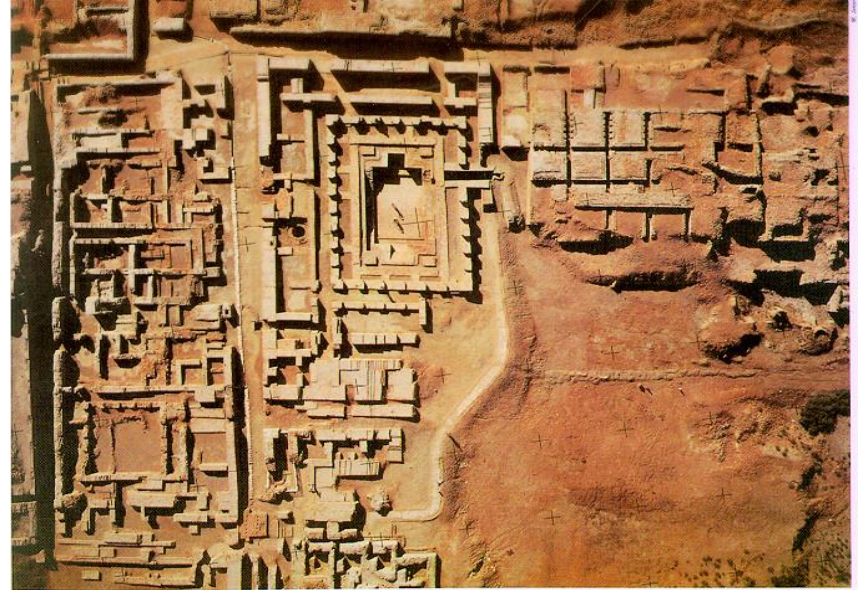
# Cities and water through history

Through history most cities emerged next to sources of water...



# Ancient wisdom of city planning

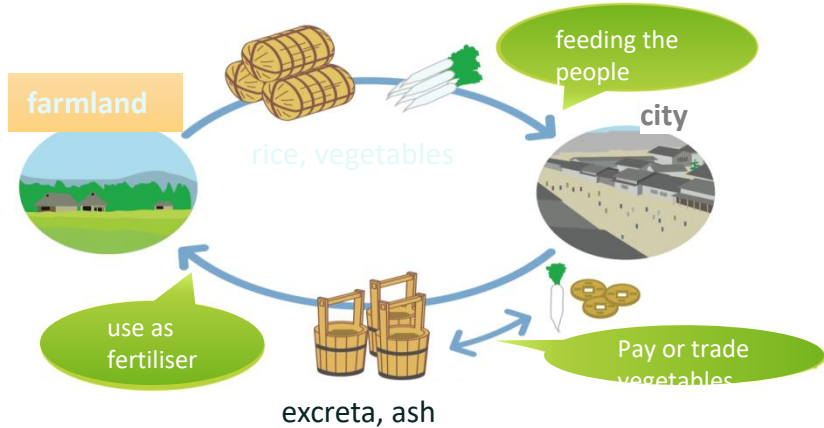
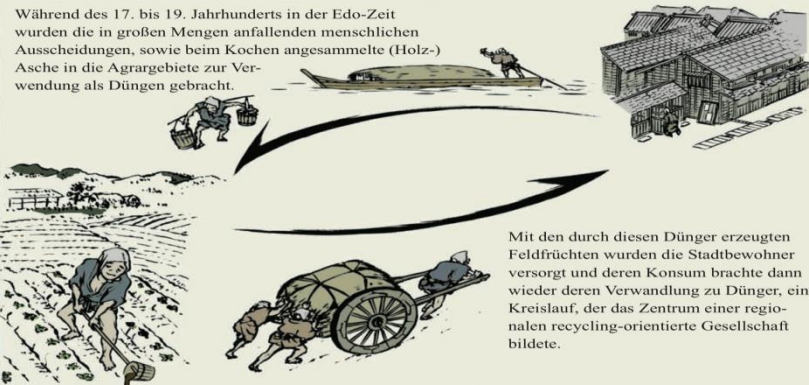
- City planning was known 2500 years ago
- These ancient cities had network of water sources
- and drainage systems with a well-developed system of urban sanitation



Mohenjo-daro : aerial view

# From Edo to Rome....

- Clean water supplied from the river and waste sold to farmers -
- circular flow concept: for nutrients and water

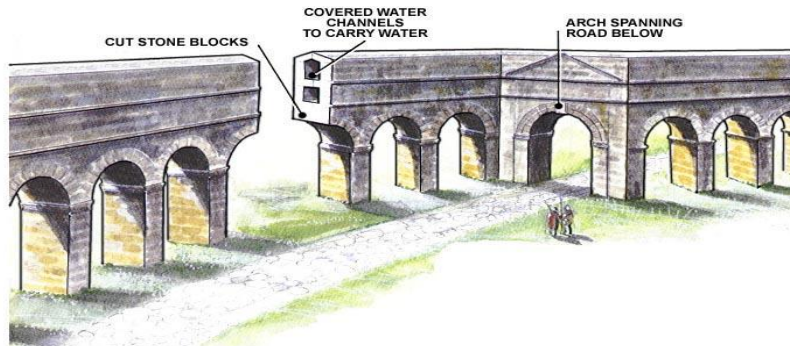
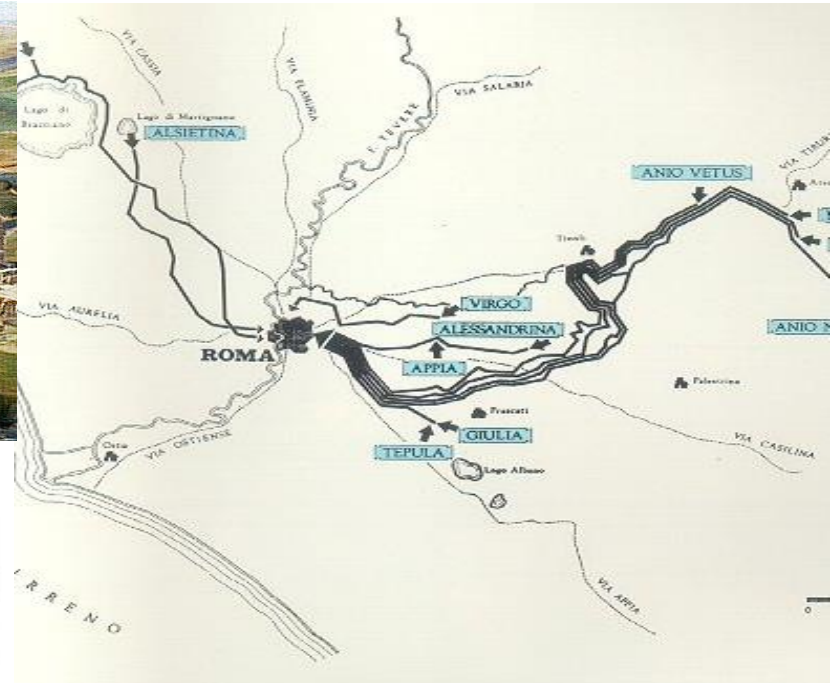
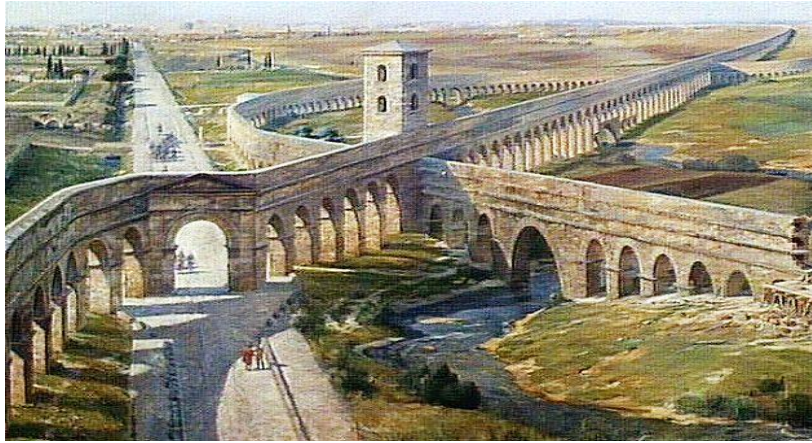


Source: BORDA (2010),  
“Decentralized waste  
water treatment:  
experience sharing”,  
presentation at CEPT  
University – Anil  
Agarwal, CSE 2001

# From Edo to Rome....

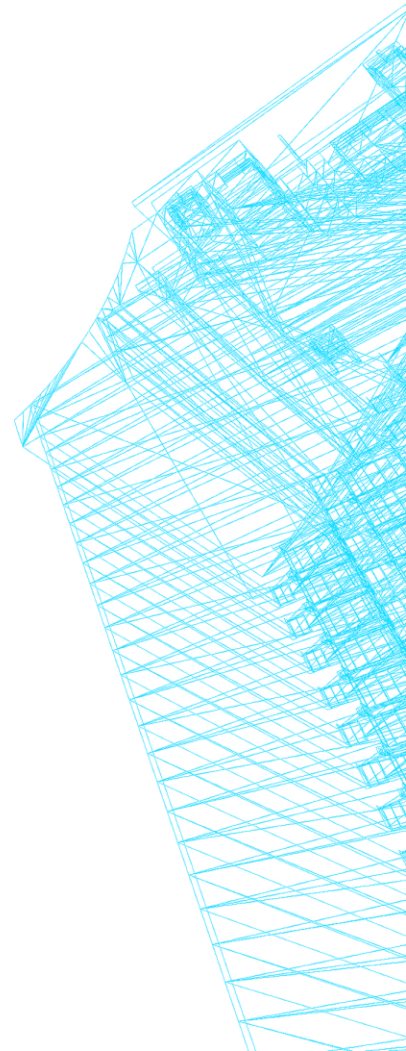
– Excellent aqueducts, a symbol of stupidity?

Introducing linear flow concept: clean input / use / waste output



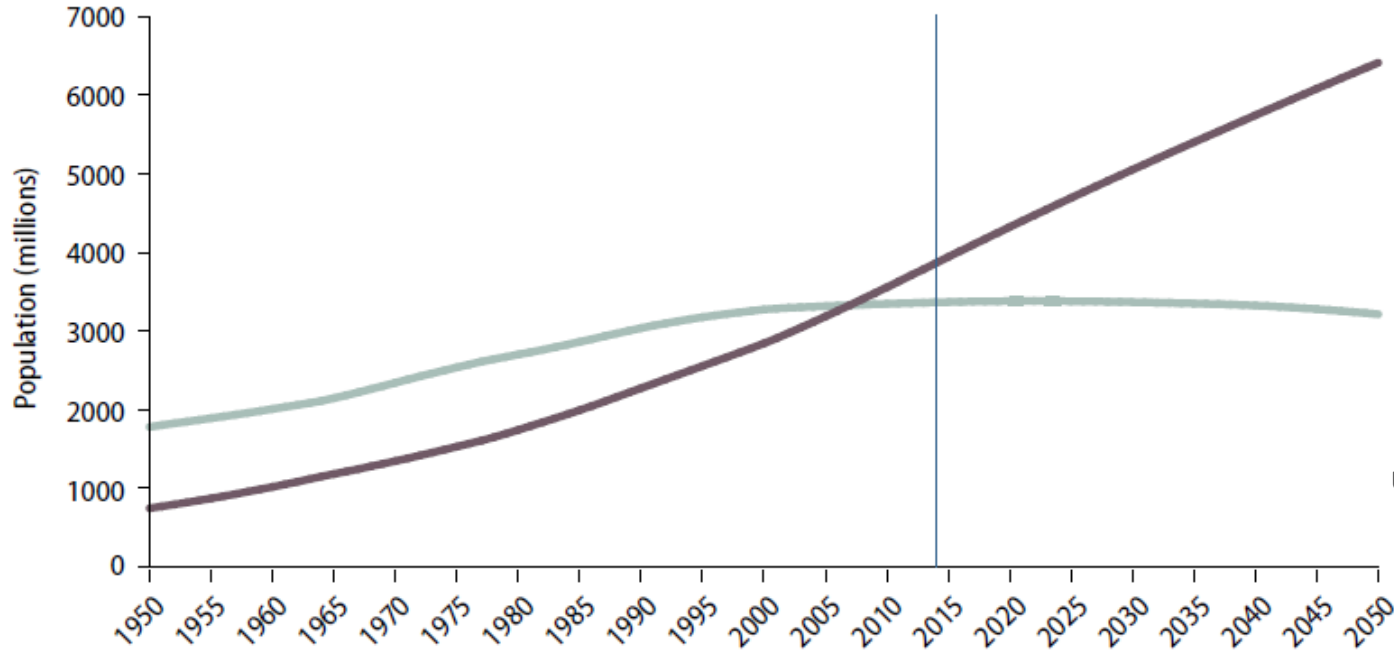
Source: BORDA (2010),  
“Decentralized waste  
water treatment:  
experience sharing”,  
presentation at CEPT  
University

# Challenges faced by contemporary cities

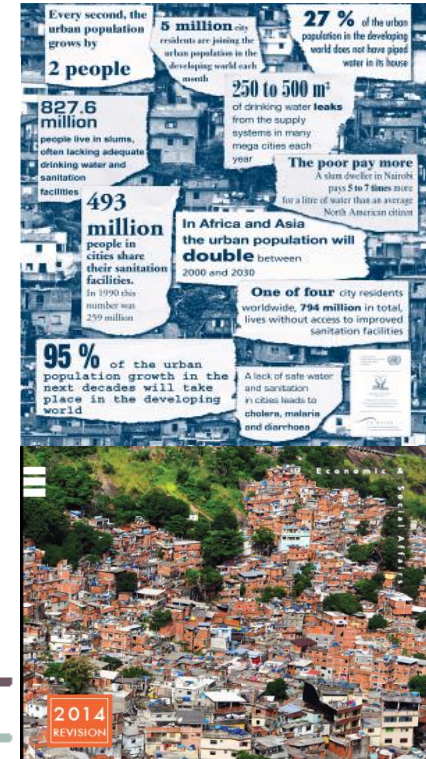


# World is more urban now!!

Urban and rural population of the world, 1950–2050



Source: United Nations, Department of Economic and Social Affairs, Population Division (2014) World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352).

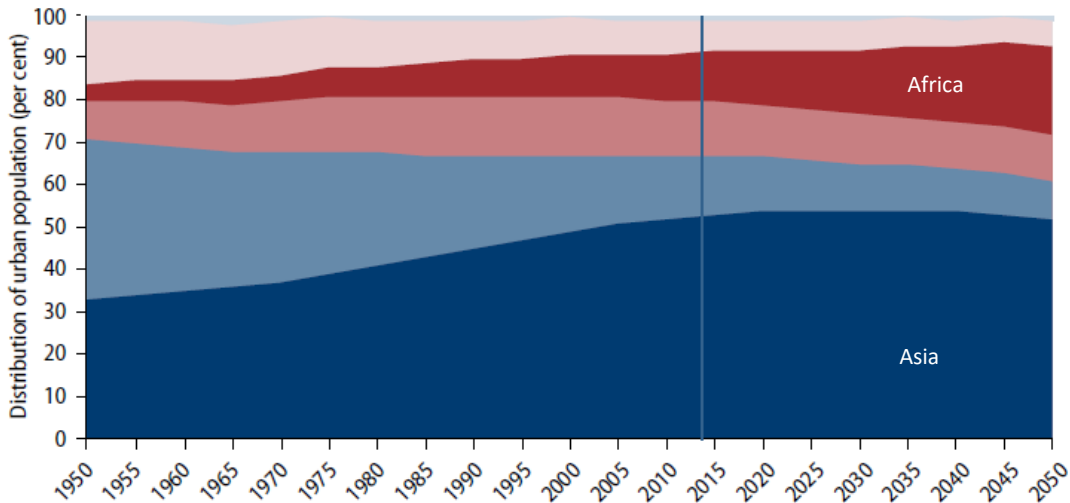


World Urbanization Prospects

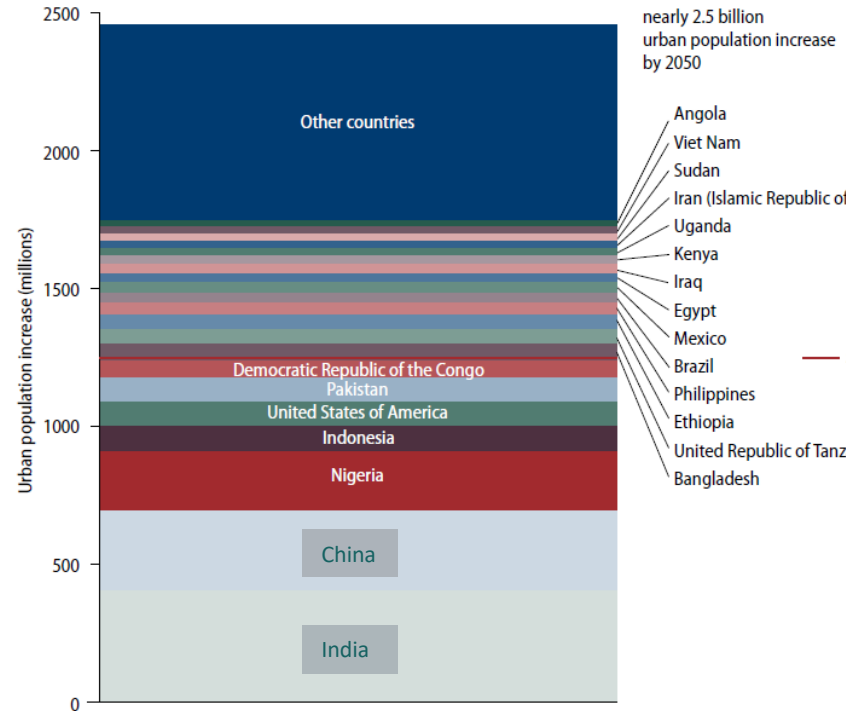


[highlights]

# Asia, Africa will have a greater share of urban population over the next 30 years



Contribution to the increase in urban population by country, 2014 to 2050





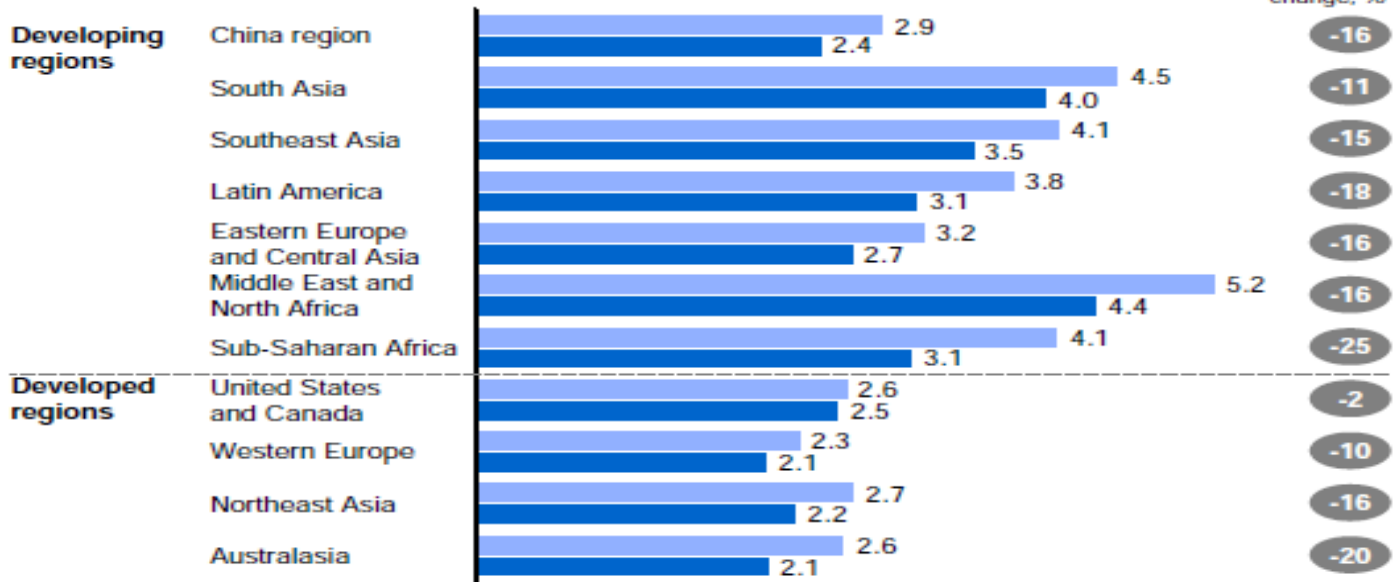
# Declining household size

## More demand for infrastructure and services

### Exhibit 16

#### The size of households is declining and converging globally; MENA and Sub-Saharan Africa have the largest absolute declines

Household size in the City 600, 2007 and 2025<sup>1</sup>



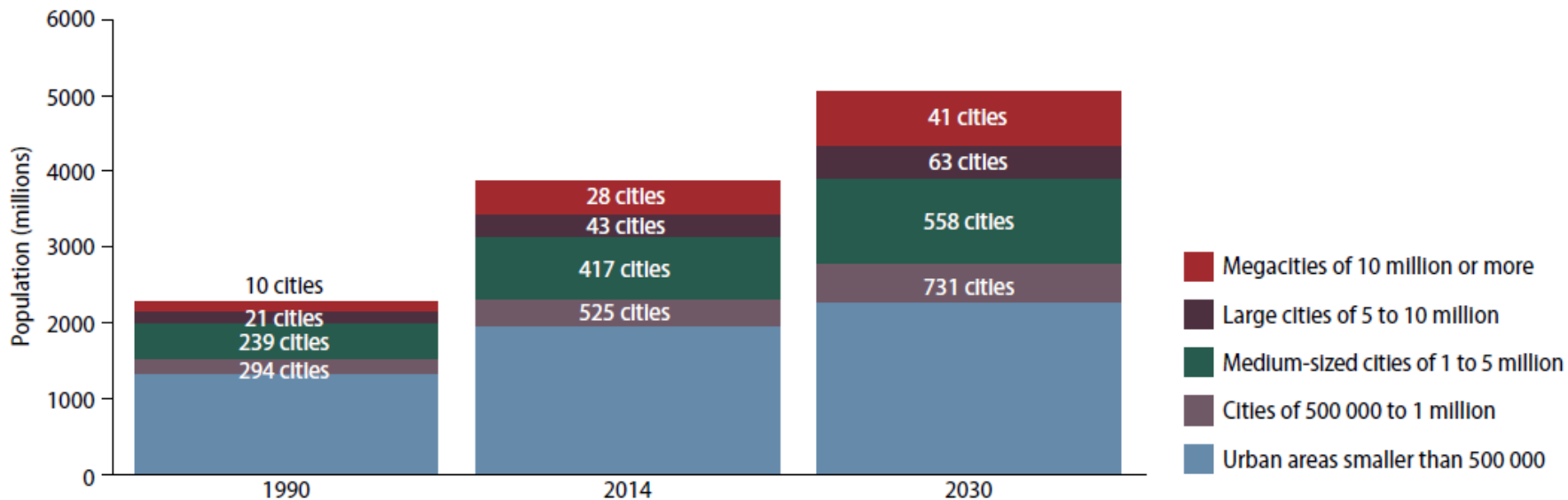
<sup>1</sup> Household size calculated by taking the simple average of the household size of all cities within a region.  
NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute Cityscope 1.0

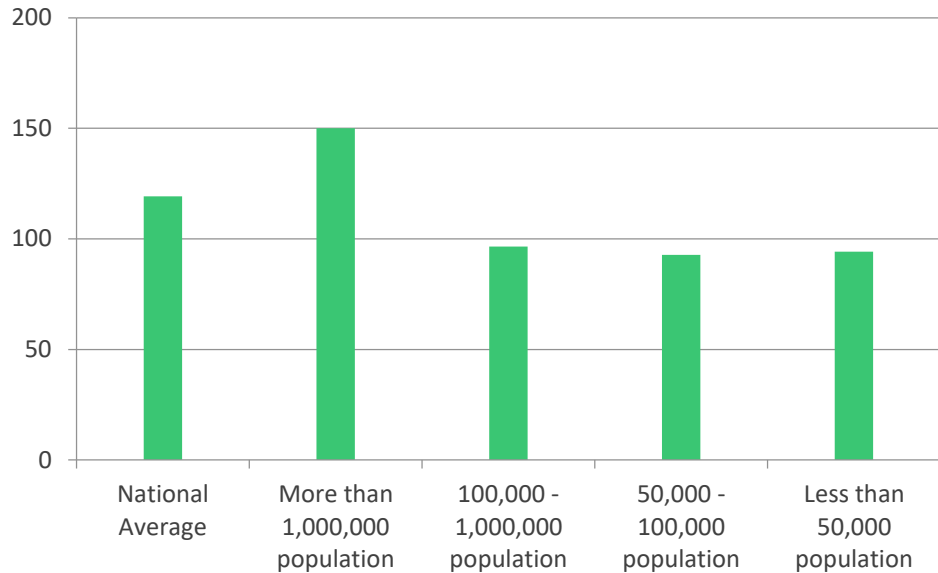
# Megacities or small towns?

Figure 8.

Global urban population growth is propelled by the growth of cities of all sizes



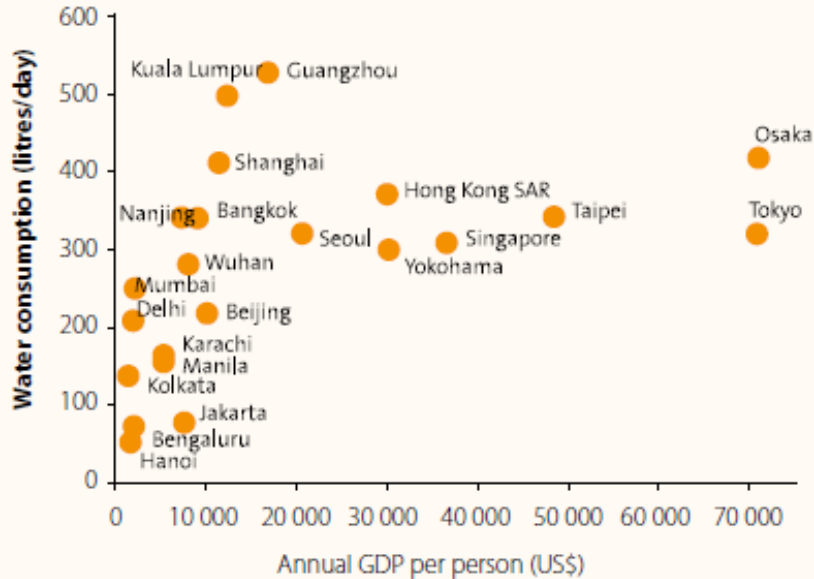
# Larger cities also have larger per capita water demand



Information from across about 1500 cities in India for 2012 suggests that beyond 1 million per capita supply of water almost doubles

# Rising incomes leads to increased water consumption

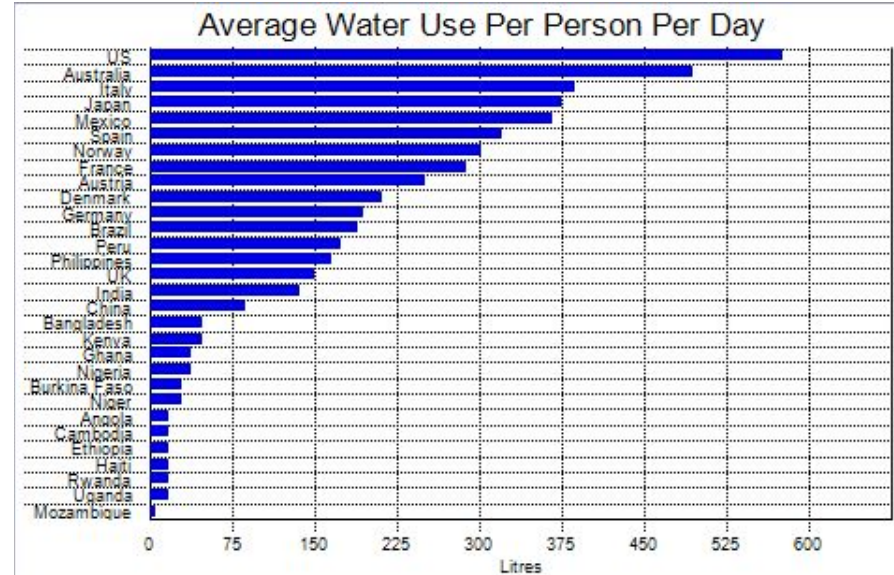
## Water consumption and per capita income in selected Asian cities



Note: Years differ from city to city from 2005 to 2009. Annual Gross Domestic Product (GDP) per person in US\$ is based on current prices at the time.

Source: UN Water (2014), "United Nations World water Development Report 2014", UNESCO, WWAP, p. 63.

Rising incomes in urban areas also suggest rising demand for water supply



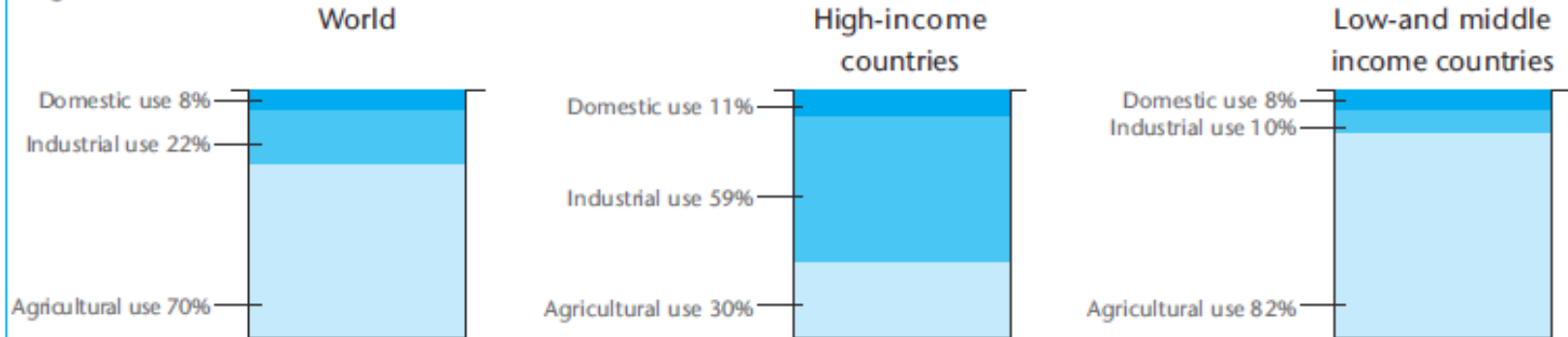
www.data360.org

Source: [http://www.data360.org/dsg.aspx?Data\\_Set\\_Group\\_Id=757](http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757), downloaded on Aug 18 2014

# Higher income also means increased demand for water by industries

## Competing water uses for main income groups of countries<sup>6</sup>

Industrial use of water increases with country income, going from 10% for low- and middle- income countries to 59% for high-income countries.



Ref. 6: "Water for People, Water for Life" United Nations World Water Development Report, UNESCO, 2003  
[www.unesdoc.unesco.org](http://www.unesdoc.unesco.org)

# Spatial growth three times population growth

Accra, Ghana



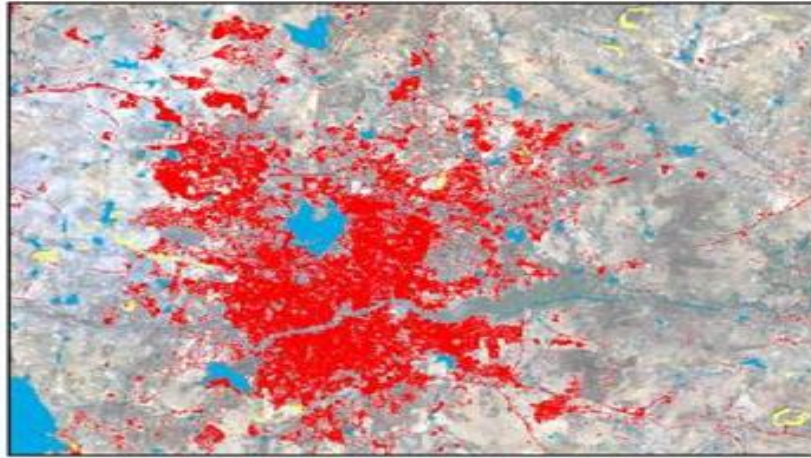
T<sub>1</sub>: 6-Mar-85



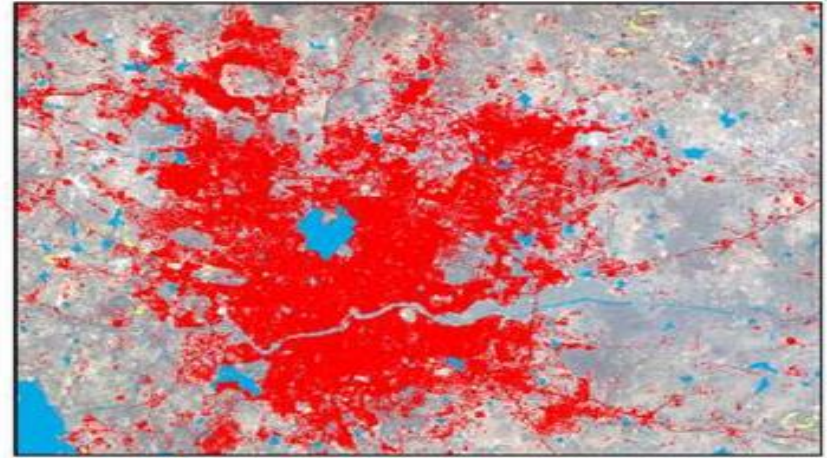
T<sub>2</sub>: 4-Feb-00

# With expanding cities, infrastructure costs rise

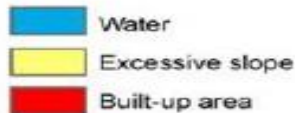
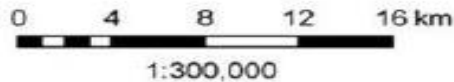
## Hyderabad, India



T<sub>1</sub>: 21-Nov-89



T<sub>2</sub>: 29-Oct-01

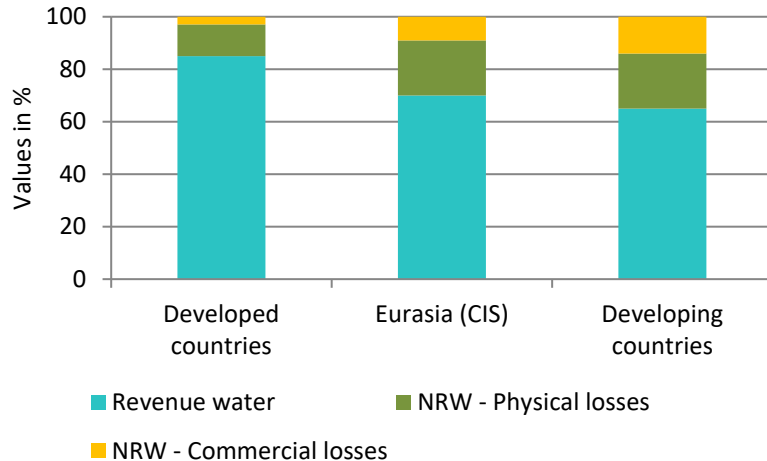


Measure	T <sub>1</sub>	T <sub>2</sub>	Annual
			% Change
Population	4,887,789	5,707,677	1.31%
Built-Up Area (sq km)	166.96	301.89	5.09%
Average Density (persons / sq km)	29,275.98	18,906.43	-3.60%
Built-Up Area per Person (sq m)	34.16	52.89	3.73%
Average Slope of Built-Up Area (%)	2.82	3.12	0.84%
Maximum Slope of Built-Up Area (%)	14.43	17.16	1.46%
The Buildable Perimeter (%)	0.94	0.93	-0.04%
The Contiguity Index	0.75	0.88	1.36%
The Compactness Index	0.37	0.38	0.22%
Per Capita Gross Domestic Product	\$1,541.53	\$2,343.04	3.57%

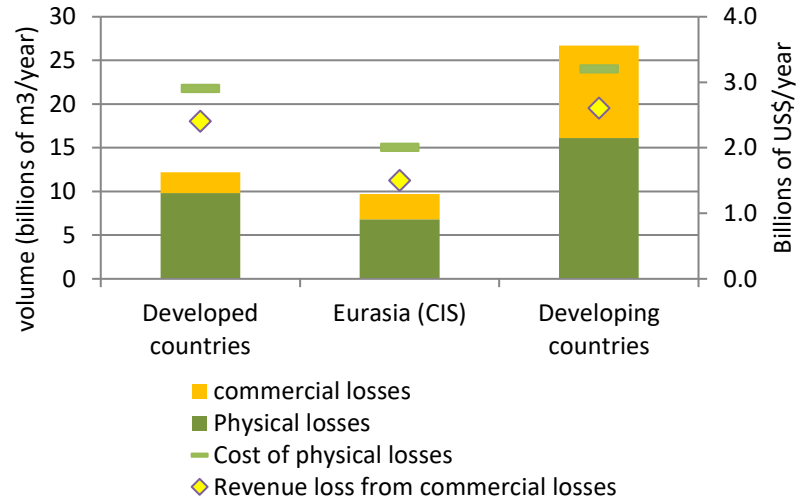
# Water losses

- Every year around **32 billion cubic meter of treated water is physically leaked from water supply systems** while 16 billion cubic meter are delivered to consumers for zero revenue
- More than US\$ 14 billion is lost every year by water utilities around the world – and more than a third of that by water utilities in developing countries

Estimates of NRW (%)



Estimates of NRW (water quantity)





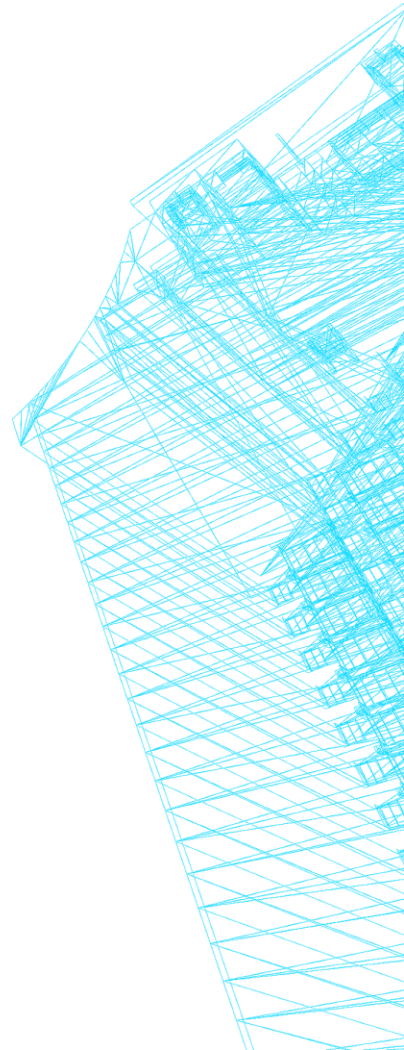
# NON WATER DAYS...



# THE 'WATER DAY'



# A new approach Water Sensitive Urban Design and Planning



# Many types of water in our cities

## WATER DEFINES OUR PLACES

**VITALITY:** The support and sustenance for a growing population.

**IDENTITY:** The river, pond, lake or coastline that has become central to the identity of our cities and towns.

**ACTIVITY:** A provider of recreation and well-being for all.

**HEALTH:** The supporter of essential ecosystems and food supplies.

**LANDSCAPE:** A desirable landscape feature that communities love to be near.



## OUR PLACES CONTAIN MANY TYPES OF WATER

Greywater

D  
i  
n  
k  
Irrigation  
W  
a  
t  
e  
r

E  
n  
v  
i  
r  
o  
n  
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al  
W  
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e  
r

Surface water runoff

n  
t  
Wastewater

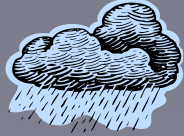
W  
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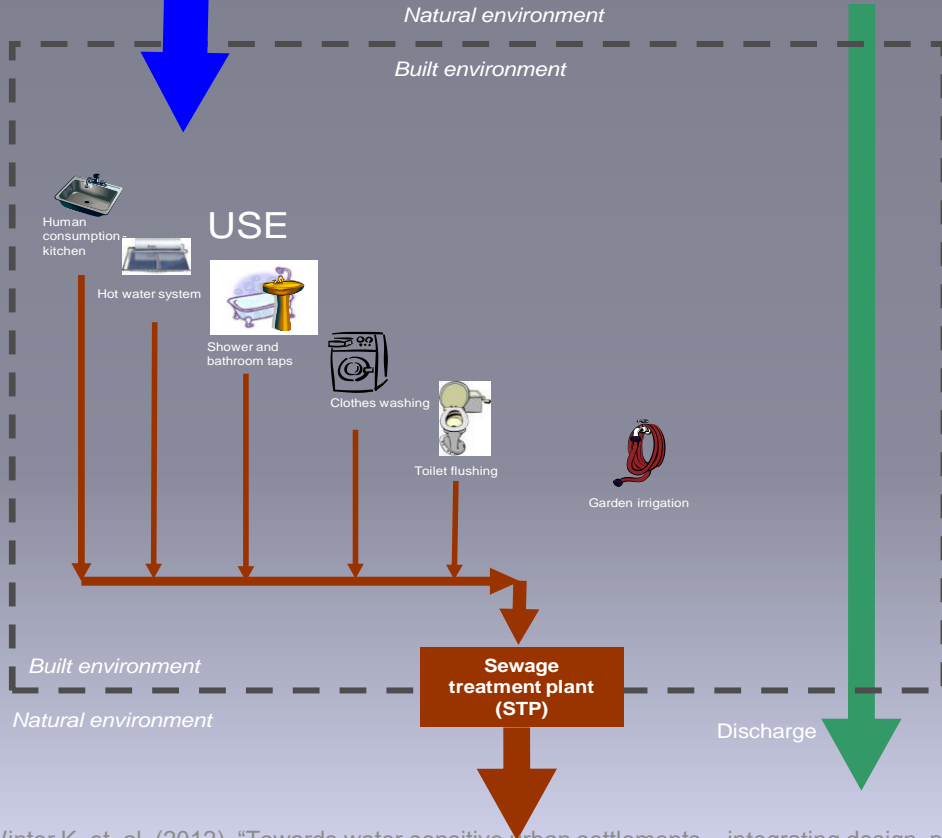
Potable water supply and treatment plant



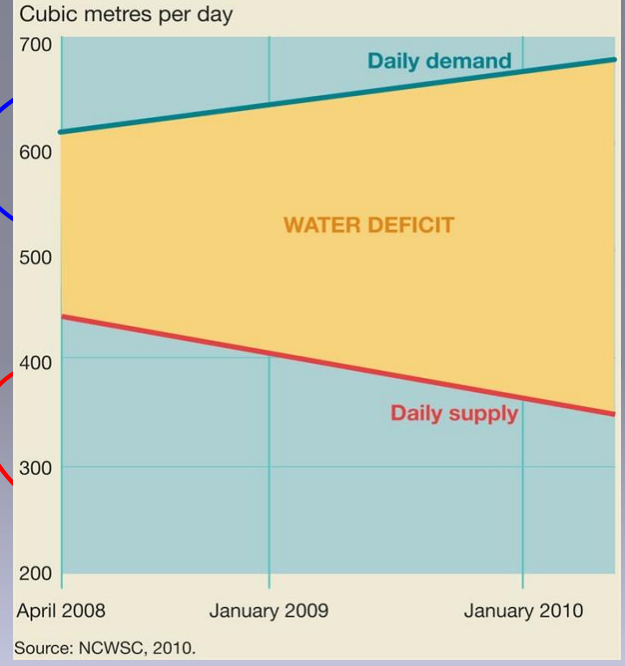
Water treatment plant



# Conventional approach



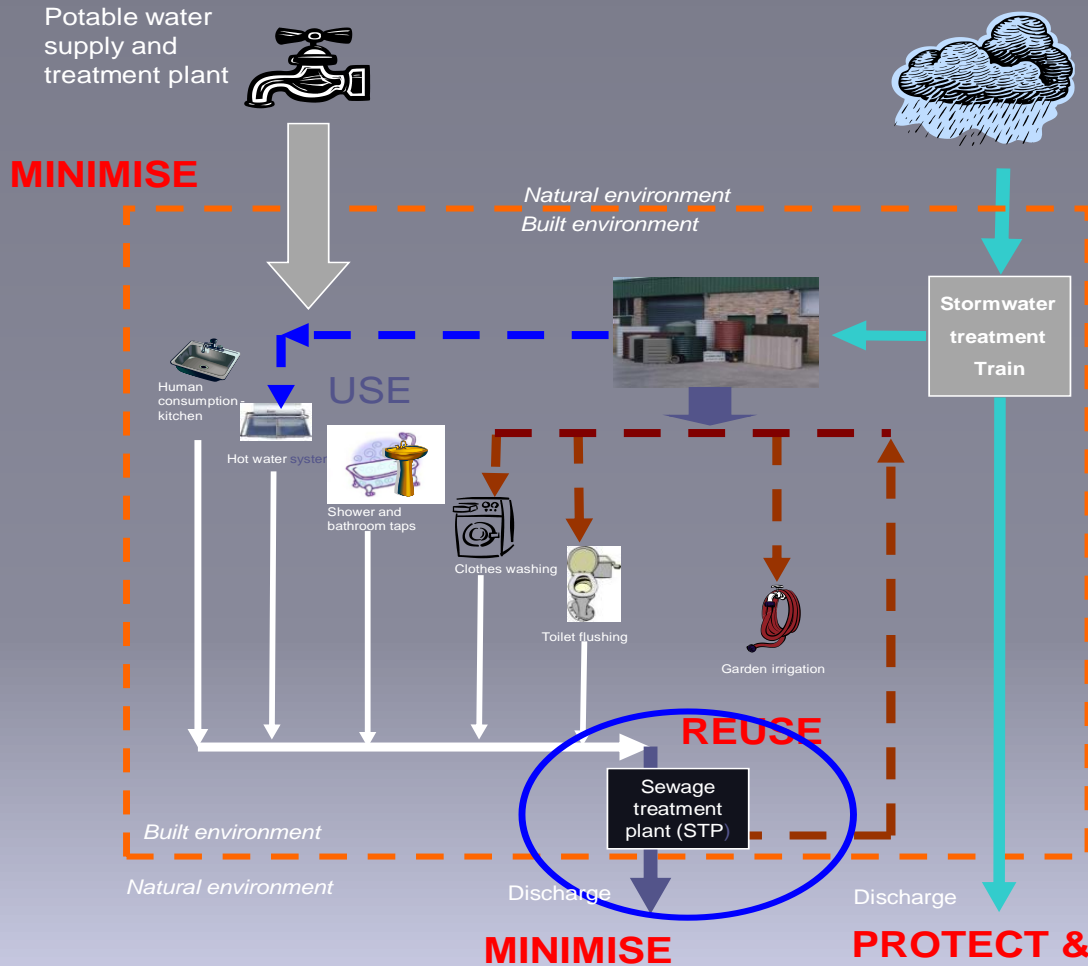
## Water supply and demand in Nairobi



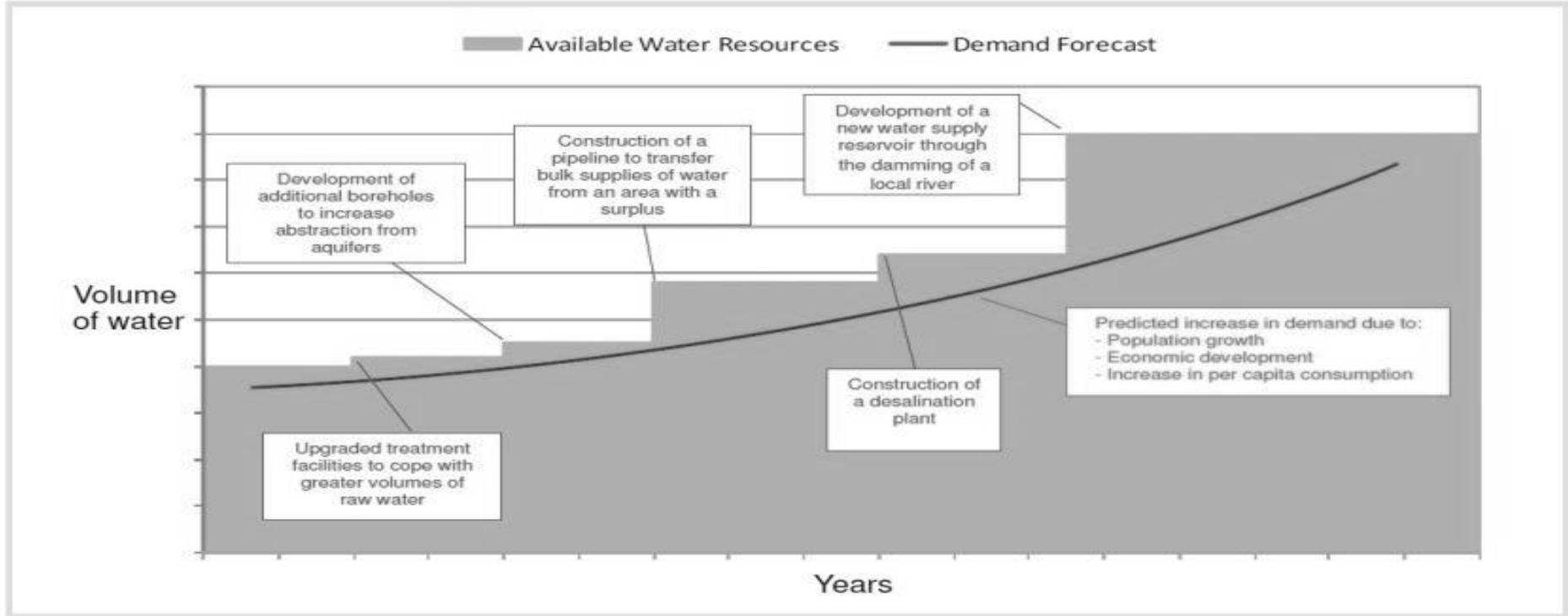
Source: Winter K. et. al. (2012), "Towards water sensitive urban settlements – integrating design, planning and management of South Africa's towns and cities", Public input into the National Water Resource Strategy, Water Research Commission

# Water sensitive Urban design approach

All water is an opportunity  
Not a threat

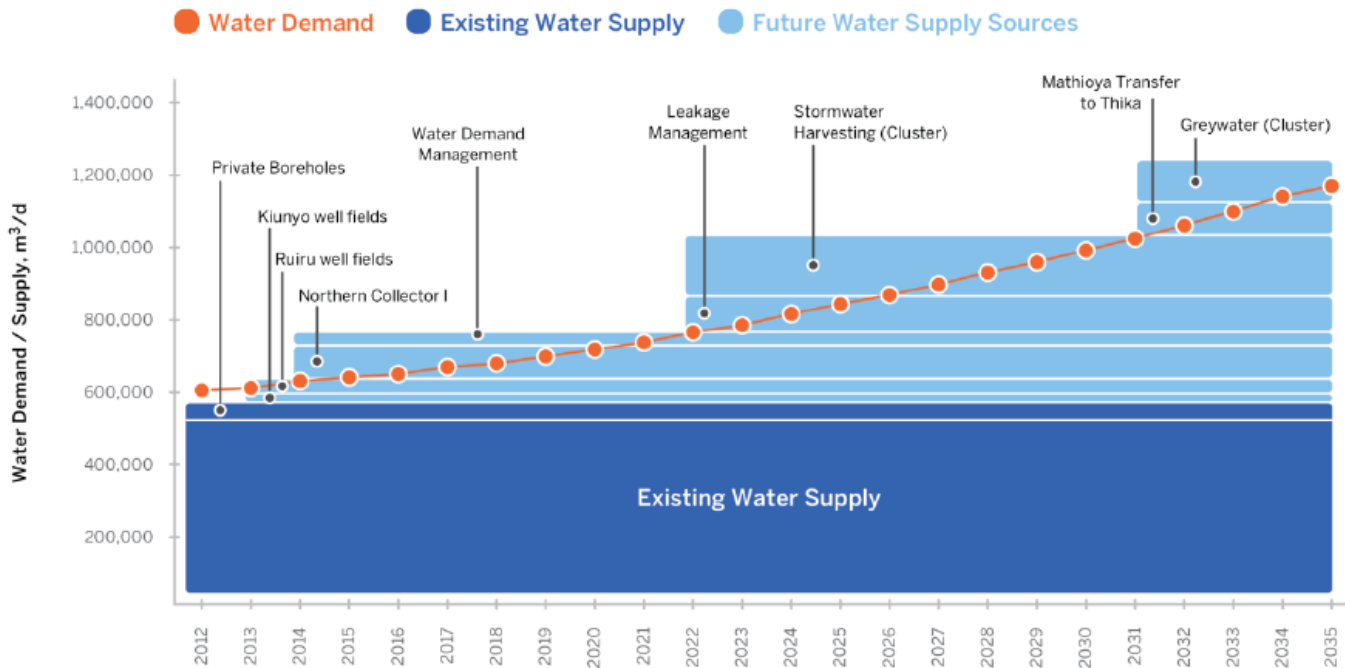


# Supply-demand graph for a conventional approach to water supply services



# WSUD for Nairobi water supply plan by 2035

Figure 3. Proposed staged development of alternative water sources in Nairobi 2010 to 2035.

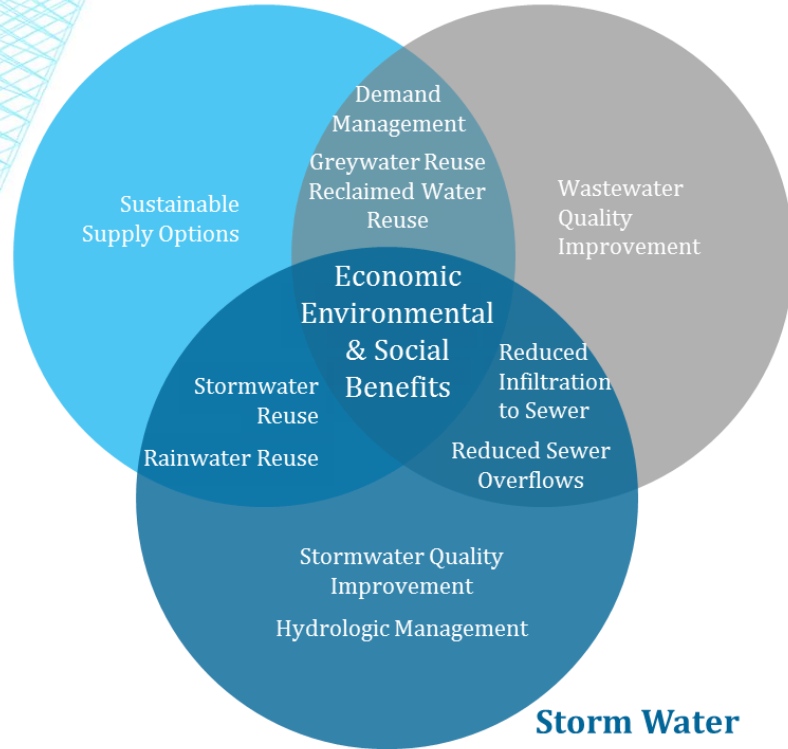




# What is water sensitive urban design (WSUD)?

## Potable Water

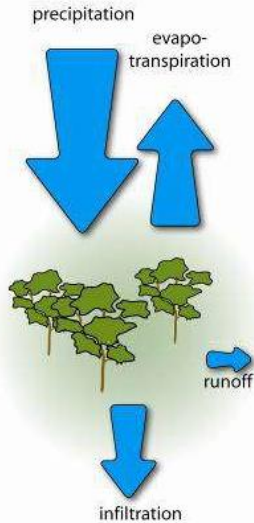
## Waste Water



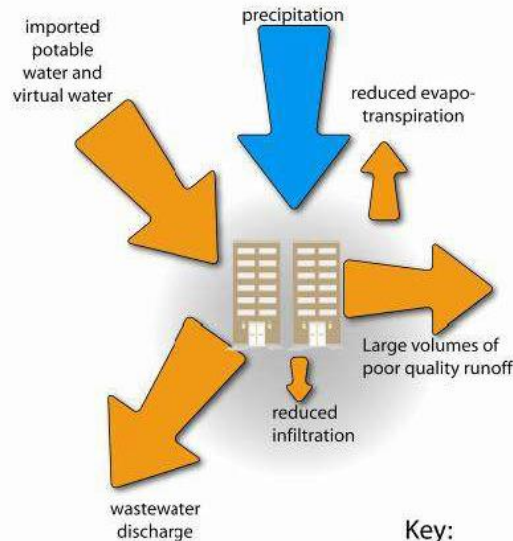
- An approach to urban planning that integrates all parts of the water cycles
- Applies to all urban scales: whole-of-city planning, new communities to in-fill developments
- Reduces demand for external fresh water through: demand management, reuse of grey water, treated black water for non-potable/env uses/industries, capture and reuse of storm water, promote sustainable use of ground water
- It generates economic, environmental and social benefits, and leads to improved water security
- Considers the environment in conjunction with infrastructure planning, design and management

# Influence of WSUD on the urban water cycle

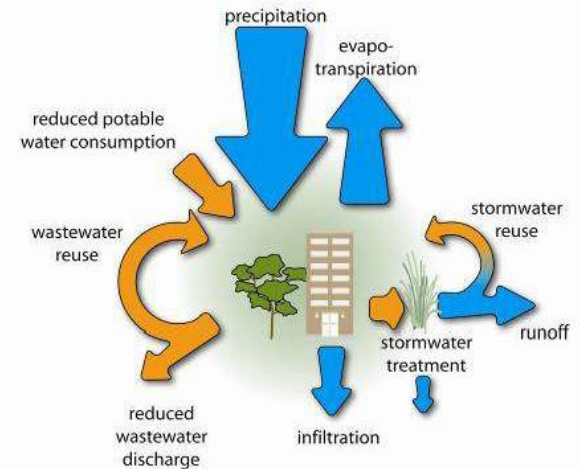
natural water balance



Urban water balance



WSUD water balance



Key:



# The old and the new paradigms...

Human waste is a nuisance

Human waste is a resource

Storm water is a nuisance

Storm water is a resource

Build to meet the demand

Manage demand

Demand is a matter of quantity

Demand is multifaceted

One use (throughput)

Reuse and reclamation

Grey infrastructure

Green infrastructure

Bigger/centralised is better

Small/decentralised is possible, desirable

Use standard solutions

Allow diverse solutions

Integration by accident

Design physical & institutional integration

Collaboration = public relations.

Collaboration = engagement.

# IUWM Projects in Africa

## ● Integrated Urban Water Management New Projects



### Sustainable Urban Resilient Water and Sanitation in the face of climate change (SURE WATER)

- Working with 6 local governments in South Africa, Botswana, Zambia, Malawi, Namibia and Zimbabwe
- Overall objective: To contribute to sustainable climate change (CC) resilient urban water planning mechanisms and actions, based on international benchmarking within LAs and ensuring multiplier effects to the region.
- **Cities:** Francistown; Livingstone; Bulawayo; Knysna; Walvis Bay; Blantyre.



*A dynamic, interactive and dedicated network for African local governments committed to addressing urban water and sanitation challenges on the continent*

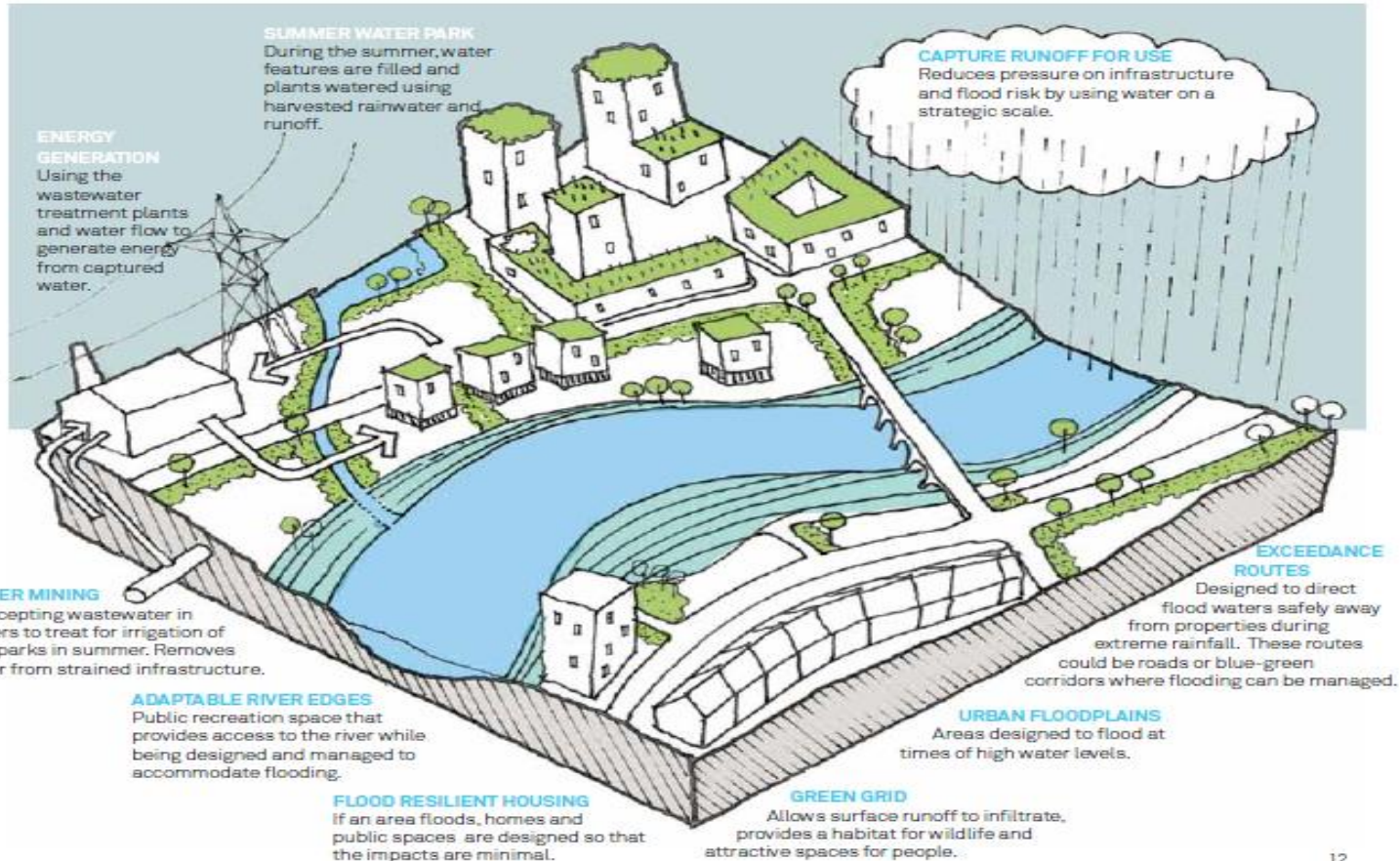
Dialogues

Knowledge  
centre

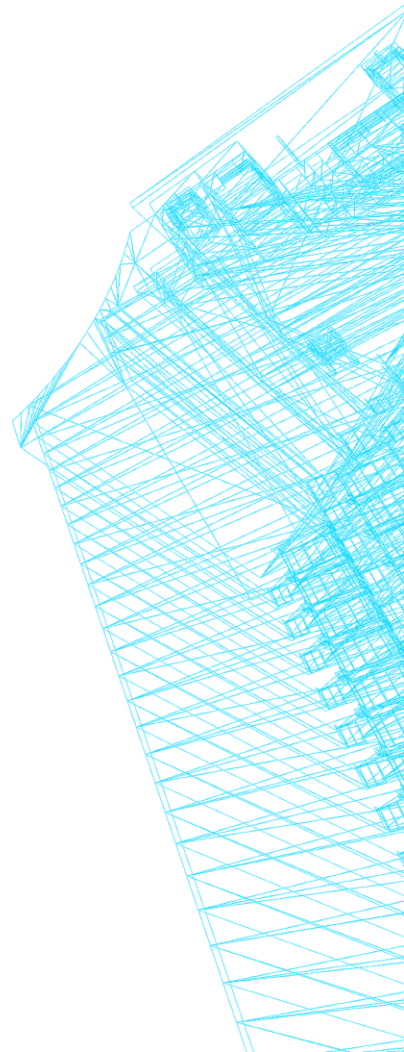
Tailored  
training  
programmes

# Future cities will look like this someday

## WHAT COULD A WATER SENSITIVE CITY LOOK LIKE?



From building infrastructure  
to delivering UWSS services



# From infrastructure to service delivery

## Infrastructure approach



**'PROJECT'**  
*based approach*

Oriented towards achieving **OUTPUTS**

Starting point is an assessment of funding resources available – **SUPPLY DRIVEN**

Focus on developing **INDIVIDUAL PROJECTS** of various sectors

## Service delivery approach



**'SERVICE'**  
*based approach*

Oriented towards achieving **OUTCOMES**

Starting point is measurement of current performance and local priorities – **NEED DRIVEN**

Focus on developing integrated **SECTORAL SOLUTIONS**

# Informed decision making for planning and investment

- Aggregate statistics suggest good coverage of water and sanitation in urban areas
- BUT little is known about the **quality, level and financial sustainability of service**



Need to move from laying pipes to delivering water





# PAS

Performance Assessment System  
PAS Programme at CEPT University

in over **400+**  
cities in two states

covering **76 million**  
urban population

**Urban services for: Water Supply, Sanitation, Solid Waste  
Management & Storm Water Drainage**

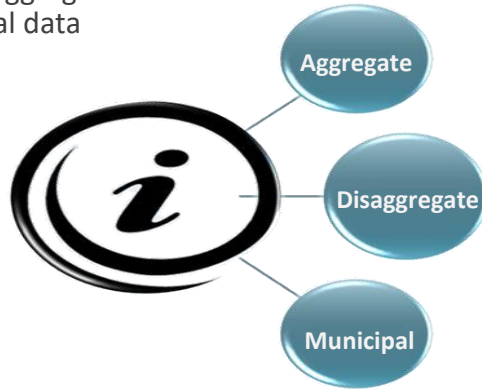


# Performance measurement and monitoring: Brazil and Kenya

## SNIS – Brazil

Data component are grouped according to three bases:

- Aggregate data
- Disaggregated data
- Local data

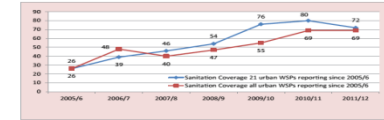
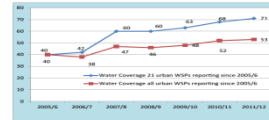


The application of historical series of the SNIS provides amicably all the data collection system, allowing unrestricted access to information and indicators contained in the database.

Source: <http://www.cidades.gov.br/serieHistorica/>

## WASREB – Kenya

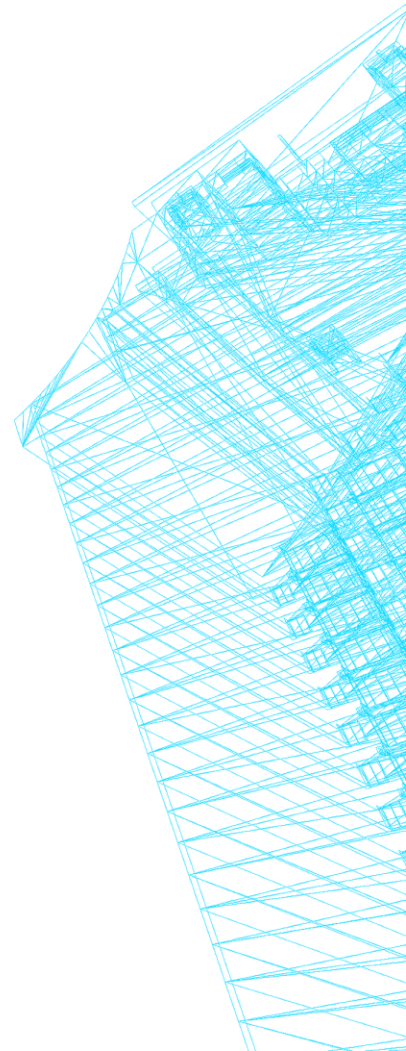
water supply providers' (WSP) performance are analysed with respect to the nine KPIs.



Indicators	Sector Benchmarks			Scoring Regime										
	Good	Acceptable	Not Acceptable	URBAN		RURAL								
1 Water Coverage	≥91%	80-90%	≤79%	Performance	Score	Performance	Score							
2 Sanitation														
3 Drinking Water Q														
Status of data submission	Impact 1		Impact 2		Impact 3		Impact 4		Impact 5		Impact 6			
	2005/6		2006/7		2007/8		2008/9		2009/10		2010/11		2011/12	
Complete	No. of WSPs	%	No. of WSPs	%	No. of WSPs	%	No. of WSPs	%	No. of WSPs	%	No. of WSPs	%	No. of WSPs	%
	25	76	66	67	77	60	77	67	65	87	100	96	100	96
Incomplete	33													
Non-submission	33													
Total	91													
Rank	WSP	Score 2011/12	Score 2010/11	Scores +/-	Rank	WSP	Score 2011/12	Score 2010/11	Scores +/-					
1	Nyeri	179	169	10	33	Wote	63	67	-4					
2	Embu	138	107	31	34	Yatta	63	49	14					
3	Eldoret	138	124	14	35	Iten Tambach	63	68	-5					
4	Malindi	122	170	-48	36	Mombasa	62	66	-4					

WSPs are ranked on the basis of their performance on these KPIs as well as with respect to their performance development from the previous to the current reporting period.

# Leveraging public finance using new and innovative sources of funds





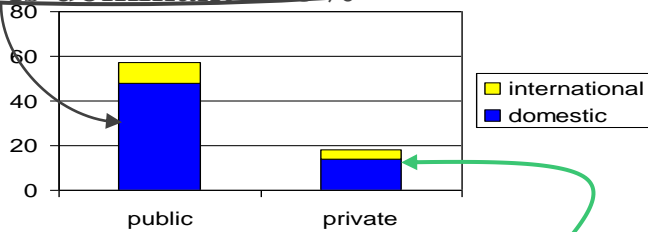
# 1990s... the hope...

- ✓ Large infrastructure investment needs
- ✓ Limited – or even declining public resources
- ✓ Limited share of international aid
  
- ✓ Worldwide interest from private sector in cross border infrastructure investments
- ✓ *So... the private sector will “fill the gaps”...*

# The realities...

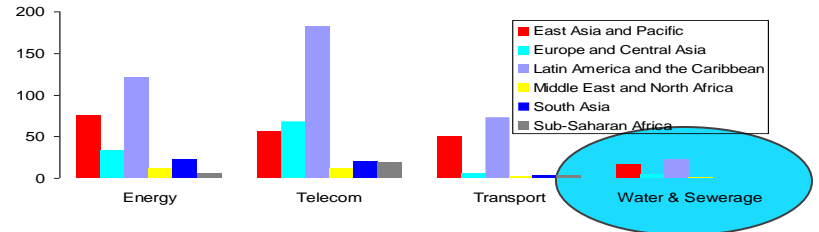
Financing flows into water in 2000

Public is dominant ~85%



Domestic is dominant ~ 85%

International private investment in infrastructure in 1990-2002 –Very low in WSS





# In the new millennium – 2000s: A plea for aid resources

- ✓ Camdessus Panel Report

- *“There is widespread agreement that the flow of funds for water infrastructure has to roughly double...”*

- ✓ Sachs Report - UN Millennium Project

- *“The report says the MDGs can be achieved if total annual development assistance is doubled to \$135 billion—or 0.44 percent of donors’ GNP—in 2006, and rises to 0.54 percent of donors’ GNP by 2015. “(The Economist)”*



# Rethinking Waste water and sanitation as social investments

- There is a need to rethink waste water and sanitation as social investments as they accord high level of positive externalities and help reduce disparities
- They also help generate positive and wider environmental impacts

# Sources of funds for water management

## Sustainable urban water service

### Revenue

*there are two primary sources of financing:*

- User fees
- Public funds
- **Social investment funds**
- **CSR**
- **Crowd funding**

### Examples of expenses

*to build operate and maintain water supply and sanitation systems:*

- Training and paying workers
- Repay loans for infrastructure investment
- Maintenance of pipes, pumps and equipment
- Materials for cleaning water
- Energy to deliver water

Need to identify additional sources of funds beyond user charges and public finance



# Social impact investors

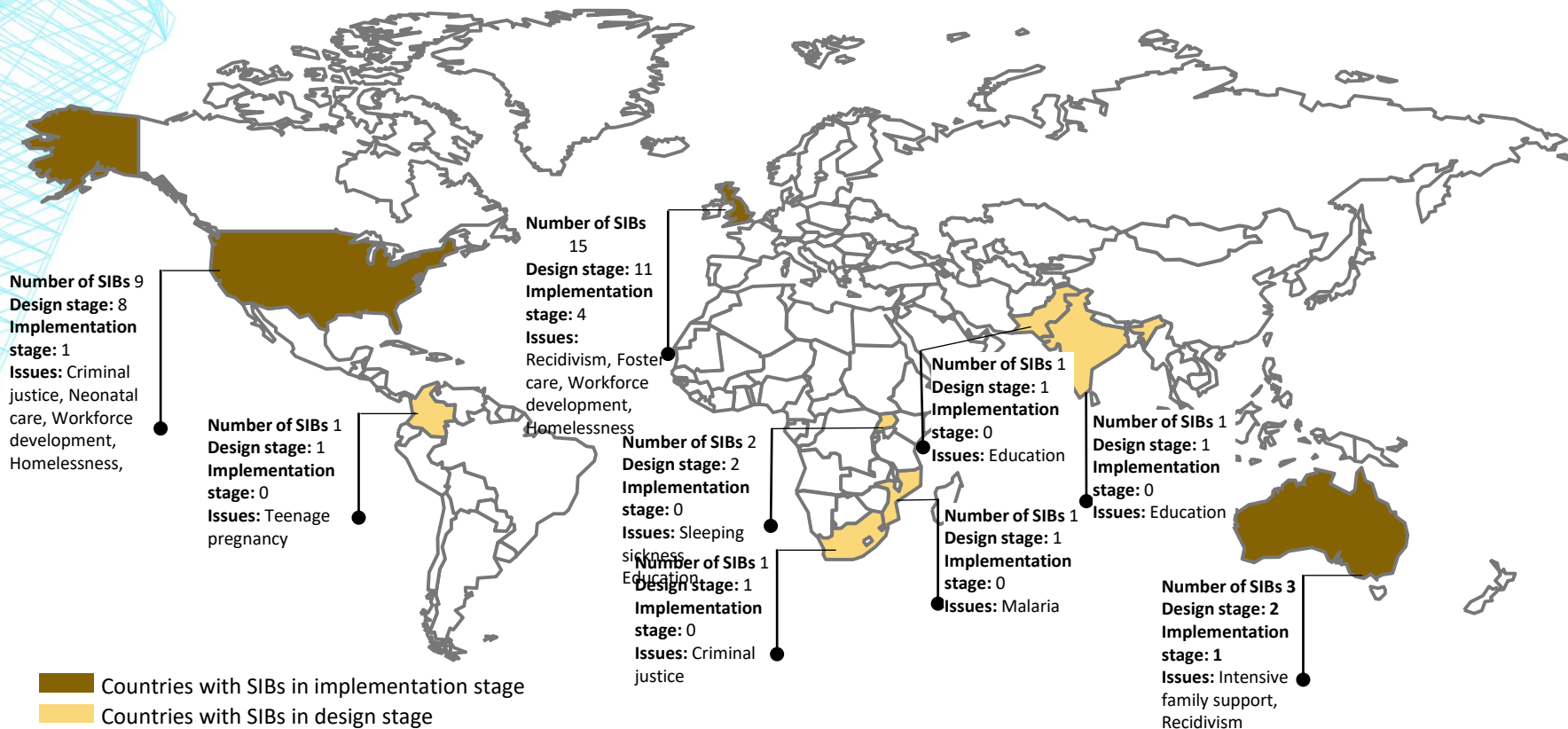
- Social impact investors emerging as a potential new source.. **High net worth individuals (HNI), Institutional social investors, Foundations**
- For example, a recent 3-year Debt Fund for Cancer Cure by HDFC Mutual Fund mobilized about Rs 77 + Rs 180 crore (~USD 40million). **The dividend from this was provided to Indian Cancer Society.**

**HDFC DEBT FUND FOR**  
**CANCER** *cure* **2014**

A 3 year closed ended capital protection oriented income scheme®



# SIBs have been used in developed countries as well as developing countries to generate investment for a range of social issues



Source: Instiglio database, Dalberg research

# CSR – A potential new source

- In India, the Companies Act, 2013 promotes new models of social engagement by mandating that large companies spend 2% of their annual profit for corporate social responsibility (CSR)
  - **potential estimated annual flows from CSR of nearly USD 3,000 million**
- Though sanitation is included in the list of activities, it is still challenging to direct **CSR funds to urban sanitation**
- Many companies already active in sanitation space but largely in rural areas – HUL, Ambuja Cement, ACC, Amul, GAIL, NTPC



Our work is based on our mission and underscores our belief in communities and in our role as catalysts to bring in change.

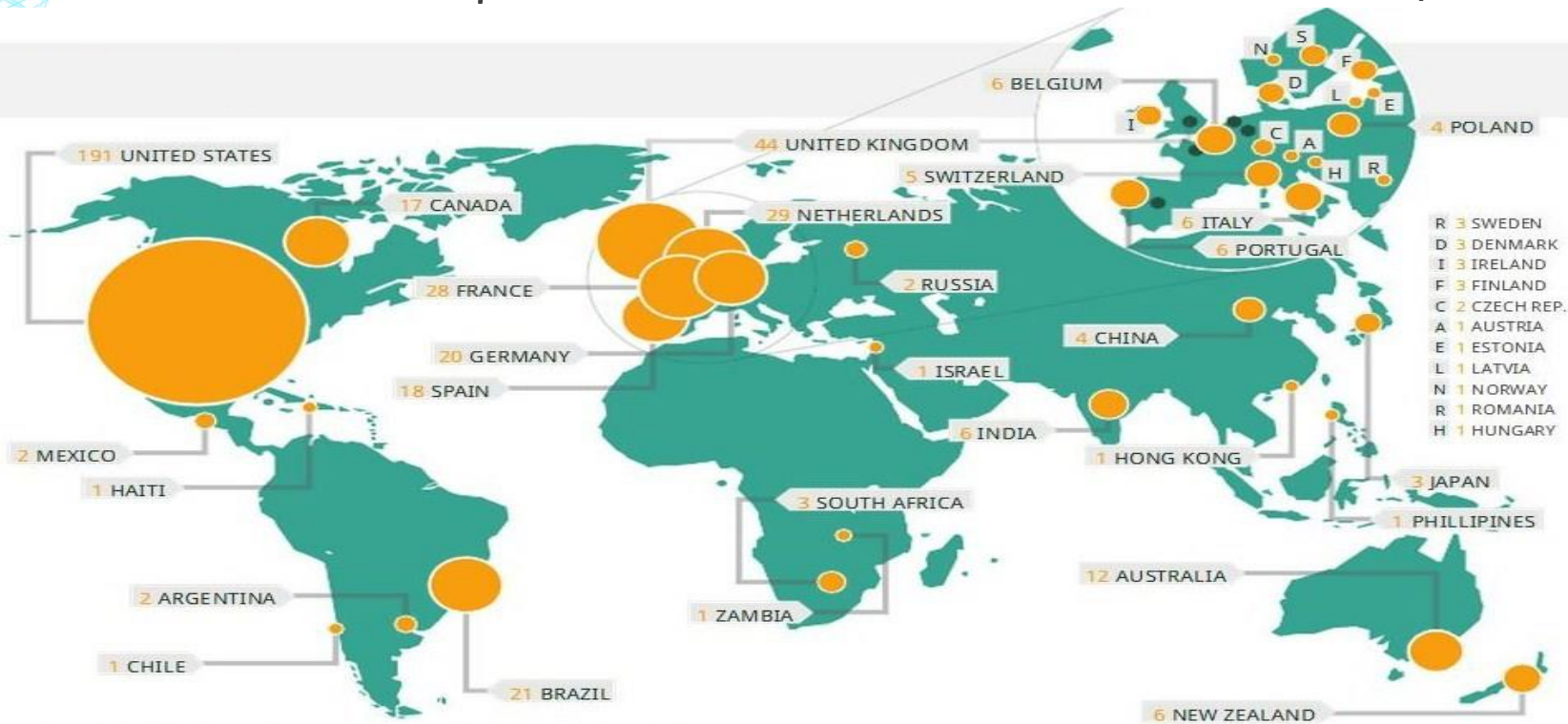
# Some of the major corporates have invested in water and sanitation projects as a part of their CSR

	Company	Description	Geographical focus
FMCG	Hindustan Uniliver Ltd. (HUL)	<ul style="list-style-type: none"> <li>Unilever Foundation and Domestos, HUL's toilet hygiene brand support UNICEF's Community Approaches to Toilet Sanitation (CATS) Program through Community Awareness</li> <li>Domestos educates customers and raises awareness about the Sanitation Crisis.</li> </ul>	India, Gambia, Ghana, Nicaragua, Nigeria, Pakistan, Philippines, South Sudan, Sudan and Vietnam.
	Nestle	<ul style="list-style-type: none"> <li>Sponsors the construction of sanitation facilities for female students in village schools around their factories.</li> <li>37 sanitation facilities invested in so far, benefiting over 15,000 female students.</li> </ul>	Tamil Nadu, Karnataka, Haryana, Punjab, Uttarakhand, Himachal Pradesh
	Amul	<ul style="list-style-type: none"> <li>Has initiated a Rural Sanitation Campaign with the aim of making the milk producers community OD free.</li> <li>Has prepared a model low cost toilet block which costs Rs. 11,500 per unit. Provides interest free loans to the milkmen to purchase the toilet block. The loan amount is recovered by deducting Rs. 100 from the monthly salary.</li> </ul>	Gujarat
Cement	ACC Ltd.	<ul style="list-style-type: none"> <li>Aims to provide better Sanitation facilities for families living around their factories.</li> <li>Spent 1.48 Cr in 2012 on health and sanitation programs. Built 7 community toilets and 310 household toilets.</li> <li>Installed new sewage treatment plants in Jamul and Chanda.</li> </ul>	Maharashtra, Jharkhand

# Crowdfunding is also emerging as an important source

## 2012- More than 450 Crowdfunding Platforms

- 2011- Amount raised **US\$1.5 billion**
- 2014- amount increased to **US\$ 5.1 billion**



# Spacehive - Transforming civic spaces

- ✓ World's first funding platforms for civic projects
- ✓ Since Dec. 2011, platform to more than 240 civic initiatives in UK
- ✓ Hives- online hubs, bring local people and councils together
- ✓ Charges 5% fee (only when target is achieved)



Raised more than 792,000 pounds to build a multi-purpose, energy efficient community center



Raised 36,850 pounds to provide free access to Wi-Fi for visitors to Mansfield Town

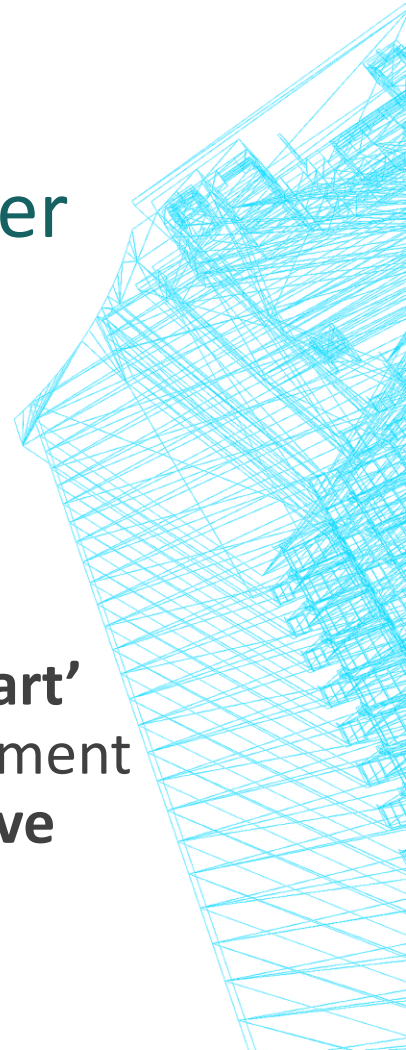


Till now raised 40,800 pounds for turning derelict flyover into urban park, backed by City Council

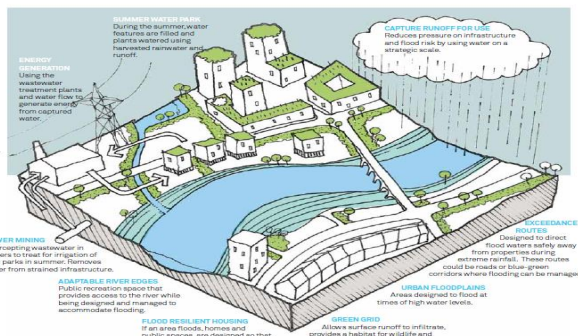
# In Summary..

## From challenges to opportunities in water and sanitation management

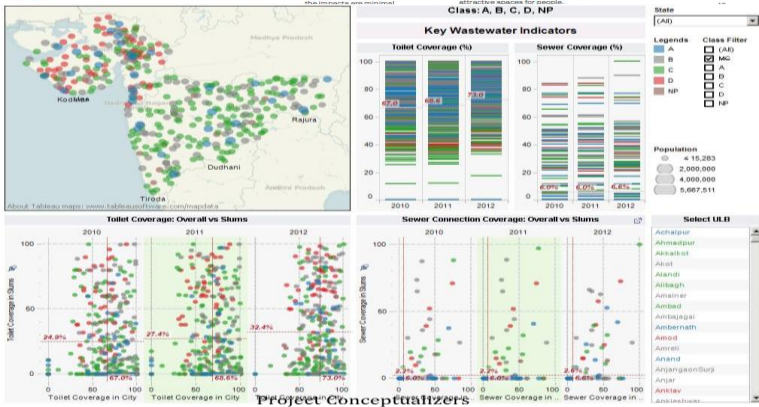
- ✓ Meeting the rising water demand and waste treatment requirement through **Water Sensitive urban Design (WSUD)**
- ✓ To improve service performance and reduce disparities focus on **service delivery** – set up **‘smart’ monitoring systems** for assessment and improvement
- ✓ To meet the investment needs, **tap new innovative finance** for urban development



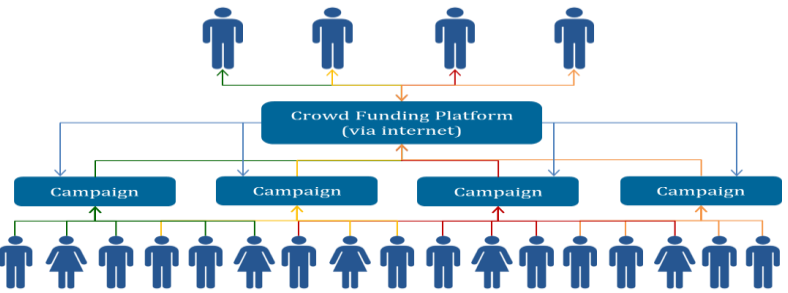
# WHAT COULD A WATER SENSITIVE CITY LOOK LIKE?



water sensitive urban design



Project Conceptualizers



# Thank you...

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