

# **Energy and Resource Efficiency in Urban Water Management**

*Challenges & potential for enabling paradigm shift under NURM*

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## CSE's Recent Publication



**Volume 1** - dwells on how urban India is soaking up water, polluting rivers and drowning in its own waste ( 296 pages).

**Volume 2** - contains a very detailed survey of 71 cities, and presents an assimilation of the survey's results (496 pages).

<http://cseindia.org/content/excreta-matters-0>



# Structure of the Presentation

- Summary assessment of **water (and sewage) management in India** CSE's recent publication – Excreta Matters (2012) and earlier backgrounder
- **Challenges** & Potential for Paradigm Change –  
Mainstreaming Energy & Resource Efficient Urban Water Management Best Practices in ULBs.



# The water-sewage connection

The conventional way:

Bring water **into** the city – storage, diversion, pipe, pump, treat – **from further and further away.**

Flush and carry the waste **out** of the city – pipe, pump, divert, treat – **further and further away.**

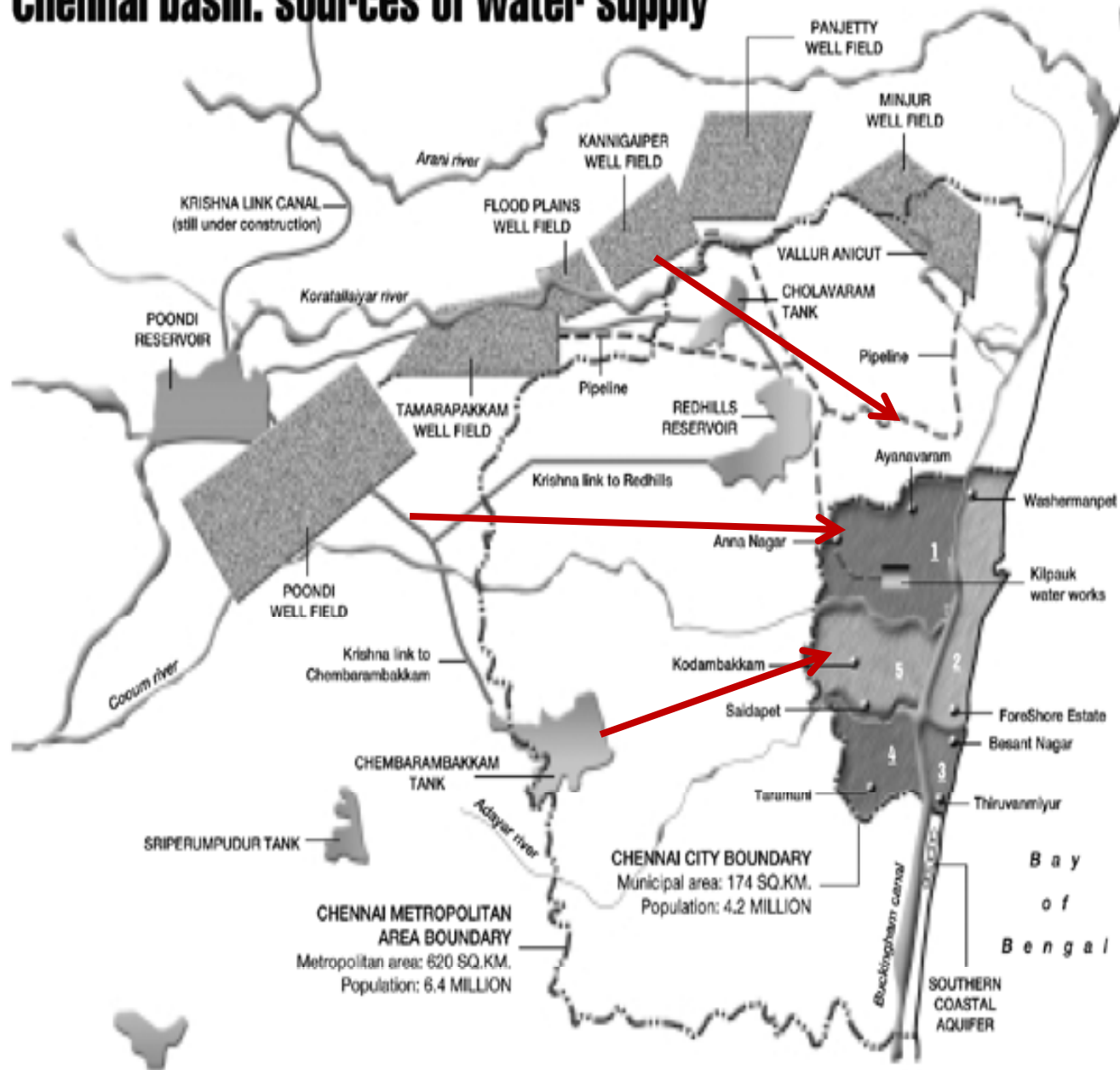
**Not even single city has 24-7 water supply**



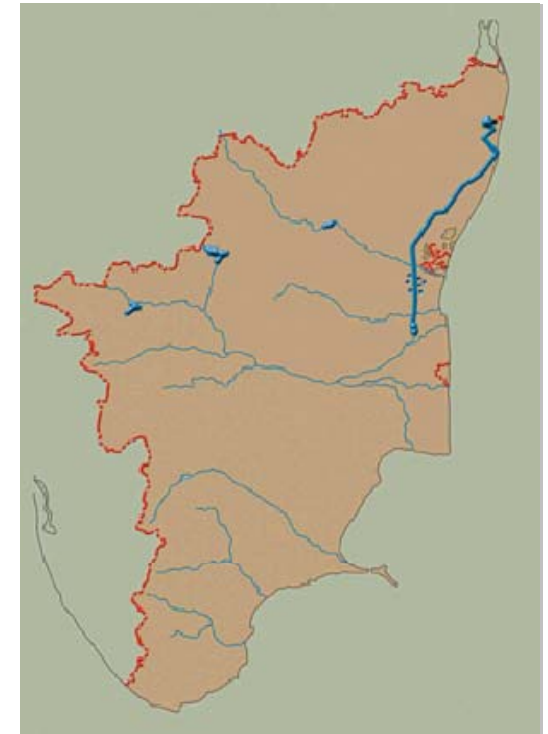
# Location of WTPs and Sources of Water - Delhi



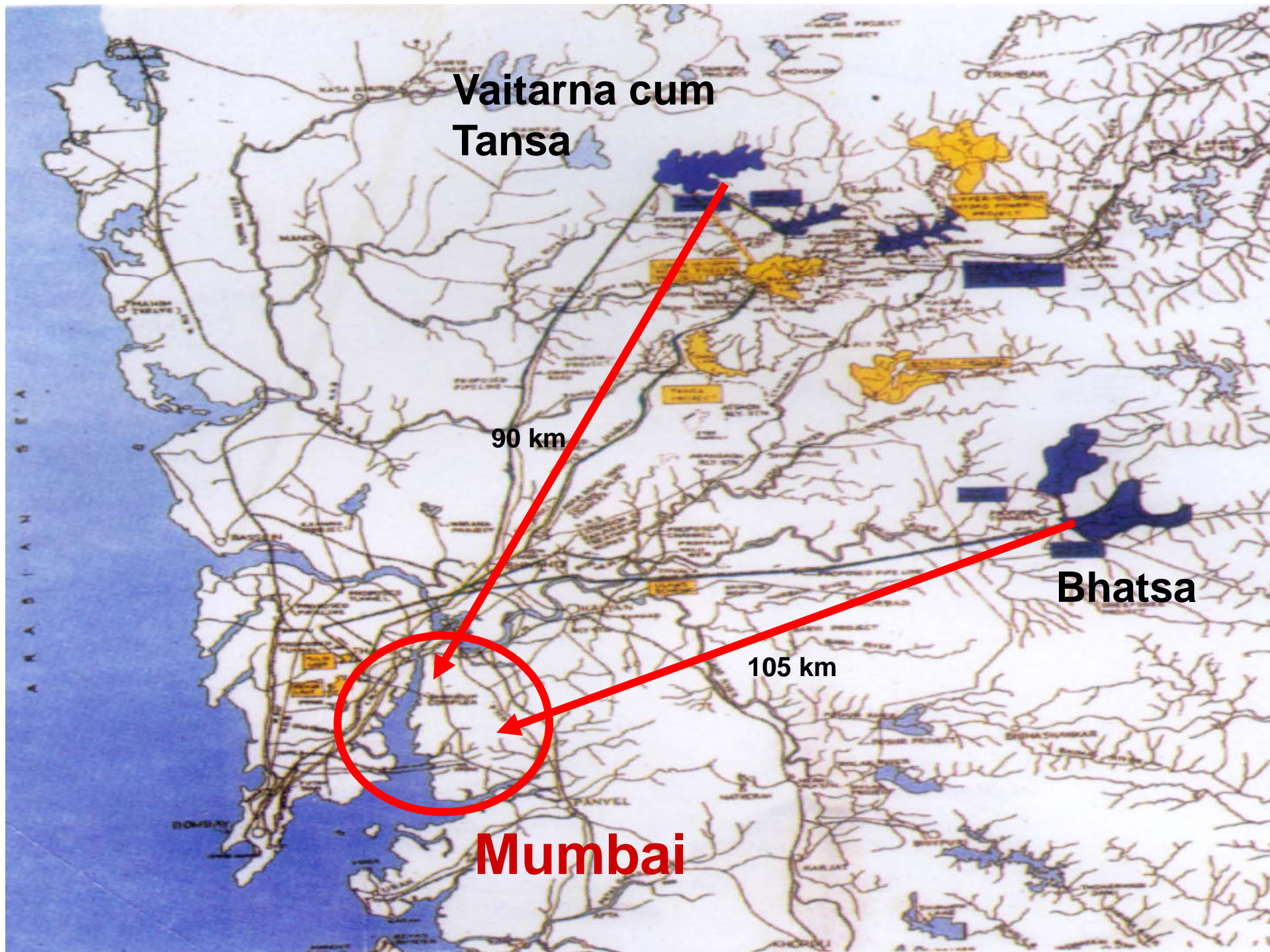
## Chennai basin: sources of water supply



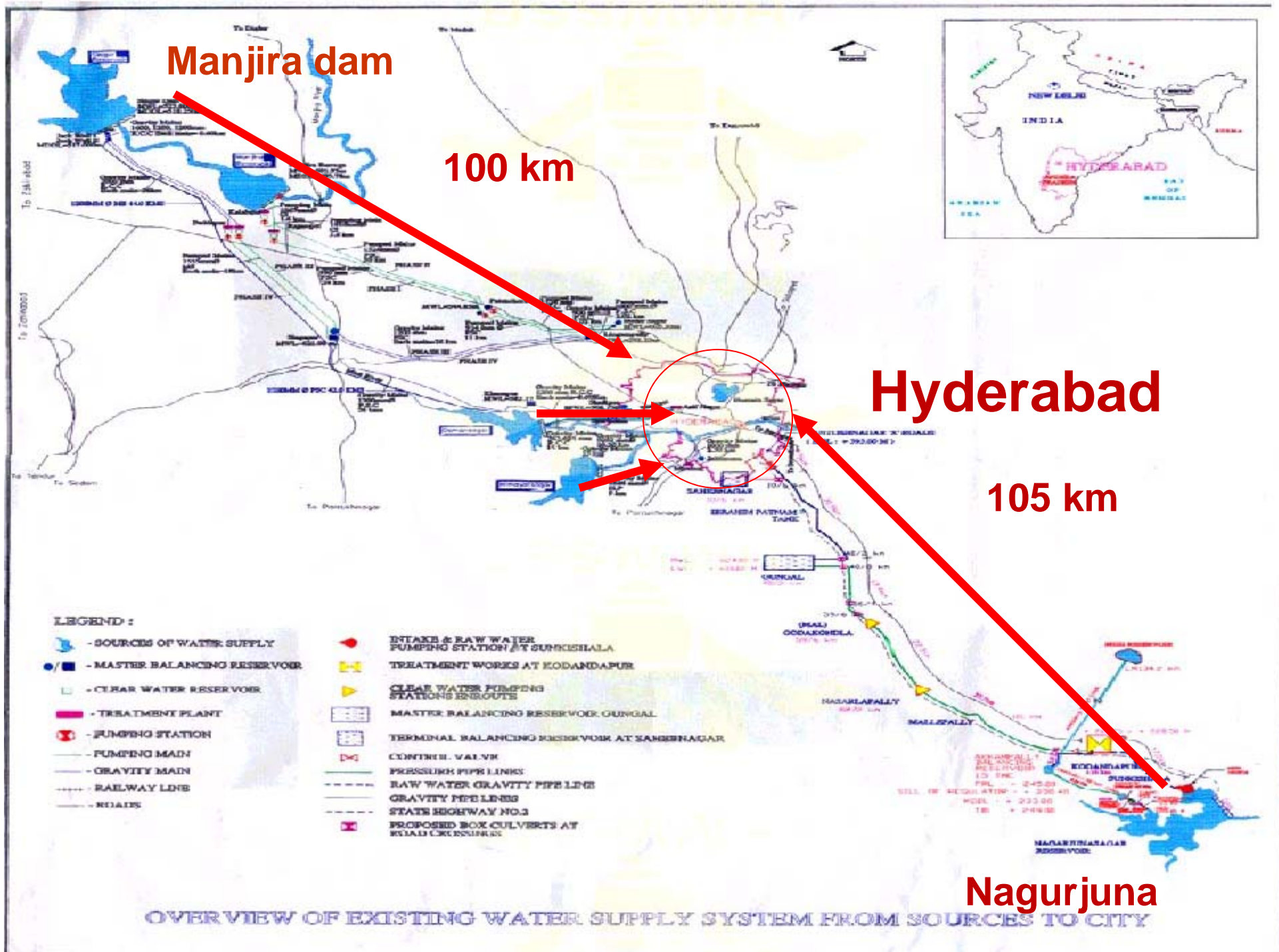
Relentless  
**search** for  
water



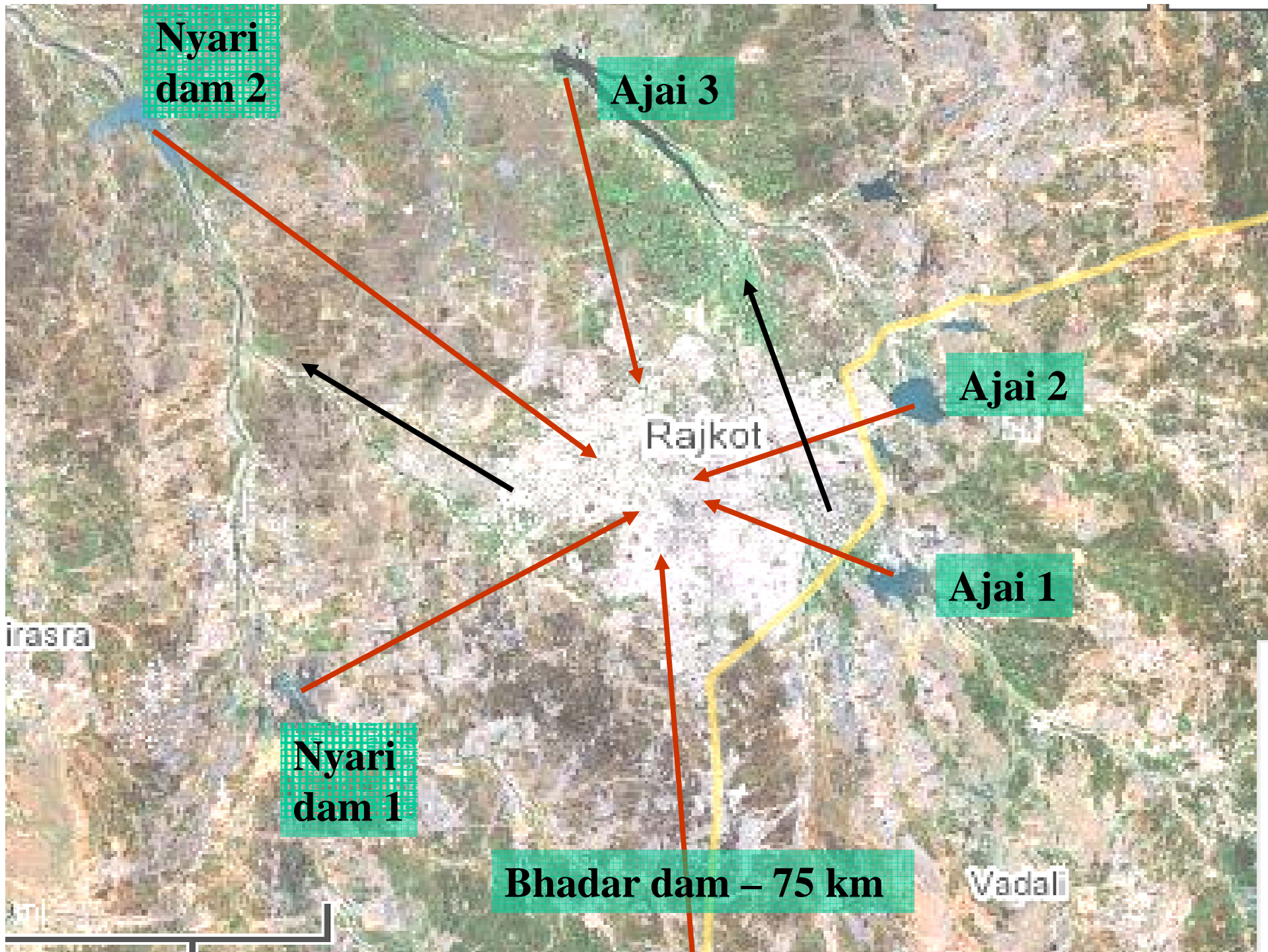


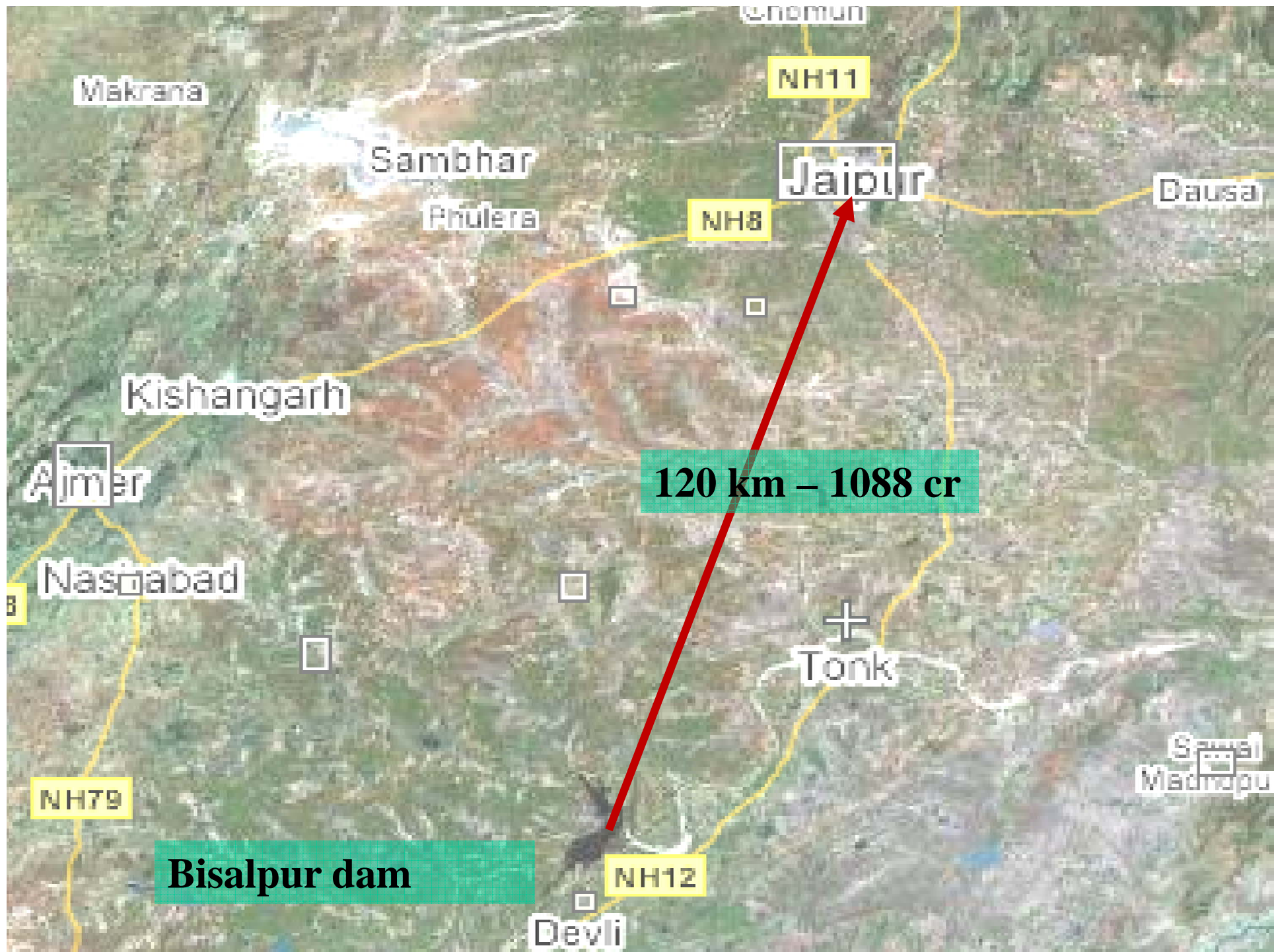




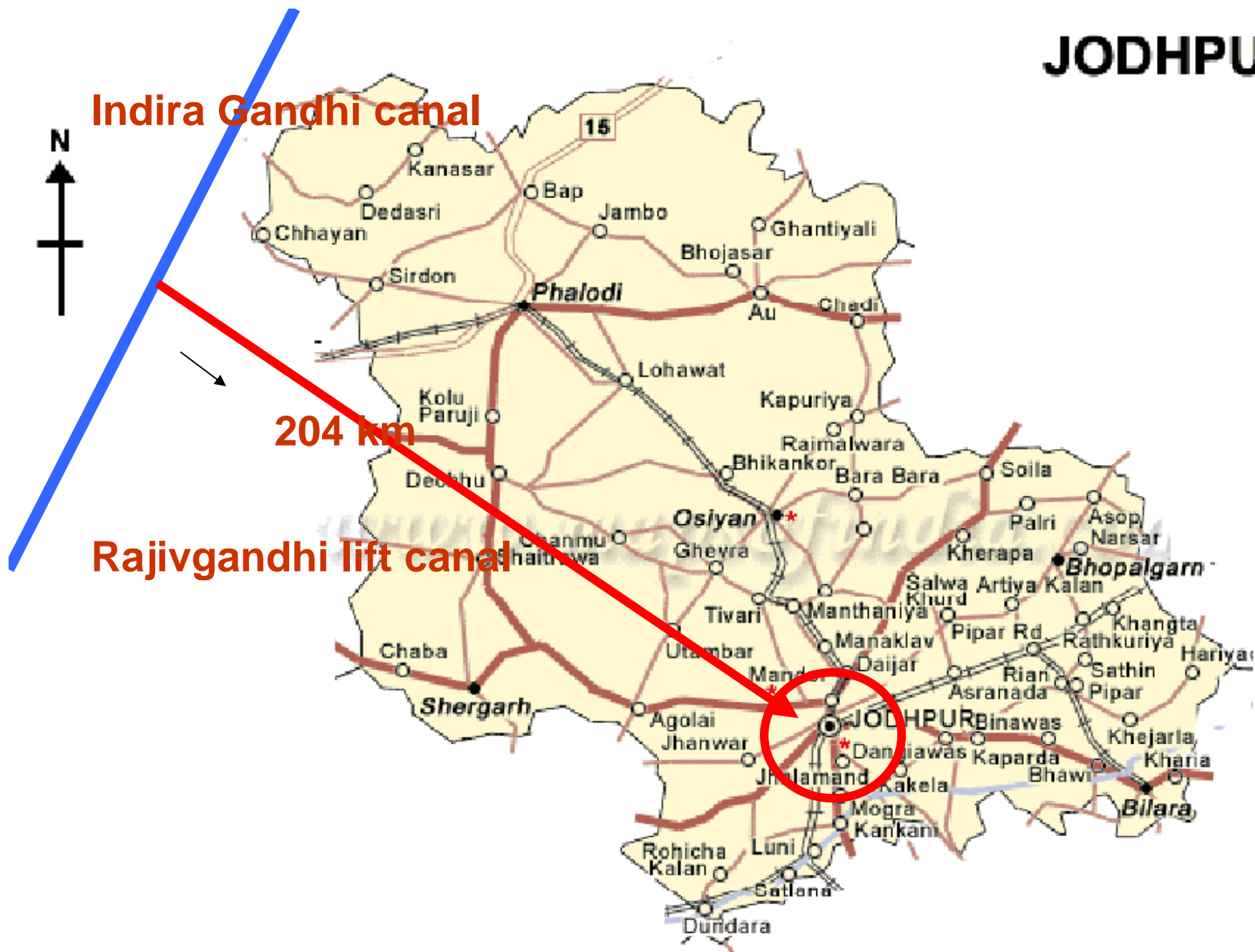








# JODHPUR



# How is urban water supply need is calculated in India ?

<b>Classification of towns/cities</b>	<b>Recommended maximum water supply levels (lpcd)</b>
Towns provided with piped water supply but without sewerage system	70
Cities provided with piped water supply where sewerage system is exists	135
Metropolitan and Mega cities provided with piped water supply where sewerage systems existing	150

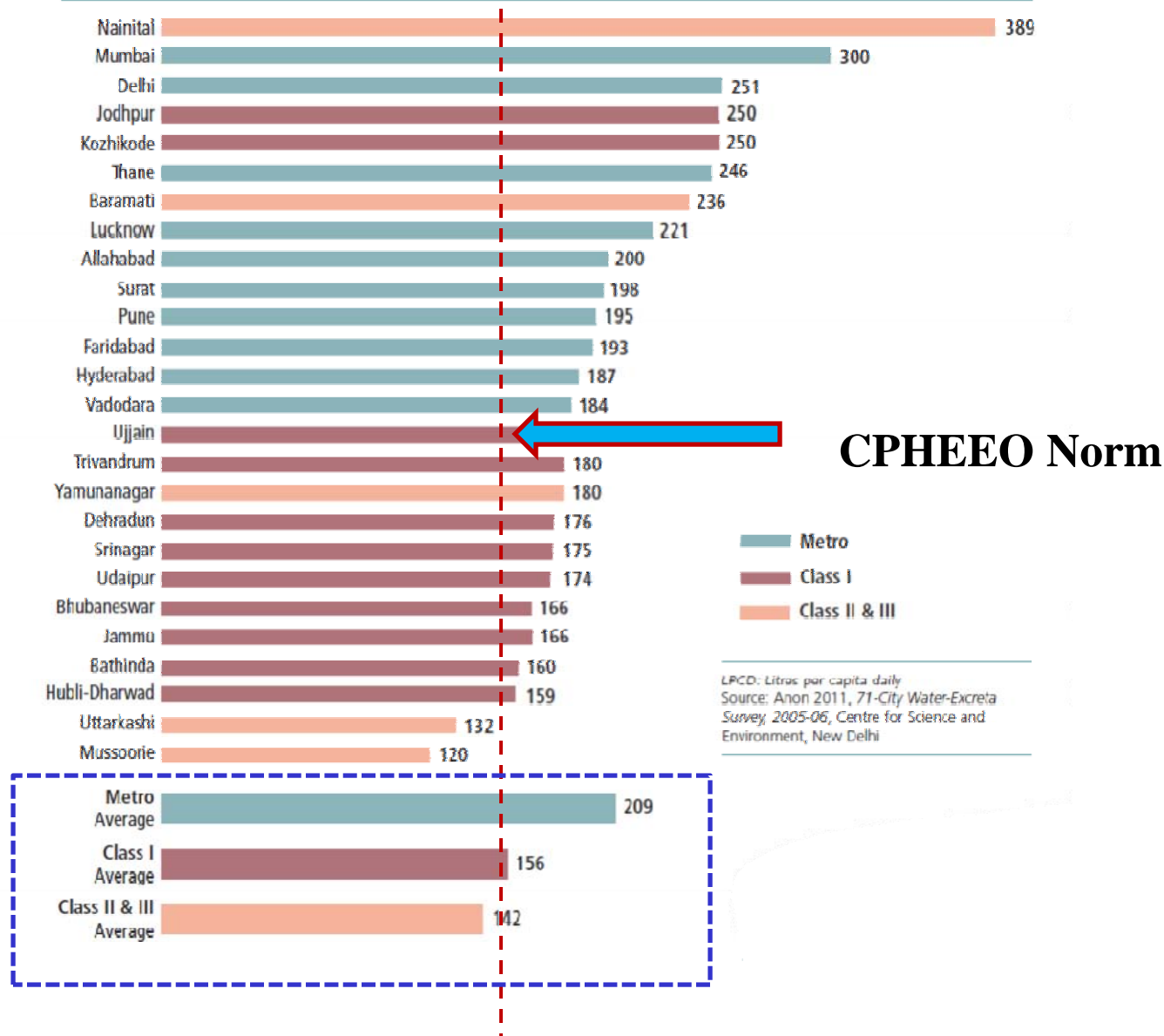
Source: Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation Manual on Water Supply and Treatment, Third Edition -Revised and Updated (May 1999), New Delhi.



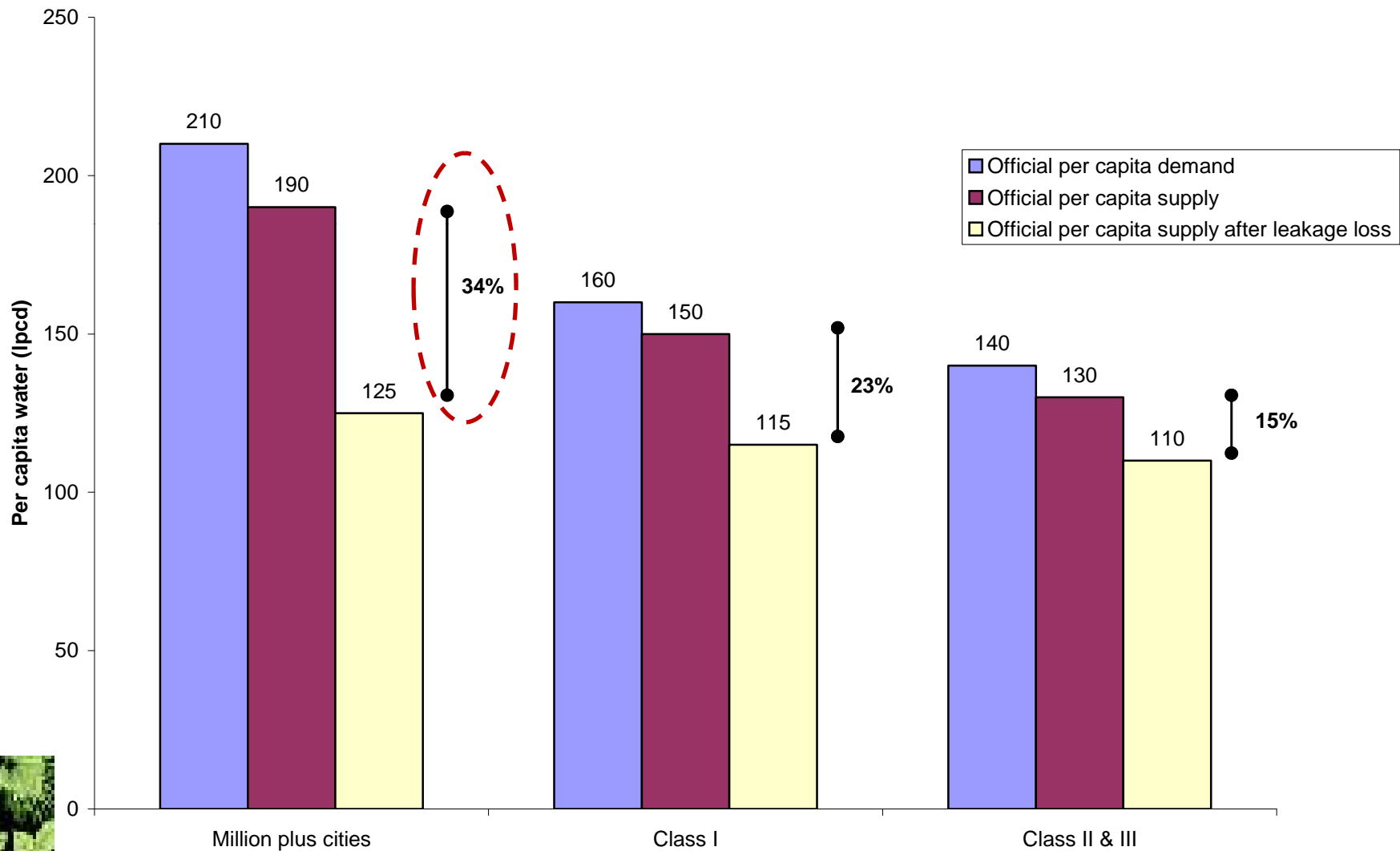


# Per capita supply is high and completely arbitrary

PER CAPITA PRESTIGE: WATER SUPPLY LEVELS CITIES DECIDE ARE COMPLETELY ARBITRARY (IN LPCD)



# Official Water Demand, Supply, leakage loss and supply after loss



# Slums : Unreached, Un-supplied

## THE WATER DIVIDE IN URBAN INDIA

### METRO

15,749

843

### CLASS I

2,639

136

### TOTAL

18,388

979

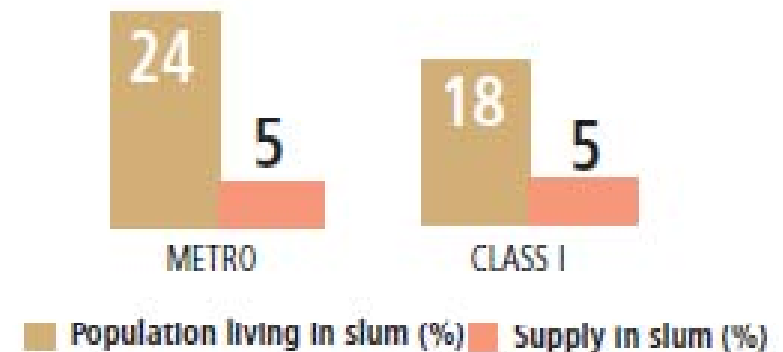
19,367

■ Supply in non-slum, MLD    ■ Supply in slum, MLD

MLD: Million litres daily

Source: Anon 2011, 71-City Water-Excreta Survey, 2005-06, Centre for Science and Environment, New Delhi

## 71-CITY SURVEY: WATER THAT ACTUALLY TRICKLES DOWN TO SLUMS



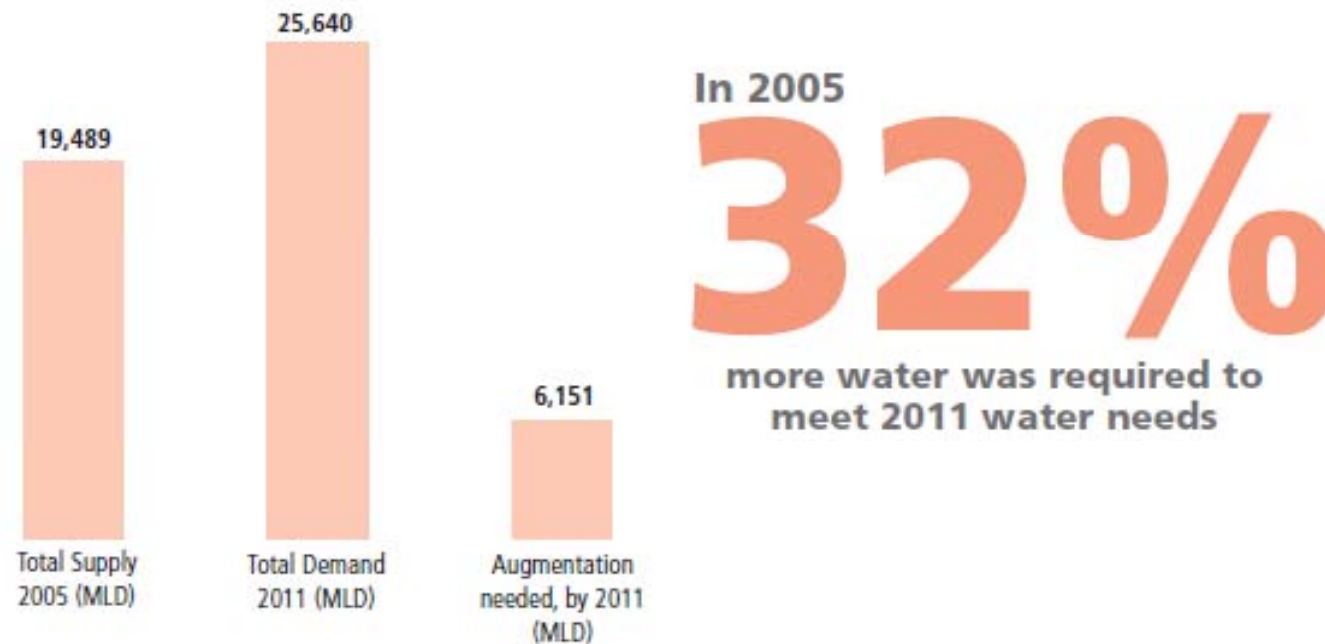
Source: Anon 2011, 71-City Water-Excreta Survey, 2005-06, Centre for Science and Environment, New Delhi



## Cities Craving to Supply More

71 Indian Cities Survey by CSE reveals:

	Supply 2005 (MLD)	Demand 2011 (MLD)	Augmentation needed (MLD)	% Augmentation in 2011
Metro	16,591	21,805	5,214	31
Class I	2,775	3,605	829	30
Class II&III	123	230	107	87



MLD: Million litres daily

Source: Anon 2011, 71-City Water-Excreta Survey: 2005-06, Centre for  
Science and Environment, New Delhi





## ‘Loss’ not just inefficiency

- Distribution loss is **not just** about inefficiency
- Distribution loss **intrinsic to supply system**
  - distance leads to **high transmission losses**
  - distance leads to **high costs of energy**
  - distance leads to **high O&M costs of repair**

But **‘augmentation’** is name of water supply

**Build, pipe, pump and do not worry about supply**



City	Source	Distance	Per kl cost to supply
Aizwal	Tlwang river	1000 metres down the valley, 18 km away	<b>Rs 53.93</b>
Bangalore	Cauvery	95 km from the city	<b>12.00</b>
Chennai	Lakes, Groundwater and Veeranam lake.	60 to 245 km	<b>14.00</b>
Delhi	Yamuna river, Bhakra storage and groundwater	Across the city	<b>9.90</b>
Indore	Narmada river	70 km	<b>11.00</b>
Jodhpur	Rajiv Gandhi Lift Canal	240 km	<b>8.70</b>
Mussorrie	Springwater Bhilaru, Jinsi, Khandighat, Murray rose and Dhobighat	6 to 7 km down	<b>18.13</b>
Mumbai	Bhatsa, Vihar, Tulsi, Tansa, Upper Vaitarna	100 to 120 km	<b>8.40</b>
Hyderabad	Nagarjuna sagar and Majira dam	116 km	<b>5.30</b>
Hubli-Dharwad	Neersagar and Malaprabha reservoir	20 and 55 km	<b>6.70</b>

<b>City</b>	<b>Water Production cost Rs/kl</b>	<b>Water charges Rs/kl</b>
Delhi	8.95	2.00
Mumbai	5.74	2.25
Jodhpur	20.00	1.21
Indore	9.50	2.00
Bangalore	13.00	5.60



# The current paradigm – water supply

**More water supplied = More waste water  
generated = more costs for treatment =  
Unsustainable**





# Water, not supplied

- Planners obsessed with water, **not supply**
  - Water sourced from further and further away, **leads to increasing cost of supply**
  - Leads to high distribution losses and **less water to supply at end of pipeline**
  - **Less water means more costly water**

**Cities not able to recover costs of supply, have no money to invest in sewage**



# Water = Wastewater

## Cities plan for water, forget waste

- 80% water leaves homes as sewage
- More water = more waste
- Cities have **no accounts** for sewage
- Cities have **no clue** how they will convey waste of all, treat it, clean rivers
- Cities **only dream** of becoming New York or London



# Urban Sanitation - Rating Card

No.	Category	Description	Points	Cities
1	RED	Cities Needing immediate attention	<33	182
2	BLACK	Needing considerable improvement	34-66	230
3	BLUE	Recovering	67-90	4
4	GREEN	Healthy and Clean Cities	91-100	Nil

**Red-** Shimla, Srinagar, Allahabad,

**Black-** Tiruchirapalli, Jamshedpur, Rajkot, Mangalore,  
Hyderabad

**Blue-** Chandigarh, Mysore, Surat, NDMC & Delhi Cantt

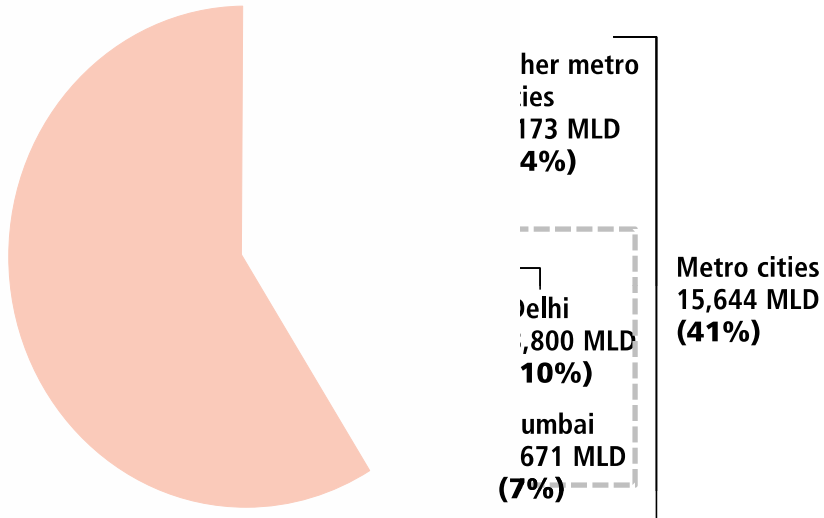


Source: Ministry of Urban Development 2010

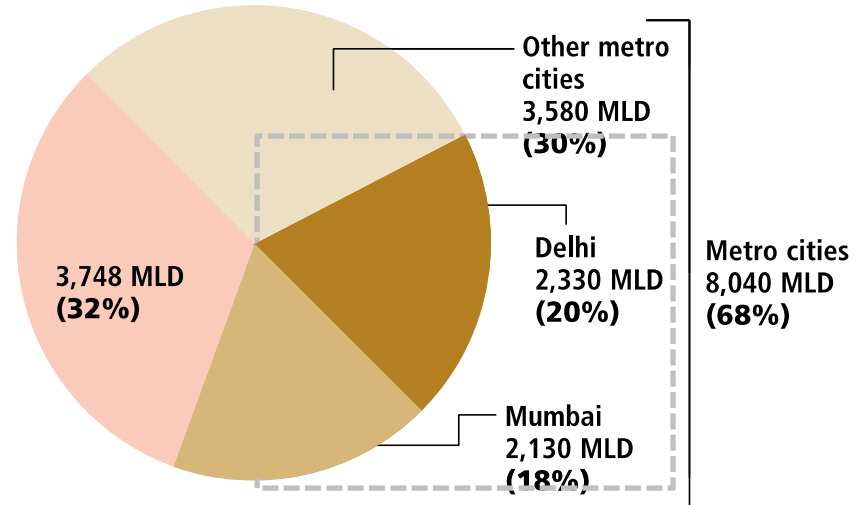
# Sewage : **more** sums

## TWO METROS: DISPROPORTIONATE TREATMENT

Total wastewater generation 38 255 MLD



Total treatment capacity 11,788 MLD



MLD: Million litres daily

Source: Anon 2009, *Status of Water Supply, Wastewater Generation and Treatment in Class-I cities and Class-II towns of India*, Central Pollution Control Board, Ministry of Environment and Forests, Delhi

- 30% of total sewage can be treated
- But Delhi and Mumbai alone have **40 per cent** of sewage treatment capacity in the country



# Cost Estimates of Select Technologies

Technology	Cost /mld (at 2008 prices) in Rs.lakhs
Waste Stabilization Ponds	25
UASB + Post treatment	55
Activated Sludge Process, C-Tech, FAB	87

- Cost of Interception & Diversion works (main trunk sewers, SPS excl. house connections, branch and lateral sewers) and cost of land acquisition is around **Rs. 3-4 crore per mld**
- Estimated **Class I & II Sewage Generation in year 2020 = 45000 mld**
- Cost would increase to the extent of **Rs. 45,000 crore to Rs. 1,32,000 crore.**



# Planning for **hardware**

## **Cities plan for treatment not 'sewage'**

- Treatment plants are not simple answers
- **Can build plants to treat, but there is no waste being conveyed for treatment**
- Most cities do not have underground sewerage. But engineers sell pipe-dreams of **catching up with infrastructure**
- Politicians buy pipe-dreams
- We lose rivers. Generations of **lost rivers**





## 71-CITY SURVEY: AREA COVERED BY CLOSED DRAINS SHOWS REAL STATE OF SEWAGE COLLECTION

### % of area covered

0-10	Cuttack, Guwahati, Jabalpur, Jammu, Ranchi, Thane, Aizawl, Bathinda, Bhilwara, Siliguri, Srikakulam
10-30	Agra, Alwar, Aurangabad, Indore, Mathura, Meerut, Puducherry, Thiruvananthapuram, Dehradun, Dewas, Hubli-Dharwad, Jhansi, Kozhikode, Lucknow, Solapur, Tumkur, Udaipur, Ujjain, Dhanbad
30-50	Allahabad, Bengaluru, Bhopal, Delhi, Lucknow, Patna, Srinagar, Amritsar, Bhubaneswar, Jodhpur, Mumbai
50-70	Faridabad <sup>2</sup> , Hyderabad, Jaipur <sup>1</sup> , Kanpur, Kolkata, Nagpur, Gwalior, Mussoorie, Nainital, Rajkot, Vadodara, Yamunanagar
> 70	Chennai, Pune, Surat, Gurgaon <sup>2</sup>

<sup>1</sup>Claims 80% coverage in CSE survey, 65% in City Development Plan for JNNURM; <sup>2</sup>Faridabad and Gurgaon: only old-city within municipal limit included  
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

<10

Guwahati, Jabalpur, Jammu,  
Ranchi, Thane, Aizawl,  
Bathinda, Bhilwara, Jammu,  
Jabalpur, Siliguri,  
Srikakulam

- **Cities do not have drains**
- **New growth cities are growing without drains**
- **Backlog and front-log impossible to fix**
- **As cities fix one drain, another goes under**



## For example - Bengaluru: **sewage not** reaching

- 3610 km of sewage pipes
- **14 sewage treatment plants = 781 mld**
- Generates 800-1000 mld of sewage
- **But treats only 300 mld**
- Rest does not reach
- Now plans to build 4000 km more
- **Builds, grows and more lines need repair**
- **Catch-up that does not catch-up**



# Partial treatment = pollution

**“Cities do not control pollution” and Cost of building system is high**

- City can build sewerage system for **few** not all
- Spends on building pipes, repair and energy costs of pumping to treatment plant of this waste of some **few**
- Spends to treat waste of some **few**
- Treated waste of **few** gets mixed with **untreated waste of majority**
- The result **is pollution**



## For example : Delhi

MERRY-GO-ROUND III: DELHI'S ATTEMPT TO CLEAN THE YAMUNA IS THE MYTH OF SISYPHUS ACTUALISED

Has 20 drains

Has 17 STP

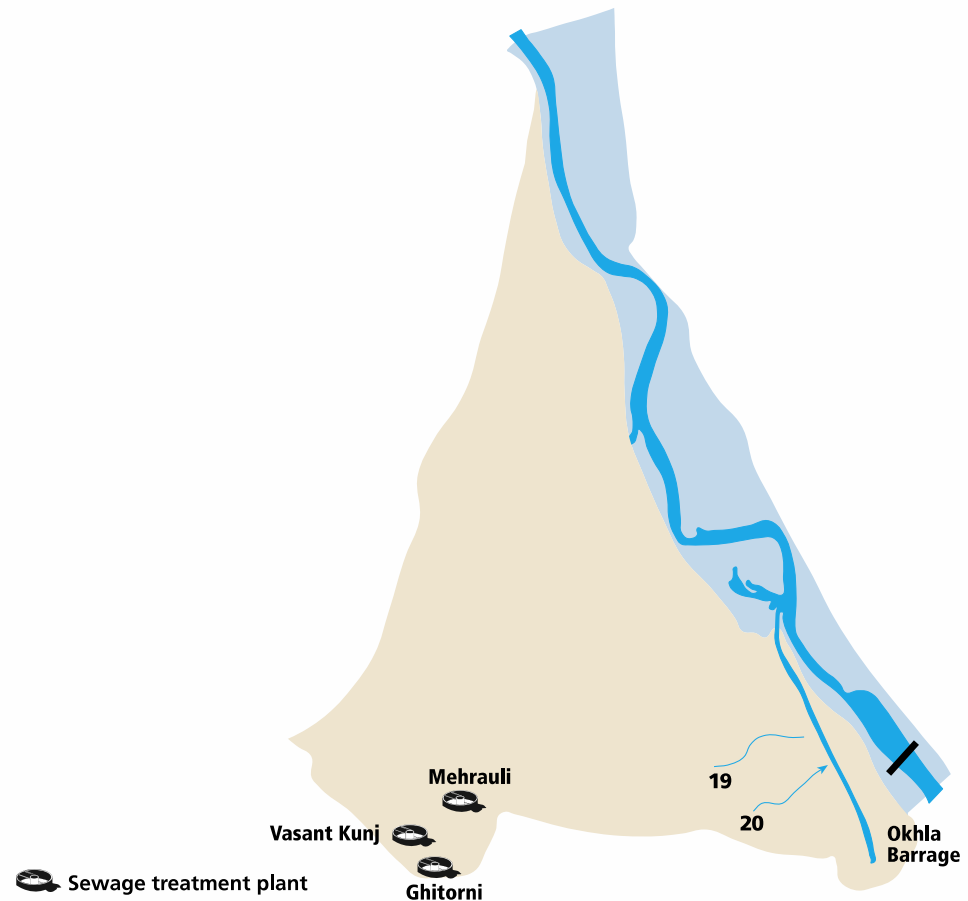
Capacity exists  
But River Yamuna  
dead

Why?

Delhi keeps building  
to 'catch up'

Can't

Sewage reaches river



Source: Anon 2011, 71-City Water-Excreta Survey, 2005-06, Centre for Science and Environment, New Delhi



River has no water only sewage

## For example : Chennai

### Funds spent

Sewage system coverage high

Large number of pumping stations

### Why still polluted?

Pumps and pumps

Takes to outskirts of city

Dumps it back into canals and rivers

These flow through city

Engineers say 'all is well'

Waste is intercepted

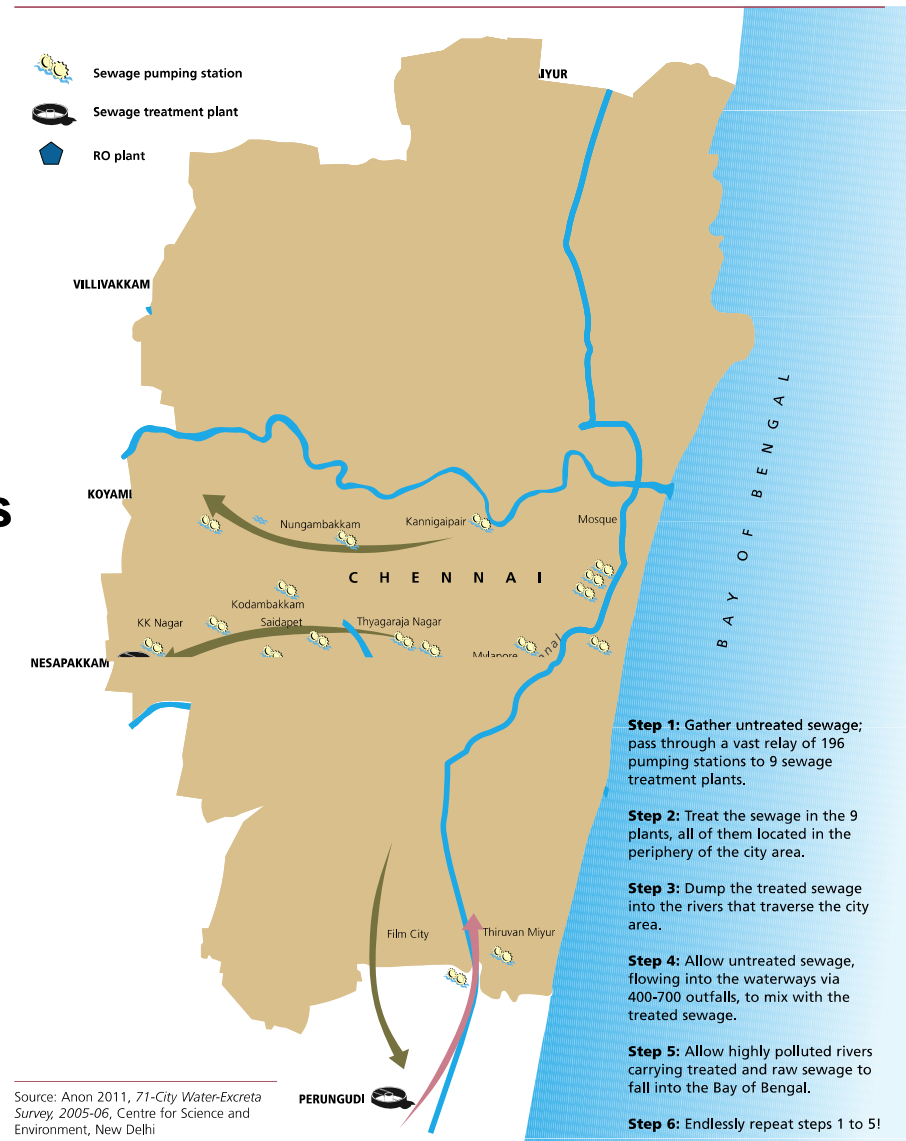
Only stormwater flows

### But not true

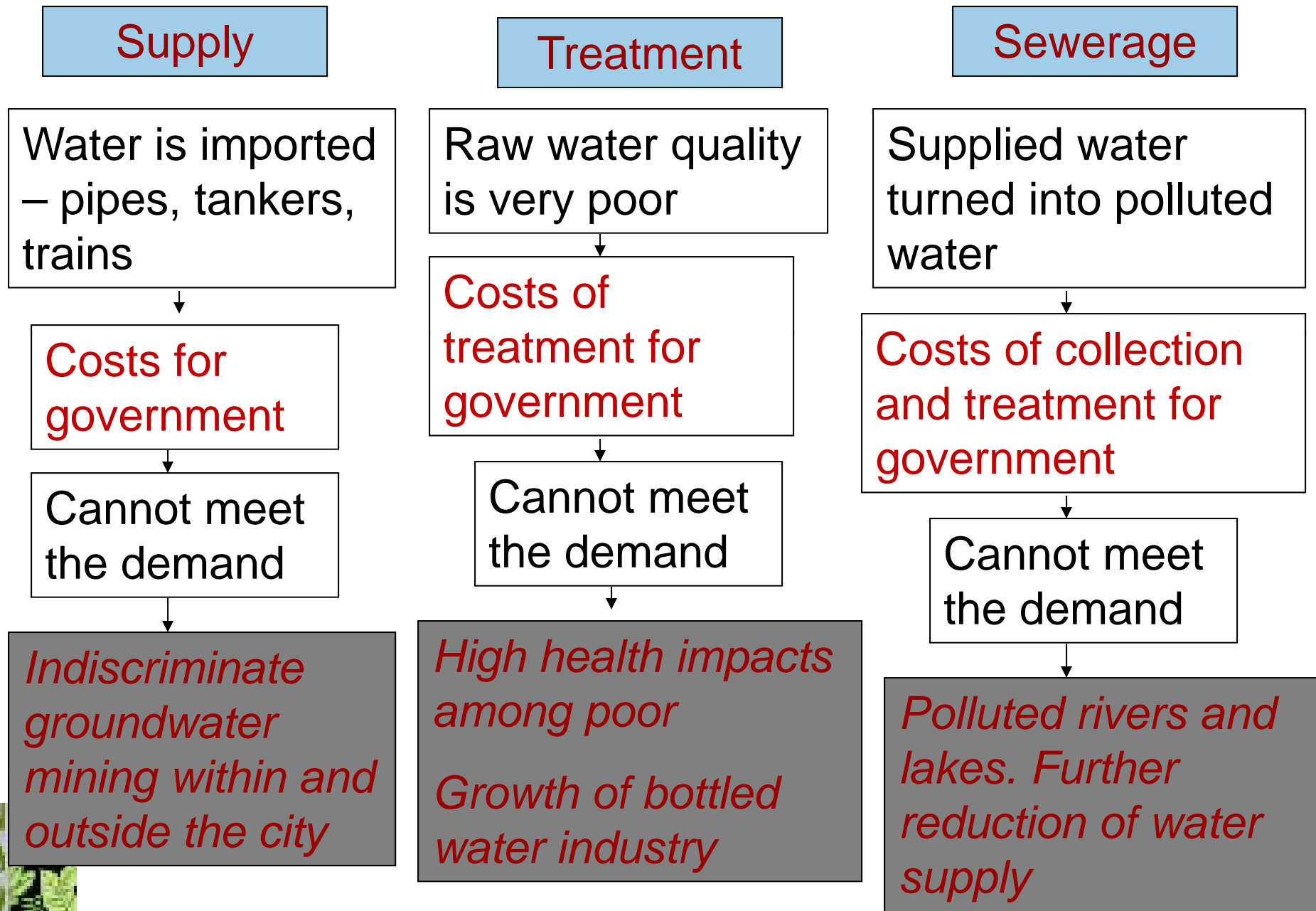
Sewage flows ,

Treated sewage flows

#### MERRY-GO-ROUND I: CHASING EFFLUENTS IN CHENNAI

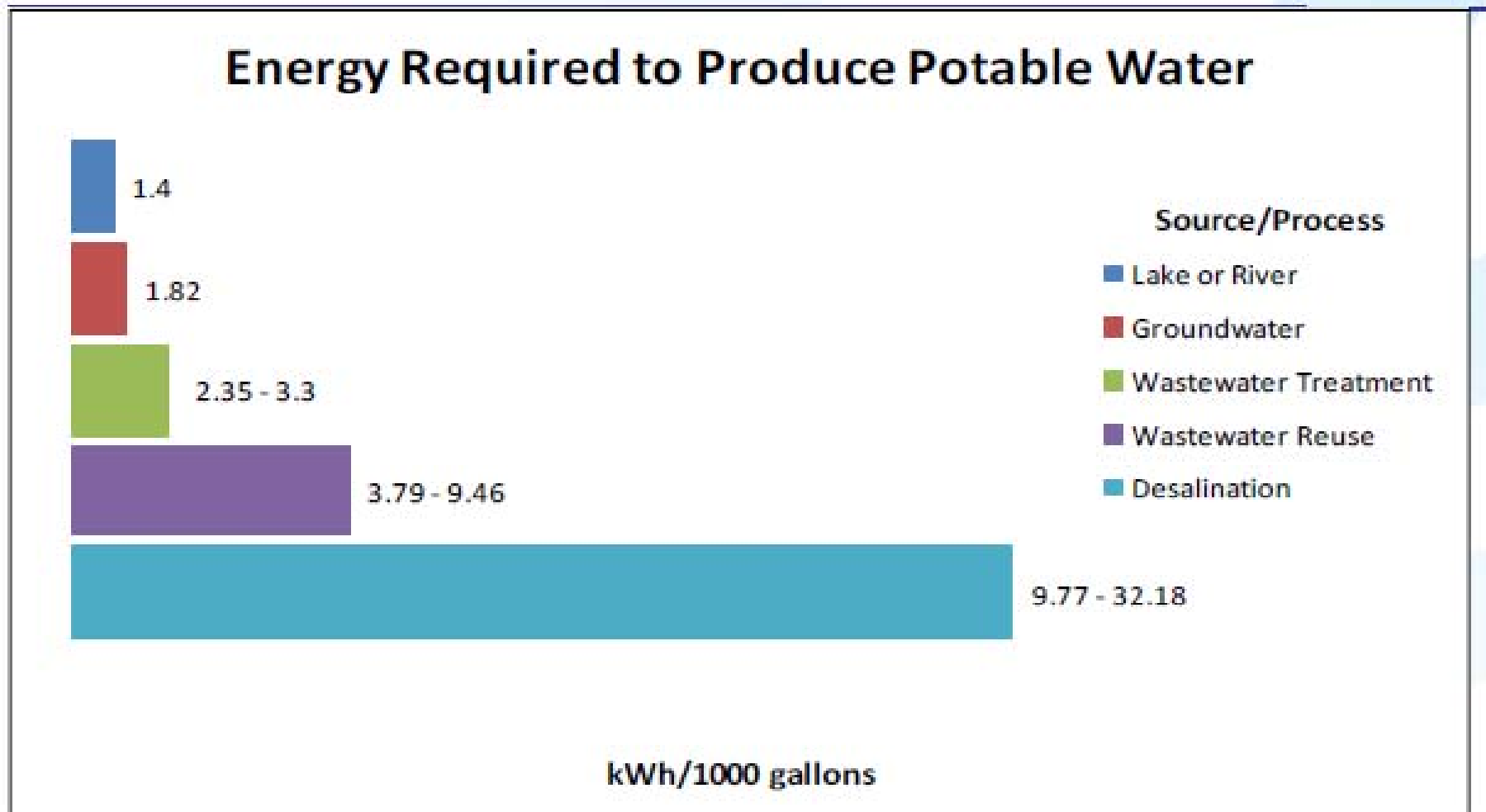


# Urban water paradigm – cause & effect



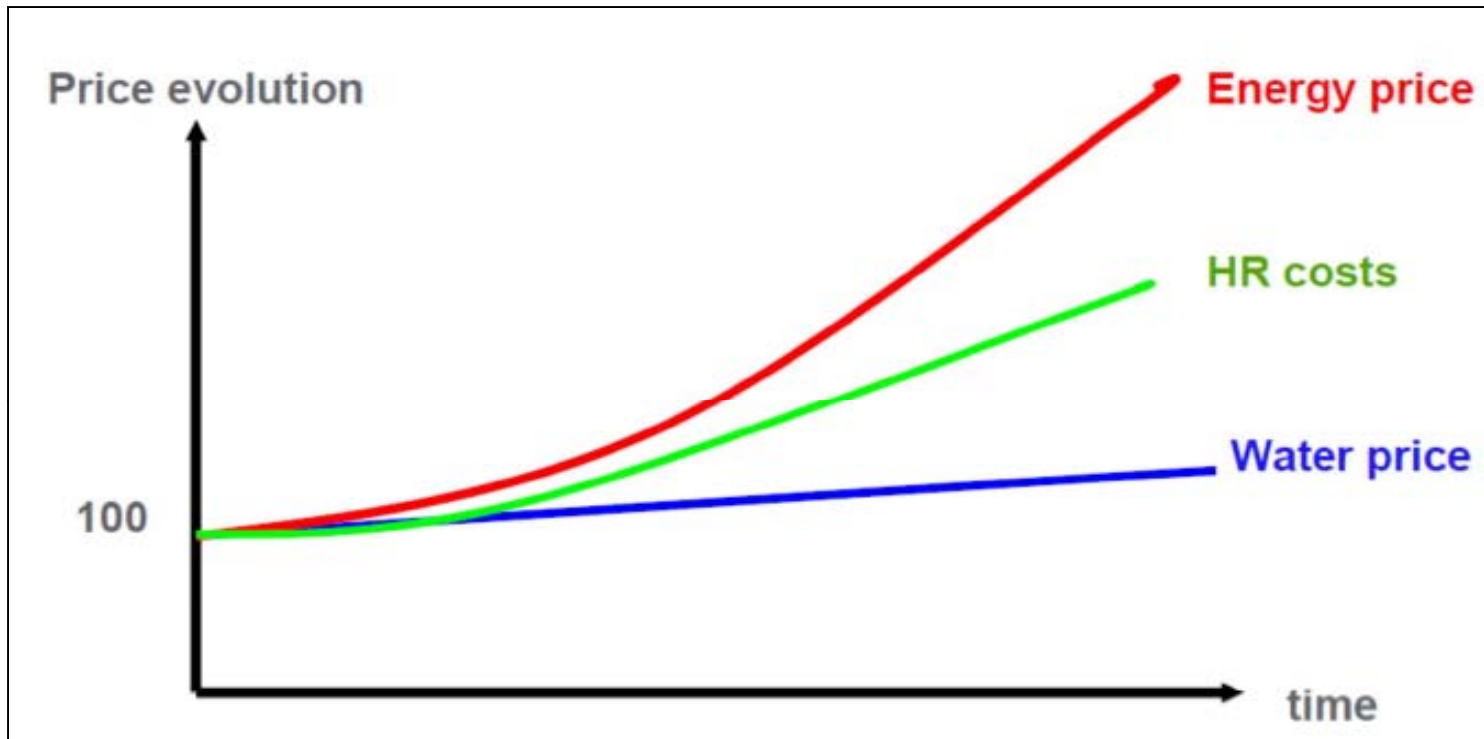


# Water Production & Energy Use



Source: Alliance to Save Energy

# Water financials, a dilemma



- Water price is a public issue (no volatility, even fixed)
- Chemicals & additives will increase
- Asset management need regular investments



Source: Schneider Electric

Cannot play catch up game

Cannot flush – and forget

Have to find new approaches :

**affordable and sustainable**



## Rework water-energy nexus in UWM; rework economics

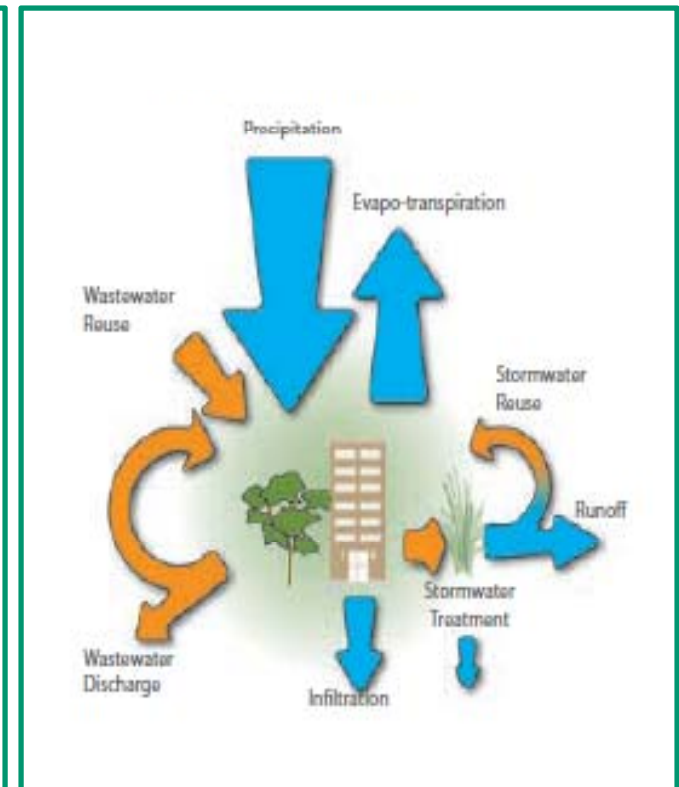
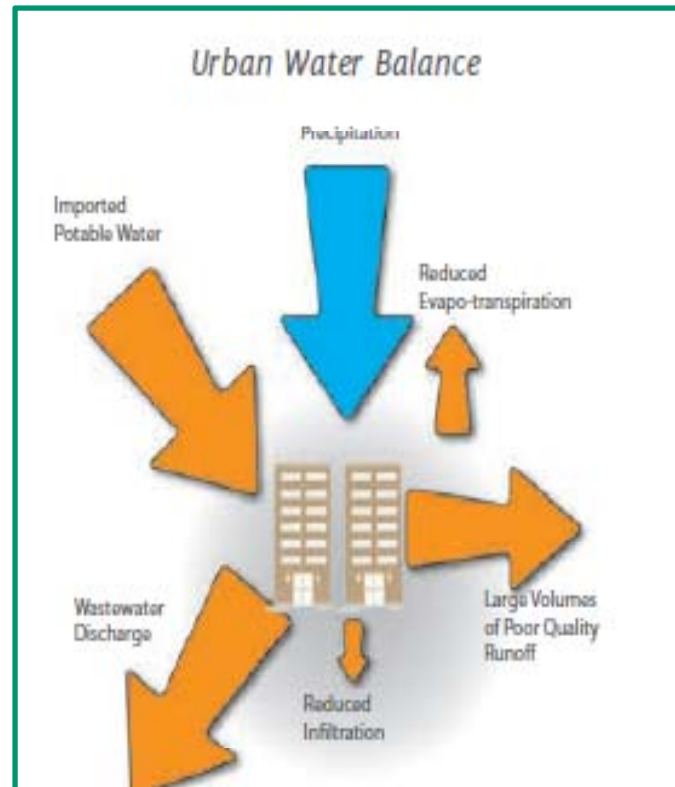
- Need to fix urban water use. Cannot be wasteful any more.
- Reduce energy to cut costs; Need to charge to reduce wastage
- Local recycle and reuse waste water
- **Closing the loop!**



*Natural Water Balance*



*Urban Water Balance*



New Paradigm



# Reform agenda

1. Prioritize public investment differently
2. Plan to cut costs of water supply
3. Invest in local & decentralised water systems
4. Reduce water demand
5. Spend on sewage not on water
6. Cut costs on sewage systems
7. Plan to recycle and reuse every drop





# Today's Sustainable Water Management - Agenda

## Challenge of innovative policy and practice

**Challenge of scale** -- implement change at the scale of the transition needed

**Challenge of capacity** – need multipliers in society to implement changes, think and act differently



# Reform Agenda for Sustainable Water Management

Today **idea** is accepted but **practice** is not

**Practice difficult**

Practices, methods evolved in the rich world are  
**unaffordable or unworkable**

**Practice does not push envelope of change**

At ULB level need big-ticket change



# Innovative technologies need innovative policies

WAB & CSE pushing to get different approach in water-waste management - Decentralised, cost-effective technologies

Need capacity in society – training programmes

Need strategies to experiment / practice and scale-up



# Paradigm Shift in Enabling Environment

Mainstreaming requires paradigm shift at all four levels  
– in terms of development in practice:



In DPRs for JnNURM Phase II :

We need **objectives, indicators and standards** that can be measured and monitored and that meet challenges of '**energy efficiency aimed at carbon neutral city**'.



## Future Urban Hydrology

- **Capturing rainwater from macro and micro catchments**
  - Rooftop water can be used for domestic purposes
  - Groundwater recharge
- and also –
- **Recycle wastewater**
  - Look at dry sanitation options
  - Use less water. Do not be wasteful - **Do not make cities first water-wasteful and then think efficiency.**
  - Only bring the deficit water from outside.



# Future Urban Hydrology

- Not a task for engineers alone
- Integrated planning of urban land and water
- Objective of equity, economic efficiency and environmental integrity
- Making water everybody's business...



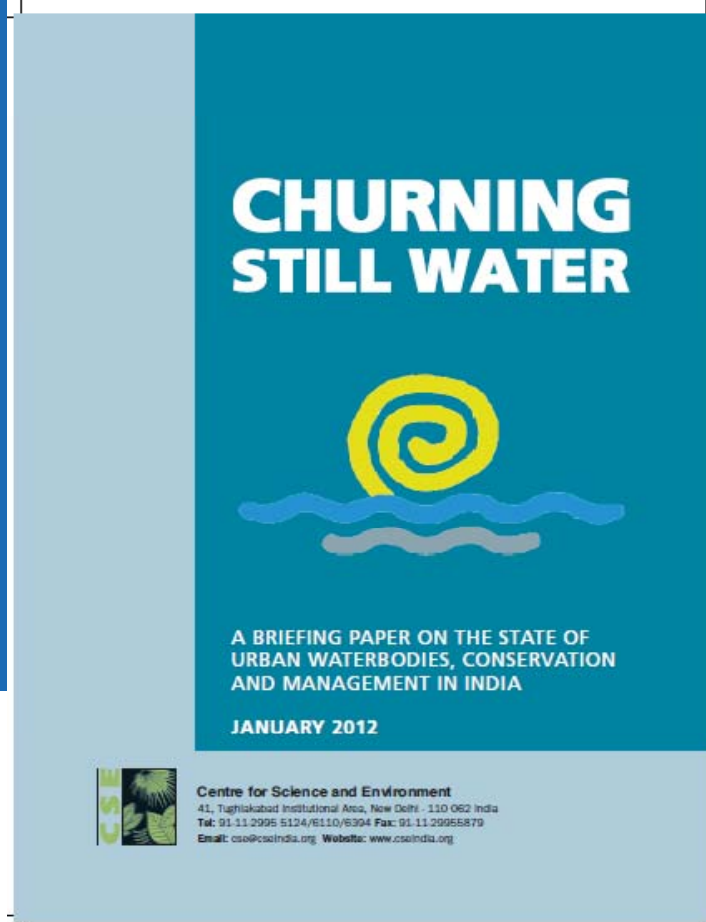
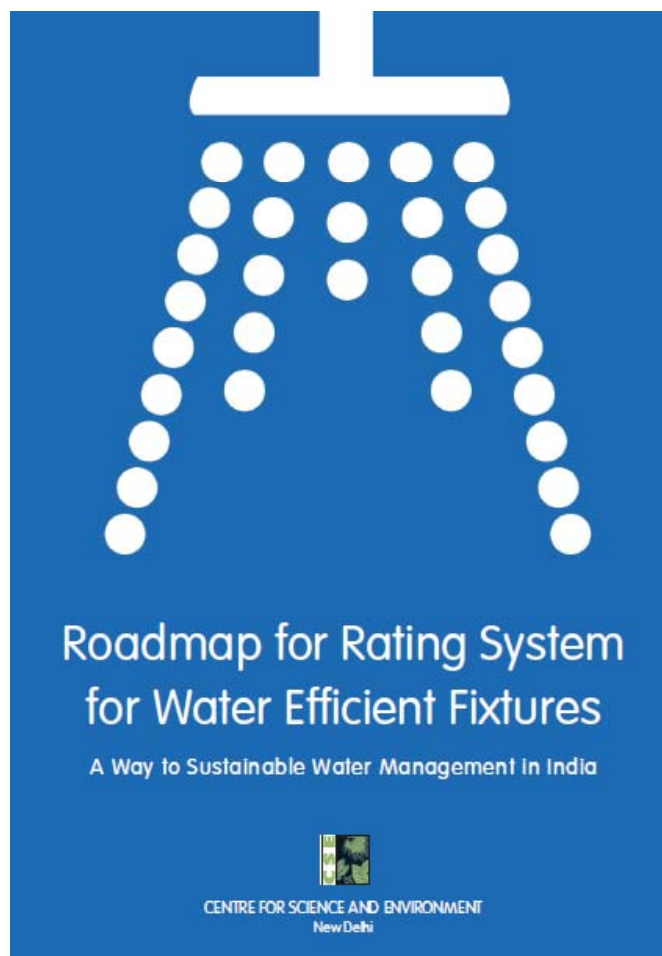


# Way ahead

- Create **informed public opinion**
- **Demand side** management
- **Capacity building & training** the real users and implementers
- **Legislation** followed by strict implementation



# Policy Papers and Roadmap for mainstreaming Resources & Energy Efficiency



THANK YOU

