Sustainability of Urban Water Supply and Sanitation in Dryland Areas - Case Study of Indore City

The attainment of financial, environmental and social sustainability of urban service provision is a problematical project nowadays. Given the huge investments that are being made in the improvement of urban infrastructure and services it is of the utmost importance that these investments are made to bring about the greatest good of the greatest number in a sustainable manner. Within urban infrastructure the supply of water and its disposal after use has become very important because water has to be brought from distant sources and the wastewater needs to be treated before being discharged into natural water bodies or rivers. In dryland areas which are physically water scarce and constitute some 70 percent of the country the problem becomes even more acute as the costs associated with setting up and running water supply and sanitation services goes up exponentially. Thus, there is a need to study in depth the financial, environmental and social aspects of water supply and sanitation infrastructure and services in big cities in the dryland areas. The situation is particularly problematical in this regard in Indore which is the largest city of Madhya Pradesh. The city is situated on the dry Malwa Plateau which is naturally water scarce similar to most parts of western, northwestern, central and peninsular India. This paper critically reviews the financial, environmental and social sustainability of urban water supply and sanitation infrastructure and services in the city of Indore and suggests some alternative measures.

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1. Introduction

The turn of the century from the twentieth to the twentyfirst witnessed an important historical transition; for the first time in human histroy more than half the population are now residing in urban habitats, which are the main drivers of economic activity. This increasing urbanisation worldwide, especially in the third world countries, is of an informal and unplanned nature and has led to tremendous social and environmental pressures on towns and cities. More than a billion people lived in cities that exceeded healthful levels of air quality, 420 million had inadequate sanitation; and 220 million city dwellers did not have access to safe drinking water (Leitmann 7). Consequently urban planning and management have currently become severely stressed.

Specifically with respect to the development of cities it came to be realised as early as in the first United Nations Conference on Environment and Human Settlements held in Vancouver in 1972 that there was a need for adequate provision of sustainable and equitable access to municipal services required to make them healthy and liveable (Mahadevia "Globalisation", 29). This was named as the "Brown Agenda"(McGrahanan and Satterthwaite 75). Subsequent to this in 1983 the World Commission on Environment and Development set up by the United Nations studied the problem of environmental degradation brought about by development. The Commission came out with a report in 1987 that for the first time put forward the concept of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". (United Nations Organisation, 34). Subsequent to this the issue of environmental sustainability began to assume more and more importance and in the case of urban development this was named as the "Green Agenda" (McGrahanan and Satterthwaite 75).

The increasing urbanisation of the world gave rise to the difficulty of reconciling the Brown and Green Agenda. Cities as the engines of economic growth obviously needed good civic infrastructure to be able to accommodate the growing population and burgeoning economic activity but at the same time their ecological footprints were much larger than their own territories both for resource extraction and waste disposal (Martinez Alier, 13). In local terms also problems crop up as the poor develop vast shanty towns and slums in the marginal spaces like riversides and waste lands and these are precisely the areas that the rich seek to sequester to beautify the city or for dumping garbage. The drive for environmental and financial sustainability in such circumstances leads to social conflicts as the poor get squeezed out of their habitats and livelihoods while at the same time being asked to pay for municipal services (COHRE 9).

The first World Conference on Environment held in 1992 in Rio de Janeiro further stressed the need for sustainable development and was followed by the second UN Habitat Conference held in Istanbul in 1996 when an attempt was made to bridge the brown and green agenda and a Sustainable Cities Programme (SCP) was conceptualised and executed under the aegis of the United Nations Human Settlements Programme (UN HABITAT) and the United Nations Environment Programme (UNEP) in two phases upto 2007. However, this programme has been criticised for stressing more on the environmental and financial sustainability of city development at the cost of inclusion of the majority of poor inhabitants of cities, especially in developing countries where municipal services are of poor quality and reach due to lack of resources (Mahadevia "Sustainable Urban Development" 249).

Nevertheless, stress was laid on financial sustainability of infrastructure services and private sector participation in their setting up and operation by donor agencies like the USAID, World Bank and Asian Development Bank (World Bank CAS 15). Consequently urban local governnments were pressurised to improve cost recovery for investments and operation and maintenance in the water supply and sanitation (WSS) sector from the beginning of the 21st century. This involved ringfencing the watersupply and sanitation functions of urban local bodies through the creation of separate water supply and sewerage boards and the strengthening of the capacities of these bodies to access the financial markets directly or raising funds through commercial bonds (World Bank "Bridging the Gap" 35). This, has become the predominant mode of development of the WSS sector in urban areas and has been tried out in many cities. Four major cities in Madhya Pradesh too have seen the same kind of changes especially after a loan for improvement of their WSS infrastructure and services was sanctioned by the Asian Development Bank in 2004.

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was initiated by the Central Government in 2005 to improve the urban infrastructure and services in 35 cities with one million plus population in 2001 and 28 other urban areas of tourist or historical/religious importance (JNNURM 8). The JNNURM envisages heavy grant funding from the Central and State Governments of over Rs 1,20,000 crores over a seven year period from 2005-6 to 2012-13 to urban local bodies for specific projects and water supply, sanitation and solid waste management is one of the major areas. There is a stress here also on private public partnership to ensure that in the long run the operation and maintenance costs are recovered. Nevertheless, there is simultaneously a stress on the provision of basic services to the poor. Thus, the JNNURM seems to strike a balance between the two goals of achieving financial and social sustainability in provision of urban infrastructure and services. The cities of Bhopal, Indore and Jabalpur from Madhya Pradesh have been included under this mission.

The above discussion clearly establishes that the attainment of financial, environmental and social sustainability of urban services is a problematical project. Given the huge investments that are being made in the improvement of urban infrastructure and services it is of the utmost importance that these investments are made in a manner that brings about the greatest good of the greatest number in a sustainable manner. Within urban infrastructure the supply of water and its disposal after use in cities has become one of the most important aspects of planning and management, as stated earlier, because water has to be brought from distant sources and the wastewater needs to be treated before being discharged into natural water bodies or rivers. Urban planning cannot be undertaken unless the water supply and wastewater disposal is first accounted for. In dryland areas which are physically water scarce and constitute some 70 percent of the country the problem becomes even more acute as the costs associated with setting up and running WSS services goes up exponentially. Thus, there is a need to study in depth the financial, environmental and social aspects of WSS infrastructure and services in big cities and especially in the dryland areas.

The situation is particularly problematical in this regard in Indore which is the largest city of Madhya Pradesh. The city is situated on the dry Malwa Plateau which is naturally water scarce similar to most parts of western, northwestern, central and peninsular India. The city also has a fairly long history of urban planning from the early twentieth century providing rich material for a critical study. This paper critically reviews the financial, environmental and social sustainability of urban water supply and sanitation infrastructure and services in the city.

2. Situational Analysis of Indore

The demographic, historical, geographical and hydrogeological characteristics of Indore city are described below in brief to contextualise the present paper.

2.1 Demography

The population dynamics of the district are given in Table 1 below. The decadal growth rate of population for the district as a whole over 1991-2001 was 38.7% while that for the total planning area was higher at 42.8% and for the municipal area slightly lower at 37.9%. This seems to indicate that the other smaller towns in the district too have seen migration from rural areas because the average growth rate is much higher than that for the whole of Madhya Pradesh which is 24.3%. The decadal urban population growth rate over 1991-2001 for the whole of India was much lesser at 31.2% (Census 2001), which means that the challenge for planning in Indore is that much greater. The female-male sex ratio in 2001 was 896 while the density was 663 persons per sq km. The city population density is far higher at 12272 persons per sq km. The Indore Development Plan 2021 does not disclose the methodology adopted for projecting the population growth into the future but the figures indicate an assumed average decadal growth rate of 40.7%. The 2011 Census gives the district population as 3372335 instead of the projected 3402841 as the actual decadal growth rate is only 32.7%. The present density is 839 persons per sq km.

Table 1: Population Dynamics of Indore

Area	1991	2001	2011	2021*
Indore District	1777685	2465827	3402841	4695921
Indore Municipal Corporation	1091618	1506062	2179873*	3117548
Total Indore Planning Area 2021	1189797	1698474	2534685*	3566994

* Projections, Source: Indore Development Plan 2021, Directorate of Town and Country Planning, M.P.

The Scheduled Caste population was 388459 or 15.8% and the Scheduled Tribe Population was 163872 or 6.6%. The literacy rate was the highest in the state at 64.2% with 72.7% for males and 54.9% for females. The total working population in the district in 2001 was 890961 or 36.1%. The ratio between female and male workers was 1:3. In urban areas other workers constituted 92.3% of the total workers.

The Indore Development Plan 2021 estimates the population that was living in slums in 2001 to be 485585 or 30.4% of the total. However, a detailed city wide household survey carried out in 2006 (Water Aid 4) found that there were 604 slum clusters in Indore city with 176545 households or an estimated population of 8.8 lakhs if we conservatively assume an average household size of 5. This is close to 51% of the extrapolated population in 2006. Most of the dalit and almost all of the tribal population live in these slums. These people live mostly in hutments of less than 35 sq metre area (George et al 45). Thus, provision of services to these slum clusters, especially WSS services, is an important aspect of planning and implementation in the city. Thus, this underestimation of the slum population seriously affects the viability of the planning process.

There is a considerable amount of migration into the city, especially among the poorer sections residing in slums. This also creates additional demands on the infrastructure. There is very little provision of WSS services for this migrant population. However, there are no reliable data regarding this important phenomenon that crucially impacts urban planning and development and it has not even been considered in drawing up the 2021 Development Plan

2.2 History

The town of Indore first grew on the banks of the Saraswati river as a resting place between the two important pilgrimage destinations of Ujjain on the Malwa plateau and Omkareshwar on the banks of the Narmada river, which both have temples with Jyotirlingas of God Shiva. It was also a convenient halting place on the major north south route from Delhi to Rameshwaram. The Marathas made it a camping place during their campaigns against the Mughals in the north in 1713. Local landlords who were initially subservient to the Mughals, fearing attacks from the Marathas, shifted to the banks of the Saraswati river where they built a small fort on a hillock. There was a temple of the God Indreshwar there from which the town was initially called Indrapur and it later became Indore (Geddes 15). The Marathas siezed control of the Malwa region in 1733 and Malharrao Holkar became the de facto ruler of Malwa by 1760. The British gained control of the region in 1818 and the capital was shifted to Indore from Maheshwar on the banks of the River Narmada. This was a significant development that over the past two centuries has led to the modern city of Indore.

The British initially collaborated with the Holkars to promote the cultivation of opium in the region for export to China. This was an extremely profitable trade for over a century and it attracted Marwari businessmen from Rajasthan to the city further increasing its trading importance by expanding the grain trade (George et al 14). Rail transport came to the city in 1875 further enhancing trade between the Malwa region and Bombay. The textile industry was also set up about the same time in 1871 providing an industrial base for the development of the region as a whole and the city in particular. Electricity came to the city in 1906. At the time of independence Indore had become the major industrial and commercial centre of the central Indian region. The process of industrialisation received a further boost after independence with special government policies and subsidies. Pithampur in Dhar district bordering on Indore is referred to as the Detroit of India with Firodia Enterprises, Larsen & Toubro, Eicher Motors, Hindustan Motors, Crompton Greaves and various steel and pump making industries. The Tatas, S. Kumars, Caparo Industries and Ranbaxy have large units in the Dewas industrial area nearby.

Processing of agricultural products like oil seeds and pulses is also a major activity in the city as its hinterland produces large quantities of both. The city acts as a transhipment hub between north and south for the road transport sector. It is also a major manufacturing and trading centre for ready made garments and pharmaceuticals. Finally the city is a major educational centre in Central India with several government and private engineering, medical and management colleges and coaching centres. Thus, Indore fulfils in every way the engine of growth characteristic of a city and deserves to be studied in detail for the sustainability of its water management.

Indore municipality was formed in 1870. Two reservoirs were constructed in Pipliyapala and Sirpur and piped water supply began in 1894. A pumphouse was established on the Bilaoli Tank in 1906 after electricity came to the city. The augmented water supply also allowed for the installing of flush latrines and the implementation of a sanitation plan. The first systematic plan of the city was drawn up in 1918 by the Scottish planner Patrick Geddes. This plan addressed the problem of open drains emptying untreated waste water into the nullahs and rivers (Geddes 165). Subsequently solid waste disposal for composting in farms was also tried (Howard 23). An underground sewerage scheme was implemented in the central areas of the city from 1936 onwards but the sewage was emptied into the rivers without treatment. A dam was built on the Gambhir river about 20 kms away in 1939 along with a filtration plant in 1939 to further augment the water supply of the city and this was the WSS position at the time of independence in 1947.

2.3 Geography

The urban planning area under the Indore 2021 Plan is 50469 hectares extending roughly between $75^0$47' and $75^0$57' E Longitude and $22^0$37' and $22^0$47' N Latitude. The district as a whole has an area of 3831 square kilometers situated on the southern edge of the Malwa plateau with the city more or less in the centre. The land slopes gently towards the north with the southern fringe constituting the Vindhya ranges. Most of the northern and central part of the district has a slope of less than 10 m per km while the southern part from the Vindhyas northwards has a slope of 10 – 20 m per km. The district mostly has medium black clayey soils except in the southern hilly fringe which has shallow black soils. The maximum temperature is about 45^0C in summer and the minimum temperature about 7^0C in winter. The mean annual rainfall is 1000 mm and most of it comes in the months of June to September. Three quarters of the district including the city of Indore lies in the Chambal sub basin of the Ganga basin and the southern quarter lies in the Narmada basin. The main rivers draining the district in the north are Chambal, Gambhir, Khan and Shipra. The southern fringe of the district is drained by the river Narmada the main tributaries being Choral and Kanar. The southern hilly area is fairly forested with crown cover exceeding 40% and is constituted into Reserved Forests. These geographical features are shown in Fig 1 below.

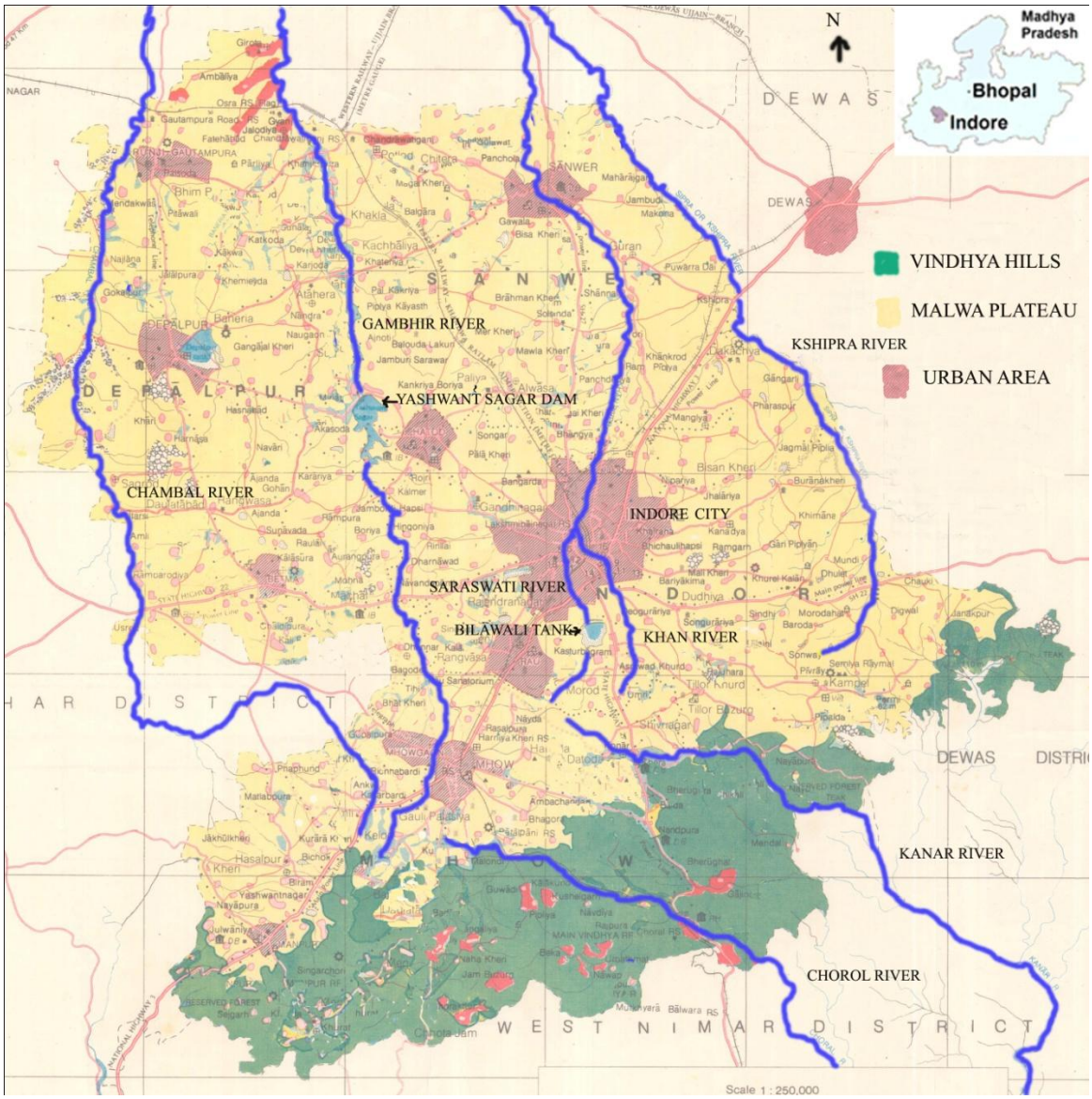

Fig. 1 : Map of Indore adapted from District Planning Map (NATMO, 1995)

2.4 Hydrogeology

The predominant rocks in the district are the Deccan Traps. The water bearing properties of these rocks vary widely. The weathered zones and secondary porosities of the massive basalts and the minutely connected and partially filled vesicles of the vesicular basalts determine the occurrence, movement and storage of ground water. These are the potential aquifers. The run off is very high due to low permeabilities of basalts topped by clayey black cotton soils. Consequently the natural recharge to ground water aquifers is low. There are some confined aquifers due to the alternating layers of the impermeable massive and productive vesicular basalts. At places, like Khajarana, Betma and Gautampura, semi-artesian conditions prevail (CGWB 3-7).

Exploratory drilling by the Central Ground Water Board shows that in the northern and north western part of the district the deeper and older trap units have recorded larger yields – 375 to 825 lpm compared to the shallower and younger trappean units in the southern part of the district where yields are - 75 to 225 lpm. There are ten vesicular layers within a thickness of 218 m with individual layers of thickness from 3 to 20 m. The transmissivity values range between 127.7 m^2 /day to 149.6 m^2 /day. The vesicular zones occurring below a depth of 30 m have poor water yielding capacity. The thickness of the weathered formation encountered ranges between 6 and 30 m. The thickness of the water bearing zones is generally between 1 and 3 meters. However, a 14 m thick water bearing zone exists at Gautampura. The consequence of this hydrogeological situation is that natural water availability is low.

Ground water development in the district is high with two overexploited, one critical and one safe block. The withdrawal of ground water exceeds the natural recharge in the overexploited blocks in a normal monsoon year. "The total annual ground water recharge in the district is 598.97 Million Cubic Metre (MCM) out of which 29.95 MCM is treated as natural discharge during non-monsoon season, leaving a net annual ground water availability of 569.02 MCM. The existing ground water draft for irrigation is 569.43 MCM and the existing ground water draft for domestic and industrial requirement is 24.84 MCM making a total of 594.26 MCM for existing gross ground water draft for all uses. The stage of ground water development comes out to be 104%." (CGWB 9). The current domestic and industrial demand of Indore city is above 100 MCM. This effectively means that even after over-exploitation of groundwater the demand for water cannot be met and so water has to be brought in from other sources as will be discussed in the next section.

The Central Groundwater Authority (CGWA) has declared Indore a severely exploited area with regard to groundwater and directed the District Collector under the provisions of the Groundwater (Control and Regulation) Act 1992 to ban any further tubewell boring in the city of Indore (HT Live I 1). However, in the absence of adequate surface water supply obviously this ban has not been imposed and the number of tubewells continues to increase and now the static reserves of groundwater built up over thousands of years are being depleted. The situation is particularly grave in Indore city where a survey carried out by the Indore Municipal Corporation revealed that there were 51000 tubewells in the municipal region in 2010 (Dainik Bhaskar 1). This had gone up from 13400 recorded in 2004.

The CGWA has gone on to say that apart from natural recharge being low in the Indore area due to the underlying hardrock structure, the continuing construction activity has lowered green spaces resulting in a high level of run off which further aggravates the lack of recharge. The CGWA has recommended that a systematic plan for artificial recharge be drawn up and implemented. The annual availability of surface water in the district at 75% dependability is 871 (MCM) but most of it flows away as there is little attempt to artificially recharge it into groundwater aquifers on a large scale.

3. Water Sector Governance in Indore

The water supply problem of the city assumed serious proportions in the 1970s and a plan to pump water up from the Narmada river 70 kms away and at a level 500 metres below was drawn up. This began to be implemented in 1978 and was completed in 1984. This first phase of the project proved inadequate in comparison to the rising demand and so a decade or so later in 1992 a second phase was implemented. A third phase has now been commissioned in 2010 partly funded by a loan from the Asian Development Bank (ADB). This loan will also fund improvements in sewerage and sanitation and solid waste management. The UN Habitat Asian Cities Programme and Department For International Development of the United Kingdom (DFID) too have provided grant and technical support for creation of slum infrastructure. Apart from this the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) has sanctioned several infrastructure projects in the water, wastewater and transportation sectors and in improvement of slum infrastructure that are under way.

The water supply, sewerage, stormwater drainage, solid waste collection and disposal and sanitation in Indore are all the responsibility of the IMC. There are separate departments for each of these functions. The water supply function has two departments one for the Narmada water supply and another for the locally sourced water supply. The Narmada water supply was initially being taken care of by the Public Health Engineering Department since its inception in the 1970s. Now it has been handed over to the Indore Municipal Corporation (IMC) at the behest of the ADB which has stressed that the IMC must run the project and also arrange for the finances required for operation and maintenance and repayment of the loan through better collection of user fees and taxes. There are two members in council of the IMC in charge of water supply and sanitation and they are the chairmen of the respective advisory committees.

The IDA has the responsibility only for developing new residential and other developmental infrastructure and then handing them over to the IMC for their operation and maintenance. Under the Urban Water Sector and Environment Improvement Project funded by the ADB loan a separate project implementation unit has been set up that after constructing the infrastructure will hand them over to the IMC for operation and maintenance. Thus, the IMC is responsible for collection of water and sanitation cesses and fees for defraying the expenses of providing the WSS services.

The total water supply for Indore according to the IMC is 252.5 million litres per day (MLD) from four sources and their actual respective contributions in 2011 are as follows (Parmar 1) –

1. Three Phases of Narmada – 200 MLD
2. Yashwant Sagar Reservoir on Gambhir River – 22 MLD
3. Bilawli Tank – 3.5 MLD
4. Tubewells, Open Wells and Handpumps – 27 MLD

Surprisingly the IMC does not have any reliable data on the number of connections through which this water is distributed. An estimate prepared by The Energy Research Institute in a study on Water Demand Management in Indore (TERI 21) gives the following rough data - House Connections 136 730 – 155 889, Commercial Connections 1024 – 1253, Industrial Connnections 1320 – 1354, Community Standposts 7263 and Illegal Connections between 20 000 and 40 000. The study states that all these are likely to be underestimates.

Even the total water supply claimed by the IMC of 252.5 MLD requires some critical analysis to verify its authenticity. The first two phases of the Narmada River Supply are each of installed capacity of 90 MLD for a total of 180 MLD. At the behest of the ADB meters were installed on these two phases in December 2008 to do a water audit (Khan "Unquiet Flows the Narmada" 4). As a consequence of this audit it was found that 8 MLD are lost in pumping the water from the intake well upto the filtration plant. 55 MLD more is lost or is unaccounted for in the transit of the filtered water by pumping over a distance of 20 kilometers and a height of 600 meters to the Backpressure Tank at Wanchoo Point. Thereafter as the water flows through gravity over a distance of 50 kms to the city of Indore and then through the distribution networks another 31 MLD is lost or is unaccounted for (HT Live II 3). Thus, the actual accounted for supply to households is only 86 MLD. This implies a huge loss due to technical inefficiencies like bad maintenance and out and out theft.

The new third phase built with the ADB loan has not been metered yet but assuming a nominal 10% technical loss because it is a new pipeline and a similar 10% distribution loss, the volume of water available to households from the third phase is 72 MLD instead of the installed capacity of 90 MLD. So the total Narmada water supply is actually 158 MLD against an installed capacity of 270 MLD. Similarly the supply from Yashwant Sagar is actually 18 MLD against the installed capacity of 45 MLD (AME 48). However, even this level of supply results in the reservoir drying up by the first week of May and thereafter there is no supply during the crucial summer period. The contribution from the Bilawli Tank of 3.5 MLD against an installed capacity of 9 MLD can be taken as given but here too the supply stops from the first week of May due to the reservoir drying up. The number of operational IMC borings is 3500 or so. Given the shortfall in IMC surface water supply the figure of 27 MLD is likely to be an underestimate for groundwater supply from these borewells, wells and handpumps but in the absence of other data this value has to be accepted. Like in the case of the Yashwant Sagar and Bilawli supply the tubewell supply too goes down in summer as some wells dry up. So the piped water supply is only 206.5 MLD and this reduces to 185 MLD in the peak summer months when tanker supply has to be provided. The Census 2011 population of Indore is 31.2 lakhs. Thus, the piped water supply provided by the IMC in litres per capita per day (lpcd) is a dismal 66.18 as opposed to the norm of 135 as given in the government guidelines (MP Govt 143). In fact about 1.5% of the total accounted for supply goes to bulk consumers but that is being ignored here and included in household supply as it is negligible. As will be detailed later through a detailed analysis of the IMC budget, the costs of this limited water supply are exorbitant.

This shortfall in the supply of water and its high cost has resulted in extremely poor supply to the slums. The Slum Environment and Sanitation Initiative (SESI) which is a collaborative project funded and technically supported by Water Aid India and UNHABITAT is being implemented in around a 1000 households in 17 slums of Indore (Water Aid 1). Under this programme piped water and pit latrines are to be provided to the slumdwellers. Due to the limited availability of water and its high cost, supply has not been maintained and so both water supply and sanitation are severely constrained in the project slums despite the implementation of the project.

The project found in a survey conducted in 2006 that 72% of slum households in Indore did not have access to piped water supply from the IMC and they have to depend on standpipes, public borewells or wells and 4.7% from among these do not have access to even safe water sources. Even the 28% that had access to piped water supply complained of irregular and inadequate supply of about half an hour every alternate day. And even among these 20% said that there taps are completely dry and they had to rely on standposts instead(Water Aid 7). This leads to a loss of work hours for fetching water and also because

of affliction with water borne diseases due to lack of sanitation. This affects women more because of the patriarchal gender division of labour which puts the responsibility for home care work on women.

4. Analysis of Finances of Indore Municipal Corporation

The major hurdle in urban development in developing countries is its financing. This is especially so in the case of water resource management since water supply and wastewater disposal infrastructure are costly to set up and maintain. With the huge increase in city size these costs have gone up exponentially, badly straining public finances. The World Bank, consequently, categorically states that urban local bodies must become financially sustainable following global best practice in the water supply and sanitation sector wherein such financially sustainable service providers "recover operation and maintenance costs and ideally capital costs, from user charges, rather than from taxes" (World Bank 16). The Government of India also is pressing for financial sustainability following the lead of the World Bank in order to reduce subsidies and achieve fiscal prudence. Thus, it is necessary to study the finances of the IMC to find out the situation prevailing in this regard and the possibilities of achieving such financial sustainability while maintaining a high level of service provision to all sections of society and also ensuring environmental sustainability.

The annual published budgets of the IMC for the five years from 2006-07 to 2010-2011 have been analysed here. The funds for implementing JNNURM projects began to be available from the financial year 2006-07 onwards and the Asian Development Bank funded Water Supply and Urban Services Improvment Project too began to be implemented in earnest from this year. The overall revenue and capital receipts and payments have been analysed first. The actual receipts and payments are available for the years 2006-07 to 2008-09 so these too have been compared with the budget estimates and analysed by the broad categories to get an idea of the structure of the IMC's finances. The categories have been clubbed together from the detailed budget items according to their similarity of function. The capital expenditures in the creation of infrastructure have also been separately analysed. The differences between the budget estimates and the actuals for all categories of receipts and payments have been analysed for the three years from 2006-07 to 2008-09 to get an idea of the reasons for the differences in budget estimates and actual spending.

4.1 Revenue Receipts and Expenditures

The trend in budgeted revenue surplus is a rising one from 23.7% of revenue receipts in 2006-07 to 30.5% in 2010-11 with a peak of 38.8% in 2009-10. The per capita revenue receipts go up from Rs 1895.05 in 2006-07 to Rs 3439.32 in 2010-11. While the per capita revenue expenditure goes up from Rs 1446.34 in 2006-07 to 2391.88 in 2010-11. The average per capita revenue expenditure for Tier I Indian cities in 2007-08 was Rs 3450 (MGI 63). Thus, Indore, even despite the substantial increase of 65% in revenue expenditure over the five years under consideration, is still way below the Indian average. The average revenue expenditure on urban services in Indian cities is itself only 2% of that in the United Kingdom, 9% of that in South Africa and 13% of that in China (MGI 62).

The actual revenue receipts are less than the estimates by 41.18%, 32.88% and 38.65% in the years 2006-07, 2007-08 and 2008-09 respectively. Consequently the actual receipts are less than the budgeted expenditures in all these years leading to actual revenue expenditures being lesser by 39.85%, 42.01% and 29.43% than the budgeted estimates in these three years respectively. In all likelihood the actual receipts and payments in 2009-10 and 2010-11 will also be lesser by a similarly high proportion.

This is a major drawback as far as financial sustainability is concerned because the projected revenue collections, which are anyway much less than what is required, are not taking place. Consequently the revenue expenditures necessary for proper provision of urban services are not being made. Moreover, there is a shortfall in the actual revenue surpluses generated also by 40%, 42% and 29% from the budgeted estimates over these three years. This hampers the ability of the IMC to pay back the loans it has taken and to undertake capital expenditure on infrastructure projects as will be detailed below.

4.2 Capital Receipts and Expenditures

Capital receipts consist of loans taken from banks, through bonds and from the ADB and grants from the Central Government and State Government for JNNURM projects and for other purposes. The proportion of estimated loans to total estimated capital receipts, does not show any trend across the years, being lowest in 2010-11 at 24.93% and highest in 2007-08 at 48.33%. The per capita capital receipts goes up from Rs 1887.3 in 2006-07 to Rs 3519.82 in 2010-11. The per capita capital expenditure goes up from Rs 2403.92 in 2006-07 to Rs 3519.82 in 2010-11. The average per capita capital expenditure for Indian Tier 1 cities is Rs 2800 (MGI 63). So due to the increased contributions from ADB and JNNURM the capital expenditure is more in Indore in 2010-11. However, this will decline steeply from 2013 once the ADB and JNNURM contributions sieze in 2012. Once again the average capital expenditure on urban services in Indian cities is itself only 4% of that in the United Kingdom, 13% of that in South Africa and 15% of that in China (MGI 62).

The actual capital receipts and loans over the three year period from 2006-07 to 2008-09 are again much lower than estimated with the shortfalls being above 50% in all cases and being the highest in 2006-07 at 77.77% for loans and 61.94% for grants. This has had a negative effect on the capital expenditure. Since the repayment of loans has more or less to be kept on track to avoid a downgrading of the credit rating of the IMC, this failure to mobilise capital receipts through loans and grants in accordance with the estimates has meant that the actual capital expenditure in the creation of infrastructure has gone down by over 50% from the budget estimates. The highest shortfall being 64.59% in 2006-07.

There is anyway a budgeted capital deficit that exceeds the revenue surplus resulting in a budgeted overall deficit which is on an average around 3% of total receipts. There is no indication as to how this budget deficit is to be made up. This deficit remains even in the actual finances of the three years from 2006-07 to 2008-09 with the proportion being more or less the same as for the budget estimates. These actual deficits keep on accumulating over the years and manifest themselves as outstanding payments. The shortfall in actual receipts and expenditures from the budgeted receipts and expenditures is much larger and reflects the real resource crunch of the IMC as will be discussed in more detail later in the analysis of financial ratios. These deficits accumulate and eventually have to be made up by grants from the state government.

4.3 Categorywise Revenue Receipts and Expenditures

More insight can be gained into the financial status of the IMC by studying the category wise breakup of the revenue receipts and payments and capital expenditure. The Capital receipts are mainly from heavy grant receipts from the Central and State Governments under various schemes like the JNNURM and the Loan receipts from the ADB so they have not been studied separately. The biggest source of revenue is that of Octroi compensation which contributed as much as 39% of the actual revenue in 2008-09. This is the amount given by the State Government in lieu of revenue foregone by the IMC by not collecting octroi on goods coming into the city. The next highest source are the combined water taxes and charges

which reached a high of 17% in the actual revenue of 2007-08. This is followed by the group of fees for Building Permission, Transfer of Property and Colony Development which reached a high proportion of 12% of actual revenue in 2008-09. The Drainage and Cleanliness Tax comes next with a high of 11% of actual revenue in 2006-07. This is followed by the Property Tax which too reached a high proportion of 11% of actual revenue in 2006-07. There are surcharges levied on various taxes by the State Government which are given to the IMC and this constitutes the last major revenue source reaching a high proportion of 10% of the actual revenue of 2006-07. The contribution from Central Grants reached a high proportion of 3% of actual revenue in 2006-07 while the State Grants contributed a high of 7% of actual revenue in 2007-08 of which 3% was for the salaries of the staff who manage the Narmada Water Supply system. These major sources constitute more than 87% of the revenue income while other sources are of a small nature. Own revenues in which Octroi and Passenger Tax Compensation are also included as being substitutes for own revenue constituted more than 90% of the total revenue receipts.

Salaries constituted the highest item of expenditure with a proportion above 30% of total actual expenditure in all the three years from 2006-7 to 2008-09. Electricity charges for the Narmada Water Supply was the next highest item of expenditure with a proportion of 14% of total actual expenditure in 2007-08. Water supply as a whole constitutes more than 30% of the total actual expenditure underlining its importance in the municipal services.

4.4 Property Tax analysis

The international financial institutions concerned more with the financial sustainability of urban service provision are putting pressure on governments to reduce subsidies and improve tax and user fee collection. A related policy thrust is to stop grant funding and encourage urban local bodies to access the debt market. To make this possible the USAID has extended loans and grants to improve the capacity of urban local bodies to tap the commercial debt market through the Financial Institution Reform and Expansion (FIRE) project (Mahadevia "Sustainable Urban Development" 249). Apart from this USAID also sponsors technical assistance projects for improving the technical skills of urban local bodies. The National Institute of Urban Affairs has been designated as the nodal agency under this project by the Ministry of Urban Development of the Government of India and has the following mandate to support the GoI's efforts (NIUA para 3) –

i) in promoting decentralisation as an efficient mechanism for good urban management through implementation by the states of the 74th constitution amendment,

ii) capacity building of state level entities for development of commercially viable water and sanitation projects with market based financing,

iii) development and expansion of an efficient urban management training network in the country and

iv) in dissemination of reforms.

The focus for improving the own tax revenue of the urban local bodies is the property tax. Propery tax should ideally be the major source of revenue for municipal governments because it is a progressive tax that is borne more by the richer propertied sections than the poorer property less sections of the city (Bahl and Linn 7). However, in India typically collusion between property owners and assessors has led to non registration and undervaluation of properties, low tax rates and bad collection as mentioned in a study done by the National Institute of Public Finance and Policy (NIPFP 1). This study notes that the stress on better tax collection has been reiterated by the JNNURM based on several studies

that have pointed out the need to augment and rationalise the property tax system in particular and the property market in general (NIPFP 54). The JNNURM has stipulated as a condition of funding projects that by the end of the mission period in 2012 the following should be accomplished –

i. GIS must be used to completely cover and register the properties in a city,

ii. tax rates should be rationalised and property valuations raised to realistic levels from the present low ones,

iii. tax collection should rise to 85% of the potential,

iv. rent control laws should be updated to encourage investment in property

v. stamp duties on property transfer should be decreased.

This insistence of the JNNURM for financial independence of the municipal bodies is primarily to ensure that they have untied local funds for development. The 30% share that the municipalities have to contribute to the JNNURM projects and also the repayment requirements of loans and bonds that these entities may raise could only be garnered, it was felt, from a bouyant property tax regime.

A further aspect of this decentralisation and commercialisation of the operation of urban local bodies is the ringfencing of the WSS functions through the formation of separate water supply and sewerage boards. This is crucial because to be able to pay back the loans taken for implementing WSS projects there has to be a dedicated income source specifically for these projects. So by creating separate institutions the taxes and user fees can be increased and collected separately for WSS services.

The big problem in terms of achieving financial sustainability for the IMC is that Property Tax is the fourth highest source of income even lower than water taxes, drainage and cleanliness taxes and building permission and colony development fees and constitutes only about 19% of the own revenues raised by the IMC. In fact the actual per capita property tax income in 2008-09, the latest year for which data are available, is only Rs 66.66 (The population of Indore in 2008-09 has been straight line intrapolated as 31 Lakhs based on the 2001 and 2011 census figures). This compares very unfavourably with the national average for large cities of Rs 486 per capita estimated by a study done by the National Institute of Public Finance and Policy (NIPFP 1). The study says that undervaluation of properties, their non-registration and failure in collection combine to severely undermine property tax collection throughout the country. This problem is very serious in Indore. According to a news report the IMC claimed in February 2010 that "over 1.92 lakh property tax account holders hadn't paid taxes at all for the last three years in a row and cumulatively owe it Rs 297 crore" (HT Live III 3). The report goes on to quote the IMC Commissioner as saying "We have instructed the revenue department to scour each zone so that the largest possible number of unlisted properties can be unearthed."

The Indo-US FIRE-D project that was implemented in Indore from 1997-2003 resulted in an increase in own source revenue from Rs 1945 lakhs to Rs 6351 lakhs over the six year period at a compound annual growth rate (CAGR) of 21.8% mainly through better identification of properties, rationalisation of tax rates and better collection of taxes (FIRE-D 2). The whole data base and accounting systems were computerised and an accrual based system of accounting was adopted. The number of properites registered for assessment went up from just 80,000 to 236,000 and has now reached 300,000. Thus the trend in own revenue increase has continued later also as the budget estimates of own revenue show an increase of about 19% CAGR between 2006-7 and 2010-11. The budgeted revenue expenditure grew at

about 13% CAGR over the same period and so there must have been some improvement in the financial situation of the IMC. However, there is still a basic inadequacy in the tax rates and the collection mechanism leading to heavy shortfalls in actual collection. Most importantly the proportion of property tax in the own tax revenue has still remained only a low 20%. Given that the property tax is a progressive tax that makes the richer sections pay more towards the costs of urban governance it should be the main source of income for the IMC. The JNNURM as mentioned earlier and the ADB have both mandated a higher property tax collection as a sustainable way of improving the finances of the IMC. However, progress on this has been extremely tardy in Indore and the shortfall in actual collection in 2008-09 from the budget estimate was a whopping 51 %. Despite the fact that this was the year in which the repayment of the ADB loan and interest had started.

4.5 Water Sector and Waste Management Finances

The next major area of concern is the financing of water supply. Taking the year 2008-09 which is the latest for which actual payment details are available, the budgeted cumulative receipts from various Water Supply related charges and fees is Rs 6725.01 Lakhs and the State Government Grant for Narmada Water Supply is Rs 1210 Lakhs thus totalling Rs 7935.01 Lakhs. Whereas the various budgeted payments related to water supply are as follows – Other Water Supply (From Yashwant Sagar and Bilaoli reservoirs and Tubewells) Rs 868.6 Lakhs, Salaries for Other Water Supply Staff Rs 531.49 Lakhs, Electricity Charges for Other Water Supply Rs 551 Lakhs, Narmada Water Supply Rs 1858 Lakhs, Salaries for Narmada Water Supply Rs 1120 Lakhs, Electricity Charges for Narmada Water Supply Rs 6000 Lakhs and Emergency and Tanker Water Supply Charges of Rs 360 Lakhs totalling Rs 11289.09 Lakhs. Thus, even in the budgeted estimates there is a huge deficit in water supply finances of 42.26%. This becomes even starker when the actual receipts and payments situation is studied.

The actual Water Charges collection is Rs 2798.15 Lakhs and the Government Grant for Narmada Water Supply is Rs 1135 Lakhs totalling Rs 3933.15 Lakhs. The actual payments are as follows - Other Water Supply (From Yashwant Sagar and Bilaoli reservoirs and Tubewells) Rs 845.57 Lakhs, Salaries for Other Water Supply Staff Rs 464.81 Lakhs, Electricity Charges for Other Water Supply Rs 534.35 Lakhs, Narmada Water Supply Rs 387.17 Lakhs, Salaries for Narmada Water Supply Rs 974.58 Lakhs, Electricity Charges for Narmada Water Supply Rs 978 Lakhs and Emergency and Tanker Water Supply Charges of Rs 232.01 Lakhs totalling Rs 4416.49 Lakhs. Assuming that the budgeted estimates of payments to be made are realistic ones the huge shortfall in receipts of 50% further aggravates the deficit situation of water supply finances. The most glaring shortfall is in the payment of electricity charges for the Narmada Water Supply which is 84%.

The sewerage, storm water and solid waste management finances are in better shape. The budget estimate for the drainage and clearnliness tax receipts is Rs 4265.32 Lakhs while the actual receipts are 2188.44 Lakhs resulting in shortfall of 49%. The estimate of expenses are – Sanitation Rs 169.5 Lakhs, Sewerage and Storm Water Rs 397.78 Lakhs and Solid Waste Rs 529 Lakhs. This gives a total of Rs 1096.28 Lakhs. The salary expenses have not been separately tabulated for these activities but assuming the same proportion as for overall expenses other than water supply the salary estimate works out to Rs 418.25 Lakhs. Thus, the estimated total waste management costs are Rs 1514.53 Lakhs which is well within the budgeted receipts. The corresponding actual expenditures are – Sanitation Rs 11.47 Lakhs, Waste Water Rs 515.47 Lakhs and Solid Waste Rs 540.96 Lakhs. The salary costs are Rs 320 Lakhs. Thus, the actual waste management costs are Rs 1387.9 Lakhs which is well within the actual collections. However, there are a lot of inadequacies with the quality and extent of

waste management and it looks as if some of the huge deficit in water supply is being sought to be made up by under spending in this sector. A water recharge and plantation tax is also collected. Here there is an anomaly in that despite there being an excess actual collection of 31% the actual expenditure is less by 69% once again indicating a diversion to water supply.

4.6 Other Services

Two more important service areas are those of maintenance of roads and provision of streetlighting. The provisioning for these has to be made from the general revenues of the IMC and since these are much less than what they should be it is not surprising that in these services too there are large expenditure shortfalls of 69% for road maintenance and 51% for streetlighting. The resulting combination of potholed roads and lack of adequate streetlighting is a fatal one.

4.7 Interest Payments

Finally in interest payments too there is a huge shorfall of 87%. The ADB loan repayments had started from 2008-09. It looks as if the interest payments for other outstanding loans have been ignored to service the ADB loan both for the water infrastructure and for the outstanding Narmada electricity bill. However, since the water from the Narmada third phase began coming only from the 2010 onwards and is still not being distributed through metered connections the earnings are not forthcoming. Consequently overall the low level of property tax and water taxes in both the budget estimates and actual collections has resulted in a tight and unsustainable financial situation for the IMC. The outstanding cumulative electricity payment for the Narmada Water Supply itself currently stands at over Rs 200 crores despite a payment of Rs 500 crores having been made in 2005 with a loan from ADB to clear the earlier backlog (HT Live IV 1). The severe resource crunch has also affected the implementation of the JNNURM as the IMC has found it difficult to mobilise its own 30% contribution. There is no possibility of the JNNURM works being completed by the original deadline of 2012 and in many projects the release of final instalments by the Central Government have been held up (HT Live V 3). In fact with the JNNURM funding coming to an end in 2012 and the loan repayments for the ADB loan having started the interest payments and loan repayments are going to cumulatively increase to Rs 59 Crore annually from 2015 (HT Live VI 3) onwards. This is to be compared with the Rs 2.06 crores of actual interest payment made in 2008-09 and the budgeted estimate of interest payment of Rs 37.89 crores for 2010-11.

4.8 Categorywise Capital Expenditure

The category wise breakup of capital expenditure in infrastructure development is as follows. Water supply has the highest share at 71% of actual expenditure in 2007-08. This is followed by roads at 12% of actual expenditure in 2007-08. Sewerage and Stormwater come next with 8% of actual expenditure in 2007-08 and the last major head is Slum Development with 4% of actual expenditure in 2008-09. The miscellaneous category had a share of 25% of actual expenditure in 2006-07 and includes, computerisation, GIS mapping of various assets and services and construction of buildings. However, the funding for these expenditures came from the JNNURM and the ADB loan which have now come to an end and so the expenditure shares from 2011-12 onwards are likely to be different.

Once again the shortfall between estimates and actuals for 2008-09 is quite high being 51% overall. Among the major expenditure categories mentioned above the highest shortfall of 78% is in slum development. This is an important programme funded by JNNURM and also DFID and yet it has suffered from under implementation. This is a serious cause for concern because given the financial crisis facing the IMC which is going to go on

deteriorating as the costs of water supply increase exponentially with time, there is little likelihood of the IMC being able to devote resoures for slum development from its own revenues. The IMC will thus have very little resources to even maintain the present level of services let alone cater for growth and quality improvement in future.

4.9 Analysis of Financial Ratios

The fiscal deficit is the difference between the sum of the revenue and infrastructure expenditure and the sum of the revenue and grant receipts. An important indicator of financial sustainability is the ratio of the fiscal deficit to the sum of the revenue and grant receipts or the non debt receipts. Generally for any governing institution at the national or sub-national level it should be in the 10 – 15% range to balance the needs of infrastructure development, the provision of services and the maintenance of sustainable finances (CAG 24). It can be higher at the national level because the national government has greater resource mobilisation powers and it should be lower at the municipal level.

Table 2: Indore Municipal Corporation Financial Ratios 2006-07 to 20010-11

Financial Ratios	2006-07		2007-08		2008-09		2009-10	2010-11
	Bud. Est.	Actuals	Bud. Est.	Actuals	Bud. Est.	Actuals	Bud. Est.	Bud. Est.
Capital /Revenue Receipts (%)	100.00	55.00	130.80	85.00	130.00	95.00	113.00	102.34
Fiscal Deficit/(Grants+Revenue Receipts) (%)	22.76	6.77	36.40	24.04	23.55	22.04	18.52	12.62
Shortfall Ratio of Actual Revenue Expenditure/ Budgeted Receipts (%)		55.4		49.54		65.60	N.A.	N.A.
Shortfall Ratio of Actual Capital Expenditure/ Budgeted Receipts (%)		52.69		43.29		34.68	N.A.	N.A.

Source: Tabulation based on Indore Municipal Corporation Budget Estimates 2006-07 to 2010-11.

The estimated ratio as shown in Table 2 above is highest in 2007-08 at 36.4% and lowest in 2010-11 at 12.62%. The lower ratios in 2009-10 and 2010-11 are because of the high amounts of grants received under the JNNURM which are a temporary source that will be exhausted in 2012. This ratio goes down in the actuals for the first three years because of comparatively lesser expenditure. This ratio is much higher for most years than the value of the same ratio for the Madhya Pradesh Government which is around 15% despite the latter's greater fiscal and borrowing powers and seems to point towards an inability on the part of the IMC to mobilise enough resources on its own commensurate with the planned development and service provision requirements of a growing city.

Another crucial indicator is the ratio of capital receipts to revenue receipts which is the lowest at 100% in 2006-07 and the highest at 131% in 2007-08. Due to the lesser actual mobilisation of capital receipts as compared to revenue receipts these ratios go down somewhat in the actuals but they are still very high. This means that there is a heavy dependence on grants and loans for infrastructure development and even after that the capital deficit exceeds the revenue surplus because the budgeted captial expenditures are very high. The ratio of the shortfall of the actual revenue and capital expenditure to the estimated budget revenue and capital expenditure for a particular year is a clear indicator of the inadequacy of resource mobilisation exercises of IMC. This ratio was as high as 65.60% for revenue expenditure in 2008-09 while for capital expenditure it was as high as 52.69% in 2006-07. Even though the capital expenditure shortfall reduced to 34.68% in 2008-09 this is likely to rise again as the JNNURM grants cease. A comparative study of the municipal finances of the five cities of Ahmedabad, Pune, Mumbai, Chennai and Bengaluru reveals that while there is a shortfall of the actual receipts and expenditures from the budgeted estimates in these cities also it is generally in the range of 4 to 50% for revenue receipts and 13 to 55% for

revenue expenditures (Sekhar and Bidarkar 1202). The city of Pune with the lowest shortfall is also the one with a good own revenue mobilisation. Thus, prima facie, from an analysis of the overall budget it looks as if the IMC is nowhere near achieving financial sustainability in the terms set out by the World Bank as mentioned earlier.

5. Review of Water Supply and Sanitation in Indore

A more detailed study of the water supply and sanitation situation in Indore will now be undertaken to arrive at a proper understanding of the hurdles to sustainable water management in the city.

5.1 Unit cost of Water Supply

The rought estimation of the per unit volume cost of the water supply of IMC in 2010-11 can be done assuming the budget estimates to be a correct reflection of the various costs involved. The costs have been estimated separately for the various sources for comparison. It has been assumed that the water that is lost and unaccounted for is non-revenue water for which the IMC does not get any payment. For calculating the per unit volume cost of water it is assumed that there is supply of water on all 365 days from all sources even though in reality there are large gaps in supply, most glaringly so in the Yeshwantsagar, Bilawli and Tubewell supplies which dry up in peak summer. It is also assumed that the average household is of 5 members. The monthly costs have been worked out for the norm of 135 lpcd supply and also for the actual average supply prevailing in IMC planning area of 66.18 lpcd. The estimates are given in Table 3.

Table 3: Indore Municipal Corporation Cost of Supply of Water in 2010-11

Type of Supply		Narmada Water Supply (NWS) Phase I & II	NWS Phase III ADB	Yeshwant Sagar & Bilawli	Tubewell Supply	Total
Costs in Rs Lakhs	Salaries	2351.34	57	535	86.86	3030.2
	Maintenance	1783.3	470	705	431.6	3389.9
	Electricity	7500	7200	206	875	15781
	Interest and Loan Payments	1030	700			1730
	Total	12664.64	8427	1446	1393.46	23931.1
Water Supply in MLD		86	72	21.5	27	206.5
Cost of Water in Rs/1000 litres		40.35	32.07	18.43	14.14	31.75
Monthly Cost of 135 lpcd supply for a household of 5 in Rs		817.01	649.34	373.13	286.33	642.95
Monthly Cost of 66.18 lpcd supply for a household of 5 in Rs		400.33	318.18	182.83	140.30	315.04

Source: Calculated from IMC Budget 2010-11 and Water Supply Data.

The cost of the water from the older Narmada Supply is the highest at Rs 40.35 per 1000 litres. The monthly cost of supplying a five member household the standard supply of 135 lpcd is Rs 817.01 while it is Rs 400.33 for supplying the average volume actually being supplied of 66.18 lpcd. The newer Narmada Supply phase III funded by the ADB has a cost of Rs 32.07 per 1000 litres. The monthly cost for Narmada III of supplying 135 lpcd to a

family of five is Rs 649.34 and for supplying 66.18 lpcd it is Rs 318.18. For water supply from Yashwant Sagar and Bilawli these values are Rs 18.43 per 1000 litres, Rs 373.13 and Rs 182.83 respectively. Whereas the costs are lowest for groundwater supply at Rs 14.14 per 1000 litres, Rs 286.33 and Rs 140.30 respectively. The overall combined average costs are Rs 31.75 per 1000 litres, Rs 642.95 and Rs 315.04 respectively.

A further analysis of the unit cost of water by the major expenditure items given in Table 4 reveals the reasons for this difference in costs for different sources. The main reason for the difference is that the electricity cost is very high for the Narmada water supply as compared to the Yeshwant Sagar, Bilawli and Tubewell supply. The salary costs for the older Narmada supply too are quite high whereas they are negligible for Tubewell supply.

Table 4: IMC Unit Cost of Water Supply by Item of Expenditure (Rs/1000 litres)

	Narmada Water Supply (NWS) Phase I & II	NWS Phase III ADB	Yeshwant Sagar & Bilawli	Tubewell Supply
Salaries	8.95	0.22	5.43	0.88
Maintenance	5.68	1.79	8.98	4.38
Electricity	23.89	27.40	2.63	8.88
Interest and Loan Payments	3.28	2.66	0.00	0.00

Source: Calculated from IMC Budget 2010-11 and Water Supply Data.

The average cost of water supply from all sources combined is Rs 31.75 per 1000 litres. This is to be contrasted with the budgeted estimates of receipts from the various water taxes and charges which is Rs 12.83 per 1000 litres actually supplied (1000 x Rs 9674.5 Lakhs/ 206.5 MLD x 365 days). Thus, in the budget estimates themselves, there is a shortfall in the recovery with respect to budgeted costs of 60%. As we have seen for 2008-09 the actual water charges collection is less by 58% from the estimates which means that the actual shortfall in collection is about 85% vis a vis the costs. The bulk consumers are being charged at only Rs 10 per 1000 litres. To add insult to injury despite such a low bulk rate even state and central government agencies are not paying their dues and have run up bills of over a lakh each and the total outstanding is close to Rs 100 crores (HT Live VII 1).

5.2 Critique of Water Supply System

The TERI study mentioned earlier uses some of the rough data provided by the IMC in the absence of metering and a proper inventory of the distribution system to calculate an Infrastructure Leakage Index (ILI) of 404.3 for the IMC water supply (TERI 67). This index is the ratio between the actual water losses taking place in the system to the minimum unavoidable water losses in a water system and is a measure of the efficiency of the system. Obviously the lower its value the better it is and it should ideally be between 2 and 6. The extremely high value of the ILI for IMC is an added proof of the severe inefficiency of the system. The values for water availability used for this calculation are much higher than those actually prevailing that have been used in the analysis here and so the actual ILI is even higher indicating a higher inefficiency. Despite a detailed study of water and associated energy demand having been done, there is still no effort on the part of the IMC to reduce losses in the water supply system.

No wonder the IMC is severely stressed in meeting the water supply costs and is running up huge outstanding payments of electricity bills in addition to being unable to maintain the water supply systems properly. The present water tax is Rs 220 per month per water connection. This is less than the average monthly cost of providing 66.18 lcpd to a

family of 5 which is Rs 315.04. In reality there are on an average more than one household served by one water connection. Thus, from the point of view of financial sustainability the major problem is that the huge costs of water supply cannot be passed on to the consumer. The foregoing analysis can now form the basis of a critique of the water supply system of the IMC as follows –

1. The older Narmada Water Supply system is in serious disrepair. There are not only breaks in the piping system but also a high level of water theft is going on. The cost of Narmada water supply has always been high and so from the beginning there have been under recoveries as the consumers have been subsidised. The State Government has been providing grants to somehow keep the system running but this has resulted in poor maintenance of the system and with age it has deteriorated. The first phase of the system is close to 40 years old and the second phase is more than 20 years old. Moreover water meters have not been installed to keep a tab on the water being supplied and so this has resulted in theft and diversion with the collusion of IMC staff.
2. Groundwater supply is much cheaper but possibilities of enhancing this supply have not been explored at all by the IMC. Instead given the huge under supply of water by the IMC, private parties have indiscriminately exploited the ground water reserves for commercial supply as will be discussed later. Neither have any serious steps been taken by the IMC to ensure recharge of water.
3. The major cost component of the Narmada supply systems is the electricity cost which is 59% for the older phases and 85% for the newer phase though this is because the delivery system of the newer phase has not been completed as yet. The cost of electricity also is going up in leaps and bounds because there is pressure on the electricity generation and distribution companies to recover costs. Currently the accumulated losses of all the government companies involved in distribution of electricity in Madhya Pradesh is more than Rs 12000 crores (Dixit 3). Whereas the price of high tension power required for the Narmada pumping has gone up from Rs 3.68 per unit to Rs 5.13 per unit in 2011, it has gone up from Rs 3.42 per unit to Rs 4.47 per unit for low tension power used for tubewells (HT Live VIII 1). This will further increase the financial unsustainability of the Narmada water supply system. The start of the first phase of 90 MLD of the new Narmada supply funded by the ADB loan was in fact held up due to the power distribution company refusing to provide power unless an advance payment of Rs 10 crore was made. Eventually the Madhya Pradesh Electricity Regulatory Commission ruled that the outstanding dues on the earlier phases could not be advanced as an excuse for demanding such a high advance for starting the third phase and so the water supply started (HT Live IX 1).

There are some serious consequences of this wrong planning and even worse management of water supply. The first is that the draft of groundwater by private sources both for domestic use and for commercial supply has gone up tremendously. There is no systematic survey being carried out to enumerate the number of tubewells in the IMC planning area and there total water withdrawal. There are over a thousand residential colonies in the city, both legal and illegal, with on an average about 200 houses each and most of the houses have tubewells to supplement the Narmada water supply which is inadequate even where it is available. Apart from this there are many tubewells which draw water from the

deep aquifer at 200 metres or more depth to supply water commercially through tankers at rates which are currently about Rs 70 for 1000 litres (HT Live X 1).

There is a water recharge cell in the Indore Municipal Corporation and it also collects a cess for water recharge and plantation activity. However, as shown earlier the expenditure on recharge is less than the collection which seems to indicate that this crucial activity is not being seriously pursued. The mandatory 14% green area that is required within the planning area too has not been retained due to massive illegal construction of residential colonies in the stipulated green belt areas. In a desperate bid to retain the green belt areas in the new Town Plan 2021 notified in 2008, the Government announced that it would acquire the agricultural land in the catchment of the Bilawli tank and hand it over to a franchisee to operate a golf course. Little did the government know that a golf course requires huge amounts of water for its operation. Anyway a massive agitation by the farmers put paid to this proposal (HT Live XI 1). The cumulative effect of the financial unsustainability of surface water supply and the environmental unsustainability of groundwater supply bodes a future water crisis of gargantuan proportions. The second serious consequence of water supply mismanagement is the high price of water for those without access to IMC supply or private sources of their own. As mentioned earlier this proportion is around 50% of the total population of the city.

5.3 Critique of ADB Plan

All this brings into question the rationale of the ADB for giving a loan to implement the Narmada third phase in Indore for adding another 360 MLD to the water supply and the accompanying overhead tanks and distribution system. The ADB sanctions a loan only if the economic internal rate of return or EIRR and the financial internal rates of return or FIRR suitable (ADB 16). The EIRR reflects the economic returns from the project to the people of Indore as a whole while the FIRR reflects the financial returns to the IMC. A project should be chosen from a menu of options by comparing their EIRR and selecting the one with the highest EIRR. Subsequently the FIRR of this selected project should be checked to see whether it is financially viable also. This is because in calculating EIRR many non-tangible benefits are also expressed in economic prices for quantification but in reality they do not contribute to the financial cash flows. However, the ADB discarded the groundwater option altogether by stating that the area is semi-arid and natural recharge is not assured without exploring the possibilities of artificial recharge of storm water and the treatment and reuse of waste water. It then considered only the one option of augmenting water supply from the Narmada. This despite its own review having revealed that the technical, managerial and financial operation of the existing two phases were severely inadequate and suffered from huge revenue losses. So only different options within surface systems were evaluated.

For the calculation of the EIRR a sample contingent valuation survey was conducted among the citizens to quantify the non-monetary benefits of getting a good supply of water defined as – 100 lpcd for in house connections and 75 lpcd for standposts. The respondents were asked to compare the benefits of the enhanced water supply with the prevailing dismal scenario which would soon lead to a water crisis and jeopardise their immediate household existence as well as the continuance of Indore. The EIRR for Indore came out to be a healthy 16.5% (ADB 45). However, the problem here is that it was assumed in these calcualtions that the losses in the water supply system would be negligible as a result of better technical and management practices reducing them from the prevailing levels drastically. This has been belied as demonstrated earlier.

Moreover, the cost of power has gone up much more than was envisaged in these calculations. A sensitivity analysis conducted in the EIRR analysis showed that slippage in

completion dates of the project, cost overruns and failure to improve the operation and maintenance and cost recovery would greatly reduce the EIRR and render the project unfeasible. These negativities have all occurred and so the project has in reality become unviable. Crucially the new distribution system for the third phase is not in place and so the same old leaky system is being used leading to frequent breakdowns and higher losses.

The FIRR was calculated as 5.6% on the assumption of the water tax going up from Rs 60 in 2003 to Rs 190 in 2009 and thereafter metering was to be introduced in all old connections and new ones are to be compulsorily metered. Simultaneously the coverage and collection efficiencies were to be 75% and the non revenue water was to be only 20%. However, even in 2011 none of these assumptions are true as we have seen in the financial analysis done earlier and in reality huge losses and outstanding dues are being run up. These losses and dues are going to increase even more as the full annual loan repayment burden of Rs 59 crores starts from 2015 onwards.

The ADB has suggested that to improve operation and maintenance efficiency and recovery of costs the distribution of water under the new phase should be done as a PPP enterprise wherein the IMC would supply water in bulk to an overhead tank and the further distribution and charge collection would be undertaken by a private franchisee. There would be 24x7 water supply with metering to improve efficiency and cutdown on losses. The Rajendranagar locality has been chosen as the first area for this new mode of water supply. However, the project at the moment is mired in litigation as one of the bidders has contested the award of the contract to another franchisee in the High Court. Even so as the project has evolved, the capital costs of construction of overhead tanks and the laying of distribution lines will have to be borne by the IMC and the franchisee will only recover the operation and maintenance costs through user fees (HT Live XII 1). This further undermines the financial viability of this model as the loan repayment for the infrastructure will have to be borne from other sources.

5.4 Critique of Sewerage, Stormwater and Solid Waste Management

The sewerage, storm water and solid waste management systems in Indore are in total disarray. There is an old sewerage system in some parts of the city but it is leaking heavily due to broken pipes. Mostly the wastewater is released into the natural drainages and these lead to the Khan and Saraswati rivers which have become stinking Nalas. The BOD level of the Khan river in the stretch downstream of Indore to its confluence with the Shipra river is 65 – 120 mg/litre (CPCB 1) against the norm of 3 mg/litre for open clear water sources. This means that in Indore city itself the water in the nullahs have much higher BOD. There is no storm water drainage in the city and many of the smaller natural drainages have been built up and this obstructs the flow of storm water which collects on the roads leading to severe water logging in the monsoons.

The solid waste collection is only about 60% of the total waste generated which is about 1000 metric tonnes daily. The rest of the garbage putrefies in the city itself creating health hazards (HT Live XIII 1). The 60% that is collected is dumped in a dumping ground at Dev Guradiya village which has now come within the city limits in the new Town Plan 2021 notified in 2008. Since scientific incineration is not taking place it is releasing polluting gases and creating a public health hazard (HT Live XIV 1). This situation has arisen mainly because the revenues collected as drainage and sanitatioin tax have been diverted to make up for the deficit in water supply.

The ADB loan and the JNNURM grants together have provided for capital investments in providing a city wide sewerage system, stormwater drains, sewage treatment plants, solid

waste collection and an incineration system. However, the operation and maintenance of this enhanced system will require the drainage and cleanliness tax to be raised from its present nominal level considerably and as we have seen in the case of water taxes, this might not be feasible due to resistance from the tax payers both institutional and individual. Apart from this, the bottom 40% of the population living in slums will not be able to pay at all.

Similar to the case of water supply, this under performance in the sewerage and sanitation sector adversely affects the poor in Indore. Currently the 604 poverty pockets described earlier are very ill served as far as sanitation services are concerned. The proportion of households in poverty pockets without toilets in Indore is 77%, the proportion of poverty pockets without community toilets is 80% and the proportion of poverty pockets that get waterlogged in the monsoons is 78% (Water Aid 8 -11). The waterlogging is mainly due to the clogging of drains with solid waste which is not collected regularly from these areas. There is a realisation among the planners following accepted global thinking that poor people have to be shielded from the marketisation of civic amenities as they do not have the economic wherewithal to pay for them (Mkandawire 14). So there are provisions in the JNNURM, ADB Plan, the UN Habitat project and the DFID project for slum improvement ranging from water supply, sewerage, storm water drainage and solid waste collection. However, the implementation of this Basic Services for the Urban Poor component has been lagging behind badly (HT Live XV 1).

The net result of the lack of proper sewerage and sanitation services has meant that the poor have had to resort to open defecation. The more affluent households that are not connected to the limited sewerage system have to rely on septic tanks. These septic tanks are not properly constructed and release their untreated water into the ground thus polluting the groundwater. Tests carried out by the IMC on samples of tubewell water have shown that most of them are contaminated. Even for the Narmada supply 10% of the samples were found to be contaminated indicating that ingress of polluted water is taking place in the distribution network (HT Live XVI 4).

The ADB has claimed that the combined enhanced water supply and sanitation charges are within 4-5% of household expenses and so has deemed them to be affordable (ADB 52). However, the monthly charge was assumed to be cumulatively only Rs 125 per household in 2004 and an inflation multiplier of 1.1 was used which gives a value of Rs 244 in 2011. The actual average monthly charge in 2011 for water supply alone for the 100 lpcd supply assumed by ADB assuming five members per water connection on the basis of the analysis done earlier is Rs 476. If we add another Rs 124 for sanitation charges the total comes to Rs 600 per household. The Average urban monthly per capita consumer expenditure in the 61st round of the NSSO survey for Madhya Pradesh in 2004-5 was Rs 904 (NSSO 47). Assuming a household of five persons and an annual inflation of 10% this gives an average monthly household consumer expenditure in 2010-11 of Rs 8007. Thus, the proportion of the combined water cum sanitation tax works out to a high 7.5% of the average monthly household expenditure. The proportion of households who had a monthly per capita consumer expenditure less than Rs 904 in 2004-05 is 69%. Thus, a large section of the population of Indore would find it difficult to meet the actual costs of water supply and sanitation being incurred by the IMC at present.

As found in the Water Aid survey, 40% of the population of Indore live in poverty pockets and they are in no position to pay any taxes or charges whatsoever but must be provided with water and sewerage services free from a socially desirable point of view. This means that for financial viability the charges to be levied from the rest of the population will be even more putting a severe strain of upwards of 10% of their income on the 29%

households below the average income level but above the poverty level. Even for many of the households having monthly income above the average expenditure, levy of the full water charges will prove to be a burden.

6. Discussion of Possible Remedial Measures

There is consequently an urgent need to explore other systems of WSS for Indore than the one that has been adopted so far. Even if the technical inefficiencies and the theft of water are controlled the problem of the burgeoning electricity bill for Narmada water supply as also for sewage treatment will always remain. Normally for any public body faced with a problem in water supply either due to an increase in costs or due to lack of sources there should be a genuine evaluation of different alternatives to choose the best solution.

As we have seen it is far cheaper to source groundwater in Indore than surface water from the Narmada. In fact if a proper water inventory of all the groundwater being sourced in Indore by private parties for domestic and commercial supply is done it may well turn out that it is more than the surface water supply. However, due to unplanned pumping of groundwater and lack of artificial recharge, over exploitation has taken place. It is in this context that solutions that incorporate extensive water recharging and wastewater treatment and reuse have to be explored for a sustainable hybrid ground cum surface water combination. One such proposal is that given by the hydrogeologist Mr Sudhindra Mohan Sharma (Mekaad 1). There are locations within the IMC area where there are substantial fractures in the deep aquifer layer at a depth of about 40 meters. The normally impervious basalt rock in this layer can absorb and store large quantities of water in these fractures. Thus, if the rain water in the catchment of these fractured zones is collected and channelled to these areas and then filtered and recharged into the fractures through vertical shafts then cumulatively a reserve that can yield 65 MLD of water throughout the year can be created. The cost of such a decentralised recharge system is far less than laying a network of underground stormwater drains throughout the city.

In addition to this there are already rules that all buildings of area more than 140 sq mtrs must have water recharging systems in place so that all the stormwater is filtered and recharged within these building premises in a decentralised manner (MP Govt 121). However, these rules are not being followed. The cost of installing a water recharge system is about 3% of the total building cost and it goes down proportionately as the size of the building increases, yet this is not being done. The benefits in terms of obviating the need for extensive centralised storm water drainage systems and increasing the groundwater availability far outweigh these costs. Moreover, since these costs will be borne by the building owners themselves it is a progressive measure wherein those with better economic capacity are made to bear the costs of WSS directly without burdening the IMC.

The Central Groundwater Board has prepared a detailed an artificial recharge master plan for the whole of the country so as to replenish the available groundwater storage capacity. The details of the measures needed to be adopted in the Gambhir and Shipra River basins which form the catchment of Indore city have been given in it (CGWB "Masterplan" 65). If this plan were to be implemented then the availability of groundwater in the whole of the catchment of Indore city would be improved considerably resulting in the people in rural areas desisting from stealing water from the Narmada pipeline as they are doing at present. Moreover the availability of water in the Yashwant Sagar and Bilawli reservoirs would be increased considerably leading to a greater supply from these sources than is taking place at present.

Finally there is the issue of treatment and reuse of wastewater. As with storm water so with wastewater it is much cheaper to treat and reuse or recharge it in a decentralised manner. The Dhas Gramin Vikas Kendra in Indore has installed such a decentralised system in its office premises in which the bathroom and kitchen wastewater is filtered through a soakpit and recharged into the ground with a BoD of less than 30 mg/litre which is the permissible limit. The toilet waste water is first directed into a septic tank. This septic tank has an aerator installed in it that causes aerobic digestion of the waste to take place. Thus, the inlet water which has a BoD of about 500mg/litre is treated by the aeration process resulting in a BoD of about 55 mg/litre of the water flowing out of the septic tank. This water is then filtered through a soakpit and the final water that seeps into the ground has a BoD within the permissible limit of 30 mg/litre. The installation cost of this system is less than 1% of the total building cost while the running cost of the aerator is only Rs 2/1000litres/day of toilet sewage. Moreover, due to the oxidation of sewage through aeration there is no generation of sludge and foul smelling greenhouse gases. Most importantly the need for a centralised underground sewer system and sewage treatment plants, which are expensive to construct and maintain, can be done away with. Over and above this all the waste water which constitutes about 90% of the potable water supplied is recharged into the ground enhancing the groundwater availability. The greater availability of groundwater will mean a lesser use of electrical energy which in turn means the lesser production of greenhouse gases. Thus, this alternative system will also have a positive climate change mitigation impact.

Thus, the stress should be on the design of a hybrid ground cum surface water system of water supply. This will be augmented by storm water recharge and waste water treatment and recharge done in a decentralised manner that is much more sustainable in financial, social and environmental terms. Instead of relying on taxes, user charges and grants to fund hugely expensive centralised systems, this alternative system would put the onus on the more affluent citizens, who are in possession of a considerable portion of urban land to tackle their water supply and waste water disposal needs in a decentralised manner. Detailed surveys and design would have to be carried out to determine the actual benefit/cost ratio and EIRR and FIRR of such an alternative plan and then compare it with the surface water only alternative that has been implemented. This is what should have been done by the ADB and the JNNURM instead of rejecting the hybrid alternative out of hand altogether.

7. Conclusions and Recommendations

The facts and the analysis above lead us to the following conclusions –

1. The finances of the Indore Municipal Corporation as a whole are unsustainable. Property taxes which should constitute the major source of income because they are a progressive tax that is borne proportionately more by the more affluent citizens, contributes on an avergae only 11% of the revenue income. The per capita property tax revenue is a meagre Rs 66.66 as against the national average of Rs 486. The identification of properties for taxation is poor, the rate of taxation is low and the collection too is far below standard. Consequently, the IMC faces a severe resource crunch which affects the quality of services that it provides. Moreover, the actual revenue receipts are about 60% of the budget estimates. This leads to a resource crunch and a shortfall in the revenue payments also. There is an excessive dependence on grants and loans for capital expenditures as the revenue surplus is not enough to fund these. The fiscal deficit to grants and revenue receipts ratio is higher than 20% when it should be around 10% for sustainability. There is a shortfall over 50% in the capital expenditures leading to slippages in the infrastructure development

work which in turn put higher pressure on the existing infrastructure. This further jeopardises service provision.

2. The revenue model of the Water Supply and Wastewater Management section is on an even more unsustainable footing. The actual recovery of costs through water taxes is only about 15%. The major cost item is that of the electricity bills for pumping water up from the Narmada to Indore. Despite the increase in water taxes to Rs 220 in 2011 the situation has not improved. Revenues from other taxes have to be diverted to compensate partially for the huge deficit in the water supply budget. Consequently the services and infrastructure in general suffer. The electricity bills are slated to go up astronomically in future as there is pressure on the power distribution companies to recover costs also.

3. The status of the WSS sector is extremely poor. Non revenue water in the water supply system is very high due to leakages and theft. The actual supply is only 206.5 MLD against the design value of 350 MLD. As a consequence the cost of water is also unsustainably high. The water supply from the Narmada is the costliest at Rs 40.35 per 1000 litres while groundwater tubewell supply is the cheapest at Rs 14.14 per 1000 litres. The actual supply is only 66 lpcd as opposed to the norm of 135 lpcd. The poor IMC supply has resulted in a proliferation of private and commercial groundwater supply which has seriously depleted the aquifers in Indore.

4. The waste water system is grossly inadequate and so most of the waste water is disposed of untreated into the streams running through the city which have unacceptable levels of BoD and are highly polluted. There is no proper storm water drainage and since the natural drainages have become blocked due to construction the city suffers from extensive flooding in the monsoons.

5. Despite the review of the water supply system done by the ADB having clearly shown that the current supply from the Narmada is highly financially unsustainable no other alternatives were explored for augmenting the system. Instead a third phase of the Narmada supply has been implemented at a huge cost. Later analysis shows that the IERR and FIRR calculated at the time of sanction on the basis of certain assumptions are grossly inflated. The loan repayment burden is going to be Rs 59 crores annually from 2015 onwards whereas the revenues are still very much in the red and there is no way in which the IMC will be able to garner this huge amount from its own income. This will push the IMC into a severe resource crunch which will not only further aggravate the poor O&M of the water supply and wastewater disposal systems but also affect the other services being provided by the IMC.

6. The slum areas in the city which are home to 40% of the population are very poorly served in terms of WSS facilities and given the high cost of these services they are not in any position to pay for them. The special projects for the provision of basic services to the urban poor under the ADB, JNNURM and DFID projects are not being implemented properly and so there is every possibility of further deterioration of the WSS situation in the slum areas in future.

7. The detailed analysis of the finances and physical systems of the WSS sector in Indore clearly shows that they are unreliable, unaffordable for a majority of the citizens. They are also financially, environmentally and socially unsustainable.

On the basis of the above review the following recommendations are being made –

1. A GIS must be used to map all the properties within the municipal limits and then grade them according to zones and building quality for determination of adequate property tax rates. The share of property taxes must increase substantially to at least 30% of revenue receipts and the per capita tax realisation too should reach Rs 500. The tax collection system must be improved drastically and penal measures taken against defaulters.

2. A Proper inventory of the WSS systems in the city has to be prepared including both surface and ground water and the storm and waste water disposal systems. Only then can an authentic water demand and waste water and storm water generation scenario be chalked out for planning of services. Despite clear directions from the ADB and the CGWA in this regard no progress has been made so far.

3. The use of WSUD principles should be made to design a hybrid ground cum surface water system of water supply augmented by storm water recharge and waste water treatment and recharge done in a decentralised manner that is much more sustainable in financial, social and environmental terms. Instead of relying on taxes, user charges and grants to fund hugely expensive centralised systems, this alternative system would put the onus on the more affluent citizens, who are in possession of a considerable portion of urban land to tackle their water supply and waste water disposal needs in a decentralised manner from their own resources. This would then free the IMC resources for WSS services to the poor and middle class who are not in a position to pay for them wholly.

4. Detailed surveys and design should be carried out to determine the actual benefit/cost ratio and EIRR and FIRR of such an alternative plan and then compare it with the surface water only alternative that has been implemented so far. Most probably the former will turn out to be more suitable for Indore. If so then this alternative plan should be implemented forthwith.

5. The detailed plan for artificial recharge in the Gambhir and Shipra River Basins drawn up the CGWB should be implemented without any delay so as to improve the overall availability of water in the catchment of Indore city.

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