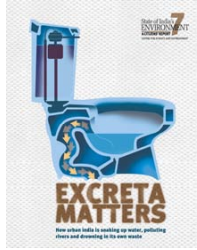




# **Excreta Matters:** Citizens' Report on the state of India's Environment

An agenda for water-prudent and  
waste-wise India



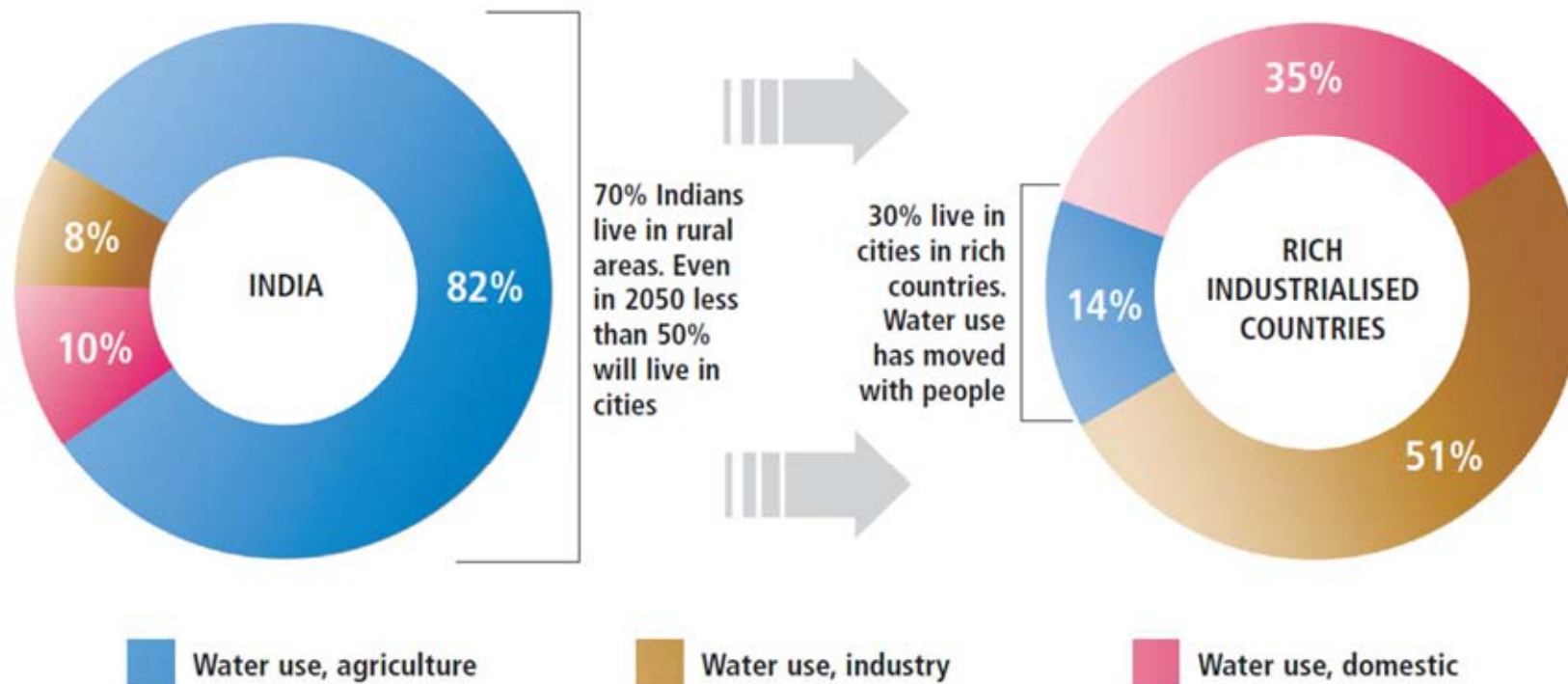
# Water for growth?

- Cities-industries need water for growth. Where will this come from?
- India will not follow transition of rich world – people move to cities; economies move to service-industry; **water moves with it**



## WATER TRANSITION THAT WILL NOT HAPPEN

Urban-industrial growth needs water but in India, even as this sector will grow, people will continue to live in rural areas and depend on agriculture

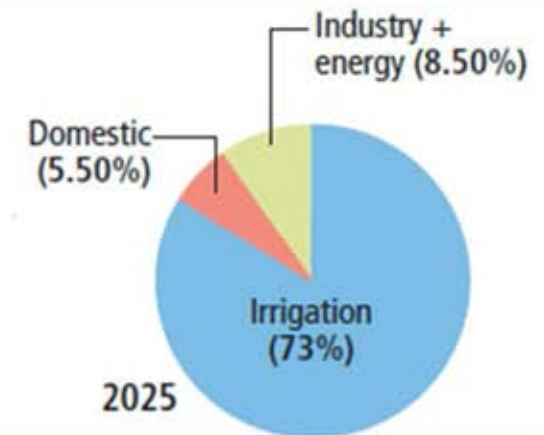
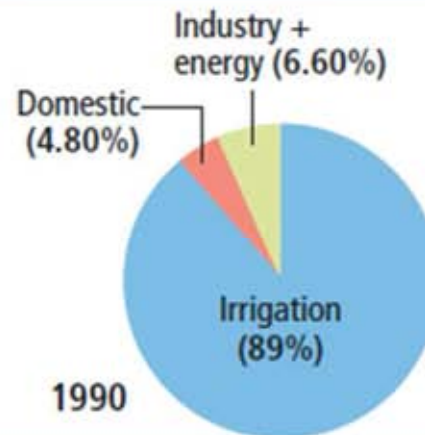


Source: Anon 2009, *Water in a Changing World*, Third UN World Water Development Report, UNESCO, Paris



## UPDATE REQUIRED: THE LAST TIME INDIA ESTIMATED ITS FUTURE WATER USE WAS IN 1999

Category	1990 (BCM)	2025 (BCM)
Irrigation	460	688
Domestic	25	52
Industry + energy	34	80
<b>Total</b>	<b>519</b>	<b>942</b>



BCM: billion cubic metres

Source: Anon 1999, National Commission on Integrated Water Resources Development, Ministry of Water Resources, Delhi



## CSE study shows water consumption in industrial sector set to double

### SOBERING PROJECTIONS: THE FUTURE OF SIX KEY INDUSTRIAL SECTORS (IN MLD)

Sector	Freshwater withdrawal 2008-09	Freshwater consumption 2008-09	Projected withdrawal 2020-21	Projected consumption 2020-21
Power	108,334	13,995	117,940	23,597
Paper and pulp	2,375	238	3477	483
Iron and Steel	1,860	674	4482	1,901
Fertilizer	545	273	652	379
Cement	249	249	674	674
Aluminium	441	27	1246	94
<b>Total</b>	<b>113,803</b>	<b>15,455</b>	<b>128,471</b>	<b>27,132</b>

MLD: Million litres daily

Source: Chandra Bhushan 2010, *Challenge of the New Balance*, Centre for Science and Environment, New Delhi



# Need to reinvent

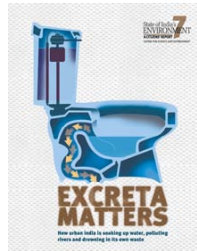
- Violence will grow
- Already cases of protest and police firing over water allocation to industry or city
- **Indian cities need to become prosperous without more water**
- How is that possible?



# 12<sup>th</sup> Plan Working Group

- Issues discussed with state government
- **Consensus** in group and in ministry
- Discussions in Plan Com
- Agreement on problems and need to evolve new directions
- What is it we are finding?
- **What needs to be done?**





# Our study

71 city data analyzed

City water-waste profiles: Where does water come? Where does waste go?

Simple questions

But not asked

Never answered







# Water, not supplied

1. Water supply in cities: Planners obsessed with water, **not supply**

Water sourced from further and further away

Leads to increasing cost of supply

Leads to high distribution losses

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

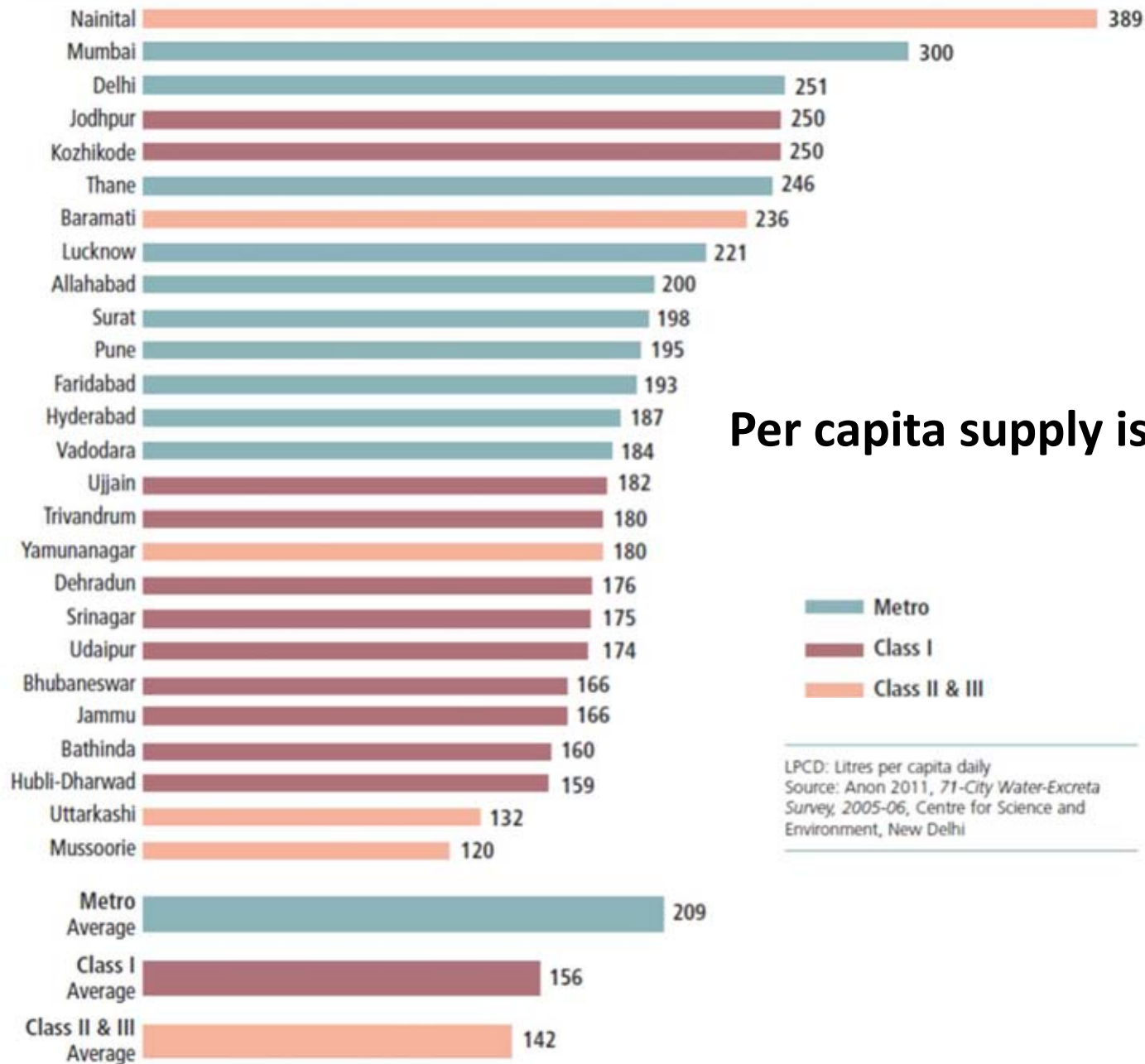


# Demand, **not supply**

- Most Indian cities have ‘enough’ water for supply
- But water does not reach all
- Intra-city inequity is huge and growing
- Challenge is about justice, **but it is about technology** – current system expensive, too wasteful to supply to all, take back the waste of all



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



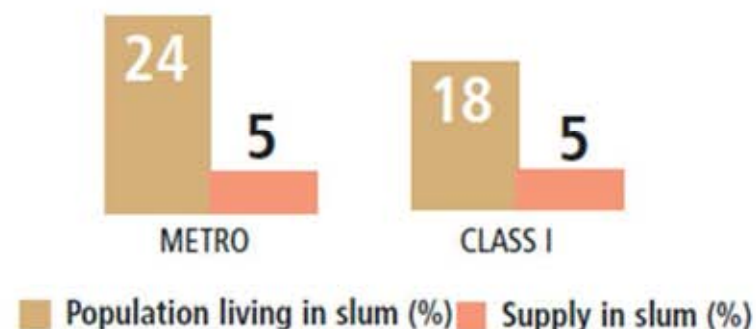
## 71-CITY SURVEY: HOW LEAKAGE LOSSES CREATE THE REAL SHORTFALL IN WATER ACTUALLY SUPPLIED

	Demand 2005 MLD	Supply 2005 MLD	Gap in 2005 MLD	Shortfall in supply, 2005 (%)	Leakage loss MLD	Supply after loss, 2005 (MLD)	Demand- actual supply gap, 2005 (MLD)	Shortfall in actual supply, 2005 (%)
Metro	17,987	16,591	1,396	8	6,150	10,441	7,546	42
Class I	2,879	2,775	104	4	706	2,069	811	28
Class II & III	129	123	7	6	21	101	28	22
Total	20,996	19,489	1,507	8	6,877	12,611	8,385	40

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



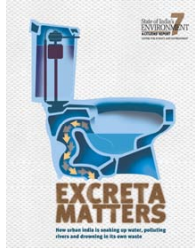
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

Water highway leaks at both ends

Water is **lost** in distribution

But then this water is distributed to **less people**

Water inequity grows



# Loss + Gain

## Supplied; lost; supplied **lot** to **some**

### ZERO-TO-SLUM GAME: HOW CITIES MANAGE WATER ADEQUACY

	Total supply, MLD	Actual supply, (after leakage loss) MLD	Actual supply in non-slum area, MLD	Per capita overall supply, (including leakage) LPCD	Per capita actual supply (after leakage loss) LPCD	Per capita actual supply in non-slum, LPCD
Mumbai	3,050	2,135	1,854	235	165	311
Delhi	3,800	1,824	1,706	241	115	133
Bengaluru	900	540	514	138	83	88
Chennai	765	536	501	170	119	137
Nagpur	470	329	295	200	140	196
Jodhpur	220	176	165	239	191	253
Gwalior	162	130	119	162	130	160

MLD: Million litres daily; LPCD: Litres per capita daily

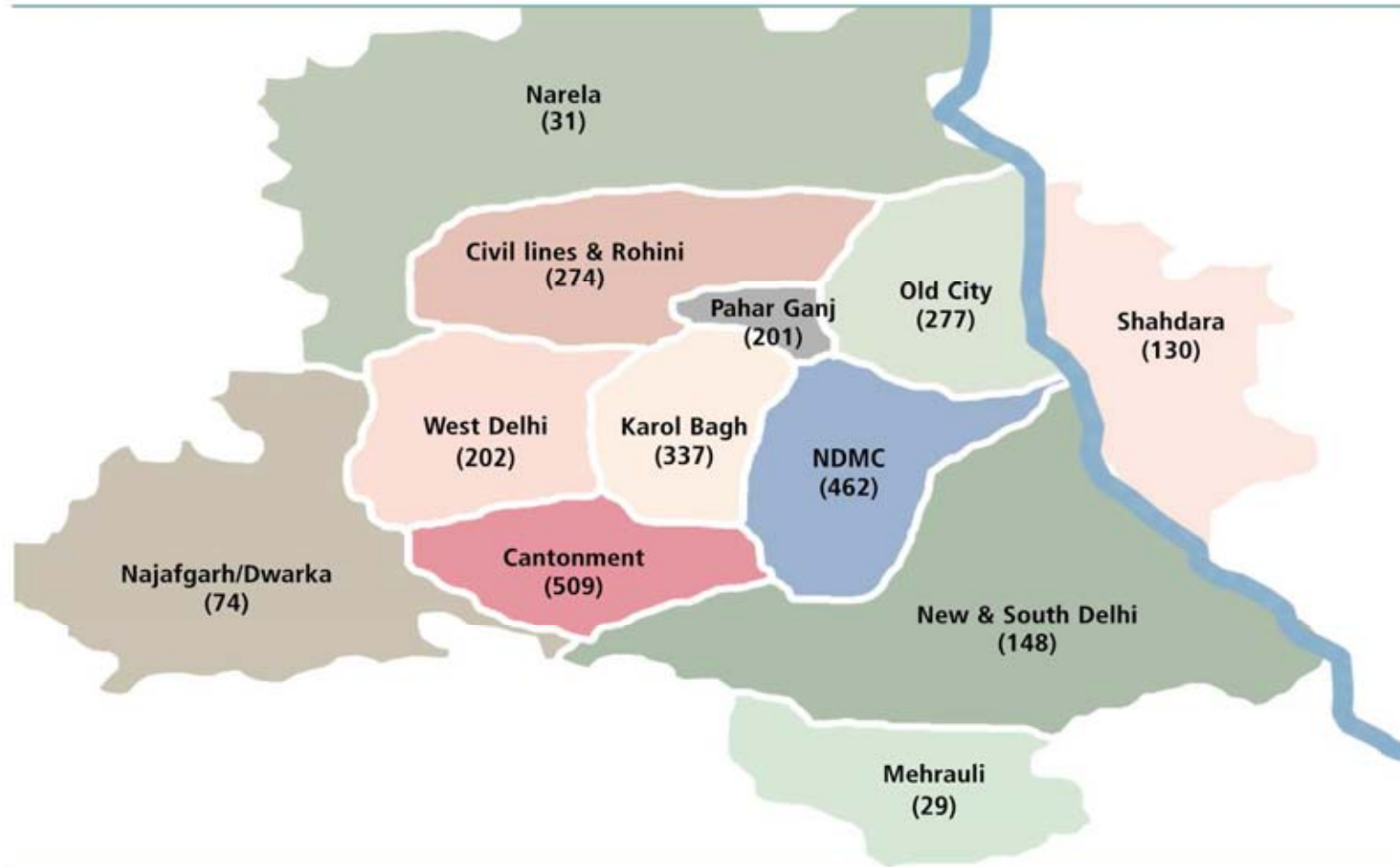
Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi





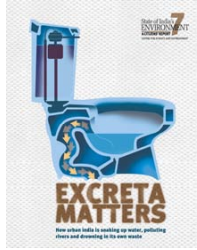
= ‘Official inequity’

#### DELHI: CAPITAL INEQUITY (IN LPCD)



LPCD: Litres per capita daily; NDMC: New Delhi Municipal Corporation

Source: Sunita Narain et al 2007, *Sewage Canal: How to Clean the Yamuna*, 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

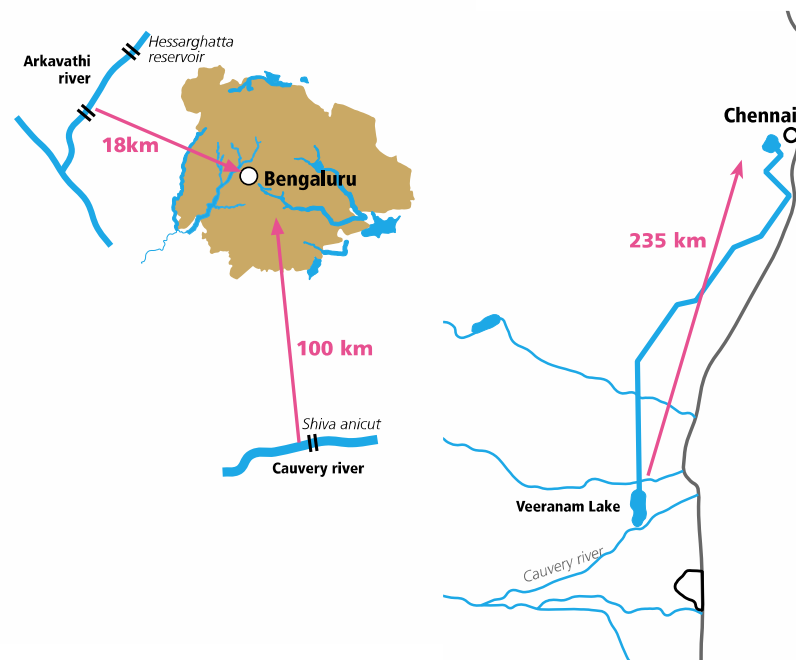
Build, pipe, pump and do not worry about supply



## THE SEARCH FOR WATER IS MAKING CITIES GO FURTHER AND FURTHER AWAY

City	Traditional source	Distance from city	Subsequent source	Distance from city	Current/Future source	Distance from city
Agra	River Yamuna	Within the city	River Yamuna	Within the city	Mathura-Vrindavan water supply scheme	400 km
Rajkot	Barrages on river Aji	11 km	Bhadar dam (River Bhadar)	65 km	River Narmada water from Malia canal	400 km
Delhi	Stepwells	Within the city	Tehri dam (River Ganga)	Over 300 km	Renuka dam	325 km
Chennai	Redhills and Poondi lakes	50-70 km	Veeranam lake	235 km		
Jodhpur	Stepwells and lakes	Within the city	Indira Gandhi Canal	205 km		
Aurangabad	Shallow wells	Within the city	Nath Sagar dam	42 km	Nandur Madhmeshwar dam (River Godavari)	185 km
Dewas	Stepwells	Within the city	River Shipra	12 km	River Narmada	168 km
Bhilwara	Meja dam	11 km	Groundwater from bed of river Banas	9 km	Bisalpur dam (River Chambal)	138 km
Tumkur	Maidala tank	Within the city	Bugudanahalli reservoir	8 km	Hebbaka tank Hemavati dam	133 km
Mathura	Groundwater (shallow wells)	Within the city	Groundwater and River Yamuna	Nearby	Upper Ganga Canal	130 km
Mumbai	Prior to 1870, shallow wells	Within the city	Bhatsa, Tansa, Upper Vaitarna, Tulsi, Vihar lakes	100-110 km	Middle Vaitarna	120 km
Hyderabad	River Musi and Hussain Sagar lake	Within the city	Osman Sagar lake Himayat Sagar lake	15 km 9.6 km	Manjira, Singur IV & Nagarjuna Sagar dams	59-80 116 km
Solapur	Hipparaga lake	Nearby city	River Bhima and Ujani dam	27 km 110 km		
Bengaluru	River Arkavathi	25 km	River Cauvery	100 km & 1,000 m below city		
Jhansi	Shallow, open wells	Within the city	Matatila dam on river Betwa	45 km	Rajghat dam on river Betwa	95 km
Surat	Borewells and ranney wells	Within the city	River Tapi (Ukai dam)	90 km	River Tapi	5 km
Gurgaon	Groundwater (shallow wells)	Within the city	Groundwater and Yamuna canal	69 km	Yamuna canal (through pipeline)	70 km
Indore	Yashwant Sagar dam and Bilawali tank	8-12 km	River Narmada	70 km		
Bhopal	Upper and Lower lakes	Within the city	Kolar dam	44 km	River Narmada	67 km
Kozhikode	The Poonurpuzha river	Within the city	River Chaliyar	20 km	Peruvannamuzhi reservoir	55 km & 500 m above MSL

continued...

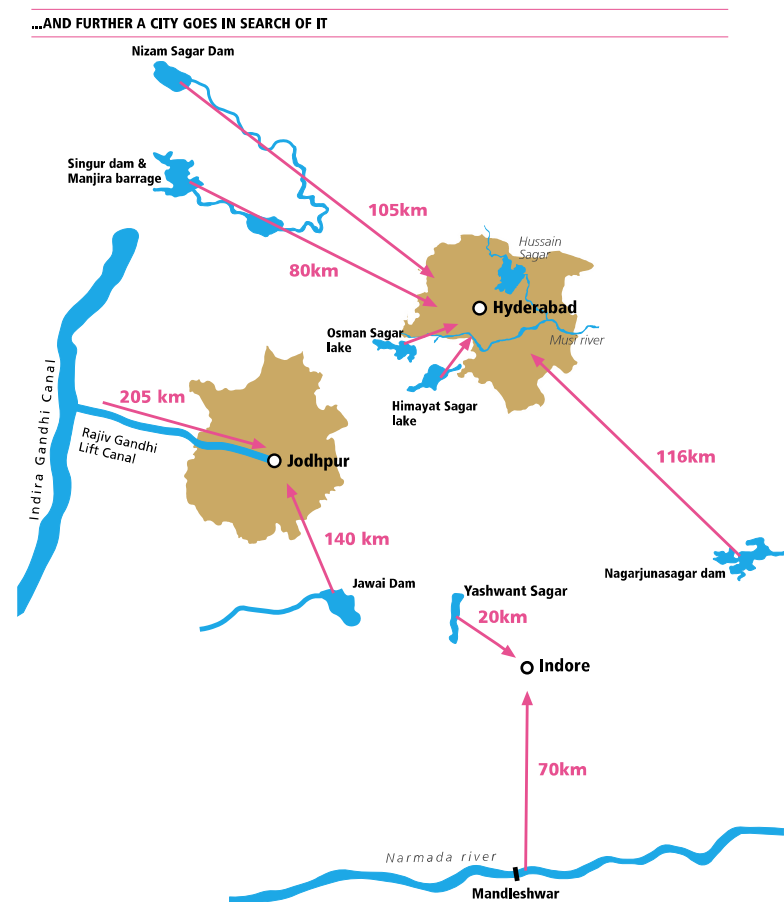


Source: Anon 2011, 71-City Water-Excreta Survey, 2005-06, Centre for Science and Environment, New Delhi

City	Traditional source	Distance from city	Subsequent source	Distance from city	Current/Future source	Distance from city
Thane	Shallow open wells	Within the city	Bhatsa dam,	58 km	Temghar dam	26 km
Hubli-Dharwad	Shallow wells	Within the city	Neera Sagar lake and Malaprabha reservoir	30 km & 55 km	Malaprabha reservoir	30/55 km
Udaipur	Stepwells and lakes	Within the city	Jaisamand lake	50 km	Mansi, Wakal and Dewas dams	42-45 km
Baramati	Left bank canal from river Neera	Near city	Ujani dam (River Bhima)	50 km		
Thiruvananthapuram	Aruvikkara dam across river Karamana	16 km	Peppara dam (River Karamana)	45 km		
Nagpur	River Kannan Gorewada lake	20 km 10 km	Pench dam	45 km		
Bhubaneswar	Rivers Kuakhai and Daya	2-3 km	River Mahanadi	30 km	Mundali dam	40 km
Dhanbad	Shallow open wells	Within the city	Topchanchi lake River Damodar	20 km 22 km	Maithan dam across river Barakar	35 km
Gwalior	Shallow open wells	Within the city	Tighara dam	27 km		
Srinagar	Shallow wells and Dal lake	Within the city	River Doodhganga Harvan Tarn	15 km 21 km	Sindh nullah (tributary of river Jhelum)	25 km
Ujjain	River Kshipra	Within the city	River Gambir	22 km		
Dehradun	Open wells and springs	Within the city	Groundwater, springs and canals	8-10 km	Dam on river Song	20 km
Ranchi	Shallow wells	Within the city	Kanke and Rukka dams and Dhurwa reservoir	7-20 km		
Aizawl	Springs and rooftop rainwater	Within the city	Tlawng river	18 km & 1,000 m below		
Jaipur	Ramgarh lake	27 km	Groundwater	Within the city	Bisalpur dam	12 km
Pune	Open wells and shallow borewells	Within the city	Khadakwasla dam	12 km		
Mussoorie	Spring water from Jinsi and Bhilaru	6-7 km down the valley	Spring water from Jinsi and Bhilaru	6-7 km down the valley	Hardy Falls	10-12 km
Uttarkashi	River Assi Ganga	8 km	Kohri Ghad	11 km	Basunga spring	5 km
Kanpur	River Ganga (shallow wells)	Within the city	River Ganga (shallow wells)	Within the city	Luv-Kush Barrage (River Ganga)	10 km
Hazaribagh	Hazaribagh lake	3 km	Chharwa dam	8 km		
Srikakulam	Shallow open wells	Within the city	River Nagavali	5 km		

MSL: mean sea level; m: metre; km: kilometre

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



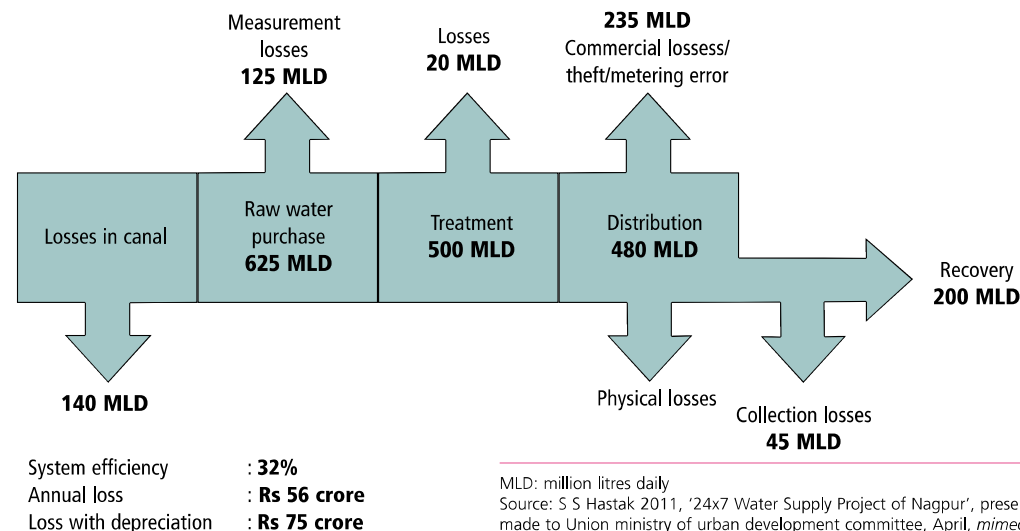
Source: Anon 2011, 71-City Water-Excreta Survey, 2005-06, Centre for Science and Environment, New Delhi



# Nagpur: **lost** accounts

- Only city with accounts of **where** water is lost
- **765 mld** – sourced from tiger reserve of Pench – 45 km away. Ends with **200 mld**

## DRIP DROP OFF: NAGPUR'S WATER HIGHWAY ILLUSTRATES HOW WATER GETS LOST





# Water highway: **losses, costs**

- Every city reports 30-50% water lost in distribution. **Adds** to cost

**71-CITY SURVEY: IF ONLY THE LEAKAGES COULD BE PLUGGED**

		Cost of total water supply (Rs/kl)	Cost after leakage loss (Rs/kl)	Average (Rs/kl)	<div> <div>Total water supply</div> <div>After leakage loss</div> </div>
Metros	Bengaluru	13	21		
	Chennai	12	17		
	Indore	11	17		
	Mumbai	11	15		
	Delhi	9	18		
	Dhanbad	9	11		
	Hyderabad	6	11		
	Jaipur	6	11		
	Rajkot	6	8		
	Vadodara	6	9		
	Meerut	0.8	1		
Class I	Aizwal	54	83		
	Khanna	14	18		
	Alwar	9	12		
	Jodhpur	9	11		
	Kozhikode	8	12		
Class II & III	Nainital	17	20		
	Mussoorie	17	24		
	Raman	2	3		
	Uttarkashi	2	3		
	Goniana	2	2		

kl: kilolitre;

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



# Less water, **more expensive**

- Energy costs of water supply crippling

## IT TAKES MORE MONEY TO SUPPLY WATER, THE FURTHER...

City	Source	Distance	Cost to supply (Rs/kl)
Aizawl	River Tlwan	1,000 metres down the valley, 18 km away	53.90
Bengaluru	River Cauvery	100 km from the city	12.70
Chennai	Lakes, groundwater and Veeranam lake	60-235 km	11.60
Delhi	River Yamuna and groundwater	Across the city	8.70
Indore	River Narmada	70 km	11.00
Jodhpur	Indira Gandhi Canal	205 km	8.70
Mussoorie	Springwater: Bhilaru, Jinsi, Khandighat, Murray, Mount Rose and Dhobighat	6-7 km down the valley	16.80
Mumbai	Bhatsa, Vihar, Tulsi, Tansa, Upper Vaitarna	100-110 km	10.70
Hyderabad	River Krishna	116 km	6.40-18

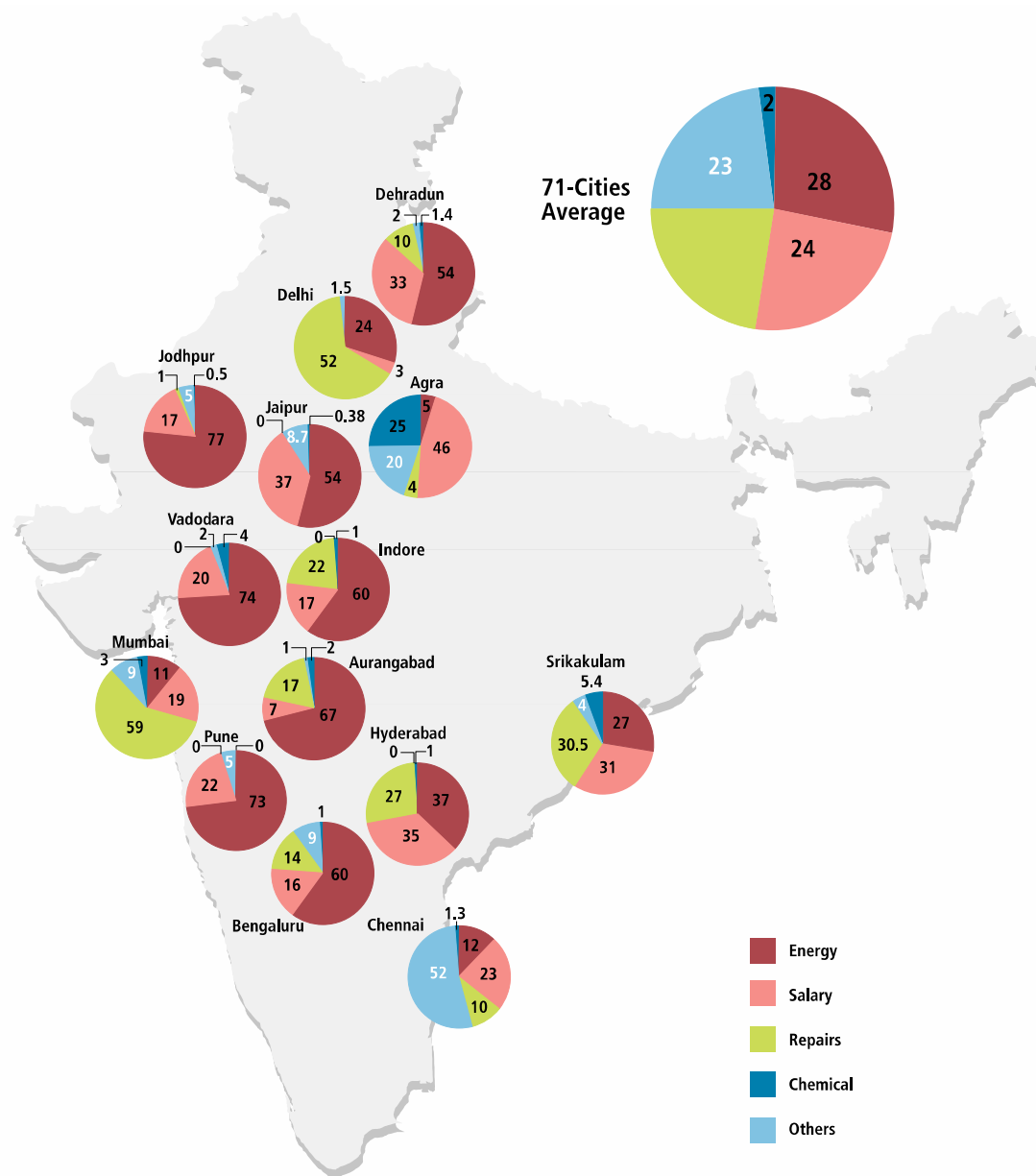
kl: kilolitre

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



Cost of energy  
high and  
growing  
component of  
water supply

COMPONENTS OF WATER SUPPLY IN DIFFERENT CITIES (IN PER CENT)



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



# Groundwater: **abused**

**2.** Water supply does not reach all, only few. No alternative but to move to groundwater

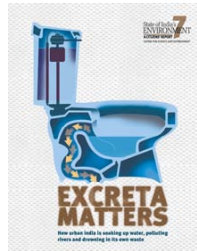
But this is not accounted for

Cities only consider 'official' groundwater use

Millions depend on private wells, tanker mafia, bottled water

**No recognition** of this water source; **no respect** for its management



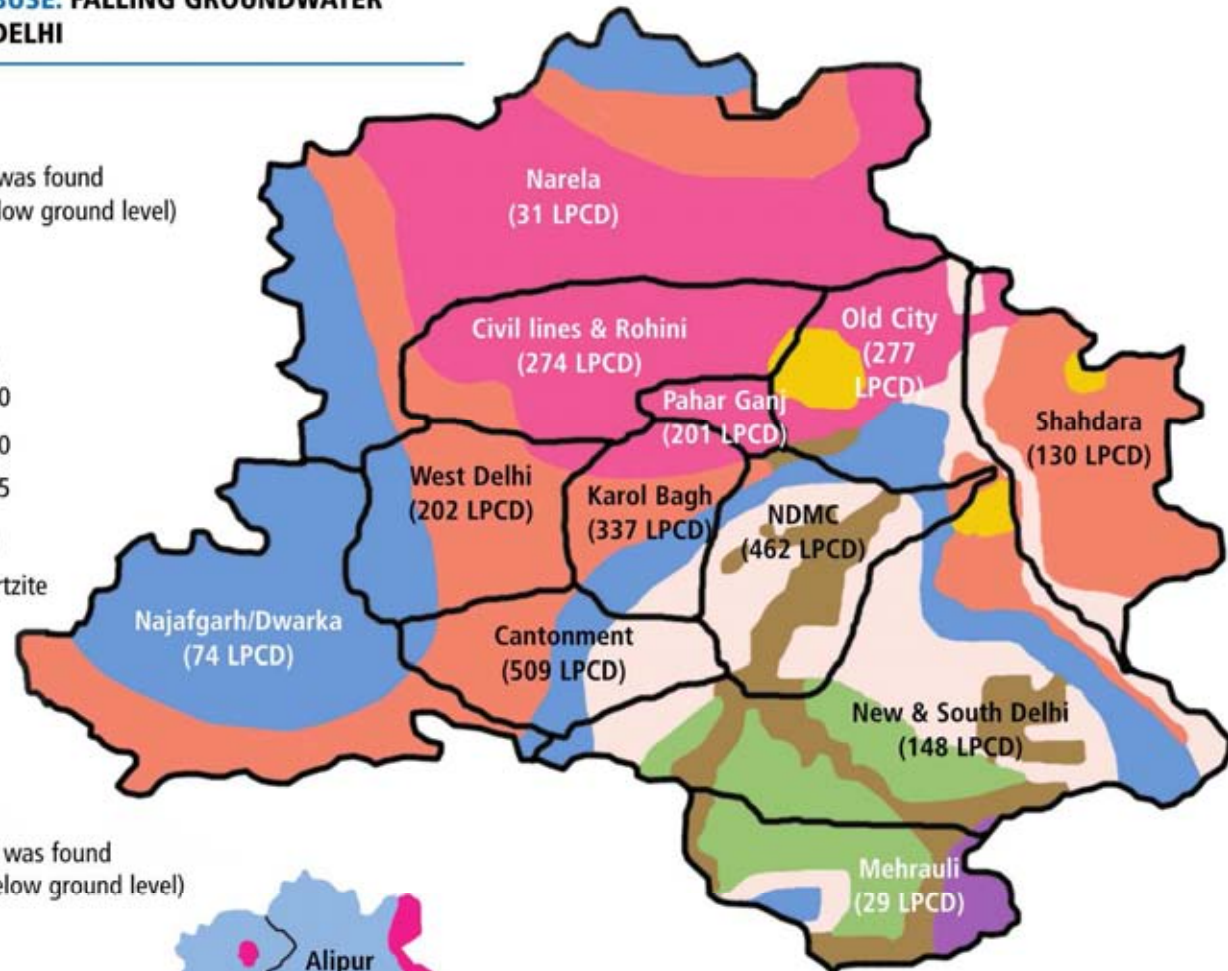


Where  
pipeline  
does not  
reach  
People  
depend on  
groundwater  
Falling  
groundwater  
levels tell us  
about  
inequity

## AQUIFER ABUSE: FALLING GROUNDWATER LEVELS IN DELHI

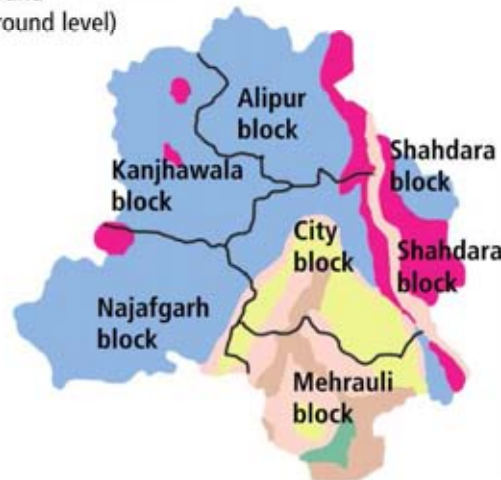
**MAY 2002**

Where water was found  
(in metres, below ground level)

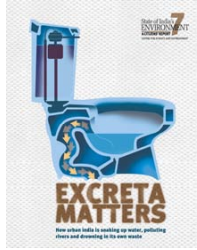


**1960**

Where water was found  
(in metres, below ground level)



LPCD: Litres per capita daily  
Source: Central Ground Water Board, 2002



## Lakes: **Present lost**

**3.** Groundwater is not not considered as critical for water supply, recharge is neglected

Land is valued, **water is not**

No legal protection for city lakes, catchment and drainage systems

Sponges of cities being destroyed. **Deliberately**



## Ahmedabad:

built over its water

Case in high court to  
protect lakes

Fought by builders

Do not want catchment  
protected

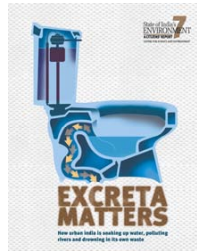
Do not want area around  
lake demarcated

### CITY OF LAKES AND FAKES

The 137 lakes of Ahmedabad, as listed by the collector's office.  
65 of these are already been built upon, found the AMC



Source: Sopan Joshi 2002, 'Concrete Drama', *Down To Earth*, Vol 11 No 3, June 30, Society for Environmental Communications, Delhi

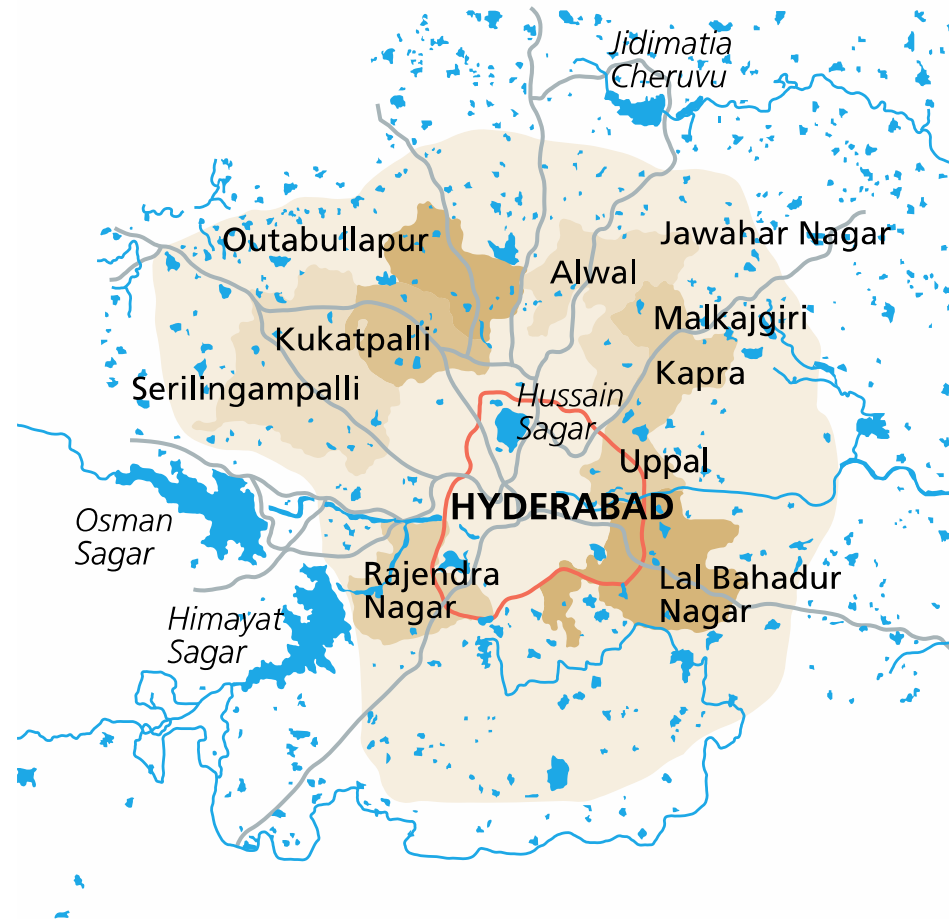


**Hyderabad:**  
Built airport on  
catchment of Himayat  
Sagar

---

## HYDERABAD: LOST GLORY

---



---

Source: Chigurupati Ramachandraiah and Manikoda Vedakumar 2007, 'Hyderabad's Water Issues and the Musi River: need for Integrated Solutions', paper presented in the International Water Conference, Berlin, September 1-4, *mimeo*

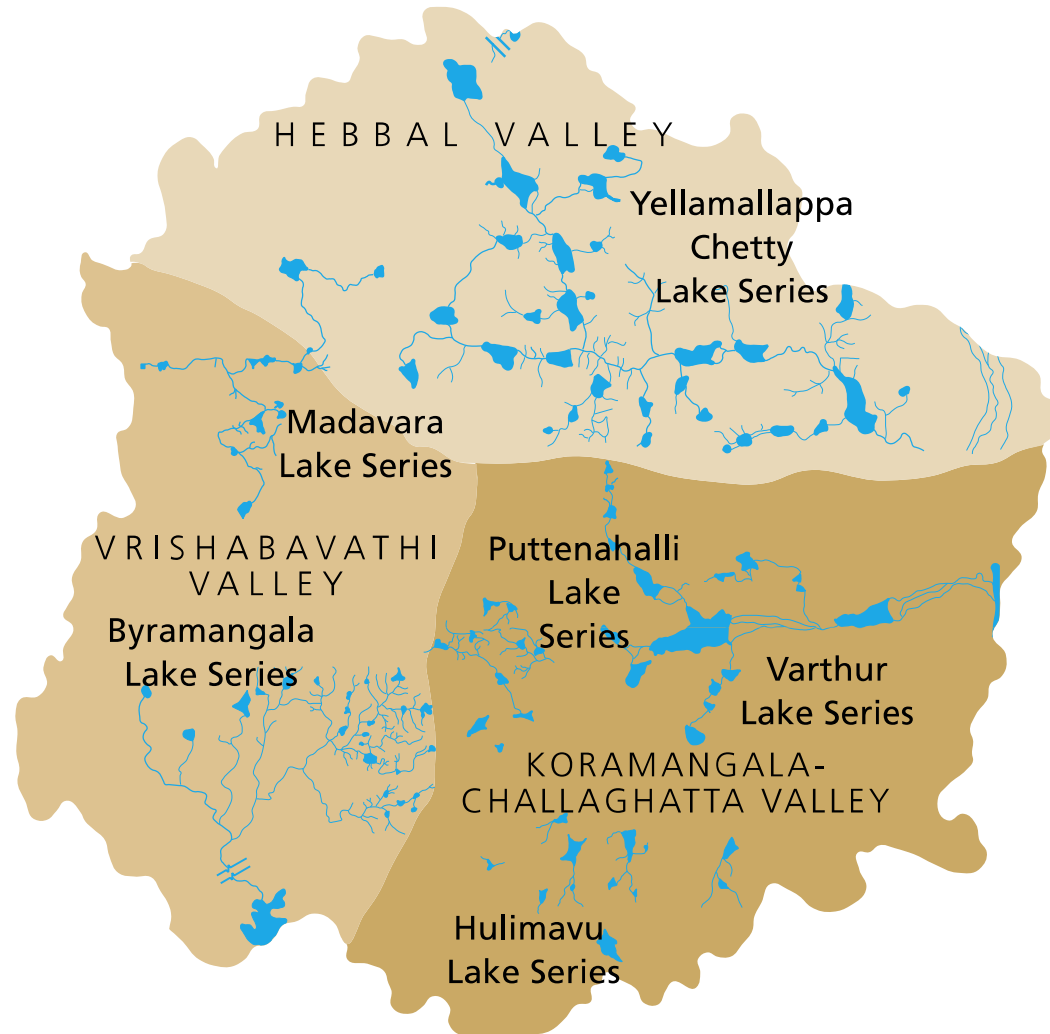
---



---

## BENGALURU: CORRUPTION HAS EATEN AWAY AT THE CITY'S FEBRILE LAKE SYSTEM

---

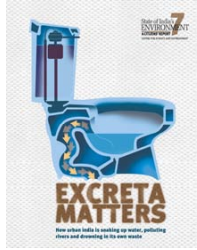


---

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

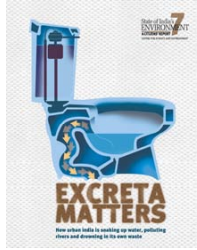
---





# Lakes: **Future lost**

- Climate change is new threat
- Extreme rainfall events will grow
- More rain, fewer rainy days
- Cities need sponges to capture rain, recharge for scarcity
- But not considered in planning
- Cities **see land**, not water



# Nobody knows: **or cares**

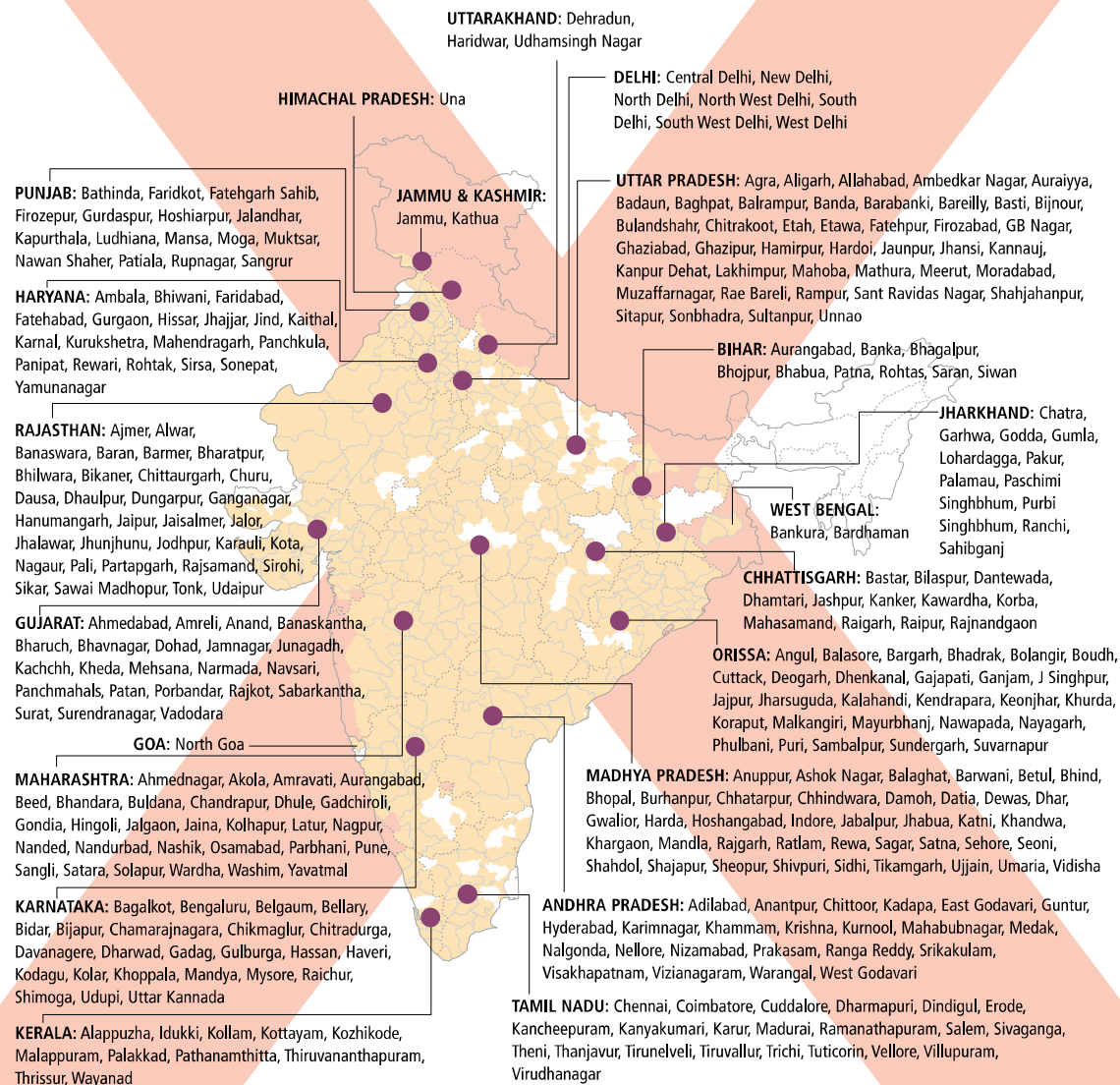
- Little monitoring of groundwater levels in cities – roughly 40 cities with 2 observation wells. Inadequate to measure
- But what is known shows:
  1. Water levels falling dangerously
  2. Cities unable to regulate private groundwater
  3. Water becoming more polluted – nitrate levels growing. Sign of **sewage** in water

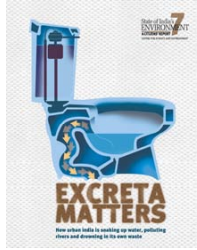




## Localised presence of nitrate at a level more than 45 mg/l in groundwater in different states of India

Nitrate > 45 mg/l in water means that water is not fit to drink.  
Nitrate contamination in groundwater is a sure sign that excreta has leached into the aquifer





# Water=waste

## 4. Cities plan for water, **forget waste**

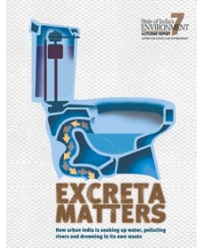
80% water leaves homes as sewage

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



## Excreta: **sums**

- 2009:

Sewage generated = 38,255 mld

Capacity to treat = 11,788 mld (30%)

Sewage actually treated = 8,251 mld (22%)

**78 % sewage** is officially untreated and disposed off in rivers, lakes, groundwater

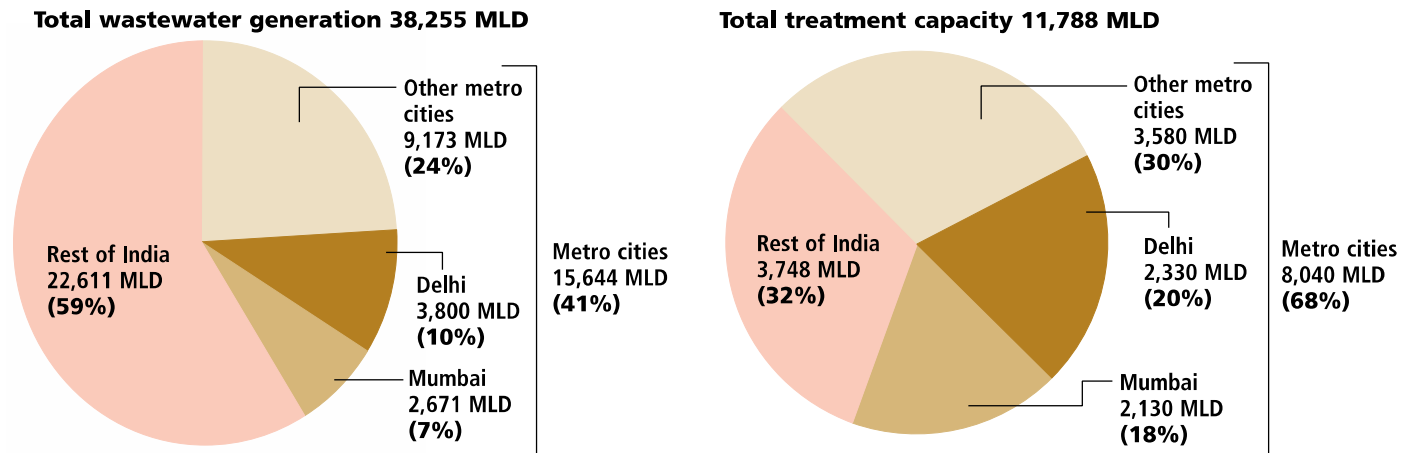
**We flush, we forget**



# Excreta: **more** sums

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

## TWO METROS: DISPROPORTIONATE TREATMENT



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



# Planning for hardware

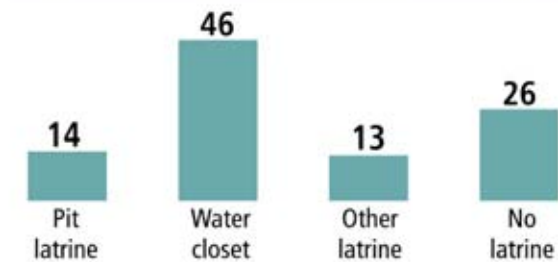
## 5. Cities plan for treatment not sewage

- 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 sewage But engineers sell pipe-dreams of **catching up with infrastructure**
- Politicians buy pipe-dreams
- We lose rivers. Generations of **lost rivers**



## • Don't know our toilet maths

**2001 CENSUS OF INDIA: URBAN HOUSEHOLDS  
ACCORDING TO TOILET TYPE (IN PER CENT)**



Source: Anon 2004, *Housing Atlas of India 2001*, Office of the Registrar General, Government of India, Delhi

### FOR NOW, CHANGING DEFINITION OF TOILET MAKES COMPARISON ODIUS (HOUSEHOLDS; IN PER CENT)

	No toilet	Service latrine <sup>a</sup>	Septic tank <sup>b</sup>	Pour flush <sup>c</sup>	Sewage system <sup>d</sup>	Others
54th Round (1998)	25.5	5.9	35.2	8.4	22.5	2.5
58th Round (2002)	17.9	4.1	70 <sup>1</sup>	6.3 <sup>1</sup>	—	
65th Round (2008-09)	11.3	1.6	77.3	8	—	1
NFHS (2005-06)	16.8	24.2 <sup>2</sup>	27.6		18.8	12.6

a Non-sanitary latrine where excreta is accumulated at the excretion spot and physically removed

b Connected to underground septic chamber

c Flush toilet and soak pit where liquid is leached out from the pit to be dispersed in the soil system

d Off-site sanitation system and connected to underground pipeline

<sup>1</sup> By this survey definition is changed and toilets connected to septic tanks/flush are combined and pit latrines introduced

<sup>2</sup> All other systems combined, including shared latrines

Source: Anon 2010, *Housing Condition and Amenities in India, 2008-09*, NSSO 65th Round, July 2008-June 2009, National Sample Survey Office, Ministry of Statistics and Programme Implementation, Government of India, Delhi



## Counting toilets: Important sums

### CENSUS 2011 DOES NOT CONFUSE TOILETS WITH DISPOSAL SYSTEMS: DATA WILL BE MUCH BETTER

Census 2001	Census 2011 (data awaited)	National Family Health Survey (NFHS-3): 2005-06 (urban, %)
No latrine	<b>Flush/pour toilet latrine connected to</b>	<b>57.2</b>
Service latrine	a. Piped sewer system	18.8
Pit latrine	b. Septic system	27.6
Water closet	c. Pit latrine	4.7
	d. Others (including no connection)	6.1
	<b>Pit latrine</b>	
	a. With slab/ventilated improved pit	1.4
	b. Without slab/open pit	0.7
	c. Night soil disposed into open drain	
	<b>Service latrine</b>	
	a. Night soil removed by humans	
	b. Night soil serviced by animals	
	<b>No latrine within premises</b>	
	a. Public latrine	24.2
	b. Open	16.8

Source: Anon 2011, *Provisional Population Totals, India Series 1*, Census of India, Office of the Registrar General and Census Commissioner, India; Anon 2007, *National Family Health Survey (NFHS-3) 2005-06, Volume 1*, International Institute of Population Sciences, Mumbai

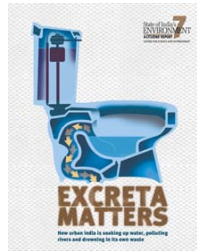




# Counting toilets: 2011

Census 2001	Census 2011	
No latrine	<b>Flush/pour toilet latrine connected to</b>	<b>72.6</b>
Service latrine	a. Piped sewer system	32.7
Pit latrine	b. Septic system	38.2
Water closet	c. Other system	1.7
	<b>Pit latrine</b>	
	With slab/ventilated improved pit	6.4
	Without slab/open pit	0.7
	Night soil disposed into open drain	1.2
	<b>Service latrine</b>	
	Night soil removed by human	0.3
	Night soil serviced by animals	0.2
	<b>No latrine within premises</b>	
	Public latrine	6.0
	Open	12.6

Source: Census of India 2011, Houses, Household Amenities and Assets: Latrine Facility,



**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**

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

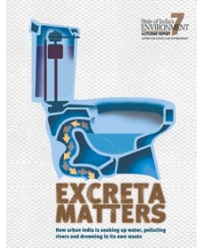
% of area covered

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



# Bengaluru: **not** reaching

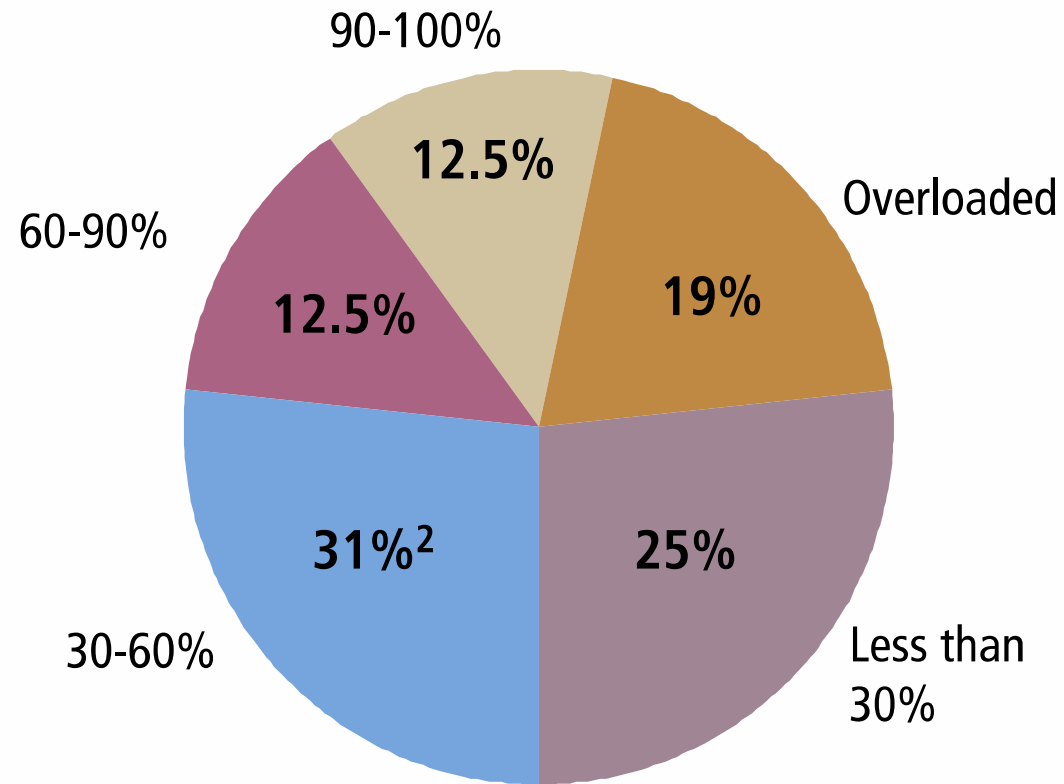
- 3610 km of sewage pipes
- 14 sewage treatment plants = **781** mld
- Generates 800-1000 mld of sewage
- **But treats only 300 mld**
- Rest does not reach
- Now plans to build 4000 km more
- **Builds, grows and more lines need repair**
- Catch-up that does not catch-up



---

## HOW DELHI USES SEWAGE TREATMENT PLANTS (2008)

---



---

Source: Anon 2009, *Economic Survey of Delhi 2008-2009*, Planning Department, Government of NCT, Delhi

---



# Partial treatment=pollution

## 6. Cities do not control pollution

Cost of building system is high

- City can build sewage 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**



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

**Delhi**

**Has 20 drains**

**Has 17 STP**

**Capacity exists**

**But Yamuna dead**

**Why?**

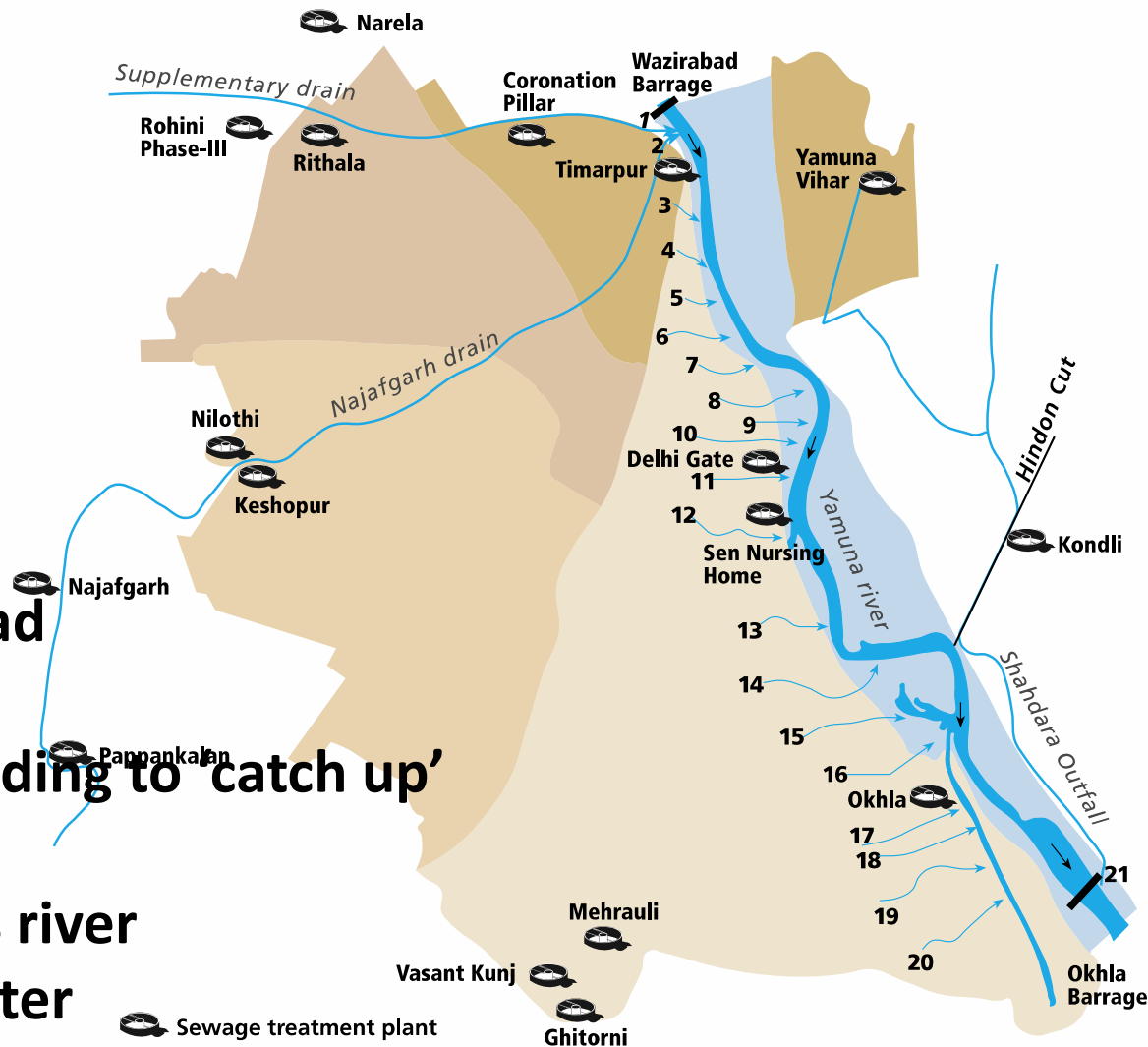
**Delhi keeps building to 'catch up'**

**Can't**

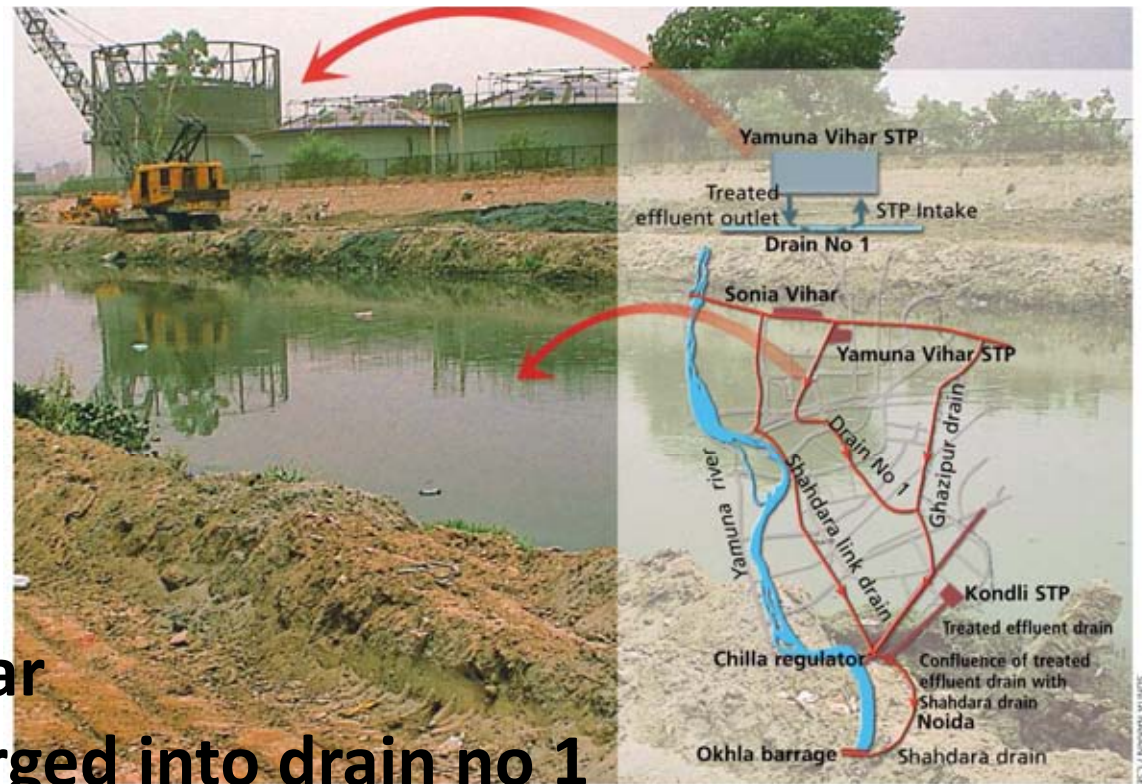
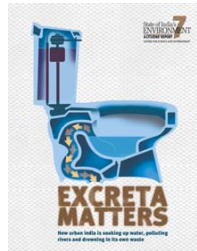
**Sewage reaches river**

**River has no water**

**Only sewage**



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



Drain no 1 links past the Yamuna Vihar Sewage Treatment Plant, which picks up its wastewater, treats it, only to then flush the treated effluent back

Source: Survey, 2005-06, Centre for Science and Environment, New Delhi

Treats in Yamuna Vihar  
Clean effluent discharged into drain no 1  
Drain No 1 also picks up effluent  
People not connected sewage  
Treats at Kondli  
Clean effluent discharged into Shahdara  
Shahdara drain already full of waste  
**Treats but does not clean**





## Take Gurgaon

Sewage of majority not intercepted

Flows to Najafgarh jheel

Flows to Najafgarh nallah

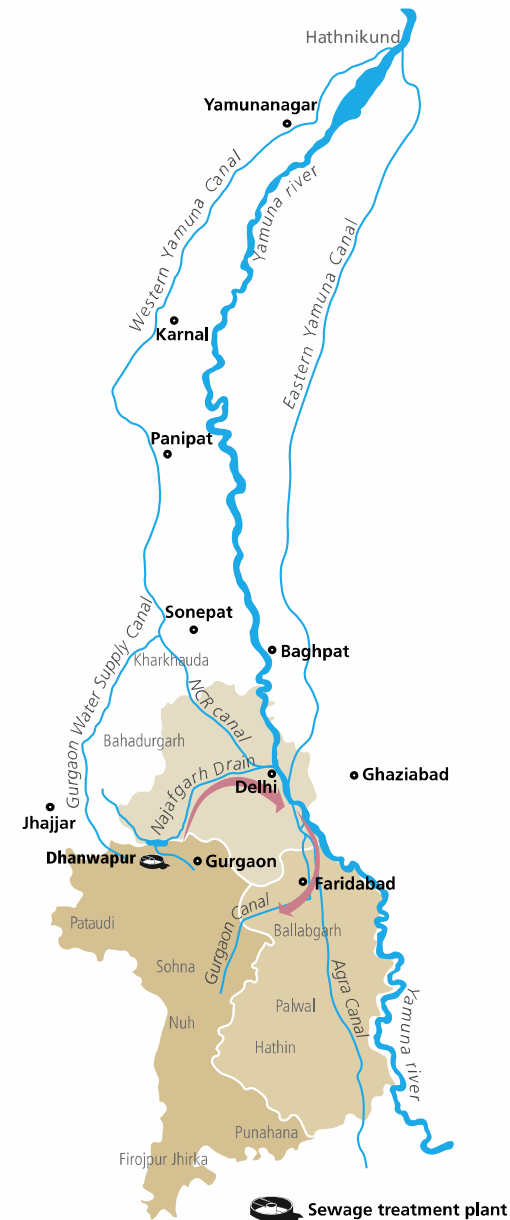
Down the Yamuna

Gurgaon picks it up after

Okhla for use

Merry-go-around of sewage

## MERRY-GO-ROUND II: NEW INDIA'S SEWAGE TANDAV



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



## 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

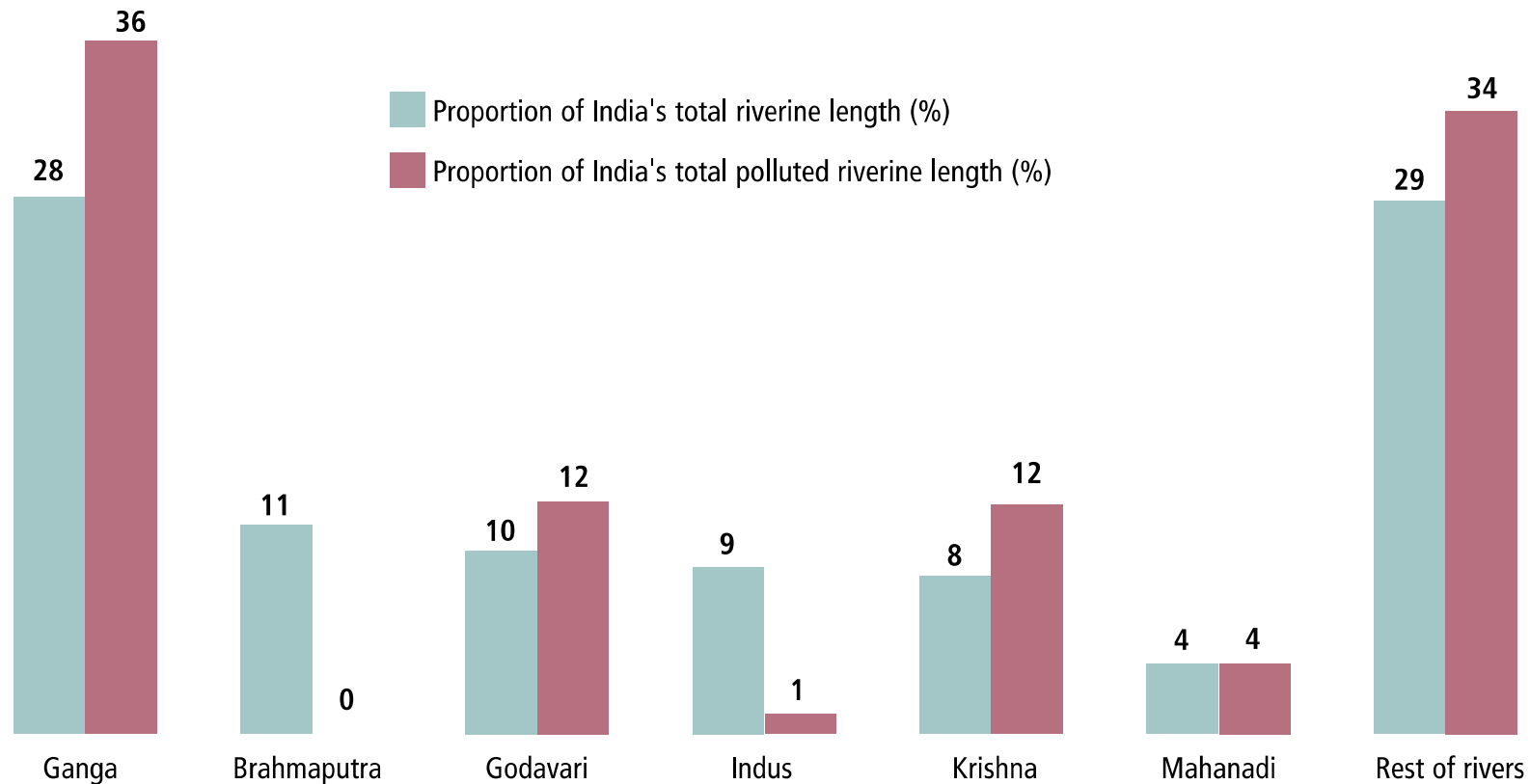
### MERRY-GO-ROUND I: CHASING EFFLUENTS IN CHENNAI



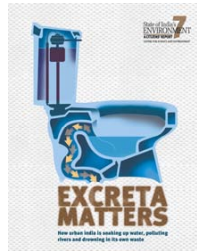


# Rivers: **dying and dead**

## THE STATE OF INDIA'S RIVERS: THE EXTENT RIVER STRETCHES ARE POLLUTED



Source: R C Trivedi 2007, *Pollution in our rivers: the CPCB perspective*, presentation, New Delhi, June, mimeo



**We all live downstream**





**Agra:** will spend more on treating water than it costs to treat sewage

144 mld

water treatment plant

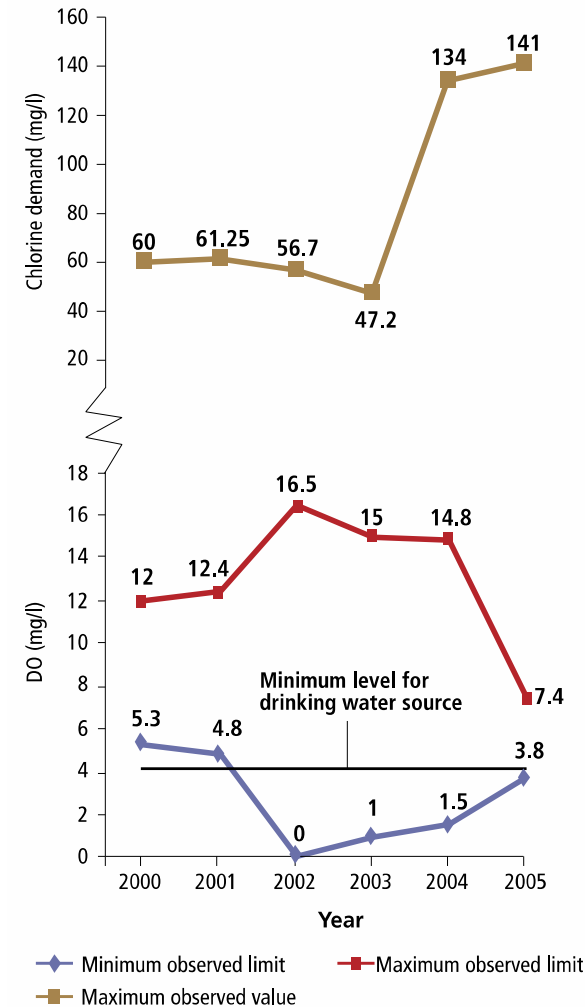
Capital cost: Rs 1 crore/mld

Operation costs: Rs 3-4/kl

Cities forget:

**we all live downstream**

#### UNDOING UPSTREAM DAMAGE: CHLORINE DEMAND AT AGRA WATER INTAKE POINT (MG/L)



mg/l: milligramme per litre; DO: Dissolved Oxygen

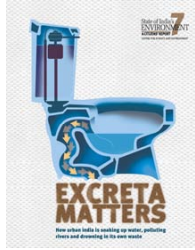
Source: Sunita Narain et al 2007, *Sewage Canal: How to Clean the Yamuna*, Centre for Science and Environment, New Delhi



# Generation of **lost** rivers

- Delhi knows only Najafgarh – a dirty drain of Yamuna
- Delhi does not remember that this was Sahibi – which once flowed from the Aravalli into a jheel
- Mumbai knows only Mithi – a dirty drain. It even calls it a drain. But this was its river
- Ludhiana knows Budha Nullah as a drain. But this was a darya – a river

Generation of lost rivers. **How many more will we have to lose before we remember**



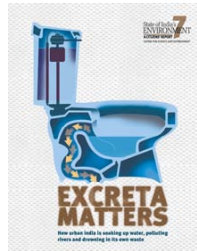
# Cannot pay **full** costs

## **7. Infrastructure is not simple answer**

Assumption that infrastructure is about costs is **flawed**

1. Water tariffs are high in many cases
2. Tariffs are high but recovery is poor because meters do not work
3. Poor pay high costs; money or with their health
4. Where tariffs are high, people move to groundwater; cities cannot recover
5. Water-sewage-pollution costs are high and **unaffordable by all**





# Need to charge for water

## But tariffs are already high

## Why are cities not being able to balance books?

### 71-CITY SURVEY: CITY DOMESTIC WATER TARIFFS ARE WIDE-RANGING, BUT NONE FACTOR IN SEWAGE

City	< 15 kl (Rs)	15-25 kl (Rs)	25-50 kl (Rs)	> 50 kl (Rs)
Rajkot <sup>1</sup>	12	12	12	12
Aizwal	10	10	20	30
Chennai	2.50 <sup>2</sup>	10	15	25
Guwahati	7	7	7	7
Kolkata	7	7	7	7
Bengaluru	6 <sup>3</sup>	8	12	30-36
Hyderabad	6	8	15	20-35
Kerala state (domestic)	4-5 <sup>4</sup>	6	6-14	25
Delhi	2 <sup>5</sup>	3	15	25
Mumbai	2.25	3.50-7.00	10	14
Bhilwara, Udaipur, Faridabad	1.50	1.50	2-3	3-4
Uttarkashi	1.25	1.25	1.25	1.25
Alwar	1.50	1.50	1.50	1.50

kl: kilolitre

<sup>1</sup> only 715 institutional buildings and high-rise buildings are metered. Residential houses pay a monthly flat rate

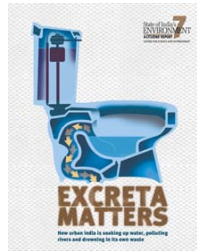
<sup>2</sup> plus Rs 50/house/month

<sup>3</sup> up to 15 kl

<sup>4</sup> up to 10 kl + Rs 20 charged

<sup>5</sup> up to 10 kl

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



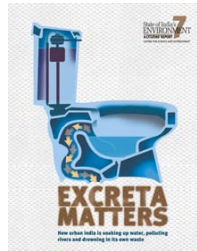
**Cities cross-subsidize with high tariff on industries and commercial**  
**But industries move to groundwater**  
**Unsustainability grows**  
**Cities unable to recover costs**

## IT IS A CROSS-SUBSIDY: WHAT CITIES CHARGE FOR INDUSTRIAL WATER USE

City	Commercial (Rs/kl)	Industrial (Rs/kl)
Agra	17.50	35
Amritsar	6.40	6.40
Allahabad	7.50	12.50
Alwar	4.68	11
Aurangabad	16	39
Bengaluru	36-60	60
Bhilwara	11-16.50	11-16.50
Bhubaneswar	8	8
Chennai	50-60	50-60
Cuttack	2.88	2.88
Delhi	10-100	10-100
Dhanbad	7	7
Gwalior	20	30
Hyderabad	35	35
Indore	11	22.50
Jabalpur	10.50	10.50
Kolkata	10	NA
Lucknow	6	6
Nagpur	12	20
Pune	16	16
Rajkot	12	12
Ujjain	25	25
Vadodara	10.80	10.80

kl: kilolitre;

Source: Compiled



# Under-recovery growing

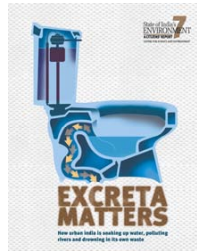
## This when only spent on water **and not sewage**

### 71-CITY SURVEY: THE BRUTE FACT OF LEAKAGE LOSS

	Expense, Rs/kl	Cost recovered, Rs/kl	Actual expenses (after leakage loss) on supply, Rs/kl	Actual cost recovered (after leakage loss), Rs/kl	Cost recovery (%)
<b>METRO</b>					
Delhi	9	4	18	8	47
Mumbai	11	13	15	18	118
Hyderabad	6	8	11	13	125
Bengaluru	13	12	21	20	96
Kolkata	3	1	5	1	19
Chennai	12	11	17	16	96
Kanpur	3	2	4	3	78
Pune	1	1	2	1	78
Surat	2	2	3	2	82
Jaipur	6	2	11	4	35
<b>CLASS I</b>					
Jabalpur	3	1	3	2	70
Aurangabad	4	1	5	2	33
Jodhpur	9	2	11	3	24
Ranchi	5	1	8	1	14
Guwahati	2	0.3	2	0.3	14
<b>CLASS II &amp; III</b>					
Mussoorie	17	8	24	12	50
Mansa	2	1	2	2	96

kl: kilolitre;

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



**Investment in sewage needed**  
**Priority**  
**But cost is high**  
**Will have to prioritize spending**  
**Plan differently**

**IT REALLY TAKES A LOT OF MONEY TO SUPPLY WATER AND TAKE CARE OF SEWAGE**

	Rs crore per MLD	Rs crore per km	Rs per connection	Per capita (Rs) <sup>1</sup>
Average cost of comprehensive water supply schemes (JNNURM) <sup>2</sup>	3.00			4,500
Augmentation of water supply schemes	2.00			3,000
Rehabilitation of water supply distribution scheme (laying pipelines) <sup>3</sup>		0.74-1.00	20,000-30,000	
Water treatment plants (cost depends on technology and quality of intake water)	0.22-1.00 <sup>4</sup>			330
Average cost of comprehensive sewage project, including collection network and treatment plant	3.33-6.00 <sup>5</sup>			4,000
Building underground sewage systems		0.74-1.25		
Sewage treatment plant	0.30-1.00			360-800
Sewage network – pumping stations and mains		0.80		

MLD: Million litres daily

<sup>1</sup> Water supply estimated at 150/LPCD and sewage generation at 120/LPCD

<sup>2</sup> Based on 36 schemes funded by the Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

<sup>3</sup> Depends on location and size of mains: smaller diameter lines cost Rs 0.50 crore/km. Most DPRs estimate costs at Rs 0.74 crore/km

<sup>4</sup> Agra will spend this amount because the intake water is extremely polluted

<sup>5</sup> Ganga programme



# Public **vs** Private?

- Not the question
- Investment is the issue
- Management is the issue
- Private sector experience in this sector limited
- Current contracts about public investment, private profit: **PIPP**
- Standard PPP will not work in this sector
- Not about building roads or airports



# Reform agenda

1. Prioritize public investment differently
2. Plan to cut costs of water supply
3. Invest in local 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



# Affordable water

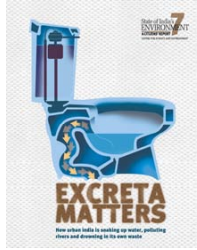
- **Agenda:** Cut costs of water supply
- Supply to all and not some
- Protect local water systems

To reduce losses in distribution; reduce costs of supply, cities must depend more on local water systems

Cities **must legislate** to protect local water bodies

**No new water supply scheme unless local water system is protected; local water is planned for**





# Reduced water

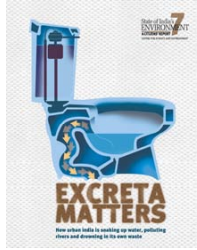
**Agenda:** Demand and not supply management

Promote water-efficient appliances

**Do not give more water to cities unless they  
reduce wastage, reduce intra-city inequity,  
reduce demand of water**

Promote **water-prudent** cities

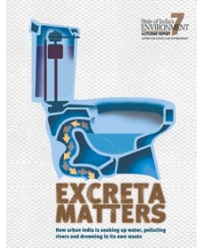
Promote **water-wise** societies



# Plan for **sewage**

## Agenda: Plan for sewage before water

- **No water scheme must be passed without sewage component**
- Costs of sewage must be designed
- Will force re-evaluation of technology to design for affordable solutions
- **Sewage must be our obsession**



# Plan **differently** for sewage

- Do not wait for underground sewage drain, pipe, pump, treatment plant to be built, repaired, or inaugurated
- Plan for sewage treatment now
- Use open drains as treatment zones
- Use lakes and ponds as treatment zones
- Treat locally so that treated water can be used locally



# Re-design flush toilet

**Agenda:** Re-design sewage for reuse

Close nitrogen-phosphorus cycle

Human waste is a resource

Question is to find affordable ways to treat waste as resource

Can be done



**Amarnath yatra:**  
in cold climate; high  
altitude; difficult  
conditions; sewage is  
treated using microbes  
Sewage is cleaned to less  
than 15 BOD  
**Waste is turned to water**  
and returned to  
hydrological cycle



*Cleaning the waste of millions: toilets are dosed with microbes and so don't smell; waste goes to a reed bed and oxidation tank.*



# Plan **deliberately** for reuse

**Agenda: plan for reuse of every drop of sewage**

Singapore treats waste to water

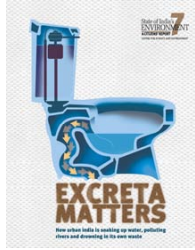
Expensive

We can treat waste for reuse in agriculture

Less expensive

Kolkata wetlands were city's kidney – flushed and cleaned waste. **But discounted**

Many other cities sewage used by farmers. But polluted. **Needs attention**

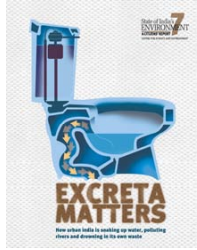


# Plan **with** knowledge

- Last assessment of industrial-urban water demand was in 1999
- Water supply is **simple** calculation:  
water demand **x** population
- Waste is simple calculation:  
water supply **x** 0.80
- As water supply not known, waste estimation off the mark. Water demand is not known

Rule is augment supply but don't worry about supply and never think of sewage





# Excreta does **Matter**

- Is about **affordable** urban growth
- Is about **inclusive** urban growth – planning for all and not some
- Is about **sustainable** urban growth – planning for true-green cities
- Is about our need to re-invent **growth without pollution**