Urban Water and Sewage Management

Challenges & potential for enabling paradigm shift

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May 01, 2013

CSE CCBP NURM Regional Workshop
at
Lucknow

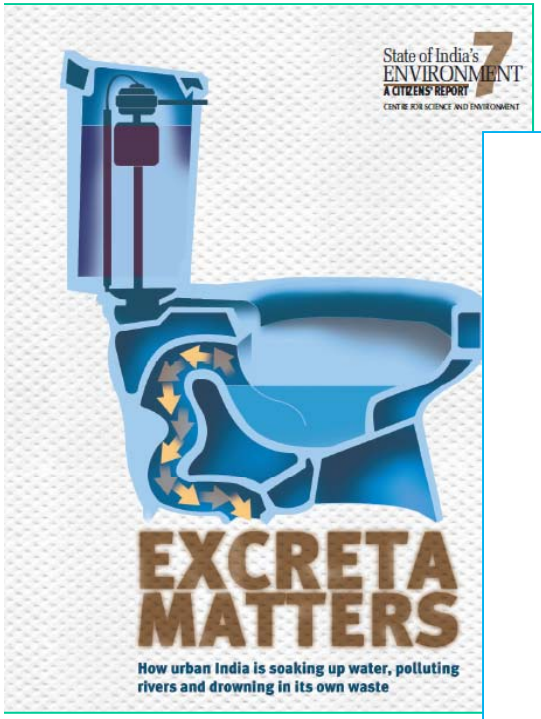
Structure of the Presentation

- Summary assessment of water (and sewage) management in India based on latest CSE publication – Excreta Matters (2012)

- CSE recommended - current reform agenda

- Challenges & Potential for Paradigm Change – Mainstreaming Best Management Practices.

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

Buy online at http://csestore.cse.org.in

Water & Sanitation – Official Statistics

Increase in accessibility & availability of water / wastewater infrastructure 1961-2011

but

Resource sustainability and Slippages in achieved targets are common feature of urban water /wastewater management in India

Urban Water Challenges in India

- Most cities are water stressed
- Many places industry is given sewage (in place of water)
- Every summer, there are riots, protests and sometimes killings
- Urban water bodies disappearing
- Is available water safe ?
- When rains come, it leads to flooding

Not a single city has 24-7 Water Supply in India

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

The water-sewage connection

The conventional way:

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

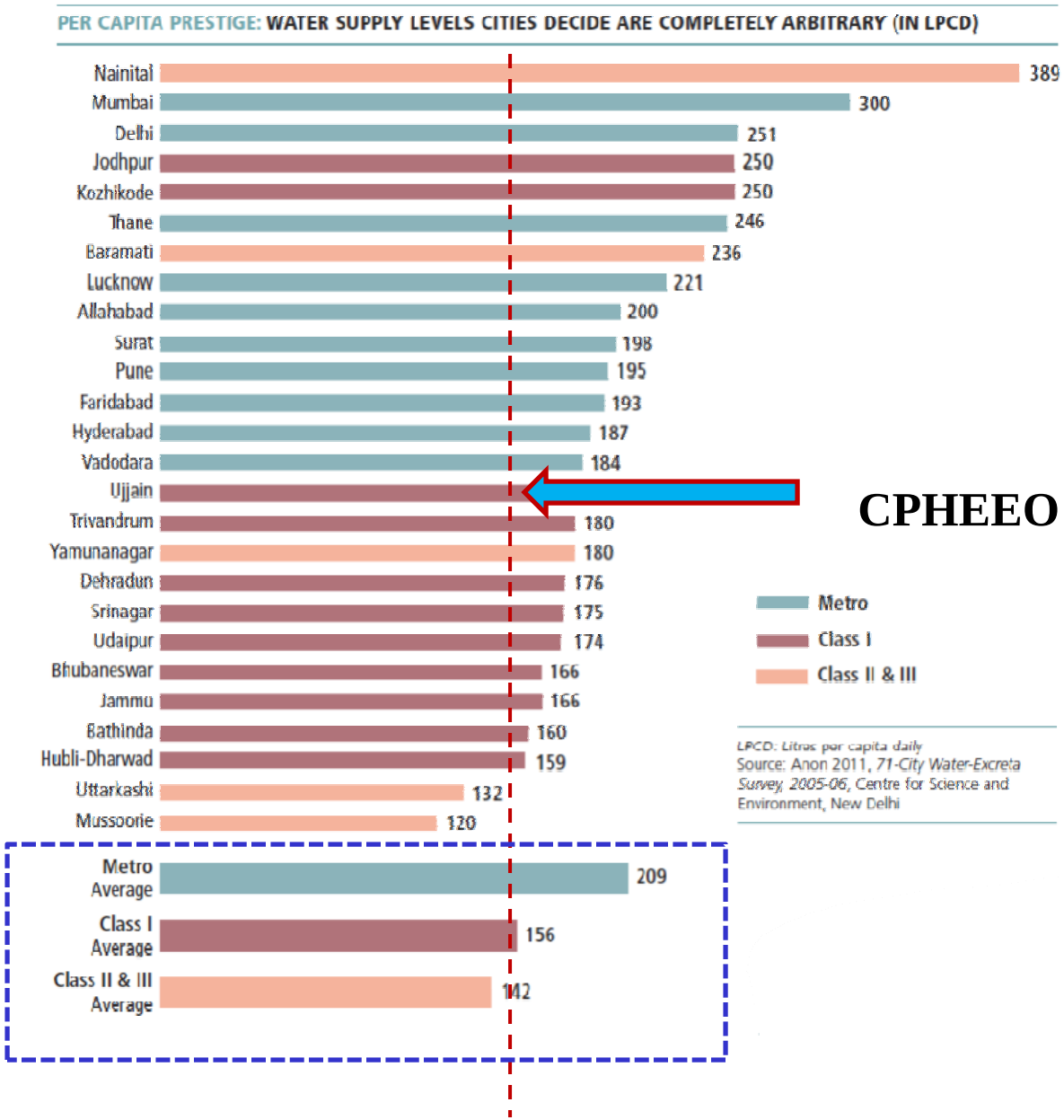
Flush and carry the waste out of the city – pipe, pump, divert, treat – further and further away.

How is urban water supply need calculated in India ?

Classification of towns/cities	Recommended maximum water supply levels (lpcd)
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

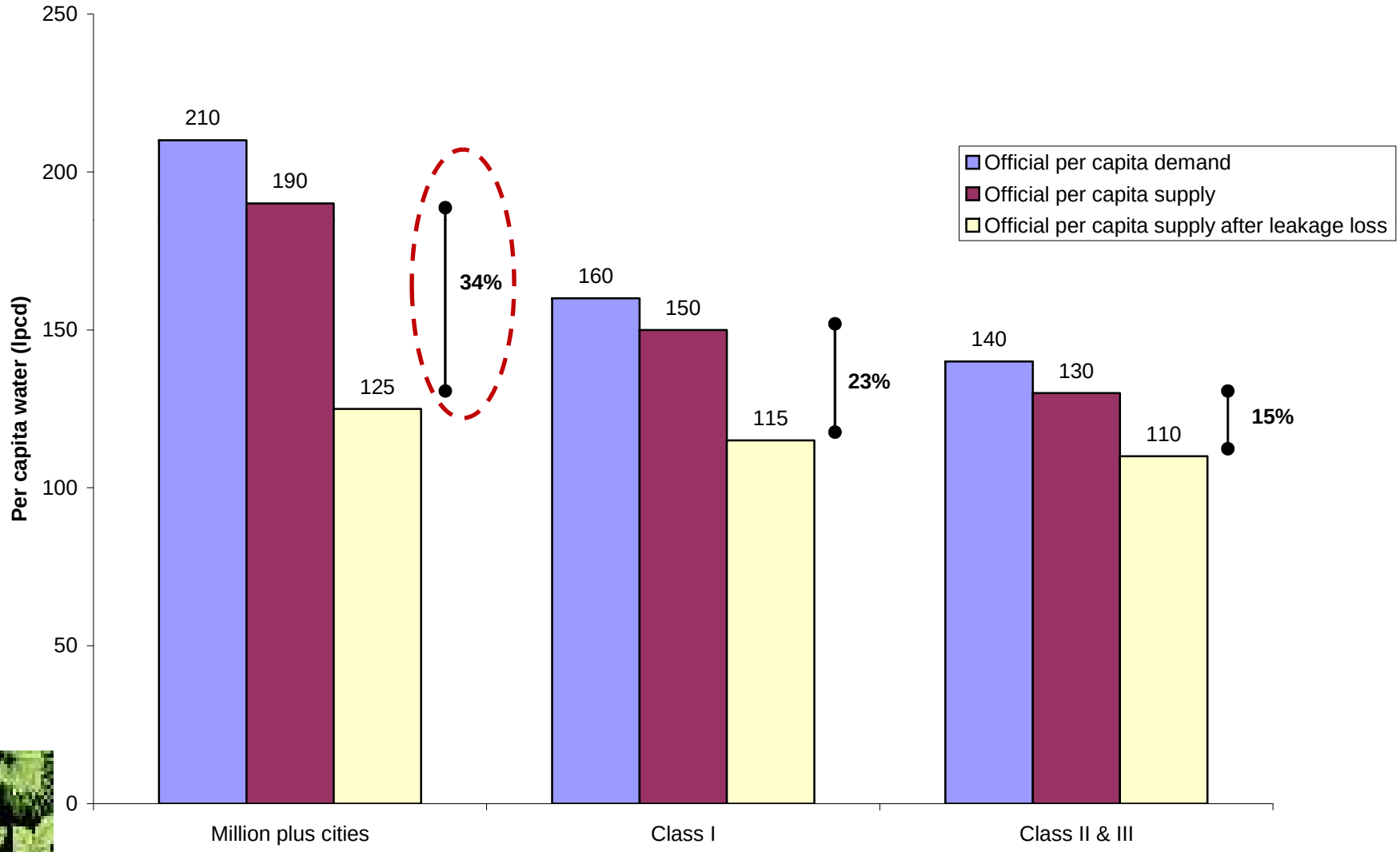
Source: Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation Manual on Water Supply and Treatment, Third Edition -Revised and Updated (May 1999), New Delhi.

Per capita supply is high and completely arbitrary

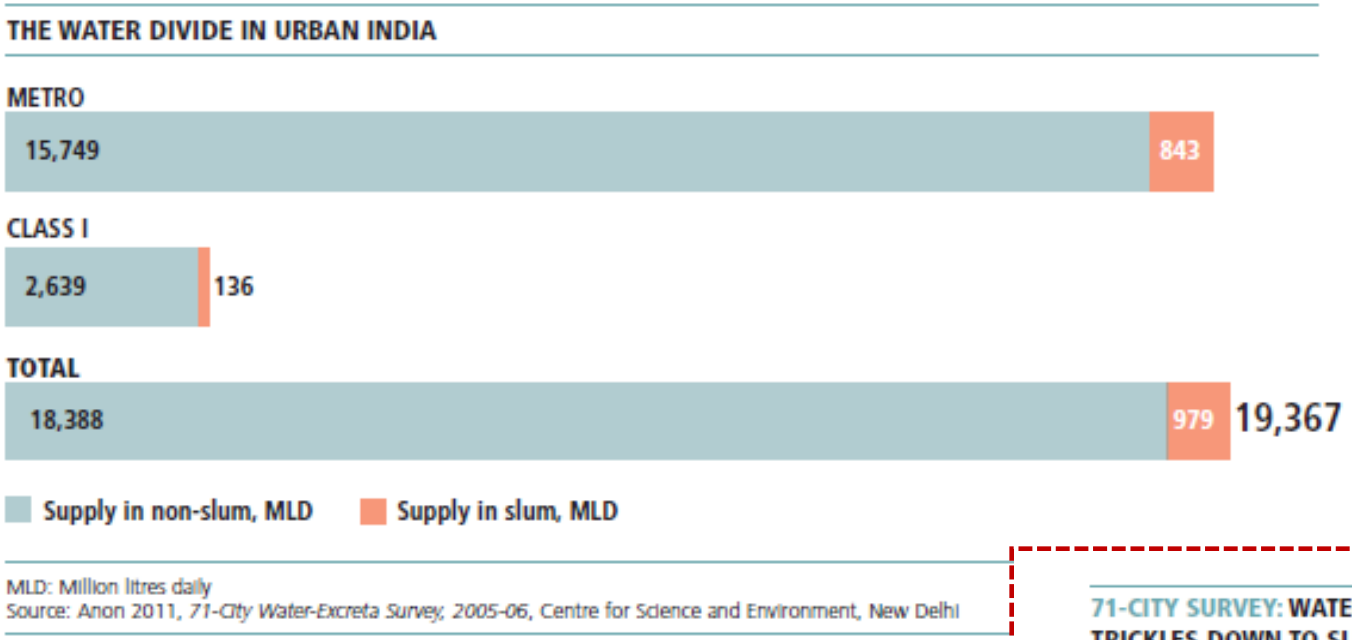


CPHEEO Norm

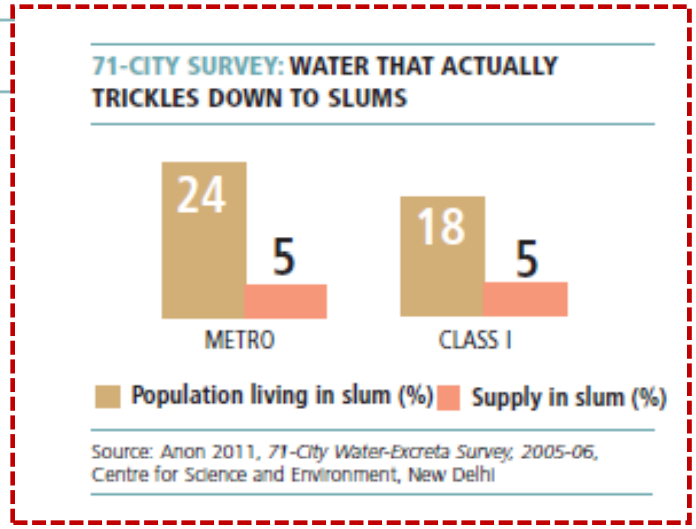
Official Water Demand, Supply, leakage loss and supply after loss



Slums : Unreached, Un-supplied



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

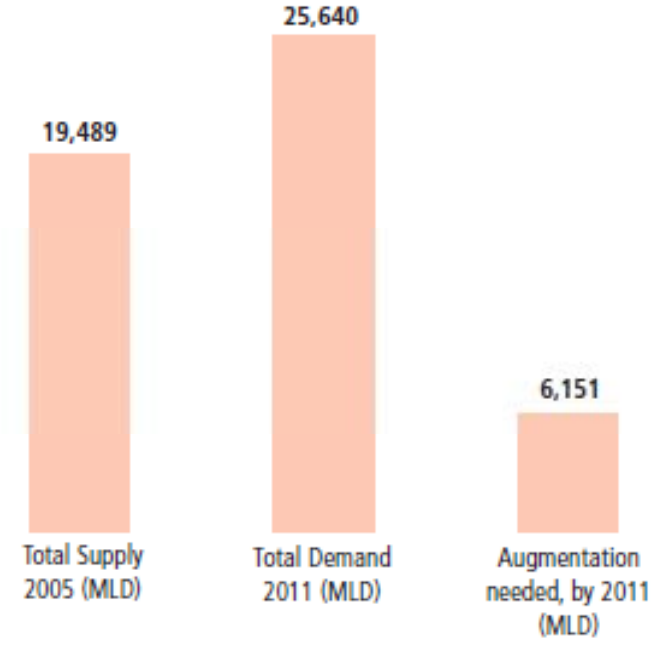


Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi

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

In 2005

32%

more water was required to meet 2011 water needs

Water / Sewage Management - Costs

19 %

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

Sector	Per capita cost (Rs)	Per capita O&M (Rs)	Total capital expenditure needed (Rs crore)[1]	Relative share of sector (%)
Water supply	5,099	501	3,20,908	10.4
Sewage	4,704	286	2,42,688	7.8
Solid waste management	391	155	48,582	1.6
Urban roads	22,974	397	17,28,941	55.8
Stormwater drains	3,526	53	1,91,031	6.2
Transport	5,380	371	4,49,426	14.5
Traffic support infrastructure	945	34	97,985	3.2
Street lighting	366	8	18,580	0.6
Total	**43,386**	**1,806**	**30,98,141**	

[1]At 2009-2010 prices; O&M: Operation and maintenance

Source: Anon 2011, *Report on Indian Urban Infrastructure and Services, the high powered expert committee for estimating the investment requirements for urban infrastructure services, JNNURM*, Ministry of Urban Development, GOI, Delhi

Water / Sewage Management - Costs

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)[1]
Average cost of comprehensive water supply schemes (JNNURM)[2]	3.00			4,500
Augmentation of water supply schemes	2.00			3,000
Rehabilitation of water supply distribution scheme (laying pipelines)[3]		0.74-1.00	20,000-30,000	
Water treatment plants (cost depends on technology and quality of intake water)	0.22-1.00[4]			330
Average cost of comprehensive sewage project, including collection network and treatment plant	3.33-6.00[5]			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

[1] Water supply estimated at 150/LPCD and sewage generation at 120/LPCD

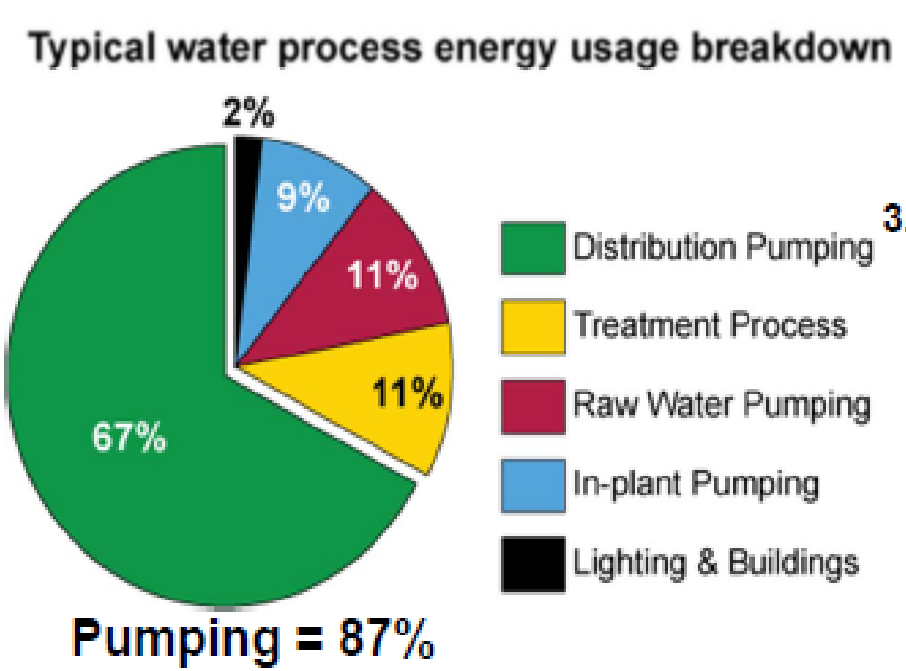
[2] Based on 36 schemes funded by the Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

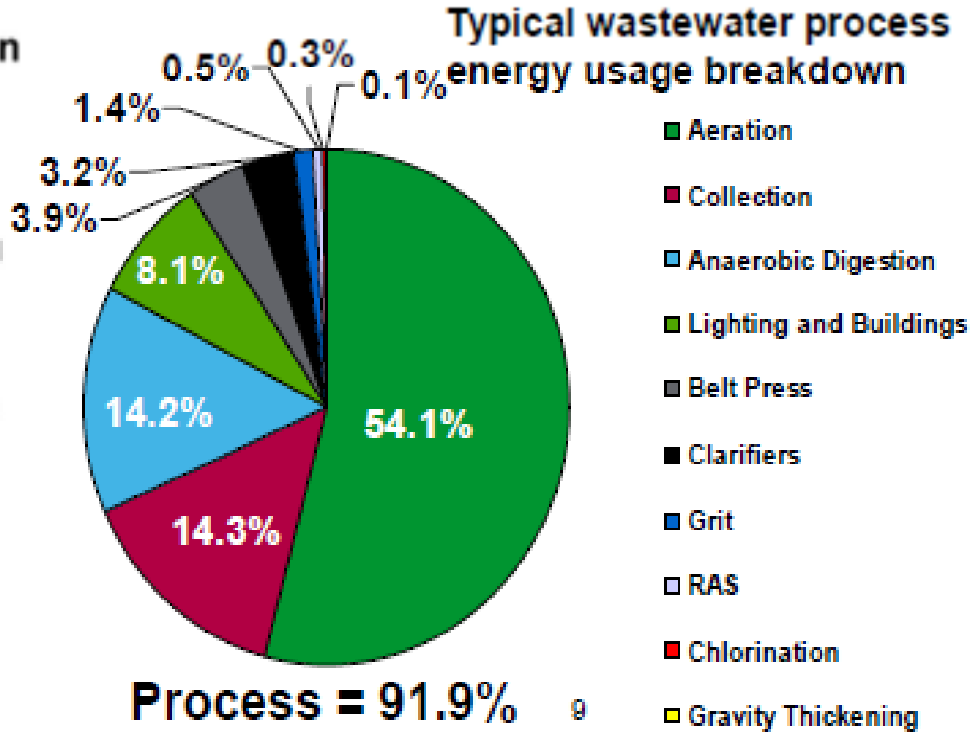
[3] Depends on location and size of mains: smaller diameter lines cost Rs 0.50 crore/km. Most DPRs estimate costs at Rs 0.74 crore/km

[4] Agra will spend this amount because the intake water is extremely polluted

[5] Ganga programme

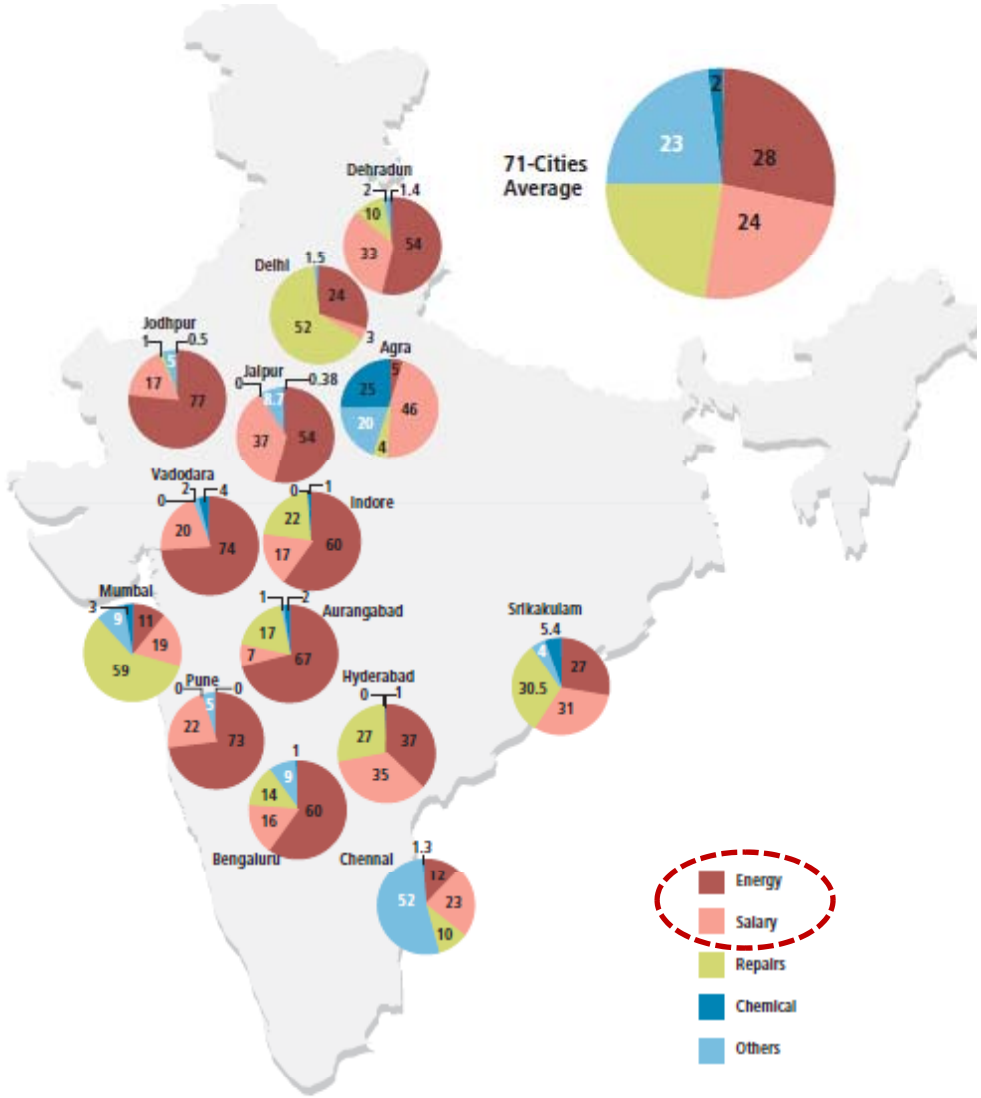
Typical Water Production / Wastewater Treatment & Energy Use





Energy can make up 25-40% of the total operating cost of WWT facility

Cost Components



71-CITY SURVEY: WATER SUPPLY REQUIRES EXHAUSTIVE SPENDING ON ENERGY (TOP 22 CITIES)

City	Energy expense[1]		
	Rs crore	%[2]	Rs lakh/MLD
Jodhpur	54	77	24.40
Vadodara	41	74	15.30
Pune	22.5	73	2.8
Aurangabad	20	67	9.8
Nagpur	20	63	4.3
Bhopal	21	60	7.9
Indore	49	60	24
Mussoorie	3	60	37
Bengaluru	251	60	28
Baramati	0.22	57	1.8
Ranchi	12	57	10.3
Bhubaneswar	14	56	6.9
Dehradun	6	54	5.2
Jaipur	42	54	12
Alwar	5	47	15.8
Bhilwara	0.91	45	4.8
Faridabad	8.55	44	3.7
Aizawl	9	44	86
Jammu	13.79	40	6.3
Jabalpur	5.5	38	3.5
Hyderabad	80	37	8.6

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

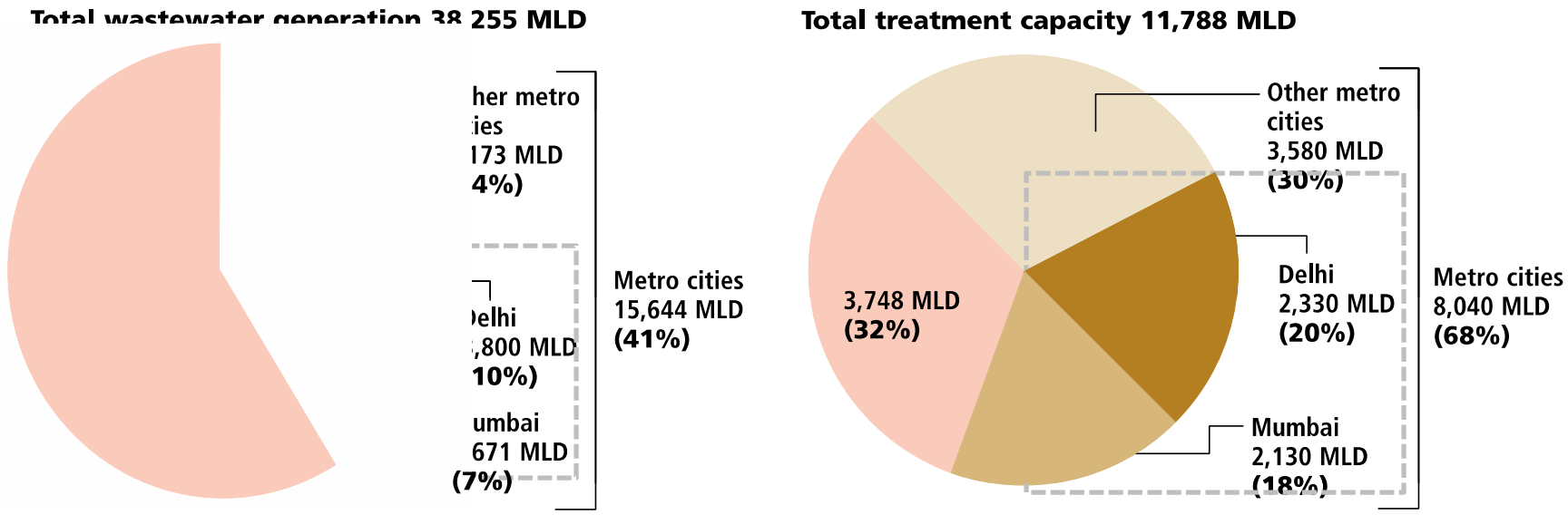
Water = Wastewater

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**

Sewage : **more** sums

TWO METROS: DISPROPORTIONATE TREATMENT



MLD: Million litres daily
Source: Anon 2009, *Status of Water Supply, Wastewater Generation and Treatment in Class-1 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[2], Hyderabad, Jaipur[1], Kanpur, Kolkata, Nagpur, Gwalior, Mussoorie, Nainital, Rajkot, Vadodara, Yamunanagar
> 70	Chennai, Pune, Surat, Gurgaon[2]

[1]Claims 80% coverage in CSE survey, 65% in City Development Plan for JNNURM; [2]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

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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

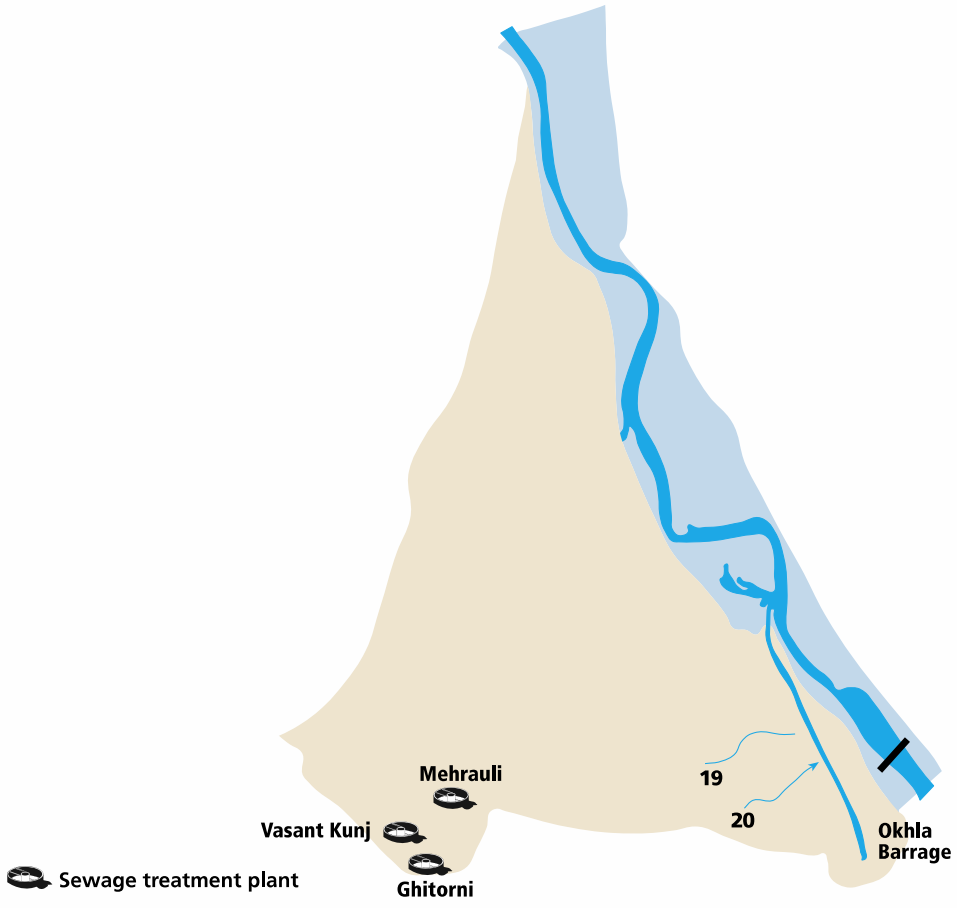
MERRY-GO-ROUND III: DELHI'S ATTEMPT TO CLEAN THE YAMUNA IS THE MYTH OF SISYPHUS ACTUALISED

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

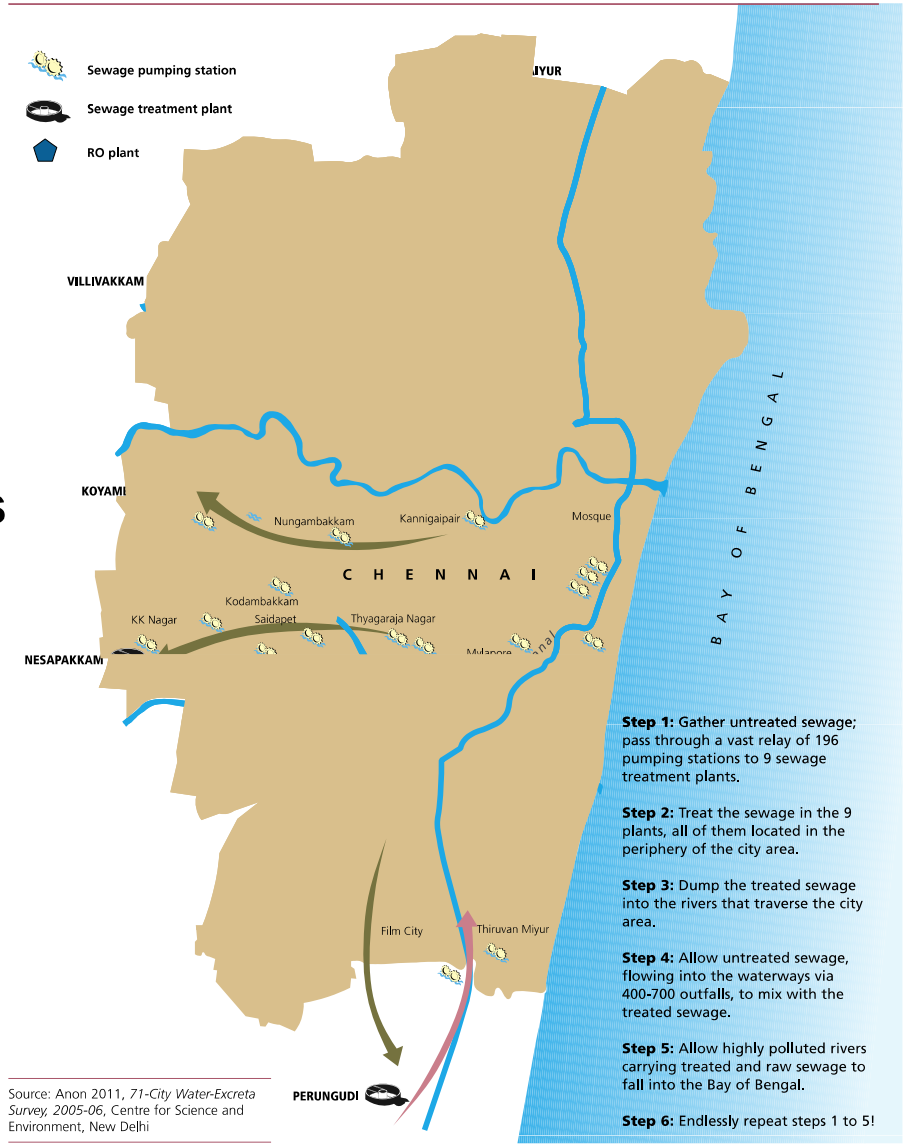
Why still polluted?

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



What is happening in U.P - and Indo-Gangetic Plains ?

Agra

A river runs through growing city, but upstream neighbors have rendered its waters unusable. A desperate city is now driven to unwieldy and expensive solutions like getting water from Ganga – 130 kms away – or Squeezing out drinking water from sewage.

Allahabad

City of Kumbh can treat only 25 % of its sewage, this adds to immense burden. And its two rivers bear brunt of it all. Despite judicial intervention, things have not improved.

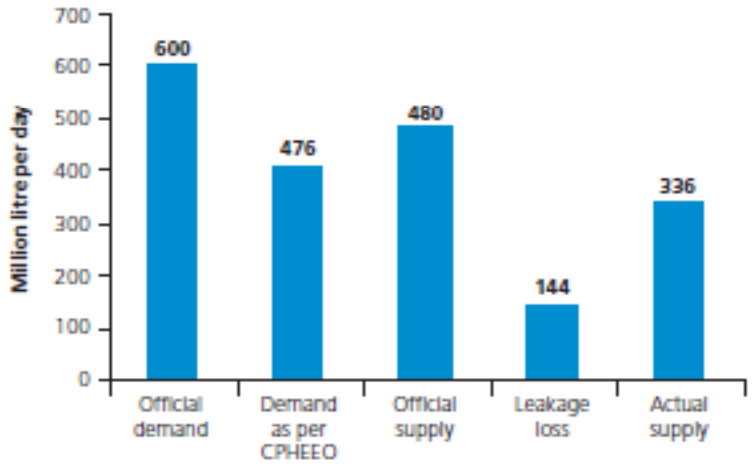
Kanpur

City dumping 70 of city sewage untreated into river through nullahs. Half of Kanpur's water supply is on groundwater.

Lucknow

GRAPH: **DEMAND AND SUPPLY**

About 30 per cent of the official supply is lost in leakages



Source: Based on data received from Lucknow Jal Sansthan, 2005-06

THE WATER	
Demand	
Total water demand as per city agency	600 MLD
Per capita water demand as per city agency	221 LPCD
Total water demand as per CPHEEO @ 175 LPCD	476 MLD
Sources and supply	
Water source	Gomti river, groundwater
Water sourced from surface sources	60%
Water sourced from ground sources	40%
Total water supplied	480 MLD
Per capita supply	176 LPCD
Leakage loss	30%
Actual supply (after deducting leakage losses)	336 MLD
Per capita supply (after leakage losses)	124 LPCD
Population served by water supply system	80%
Per capita supply to the served area	159 LPCD
Demand-supply gap (after leakage losses)	264 MLD
Treatment	
Number of WTPs	4
Total treatment capacity	122 MLD
Actual treatment	NA
Future demand and supply	
Demand (2011), as projected in 2005-06	710 MLD
Augmentation needed to meet the demand	230 MLD
Required increase in supply	48%

THE SEWAGE	
Generation	
Sewage generated as per CPCB	364 MLD
Sewage generated as per city agency	350 MLD
Collection	
Length of sewerage network	NA
Population covered by sewerage network	32%
Area covered by sewerage network	35%
Treatment	
Number of STPs	2*
Total treatment capacity	401 MLD
Actual sewage treated	40 MLD
Disposal	Gomti river

GRAPH: **GROUNDWATER LEVELS IN LUCKNOW**

Numerous private borewells add pressure on ground sources and raise their contribution beyond the official figure of 40 per cent. Resultantly, there has been a consistant and alarming decline in groundwater levels

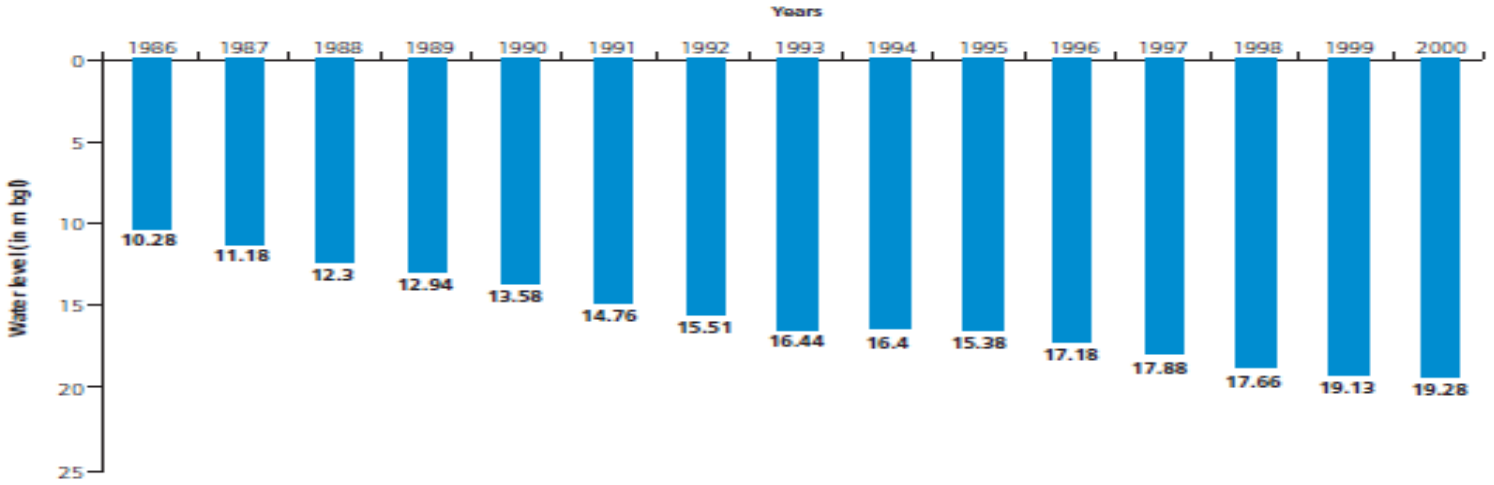


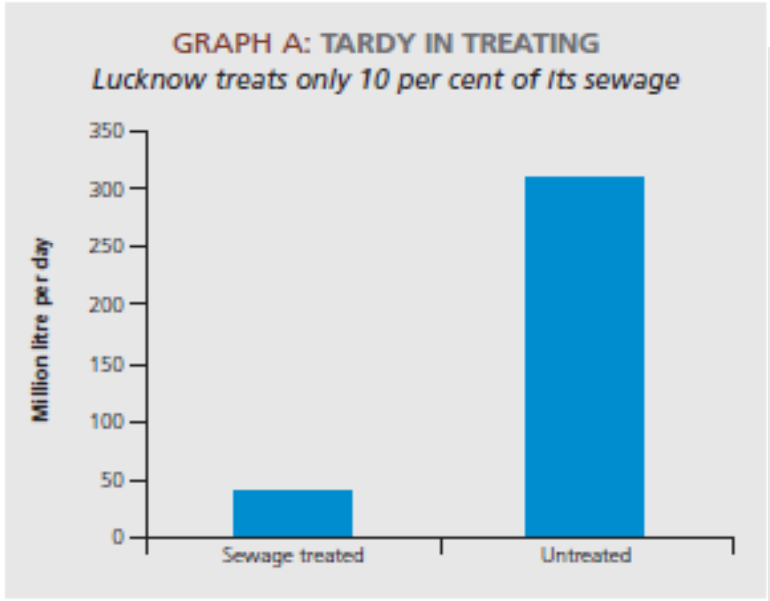
TABLE: **EXPENSES, 2003 TO 2006**

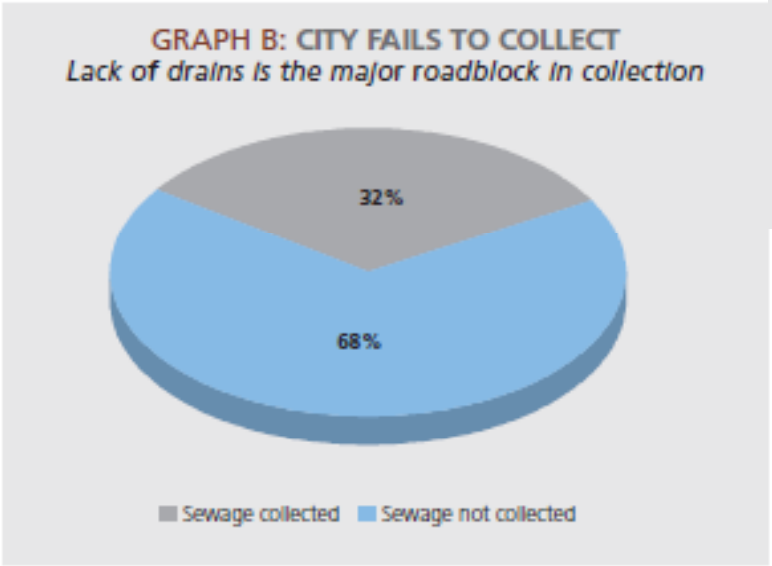
The city spent over Rs 4 per kl and got back about Rs 2

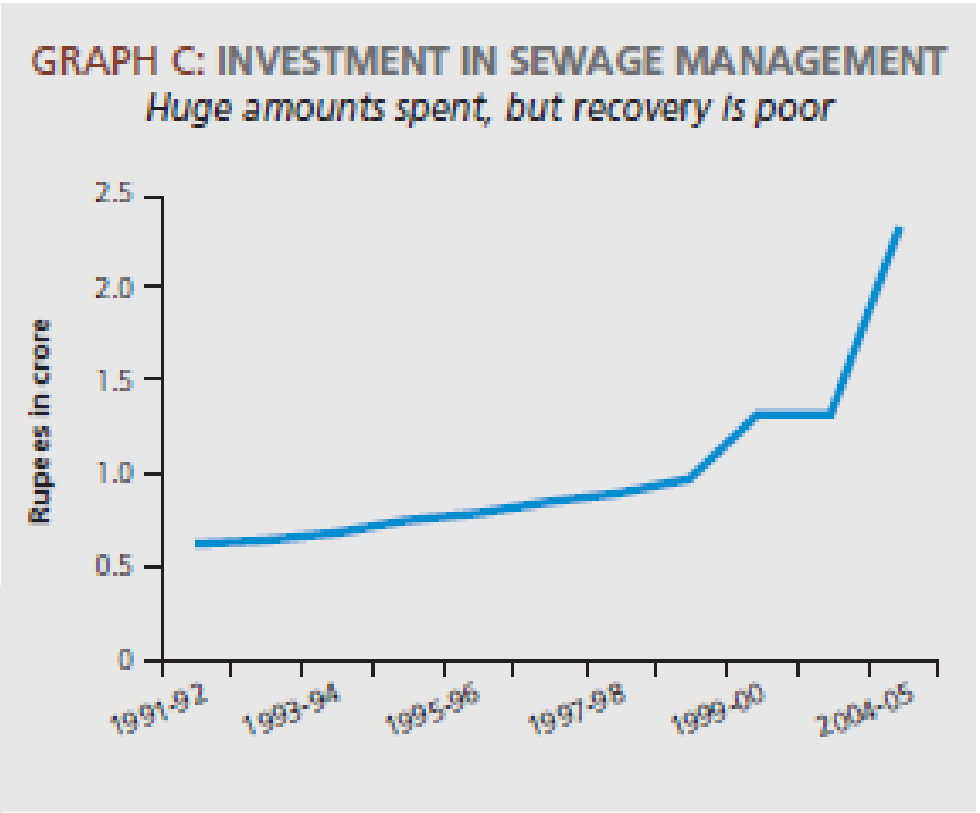
Heads of expense (Rs in crore)	2003-04	2004-05	2005-06
Capital assets	45	50	60
Operation and maintenance	22	26	31
Salary and establishment			21
Chemicals			2.43
Energy			19.05
Others			1.3

approx 40 depend on groundwater that is rapidly declining.

State of Sewage in Lucknow







80-90 % sewage flows untreated into Gomti river,

strangely the same river water goes for drinking water supply with basic chlorination and coagulation.

Urban water paradigm – cause & effect

Supply

Water is imported – pipes, tankers, trains

↓

Costs for government

↓

Cannot meet the demand

↓

Indiscriminate groundwater mining within and outside the city

Treatment

Raw water quality is very poor

↓

Costs of treatment for government

↓

Cannot meet the demand

↓

High health impacts among poor

Growth of bottled water industry

Sewerage

Supplied water turned into polluted water

↓

Costs of collection and treatment for government

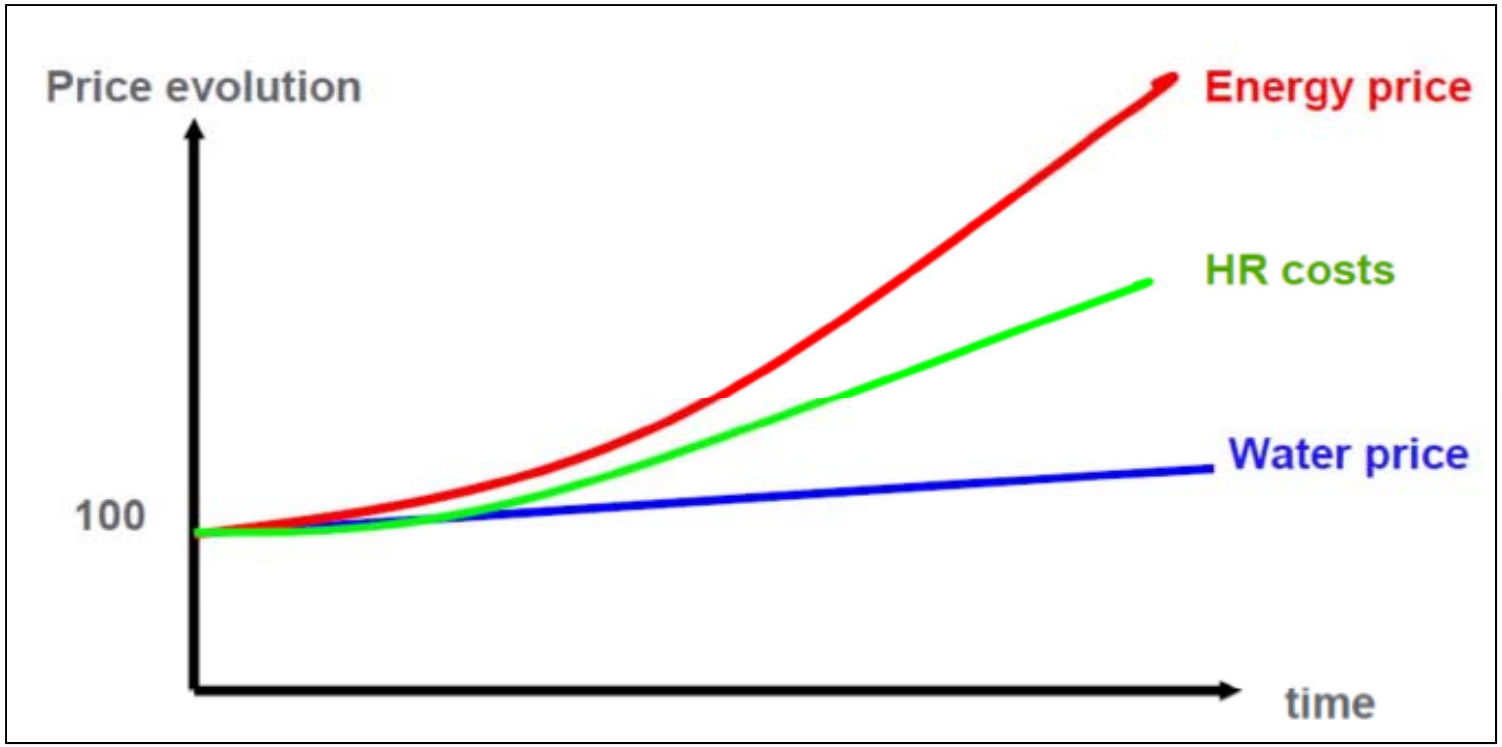
↓

Cannot meet the demand

↓

Polluted rivers and lakes. Further reduction of water supply

Water financials, a dilemna



- 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 :

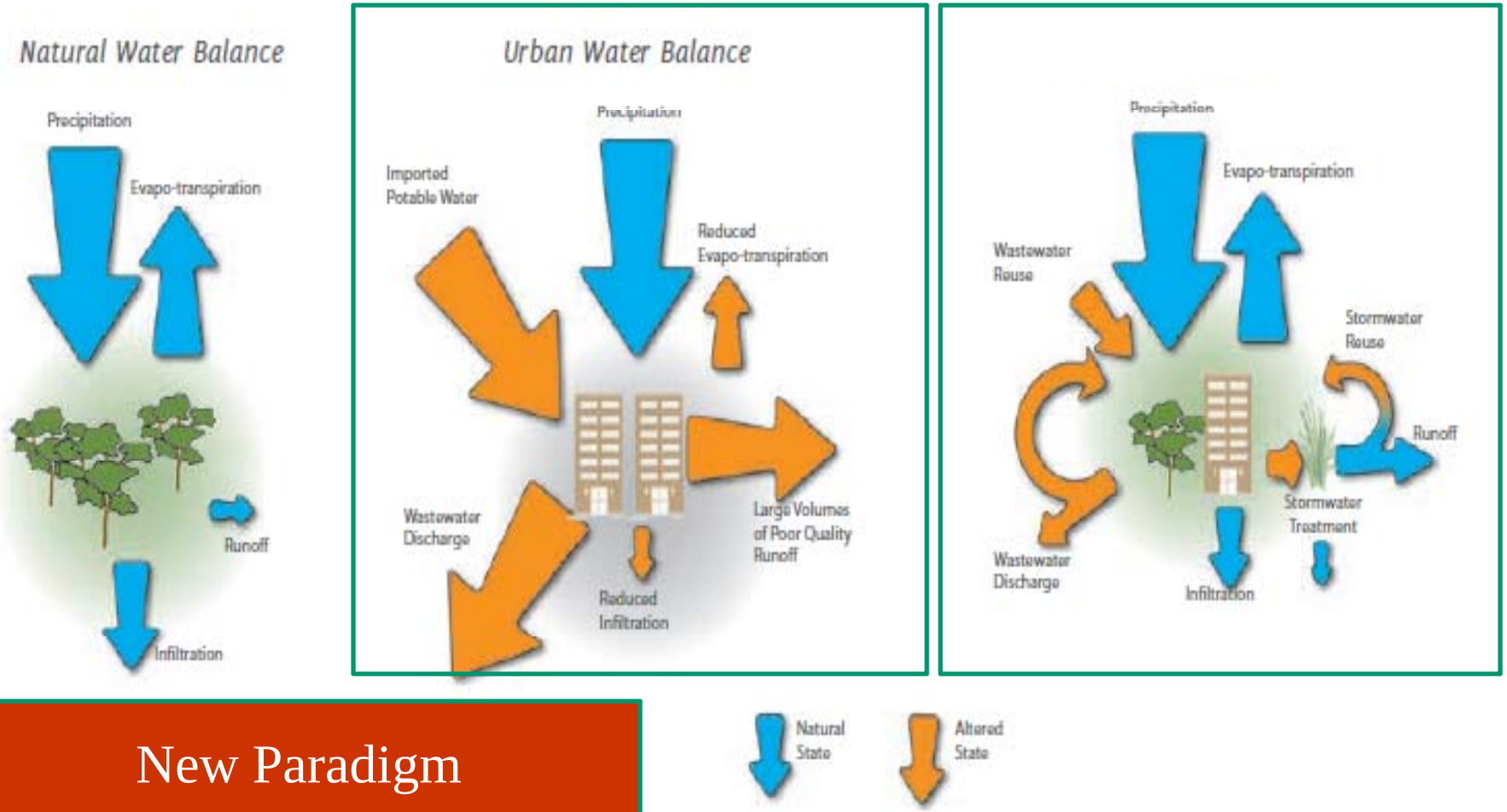
affordable and sustainable

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!**

Guiding Principles –

1) Cut / Reduce the length of pipeline
2) Water frugality is not poverty (prudent / wise use must be promoted including rating of water efficient fixtures)
3) Design systems for affordability and to 'clean' water supply for all
4) Design to treat all waste (treat waste in open drains, do not wait to build all drains)
5) Treat waste to recycle and reuse water and excreta (treat waste to generate wealth - not use water as carrier for waste disposal)
6) Treat waste locally so that reuse is possible locally (cut costs of pumping/piping ,treat using microbes/separation/biotic oxidation systems etc. , treat to reuse, not to waste)



New Paradigm

Mainstreaming Urban Environmental Sustainability

*Water and Sanitation 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/industry
- Is about our need to re-invent **growth without pollution**

Paradigm Shift in Enabling Environment

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

Policy → Plan → Programme

&

Project

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'.

Best Management Practices

- **Municipalities and Water Utilities**
- **At Home / Buildings**
- **In Industry**

Way ahead

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

THANK YOU