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Urban Water Supply & Sanitation in India

IIHS RF Paper on Water Supply and Sanitation

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ARV	Annual Rental Value
Bcm	billion cubic metres
BIS	Bureau of Indian Standards
BSUP	Basic Services for the Urban Poor
BWSSB	Bangalore Water Supply and Sewerage Board
CAG	Comptroller and Auditor General
CAPEX	Capital Expenditure
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSE	Centre for Science and Environment
CSP	City Sanitation Plan
Cu. M.	Cubic metre
CWC	Central Water Commission
DDT	dichlorodiphenyltrichloroethane
DPR	Detailed Project Report
GBWASP	Greater Bangalore Water and Sanitation Project
GoI	Government of India
GWSSB	Gujarat Water Supply and Sewerage Board
HCH	Hexachlorohexane
HH	household
HPEC	High-Powered Expert Committee
HUDCO	Housing and Urban Development Corporation
IBT	Increasing Block Tariff
IHSDP	Integrated Housing and Slum Development Program
IPCC	Intergovernmental Panel on Climate Change
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KWA	Kerala Water Authority
Lpcd	litres per capita daily
MDG	Millennium Development Goals
MGI	McKinsey Global Institute
MJP	Maharashtra Jeevan Pradhikaran
MLD	Million Litres Daily
MoHUPA	Ministry of Housing and Urban Poverty Alleviation
MoUD	Ministry of Urban Development
MoUEPA	Ministry of Urban Employment and Poverty Alleviation
MPCE	Monthly Per Capita Expenditure
MPIUSP	Madhya Pradesh Integrated Urban Sanitation Program
MSNA	Maharashtra Sujal Nirman Abhiyan
NIUA	National Institute of Urban Affairs
NRCD	National River Conservation Directorate
NRCP	National River Conservation Program
NRW	Non-Revenue Water
NSSO	National Sample Survey Organisation

NUSP	National Urban Sanitation Policy
O & M	Operations and Maintenance
OD	Open Defecation
PCB	Pollution Control Board
PHED	Public Health and Engineering Department
PPP	Public-Private Partnership
RAY	Rajiv Awas Yojana
SLB	Service Level Benchmarking
Sq. Km.	Square kilometre
SSP	Slum Sanitation Program
STP	Sewage Treatment Plant
UFW	Unaccounted for Water
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
UIG	Urban Infrastructure and Governance
ULB	Urban Local Body
UWSS	Urban Water Supply and Sanitation
WATSAN	Water and Sanitation
WHO	World Health Organisation
WC	Water Closet
WSP	Water and Sanitation Program
WSS	Water Supply and Sewerage

I. INTRODUCTION

The seriousness of the challenges associated with urban water supply and sanitation in India have been recognised in recent times. After decades of neglect, the first national effort to invest in the urban water and sanitation sector commenced in the 1970s, but was accorded considerable priority in the subsequent two decades as a part of different national- and state-level schemes, culminating most recently in the '*Swacch Bharat Mission*'. As most of the recent reports and commentaries, (M. Shah (2013) have highlighted, the problems of the urban water and sanitation sector in India are complex and shall need concerted efforts to sustain the policy momentum. This paper attempts to highlight the multidimensional nature of the challenge, and sets out recommendations for strengthening existing policies and their implementation.

While the concerns of urban water and sanitation are faced in many countries in the global South**,** the scale of gaps in access and services in India poses a dilemma. According to the 2011 census, India has a total population of 1.21 billion, which is an addition of 181 million people during the decade of 2001–2011 (Census of India, 2011b). Although only 31.16 per cent of India is urban according to the Census of India, at 377 million, India's current urban population is larger than the entire population of United States which is the third most populous country in the world. As recent commentators have highlighted, if India fails to meet its MDG or the emerging SDG targets, the global targets would not be met.

Unlike many other countries, India has the unenviable situation of needing to simultaneously improve access to water and sanitation, and responding to increasingly urgent environmental challenges. The policy responses need to provide for improved public health outcomes via universal access and improved service quality, while facing the challenge of increasingly severe water and resource constraints on one hand, and limited institutional and financial capacities on the other. This paper acknowledges that there has been considerable movement in the policy space: it takes the existing framework and initiatives as its starting point, critically examines them, and builds upon them.

Structure of the Paper

This paper is organised as follows: the first section builds the case for urgently addressing the challenges of urban water and sanitation, by laying out the impact on public health and environment. This is followed by a situational analysis of both urban water and sanitation in India, with a focus on service provisioning to the poor. The next few sections examine the current institutional and financing arrangements in the sector, including the role of the private sector, community and households. The paper then reviews the key policy responses and recent initiatives of the recent decades, and assesses how far these have addressed priorities identified in the earlier sections. Finally, the paper lays out a set of recommendations, highlighting the role of different levels of government.

Scope

It needs to be highlighted here that the paper does not address two relevant concerns regarding the water resources and urbanisation question. The first is the issue of intra-sectoral allocation of water resources in India, and whether this needs to change, given increasing urbanisation and the priorities accorded to drinking water by successive governments. For the purpose of this paper, it is assumed that water allocation for urban

areas will remain the same at best, with a possibility of reduction in the future. The second issue is the link between the pattern of urbanisation, and water availability. Studies have questioned the sustainability of current urbanisation patterns—given the growth of populous urban centres in arid and semi-arid regions of the country. While ideally, urbanisation processes should be influenced by the availability of water resources, the paper assumes that the pattern of urbanisation in India is going to be driven by a complex set of drivers, beyond water resources in the near future.

II. CASE FOR URBAN WATER AND SANITATION

This section of the paper examines and reiterates the reasons why meeting the challenge of urban water and sanitation is important in order to meet desirable public health and environmental outcomes.

1. Imperatives for Public Health

There are severe public health consequences of inadequate urban water and sanitation. Globally, diarrhoeal diseases are the second leading cause for children under 5 (UNICEF, 2010), and 25 per cent of global diarrhoeal deaths occur in India (WHO, 2009). Around 88 per cent of diarrhoeal deaths can be attributed to inadequate sanitation hygiene and water (UNICEF, 2010). Increasingly, it is been recognised that sanitation is a cause of malnourishment, leading to stunting and long-term cognitive diseases (Spears, 2013). About one in every 10 deaths in India is from causes related to inadequate sanitation and hygiene (WSP, 2010).

Lack of sanitation in India has led to economic losses for the country (6.4 % of India's GDP) (WSP, 2010). This study also highlighted that urban households in the poorest quintile bear the highest per capita economic impact of inadequate sanitation—1.75 times the national average per capita losses and 60 per cent more than the urban average (WSP, 2010a).

2. Imperatives for Environmental Protection

The largest environmental concern, posed by the current urban water and sanitation systems in India, is pollution of water bodies. 'Organic matter and bacterial pollution of fecal origin' remains the largest water pollution problem in India (CPCB, 2012). Water quality, as measured by BOD levels, and the presence of Total Coliform and Fecal Coliform, has declined steadily over the period of 1995–2011 (CPCB, 2012). The main cause of this pollution is the inability of large urban centres to adequate treat their wastewater, as will be examined in detail in later sections of the paper. Inadequate sanitation is also a cause for contamination of groundwater aquifers. Untreated sewage also remains the single biggest land-based source of pollution for coastal areas of India (CPCB).

Apart from pollution, the other critical concern faced by urban areas is its growing water demand, within the context of decreasing water availability. With 2.4 per cent of the world land area, India is home to about 17 per cent of the total world population but has only about 4 per cent of the world's renewable freshwater resources (Ministry of Water Resources, 2012). In a country like India which is densely and relatively uniformly populated, the growing water demand and the resultant search for newer sources of water is bound to come face-to-face with ecological limits. In the case of India, while per capita renewable water resource availability in 1951 was 5,177 cubic meters (cu.m) per capita per year, this became

1,588 cu.m by 2010, placing the country well within the water-stressed category (CWC, 2010).

According to the widely used Falkenmark water stress index, out of the 22 major river basins of India for which there is good quality data, four are water-stressed, 11 are water-scarce and four are facing absolute water scarcity. Only three river basins out of 22 are not facing any level of water stress or scarcity[1](See Annex A2, Map A2.1 and A2.2). In addition, ground water is depleting in some parts of the country. According to a study, out of 5,842 numbers of assessed administrative units, 802 units were overexploited, 169 units were critical, and 523 units were semi-critical (CGWB, 2012). The growing water needs of urban areas need to be seen within this context of reducing water availability.

Climate change might further reduce the availability of water for urban areas. Over the coming century, the climate of the Indian subcontinent is projected to become warmer and the monsoons more unpredictable, although it is also expected to become wetter with fewer rainy days (IPCC, 2007). These possible changes in precipitation are likely to impact availability of water to most India cities in three ways. First, previous studies have shown that volume of water supplied annually in cities like Mumbai (Rode, 2008) and Chennai ((Munian, 2010); (Sreenivasan, Gorelick, & Goulder, 2010) closely tracks rainfall patterns in reservoir catchment areas. Hence, changes in precipitation in catchment areas are likely to affect water availability. Second, cities directly dependent on perennial rivers are also at risk due to climate variability since change in precipitation patterns can alter stream flow in the river basins (Gosain, Rao, & Arora, 2011). Lastly, since most Indian cities are dependent on groundwater (Narain, 2012a), they will also be affected since renewable groundwater is also dependent on rainfall.

III. URBAN WATER SUPPLY AND SANITATION IN INDIA: SITUATIONAL ANALYSIS

1. Urban Water Supply in India

This section provides an analysis of the current situation in urban water supply in India. It presents this analysis in three parts: household, water distribution and treatment systems, and water sources.

a. Household Arrangements and Access

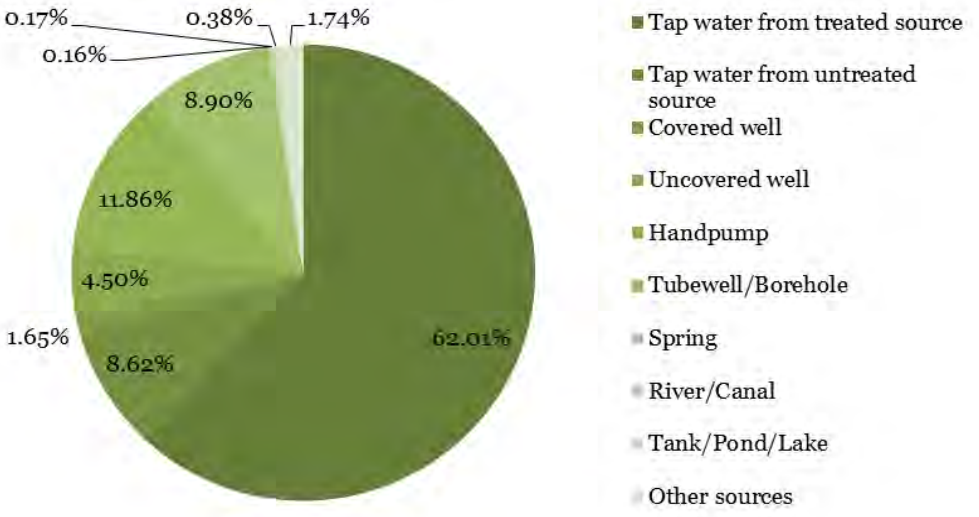
Households Arrangements: Historical Trends and Distribution

Fig. 3.1 shows the distribution of households according to the primary source of drinking water reported by Census 2011. Nearly 70 per cent households have access to tap water, out of which 62 per cent have access to treated tap water. Thus, nearly 40 per cent of urban

[1] According to the widely used Falkenmark water stress index, countries or basins with less than 1,700 cu.m per capita of renewable water are considered water-stressed, less than 1,000 cu.m per capita are considered water-scarce and less than 500 cu.m per capita are considered to be facing absolute water scarcity.
The Falkenmark index, like any index, has its own set of limitations. For example, it does not account for intra-basin differences, differences in consumption, and also does not take into account the accessibility or quality of water. The index has been used here to give an indication of severity of the scarcity.

households have no access to public supply, and have to depend on other sources of water.[2] Moreover, not all households that have access to public supply have access to it within the premise. **Only 49 per cent of households have access to piped water supply within their premises. (**See Annex A2, Table A2.3**)**

Fig. 3.1: Distribution of Households according to Source of Water



Source: Analysis of Census 2011 Data

Table 3.1 shows the percentage of households by access to water supply over the past two decades. The figure illustrates that there was a gradual increase from 1990 to 2008 in the percentage of households with access to 'improved' drinking water, but then a decline in 2011.[3] However, this decline is due to the availability of fine-grained data. Earlier all tap water was taken as 'improved' whereas disaggregated data has become available in 2011 for treated and untreated tap water categories. Similar is the case with water from wells. If untreated tap water and uncovered wells are included in the improved category, then the proportion of households which have access to improved sources would be 98 per cent in 2011.

Table 3.1: Access to Improved Urban Water Supply (MDG and Census of India)

Year	Popn. India '000	% Urban Popn.	Total Improved	Piped	Other Improved	Unimproved
1990	862	26%	**90%**	52%	38%	10%
2000	1042	28%	**93%**	50%	43%	7%
2008	1181	29%	**96%**	48%	48%	4%
2011	1210	31%	**84%**	62%	2%	16%

Source: JMP, Census, 2001, Census 2011

[2] There is no precise means to ascertain the percentage of households being catered to by public supply; it is likely that the bulk of treated water supply is from government agencies, as treatment at household levels is not admissible in this category.

[3] The definition of 'improved' sources of drinking water has been taken from the Joint Monitoring Programme (JMP) jointly run by WHO and UNICEF. The following sources are considered 'improved' drinking water sources: Piped water into dwelling, Piped water to yard/plot, public tap or standpipe, Tubewell or borehole, Protected dug well, Protected spring, Rainwater

Comparing Census 2001 and 2011, one can see that nearly 18 million additional households have obtained access to tap water whereas the overall share across different water sources appears to have changed only marginally (See Annex A2, Fig. A2.4).

Apparently, access to 'improved' sources of water is similar in slum and non-slum data. But, this might be a result of the under-estimation of slums (Sen, 2010). Moreover, this data hides two critical factors that impact service provisioning in slums: the distance between source of water and house, and shared facilities. These two concerns are analysed below.

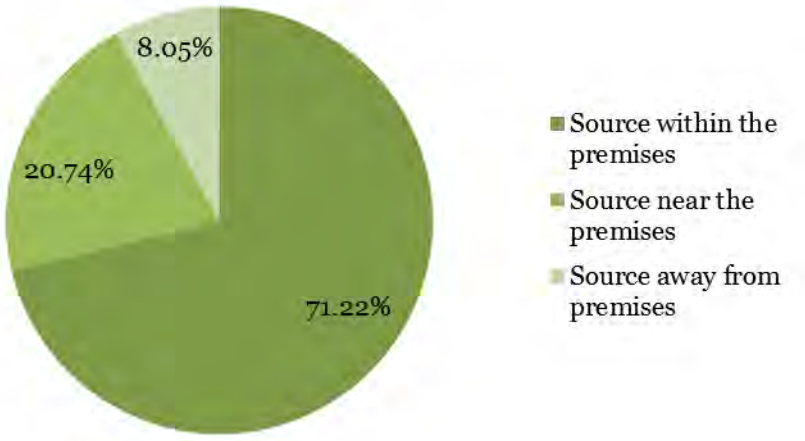
There are differences in access to public supply across districts, class size, and states. See Annex 2, Table 2.5, 2,6, and Map 2.7

It has to be highlighted here that this data indicates the source of drinking water, and hence does not indicate whether the households have access to water for other non-potable uses, including water for hygiene.

Distance of Water Source from Premises

In addition to a large percentage of households not having access to piped water supply, a large percentage of households do not have access to water within the house. Figure 3.2 shows the distribution of households according to the distance between water source and houses. **Nearly two-thirds of the households do not have access to water within the house, and 8 per cent of households need to fetch water from more than 100 metres away from their households.** The distribution of distance from households and source of water is presented in Annex A2, Table A2.3.

Fig.3.2: Distribution of Urban Households by Distance from Source



Source: Analysis of Census 2011 data

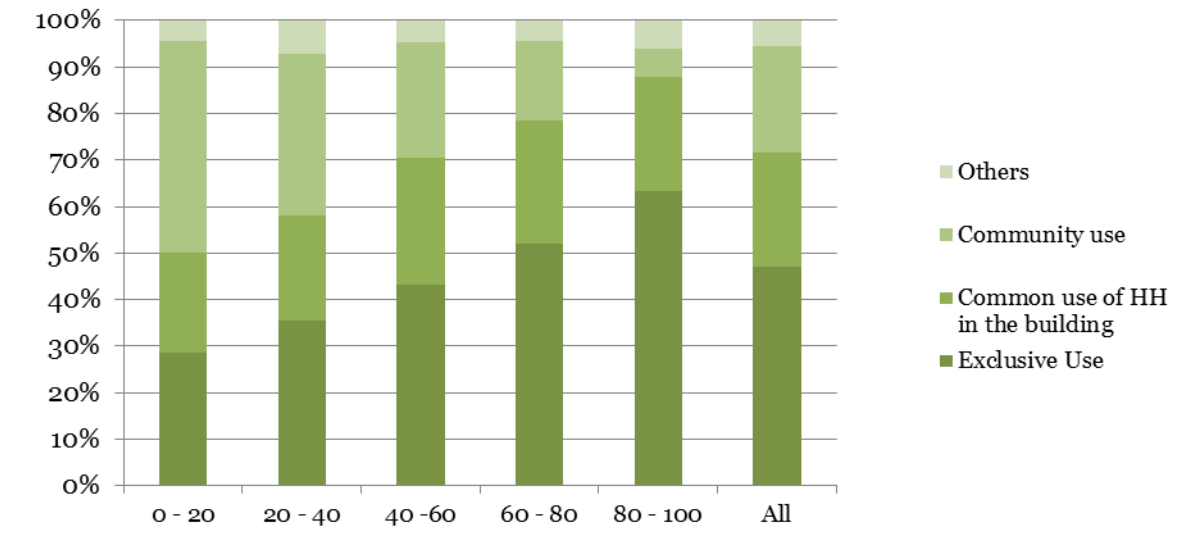
The proportion of households with water source within their premises among slum households is lower (57%) compared to 71% for overall urban India (Census, 2011).

Shared Facilities

Figure 3.3 illustrates the distribution of urban households according to access to exclusive use or shared facilities across Monthly Per Capita Expenditure (MPCE). The graph clearly illustrates that the urban poor, who constitute the lower quintile of MPCE are dependent on

community facilities. **Nearly 70 per cent of households depend on some form of shared facilities.**

Fig.3.3: Distribution of Urban Households by Access to Tap Water across MPCE



Source: NSSO, 2009

Public Supply: Poor Service Standards

The above analysis clearly illustrates that a substantial portion of households either do not have access to water supply within the premises or need to rely on shared facilities. This section will highlight concerns with the public, piped water supply system.

The biggest concern is that most cities do not provide the quantum of water according to existing per capita norms. While Indian cities are supposed to conform to the standards laid down in the Manual on Water Supply and Treatment (CPHEEO, 1999),[4] the cities are rarely able to meet these standards. Table 3.2 shows the SLB indicators for water supply, which is based on data from 1,400 cities. It clearly illustrates that cities clearly receive only 69 lpcd, as opposed to the norm of 135 lpcd.

Some larger cities like Delhi provide water supply far above this norm (Narain, 2012a). But these averages tend to mask huge inequities within the system. The extreme example of this is Mumbai, where Narain (2012b) estimates 46 per cent of the city to be using 95 per cent of the water since 54 per cent of the city officially lives in slums and consumes only about 5 per cent of the supplied water.

[4] According to this manual, cities without sewer lines are supposed to be provided 70 liters per capita per day (lpcd), while cities with existing or proposed sewer lines should receive 135 lpcd and cities with a population of more than 1 million with existing or proposed sewer lines should receive 150 lpcd. In each case 15% more is added to account for leakages (CPHEEO, 1999).

Table 3.2: SLB Indicators for Water Supply					
No.	Indicator	Unit	Benchmark	Median	Average
1	Coverage of Connections	%	100	53	50.2
2	Per Capita Supply	Lpcd	135	69	69.2
3	Metering of Connections	%	100	0	13.3
4	Non-Revenue Water	%	20	29	32.9
5	Continuity of Supply	Hours	24	2	3.1
6	Quality and Treatment	%	100	94	81.7
Source: MoUD (2010)					

In addition to inadequate quantity, the water supply in almost all cities is intermittent and often of questionable quality (Shaban and Sharma (2007); Narain (2012a)). Almost no city in India provides 24 hour water supply and a four-to-five hour water supply seems to be the norm (McKenzie and Ray (2009) ; Narain (2012a)). The SLB data shows that the duration of supply is only 2–3 hours on average.

Dependence on Multiple Sources and Coping Mechanisms

As a consequence of poor service standards, the households need to engage in a range of coping mechanisms. The biggest one of these coping mechanisms is dependence on multiple sources of water. Households depend either on small-scale private players like tankers or on self-provisioning, typically through tube-wells or hand-pumps. In absence of continuous storage mechanisms, the households invest in storage devices—the poor store water in jerry-cans and small tanks, while middle-class households invest in underground and/or overhead tanks (BWSSB/AusAID, 2002; IIHS, 2014). The middle and rich households also invest money in sumps to pump water to overhead tanks ibid.). Thus, there is considerable investment from households to ensure that they have adequate water supply.

Storing Mechanisms of a poor household in Bangalore	Middle Class Households typically invest in overhead tanks
	
Photo Credit: IIHS	

Water Quality

One of the biggest concerns at the household level remains that of water contamination, and the consequent impact on health. There are multiple routes of transmission of pathogens, and hence contamination. First, the public source of water itself might have been rendered 'unsafe' by the time it reaches the household. There is newspaper reportage which highlighted water contamination in the public supply systems, caused by leaking pipes (Kumar, 2014; Roy, 2013; Sharma, 2014; Varma, 2014). However, it is likely that water supplied by public sources is less contaminated, as the water is treated before distribution, and there are periodic checks carried out by the utilities. Second, the water supplied by private players might be contaminated—this is the area on which there is least information. Finally, a large number of households are directly dependent on groundwater, and there is evidence to prove that groundwater aquifers in Indian cities are polluted.

While geogenic contaminants like flouride and arsenic are a serious concern in parts of Gujarat, Rajasthan and Andhra Pradesh and parts of West Bengal respectively (Andezhath and Ghosh (2002); Chowdhury et al. (2000)), cities across the country show signs of groundwater contamination from anthropogenic sources. Domestic sewage is a major source of groundwater contamination both due to improper disposal of sewage and leakages in the sewer network. The groundwater in Bangalore is artificially recharged and the aquifer polluted by leaking sewer lines and the disposal of sewage into the lakes of Bangalore. (Gronwall et.al., 2010; Groundwater report of Karnataka cited in Kozhisseri (2005); Singh, Somashekar, Prakash, & Shivanna, 2010). Industrial effluents also contaminate aquifers severely as demonstrated by the case of dyeing and bleaching industries in Tirupur (SenthiInathan & Azeez, 1999), small medium and heavy industries in Coimbatore (Mohanraj, Sathishkumar, Azeez, & Sivakumar, 2000) and Ludhiana (Kakar & Bhatnagar, 2008). Besides these, anthropogenic contaminants like organochlorine pesticides including banned ones like DDT and HCH are found in the groundwater in Hyderabad (Shukla, Kumar, Bhanti, Joseph, & Taneja, 2006), Delhi (I. Mukherjee and Gopal, 2001; Mutiyar, Mittal, and Pekdeger, 2011) and Jaipur (Bakore, John, & Bhatnagar, 2004).

In addition, there is the possibility of water contamination within households. Studies have identified two domains of disease transmission: public and domestic domains. Domestic domains refer to the area under the control of the household (Cairncross, Blumenthal, Kolsky, Moraes, & Tayeh, 1996), and there have been studies that demonstrate that even with improved public sources, there is likelihood of water contamination due to household storage mechanisms and behaviour (Jensen et al., 2002). A study carried out in Calcutta slums found there was water contamination in water storage within the house, specifically water for non-potable uses, even when the water source was not contaminated (Palit, Batabyal, Kanungo, & Sur, 2012). In addition, only 50 per cent of urban households have any form of treatment mechanisms at the household level (IIPS, 2007; NSSO, 2013).

While there is limited monitoring and data available on the quality of water supply at the household level, safety of drinking water at the household level seems to be an increasing concern.

b. Water Distribution Systems and Treatment

Incomplete Coverage and Inadequate Infrastructure

As highlighted in the earlier section, there is incomplete coverage by public supply. While there are several challenges with service standards, **expansion of coverage remains a critical issue.** This is especially a concern for smaller towns, many of which might not have any kind of infrastructure system in place. However, given the general concerns with operations and maintenance, highlighted below, it is essential that adequate O & M systems are put in place to ensure sustainability of the new infrastructure being created.

Distribution Losses

The mere presence of infrastructure is no indicator of availability of water: most urban households do not receive adequate water. Often, non-availability of water or water scarcity is cited as a reason. However, the major challenge, at least among the bigger cities, is **huge distribution losses which account for a significant chunk of the non-revenue water in Indian cities.** These losses are both physical due to decrepit pipes and lack of maintenance, and also monetary losses, due to incomplete metering and billing. The physical losses occur in three main ways: leakages in distribution mains, leakages at storage tanks, or leakages at service connection points (MoUD, 2012a).

According to the survey conducted by the Centre for Science and Environment in 71 cities, 25 to 40 per cent of the water was considered to be lost in distribution in most cities (Narain, 2012a) while a study by ADB estimates this to be 27 per cent (ADB, 2007). Much of the distribution losses can be attributed to ageing and decrepit infrastructure and a lack of adequate maintenance.

However, these estimates are to be used with caution, as utilities often do not have adequate information regarding losses due to reasons like lack of metering. The average level of metering in Indian cities is only about 13 per cent (MoUD, 2012b) to 24 per cent (ADB, 2007).

Improper Operations and Maintenance

The water supply systems in urban India suffer from inadequate operations and maintenance. Lack of O & M is a major cause of distribution losses, and also affects the longevity of the system. Indian cities are currently trapped in a vicious circle of build, neglect and re-build.

Prevalence of Informal Supply Chains

In addition to public distribution systems, there are several informal supply chains in Indian cities. These typically include small to medium tanker operators, who source water from within the city or nearby areas, and supply to households. These are especially prevalent in Bangalore and Chennai.

c. Water Sources for Indian Cities

Indian cities depend on either surface water, or ground water, and more commonly on a mix of ground and surface water. Whether the city is getting water from surface or ground sources, there are a set of environmental concerns with both, which are highlighted in this section.

Increasing Distances between Cities and Their Water Sources

Increasingly, urban areas draw upon a vast regional territory to provide water to resident populations. Table 3.3 below gives an indication of the large distances from which cities draw water.

Table 3.3: Sample Cities and Distance from their Water Sources

Name of the City	Water Source	Distance between city and source (km)
Delhi	Tehri Dam	320
Mumbai	Middle Vaitarna	120
Chennai	Krishna	200
Bangalore	Cauvery	100
Hyderabad	Krishna	100
Bhopal	Narmada	70

Source: http://www.downtoearth.org.in/water_day2012/waterday2012.pdf

Using the survey of water utilities completed by the National Institute of Urban Affairs (NIUA) in 2002, S. Mukherjee, Shah, and Kumar (2010) identify that cities with larger populations rely more on surface water as opposed to groundwater sources.

While cities depend on faraway sources, there is little evidence of source conservation or protection. There are concerns about drawing water from distant sources because it leads to huge energy costs. The possibility of water losses also increases as the distance increases.

This dependence of urban areas for surface water outside their territory has begun to give rise to conflict with other uses. The case of Chennai and the Telugu-Ganga project is an example of urban surface water demand resulting in direct competition with rural users.[5] Cities like Hyderabad (Celio & Giordano, 2007) and New Delhi (Swain, 1998) are also in continual negotiations with surrounding agricultural areas for their water supply, in addition to drawing water from distant sources.

Depleting Ground Water Aquifers

While urban India is highly dependent on groundwater, the extent and nature of this dependence is poorly understood. Urban households access groundwater through three primary means: a) public supply by urban local bodies or other parastatal agencies which may be completely or partially dependent on groundwater, b) private supply from shallow

[5] Farmers along the upper riparian area in Andhra Pradesh have strongly protested against water transfer from the Krishna River to meet the water requirements of the city of Chennai (Nikku,2004). Excess withdrawal from surface water bodies can also cause ecosystem disruption, if the quantity of water in rivers and lakes are not sufficient for normal ecosystem functioning (Bunn and Arthington, 2002), although studies of this nature are rare in India.

wells or bore wells within or near premises of use, and c) semiformal and informal trading of groundwater (Narain, 2012a).

Given the multiplicity of means by which urban India depends on water, it is difficult to estimate the extent of the dependence. There are no reliable or comprehensive estimates about groundwater use in Indian cities. According to Grönwall, Mulenga, and McGranahan (2010), the statement that 'half of urban population in India depends on groundwater' is found in most official government documents related to urban water supply, including those from the Central Groundwater Board and the Ministry of Water Resources, although the source of this figure is never described. Using data on discrepancy between estimated and actual sewerage generation and the gap between official water supply and actual water demand estimates, Narain (2012b) calculates that 53–58 per cent of total urban water use in a sample of 71 cities is dependent on some means of groundwater.

The clearest evidence perhaps exists for direct groundwater dependence. Table 3.4 illustrates the distribution of households dependent on groundwater across class size. Nearly one-third of households are directly dependent on groundwater, and the proportion of households dependent on groundwater increases in smaller cities.

Table 3.4 Percentage of Households directly Dependent on Groundwater

Water Source	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	All Classes
Covered Well	1%	2%	4%	3%	2%	2%	2%
Uncovered Well	2%	6%	11%	9%	9%	10%	4%
Well (Sub Total)	3%	7%	15%	12%	11%	12%	6%
Handpump	8%	14%	16%	19%	25%	22%	12%
Tube well	9%	9%	8%	10%	11%	8%	9%
Total	**20%**	**31%**	**39%**	**41%**	**47%**	**43%**	**27%**

There is an increasing dependence on ground water for a variety of reasons. For households, in the absence of adequate public supply, privately extracted groundwater (at household levels) is the cheapest and most easily accessible alternative for most citizens. Studies from Chennai (Srinivasan, Gorelick, & Goulder, 2010) indicate that informal water trading involving supply in water tankers is 3–50 times more expensive than municipal or private bore well water. In Aurangabad, Foster and Mandavkar (2008) find private bore well water to cost around Rs 7–11/cu.m., while tanker supply costs approximately Rs 60/cu.m.

However, all households might not have the means (land, money, etc.) to extract and use groundwater. Given this, and in absence of adequate public supply, informal groundwater markets have emerged in some parts of the country. These markets have not been documented and studied enough, except in the case of Chennai and Bangalore. [6] These markets also remain outside the purview of regulation. The exception again here is Chennai, where the government utility responsible for water distribution has contracted tanker companies to purchase groundwater extracted from peri-urban areas (Joel Ruet et al. ,2002) ; Srinivasan et al. , 2010).

[6] For Chennai, see: (Joel Ruet, Saravanan, and Zerah (2002), Joël Ruet, Gambiez, and Lacour (2007); Janakarajan, Butterworth, Moriarty, and Batchelor (2007); Srinivasan et al. (2010), Hubli-Dharwad (Raju, Latha, & Manasi, 2007) and Bangalore (Grönwall et al. (2010) ; Narain (2012a)).

Apart from households and private markets, public utilities often depend on groundwater. Sometimes, the urban local bodies depend on groundwater in absence of a viable surface water source. However, many urban local bodies also tend to rely on groundwater for public supply even when surface water resources are available because of the lower capital investments required and the ease of scaling up supply to meet gradual growth in demand (World Bank, 2010).

This prevalent, almost ubiquitous dependence on groundwater can perhaps be traced back to a set of laws that entitle the landowners (households, private company, public body) to extract unlimited water from aquifers. The Easement Act of 1882 recognises water as an easement of added benefit which is inextricably linked with land. This notion is reinforced by the Transfer of Property Act of 1882 and the Land Acquisition Act of 1894 (Iyer, 2007; Saleth, 2009). While the Central Groundwater Authority has been created to regulate such indiscriminate withdrawal, it faces an uphill task due to the very large number of bore wells and also due to the non-availability of other sources in many areas (Narain, 2012a).

While so far the groundwater dependence was limited to area of the city, cities are increasingly going further in search of groundwater. The most well-known example here remains Chennai. The utility buys groundwater from the farmers in peri-urban areas. (Joël Ruet et al., 2007).

This groundwater dependence has several consequences: the most prominent one being depletion of urban aquifers. In the context of urban groundwater, the dominant narrative one finds in the popular media is one of rapidly depleting urban aquifers (Lalchandani (2011); Times News (2011); Ghosh (2012)). But the reality is much more nuanced. Within the same city, water tables are typically falling in parts which are heavily dependent on groundwater, while water levels are rising in the older parts which often have piped water supply. This variation is primarily because of high rates of leakage from water supply and wastewater pipelines (CGWB, 2011). Cities across the country like Jodhpur (Paliwal & Baghela, 2006) and Ajmer in Rajasthan (Jat, Khare, & Garg, 2009), Pune and Solapur (Naik, Tambe, Dehury, & Tiwari, 2008) in Maharashtra, Bangalore (CGWB, 2008); CGWB, 2010; Narain, 2012a), Mulbagal (Nadhamuni,2012 ; Sekhar, 2011) and Hubli-Dharwad (Hollingham, 2008) in Karnataka, and Lucknow in Uttar Pradesh (Foster & Choudhary, 2009) seem to conform to this characterisation.

While exact pattern varies, excessive groundwater extraction, leading to the depletion of aquifers remains a concern. In addition to a depletion of groundwater aquifers, coastal cities which are heavily dependent on groundwater face the risk of sea water intrusion in aquifers due to the pressure difference caused by groundwater extraction. There is evidence of saline water intrusion in Chennai (Ramesh, Kumar, Eswaramoorthi, & Purvaja, 1995), Calicut (Raju et al., 2007) and Kutch and Saurashtra in southern Gujarat (Moench,1992; T. Shah,2008). Excessive extraction of groundwater can also cause intrusion of polluted surface water from rivers or lakes. This has been documented in the case of Lucknow by Foster and Choudhary (2009).

Other Water Sources

Most Indian cities either depend on groundwater or surface water, drawn from distant sources. Few cities, if any, depend on local surface water.

BOX 3.1: RAINWATER HARVESTING IN CHENNAI

The depletion of aquifers has prompted many cities in India to initiate efforts to encourage residents to instal rainwater recharge structures. In 1994, faced with increasing failure rates of borewells and shallow dug wells, Chennai was the first city to require all new buildings within the city to have rainwater recharge structures (CMDA, 2008). In October 2002, the city made it mandatory for all existing buildings also to have them within a year. By July 2003, when it became clear that most residents were dragging their feet over the matter, the city passed an ordinance which threatened to disconnect sewer connections to properties which did not meet the October deadline (CMDA, 2008).

In relevant literature there are conflicting claims regarding the effectiveness of the rainwater recharge programme in Chennai. While the report by South Asia Network on Dams Rivers and People (1999) gives evidence of improved water quality in a few places, using results from a survey of 306 residential buildings in Chennai, Coelho and Reddy (2004), state that more than 80% of those surveyed were poorly constructed and do not function well. This has been attributed to the fact that most people rushed to construct recharge structures only after the July 2003 ordinance, causing a hike in prices for good quality material and manpower (ibid.). Sreenivasan et al. (2010) also state that due to the lack of supervision and care in construction, many of the recharge structures do not function to their full potential.

Since 2002, many municipal corporations and states in India have passed legislations mandating the construction of rainwater recharge structures in all new buildings (CSE, 2010). Although some of these legislations do have the caveat that exempt waterlogged areas, in general the legislations do not take into account soil or aquifer conditions which can vary widely within the same city.

2. Urban Sanitation in India

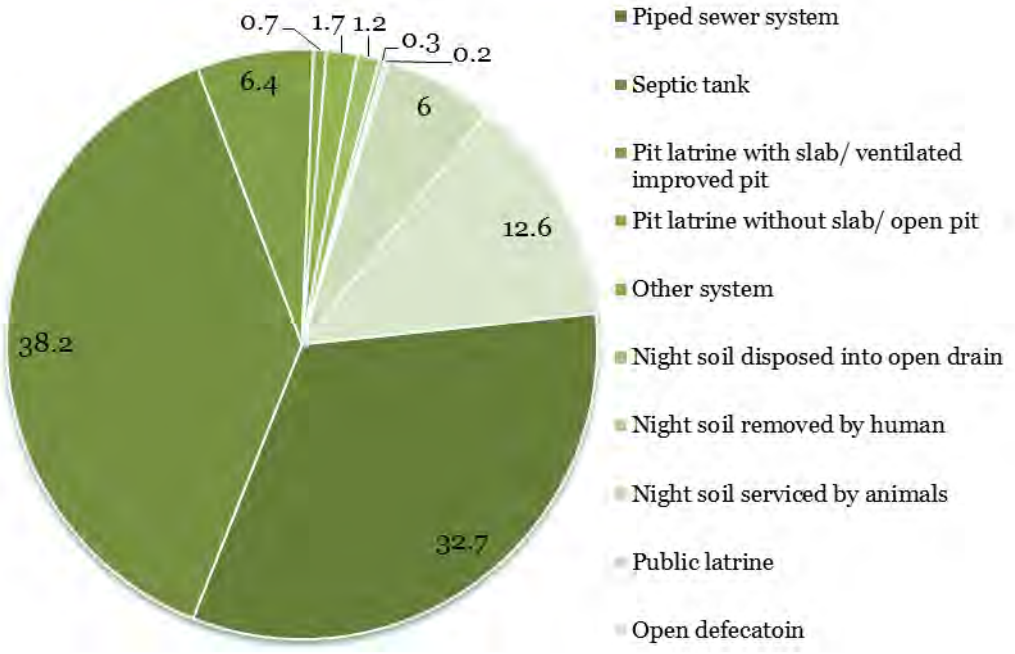
This section presents the analysis of urban sanitation in India, describing the whole wastewater cycle.

a. Household Level Arrangements and Access

Household Arrangements: Historical Trends and Distribution

Fig 3.4 represents the distribution of urban households, according to the type of toilet facility (Census of India, 2011a) . Around 81 per cent of urban households have access to toilet facilities within the household premises, 6 per cent access public toilets, and 12 per cent are forced to resort to open defecation. Thus, nearly 10 million households still defecate in the open. Open defecation, and the lack of access to any kind of toilet facilities, individual or shared, is one of the biggest concerns and challenges for urban sanitation in India.

Fig. 3.4: Distribution of Toilet Facilities in Urban Households of India, 2011



Source: Analysis of Census 2011 data

In addition, a small percentage of households that have to depend on insanitary installations like unimproved pit latrines, or toilets where waste is removed by humans, animals or drains. This often involves the practice of manual scavenging, which is unacceptable, and a serious breach of human dignity.[7] Studies also indicate that the condition and type of toilets in urban areas is highly variable. Toilets, especially among poorer communities, are often dysfunctional: clogged toilets, leaking taps, broken floors or roofs (WSP-TARU, 2008). The problems faced by the poor in accessing toilet facilities, including community toilets, are highlighted later.

Table 3.5 shows the percentage of households with access to 'improved' sanitation over the past two decades. [8] Access to improved sanitation has increased over the past two decades (from 49 per cent in 1990 to 77 per cent in 2011). While the percentage of households without access to 'basic sanitation' has decreased from 32 per cent to 17 per cent over the same length of time, the number of households practising open defecation or having unimproved toilets, has reduced from 72 million to 64 million.

[7] A recent law (The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act, 2013) has also made employment of manual scavenging illegal. It also prohibits employment of sewage workers unless they are equipped with proper safety gear, and appropriate equipment.
[8] According to JMP (Joint Monitoring Programme, UNICEF and WHO), Improved sanitation includes Flush toilet, Piped sewer system, Septic tank, Flush/pour flush to pit latrine, Ventilated improved pit latrine (VIP), Pit latrine with slab, Composting toilet.

Table 3.5: Access to Improved Urban Sanitation (MDG and Census of India)						
Year	Popn India (millions)	% of Urban Popn	Improved	Shared	Unimproved	Open Defecation
1990	862	26%	49%	19%	4%	28%
2000	1042	28%	52%	20%	6%	22%
2008	1181	29%	54%	21%	7%	18%
2011	1210	31%	77%	6%	4%	13%
Source: JMP, Census 2001, Census 2011						

It is to be noted that the Census enumerates household arrangements and does not collect data on households sharing toilets. In the most recent estimate provided by the NSSO (2010) for 2008–9shows that 24 per cent of urban households were sharing toilets. Given the estimated proportions for septic tank/flush latrines (77 per cent) and pit latrines (8 per cent), it is likely that the Census 2011 estimate of improved household sanitation in urban India is likely to be an overestimate. (It is being proposed that shared toilets be also included in the improved category)

Over the past decade, the percentage of households without access to latrines has reduced slightly from 27 per cent to 18 per cent, the actual numbers have increased slightly (14.6 million in 2011, compared to 14.1 million in 2001). (For detailed comparison between 2001, and 2011, see Annex A2, Fig. A2.8)

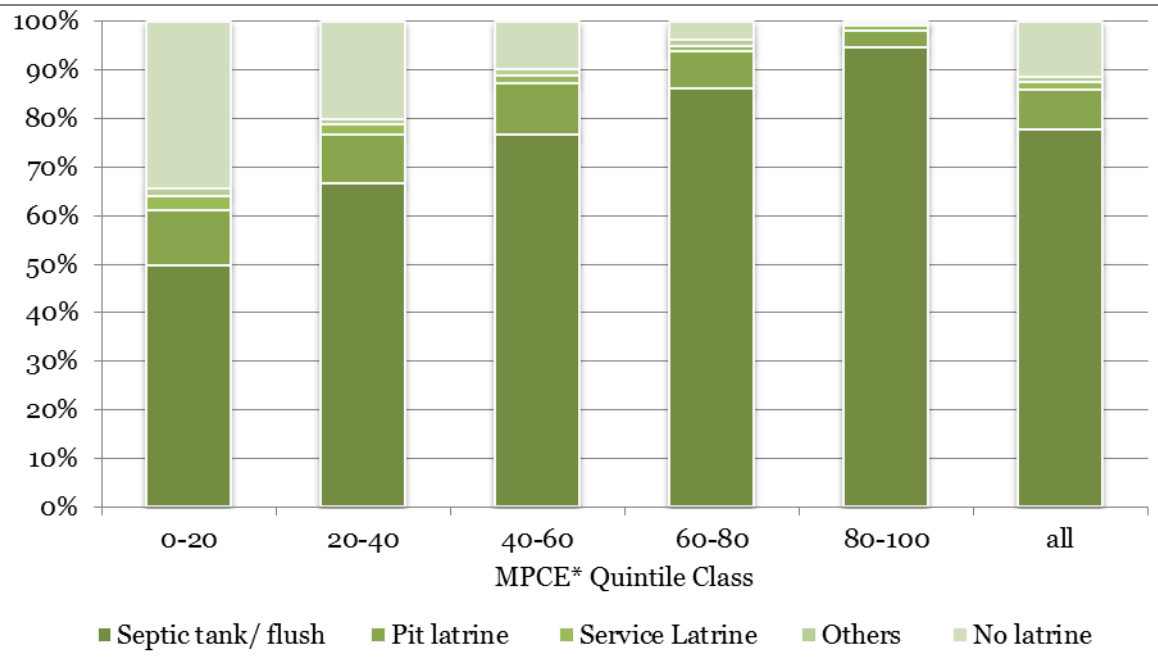
Differential Access to Sanitation

Access to sanitation is unequal across income groups, cities and states. The section below attempts to highlight the differential access to toilet facilities across different parameters.

Across Income Groups

Not surprisingly, access to toilet facilities is not distributed equally among households with varying economic status. While there are some differences in the categories for data collection in Census and National Sample Survey Organisation, an analysis of NSSO (2009) findings indicates a clear trend: the lower the MPCE quintile, the higher the possibility of lack of access to toilet facilities.

Fig. 3.5: Distribution of Toilet Facilities across Different Income Groups, 2009



Note: * - MPCE → Monthly Per Capita Expenditure
Source: NSSO 2009

Across Size Class Distribution of Cities

Indian cities can be divided into various class sizes according their population (see Annex A2, Table A2.9). India has a top heavy urbanisation structure, where Class I size cities are home to a majority of urban households (nearly 60 per cent).

Table 3.6 shows the distribution of OD households across class size. While the percentage of households defecating in the open increases for smaller class size cities, the share of OD households is spread across all cities. While Class I and II cities account for 45 per cent of the share of OD households, 55per cent of these households are distributed across the others class sizes. A detailed table presenting the distribution of toilet facilities across different classes of cities can be found in the Annex A2, Table A2.10.

Table 3.6: Distribution of 'Open Defecation' Households across city class size

Class Size	Total HH	Percentage of HH with OD	Share of OD
Class 1	3,152,143	7%	32%
Class 2	1,331,505	15%	13%
Class 3	2,508,290	21%	25%
Class 4	1,787,731	27%	18%
Class 5	1,059,014	31%	11%
Class 6	126,474	30%	1%
All Classes	9,965,157	13%	100%

Across Regions and States

An analysis of open defecation households across various states in India shows a pattern similar to class-wise analysis. While the eastern and central states of Chhattisgarh, Orissa,

Jharkhand, Bihar and Madhya Pradesh have a large percentage of their urban population defecating in the open, they account for a small proportion of the total numbers defecating in the open (See Annex 2, Map 2.11, Table 2.12). On the other hand, the top 5 states with the highest urban population account for nearly 50 per cent of OD urban households, as can be seen in the table below.

Table 3.7: Distribution of Urban and OD Households in States with Highest Urban Population

No	State	No of HH	Share of HH in Total Urban HH	No of OD HH	Share of OD HH
1	Maharashtra	10,813,928	14%	831,668	8%
2	Tamil Nadu	8,929,104	11%	1,447,304	15%
3	Uttar Pradesh	7,449,195	9%	1,104,162	11%
4	Andhra Pradesh	6,778,225	9%	807,518	8%
5	West Bengal	6,350,113	8%	714,459	7%
	Total of Above States	**40,320,565**	**51%**	**4,905,111**	**49%**

b. Waste Conveyance and Treatment

Broadly, the sanitation systems in India can be divided into two broad types: network-based systems, which refer to piped sewerage and on-site systems which includes all other categories. This section highlights issues regarding both types of systems.

Networked-Based Systems

Referring back to Fig. 3.4, it is evident that only a third of the city population is serviced by network-based systems, as apart from piped sewerage, all other categories constitute on-site systems. In a survey carried out in 300 cities, only 100 cities had sewerage systems (NIUA, 2005). The number of cities with sewerage has increased slightly, according to Census 2011. Table 3.8 shows the distribution of cities with the percentage of households connected to sewerage systems. Even now, only 792 or only 10 per cent of cities have more than 50 per cent of households connected to sewerage systems, and it is in all likelihood an overestimate. (For distribution across states and districts, see Annex 2, Map A2.13)

Table 3.8: Distribution of Cities with by Sewerage Connections

Percentage of HHs connected to Sewerage System	No. of Cities
Above 90%	42
75%-90%	115
50-75%	224
25-50%	411
10-25%	1675
5%-10%	1801
5 % and below	3658
Total	7926

Source: Analysis of Census 2011 data

There is limited data available on wastewater collection, however, various estimates indicate that only one-third of total wastewater generated is collected (CPCB, 2009). In the national

sanitation ratings carried out for 423 cities, 274 cities (65 per cent) have unsatisfactory arrangements for safe collection of human excreta. Only about 27 per cent of cities are collecting more than 80 per cent of their waste (MoUD, 2010).

The sewerage systems, where they exist, are plagued by multiple problems. The sewers in most Indian cities are badly maintained: frequent blockages, siltation, missing manhole covers, gulley pits. There is hardly any preventive maintenance with repairs being made only in the case of crises (WSP-TARU, 2008). Improper disposal of solid waste also tends to block sewer lines. Sometimes, storm water enters the sewerage network, leading to inflow in excess of the capacity of the system, and hence sewer lines cannot function.

In many Indian cities, sewers do not take wastewater to treatment plants, and instead discharge untreated wastes into surface water bodies.

Table 3.9 shows the Service Level Benchmark (SLB) indicators for sanitation. This data, based on 1,400 cities, highlights that both waste collection and treatment is a huge concern, as the median for more than 1,000 cities is zero.

Table 3.9: SLB Indicators for Sanitation

No.	Indicator	Unit	Benchmark	Median	Average
1	Coverage of Toilets	%	100	72.6	69.5
2	Coverage of Sewage Network Services	%	100	0	12.2
3	Collection Efficiency of Sewage Network	%	100	0	10.3
4	Adequacy of Sewage Treatment Capacity	%	100	0	5.3
5	Reuse and Recycling	%	20	0	4
6	Quality of Sewage Treatment	%	100	0	3.3

Source: MoUD (2010)

There is limited data available on wastewater treatment. However, a CPCB study shows that treatment capacity exists only for 21 per cent (6,190 out of 29,074 MLD) of the total sewage generated in Class I and II cities. It is estimated that most plants work only at 72 per cent of their capacity, and hence only 15 per cent of the waste is effectively treated. The problem is sometimes exacerbated by mixing industrial water with domestic wastewater. Treatment plants may not function properly for a number of reasons: insufficient wastewater due to inadequate conveyance system, frequent power cuts, breakdowns due to lack of maintenance. Most of the treatment capacity (nearly 70 per cent) is concentrated in the 35 million plus cities. Besides this, there is minimal reuse/recycling of wastewater (CPCB, 2009).

On-Site Systems

According to Census 2011, nearly two-third of the households in India are dependent on on-site sanitation systems, the most common being septic tanks, followed by a different kind of pit latrines. While on-site systems are the most common systems, most of the policy focus has been on sewerage systems, to the neglect of on-site systems.

The on-site sanitation systems are mostly constructed by households, who do not necessarily have the knowledge or resources to build these according to requisite standards. For example, the minimum distance of soak-pits from the drinking water source may not be maintained. Similarly the soakaways necessary to drain effluents from septic tanks might be missing. Often, on-site systems suffer from poor design and poor workmanship.

While there are significant differences between cities and states in general, there are limited facilities for safe emptying of pits or de-sludging of septic tanks. While some urban local bodies provide these services, a majority of households enlist the services of sweepers to manually empty the pits and tanks or private mechanical emptiers (WSP, 2008). There are very few treatment facilities for fecal sludge; most of the existing treatment involves co-treatment at conventional STPs. In most cases, the collected waste is dumped in the open without any treatment (AECOM & SANDEC, 2010; WSP-TARU, 2008).

In general, there is little information about the performance of on-site systems, and it is not possible to estimate the quantum of fecal sludge that is safely transported and treated. It has also been a poorly regulated area, with no monitoring of either the utilities or the private players.

3. Service Provisioning To the Poor

If urban India needs to meet the challenge of universal access, then it needs to pay attention to specific needs of the urban poor.

Not surprisingly, the deficits are larger among the urban poor households. On the water supply side, there is not much difference in access to treated tap water among slum and non-slum households; however slum households are less likely to have access to water within their premises (Census, 2011). Moreover, more than 50 per cent of households in the lowest quintile are dependent on shared facilities.

On the sanitation side, poor households are more likely without any access to latrine facilities (Census, 2011, see Annex 2, Table A2.14). The distribution of slum and non-slums households according to the type of latrine has been presented in Annex A11. The lack of access to reliable public supply often means that the poor spend more than the middle classes. Apart from these direct coping costs, they also have indirect coping costs including time spent in fetching water and a loss of productive hours (World Bank, 1996).

There are several challenges for service provisioning for the poor. One of the big challenges in provisioning of services for the poor is related to land ownership and tenure security. Government programmes are usually limited to notified slums, and within those which have secure tenure. Experience has shown that the urban poor often prefer to upgrade their shelter incrementally, and are ready to invest in improving their living conditions if there is security of tenure (Mahadevia, 2011).

Apart from tenure households, there are severe economic constraints and not many households may be able to invest in water and sanitation facilities. Currently, there are limited subsidies for household provisioning in India.

On the sanitation side, the provision of toilets has additional problems with regards to lack of space. Urban slums are dense, overcrowded places, where sometimes it may not be possible

to provide individual toilets. Community toilets[9] are often seen as an answer, and have been implemented in various cities, with mixed results.

4. Water Supply and Sanitation: Key Challenges and Emerging Policy Priorities

Universal access to both water and sanitation still remains an issue in urban India. As illustrated, the mere presence of infrastructure is no indicator of service levels. While 40 per cent do not have access to public piped water supply, the remaining households may not get a sufficient quantity of water, or regular water supply. In absence of public service, households depend on multiple sources of water—procuring water from private players or some form of provisioning. In addition, nearly one-third of urban households do not have any water source within their premises, and nearly a third depend on shared facilities. Water quality is likely to be a concern. At the city level, the biggest concern remains the high distribution losses, and high non-revenue water.

Nearly 10 million urban households do not have access to any form of latrine, and defecate in the open, while another 2 million have access to unimproved sanitation. Any equally pertinent concern is the abysmal record on wastewater conveyance and treatment side. Only one-third of the waste is carried through sewered networks, and only 15 per cent of wastewater is treated. There are minimal facilities for safe sullage/septage removal, transportation and treatment.

The focus has predominantly been on creation of new infrastructure, without adequate attention paid to putting in place a sustainable O & M region to ensure sustainability of infrastructure.

The urban poor are disproportionately affected by the lack of access to water and sanitation. Urban poor households are more likely to need to fetch water from outside their houses, and more likely to depend on shared facilities. On the sanitation side, they are more likely not to have access to adequate sanitation facilities. As highlighted above, there are unique challenges to ensure provisioning of services to the poor, including tenure security, affordability and space constraints.

The environmental concerns posed by the urban water supply and sanitation are two-fold. There is inadequate attention being paid to the protection of water sources, and there are hardly any efforts to move towards conjoint management of water. The more severe concern is pollution of both surface and groundwater caused by a lack of treatment of wastewater.

Thus, cities need to address the following on a priority basis:

1. Universal access to water and sanitation, especially ensuring access to the poor
2. 100per cent treatment of waste
3. Protection of water sources
4. Rationalising use of water

[9] Community toilets are distinct from public toilets. While public toilets are open to any member of the public, community toilets are generally meant for a fixed group of users, even if, the group has a floating population.

a. Increased efficiency of city-level infrastructure, specifically reduction of non-revenue water

b. Demand management

5. Ensuring adequate O &M regime

IV. INSTITUTIONAL ARRANGEMENTS

1. Institutional Arrangements

The first part of this section describes the typical institutional arrangements for water and sanitation in India, and the later part of the section illustrates some of the concerns with these arrangements.

Influential Role of the Central Government

According to the Indian Constitution, water supply and sanitation are state subjects, and hence the responsibility of provision of urban water supply and sanitation services lies with the state government. After the 74th Amendment, the responsibility for provisioning of water and sanitation lies with urban local bodies.

Irrespective of the fact that local and state governments have the mandate for provisioning of urban local bodies, the central government has been a significant and influential player in urban water and sanitation. It has influenced the sector through three primary means: a) by being the largest funder, b) setting overall policy framework, and c) setting technical standards and norms. The first route, i.e., funding of urban programmes has been most significant. The Government of India has funded several centrally sponsored schemes/ projects—the largest one of these being JNNURM, discussed in the last section. The investments made through schemes are influenced by guidelines set by the centre.

The Government of India is responsible for setting the overall policy framework, though the influence of the national policies is variable, as explained in sections below. The MoUD has recently formulated the National Urban Sanitation Policy, issued an advisory note on UWSS and septage management, and established both bi-annual National Ratings Systems and Service Level Benchmarks. These policies and initiatives are discussed in detail in the next section.

Through CPHEEO, the technical wing of the Government, it establishes norms and technical standards for design and construction of infrastructure. The Detailed Project Reports for various projects are approved on the basis of norms laid down in CPHEEO. [10] Besides this the Central Government has constituted the Central Ground Water Commission and Central Pollution Control Board which are mainly vested with monitoring and regulatory responsibilities.

[10] There are three manuals published by CPHEEO: Water Supply & Treatment, Sewerage and Sewage Treatment and Operation and Maintenance of Water Supply Systems.

Differing Arrangements among States

Since water and sanitation are state subjects, **there are a range of different institutional arrangements across states, and often across cities within the same state.** Some typical arrangements are given below.

The state government funds independent projects, and also provides supplementary funding for projects, sponsored by the Government of India. The state governments also play a major role in planning and implementation of projects. This is done through a variety of means, either by the Public Health Engineering Departments or through specially constituted State Boards (e.g., Tamil Nadu Water Supply and Drainage Board).

Despite the 74th Amendment being in place for nearly two decades—which ascribes the responsibility of UWSS to the ULBs—the role of the ULBs remains limited.[11] While there has been devolution of powers by law, there has been no concomitant devolution of financial powers.

Often, there are separate arrangements for metropolitan cities, and another set for the rest of the cities. In some metropolitan cities, the planning and implementation is sometimes done by statutory/parastatals at the city level, e.g., Delhi Jal Board, Bangalore Water Supply and Sewerage Board, and in the remaining cases by ULBs. In most of the non-metros, responsibility is split between the state and Urban Local Bodies (ULBs). However, the onus for Operations and Maintenance for a large majority of cases lies with the ULBs.

[11] The 74th Amendment was passed in 1992 with the intention of devolving responsibility to the urban local bodies, and empowering them as a third tier of government. The Amendment transferred a whole host of functions, including urban water supply and sanitation from the state to the local governments. It also required the states to pass the requisite acts that would enable this transition, and empower ULBs (GoI, 1994).

However, there were no clear deadlines in place for the devolution, and devolution has been piecemeal, slow and variable across different states in India. In particular, the devolution of financial resources has been particularly slow. The reasons for the lack of devolution are complex: one that the devolution of responsibilities has to be matched by commensurate devolution of financial resources, which has not happened. The other is lack of capacity; often the ULBs do not have sufficient capacity to take over the service provisioning.

Table 4.1 shows some arrangements for some select states.

Table 4.1: Water Supply & Sewerage Provisioning Arrangements in Different States

State	Capital Works	O & M	Revenue Functions
Andhra Pradesh	PHED	Municipal Body	Municipal Body
Bihar	PHED	PHED	Municipal Body
Chhattisgarh	PHED	PHED	Municipal Body
Gujarat	GWSSB, Municipal Body	Municipal Body	Municipal Body
Himachal Pradesh	PHED	PHED	Municipal Body
Karnataka	GWSSB, KUWSSB, Municipal Body	Municipal Body	Municipal Body
Kerala	KWA	KWA	KWA
Madhya Pradesh	PHED, Municipal Body	Municipal Body	Municipal Body
Maharashtra	MJP, Municipal Body	Municipal Body	Municipal Body
Orissa	PHED	PHED	PHED
Rajasthan	PHED	PHED	PHED
Uttar Pradesh	Jal Nigam, Municipal Body	Jal Sansthan, Municipal Body	Jal Sansthan, Municipal Body

Source: MoUD (2012b)

Existing Regulatory Bodies

The Central Pollution Control Board (CPCB) and the State PCBs are responsible for monitoring water pollution, and collects and disseminates data on water pollution. Its mandate comes from the Water (Prevention and Control of Pollution) Act, 1974. It mostly monitors point sources of pollution, and there is a fine, often paltry and inconsequential, for non-compliance. The board also conducts studies on the status of water and wastewater generation, collection, treatment and disposal in Class I cities and Class II towns in the country. The Central Ground Water Board (CGWB) is responsible for monitoring of ground water levels.

Irrespective of the specific mix of institutional arrangements within a state, there are several common concerns, described below.

Focus on Infrastructure/Asset Creation, Not on Service Delivery

Historically, the institutions responsible for water and sanitation have tended to focus on the creation of infrastructure; as has been discussed in earlier sections, the presence of infrastructure is not an indication that a particular service—e.g., good quality drinking water—is being provided. A focus on service delivery implies provisioning of services in the long term, and a shift away from standalone projects, to examining wider management and institutional aspects. It takes into account the life-cycle of a service, including both hardware and software components (IRC, 2012). It also marks a shift from measuring inputs to measuring outcomes, as has been stated in the Service Level Benchmarking Initiative(MoUD, 2010).

Lack of Capacity

One of the biggest concerns facing this sector is a severe lack of capacity at all levels. The various organisations, especially urban local bodies, are understaffed. Besides, the knowledge and skill levels related to both technical and managerial aspects are often inadequate. Hiring external consultants is therefore seen as a solution, but the ULBs/ relevant state departments may not have the capacity to manage the consultants either.

Lack of Mandate

In addition to the lack of capacity, there might be a lack of mandate/unclear mandate for the respective organisations to perform, especially with regard to environmental concerns. For example, while the ULBs are mandated to provide sanitation services to the citizens, wastewater treatment is not necessarily included in this mandate. Similarly water conservation may not be included in the mandate of ULBs. While the 12th Schedule, which outlines the functions and responsibilities of municipalities according to 74th CAA, mentions 'Urban forestry, protection of the environment and promotion of ecological aspects" as one of the functions of the ULBs, wastewater treatment and water conservation are not necessarily included. In addition, the responsibilities and mandate of ULBs are determined by respective Municipal Acts.

Lack of Incentives and Accountability

Even if the above were to be included in the mandate, there is little incentive for ULBs to perform, or conversely few disincentives. While there are pollution control boards to monitor pollution, and maintain standards, the enforcement remains weak due to a variety of reasons (CSE, 2009).

Compared to environment concerns, the mandate for service provisioning to the poor is clearly mentioned in the 12th Schedule, and in Municipal Acts. However, there are no incentives/disincentives, or indeed any systems of accountability.

Absence of/Weak Regulation

There are various regulatory bodies for environment, e.g., pollution control board or groundwater board, however, the enforcement remains weak. All the same, there are many aspects which do not have any form of regulation: e.g. drinking water quality, tariff setting, service provisioning, etc. There is a need for appropriate regulation mechanisms, which are effective.

Need for Greater Role Clarity and Integration with other Functions

While there are differing arrangements and multiple institutions in the water and sanitation sector, it is not a concern in itself. However, there is a need for responsibilities for different organisations to be clearly laid out, and a need for better coordination between different organisations. Lack of coordination and management might lead to sub-optimal functioning of services.

In addition, there are few linkages, if any, with spatial planning processes. While the larger cities have a master plan, a large majority of cities in India only have Development Control Regulations. These are mostly to do with built form, and usually do not have any guidance for water supply and sanitation. Besides, the mandate of the ULBs is often restricted to

municipal limits, whereas many cities are expanding outside these limits. This often means that most rapidly growing parts of the cities are unserved or under-served.

2. Role of Private Sector, Civil Society, Community and Households

The above scenario presents only a partial picture of the urban water and sanitation sector in India, since households and a range of small private players have a major role in provision of UWSS, given the incomplete reach of public sector provisioning. Some of the major players and their typical roles have been outlined below.

As stated earlier, a large percentage of households depend on groundwater, and supply by tankers for water. Similarly, households are also responsible for collection and disposal of waste in cities/areas where there is no sewerage network. The activities of households and private players is often unregulated (WSP-TARU, 2008).

Private Sector

Despite the increased rhetoric of the increased role of private sector, there has been limited involvement of large-scale private sector in the country, and most of these have been on the water supply side. The debate around the involvement of the private sector is outlined in Box 4.1. The issue of private sector financing has been discussed later on.

While the role of major private players remains restricted to a handful of large projects, there are multiple small- and medium-scale private players. These players typically supply water through tankers and other means to households. They also provide septage-removal services from on-site systems. There remains considerable debate about the role of these small-scale providers.

Households and Community

In the absence of public provisioning, many households, including poor households, invest in self-provisioning; household investments have been discussed in the financing section below. But in addition to investing in hardware, households are responsible for maintaining the facilities at the household level, including cleaning and emptying of on-site systems.

In certain cities, e.g., Mumbai, Pune, Trichy, poor communities have been responsible for upkeep and maintenance of community toilets.

Civil Society

While there has been slow increase in the involvement of civil society, these examples are few, and mostly restricted to larger metropolitan cities. There are also instances of middle-class advocacy groups demanding better services and initiatives. The environmental reports cards produced by the Centre for Sustainable Development and the ward quality index produced by Janaagraha in Bangalore are examples of such initiatives.

BOX 4.1: DEBATE 1: ROLE OF THE PRIVATE SECTOR

One of the biggest debates in the sector is around the role of the private sector. This debate is closely linked to the next section regarding the funding of the sector. Globally, while the involvement of the private sector in water supply and sanitation has been far less than other infrastructure like power or telecom, the debate around involvement of private sector in WSS has been more polarised, and there has been greater opposition (Davis, 2005). At the heart of the debate is the question whether responsibility for providing basic services like water and environmental protection can be reliably left to for-profit companies (ibid.).

The provision of basic services is seen by many as a fundamental duty of governments and this is often part of the reason for opposition to private-sector involvement (ibid.). One of the major reasons cited for the increased role of the private sector is the inefficiency of the public sector. Public sector utilities often have high UFW and NRW rates, low cost recovery and provide services to only a limited section of the population. It is often argued that the private sector could increase operational efficiency. However it is still not clear whether the private sector increases efficiencies.

It has also been highlighted that the public-private debate may actually be misleading, and distracting from critical issues (McGranahan & Satterthwaite, 2006). The problems that public utilities face are likely to be faced by the private sector too, particularly the issue of providing the urban poor with access to services.

As some authors have pointed out (Budds and McGranahan, 2003; Davis, 2005), there are a range of models for public-private participation depending on the proportion of financial risks borne by the private sector, asset ownership and type of contracts, etc. In the current scenario, the private sector is also seen as a means of raising capital investments for the creation of infrastructure. However, the nature of the WSS systems is not conducive for private-sector investments. Investments in water and sanitation are often 'lumpy' and require high capital investments. Also, the infrastructure systems often need to be put in place before demand is there (Davis, 2005). These systems are also natural monopolies, and cannot be easily unbundled (Budds & McGranahan, 2003).

There is limited evidence of private-sector participation in the sector. The situation is even worse on the sanitation side. Currently the formal private sector provides water services to only around 5 per cent of the world's population (Budds & McGranahan, 2003). Moreover, often increased investment is required for improving service to the un-served population. This population is likely to be located in smaller cities and towns, or in high density slums, locations which the private sector is not likely to invest in ibid.).

Apart from large formal enterprises, there are a range of small and medium service providers in cities, often referred to as the 'The Other Private Sector'. The central role played by these players is increasingly being recognised.

3. Emerging Institutional Challenges

The Government of India plays a major role in the water and sanitation sector by funding programmes, setting the overall policy framework and establishing various technical norms and standards. The responsibility of design, planning, implementation and operations is split

between state and local governments. While the exact division of roles and responsibilities differs between states, there are some common concerns. The focus of various organisations has predominantly been on infrastructure creation, as opposed to service delivery, though this is gradually changing. The sector is constrained by severe capacity constraints. Additionally, the ULBs or utilities may not have the mandate, or incentives for various functions, particularly those concerning the environment. There is a need to increase accountability in the sector. Moreover, given the role of the private players, public organisations need to be able to regulate private players.

The key priorities on the institutional side are:

1. Shift from infrastructure creation, to a service delivery approach.
2. Capacity building, across levels and domains.
3. Making environmental concerns, specifically water conservation and wastewater treatment, part of the ULB's mandate.
4. Establishing a set of incentives and disincentives.
5. Increasing accountability, through regulators and/or empowerment of citizens.
6. Putting in regulatory mechanisms for private players.

V. FINANCING AND INVESTMENTS

1. Capital Costs

Sources of Public Financing

As stated earlier, the Government of India has been responsible for the largest amount of funding to the sector. In absolute terms, over First to Ninth Plan, there has been a substantial increase in Plan funding for the urban water supply and sanitation sector. However, as a percentage of outlay, the increase has been marginal, in spite of growing attention to the urban sector (WSP, 2008).

The other major stream of funding has been through the National River Conservation Directorate (NRCD). The National River Conservation Programme (NRCP) since its launch in 1985, has supported the creation of about 4,330 MLD treatment capacity in 190 towns at a cost of more than INR 35 billion. Most of this money has gone into either building sewerage treatment plants (43 per cent) or interception and diversion (41 per cent). This funding was initially directed towards cleaning of certain rivers like Ganga and its tributary Yamuna, with inadequate attention to other rivers.

The other sources of funding have been institutional funding like HUDCO or externally aided projects, but this funding is not very significant in scale. While there has been call for increased funding from private sector, so far there has been no significant finance from large private-sector entities.

While there is no consolidated data as to where the investments have gone, most of the investments on the water side have been deployed to build a centrallised water treatment plant, building and expanding the distribution network, and more recently augmenting the

source. There is little evidence of investments in retrofitting of existing systems. On the sanitation side, the funds have mostly gone into construction of sewerage networks and conventional sewerage treatment plants. Thus, the focus of funding has been on the construction of centrallised, city infrastructure. The only exceptions have been slum upgradation programmes implemented in various cities, where grants/subsidies have been given for provision of household and community infrastructure.

Besides Government of India funding, there have been various projects funded under state governments. Some of the metropolitan cities have received investments/loans from various bilateral and multilateral agencies. Revenues through user chargers/taxes have been minimal (discussed below), and have not contributed to capital costs. From the ULB side, there is limited ability to raise money even partially for new infrastructure. This is demonstrated in JNNURM. It is reported that almost no ULB could meet the commitment of contributing to 10 per cent of the project costs (CAG, 2012).

BOX 5.1: HOUSEHOLD INVESTMENTS

Though not commonly recognised, there are some household costs (apart from connection charges), especially if the household is not dependent on the municipal/public sector. These investments vary according to the nature of supply. For households connected to public sector supply, these include connection charges. However, for the rest of the households, these investments and expenses include the construction of hand-pump/tube well for extraction of ground water, storage capacity or buying from water tankers.

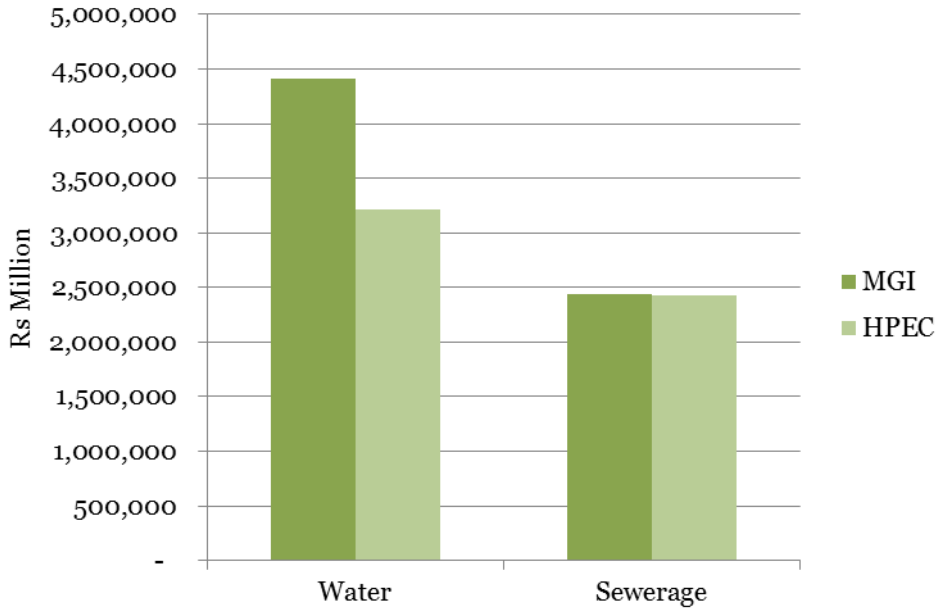
On the sanitation side, for households connected to a sewerage network the investments apart from construction of toilet include cost of connection to sewerage, and connection charges if any. In case of on-site sanitation systems, the cost of construction includes a collection and treatment system, and hence the costs are higher. The costs also include periodic cleaning and disposal of waste (WSP-TARU, 2008).

Estimates of Required Capital Investments

There is a general consensus that more investments are required in the sector urgently, even while there are disagreements around the quantum of deficit, source of funding and where the investments should be directed.

Two recent studies have estimated the quantum of investment required in this sector in India to meet the current infrastructure deficit. These estimates have been prepared by the High Powered Expert Committee (HPEC) constituted by Government of India and McKinsey Growth Institute. Figure 5.1 gives an overview of these estimates.

Fig. 5.1: Projected Investments in Urban Water and Sanitation till 2030



Source: Compiled from HPEC (2011) and MGI (2010)

The estimates for the investments depend on a number of factors, and certain assumptions have been made about each of these. The most critical of these factors include:

1. Population Estimates for Urban India
2. Estimates for Infrastructure Deficit
3. Type of Technology/System and related per unit costs
4. Selective Inclusion of Costs

While it is beyond the scope of this paper to analyse these models in detail or to build an alternative model for financing, some critical issues need to be highlighted. First, both models evidently assume certain kinds of technological systems for both water supply and sanitation. For water supply, it is a centrallised system, and for sanitation, it is sewerage. If one were to use other less expensive technology, the investment envelope would reduce. Second, these models do not take into account investments for 'soft' components like capacity building, planning, communication, etc. Various global estimates for water and sanitation tend to underestimate as they do not taken into account all costs. Moreover, both models derive the unit costs from JNNURM DPRs. While a proper study is yet to be done, there is anecdotal evidence that the costs estimated in DPRs were below the actual costs, and there has been a substantial upward revision of costs during implementation.

Closing Financial Deficit: Some Concern

Currently, most policy discussions are concerned about getting adequate funding for the sector. While there is an urgent need for additional funds to flow into the sector, there is also the possibility of reducing at least part of the financial deficit by re-examining and shrinking the funding envelope. It is possible to do so through exploring different types of technological systems, especially on the sanitation side, and second, through examining the possibility of phased improvement, especially as far as implementing 24X7 systems are concerned.

BOX 5.2: DEBATE 2: FUNDING THE SECTOR: WHO SHOULD PAY?

The debate around funding the sector revolves around two key ideas: whether the households should pay the full cost of the service, or should the government be providing a complete or partial subsidy for a public service like water and sanitation. The second debate is whether the private sector would be able to help close the investment gap, which has been detailed earlier. Given the fact that even if the private sector involvements were to increase, it is highly unlikely to meet the investment deficit. Hence the critical issue is whether the government subsidises the households, or households bear the complete cost.

The debate around the role of public sector investment in developing countries is a global one, and has picked up pace since access to water and sanitation were set as one of the MDGs. Some authors (Annamraju, Calaguas, & Gutierrez, 2001) claim that given the limited amount of international funding, governments in developing countries must increase funding to the sector. This could be done either redirecting some of the investment within the sector, or re-directing from other sectors. The assumption is that the utilities/service providers will not be able to recover full costs, unless poorer households are subsidised by the government.

Conversely, it is claimed that governments do not have the capacity to provide funding to close the infrastructure deficit gaps, and hence users should pay for costs as far as possible. Some of the arguments presented are that low contributions from users make utilities less accountable; subsidies mostly go to the rich and the middle class (Briscoe, 1996)). Moreover it is claimed that if governments finance households, then they do not have sufficient resources to either expand their services or provide environmentally beneficial services like waste water treatment (ibid.). Some authors call for better designed subsidies that target poor households, while others advocate a larger role of micro-finance to provide services to the poor.

This debate around who should bear the costs hinges partly on whether water and sanitation are public or private goods. It is often argued that private good needs to be financed by individuals, and hence 'private' components of WSS systems like household arrangements should be borne by households. On the other hand, authors who argue for the government playing a more substantial role claim that sanitation at least has positive externalities, and construction of toilets benefits the community as much as households (Trémolet, Koslky, & Perez, 2010).

2. Operations and Maintenance Costs

The urban water supply and sanitation sector is characterized by low cost recovery. While cost recovery is often associated with the ability to recover both capital and operating costs, in most Indian cities, the utilities are not even able to recover the operating costs.

Low Collection Rates

The sector is characterised by low revenues, both due to low collection rates, and low pricing. The collection rates remain low. The table below highlights that while collection rates are at least higher than 50 per cent for water, they remain below 10 per cent on the sanitation side.

Table 5.1: SLB Indicators

No.	Indicator	Benchmark	Water Supply		Sewerage	
			Median	Average	Median	Average
1	Redressal of Customer Complaints	80%	75	72.9	0	21.2
2	Cost Recovery	100%	32	38.8	0	5.2
3	Efficiency in Collection	90%	63	58.7	0	7.3

Source: MoUD (2012b)

Low Tariffs

The most common method of collecting revenues is through levying tariffs or imposing water/sewerage tax. For water, the tariff varies depending on the presence/absence of a metered connection. For metered connections, there is either a uniform volumetric rate depending on the use of water or increasing block tariff (IBT) (Raghupathi, 2002). For non-metered connections, it is either a flat rate, or a variable rate depending on the size of the ferrule, number of taps, or as a proportion of property tax.

There is no consolidated data available on tariffs; the most comprehensive study was carried out by the National Institute of Urban Affairs (NIUA). The average charge is around ₹1.5 per kl for metered connections. For non-metered connections, the average cost is around ₹45 per month.

Table 5.2: Overview of Charging Structures in India

	Metropolitan cities	Smaller cities and towns	Total	Percentage of Total
Metered				
• Uniform volumetric tariffs	11	89	100	49%
• Increasing block tariffs	8	26	34	17%
Total	19	115	134	65%
Unmetered			0	0%
• Flat-rate charge	10	135	145	70%
• Ferrule-based charge	7	37	44	21%
• ARV-based charge	1	10	11	5%
• Tap-based charge	0	6	6	3%
Total	18	188	206	100%

Source: Raguhpathy (2002), as presented in WSP (2011)

There are almost no cities that charge separately for wastewater collection. The collection charges are mostly collected as part of water bill or property tax. For cities which do have separate charges, it takes the form of levying sewerage/drainage charge, charge per WC, or a surcharge on water.

Low Cost Recovery

There is wide discrepancy between collection of revenues and cost of operations. On the water supply side, the cost of operations, on an average, works out to be ₹15 per kilolitre, 10

times higher than the average tariff (WSP, 2011). A minority of customers in cities like Chennai and Bangalore pay rates comparable to operating costs.

The concerns for raising tariffs need to be balanced by the need to protect the interests of the urban poor. Often IBT is proposed as a solution, where lifeline water is provided at free/highly subsidised rates, after which the tariffs rise sharply. The purpose of IBT is to ensure that richer households which consume more water pay a higher rate. However, in most cities, the first block is beyond lifeline level, and hence a majority of consumers fall into the first block itself (McKenzie & Ray, 2009).

3. Emerging Financial Priorities

The main financing for water and sanitation has come through the Government of India. Some additional financing has been provided by various state governments. Despite increased funding to the sector over the past decade, there remain considerable gaps between the projected investments, and current sources of financing, and there is a clear need for increased funding in the sector. However, given that it is not clear what the available quantum funding would be , it is also necessary to re-examine cost envelopes. Finally, the funding of O & M costs merits equal attention.

Thus, the emergent priorities on the financing side are:

1. Increased investment for water and sanitation,
2. Rationalising cost envelopes, through lower cost technology, and phased improvements
3. Rationalising O & M costs through lower cost technologies
4. Appropriate tariff revision, with adequate safeguards for the poor

VI. POLICY RESPONSES: CONSENSUS AND GAPS

1. Overview of Key Initiatives

There have been several key initiatives in water and sanitation in the previous decade. These initiatives can be decided into three major types of initiatives:

1. Policies and Advisories: National Urban Sanitation Policy, Advisory on Water and Sanitation Services, Septage Management Advisory
2. Investment Programmes: Swachch Bharat Mission, JNNURM, RAY
3. Data Collection Initiatives: Service Level Benchmarking (SLB), National Urban Sanitation Rating
4. Others: Revision of CPHEEO Manuals

A brief description of these initiatives is available in Annex A1. In addition, there have been various state-specific initiatives, and also city-specific programmes; however it is beyond the scope of this paper to delve into this.

These initiatives have sometimes complemented each other, and sometimes progressed independently of other initiatives. There appears to be an in-principle agreement on certain priorities like provisioning to the poor or operations and maintenance, even though there might not be any clarity on how to move forward on these matters. However, some issues have not received adequate attention, or have been accorded priority only in select policies. The following sections highlight both sets of issues.

2. Emerging Consensus

This section presents certain issues that are recognised by various documents. It does not separately list out what has been presented in each of the individual documents. The section seeks to capture what are the critical aspects of a particular issue that have been recognised, and what aspects have not received attention.

Delivery of Services to the Poor

The centrality of providing basic services to the poor has finally been recognised in most of the policies/programmes, especially JNNURM and NUSP. Reaching out to the poor communities is also recognised in the HPEC and 12th Five Year Plan. Service Level Benchmarks do not have a separate indicator for provisioning of the poor, but they highlight the issue of 100 per cent coverage of water supply and toilets. Access and use of toilets is also one of the indicators in the National Ratings.

However, it is not clear whether the underlying constraints for service provisioning to the poor are adequately understood. The most critical of these is insecurity of tenure. Many public programmes in the past have focused on slums with clear tenure rights. It has also been argued that the urban poor will not invest in house improvements, unless they have the security of tenure. Only a few initiatives have adequately addresses this issue. The emerging policy responses to these have been to delink provisioning of services to tenure security. This has found response in NUSP, and is one of the models of RAY. Delinking needs to be seen as a necessary intermediate step till security of tenure is achieved.

Poor households may not have the ability to partially or fully provide for cost of water connections or construction of toilets. Also, if the poor households invest in on-site sanitation systems, then there is an additional cost of removal of sullage/septage. As is evident from JNNURM, a large chunk of funding has gone to the construction of sewerage systems and low cost housing. In the short run, it might not be possible to connect all households to sewerage or provide housing. Hence various inexpensive and perhaps interim options like on-site sanitation systems, community toilets and in-situ development need to be considered.

Centrality of O & M

Operation and Maintenance (O & M) was highlighted as a major concern in all of the major policy documents. Since inadequate O & M has been the bane of urban water supply and sanitation systems, this attention is a welcome step; however, some concerns remain. First, most of the discussions/recommendations has focused on the financial aspects of O & M, to the exclusion of other aspects, i.e. procedures and capacity. The notable exception is NUSP which highlights all aspects of O & M. Second, the current assumption appear to be that ULBs shall raise/collect funds for O &M management, typically by levying user charges to cover O &M charges. It is not clear whether ULBs and utilities have the necessary resources,

personnel and operating systems to manage their assets properly. Besides, the incentives to invest in new capital and replace existing capital assets has weakened the resolve of utilities/ULBs to consider O & M as important for service delivery on one hand, and extending the life of the capital asset on another. Finally, it is not adequately recognised that O & M costs are dependent upon choice of technology, and particular technologies can lock utilities into a regime of high recurring costs.

Increased Efficiency in Water Supply Distribution Management

Increasing efficiency and reducing NRW have been identified as priorities in multiple policy documents like JNNURM, HPEC, MoUD Advisory Note and the 12th Five Year Plan. Reduction in NRW is also one of the indicators in SLB. A detailed toolkit for NRW reduction was prepared by JNNURM, which laid out various steps for utilities.

The most commonly cited solution to address this issue is to put a 24X7 system in place. Box 6.1 assesses the various arguments in favour of this proposed system. More rigorous studies are needed to establish its various benefits. Moreover, the benefits of a 24X7 system need to be assessed alongside the higher costs of putting these systems in place. While 24X7 remains one of the valid models, cities need to increase their efficiency, and reduce their losses irrespective of it. The cities could move incrementally towards a 24X7 system. While they achieve this, goals such increasing service standards, reducing losses, and putting O & M systems in place continue to remain crucial.

BOX 6.1: DEBATE 3: 24 7 WATER SUPPLY

Currently much emphasis is being placed on trying to achieve 24X7 water supply for Indian cities. There are five main arguments in favour of adopting 24 X 7 model for Indian cities. The strengths of these arguments are assessed below.

1. **Reduction in pollution:**

   One of the key arguments for shifting to 24X7 is the claim that continuously pressurised pipelines can reduce pollution compared to current systems, where a lack of pressure due to intermittent supply can cause pollutants to be sucked into leaky pipelines. While intuitively this makes sense , there is no empirical evidence to demonstrate that continuously pressurised pipelines by themselves can reduce pollution. Existing studies on the reduction in pollution in 24X7 water supply in India were conducted on systems where much of the pipeline itself was replaced before 24X7 water supply was initiated (Kumpel & Nelson, 2013). In other words, the impact of replacement of old pipes can be isolated from that of the 24 X 7 system.

2. **Reduced coping costs and water wastage:**

   Citizens are burdened with very significant coping costs due to the intermittency of water supply and low quality of water. This can take the form of storage tanks, pumps and water filtration units. It is also claimed that since people tend to throw away stored water when fresh water becomes available in an intermittent system, 24X7 supply would also contribute to reducing such water wastage.

   While it is possible that 24X7 systems might both reduce water usage and coping

costs, there are some caveats in order. First, the current literature does not distinguish between predictable and unpredictable intermittency. In many Indian cities, although water supply is intermittent, the supply hours are often known. Predictable intermittency will probably have less wastage of water compared to unpredictable intermittency, however, as of now, there appear to be no studies that compare water waste between unpredictable intermittency, predictable intermittency, and 24 X 7 supply.

While 24 X 7 might reduce some of the coping costs, some costs will remain, like underground storage systems, and pumping water to overhead tanks will still continue to happen.

3. Increased life of pipelines and metres:

It is claimed that intermittent supply can also decrease the life of pipelines and water metres. The pressure surge when supply is resumed can cause 'water hammering' which can increase the incidence of leaks. Domestic water metres which are currently in use also do not function well under intermittent conditions. According to Vairavamoorthy, Akinpelu, Lin, and Ali (2001), Indian cities provide intermittent water supply through systems which are designed for 24X7 water supply. If urban water supply systems were designed for intermittent supply they could reduce pressure-related issues in supply pipelines and provide relatively uniform pressure during the hours of supply (Totsuka, Trifunovic, & Vairavamoorthy, 2004).

4. Improved revenue generation and operation and maintenance:

24X7 water supply is often promoted as having the potential to set into motion a virtuous cycle of improved supply, improved metering, improved revenue collection and better operation and maintenance (WSP, 2010b). While this may be true, it is clearly not the only way to improve revenue collection and operation and maintenance. Cities like Chennai and Surat illustrate how a property tax-based approach of charging for water supply and sanitation combined with metering for large-scale customers could also significantly improve revenue collection.

5. Reduction in water use:

It is often claimed that 24X7 projects can reduce total water consumption when it is properly metered in conjunction with tariff 'reforms'. But from the literature available on this, it is not possible to verify whether the overall reduction in water use was due to elimination of illegal connections. Further, groundwater use remains unregulated in these cases, so one cannot ascertain whether households shifted to groundwater to avoid higher prices.

In addition, 24X7 water supply projects in India have so far focused primarily on converting the existing centrallised formal supply system from intermittent to 24X7. But as mentioned earlier in this paper, roughly 50 per cent of urban water use in India is reliant on groundwater, much of this is informal and not taken into account (Narain, 2012a). If a 24X7 system needs to replace the groundwater use, then urban India will have to roughly double its centrallised water resource availability, unless 24X7 utilities can figure out how to integrate decentrallised groundwater use in a massive way.

As is evident from various toolkits (including one under JNNURM) for non-revenue water (NRW) reduction that reducing NRW is a complex issue, and one that needs attention on several fronts. It requires the utility to be aware of its water balance, and have the necessary knowhow, personnel and equipment to detect losses. The utilities are then required to repair and maintain the system, through a variety of measures like pressure management. It is not clear that the utilities have the capacity to put these systems and procedures in place.

Moreover, while NRW is highlighted as an issue, there are few incentives for the cities to move to increase their efficiency, and cut their losses. Typically, centrally sponsored schemes have made available money for new construction, while ULBs need to take care of repairs, thus providing little incentive for upkeep of existing systems. There are no disincentives either for not increasing efficiencies, since funding is typically not tied to efficiency.

Judicious Use of Groundwater

There is increasing recognition of the role of groundwater in meeting urban water demand in India and the necessity for introducing appropriate policies for groundwater management. The 12th Plan and the MoUD advisory note on urban water supply and sanitation emphasises the need to conserve and replenish groundwater. They also highlight the need to bear in mind the potential for increased dependence on groundwater as water tariffs are revised upwards to increase revenues for ULBs. However, there is not enough recognition of the serious pollution threat facing urban aquifers. Given that polluted aquifers are extremely difficult to clean, this is a particularly pressing issue which needs to be addressed urgently.

Importance of Wastewater Treatment

There is also increasing emphasis on treatment and reuse of wastewater. This has found a central place in the 12th Five Year Plan. It is also stated as an objective clearly in JNNURM, HPEC and NUSP. A hundred per cent treatment of waste water is also one of the indicators in SLB. Various reports put out by CPCB have been instrumental in highlighting the huge pollution load generated by urban areas.

Similar to the case of NRW reduction, and the discussion around the 24X7 system for water supply, these seems to be an assumption here that network-based systems are the best way ahead to meet the above objective. Given the high capital and operating costs of convention sewerage systems, it is not clear whether all cities would be able to move towards a fully networked system even within the next couple of decades. NUSP recognises that 100 per cent disposal and treatment of wastewater can be achieved through multiple means.

Capacity Building

The issue of capacity building has been highlighted in all the policies and programmes. There is increasing realisation that the strengthening of capacities, technical, managerial and others, is necessary for any improvement in the sector. There is also increasing realisation that some level of support to ULBs in the interim is required, especially in the case of small ULBs. Hence JNNURM provides support to both states and ULBs. A similar model has been highlighted in the MoUD Advisory Note according to which State-level Organisations are required to provide hand-holding support to ULBs in matters of water and sanitation.

3. Other Issues

While the preceding sections highlighted certain critical issues which have gained policy salience in the last few years, there are certain other issues which have received limited policy attention.

Financial Resources

While there is a general agreement that this sector requires a higher level of capital investment than what is currently available, there is no clear agreement as to where these resources will come from in the future. While JNNURM infused a lot of capital in this sector, it is not sufficient, and it is not clear whether either the central or state governments will be able to meet the investment requirement. Given that the public sector may not be in a position to meet the needs of the sector, private financing is often proposed as the solution. However, past experience shows that private finance can only meet a small part of these investments, and will not take care of the capital investments, especially on the sanitation side.

Further, it is not clear who would take care of the O & M costs. As highlighted earlier, the assumption might not be realistic, even if tariffs were to be substantially revised.

There is little attention paid to re-examining the overall financing envelope. As argued earlier in the paper, it might be possible to bring down the financing requirements by investing in affordable solution with lower capital costs, especially on the sanitation side. The financing investments can also be brought down by considering phased improvements: gradually transitioning to a 24X7 system or to sewerage systems.

Water Source Protection and Conjoint Water Management

Conservation of water resources, particularly groundwater, and adequate treatment of waste remain primary concerns to ensure environmental sustainability. While there is sufficient recognition of groundwater depletion, more attention needs to be paid to groundwater pollution, as highlighted above. Indian cities gradually need to move towards a regime of water source protection, whether groundwater or surface water, which will place adequate premium on the ecological value of water.

There is also a need to encourage conjoint management of surface and groundwater. While the MoUD advisory note mentions the need for integrated urban water management, it does not explicitly encourage conjoint management of surface and groundwater. Aquifers could also potentially act as viable buffers for the increasingly variable precipitation that the Indian subcontinent is projected to witness. But the significance of aquifer management in adapting to climate change has not yet received much prominence in the policy discourse yet.

At present cities do not have any incentives to conserve water resources except as signalled by increased capital costs for piping water through long distances. Cities also have only regulatory disincentives for treating their water, and this too does not infuse a great extent of environmental stewardship since enforcement is ‘accommodative’. Finally, though there are huge implications for public health if ground water gets contaminated, this linkage is not understood clearly enough.

Fecal Sludge Management

For cities to become healthy, the most critical imperative is safe collection, conveyance and treatment of human wastes, in other words the full cycle of sanitation. Solving city wastewater problems have conventionally been understood as building sewer systems. However, 100 per cent treatment of waste requires not only treatment of sewerage, but also taking care of septage/sullage from on-site systems. Given that on-site systems account for a majority of household systems, it is essential that Indian cities urgently pay attention to on-site systems. This may require the city to mobilise and license/regulate sludge collection vehicles, along with basic sewage/septage treatment facilities in/identified locations.

Differentiated Approaches: Small and Medium Towns/Regional Disparity

While Class I cities still account for the largest deficits in absolute numbers, small and medium-sized towns have a larger percentage of households with inadequate access. Currently, the policy attention has focused on larger cities; a more balanced approach to cover a wide range of cities is urgently required. More importantly, it is essential to recognise that a differentiated approach might be needed for these cities. These cities might not have adequate capacities, and might need hand-holding support.

Similarly, certain states have a higher proportion of urban households without services (eg., Bihar). These states might require additional guidance and support, and more extensive capacity building.

Peri-Urban Areas

Indian cities are expanding outside their municipal boundaries, but these developments have often come about without following any planned expansion of infrastructure and services. This results in increased demands on the ULBs or the utilities to service these new areas by rapidly expanding their infrastructure. A systematic development of peri-urban areas, rather the rural-to-urban continuum, needs to be clearly laid out and needs to be planned for and provisioned in regional master plans and associated legal and financial instruments.

4. Lessons Learnt/Sustaining Policy Momentum

There has been considerable policy momentum in urban water and sanitation in the past decade, and there have been some significant shifts. While these initiatives have made some difference on the ground, they have not necessarily had the impact they could have had for a number of reasons. First, not all priorities have been recognised across various initiatives—inconsistencies persist. For example, while NUSP recognises, and encourages, the use of all kinds of sanitation systems, SLB indicators exist only for sewerage systems. In the current framework, it is especially critical that valid priorities are recognised in various investment programmes.

Second, mere recognition or according priority to certain issues might not be adequate; often the underlying causes and constraints need to be recognised. All initiatives endorse provisioning of basic services to the urban poor; however, not all lay out the necessary steps to address the barriers to provisioning.

Third, there is often inadequate understanding of the scale of the problem, or the solutions proposed might not be pragmatic. For example, the importance of raising adequate O & M

funds is recognised, but the solution universally proposed is that ULBs need to raise O & M. This might not be feasible in the short term, and other alternatives might be needed in the interim.

There has also been a tendency to prescribe specific solutions, e.g., the 24X7 system being proposed as a solution for NRW reduction. Given the diversity of cities in India, universal solutions might not be possible. The national policy framework needs to specify broad outcomes, as discussed below.

VII. RECOMMENDATIONS

The above sections have highlighted the most critical issues in the sector, some of which have already resulted in policy responses. This section recognises, and attempts to build upon these policy initiatives and reflects on how the policy frame can further be strengthened to respond to current challenges.

Role of the National Government/Decentrallise at appropriate levels

Despite WSS being a state subject, and the presence of the 74th Amendment, the central government still wields a lot of influence in this area due to two primary means: by being the main source of financing and by stipulating universal norms and guidelines across the country. The Government of India is likely to continue to play this role- unless there is considerable fiscal decentralisation. The paper, builds upon the assumption that the current programmatic frame is unlikely to change in the future, and the government of India will continue to play an important role, and hence is in a position to define its role in the sector, and also outline roles for the states and the cities.

There are huge public health and environmental impacts of water and sanitation, and these impacts, especially environmental ones, are not necessarily restricted to specific cities or even state. For example, pollution caused by untreated sewage impacts cities located downstream, and questions of intra or inter-basin allocations cut across states. Given this, it is necessary that broad outcomes or mandates are decided and agreed upon at the national level.

While the environmental impacts deem it necessary that broad outcomes are set at the national level, the wide difference between cities and states (whether in topography, resources, level of provisioning) make it necessary that the specific pathway(s) to achieve those outcomes are decides upon at the lower levels of government. Hence, strategies and plans must be developed at the state or city level. However, it is necessary for the government to specify required processes.

It is not completely clear whether setting of broad outcomes at the national level, and getting the states and cities to decide on their own would be sufficient to achieve these outcomes. As highlighted earlier in the sections, there are several constraints faced by the sector, including knowledge gaps and lack of capacity. The Government of India would need to address these constraints, and in doing so help create an enabling environment for states and cities. It can also create an enabling environment by putting in place a system of incentives and disincentives.

The above implies that the central government needs to shift its financing approach, from funding only hardware, to investing in 'soft' components that will create this enabling environment.

Hence, there are three roles/areas for the national government:

- Specify broad outcomes, and processes
- Create an enabling environment
- Re-think financing approach

1. Specify Broad Outcomes

This section outlines the broad outcomes that need to set at the national level. It builds upon the outcomes in existing policy documents, notably the NUSP.

Apart from the broad outcomes specified below, the focus needs to shift to service delivery, instead of mere infrastructure creation, hence focusing on the outcomes rather than inputs.

i. Universalise Access to Water and Sanitation, by
   - Delinking provisioning of service from tenure security
   - Considering phased improvements, where financial resources are limited

ii. Protection of Water Sources/Sustainable Use of Water

iii. Demand Management Measures for Water

iv. 100% Treatment of Wastewater

v. Ensuring O & M of water and sanitation systems

vi. Awareness Generation and Behaviour Change- for water conservation and hygiene

vii. Appropriate Mechanisms for Regulation of Private Players

viii. Community Participation

However, experience of NUSP, shows that mere outlining of broad outcomes in a policy document might not be enough. The Government of India needs to find ways to ensure that these outcomes can be mandated. The possible instruments through which the above can be mandated include:

- Specifying broad outcomes in the investment programmes
- Mandating above outcomes in relevant Municipal Acts

2. Create an Enabling Environment

i. Institutional Strengthening And Capacity Building

- Build Capacities at all levels, especially for smaller ULBs

- Build Capacities across different domains: technical, planning and managerial
- Design Capacity Building Programmes, after appropriate needs assessment
- Monitor, track and evaluate existing and future CB initiatives

Capacity remains one of the critical bottlenecks, and hence all efforts needs to directed towards it. Given the scale of the problem, however, some additional actions are required:

- Identify and prioritise critical areas of capacity building e.g. O & M management
- Develop an appropriate strategy to scale up current capacity building initiatives
- Finally, since closing capacity gaps for smaller ULBs will take time, provide support to ULBs for WSS provisioning, even while continuing to build their capacities

ii. Knowledge Generation/ Action Research/ Demonstrate and Dissemination

Lack of adequate information has been highlighted as a key challenge earlier. Often, it is not just lack of information, but new knowledge/ways of doing need to generated.

- Expand , revise and strengthen SLB and National Sanitation Rating Initiatives
- Undertake/ Commission Research Studies that will enable better decision making e.g. comparison of O & M costs for different technologies
- Undertake demonstration projects in newer area of practice, e.g., Fecal Sludge Management, Water Source Protection and Conservation
- Develop and Disseminate appropriate guidance manuals
- Create a knowledge sharing platform
- Communicate revised norms and approaches more effectively to reach frontline personnel and water sector professionals

iii. Establishing System of Incentives/ Dis-Incentives

- Explore possibility of regional/ state water authority to allocate water resources and / or regulate waste treatment
- Strengthen environmental regulation (PCBs)
- Funding to incentivise outcomes and performance

3. Rethinking Financing Approach

On the financing side, lack of adequate resources remains a significant problem. Even though there are no easy solutions to these, one of the key methods is to downsize financing requirements as discussed earlier. Also, funding of 'hardware' is going to remain critical, and it is not clear whether it is possible to get households to invest in the same. Nevertheless,

there is an urgent need for the government to redirect at least some of the funding from 'hardware' to softer components, and towards creating an enabling environment. It is unlikely that user chargers are going to meet operational costs anytime soon; however they need to be rationalised. Financing needs to be more flexible to regional contexts, and also needs to incentivise desired outcomes.

Thus priorities on this front, apart from increased funding in the sector, are:

- Downsizing financial requirement, by adopting mix of technologies, and phased improvements
- Effective fund utilisation
- Design and Implement Appropriate Tariff Regime to enable universal supply and cost recovery for financial sustainability
- Link scheme funding to performance as demonstrated by achievements of SLBs
- Build flexibility in funding to provide greater responsiveness to local contexts, specifically

Making available to state (from the central government) a pool of resources for states to determine the exact modalities for utilisation, instead of being tied to specific projects.

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ANNEX A1: POLICIES AND PROGRAMMES

There have been a number of recent policies/ programmes that highlight certain emerging concerns. This section provides an overview of these developments.

1. Swachch Bharat Mission

The Government of India launched the Swachh Bharat Mission on 2 October 2014. The Mission aims at achieving complete sanitation across both urban and rural areas in the country through a variety of measures such as:

elimination of open defecation, conversion of insanitary toilets to pour flush toilets, eradication of manual scavenging, municipal solid waste management, bringing about a **behavioural change in people regarding healthy sanitation practices, generating awareness among citizens about sanitation and its linkages with public health**, **strengthening of urban local bodies to design, execute and operate systems** to fulfill these objectives and **creating an enabling environment for private sector participation in capital expenditure and operational expenditure**.

The MoUD would be the nodal ministry in charge of implementing the programme across urban areas in the country while the Ministry of Drinking Water and Sanitation would be in charge in rural areas. The urban component of the programme is expected to cost a total of ₹62,000 crores over 5 years. Of this, ₹14,623 crores would be provided by the Centre, while the rest is expected to be borne by State governments, private entities and other sources. In total, the programme is expected to cost around ₹200,000 crores.

2. JNNURM

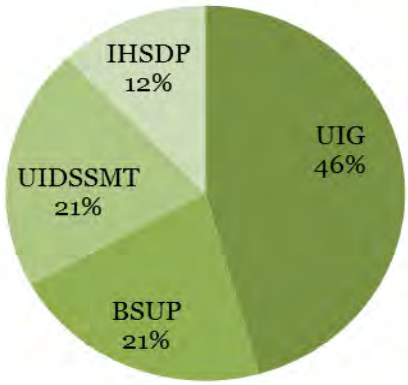
In 2005, the Government of India launched the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), a flagship programme, to close the infrastructure deficit in urban India. While supported largely by the GoI, the programme required the state and city government to also contribute to the project costs. Moreover the programme was to initiate a set of reforms in urban India by linking the disbursement of funds to implementation of reforms. The duration of the Mission was seven years beginning from 2005-06 to 2011-2012. The ongoing projects have been given a two-year extension up to 2013-14 to complete implementation.

Fig. A1.1 represents central assistance released across the sub-missions. Nearly two thirds of the funds were released to UIG and BSUP, which focused only on 65 mission cities, while the remaining one third was distributed to all the other cities in India.

The mission comprises two sub-missions: Urban Infrastructure and Governance (UIG) administered by MoUD, and Basic Services for the Urban Poor (BSUP) administered by MoHUPA. These 2 sub-missions focussed on select 65 cities (35 cities million plus cities and 30 others including capital cities/ the cities of religious/ historic/ tourist importance). For all other medium and small towns in the country, the UIDSSMT (Urban Infrastructure Development Scheme for Small and Medium Towns) and the IHSDP (Integrated Housing and Slum Development Programme) were launched. The focus area of the UIG and UIDSSMT programmes is urban infrastructure: water supply, sewerage, drainage, solid waste management, road network, urban transport and redevelopment of inner (old) city

areas. BSUP and IHSDP, on the other hand, focus on shelter for the urban poor, including re-development of slums.

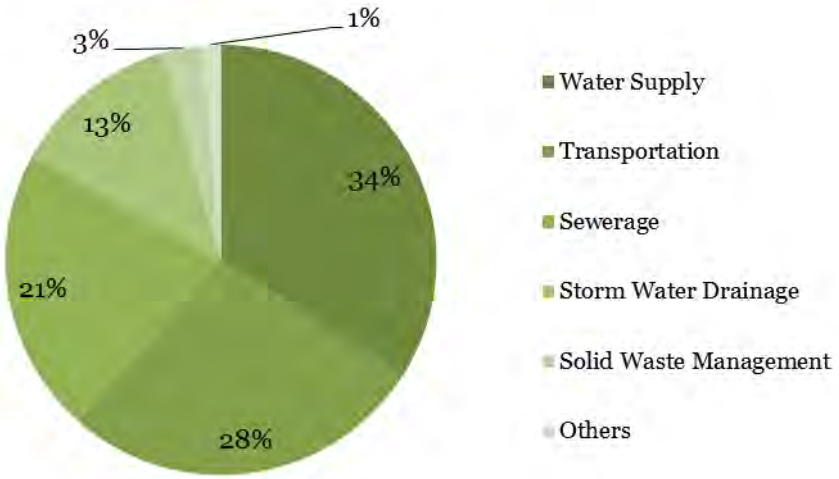
Fig A1.1: Central Assistance Released Across Sub- Missions



Source: Wankhade, 2013, Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

Fig A1.2 represents the distribution of utilization across sectors for the UIG component. As is evident, water supply and sewerage if taken together account for more of 50 percent of the total resources.

Fig. A1.2: Utilisation Across Sectors



Source: Wankhade, 2013, Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

Figure A1.3 a and b represents the utilization of the money within water supply and sewerage respectively. For water supply, two thirds for money has gone in expansion and construction of water supply systems, and a quarter of the funds have been utilized for augmentation of supply. For sewerage, more than 70 per cent of funds have gone into expansion of sewerage systems.

Fig. A1.3a: Utilisation in Water Supply

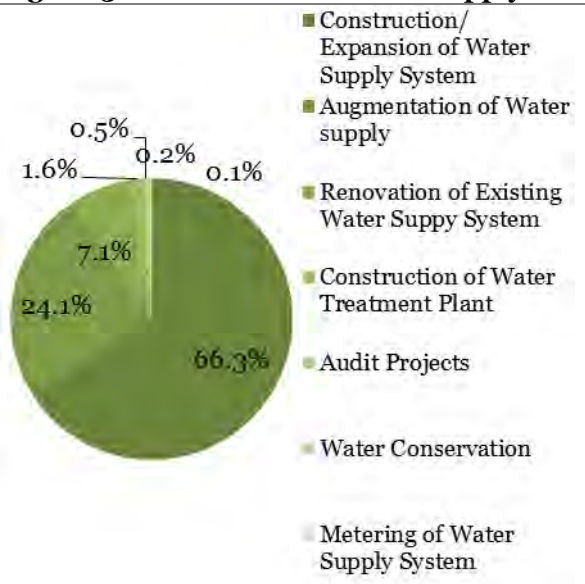
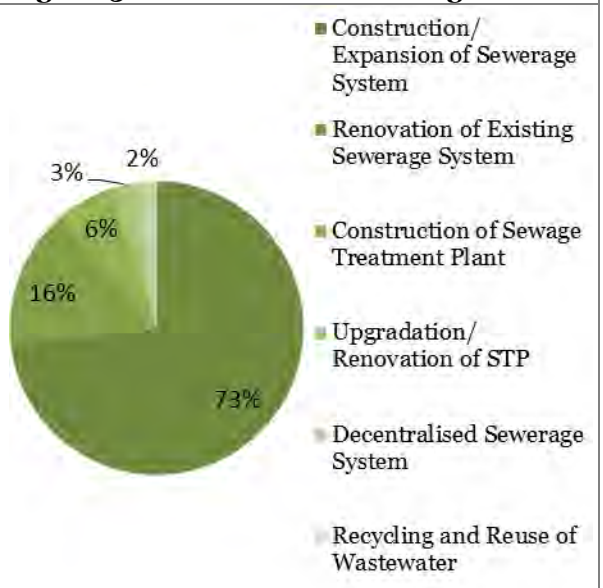


Fig. A1.3b: Utilisation in Sewerage Sector



Source: Wankhade, 2013, Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

JNNURM recognized the following issues to be of critical importance: O & M, increased efficiency of water supply system, achieving 100 percent coverage and capacity building. There was focus on sewerage systems, instead of exploring appropriate technology options (Wankhade, 2013).

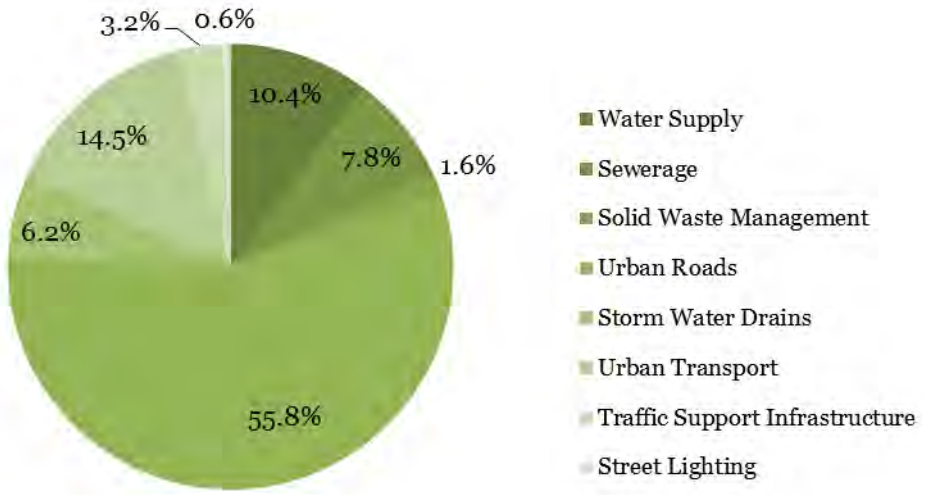
3. HPEC

In 2008, MoUD set up the High Powered Expert Committee (HPEC) to estimate investment requirements for the provision of urban infrastructure services over the next two decades. The committee recognized both the importance of urban areas as drivers of economic growth, and also the challenge faced due to deficit of infrastructure. It calculated the investment requirement for the next few decades, and also proposed a framework for governance and financing of urban infrastructure.

The Committee has estimated an overall funding of 39,18,670 crores to be spent over 25 years. This is an increase of 35 times in investment as compared to investments made under JNNURM (HPEC, 2011).

Fig 6.4 represents the sector wise allocation of proposed funding. As can be seen, only 18.2% percent of the funding has been allocated to water and sanitation. The absolute numbers proposed under HPEC are roughly 15 times the amount currently sanctioned under UIG. While these investments are to be made by central government, the ULBs are supposed to also pay for proportion of the investment.

FIG. A1.4: SECTOR-WISE URBAN INFRASTRUCTURE REQUIREMENT AS PROPOSED BY HPEC (2012-31)



Source: HPEC, 2011.

HPEC proposes a new improved JNNURM. It highlights that critical differences compared to JNNURM would be:

1. Open to all cities
2. Programme approach rather than project approach
3. Tie funding to reforms (which JNNURM was unable to do)
4. Different processes and timelines for smaller cities
5. Central emphasis on capacity building

The HPEC recognizes the need to shift from mere infrastructure creation to services provided by these assets, and hence lays stress on adequate O & M. In order to ensure service delivery, it recommends establishing a regulator and also corporatizing utilities. It also lays a great stress on capacity building, and recommends building a municipal cadre, training officials and also enabling lateral entries of experts. It also recognizes the importance of providing basic services to the poor.

4. MoUD Advisory Note on Improving Water Supply and Sanitation Services, 2012

MoUD has issued an advisory note on UWSS with the intention of providing guidance to states and cities with respect to policies and governance structure to ensure service delivery. It begins by highlighting the general service principles supported by the MoUD: state policies for UWSS, governance structures aligned to service delivery, asset ownership and responsibilities with ULB, Unbundling or Formation of Regional Entities for specific and appropriate functions like bulk supply or waste water treatment, state level regulator, move towards financial sustainability, restructuring of tariffs and building professional sector with alignment between state level organization and local bodies.

The key issues identified in the note are:

1. Clarifying the Mandates of Water Supply and Sanitation Service Providers
2. Improving the Governance of Water Supply and Sanitation Service Providers
3. Financing Water Supply and Sanitation Operations and Infrastructure Development
4. Regulating the Urban Water Supply and Sanitation Service
5. Building Capacity, Developing Procedures and Professionalizing Actors of the Water Supply and Sanitation Sector.
6. Developing Procedures for Community Participation

It recommends that states develop a detail sector programme for next 10 years, and develop a WSS business plan or service improvement plan. The plan needs to contain WSS Policies and Institutional Development Program, WSS Regulation Program, WSS Infrastructure Development Program and WSS Capacity Building Program. It also recommends preparation of O & M and CAPEX recovery program, and preparation of detailed guidelines for DPRs and PPPs.

5. National Urban Sanitation Policy

Recognising the critical of the issue of urban sanitation, the GoI released the National Urban Sanitation Policy in 2008. In its vision, the policy gives centrality to both public health and environmental outcomes, and places a special focus on serving the urban poor and women. The key issues identified by the policy are poor awareness, social and occupational aspects of sanitation, fragmented institutional roles and responsibilities, lack of an integrated city-wide approach, limited technology choices, reaching the un-served and poor, lack of demand responsiveness.

The goals laid down by the policy are:

1. Awareness Generation and Behaviour Change
2. Achieving Open Defecation Free Cities
3. Integrated City-Wide Sanitation
    - Re-Orienting Institutions and Mainstreaming Sanitation
    - Sanitary and Safe Disposal
    - Proper Operation & Maintenance of all Sanitary Installations:

One of the notable features of the policy is that it recognises that universal solutions across various cities are not possible, and hence it lays a great deal of importance on the process, and outlines the process both for preparation of state sanitation strategy as well as city sanitation plans. It also gives due recognition to various technological systems, including on site solutions. The policy also highlights the importance of building upon and improving upon the existing systems, through due attention to O & M and integrated planning. There are no specific funds attached to NUSP, but it recommends using government sources like JNNURM and UIDSSMT for financing project identified under CSP.

6. 12th Five year plan

Different aspects of urban water and sanitation are addressed under two themes: water resources and urban development. The 12th Five Year Plan highlights the public health costs due to lack of clean drinking water. The critical issues identified in the plan include loss of water in the distribution, inequitable distribution of costs, exploitation of groundwater, lack

of sanitation, and inadequate treatment of waste water. The priorities set out including access to water, protection of local water systems, investing in affordable, and sustainable sewage systems and recycling and reuse of water.

In the section on urban development, universal water supply and sanitation is stated as one of the goals. This chapter also calls for universal access to water, protection of water bodies, and reducing unaccounted water. However, in addition, it also highlights metering, 24 X 7 water supply as important parameters. It also recommends recycling waste water for industrial uses.

7. Other Relevant Policies

Apart from the NUSP, there are no other policies that are specifically related to the UWSS sector. However there are some other policies and regulations that have implications on this sector. The revised National Water Policy was released by the government in 2012. While the scope of this policy is very vast, covering ecological aspects, changes due to climate change etc., there is a separate section on urban and industrial areas. It recommends that urban water supply needs are met through surface water, and leakages and pilferages are minimised. It highlights certain specific measures like re-use of water, rainwater harvesting, and desalination. It also suggests that water supply and sewerage schemes are implemented simultaneously. The policy also calls for a National Water Framework Law to be formulated.

8. Service Level Benchmarking

In 2010, GoI started a Service Level Benchmarking Initiative for environmental services (water, waste, solid waste and drainage) to increase the accountability in the sectors, and move from mere creation of assets to achieving service outcomes (MoUD, 2010). Under this initiative, a Handbook was released that most importantly identified a set of indicators at city level. By collecting information on set of common indicators, it was hoped that cities could track their performance over time, and in comparison to other cities, and also would be in a better position to set their priorities. The GoI also launched a pilot project in 28 cities to collect these indicators. The Thirteenth Finance Commission (body through money flows from national government to state) refers to standards laid down in the handbook (Thirteenth Finance Commission) to access performance grants.

9. National Sanitation Ratings of Cities

In order to help achieve the goals laid out in the NUSP, MoUD launched a national ratings scheme for cities. The initiative is an attempt to recognize the good performance by different cities. Cities would be rated according to a set of indicators, and best performing cities will be given 'Nirmal Sheher Puruskar'. The indicators depend upon outcomes and processes, rather than inputs. The ratings were intended to enable inter and intra city comparison. The first round of ratings was carried out in 423 cities and the second round of ratings covering 465 cities is currently ongoing.

10. Other National Initiatives

In addition to the above initiatives, there are other ongoing initiatives. CPHEEO manuals are currently being revised to include on-site sanitation systems among other changes. Both MoUD and MoHUPA have recognized the importance of capacity building, and have set up Centres of Excellence and National Resource Centre to provide policy assistance, technical

support and training personnel.

State Level Initiatives

Apart from the above national policies and initiatives, some states have launched significant programmes in the water supply and sanitation sector. Two of the most prominent ones are Sujal in Maharashtra and Chief Minsiter's Urban Sanitation Scheme in Madhya Pradesh. (Gujarat, TNUDF, ODF Strategy, how many state strategies, how many CSPs)

Maharashtra Sujal Nirmal Abhiyan (MSNA)

Maharashtra launched this programme in 2010 to universal access to piped water of high quality supplied on a 24/7 basis, universal access to sewers, full treatment of wastewater and open free defecation environment, full O&M and capital cost recovery and high level of accountability to customers. The key components were service delivery, financial sustainability and environmental sustainability.

It was a incentive based reform programme that made reforms a pre-condition for receiving funding. However the programme broke down the reforms and outcomes in three phases. It also recommends different models for different city sizes, ranging from corporatization to ring-fencing WSS operations.

Madhya Pradesh Integrated Urban Sanitation Programme (MP IUSP)

Madhya Pradesh launched an integrated urban sanitation programme with the intention of moving towards open defecation free cities and safe disposal of waste. On lines of NUSP, it requires all cities to prepare a city sanitation plan. In addition, it recommends creating state, district and city level sanitation committee to create awareness, monitor processes and outcomes and review progress.

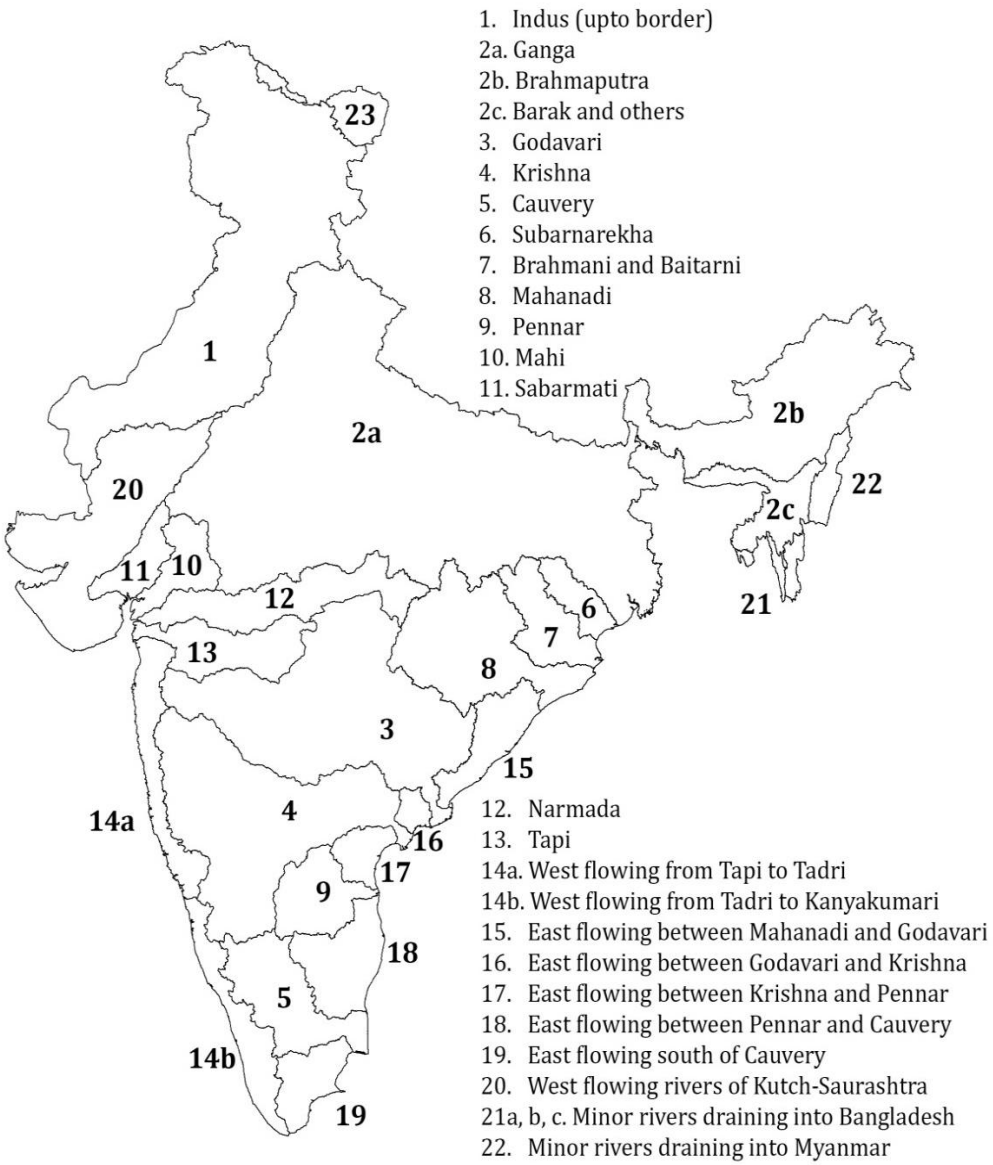
11. City Level Initiatives

Apart from national and state level initiatives, select cities have also undertaken various initiatives in water supply and sanitation. Under JNNURM, 65 mission cities have undertaken preparation of CDPs that have done situational analysis and planning for infrastructure, including WSS. In addition, in select states like Madhya Pradesh, many more cities have prepared CDPs. Also, as part of NUSP, 13 states have prepared state sanitation strategies, and 209 cities in 19 states, covering 20 million people have prepared City Sanitation Plans.

The depletion of aquifers has prompted many cities in India to initiate efforts to encourage residents to install rainwater recharge structures. Since 2002, many municipal corporations and states in India have passed legislations mandating the construction of rainwater recharge structures in all new buildings (CSE, 2009). Although some of these legislations do have the caveat that waterlogged areas are exempt from this, in general the legislations do not take into account soil or aquifer conditions which can vary widely within the same city.

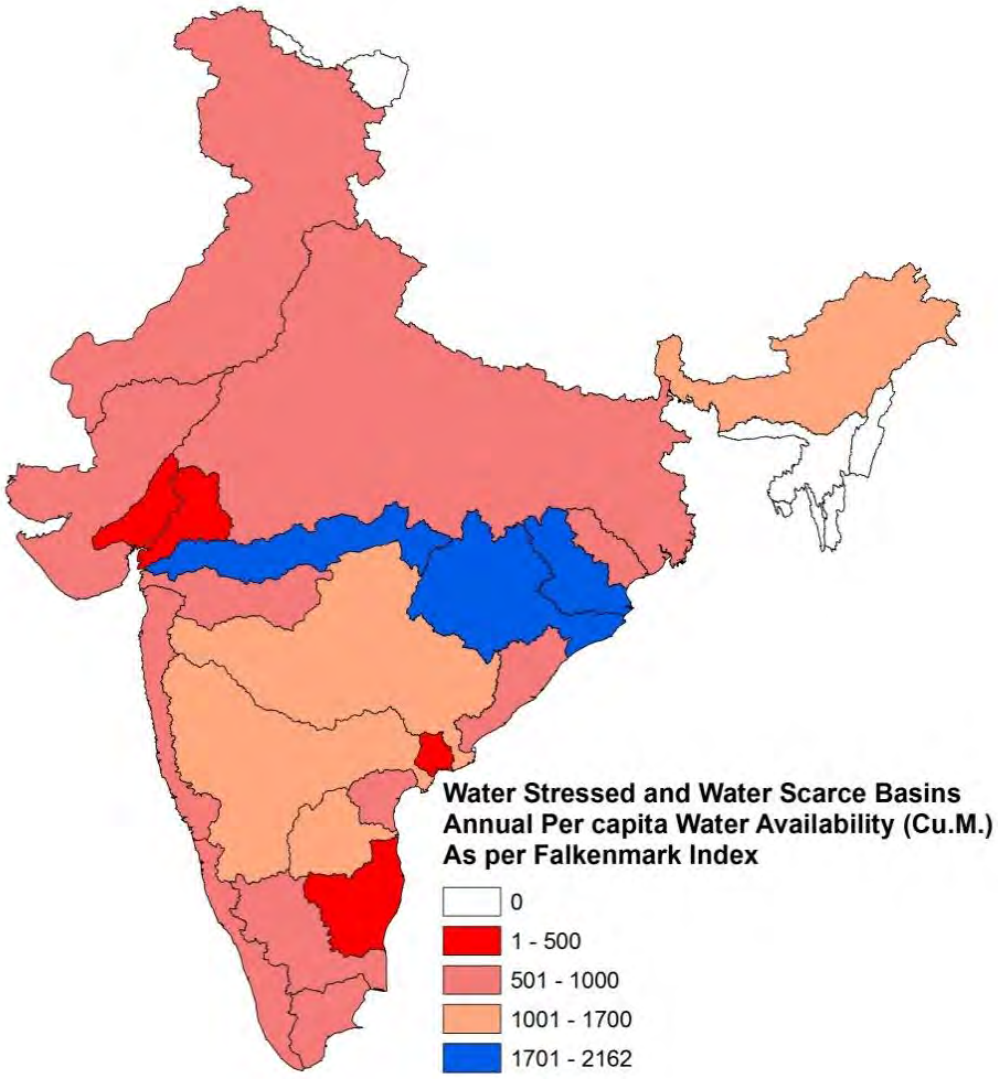
ANNEX A2: DATA TABLES AND MAPS

MAP A2.1: RIVER BASINS OF INDIA



Source: Central Water Commission, 2012

MAP A2.2: RIVER BASINS SHOWING WATER STRESS



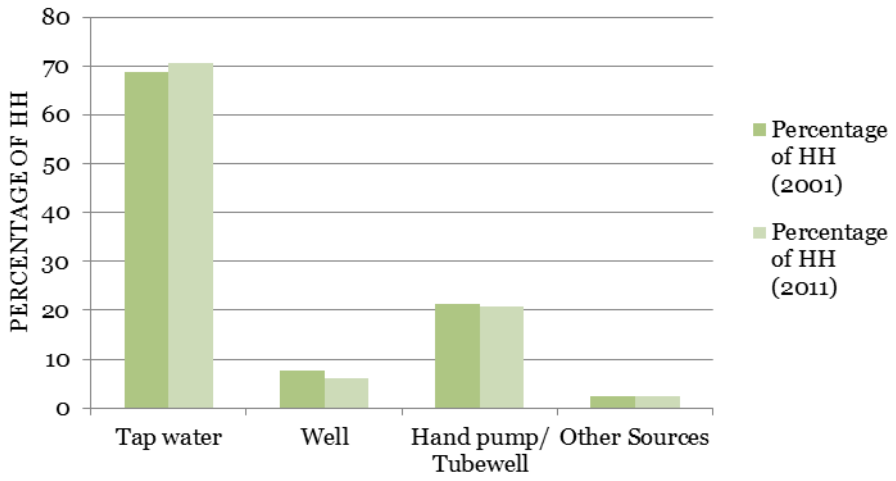
Source: Analysis based on population data from Census (2011) and water resource data from NCIWRD (1999),Thatte, et.al.(2009), Planning Commission (2007) as cited in Gaur and Amarasinghe (2011).

TABLE A2.3: DISTRIBUTION OF URBAN HOUSEHOLDS ACCORDING TO SOURCE AND DISTANCE FROM PREMISES

Location of source of drinking water	Total HH	Tapwater from treated source	Tapwater from un-treated source	Covered well	Un-covered well	Hand-pump	Tubewell/ Borehole	Other sources
Within the premises	71%	49%	5%	1%	3%	7%	6%	0%
Near the premises	29%	10%	3%	0%	1%	3%	2%	1%
Away	39%	3%	1%	0%	1%	2%	1%	1%
Total	100%	62%	9%	2%	4%	12%	9%	2%

Source: Analysis of Census 2011 data

FIGURE A2.4: PERCENTAGE OF URBAN HH BY MAIN SOURCE OF WATER 2001-11



Source: Analysis of Census 2011 data

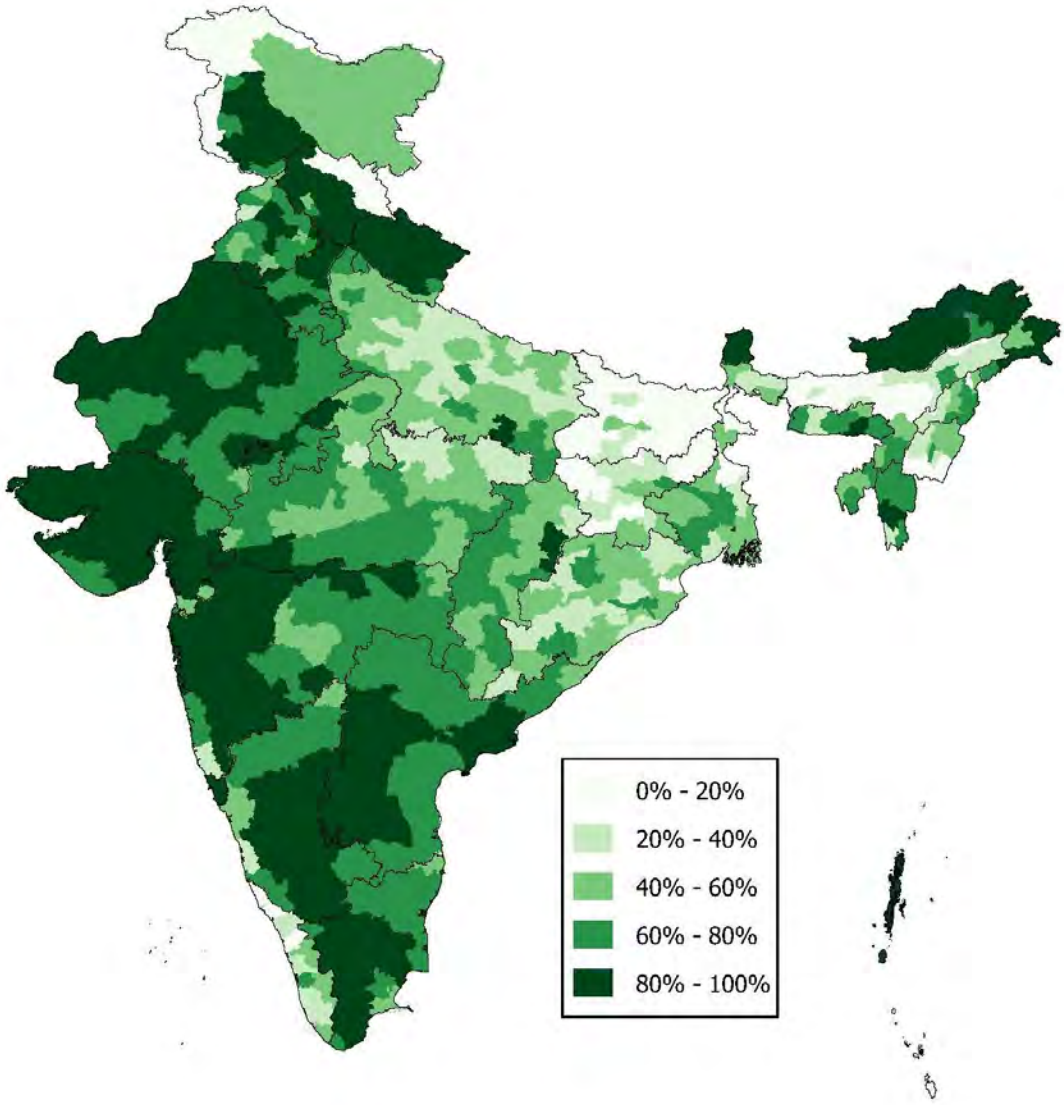
FIGURE A2.5: DISTRIBUTION OF URBAN HOUSEHOLDS BY SOURCE OF WATER

S. no	Water Source	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	All Classes
1	**Tap Water**	78%	66%	58%	57%	50%	54%	71%
a	Treated Tap Water	72%	55%	47%	42%	37%	42%	62%
b	Untreated Tap Water	6%	11%	11%	15%	13%	12%	9%
2	**Well**	3%	7%	15%	12%	11%	12%	6%
a	Covered Well	1%	2%	4%	3%	2%	2%	2%
b	Uncovered Well	2%	6%	11%	9%	9%	10%	4%
3	Handpump	8%	14%	16%	19%	25%	22%	12%
4	Tubewell	9%	9%	8%	10%	11%	8%	9%
5	Others	2%	3%	3%	3%	3%	3%	2%
a	Spring Water	0%	0%	0%	0%	0%	1%	0%
b	River Canal	0%	0%	0%	0%	1%	1%	0%
c	Tank/ Pond	0%	0%	0%	0%	1%	1%	0%
d	Other Water Sources	2%	2%	2%	2%	1%	1%	2%
	Total	100%	100%	100%	100%	100%	100%	100%
	Total Population	227,742,687	41,458,757	58,146,757	31,837,478	15,863,147	1,947,312	376,996,138

TABLE A2.6: MAJOR STATE LEVEL FIGURES FOR WATER SUPPLY AND SANITATION									
State	Total Number of HH	Number of Urban HH	Water Supply (Percentage of Urban HH)			Sanitation (Percentage of Urban HH)			
			Treated tap water supply	Tap water supply	Wells, Bore wells & Handpumps	Piped Sewer Connection	Septic Tanks	Pit Latrines	Open Defecation
Andaman & Nicobar Islands	93,376	34,346	92.66	97.94	1.19	3.01	84.01	0.19	7.77
Andhra Pradesh	21,024,534	6,778,225	75.48	83.49	13.19	33.73	44.41	4.13	11.91
Arunachal Pradesh	261,614	65,891	46.5	84.15	12.21	13.77	53.62	13.93	6.73
Assam	6,367,295	992,742	27.4	30.17	65.83	15	50.26	21	4.99
Bihar	18,940,629	2,013,671	15.09	19.95	78.01	7.21	52.72	4.56	28.88
Chandigarh	235,061	228,276	93.85	96.77	2.67	85.95	0.86	0.51	3.15
Chhattisgarh	5,622,850	1,238,738	44.21	62.45	36.55	9.1	48.6	1.15	34.44
Dadra & Nagar Haveli	73,063	37,655	35.65	50.33	49.2	8.02	71.74	0.68	11.11
Daman & Diu	60,381	47,631	48.74	72.63	26.8	6.26	77.63	1.15	4.11
Goa	322,813	198,139	87.82	90.17	8.27	18.63	59.34	3.5	9.51
Gujarat	12,181,718	5,416,315	68.78	85.58	12.21	60.38	24.25	2.14	8.74
Haryana	4,717,954	1,751,901	70.2	77.5	19.76	54.78	23.76	7.72	8.78
Himachal Pradesh	1,476,581	166,043	93.3	95.52	3.26	40.74	45.31	0.83	6.88
Jammu & Kashmir	2,015,088	517,168	70.65	87.9	9.37	25.28	37.92	4.29	10.74
Jharkhand	6,181,607	1,495,642	34.65	41.56	56.18	14.03	49.2	1.81	30.99
Karnataka	13,179,911	5,315,715	68.39	80.42	16.51	53.31	17.05	11.98	10.72
Kerala	7,716,370	3,620,696	30.35	34.86	63.46	14.32	56.69	21.87	1.67
Lakshadweep	10,703	8,180	11.7	16.93	81.34	2.87	93.84	0.53	1.87
Madhya Pradesh	14,967,597	3,845,232	5.05	16.7	35.4	20.16	50.14	1.66	22.48
Maharashtra	23,830,580	10,813,928	85.69	89.13	9.19	37.77	28.64	2.4	7.69
Manipur	507,152	171,400	50.85	56.27	10.07	7.41	43.1	23.26	2.35
Meghalaya	538,299	116,102	68.15	77.59	9.85	9.68	68.72	12.27	2.4

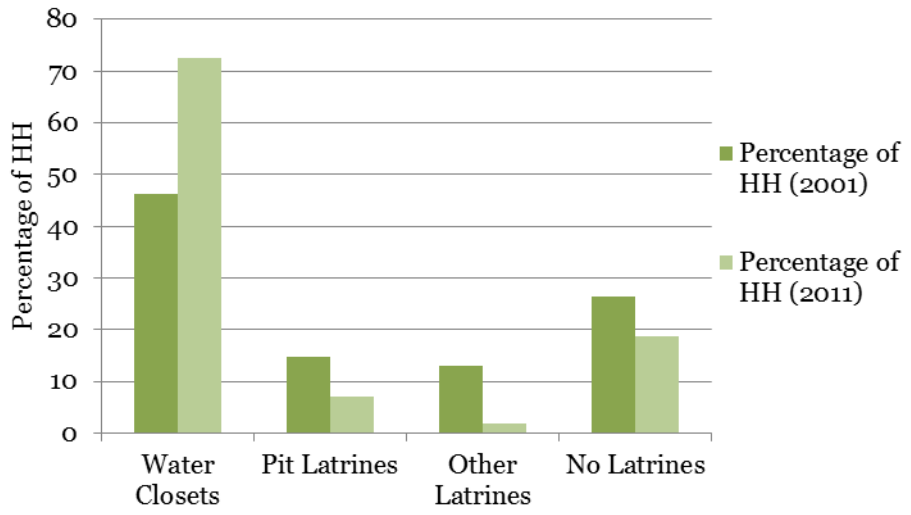
TABLE A2.6: MAJOR STATE LEVEL FIGURES FOR WATER SUPPLY AND SANITATION									
State	Total Number of HH	Number of Urban HH	Water Supply (Percentage of Urban HH)			Sanitation (Percentage of Urban HH)			
			Treated tap water supply	Tap water supply	Wells, Bore wells & Handpumps	Piped Sewer Connection	Septic Tanks	Pit Latrines	Open Defecation
Mizoram	221,077	116,203	61.84	74.36	5.73	5.09	71.33	17.2	0.88
Nagaland	399,965	115,054	6.02	35.68	44.46	4.52	67.27	14.96	2.22
NCT of Delhi	3,340,538	3,261,423	75.81	81.86	13.44	60.45	24.67	1.69	3.03
Odisha	9,661,085	1,517,073	42.11	48.04	50.11	11.46	45.05	4.18	33.17
Puducherry	301,276	206,143	91.8	95.37	4.31	19.88	60.86	0.63	12.17
Punjab	5,409,699	2,094,067	66.08	76.45	22.73	63.75	19.93	6.79	5.8
Rajasthan	12,581,303	3,090,940	75.4	82.56	13.23	25.63	45.62	5.44	16.67
Sikkim	128,131	35,761	70.03	92.08	1.07	34.35	55.68	3.29	2.19
Tamil Nadu	18,493,003	8,929,104	66.29	80.32	16.94	27.41	37.91	6.83	16.21
Tripura	842,781	235,002	43.47	54	44.41	6.68	37.59	46.97	1.27
Uttar Pradesh	32,924,266	7,449,195	44.68	51.54	47.17	28.29	46.86	2.94	14.82
Uttarakhand	1,997,068	592,223	72.72	78.42	20.43	31.67	53.07	6.54	4.72
West Bengal	20,067,299	6,350,113	49.97	55.63	42.83	13.58	45.44	22.51	11.25
India	**246,692,667**	**78,865,937**	**62.01**	**70.63**	**26.91**	**32.68**	**38.15**	**7.1**	**12.63**

MAP A2.7 OF DISTRICT WISE DISTRIBUTION OF PERCENTAGE OF HOUSEHOLDS WITH ACCESS TO TREATED TAPWATER



Source: Analysis of Census 2011 Data

FIGURE A2.8: PERCENTAGE OF HOUSEHOLDS ACCORDING TO TOILET FACILITY, 2001 AND 2011



Source: Census 2001 and 2011

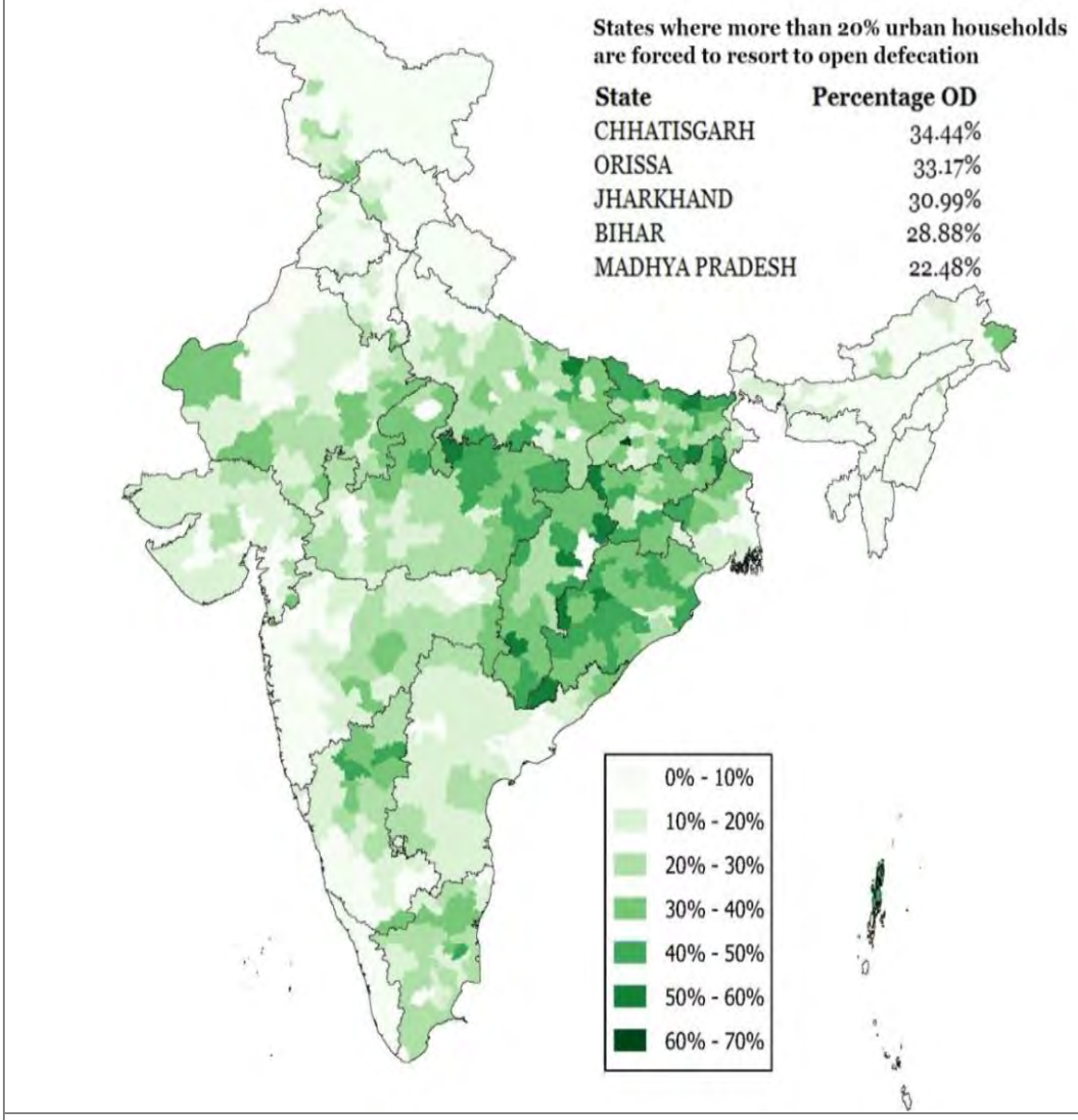
FIGURE A2.9: DISTRIBUTION OF CITIES AND URBAN HOUSEHOLDS BY CLASS SIZE

Class	Population Category	No of Cities	Total HH	% of HH
Class I	1 Lakh and Above	504	47666215	60%
Class II	50,000-100,000	607	8635358	11%
Class III	20,000-50,000	1904	12039395	15%
Class IV	10,000-20,000	2231	6732521	9%
Class V	5,000-10,000	2184	3388503	4%
Class VI	Less than 5,000	496	422140	1%
Grand Total		7926	78884132	100%

FIGURE A2.10: DISTRIBUTION OF HOUSEHOLDS ACCORDING TO TOILETS ACROSS CLASS SIZE

No	HH Arrangement	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	All Classes
I	Latrine facility within the premises							
1	Water Closet							
a	Piped sewer system	46%	16%	12%	9%	8%	11%	33%
b	Septic tank	33%	51%	48%	43%	37%	37%	38%
c	Other system	1%	2%	2%	3%	3%	4%	2%
	Sub Total (Water Closet)	**80%**	**69%**	**62%**	**54%**	**48%**	**51%**	**73%**
2	Pit Latrine							
a	With slab/ ventilated improved pit	4%	7%	10%	12%	14%	12%	6%
b	Without slab/ open pit	0%	1%	1%	1%	2%	3%	1%
	Sub Total (Pit Latrine)	**4%**	**8%**	**11%**	**14%**	**16%**	**15%**	**7%**
3	Other Latrine							
a	Night soil disposed into open drain	1%	1%	1%	1%	0%	0%	1%
b	Night soil removed by human	0%	0%	0%	0%	0%	0%	0%
c	Night soil serviced by animals	0%	0%	0%	0%	0%	0%	0%
	Sub Total (Other Latrines)	**2%**	**2%**	**1%**	**1%**	**1%**	**1%**	**2%**
	HHs with latrines within premises (1+2+3)	86%	79%	75%	69%	65%	67%	81%
II	No Latrine within the premises							
1	Public Latrines	7%	6%	4%	4%	4%	4%	6%
2	Open Defecation	7%	15%	21%	27%	31%	30%	13%
	HHs with no latrines within premise(1+2)	14%	21%	25%	31%	35%	33%	19%
	Total number of households (I +II)	100%	100%	100%	100%	100%	100%	100%

MAP A2.11: DISTRICT WISE DISTRIBUTION OF PERCENTAGE OF OD HOUSEHOLDS

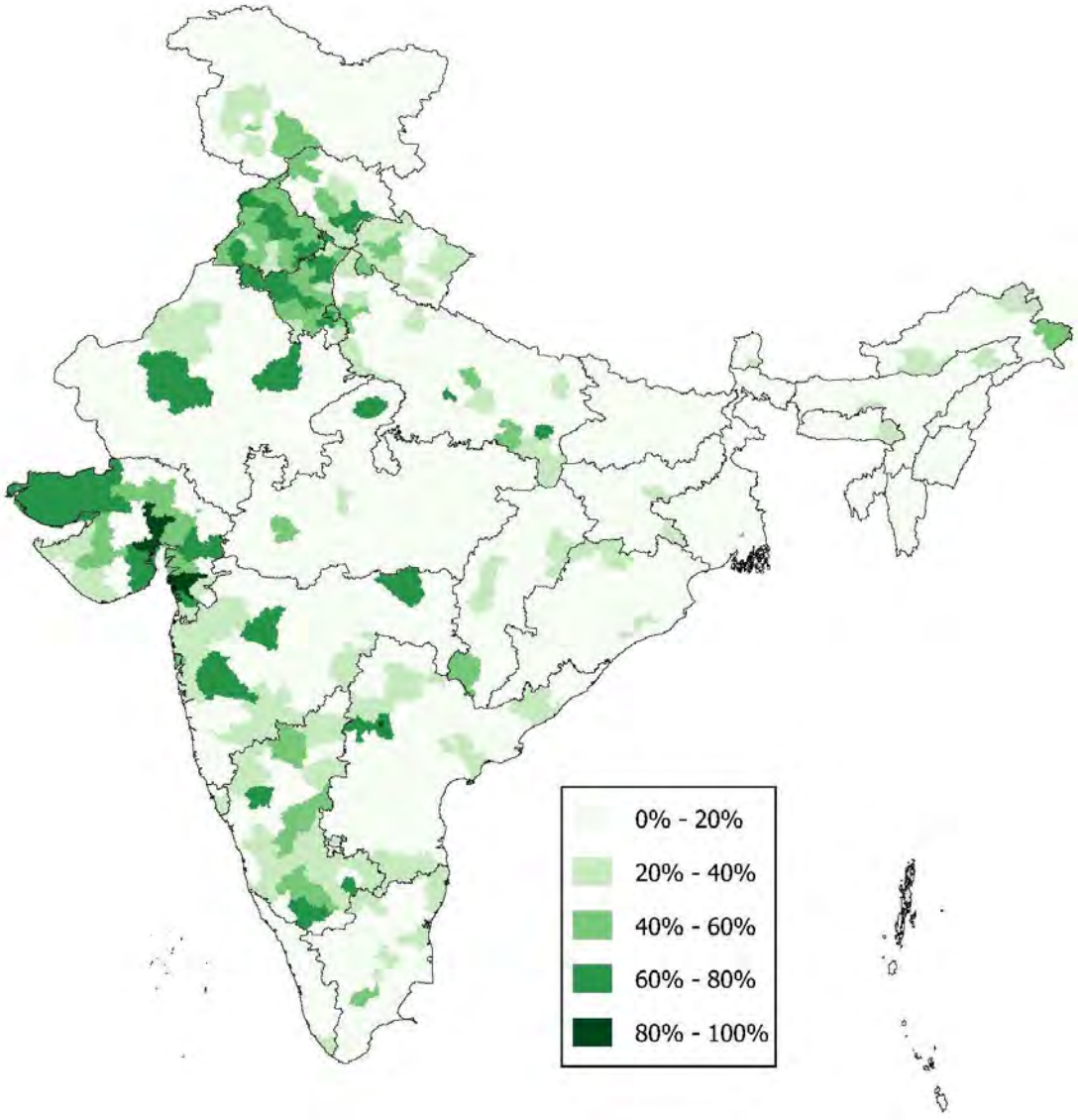


Source: Analysis of Census 2011 Data

TABLE A2.12: STATES WITH HIGHEST PERCENTAGE OF OD HOUSEHOLDS

No	State	Total HH	**Open Defecation HH**	Percentage of OD HH
1	Chhattisgarh	1,238,738	426,637	34
2	Odisha	1,517,073	503,239	33
3	Jharkhand	1,495,642	463,521	31
4	Bihar	2,013,671	581,606	29
5	Madhya Pradesh	3,845,232	864,280	22

MAP A2.1: MAP SHOWING HOUSEHOLD ACCESS TO PIPED SEWER CONNECTIONS AT THE DISTRICT LEVEL



Source: Analysis of Census 2011 Data

TABLE A2.14: DISTRIBUTION OF URBAN HOUSEHOLDS BY TYPE OF LATRINE

	Households by type of latrine facility	All Households		Slum Households	
		Number of HHs (millions)	Percentage of HHs	Number of slum HHs (in million)	Percentage of HHs
I	**Latrine facility within premises**				
1	**Water Closet**				
a	Piped sewer system	26	33%	3	25%
b	Septic tank	30	38%	4	31%
c	Other system	1	2%	0	2%
	Sub Total (Water Closet)	**57**	**73%**	**8**	**58%**
2	**Pit Latrine**				
a	With slab/ ventilated improved pit	5	6%	1	6%
b	Without slab/ open pit	1	1%	0	1%
	Sub Total (Pit Latrine)	**6**	**7%**	**1**	**6%**
3	Other Latrine				
a	Night soil disposed into open drain	1	1%	0	2%
b	Night soil removed by human	0	0%	0	0%
c	Night soil serviced by animals	0	0%	0	0%
	Sub Total (Other Latrines)	**1**	2%	0	2%
	HHs with latrines within premises (1+2+3)	**64**	**81%**	**9**	**66%**
II	**No Latrine within the premises**				
1	Public latrine	5	6%	2	15%
2	Open	10	13%	3	19%
	HHs with no latrines within premise(1+2)	**15**	**19%**	**5**	**34%**
	Total households (I +II)	**79**	**100%**	**14**	**100%**

Source: Census 2011

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