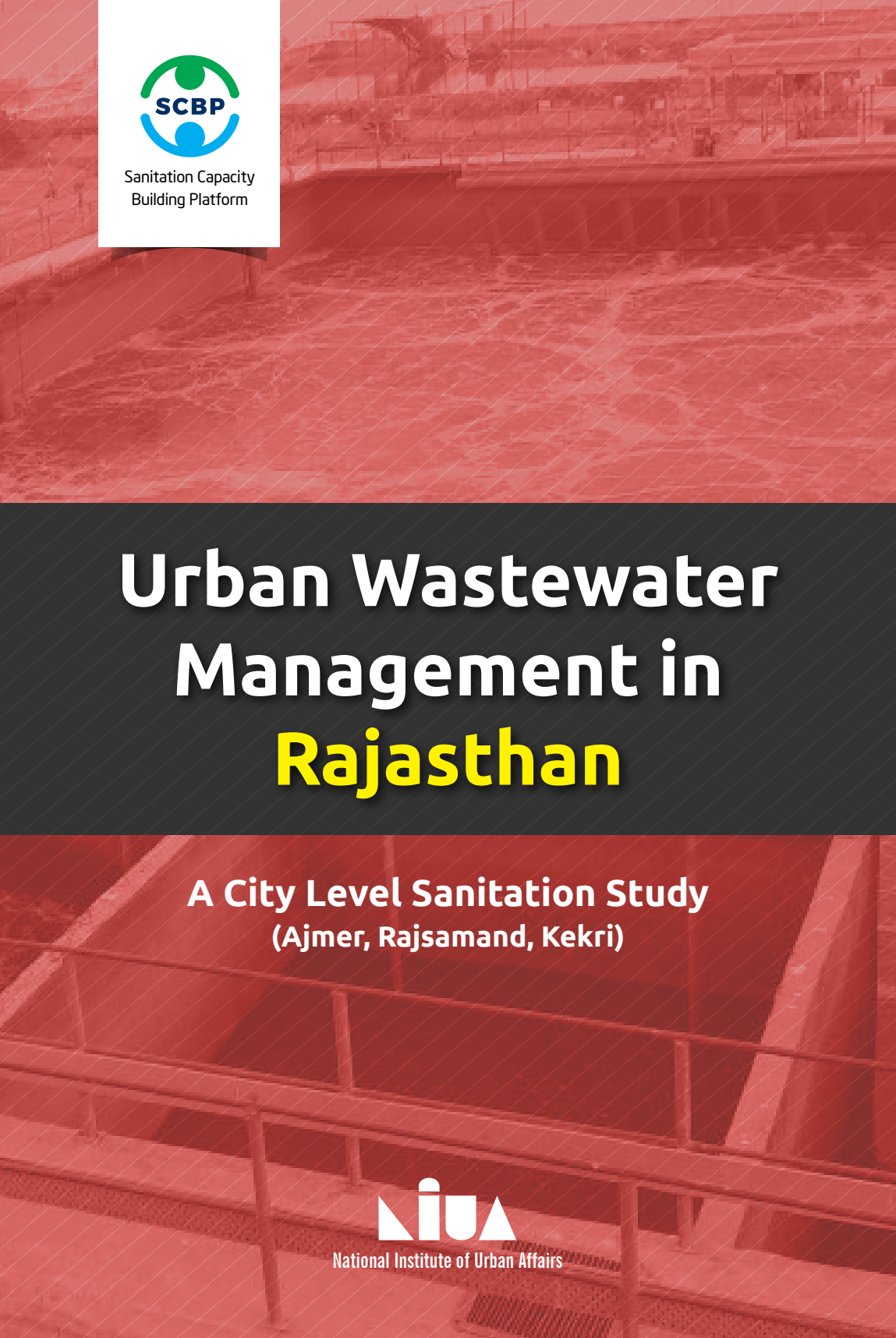
SCBP
Sanitation Capacity
Building Platform
Urban Wastewater
Management in
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A City Level Sanitation Study
(Ajmer, Rajsamand, Kekri)
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Foreword

Sanitation Capacity Building Platform (SCBP) established in 2016 is anchored by NIUA. It works as a collaborative initiative of experts and organisations committed to the goal of sanitation to support and build the capacity of towns/cities to plan and implement decentralized sanitation. The platform lends support on urban sanitation to Ministry of Housing and Urban Affairs (MoHUA), Government of India and supports states and cities to move beyond Open Defecation Free (ODF) status by addressing safe disposal and treatment of human faeces. It is a resource centre for Learning and Advocacy Material, important Government Orders and Reports, Training Modules, Workshop Reports and other publications produced under SCBP and its partner organisations.

The Platform partners include Center for Water and Sanitation (C-WAS) at CEPT University, CDD Society and BORDA, ECOSAN Services Foundation (ESF), Administrative Staff College of India (ASCI), UMC, Centre for Policy Research (CPR), iDeck and WASHi. The Platform also engages and supports Nodal AMRUT accredited training institutions, universities, research organisations and NGOs. SCBPs work on Faecal Sludge and Septage Mangement (FSSM) is a Bill and Melinda Gates Foundation (BMGF) supported urban sanitation programme initiative. It is a knowledge platform on decentralised urban sanitation. It is a resource centre for Learning and Advocacy Material, important Government Orders and Reports, Training Modules, Workshop Reports and other publications produced under SCBP and partner organisations.

ABOUT NIUA

National Institute of Urban Affairs (NIUA) is premier institute for research, capacity building and dissemination of knowledge for the urban sector in India. It is registered as an autonomous body under the Ministry of Housing and Urban Affairs, Government of India. NIUA conducts research in emerging themes such as urbanization, urban policy and planning, municipal finance and governance, land economics, transit oriented development, urban livelihoods, environment and climate change and smart cities. NIUA supports innovations in the urban sector through informed dialogues, knowledge exchanges, training and capacity building. In its mission to promote evidence-based policy-making and urban scholarship, NIUA is currently engaged in inter-disciplinary research and proactive engagements with change agents, which involve projects that create & maintain digital interface solutions.

ABOUT THE STUDY

In order to understand the urban sanitation challenges in the Indian states, a field based research on septage and wastewater management was commissioned by NIUA. The states of Rajasthan and Jharkhand were selected for the study. Under this project 3 towns were also selected per state by the researchers for qualitative and quantitative assessment of current sanitation, septage and wastewater management. The ULB's institutional landscape and the major challenges in these towns were analysed. Using the town wise findings, a state level perspective and understanding of urban sanitation management was obtained. The deliverable of the research will be used as inputs into the training material for the Sanitation Capacity Building Platform (SCBP).

The key research areas for the study were –

1. Status of septage containment, conveyance, disposal and treatment systems in each town.
2. Analysis of the sustainability and equitability of the existing and proposed sanitation services in the context of municipal finances and institutional structure of the ULBs.
3. The business and operational model for private sector operators with a special focus on profitability and their relationship with ULB.
4. Impact of unsafe disposal and lack of treatment of wastewater and faecal sludge on ground water and surface water bodies.
5. Possible improvements that can be brought about in septage and wastewater disposal in terms of provisioning and governance in urban areas of the state and towns.

The research focused on primary data collection in the 3 towns and its contextualization and assessment at the state level. Municipal and ULB norms, actual operations of ULBs and government departments were studied along with an analysis of the budgets and expenditures of ULBs related to sewerage management. The study also focused on the affordability, equity and technology comparison between septage and sewerage management. Slum sanitation and wastewater challenges in the 3 towns also provided some perspective on equity issues. Review of other secondary data such as DPRs, performance reports, annual budget documents etc. were used in the study. Laboratory tests of water samples from surface water, groundwater and potable water were also conducted to provide the evidence for contamination and environmental damage.

Introduction to the Research

The Swachh Bharat Mission was launched in 2014 to tackle the problem of sanitation head on. This brought to the fore the need for cost-effective and robust solutions not only for the problem of conveyance of human excreta and wastewater through sewers and their proper treatment but also for the even greater problem of the proper treatment and disposal of the huge excreta load of On-site Sanitation (OSS) systems like septic tanks, cesspools and leach pits. The National Policy on Faecal Sludge and Septage Management (FSSM) clearly states that due to high capital and operation and maintenance costs, centralised sewerage and treatment systems will not be implementable in all towns and so decentralised OSS systems along with proper FSSM must be implemented on a large scale. The policy lists the following problems plaguing FSSM that must be overcome -

1. The widespread perception due to the caste system that handling of faeces pollutes the person and so the reluctance to even consider cleaning the septic tanks and leach pits at regular intervals.
2. Reliance on illegal manual scavenging despite a stringent legislation (The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013) having been enacted to prevent this.
3. Septic Tanks or pits are often placed under toilets and sealed or are in corners resulting in no or limited access for cleaning.
4. Septic tanks are often oversized due to lack of technical competence of the constructors and so they do not meet the standards prescribed in the National Building Code or the Manual on Sanitation prepared by the Central Public Health and Environmental Engineering Organisation (CPHEEO). Thus, regular cleaning is not done and the householder waits for the tank to fill up.
5. Septic tanks are not accompanied by soak trenches or soak pits which are essential to treat the effluent further before releasing it into the ground. So, in most cases the septic tanks are built without a concrete floor and the highly polluted effluent directly leaches into the ground. Even if they are built with a concrete floor the effluent is released into the open drains along with the grey water from the bathroom and kitchen.
6. Urban Local Bodies have inadequate services like suction tankers and trained human resources to provide proper tank cleaning services at a moderate cost.
7. There are very few formal private tank cleaning service providers who can provide quality tank cleaning services and treat the septage properly afterwards. Informal small scale contractors provide substandard services

and empty the septage into open fields and water bodies creating serious health hazards.

8. Most towns lack proper septage treatment systems and even the municipal suction tankers dump the septage in open grounds and water bodies. There is no clear citywide approach to FSSM integrating good technology and cultural practices.
9. There is a huge lack of awareness among the public about the serious health hazards of improper septic tank construction and FSSM. Especially affected are women and children who suffer most from the insanitary conditions as established by the Economic Survey Report for 2016-17 (MoF, 2017).
10. Despite there being stringent laws like the Water (Prevention and Control of Pollution) Act 1973, the CPHEEO manual and Building Codes and Rules, these are all being flouted at will by all with the ULBs being the biggest culprits and the Pollution Control Boards being lax in their monitoring.

Research Questions and Methodology of Study

Given these problems with FSSM and the inadequate number and underperformance of the Sewage Treatment Plants (STP) the following research questions have been decided upon to provide information for proper future planning -

1. What is the status of sanitation, septage and wastewater management?
2. What are the septage containment, conveyance, treatment and disposal systems.
3. How environmentally and financially sustainable and socially equitable are the existing and proposed waste management systems.
4. What is the contribution of unsafe disposal and treatment to the contamination of ground and surface water?
5. What are the possible improvements that can be brought about in the wastewater and septage management?

The study is based on a critical review of secondary sources, interviews with key informants and group discussions with a sample of the general population, especially in the poverty pockets as follows –

1. Study of Town Plans, City Development Plans, Detailed Project Reports and Performance Reports of various projects proposed or undertaken with funding from the Asian Development Bank (ADB), Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission and UN HABITAT.
2. Analysis of the annual budget documents of the concerned municipal

bodies and the State Government and the actual operation of the various departments concerned with wastewater management including FSSM.

3. Interviews with key informants in the Government, Bureaucracy and from Civil Society, sludge operators (private and government) and group discussions with residents welfare associations, residential committees and other communities, especially those residing in poverty pockets in the core city areas and survey of these areas to record pictorially the status of sanitation services being provided.
4. Laboratory testing of water quality of water bodies in the urban areas like rivers, streams and lakes and also of ground water and the potable water which are often contaminated.
5. Comparison of the standard of waste disposal services with the norms specified by various statutes and manuals to determine the reliability and efficiency of these services.
6. Review of literature on alternative wastewater disposal and FSSM and best practices in India and abroad to arrive at possible remedial measures.

This report gives insights on the obstacles to faecal sludge and septage management. An overview of the sanitation situation in the state is given along with the summarised findings of the sanitation situation in the three study towns (the detailed data files are in the annexure). The findings of the study regarding the research questions are detailed in the penultimate section followed by the recommendations for improvement in the concluding section.

Executive Summary

The study gives an overall review of the sanitation, septage and wastewater management situation in Rajasthan with special emphasis on three towns selected for detailed study namely Ajmer, Rajsamand and Kekri

Cities as the engines of economic growth need good civic infrastructure to be able to accommodate the growing population and burgeoning economic activity. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was initiated by the Central Government in 2005 to improve the urban infrastructure and services with Water supply, Sanitation and Solid waste management being essential areas. Despite these measures the provision of quality municipal services sustainably and equitably has remained a distant dream. A significant area of concern is in the provision of sanitation services with not only the prevalence of open defecation but also inadequate treatment and disposal of human liquid and solid waste from toilets and households, leading to pollution of open spaces and surface and groundwater resulting in adverse health impacts.

The Swachh Bharat Mission was launched in 2014 to tackle the problem of sanitation head on. This brought to the fore the need for cost-effective and robust solutions not only for the challenge of conveyance of human excreta and wastewater through sewers and its proper treatment but also for the even more significant challenge of the adequate treatment and disposal of the enormous excreta load of On-site Sanitation (OSS) systems like septic tanks, cesspools and leach pits.

Given the problems with faecal sludge and septage management (FSSM) and the inadequate number and underperformance of the Sewage Treatment Plants (STP) the following research questions were decided upon for this study to provide information for future planning -

1. What is the status of sanitation, septage and wastewater management?
2. What are the septage containment, conveyance, treatment and disposal systems.
3. How environmentally and financially sustainable and socially equitable are the existing and proposed waste management systems.
4. What is the contribution of unsafe disposal and treatment to the contamination of ground and surface water?
5. What are the possible improvements that can be brought about in the wastewater and septage management?

The study is based on a critical review of secondary sources, interviews with key informants and group discussions with a sample of the general population, especially in the poverty pockets and testing of water samples.

An analysis of the Census 2011 data for the whole of Rajasthan was carried out, and this revealed that the proportions of households with toilets in the whole population is 82 per cent while that for Scheduled Castes(SC) is significantly lower at 62.8 Per cent and Scheduled Tribes(ST) are slightly higher at 63.7 per cent. There is also a big difference between the AMRUT towns and the non-AMRUT towns with the former having 88.4 Per cent of households with toilets and there being only 72 per cent in non-AMRUT towns. Similarly, the data for open defecation also show a poorer situation in the SC, ST and NAT categories.

Septic Tanks are the most used means of disposing of toilet waste at 55.6 Per cent for the total population. There is not much difference between the SC, the ST households and the total population. However, there is a big difference between AMRUT and non-AMRUT towns with the former having 48.2 per cent households with septic tanks as opposed to 69.9 per cent for the latter mainly due to a lesser provision of sewerage systems. The proportion of pit latrines is very low across all categories, but this must have increased slightly with the implementation of the Swachh Bharat Mission since 2015. Provision of sewerage systems is minimal especially in non-AMRUT towns.

Most of the grey water is disposed of in open drains with SC households having the highest proportion of 57.7 Per cent. The ST households has the highest proportion of 28.1 per cent with no drains at all and in a unhygienic situation. As in the case of household toilets before, the AMRUT towns had a much better sanitation situation with much better proportions for closed drains, open drains and no drainage than the Non-AMRUT towns.

Rajasthan state has installed 16 STPs in selected towns with the total treatment capacity of 384.5 MLD as per the Central Pollution Control Board Study (CPCB, 2015) . Another 11 STPs has either been constructed or is under construction with a capacity of 149.3 MLD. In addition to this, another 36 STPs of 322.12 MLD capacity is proposed to be constructed.

Not only is this operational installed capacity of 384.5 MLD only about 18 Per cent of the estimated generation of sewage and septage for the urban areas of the state of 2200 MLD but according to another more detailed assessment by the CPCB (CPCB, 2015b) , the actual treatment being done was much less. This second report of the CPCB says that the STPs in Alwar were not operating. The rest of the STPs in Rajasthans were operating well below capacity because the sewerage systems were either not connected to the STPs or their flow was

being by passed and actual treatment was only about 240 MLD. Thus, bringing down the actual sewage treatment to only 11 Per cent of the total estimated generation of sewage and septage. The STPs at Delawas in Jaipur of capacity 125 MLD need a special mention here. These are run using the activated sludge process which uses a part of the sludge which has active bacteria in it to treat the influent sewage and thus reduces the need to inject large doses of bio enzymes and chemicals for treating the waste water. Moreover, after this treatment the wastewater and sludge are separated and while a small part of the sludge is recycled for use in treatment, the rest is directed into an anaerobic digester for the production of biogas. This biogas is then burned in a gas generator to produce electricity. This electricity not only takes care of all the power needs of the STP but the excess is sold to the electricity distribution company. Thus, this is an excellent model for the operation of STPs which are otherwise constrained by the lack of funds. This is the model that has been implemented in the STP in the study town of Rajsamand also and in the one under construction in Ajmer. However, in these towns the flow in the sewerage system is inadequate for the proper operation of this model.

The second CPCB report mentioned above (CPCB op cit) says that all the STPs in Rajasthan were not being operated properly because of the lack of qualified staff, the supply of chemicals and electricity and upkeep and having not been cleaned regularly. As a result, the treated effluent discharged from these STPs is of a polluted nature with values well above the prescribed limits, especially for the disease spreading coliform bacteria and most of the sewage coming to them was being bypassed and released into the nalas instead of being treated in the STPs.

The Rajasthan Urban Infrastructure Development Programme (RUIDP) has initiated a massive programme for the construction of STPs and sewage systems in urban areas across the state to add another 470 MLD of sewage treatment capacity. However, the main problem with this is that in most cases the household toilets are not being connected to the sewerage systems and so the STPs being newly built are either not operating or are operating much under their installed capacity. At the most, the outflow of the septic tanks are connected to the sewers, and this reduces the flow and also the sludge. There seems to be little coordination between the RUIDP and the urban local bodies (ULB) so that the former constructs sewers and STPs and moves out without the ULBs taking the responsibility of running the STPs.

The lack of financial resources is the major constraint that faces efficient disposal and treatment of sewage and septage in India. The centralised collection and treatment of sewage and septage involve substantial capital expenditures initially in laying sewers and constructing STPs. Subsequently, these STPs

have to be run 24x7x365, and this requires high operation and maintenance costs. Even though there are successful examples of STPs producing biogas and electricity from the sludge and so becoming financially profitable as in Delawas in Jaipur, these models are not replicated elsewhere in practice. Since ULBs do not have the funds to acquire mechanical sewer cleaning machines, this work is done by manual scavengers in violation of the Prevention of Manual Scavenging Act.

The construction of septic tanks does not follow the norms set by CPHEEO and are being built in all shapes and sizes and mostly without soak pits and the water is released untreated into the open drains. Even in the case of faecal sludge management through the use of vehicles with tanks and pumps to empty the sludge from septic tanks and pit latrines in urban areas and carry them to faecal sludge treatment plants or compost pits on farms in nearby villages there is the issue of the high cost of transportation. This makes the householders delay the cleaning of the tanks till they become clogged with sludge, considerably reducing the efficacy of the septic tanks leading to the release of more polluted water into the drains.

Status of Faecal Sludge and Septage Management in Study Towns

Coming to the status of FSSM in the study towns according to the Census 2011 data the proportion of households with toilets is highest Ajmer and lowest in Kekri as is to be expected given the increase in per capita income and per capita municipal expenditures with the size of the towns. Septic Tanks remain the most popular means of disposal of toilet waste and Ajmer which has some sewerage connection. Thus, given the huge investments involved in laying sewers and constructing STPs, proper decentralised faecal sludge management will have to be the way ahead to ensure adequate sanitation in the state. The situation of disposal of grey water is better in Ajmer than for the other towns except in the case of open drains which are less for Ajmer and Rajsamand than for Kekri mainly since it has a very low proportion of households with closed drains.

The ground level data collection of septage management in the study towns was done by conducting group discussions with the residents and inspecting the septage management procedures in a selected sample of wards in each of the towns. These wards were selected in consultation with local NGO staff with experience of working in the slums in the city.

The slums had mostly single pit latrines which have been built recently with grants from the municipal corporation under the Swachh Bharat Mission.

Many residents complained that despite their names having been enrolled for toilets, but not allocated yet. The houses in the colonies nearby had septic tanks which released their outflow into the open drains. Consequently, these drains carry contaminated water which is a breeding ground for pigs. Due to the inadequacy of the pit latrines in some congested slums, there are community toilets but even in these the septic tanks have outflows going into the nala behind the toilets.

Septic tanks are not built as per the norms prescribed by the CPHEEO. In most cases, these are big leach pits with open bottoms. However, over time the sludge at the bottom reduces the leaching velocity, and so there is some outflow into the open or closed drains. The outlets of these septic tanks or leach pits are below the level of the ground and so these must be closed and the sewage connected directly to the new sewer lines that have been laid in the towns of Ajmer and Rajsamand. This is also necessary to ensure enough flow in the sewers. However, the householders with septic tanks or leach pits in both towns are reluctant to do this because of the costs involved in connecting their toilet lines with the sewers.

The Ajmer Municipal Corporation and the Rajsamand municipality have septic tank cleaning vehicles, but these are not able to meet the demand. So, there are private operators who offers the services. These operators charge more than the municipal bodies and like the former empty the sludge in drains and fields without treatment. Proper and regular cleaning of septic tanks as per the CPHEEO norms and its treatment and disposal will require more funds than are currently available. Apart from this, there is manual scavenging reported where the cleaning vehicles are not able to go even though this is in clear violation of The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.

Status of Sewage Collection and Treatment in Study Towns

All the three towns have underground sewer lines in both Government and private residential colonies. Currently some of the sewage from the Anasagar Zone in Ajmer is being carried through a sewer system and diverted to the sewage treatment facility near Anasagar which has a capacity of 12 million litres per day (MLD), but the actual flow only about 5 MLD. The initial structure for dosing the wastewater with chemicals and distributing it to the facultative ponds was lying idle. Another STP has been constructed in Khanpura but is not operating while yet another is under construction there. A 5 MLD STP has been constructed in Rajsamand which is not operational yet. With the population in general unwilling to connect their toilets to the sewer lines at their own cost, it

is difficult to get the sewerage system and the STPs to work. The polluted water from the open drains and the septage not only contaminates the surface water but also the ground water as revealed by the various tests conducted.

Status of Planning in Study Towns

The Ajmer Town Plan 2033 (ADA, 2013) states that under various schemes most of the city has been covered by sewer lines and only the work of connecting the household toilets to these lines remains. The plan also mentions that sewage treatment plants are to be constructed near Anasagar and Khanpura to treat the sewage from these sewer lines. The Kekri and Rajsamand Town Plans 2031 (TPDR, 2013) mention that the town does not have a proper wastewater disposal system and that one should be planned and implemented in future. However, there are no details provided other than the advice to the Municipal Corporation to collaborate with the Public Health Engineering Department in preparing a wastewater conveyance and treatment plan. It is noteworthy that there is no mention of on-site faecal sludge and septage management and wastewater treatment and recycling in any of the plans.

Staffing Pattern of Municipal Bodies in Study Towns

The Urban Local Bodies in the state are headed by a Chief Executive Officer with a sanitation department headed by a health officer to take care of water supply, maintenance of drains and sewers. The staff strength of the Health and Sanitation Department of the studied towns is grossly inadequate. There is severe understaffing of the sanitation department which is affecting the provision of sanitation services, especially to the slum areas.

Status of Finances of Municipal Bodies in Study Towns

The low levels of revenue mobilisation and the high dependence on State and Central Government grants make the finances of the ULBs very unsustainable, and they are not able to offer proper sanitation services .Moreover, the budget estimates are inflated as actual incomes and expenditures are almost 50 Per cent less and severely affects the ability of the ULBs to provide services to the citizens .This is especially visible in the poor state of faecal sludge and septage management and wastewater management. A significant reason for the low level of revenue mobilisation is the very low property taxes. Urban development tax is levied only on residential plots of area greater than 2700 sq. ft., residential flats of area greater than 1500 sq. ft. and commercial plots of size greater than 900 sq. ft. This results in the property tax contributing only about 4 per cent of the total revenue of the ULBs. This is far below the recommendation of 25 per cent collection of revenue by urban local bodies

from property taxes as mandated by the guidelines prescribed by the Jawaharlal Nehru Urban Renewal Mission. The budgeting procedure is highly unsatisfactory as it does not allow the ULBs to properly analyse the financial weak points in resource mobilisation and expenditure. Most importantly since the expenditures of various departments are clubbed together under overall heads like establishment and operation and maintenance, it is not possible to separately calculate and analyse the expenditures for each department and do a cost benefit or affordability analysis.

Conclusions and Recommendations

Given the sad state of affairs about FSSM and wastewater management in general there is a need for a drastic overhaul in this sector in Rajasthan. Sanitation systems should be designed in tandem with water supply and storm water management systems since all three are very closely connected to each other. The following are the measures that need to be taken and these have been described in detail in the main report -

- Recharging of Groundwater Aquifers
- Treatment and Reuse of Waste Water
- Equitable and Sustainable Sanitation Management
- Better Management of Sewerage Systems
- Better Management of Sewage Treatment Plants
- Better Management of Faecal Sludge and Septage disposal
- Coordination between Various Agencies
- Provision of Funds, Functions and Functionaries
- Awareness Building and Training

Urban Sanitation in India

The problems facing the management of cities and towns in developing countries became the focus of attention as early as in the first United Nations Conference on Environment and Human Settlements held in Vancouver in 1972. There was recognition of the need for adequate provision of sustainable and equitable access to municipal services required to make urban environments healthy and liveable (Mahadevia, 2003). This was named as the "Brown Agenda"(McGrahanan and Satterthwaite, 2000). After 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, 1987). This report gave environmental sustainability more importance and in the case of urban development this was named as the "Green Agenda" (McGrahanan and Satterthwaite, op cit.).

The increasing urbanisation of the world made the reconciling of the Brown and Green Agenda very difficult as many people migrated from the rural areas into the towns and cities for livelihoods. Cities as the engines of economic growth obviously needed good civic infrastructure to be able to accommodate the growing population and burgeoning economic activity. Such a growth path had very large ecological footprints, much larger than their own territories both for resource extraction and waste disposal (Martinez Alier, 2002). Problems crop up as the poor develop vast shanty towns and poverty pockets in the marginal spaces like riversides and waste lands. 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, 2006).

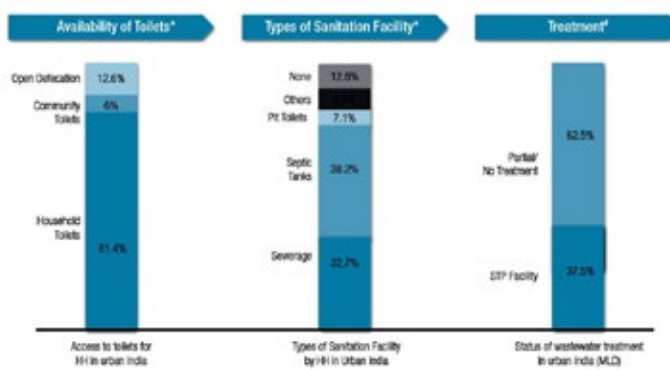
The World Conference on Environment held in 1992 in Rio de Janeiro further stressed the need for sustainable development. This was followed by the second UN Habitat Conference held in Istanbul in 1996 when an attempt was made to bridge the brown and green agenda and a Sustainable Cities Programme (SCP) 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 up to 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 most poor inhabitants of cities. Especially in the developing countries where municipal services are of poor quality and reach due to lack of resources (Mahadevia, 2001).

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 (Census 2001) and 28 other urban areas of tourist or historical or religious importance (JNNURM, 2005). The JNNURM envisaged 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, Water supply, Sanitation and Solid waste management were important areas. There was a stress on public private partnership to ensure that in the long run the operation and maintenance costs, which always pose a problem, could be recovered. Nevertheless, there was simultaneously a stress on the provision of basic services to the poor. Thus, the JNNURM struck a balance between the two goals of achieving financial and social sustainability in provision of quality urban infrastructure and services.

Despite these measures the provision of quality municipal services sustainably and equitably remained a distant dream. A major area of concern was in the provision of sanitation services with not only the prevalence of open defecation but also inadequate treatment and disposal of human liquid and solid waste from toilets and households, leading to pollution of open spaces and surface and ground water resulting in adverse health impacts (CSE, 2012). The status of urban sanitation, as portrayed by the Census 2011 data and the Central Pollution Control Board (CPCB) Report on sewage treatment as quoted in the National Policy on Faecal Sludge and Septage Management (MoUD, 2017), was nothing short of alarming as shown in Fig. 1 below.

Fig. 1: Status of Urban Sanitation in India 2011



Only 32.7 Per cent of households were connected to sewerage systems and only 37.5 Per cent were connected to Sewage Treatment Plants. Moreover, there is little reliable information regarding the treatment of faecal sludge and septage being generated by septic tanks which account for 38.2 Per cent of all households. Consequently, there is a need to study the situation of sanitation prevailing in various states to be able plan properly to improve the overall sanitation situation in the country as the ameliorative interventions must be state specific in nature.

Section I

Status of Wastewater Management in Rajasthan

Status of Wastewater Management in Rajasthan

The census has a category called Census Towns in addition to the statutory towns like municipality, municipal corporation, cantonment board or notified town area. A census town is defined as -

1. Having a minimum population of 5,000;
2. With at least 75 per cent of the male main working population engaged in non-agricultural pursuits; and
3. Having a density of population of at least 400 persons per sq. km.

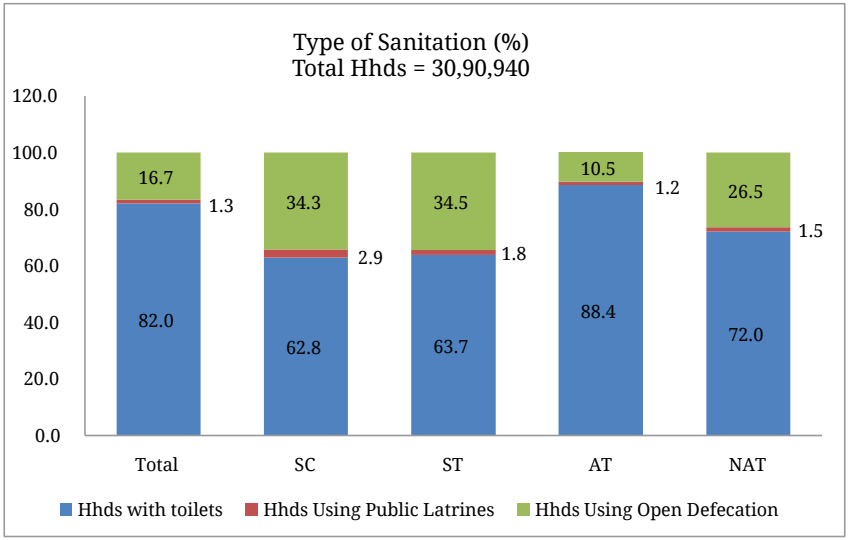
Table 1 gives the number, number of households and the proportion of households of the total of different categories of urban areas in Rajasthan.

Table 1: Category of Urban Area with Population (2011)

Category	Number	Population	Proportion of Total Population (%)
Census Town	111	12,33,023	7.2
Municipality	166	65,06,925	38.2
Municipal Council	13	29,59,261	17.4
Mun. Corporation	5	62,90,775	36.9
Cant. Board	1	50,804	0.3
Total	296	1,70,40,788	100.0

Thus, we see that the five large municipal corporations cumulatively have the second highest proportion of the population very close to the proportion of population living in the 166 municipalities. The 13 Municipal Councils too have a high proportion of the population at 17.4 per cent. The proportion of the population in the 27 AMRUT (Atal Mission for Rejuvenation and Urban Transformation) towns is 60.2 Per cent. The provision of services too is much better in the larger AMRUT towns as compared to the smaller non-AMRUT ones as can be seen from the Census 2011 Household Tables data which have been summarised in the charts below.

Fig. 2. Type of Sanitation in Urban Areas in Rajasthan

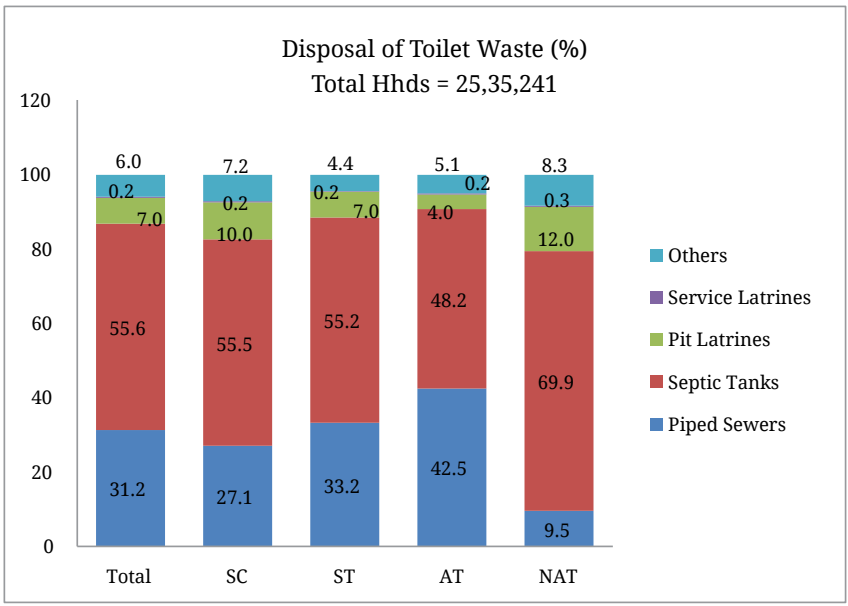


SC-Scheduled Caste, ST-Scheduled Tribe, AT-AMRUT Town, NAT-Non-AMRUT Town

The proportion of households with toilets in the whole population is 82 Per cent while that for Scheduled Castes is significantly lower at 62.8 Per cent and Scheduled Tribes are slightly higher at 63.7 Per cent. There is also a big difference between the AMRUT towns and the non-AMRUT towns with the former having 88.4 Per cent of households with toilets and there being only 72 Per cent in non-AMRUT towns. Similarly, the data for open defecation also show a poorer situation in the SC, ST and NAT categories. However, due to the Swachh Bharat Mission (SBM) there has been a reduction in open defecation and an increase in the proportion of households with toilets as 3,31,114 individual toilets and 16,326 community toilets have been constructed in the state under SBM (as on Jan 2019).

Septic Tanks are the most used means of disposing of toilet waste at 55.6 Per cent for the total population. There is not much difference with the SC and the ST households and the total population. However, there is a big difference between AMRUT and non-AMRUT towns with the former having 48.2 Per cent households with septic tanks as opposed to 69.9 Per cent for the latter mainly due to a lesser provision of sewerage systems in the latter. The proportion of pit latrines is very low across all categories but this must have increased slightly with the implementation of the Swachh Bharat Mission since 2015. Provision of sewerage systems is low and especially so in non-AMRUT towns.

Fig. 3. Disposal of Toilet Waste.



SC-Scheduled Caste, ST-Scheduled Tribe, AT-AMRUT Town, NAT-Non-AMRUT Town

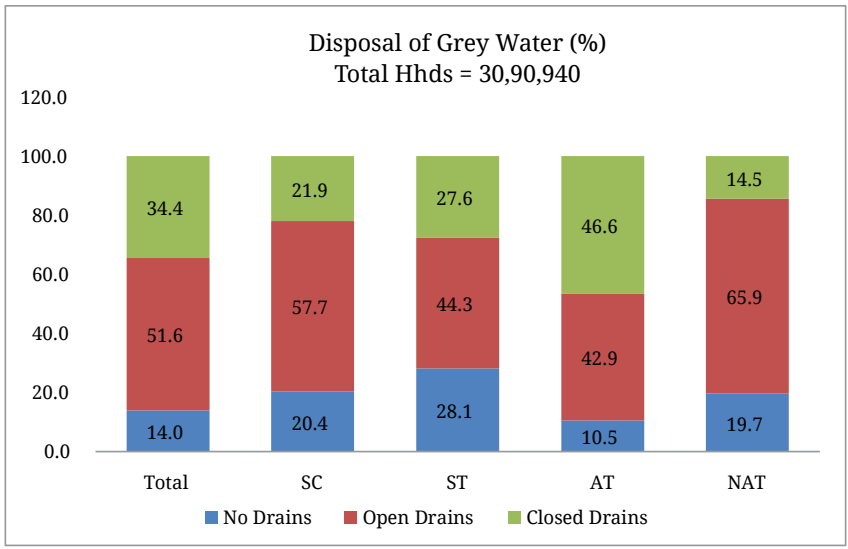
The data on the methods of disposal of Grey water generated from bathrooms is shown in Fig. 4 below. Most of the water is disposed in Open drains with Scheduled Caste households having the highest proportion of 57.7 Per cent. The Scheduled Tribe households 28.1 Per cent of the greywater production with no drains at all which is a very unhygienic situation. As in the case of household toilets earlier, the AMRUT towns had a much better sanitation situation with much better proportions for closed drains, open drains and no drainage than the Non-AMRUT towns.

There is no reliable data about the treatment of black and grey wastewater that is carried out away from the households by open drains and sewers or septage emptied from tanks. These are mostly being discharged untreated into fields and surface water bodies.

The census data paint a dismal picture of the situation of sanitation in urban areas of the state, especially so in the non-AMRUT towns which constitute almost 40 Per cent of the total urban population. Some sewage treatment capacity has been installed in a few towns and the Central Pollution Control Board Report on Inventorisation of Sewage Treatment Plants (STP) in 2015 (CPCB, 2015) gives the data for Rajasthan shown in Table 2 below. According to

this Rajasthan has 16 STPs that are operational having total treatment capacity of 384.5 MLD. Another 11 STPS is either been constructed or under construction with a capacity of 149.3 MLD. In addition to this another 36 STPs of 322.12 MLD capacity were proposed to be constructed.

Fig. 4. Disposal of Grey Water



SC-Scheduled Caste, ST-Scheduled Tribe, AT-AMRUT Town, NAT-Non-AMRUT Town

Table 2: Inventorisation of Operational STPs in Rajasthan 2015 by CPCB

Sl. No	City/ Town	STP Location	Year of Commis-sioning	Operational Status	Installed Capacity (MLD)	Tech.	PCB Consent Status
1	Jaipur	Swarn Jayanti Park Vidyadharnagar	2014	Operational	1	MBBR	Obtained
2		Gajodharpura	2013	Operational	30	ASP	Obtained
3		Amer Road	2008	Operational	27	ASP	Obtained
4		Delawas – I	2006	Operational	62.5	ASP	Obtained
5		Delawas – II	2010	Operational	62.5	ASP	Obtained
6		Jaisinghpura Khor	2010	Operational	50	ASP	Obtained
7		Jawahar Circle	2010	Operational	1	MBBR	Obtained
8		JDA Ramniwas Garden	2011	Operational	1	MBBR	Obtained

Sl. No	City/ Town	STP Location	Year of Commis-sioning	Operational Status	Installed Capacity (MLD)	Tech.	PCB Consent Status
9	Alwar	Agayara Ramgarh	2012	Operational	20	WSP	Obtained
10		Bhiwadi	2012	Operational	4	SBR	Obtained
11	Jodhpur	PHED Nandari	No Info.	Operational	20	A&FP	Obtained
12		Salawas – I	2011	Operational	50	ASP	Obtained
13	Sawai Madhopur	Sawai Madhopur	2012	Operational	10	FSP	Obtained
14	Bikaner	Vallabha Garden	2007	Operational	20	A&FP	Obtained
15	Bhilwara	Bhilwara Sewage	2012	Operational	5.5	ASP	Obtained
16	Udaipur	Eklingpura	2014	Operational	20	MBBR	Obtained
17	Ajmer	Anasagar lake	2017	Operational	13	SBR	Obtained

Not only is this operational installed capacity of 384.5 MLD only about 18 per cent of the estimated generation of sewage and septage for the urban areas of the state of 2200 MLD but according to another more detailed assessment by the CPCB, the actual treatment being done was much less. This second report (CPCB,2015b) says that the STPs in Alwar were not operating. All the other STPs were operating well below capacity because the sewerage systems were either not connected to the STPs or their flow was being by passed and actual treatment was only about 240 MLD. Thus, bringing down the actual sewage treatment to only 11 per cent of the total estimated generation of sewage and septage. It is also to be noted that though in the table above it is said that the consent from the State Pollution Control Board to operate these STPs has been obtained, the second CPCB report (CPCB op cit) says that these are not current indicating that the operation of these STPs are not proper.

The STPs at Delawas in Jaipur need a special mention here. These are run using the activated sludge process which uses a part of the sludge which has active bacteria in it to treat the influent sewage and thus reduces the need to inject large doses of bio enzymes and chemicals for treating the waste water. Moreover, after this treatment the wastewater and sludge are separated and while a small part of the sludge is recycled for use in treatment, the rest is directed into an anaerobic digester for the production of biogas. This biogas is then burned in a gas generator to produce electricity. This electricity not only takes care of all the power needs of the STP but the excess is sold to the electricity distribution company. Thus, the company which is running the STP has not only recovered its investment but is also now earning a profit from its operations. Thus, this is an excellent model for the operation of STPs which

are otherwise constrained by the lack of funds. This is the model that has been implemented in the STP in the study town of Rajsamand also and in the one under construction in Ajmer. However, in these towns the flow in the sewerage system is inadequate for the proper operation of this model.

The second CPCB report (CPCB op cit) mentioned above says that the STPs were not being operated properly because of lack of qualified staff, supply of chemicals and electricity and upkeep and having not been cleaned regularly. As a result the treated effluent discharged from these STPs is of a polluted nature with values well above the prescribed limits, especially for the disease spreading coliform bacteria and most of the sewage coming to them was being by passed and released into the nalas instead of being treated in the STPs. This assessment was confirmed by actual site visits made to these STPs in the course of the research. Thus, the situation with regard to treatment of sewage too is unsatisfactory in the state. The main reasons for this as noted in the CPCB report are as follows -

1. There is a big gap between the wastewater generation and treatment. The inadequately treated and untreated wastewater is being released into water bodies causing ground and surface water contamination.
2. Cities do not have proper sewerage networks to collect the entire sewage and a major part of the untreated sewage is discharged in open drains which lead to surface water bodies or percolate into the subsoil.
3. Majority of STPs are operating without obtaining consent to operate from the State Pollution Control Boards under the provisions of the Water (Prevention & Control of Pollution) Act, 1974.
4. The agencies or departments engaged in the Operation & Maintenance of STPs are suffering from financial crisis and lack of skilled manpower.
5. The treatment and disposal of sludge from the STPs is a problem leading to a reduction of cleaning of the STPs resulting in a drastic reduction in treating capacity.
6. Industrial effluents are also being mixed into the sewage coming to the STPs instead of being treated in ETPs separately.
7. Majority of the STPs have no arrangements to measure inlet and outlet flow. A few plants have flow meters at the inlet to measure flow but none of them are working.
8. All the STPs have a by-pass arrangement. The STPs treat only a portion of the sewage received and the rest of the sewage is discharged through by-pass arrangements. During monsoons the whole flow is bypassed.
9. The oxidation ponds & waste stabilization ponds do not have proper paths and approach roads and the surroundings are covered with grass and bushes. More importantly some STPs do not have even lighting arrangements and boundary wall. The overall maintenance of these oxidation ponds and

waste stabilization ponds is very poor.

10. The treated sewage of most of the STPs is not being monitored and analysed on a regular basis for the assessment of the degree of treatment as there are no dedicated laboratories in the STP campus for this purpose.
11. Proper records are not being maintained for the operation of the STPs like inlet flow, outlet flow, sludge generation etc. by the operators.
12. There is no planned reuse or recycling of treated wastewater which is an important means of cost recovery.
13. The treated sewage is being discharged in the nearest wastewater drain. Chlorination is not being done at the outlet of any of the STPs for control of Total and Faecal Coliforms thus contributing to contamination of surface water bodies.
14. Diesel generator sets are not provided in the STPs for backup power for operation of the biological system without any interruption during power failure.

The Rajasthan Urban Infrastructure Development Project (RUIDP) has initiated a massive programme for the construction of STPs and sewage systems in urban areas across the state to add another 470 MLD of sewage treatment capacity. However, as mentioned earlier the main problem with this is that in most cases the household toilets are not being connected to the sewerage systems and so the STPs being newly built are either not operating or are operating much under their installed capacity. At the most, the outflow of the septic tanks are connected to the sewers and this reduces the flow, and also the sludge. There seems to be little coordination between the RUIDP and the urban local bodies so that the former construct sewers and STPs and moves out without the urban local bodies taking responsibility for running the STPs.

This brings to the fore the major constraint that faces efficient disposal and treatment of sewage and septage in India - the lack of financial resources. The centralised collection and treatment of sewage and septage involve substantial capital expenditures initially in laying sewers and constructing STPs to connect them to. Subsequently, these STPs have to be run 24x7x365 and this requires high operation costs in keeping the sewers and STPs operational. Even though there are successful examples of STPs producing biogas and electricity from the sludge and so becoming financially profitable as in Delawas in Jaipur, these models are not being replicated elsewhere in practice. Consequently, as detailed in the fourteen points above, the STPs are not properly designed and also not properly run. A major issue is that for sewers to run properly there must be adequate supply of water and this is not always the case, even in Tier I cities. Thus, in the absence of adequate flow the sewers tend to clog up and have to be frequently cleaned further increasing the costs. Since ULBs do not have the funds to acquire mechanical sewer cleaning machines, this work is

done by Dalits in violation of the Prevention of Manual Scavenging Act and every year a considerable number of Dalit sewer cleaners die after descending into sewer manholes to clean them.

The construction of septic tanks does not follow the norms set by CPHEEO and are being built in all shapes and sizes and mostly without soak pits and the water is released untreated into open drains. Even in the case of faecal sludge management through the use of vehicles with tanks and pumps to empty the sludge from septic tanks and pit latrines in urban areas and carry them to faecal sludge treatment plants or to compost pits on farms in nearby villages there is the issue of the high cost of transportation. This makes the householders delay the cleaning of the tanks till they become clogged with sludge, considerably reducing the efficacy of the septic tanks leading to the release of more polluted water into the drains.

An even more disturbing result of this lack of financial resources is the dilution in the norms for discharge of treated effluents from STPs for surface water bodies and agriculture. The Environmental Protection Rules 1986 were amended in 1993 to relax the standards for release of STP effluents. To take just one important parameter, the Biochemical Oxygen Demand (BOD) was made 30 mg/l for release of effluents into surface water bodies like lakes and streams. The permissible levels of BOD for such surface water bodies is 3 mg/l (IS:2296, 1982) and this is also the recommendation of a committee set up by the National River Conservation Directorate. However, the Bureau of Indian Standards has since withdrawn IS:2296. If STPs release large amounts of effluents into streams and lakes with BOD of 30 mg/l then these water bodies are bound to be contaminated for quite a length beyond the point of such release. Indeed a high level committee appointed by the Ministry of Urban Development and Poverty Alleviation recommended that the BOD standard for release of effluents by STPs into the Yamuna River should be 10 mg/l (CPCB, 2008). Given the serious contamination of surface water bodies that is taking place, The Ministry of Environment, Forests and Climate Change (MoEFCC) has notified in 2015 under the Environment Protection Rules 1986, a more stringent standard for BOD of effluents of STPs to be built in future at 10 mg/l with the proviso that all existing STPs will also have to meet this standard within 5 years of its notification (MoEFCC, 2015). However, since even the earlier diluted standards are being violated it remains a moot point as to whether the newer more stringent ones will be followed.

Section II

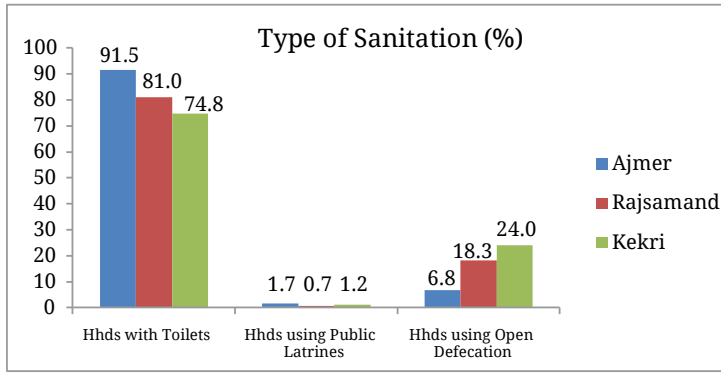
Status of Wastewater Management in Study Towns

Status of Wastewater Management in Study Towns

Fig. 5. River Basin Map of Rajasthan Showing Location of Study Towns

The location of the three towns is shown in the map of river basins in Rajasthan in Fig. 5 above. The Banas river basin has been selected for the study as it is the biggest of the basins in Rajasthan that have their waters flowing in India with an area of 45,833 sq. kms and it contains the most developed urban areas including the capital city of Jaipur. The brief characteristics of the three towns revealed from the study, as summarised from the detailed reports given in the annexure, are described here.

Fig. 6. Type of Sanitation Available in Towns in Rajasthan in 2011 (%)



The proportion of households with toilets is the highest in the case of Ajmer and lowest in the case of Kekri as is to be expected given the increase in per capita income and per capita municipal expenditures with the size of the towns. The implementation of SBM since 2015 has resulted in more toilets being constructed as shown in Table 3 below.

Fig.7: Disposal of Toilet Waste in Towns in Rajasthan in 2011 (%)

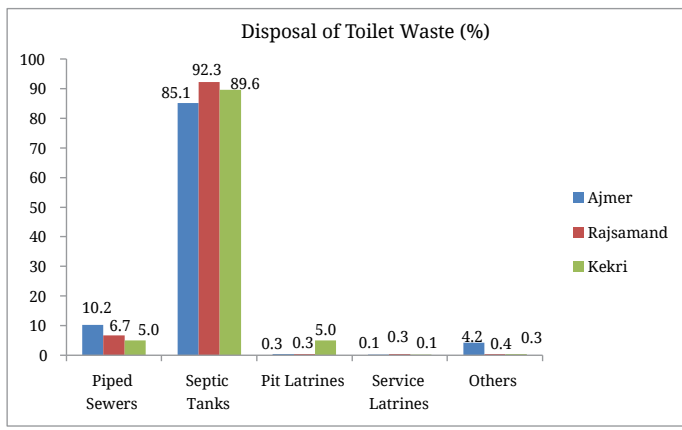
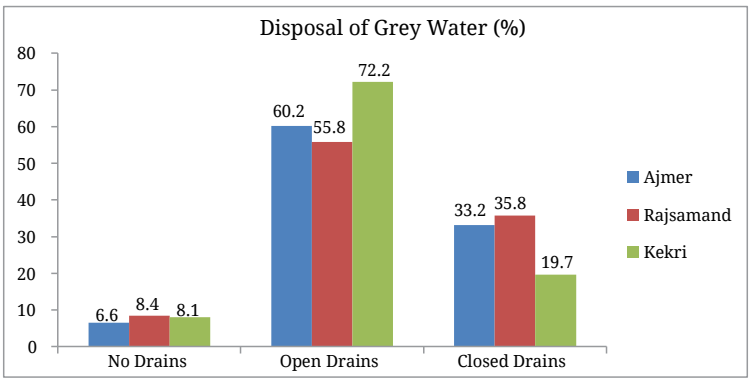


Table 3: Individual Household Toilets Constructed under SBM in Study Towns 2018

Town	Toilets Constructed	Total no. of Hhs
Ajmer	4325	109229
Rajsamand	936	13756
Kekri	542	7577

Septic Tanks remain the most popular means of disposal of toilet waste, even in the large town of Ajmer which has some amount of sewerage. Thus, given the huge investments involved in laying sewers and constructing STPs, proper decentralised faecal sludge management will have to be the way ahead to ensure proper sanitation in the state.

Fig. 8: Disposal of Grey Water in Towns of Rajasthan in 2011 (%)



Once again the situation in Ajmer is better than for the other towns except in the case of open drains which are less for Ajmer and Rajsamand than for Kekri mainly due to the fact that the latter has a very low proportion of households with closed drains.

The ground survey of septage management in the study towns was done by conducting focus group discussions with the residents and inspecting the septage management procedures in a selected sample of wards in each of the towns. These wards were selected in consultation with local NGO staff with experience of working in the slums in the city. Wards were chosen as follows -

- From the main congested areas of the city
- From those areas where there is a high concentration of Scheduled Castes and Scheduled Tribes residing in slums.

The slums had mostly single pit latrines which have been built recently with grants from the municipal corporation under the Swachch Bharat Mission. Many residents complained that despite their names having been enrolled for toilets, they had not got the same. The built-up houses in the colonies nearby had septic tanks which released their outflow into the open drains. Consequently, these drains carry contaminated water which is a breeding ground for pigs. Due to the inadequacy of the pit latrines in some congested slums, there are

community toilets but even in these the septic tanks have outflows going into the nala behind the toilets. The closed drains get clogged and they must be cleaned from time to time. This cleaning is done by staff of the ULBs and like elsewhere in India they clean out the drains and leave the waste on the road. The single pit latrines have been constructed poorly given the very low grant amount of Rs 12000 per latrine and so are likely to fall into disuse soon.

Septic tanks too have mostly been built in violation of the norms prescribed by the CPHEEO. In most cases these are actually big leach pits with open bottoms. However, over time the sludge at the bottom reduces the leaching velocity and so there is some outflow into the open or closed drains. The outlets of these septic tanks or leach pits are below the level of the ground and so these will have to be closed and the sewage connected directly to the new sewer lines that have been laid in the towns of Ajmer and Rajsamand. This is also necessary to ensure enough flow in the sewers. However, the householders with septic tanks or leach pits in both towns are reluctant to do this because of the costs involved in connecting their toilet lines with the sewers.

The Ajmer Municipal Corporation and the Rajsamand municipality have septic tank cleaning vehicles. These are meeting the present demand where residents are using this service when most needed. They will, however, fall short if septic tanks are cleaned on a regular basis. So, there are private operators who cleans the septic tanks. These operators charge more than the municipal bodies and like the former empty the sludge in drains and dispose it off to the fields without treatment. Proper and regular cleaning of septic tanks as per the CPHEEO norms and its treatment and disposal will require more funds than are currently available. Apart from this in all three towns there are still manual scavengers who clean septic tanks by hand in the more congested areas where the cleaning vehicles are not able to go even though this is in clear violation of The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013. The septage is emptied without treatment into open fields and nalas by both the municipal and private vehicles.

All the three towns have some underground sewer lines in both Government and private residential colonies. Currently some of the sewage from the Anasagar Zone in Ajmer is being carried through a sewer system and by diverting nalas to the sewage treatment facility near Anasagar which has a capacity of 12 million litres per day (MLD) but the actual flow that was observed was a few kilolitres per day only is only about 5 MLD. The initial structure for dosing the wastewater with chemicals and distributing it to the facultative ponds was lying idle. Another STP has been constructed in Khanpura, but is not operating while yet another is under construction there. A 5 MLD STP has been constructed in Rajsamand but that too is not operational. With the population

in general unwilling to connect their toilets to the sewer lines, it is difficult to get the sewerage system and the STPs to work. Reasons for residents reluctant to get their toilets connected to the sewer lines area. the cost of connections b. residents' lack of confidence in the proper working of the sewer system (they are apprehensive that the excreta will flow back into their toilets)

The polluted water from the open drains and the septage contaminates not only the surface water but also the groundwater. Tests were carried out on various surface water and groundwater sources in the study towns. The results of these tests are given in Table 4 below. The various parameters that have been tested are –

BOD – Biochemical Oxygen Demand, TDS – Total Dissolved Solids, TSS – Total Suspended Solids, DO – Dissolved Oxygen, TC – Total Coliform, FC – Faecal Coliform, FS – Faecal Streptococci, AN – Ammoniacal Nitrogen, TN – Total Nitrogen

Table 4: Results of Tests Conducted on Water Sources in the Study Towns

Town	Type of Water Source	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg / l	TN mg / l
					Most Prob. No./100 ml				
Ajmer	Open Well in Dargah	69.7	280	4.41	<9	<9	<0.3	5.85	13.86
	Bore well in Pilikhan	9.7	812	3.68	<0.3	<0.3	<0.3	1.14	13.28
	AnaSagar Lake	39.7	1328	3.08	<0.3	<0.3	<0.3	10.31	3.833
	PHED Water Supply	7.2	208	4.62	<0.3	<0.3	<0.3	1.2	2.392
	Dargah Drain	229	819	0	>1100	>1100	<0.3	10.86	7.723
	Khanpur Nala	280	776	0	<0.3	>1100	<0.3	7.48	7.76
Rajsamand	Sadhana Shikhar Lake	69.7	270	4.9	>1100	>1100	<0.3	4.9	1.386
	SS Lake Filter Plant	49.7	1530	4.65	>1100	>1100	<0.3	1.35	2.863
	SS Lake Treated Water	29.7	280	4.99	>1100	>1100	<0.3	1.11	2.11
	Bandya Nala	120	2090	0.5	>1100	>1100	<0.3	3.171	2.916
	Borewell near Salus Road	39.7	939	3.45	>1100	>1100	<0.3	3.7	11.7
	PHED Water Supply	8.9	293	4.9	>1100	>1100	<0.3	1.4	2.06

Town	Type of Water Source	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg / l	TN mg / l
					Most Prob. No./100 ml				
Kekri	Machhola Taalab Lake	129.7	272	2.10	>1100	>1100	<0.3	0.85	9.46
	Bada Taalab Lake	99.7	564	1.5	1100	2.4x104	<0.3	62.0	11.186
	Chhota Taalab Lake	110	398	1.21	<0.3	1.5x103	<0.3	3.77	9.62
	Open Well Ghantaghar	49.7	289	3.4	<0.3	<0.3	<0.3	1.34	7.36
	Borewell	39.7	2.16	4.3	<0.3	4.6x103	<0.3	1.71	14.31
	Trenching Ground	110	420	2.1	<0.3	4.6x103	<0.3	6.8	8.48
	Nala on Deoli Highway	159.7	684	1.52	2.1x104	>1100	<0.3	3.88	8.07
	PHED Water Supply	49.7	206	4.48	<0.3	<0.3	<0.3	1.71	3.36
Permissible Value for Class A Water Sources (IS:2296)		**2**	**500**	**>6**	**50**	**50**	**50**	**Absent**	**Absent**
Permissible Value for Class C Water Sources (IS:2296)		**3**	**1500**	**>4**	**5000**	**5000**	**5000**	**Absent**	**Absent**

Even though the Bureau of Indian Standards has withdrawn IS:2296, this is the standard that is being adopted here to assess water quality as being more appropriate than the later diluted standards prescribed by the MoEFCC given the serious impact on environmental and human health that such a diluted standard is having. Class A water is that which can be used for drinking without conventional treatment but with disinfection and Class C water is that which can be used for drinking with conventional treatment and disinfection. Clearly most of the water sources are polluted for class A water as shown by the values marked in red in the table above. Even as per the standards for Class C water, the Biochemical Oxygen Demand, Dissolved Oxygen, ammoniacal nitrogen and total nitrogen values are above the prescribed limits and so most of the sources are polluted.

Section III

Planning for Wastewater Management

Planning for Wastewater Management

The Ajmer Town Plan 2033 (ADA, 2013) has a brief paragraph that states that under various schemes most of the city has been covered by sewer lines and only the work of connecting the household toilets to these lines remains. The plan also mentions that STPs are to be constructed near Anasagar and Khanpura to treat the sewage from these sewer lines. The City Development Plan prepared as part of the JNNURM (AMC, 2006) has the following provisions -

i. To make Sewerage System already been laid operational and utilize the assets to their optimum level through increasing house connections.
ii. To achieve environmentally safe collection and disposal system, for sewage generation demand up to 2011.
iii. To achieve universal coverage in the city Area and the newly developing areas, by 2011, and to provide total sanitation to all Important tourist destinations and *Vishram Sthalis*, by 2008.
iv. To provide for augmentation of the collection system and treatment capacity, beyond 2011.
v. Provision of safe and hygienic sanitation facilities to major tourist and pilgrim locations and other city locations by 2008.

The Kekri and Rajsamand Town Plans 2031 (TPDR, 2013) mention that the town does not have a proper wastewater disposal system and that one should be planned and implemented in future. However, there are no details provided other than the advice to the Municipal Corporation to collaborate with the Public Health Engineering Department in preparing a wastewater conveyance and treatment plan. A sewerage system and sewage treatment plant have been implemented under the Rajasthan Urban Infrastructure Development Programme with a loan from the Asian Development Bank in Rajsamanad but this system is not operational.

It is noteworthy that there is no mention of on-site faecal sludge and septage management and wastewater treatment and recycling in any of the plans. Even though these plans predate the national and state policies of faecal sludge and septage management which have subsequently made extensive provisions in this regard, nevertheless these plans are deficient because the CPHEEO guidelines with regard to wastewater management, which have been there for quite some time, too have not been followed and so whatever sewerage and treatment capacity has been built is not performing well due to bad design and lack of operation and maintenance.

Section IV

Staffing of Sanitation Services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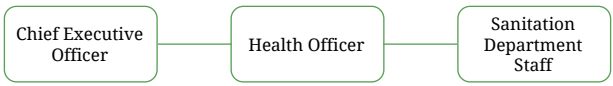
Staffing of Sanitation Services

The Urban Local Bodies in the state are headed by a Chief Executive Officer with a sanitation department headed by a health officer to take care of water supply, maintenance of drains and sewers as shown in Fig. 9 below.

Fig. 9: Organogram of Urban Local Bodies Related to Sanitation



The staff strength of the Health and Sanitation Department of the studied towns is grossly inadequate. The sanctioned strength and the actual employment is given in Table 5 below. There is severe understaffing of the sanitation department which is affecting the provision of sanitation services, especially to the slum areas.

Table 5: Staffing of Health and Sanitation Department of Study Towns

Post	Ajmer		Rajsamand		Kekri	
	Sanc.	Act.	Sanc.	Act.	Sanc.	Act.
Chief Health Officer	1	0	-	-	-	-
Health Officer	2	1	1	0	-	-
Assistant Health Officer	8	2	3	0	1	0
Chief Sanitation Inspector	23	15	5	0	-	-
Sanitation Inspector Grade I	45	17	9	2	1	0
Sanitation Inspector Grade II	89	30	9	2	3	1
Asst. Sanitation Supervisor (Jamadar)	150	40	31	8	3	2
Sanitation Workers (Permanent)	2256	1154	471	471	91	87

The shortage of permanent staff is sought to be made up with contract workers who are hired as and when the requirement arises. A result of this is that there is also a serious lack of qualified personnel to address the problems of sewerage and sewage treatment. The municipalities do not have the capacity to operate and maintain the sewerage and sewage treatment plants and so are reluctant to take charge of them.

Section V

Review of Municipal Finances

Review of Municipal Finances

The overall finances of the three study towns have been summarised in Table 6 below.

Table 6: Overall Finances of Study Town ULBs from 2017-18 Budget Estimates

Item	Ajmer		Rajsamand		Kekri	
	Total (Rs Lakhs)	Per Capita (Rs)	Total (Rs Lakhs)	Per Capita (Rs)	Total (Rs Lakhs)	Per Capita (Rs)
Revenue Receipts	16358.00	2742	6258.70	8392.2	1963.95	4262
Revenue Exp.	21558.00	3614	3561.60	4775.7	787.20	1708
Revenue Surplus	-5200.00		2697.10		1176.75	
Cap Receipts	15880.00	2662	2458.10	3296.0	2195.00	4764
Cap Expenditure	10983.00	1841	5139.20	6891.0	3290.00	7140
Cap Surplus	4897.00		-2681.10		-1095.00	

Extrapolating from the analysis presented in a study by the Mckinsey Global Institute, the per capita revenue expenditure for Tier I Indian cities in 2017-18 was Rs 9000. The average revenue expenditure on urban services in Indian cities was only 2% of that in the UK, 9% of that in South Africa and 13% of that in China (MGI, 2010). Similarly the per capita capital expenditure for Indian Tier 1 cities in 2017-18 was Rs 7300. The capital expenditure on urban services in Indian cities was 4 per cent of that in the UK, 13 per cent of that in South Africa and 15 per cent of that in China. The per capita expenditures are way below the Indian average, especially as the actual expenditures are 50 per cent of the estimates.

The low levels of revenue mobilisation and the high dependence on State and Central Government grants makes the finances of the ULBs very unsustainable and they are not able to offer proper sanitation services as described earlier. Moreover, the budget estimates are grossly inflated as actual incomes and expenditures are almost 50 per cent less. This severely affects the ability of the ULBs to provide services to the citizens and this is especially visible in the poor state of faecal sludge and septage management and wastewater management.

A major reason for the low level of revenue mobilisation are the very low property taxes. An urban development tax is levied only on residential plots of area greater than 2700 square feet, residential flats of area greater than 1500 square feet and commercial plots of size greater than 900 square feet. This results in the property tax contributing only about 4 per cent of the total

revenue of the ULBs. This is far below the recommendation of 25 per cent collection of revenue by urban local bodies from property taxes as mandated by the guidelines that had been prescribed by the Jawaharlal Nehru Urban Renewal Mission.

The budgeting procedure is highly unsatisfactory as it does not allow the ULBs to properly analyse the financial weak points in resource mobilisation and expenditure. Most importantly since the expenditures of various departments are clubbed together under overall heads like establishment and operation and maintenance, it is not possible to separately calculate and analyse the expenditures for each department and do a cost benefit or affordability analysis.

Section VI

Conclusions and Recommendations

Conclusions and Recommendations

The foregoing discussion has made it clear that the sanitation situation in urban areas in Rajasthan is in severe crisis. The sanitation services being provided and the plans are environmentally and financially unsustainable and lacking in equity. Given the fact that centralised sewage collection and treatment is very expensive and ULBs do not have the capacity to generate resources to implement and maintain them, the policy of making one time investments through AMRUT to facilitate these will prove counterproductive in the long run and further aggravate the situation. Especially so as on site sanitation will remain the main mode of toilet waste disposal given the fact that most towns are not big enough and do not have enough water supply for sewage systems to be feasible as shown in Table 7 below. The table clearly shows that as many as 197 towns in Rajasthan have more than 50 per cent of the households with onsite sanitation systems. Only the two cities of Jaipur and Jodhpur have less than 25 per cent of the households with onsite sanitation systems.

Table 7: Distribution of On-Site Sanitation Systems in Rajasthan

% of HHs with On-Site Sanitation System	Number of Towns	% of Total no. of Towns	Total HHs in these Towns	HHs with OSSF in these Towns	OSSF as % of Total HHs	Major Towns in the Category
>75%	67	22.60%	793,009	652,480	82%	Ajmer, Udaipur, Bhilwara, Sri Ganganagar, Hanumangarh, Sikar
50-75%	130	43.80%	1,057,743	659,956	62%	Kota, Jaisalmer, Alwar, Bharatpur, Tonk, Sawai Madhopur, Jhalawar
25-50%	89	30.00%	462,110	185,146	40%	Pali, Bikaner
<25%	11	3.70%	778,078	155.497	20%	Jodhpur, Jaipur

Source: Draft Policy on Faecal Sludge and Septage Management - Rajasthan (GoR, 2017)

Consequently, there is an urgent need to explore other sanitation systems for urban areas than the centralised ones being proposed.

Water Sensitive Urban Design

Sanitation systems should be designed in tandem with water supply and storm water management systems since all three are very closely connected to each other. The concept of Water Sensitive Urban Design (WSUD) is defined as "an approach to urban planning and design that integrates the management of the total water cycle into the urban development process" (SASTORM, 2011). It includes:

1. Integrated management of groundwater, surface runoff (including storm water), drinking water and wastewater to protect water related environmental, recreational and cultural values,
2. Storage, treatment and beneficial use of runoff,
3. Treatment and reuse of wastewater,
4. Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity, and
5. Utilising water saving measures within and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non-drinking water supplies.

Thus, by reusing storm water through appropriate decentralised water harvesting techniques involving both surface and aquifer storage and the treatment and reuse of waste water, the need for expensive drainage and water supply systems is reduced considerably. The design of buildings is done in such a way as to save on water use and increase water storage and reuse. In the process the environment is also conserved as extensive soil conservation and plantation activity is undertaken in the unbuilt environment. This approach can bring about substantial benefits at less cost compared to further investments in solutions that rely only on technological fixes for water supply and wastewater management problems. Moreover, decentralised solutions can be adopted by private parties who are financially capable of doing so on their own, thus considerably reducing the financial load on the ULBs. In the urban water management context, this involves an optimal use of both groundwater and surface water sources and where feasible recharging, harvesting and reuse of storm and waste water.

Recharging of Groundwater Aquifers

Extensive water recharging and wastewater treatment and reuse must be explored for a sustainable hybrid ground cum surface water combination.

There are already rules that all private buildings of an area more than 500 sq. mtrs and all public establishments must have water recharging systems in place so that all the storm water is filtered and recharged within these building premises in a decentralised manner. However, these rules are not being followed. The cost of installing a water recharge system is about 3 per cent 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 directly without burdening the ULBs. The Central Groundwater Board has prepared a detailed artificial recharge master plan for the whole of the country to replenish the available groundwater storage capacity. The details of the measures to be adopted have been given in this document (CGWB 2016). If this plan were to be implemented, then the availability of groundwater would be improved considerably. Moreover, the many surface water bodies in would be suitably replenished.

Treatment and Reuse of Waste Water

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 soak pit and recharged into the ground with a BOD of less than 30 mg/litres which is the permissible limit for discharge into the ground (Pillai, 2012). The toilet wastewater 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/litres of the water flowing out of the septic tank. This water is then filtered through a soak pit and the final water that seeps into the ground has a BOD within the permissible limit of 30 mg/litres. The installation cost of this system is less than 1 per cent 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 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 wastewater which constitutes about 80% of the potable water supplied, is recharged into the ground enhancing the groundwater availability. The greater availability of groundwater will mean 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. There is also the option of treating the wastewater a little more and re-using it for flushing of toilets and gardening which together constitute close to 47 per cent of the domestic water use (CPHEEO, 1999). There are many other cost effective and environmentally sound decentralised treatment options, some of which have been detailed in the CPHEEO manual on sewerage and sewage treatment (CPHEEO, 2012).

Equitable and Sustainable Sanitation Management

Storm water recharge and wastewater treatment and recharge and reuse done in a decentralised manner, is a much more sustainable alternative in financial, social and environmental terms. This kind of hybrid alternative system has also been recommended by a committee formed to recommend National Sustainable Habitat Standards for the Urban Water Supply and Sewerage sector under the National Mission for Sustainable Habitat (NMSH, 2011). 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, corporations, private institutions and government institutions, who are all in possession of a considerable portion of urban land, to tackle their water supply and wastewater disposal needs in a decentralised manner and so leave the ULBs to take care of the water supply and sanitation needs of the slum residents who are not in a position to bear these costs.

Better Management of Sewerage Systems

The above alternative systems will take time to be implemented if at all they are accepted. So in the interim there has to be better management of the current systems. Sewerage systems have been installed in Ajmer and Rajsamand but they are not being operated properly as there is not enough flow in them. The main problem is that house connections are not being made to the sewers. In many cases only the outflow of inefficient septic tanks is being connected to the sewers and the sludge remains in the tanks. This needs to be rectified and for this both financial subsidies, training of staff and awareness building among elected representatives and citizens are necessary.

Better Management of Sewage Treatment Plants

The sewage treatment plants are not operating properly except from the one at Anasagar in Ajmer. This is primarily due to the fact that the agencies that build the STPs do not train the ULB staff about how to manage their operations. Despite there being a very successful model of financially profit making STP operation in Delawas in Jaipur, the Rajsamand STP which too is of a similar type is not operating because of the lack of enough sewage to process. There is a

need for better coordination between RUDIP the implementing agency for STPs and the ULBs so that the handover of the STPs is done properly and the ULBs are capable of running them well.

Better Management of the Faecal Sludge and Septage disposal

The septic tanks installed in most households violate the CPHEEO norms and they are also not cleaned regularly and so there efficiency is limited. There are insufficient resources with the ULBs and the private operators for providing regular cleaning to all the septic tanks and also treating the septage properly before disposal. The costs of transportation are high and this discourage the septic tank cleaners from taking the sludge to the treatment plants. Manual cleaning is also going on which is violation of the law.

Coordination between Various Stakeholders

There is a woeful lack of coordination between the implementing agencies and the ULBs which is preventing the proper management of the wastewater systems. The RUDIP or the ADA and the Smart City Special Vehicle in the case of Ajmer operate on their own without taking the ULBs into confidence. The ULBs in turn lack both resources and expertise to operate and maintain the systems that are handed over to them. This lack of coordination has to be resolved. Right from the planning stage the ULBs and the implementing agencies must work together to design and run the waste management systems optimally.

Funds, Functions and Functionaries

There are inadequate funds, functions and functionaries in the ULBs. First, there is the very poor mobilisation of own resources especially property tax. Recovery of user charges for sanitation also is inadequate. Capital investments too are well below requirements. Functions regarding wastewater management are missing and that is one of the major reasons for the reluctance of ULBs to take charge of sewage systems. Finally the ULBs neither have adequate staff nor are they trained in the technical intricacies of running the wastewater systems properly. This is especially the case with the sanitation departments which do not even have the sanctioned chief officer posts filled. Therefore, there has to be a serious effort to improve revenue mobilisation by raising the property tax collection, functions have to be created for proper wastewater management and qualified staff employed for this purpose.

Capacity Building and Training

Last but not the least a huge effort has to be made to raise the level of awareness of the elected representatives and staff of the ULBs and the citizens about the need for proper wastewater management as the lack of it severely affects the overall health of the people causing a huge loss in productivity and expenditure on health costs. Ultimately the situation will improve only when there is awareness about sanitation .Trainings on the technical aspects of septic tanks, soak pits, house connections, sewers and sewage treatment plants must be conducted to raise the technical proficiency of staff and contractors.

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Annexures

Annexure I
Septage Management in **Ajmer**

I. INTRODUCTION

The general information about the city of Ajmer, Rajasthan is as follows -

1. **Location:** Ajmer is situated in the Eastern Arid Plain agro-climatic region of Rajasthan which consists of the districts of Jaipur, Ajmer and Tonk. It is located at $25^0$27'N latitude and $74^0$37'E longitude at a height of 450m above mean sea level and is situated 130 kms away from the capital city of Jaipur and is connected to it by road and rail. It is the headquarters of both the eponymous Division and District.

2. **Terrain, Geology and Climate:** Ajmer is situated in the eastern edge of the Aravalli hill range which divides the plains of Marwar from the high table land of Mewar and is 87.5 square kilometers in area. Sand dunes and cluster of sand mounds cover a large part of the Pushkar valley. These features are formed due to abrupt termination of a hill range or existence of wind gaps in the hills. The city is in the basin of the Banas river which is a tributary of the Chambal and so a part of the Ganga Basin.

   The major water bearing formations are gneiss and granites with a poor yield of 30 - 90 m3 per day. Ground water occurs under unconfined to semi-confined conditions in weathered and fractured part of the consolidated formation. These form generally poor aquifers compared to alluvium. The pre-monsoon depth of the water table is between 10 and 20 m below ground level whereas the post monsoon depth is between 5 and 10 m below ground level.

   Mean annual rainfall is 450 mm. Almost 95% of the total annual rainfall is received during the southwest monsoon, which enters the district in the last week of June and withdraws in the middle of September. Drought analysis based on agriculture criteria indicates that the district is prone to mild and normal type of droughts. Severe and very severe type of drought is very rare and occurred only twice during 1987 & 2002. January is the coldest month with mean maximum and minimum temperatures being lowest at 22.70 C and 7.60 C. Temperature in summer month, June, reaches up to 39.50 C.

There is drop in temperature due to onset of monsoon and rises again in the month of September. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity of 80%. The annual potential evapotranspiration is 1565.6 mm.

3. **Demography:** The population characteristics of Ajmer city for all the 60 wards are given in Table 1 below.

Table 1: Demographic Characteristics of Ajmer Municipal Corporation (AMC) Area 2011

Area	Number of House-holds	Total Population	Male (%)	Female (%)	SC (%)	ST (%)	Literate (%)	Male Literate (%)	Female Literate (%)	Workers (%)	Male Workers (%)	Female Workers (%)
AMC	109229	542321	51.4	48.6	24.8	1.9	86.5	92.1	80.7	32.3	51.6	11.8

Source: Census 2011

The decadal growth rate of population is 11.7% which is very moderate and considerably less than the average population growth rate for Ajmer district of 18.4%, indicating that there is some constraint that is limiting the population growth in the city. The proportion of Scheduled Castes in the population is fairly high at 24.8 Per cent much more than the 17.8 Per cent for the whole of Rajasthan. The Scheduled Tribes proportion in the population is very low at 1.9 per cent whereas for Rajasthan the proportion is 13.5 Per cent. The literacy rate is quite high but there is a significant gender gap in it. There is an even higher difference in the work participation rate among males and females with the former being four and a half times that of the latter. The overall work participation rate is slightly lower at 32.3 Per cent as compared to the National rate of 35.3 Per cent.

Ajmer is a low-density city with a highly dense inner core around the Dargah area, with population density of over 50,000 persons/sq.km. The Anasagar zone consisting of Anasagar area, Vaishali Nagar and Chaurasiyawas have the lowest density of less than 2,000 persons/sq.km. Fig. 1 below, indicates the skewed distribution of population, across 55 wards of Ajmer, as per Census 2001.

The population and density have increased since then and the number of wards is also 60 now but clearly the inner-city areas are highly over populated posing a challenge to municipal administration. In areas of high population concentration around the Dargah there is environmental degradation and poor quality of life.

Fig. 1: Ward wise Density of Population in Ajmer City 2001

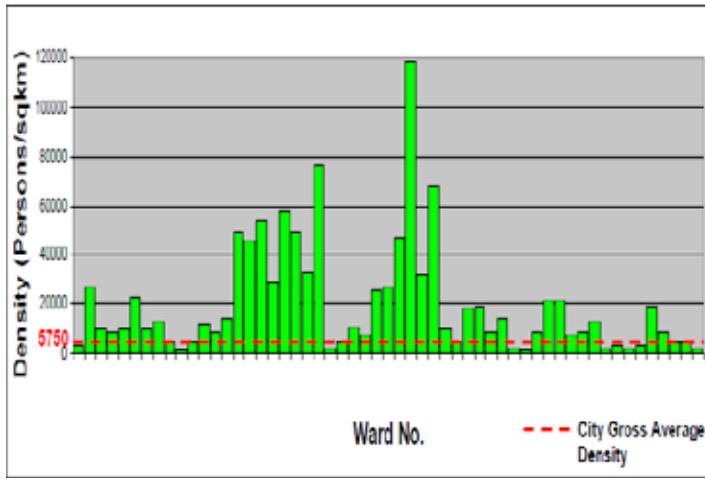


Fig. 2: Ward Map of Ajmer

The Scheduled Caste population is there in all wards but more highly concentrated in 19 of them with ward 10 having the highest population of 7618 people. The Muslim population is concentrated around the Dargah area which is also the most densely populated part of the city with very narrow roads. Ward 9 has the highest density of population.

The current ward map of Ajmer showing all the 60 wards is shown in Fig. 2.

4. **Drainage:** There are lined open drains in the city which cover the whole of the municipal area. These drains empty into nalas. Some of the nalas towards the north of the city drain into the Anasagar lake. One main nala takes the wastewater from the rest of the city to the Khanpura area and thereafter to the Khari River which is a tributary of the Banas. Both the storm water and the wastewater are drained by these drains and nalas. There is a sewerage system in place but it is not wholly functional yet as will be discussed later.

II. SANITATION SITUATION

Ajmer has an extensive sewerage network built under various schemes and the details are given in Table 2 below along with that of the proposed projects under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), which are to be implemented.

Table 2: Status of Sewerage in Ajmer Municipal Corporation Area

Sl. No.	Status of Sewerage	Length (km)	No. of Man-holes	No. of Property Chambers Constructed	No. of Property Chambers Still Needed	Area of City Covered (%)
1.	Constructed	334.2	12477	11398	26033*	72.8
2.	To be Constructed	140.7	5344		16032	27.2
3.	Total	474.9	17821	11398	42065	100.0

Source: Ajmer Municipal Corporation, *To be constructed under AMRUT

However, most households have not connected their toilets to the sewerage system. Some households have only connected their septic tanks to the sewers which means that only the outflow from these tanks goes to the sewers .One of the reasons for residents' unwillingness to get connected to the sewer lines is that they must spend Rs 6000 to connect to the sewers. So, the Ajmer Municipal Corporation has now proposed that funds be loaned to it under the Smart City Programme to connect the household toilets to the sewers with the proviso that this cost will later be recovered from the households.

There is no current data with the Ajmer Municipal Corporation on how much of the sewage is being discharged directly into open drains and sewers and how much of it is being directed first into septic tanks. Ajmer was ranked 226th in India in the Swachh Sarvekshan Survey 2017. The Census 2011 Household data related to sanitation are given in the charts below.

Fig. 3. Type of Sanitation Available in Ajmer Municipal Corporation Area 2011

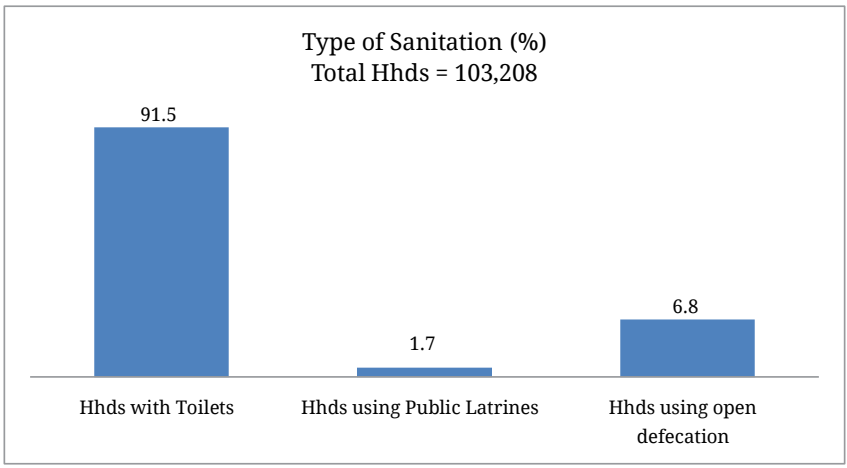
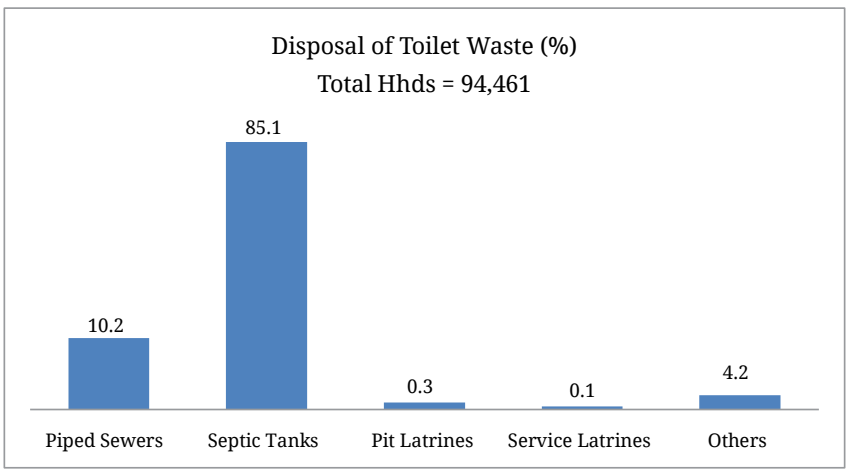


Fig.4: Disposal of Toilet Waste in Ajmer Municipal Corporation Area 2011

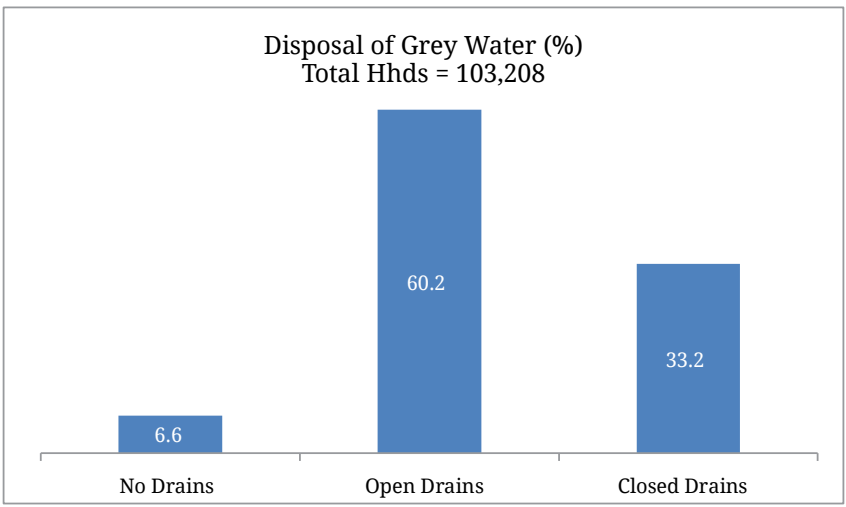


A very high proportion of 91.5 Per cent of households were being served by toilets in 2011 and this proportion has increased due to the implementation of the SBM since 2015 with the construction of 4325 household toilets. The data

with regard to the disposal of the wastes from the households that have toilets is given in Fig. 4 below. A high proportion of 85.1 Per cent of the households relied on septic tanks while sewerage was being used by 10.2 Per cent of households only despite there being sewerage in 72.8 Per cent of the city area.

Fig. 5 below gives the data on the disposal of the wastewater from the kitchen and bathroom. Only 33.2 Per cent of households was disposing their wastewater into closed drains. Most households, 60.2 Per cent, were disposing the wastewater into open drains while 6.6 Per cent had no drains for disposing their wastewater and it was collecting near their houses to seep into the ground. These drains as mentioned earlier are also carrying away the septic tank effluent outflow.

Fig. 5: Disposal of Grey Water in Ajmer Municipal Corporation Area 2011



The sanitation situation in Ajmer is thus a matter for concern and needs appropriate interventions for its proper amelioration.

III. EXISTING SANITATION PLANNING

The Ajmer Town Plan 2033 (ADA, 2013) has a brief paragraph that states that under various schemes most of the city has been covered by sewer lines and only the work of connecting the household toilets to these lines remains. The plan also mentions that sewage treatment plants are to be constructed near Anasagar and Khanpura to treat the sewage from these sewer lines. The City Development Plan prepared as part of the JNNURM (AMC, 2006) has the following provisions -

i. To make the Sewerage System that has already been laid operational and utilize the assets to their optimum level through increasing house connections.
ii. (ii) To achieve environmentally safe collection and disposal system, for sewage generation demand up to 2011.
iii. (iii) To achieve universal coverage in the city Area and the newly developing areas, by 2011, and to provide total sanitation to all Important tourist destinations and *Vishram*
iv. *Sthalis*, by 2008.
v. (iv) To provide for augmentation of the collection system and treatment capacity, beyond 2011.
vi. (v) Provision of safe and hygienic sanitation facilities to major tourist and pilgrim locations and other city locations by 2008.

IV. SEPTAGE MANAGEMENT

The ground survey of septage management was done by conducting group discussions with the residents and inspecting the septage management procedures in a selected sample of ten wards. These wards were selected in consultation with staff of the NGO, Mahila Jan Adhikar Samiti, which is involved in implementing various awareness and training programmes for women residing in the slums of the city. There is a total of 83 slums in the city accounting for 22, 055 households. Therefore, care was taken to include these areas also in the sample. Wards were chosen keeping in mind the following criteria -

5. They are located in the main congested areas of the town
6. There is a high concentration of Scheduled Castes living in the slums
7. The congested areas around the Dargah were also represented

Discussions were held with people living in slums and also in regularised built up colonies. The wards chosen were as follows –

Table 4: Sample Wards Chosen for Survey

Ward No.	9	13	17	24	35	38	41	45	47	54
Locality Name	Dargah Bazaar	Subhash nagar	Asha-ganj	Nag-phani	Pratap nagar	Parbat-pura	Bhajan-ganj	Kalyani-pura	Pilikhan	Panchsheel-nagar

The slums had mostly single pit latrines which had been built recently with grants from the municipal corporation under the Swachch Bharat Mission and which are not likely to last very long given their small size. Many residents complained that despite their names having been enrolled for toilets, they had not got the same. Some of the houses in the slums which had a little space had

septic tanks without concrete floors with the outflow flowing into the gutters near the houses where pigs fed on the faeces as shown in Fig. 6 below . This was also the case

with the built-up houses in the colonies nearby with only a few having concrete floors for the septic tanks and none having soak pits. Only a few households had connected their toilets to the sewerage system.

Fig. 6. Open drain with Pigs feeding on faeces in Pilikhan Basti

The Ajmer Municipal Corporation has two septic tank cleaning vehicles. One is a mini truck fitted with a tank and a suction pump while the other is a tractor with a tanker and suction pump attached to it. Staff are employed on a contractual basis to operate these vehicles. The charge is Rs 1500 per trip and there are on an average about 30 trips per month. Since people place a demand for cleaning of tanks only when they become clogged with sludge, the frequency of applications is very low given the size of the population. The septage is disposed in open fields away from the city. There are also private septic tank cleaners who charge depending on the size of the septic tank and its location. These cleaners also dispose the septage in open fields outside the city. Despite several attempts these private cleaners refused to meet for discussions regarding their modus operandi as they are not licensed to operate. Thus, there is a complete violation of faecal sludge and septage management norms by both the municipal corporation and the private operators.

Thus, the polluted water from these open drains and the septage not only contaminates the surface water but also the ground water. Tests were carried out to test the quality of various surface water and ground water sources at different locations for the following nine parameters –

1. BOD – Biochemical Oxygen Demand
2. TDS – Total Dissolved Solids
3. DO – Dissolved Oxygen
4. TC – Total Coliform
5. FC – Faecal Coliform
6. FS – Faecal Streptococci
7. AN – Ammoniacal Nitrogen
8. TN – Total Nitrogen

The results of these tests are given below -

a. Table 5 gives the water test results for the Open Well in Dargah area

Table 5: Test Results of Open Well Water in Dargah area

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No. /100 ml				
Observed Value	69.7	280	4.41	<9	<9	<0.3	5.85	13.86
Permissible Value for Class A Water Sources (IS:2296) except for TSS	3	500	>5	50	50	50	Absent	Absent

*Too Numerous to Count

The Dargah area is highly congested with narrow lanes and open drains. Even though there were proposals to lay 300 mm sewer lines in this area these have not been implemented and so the highly polluted water flows in the open drains and overflows during the monsoons creating unhygienic conditions. Since this area is a major pilgrimage spot there are many visitors. Multi-storeyed hotels have come up in this congested area to cater to the richer pilgrims. These hotels have big septic tanks in their basement to hold the wastewater which is then periodically pumped out and released into the open drains creating a very messy situation. Some other hotels have deep wells dug in their basement and the wastewater goes directly into the ground from these wells severely polluting the aquifer. The degenerate status of the big wells in the area can be seen in Fig. 7 below. Consequently, the shallow aquifer water is contaminated with high levels of BOD, AN and TN which are extremely harmful to health even though most pilgrims and residents use this water.

Fig.7 Open Well in Dargah area

b. Hand pump in Pilikhan: The water test results are given in Table 6 below.

Table 6: Test Results of Hand pump Water in Pilikhan Area

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./ 100 ml				
Observed Value	9.7	812	3.68	<0.3	<0.3	<0.3	1.14	13.28
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The situation with regard to lack of proper sanitation persists in most slum areas as sewerage lines have not been extended there. A meeting was held with the women residents of Pilikhan Nai Basti in ward number 47 as shown in Fig. 8 below. The women complained that they were having to pay an extra sanitation charge along with their water bill but there was no sewer line in their area and so the water flowed in open drains creating unhygienic conditions.

Fig. 8: Meeting in Pilikhan Nai Basti

Consequently, the hand pump water from the deep aquifer in the Pilikhan area is highly contaminated with high levels of BOD, TDS and AN.

c. The water quality parameters for the Anasagar lake water are given in Table 7 below

Table 7: Test Results of Anasagar Lake Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	39.7	1328	3.08	4.6x10-2	11x103	<0.3	10.31	3.833
Permissible Value for Class A Water Sources (IS:2296) except for TSS	3	500	>5	50	50	50	Absent	Absent

Many nalas with wastewater empty into the Anasagar lake and pollute it and that is why the water is highly contaminated with very high values of BOD, TDS, FC, AN and TN.

d. The test results for the water being supplied by the PHED are given in Table 8 below.

Table 8: Test Results of PHED Water Supply

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	7.2	208	4.62	<0.3	<0.3	<0.3	1.2	2.392
Permissible Value for Class A Water Sources (IS:2296) except for TSS	3	500	>5	50	50	50	Absent	Absent

The PHED water supply too is contaminated with high levels of BOD, less than permissible DO and more than permissible AN and TN. Thus, there seems to be seepage into the water supply line from the sewage lines and the open drains which is a cause for concern.

The results of the testing of water from the Nala leading into the Anasagar lake and the main nala flowing south through Khanpura are given in Table 9 below.

Table 9: Test Results of Nala Water

Test		BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
					Most Prob. No./100 ml				
Observed Value	Dargah Nali	229	819	0	>1100	>1100	<0.3	10.86	7.723
	Khan-pur Nala	280 mg/l	776	0	2.1x10-4	3.1x104	<0.3	7.48	7.76
Permissible Value for Class A Water Sources (IS:2296) except for TSS		3	500	>5	50	50	50	Absent	Absent

The water in both the nalas is highly polluted with high values of BOD, TDS, AN and TN

Status of Sewage Treatment

The sewage generated from the Anasagar zone in the north of the city in and around the Anasagar tank is 10.5 million litres per day (MLD). This is to be treated in a Sewage Treatment Plant (STP) of 13 MLD capacity situated next to the Anasagar tank. However, since only about 10 per cent of the households in this zone have been connected to the sewer lines and most of the water still flows in open drains this STP is not functioning at full capacity. The STP is being operated by the contractor who built it under agreement with the Ajmer Development Authority.

Fig. 9 : 13 MLD Sewage Treatment Plant at Anasagar Ajmer

The Ajmer Municipal Corporation has created some diversion tanks in which the wastewater from some of the bigger drains flowing into the Anasagar tank are intercepted. However, these diversion structures have not been properly designed and so fish and other solid waste from the nala water gets stuck in the wire mesh netting at the inlet of the STP creating problems for its operation. Consequently, most of the wastewater from this zone is still flowing untreated into the Anasagar tank.

The rest of the city zone wastewater amounting to 53 MLD is flowing through various drains and meeting up with the main drain which flows towards the south and eventually empties into the Khari River. An STP complex has been built at Khanpur on the banks of this drain. An STP of 20 MLD capacity has already been constructed but is not operating because the sewers have not been connected to it. The Ajmer Municipal Corporation has taken charge of this STP but is yet to connect the sewers to it.

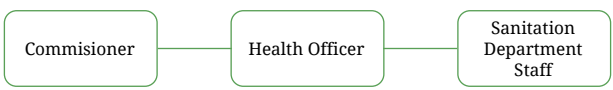
Another STP of 40 MLD capacity which will treat the sludge to produce biogas and burn it to generate electricity is under construction as shown in Fig. 10 below. Thus, presently most of the wastewater is still flowing untreated into the Khari River. There are proposals to connect the households to the sewers through the Smart City Programme and thus provide enough inflow into the two STPs for their operation but these have not yet been implemented.

Fig. 10 : 40 MLD Sewage Treatment Plant at Khanpura Ajmer

Staffing of Sanitation Department of Ajmer Municipal Corporation

The Ajmer Municipal Corporation is headed by a Commissioner. A health officer is in charge of the sanitation functions which are carried out by various staff of the sanitation department. This has been shown in an organogram in Fig.11 below. The engineering functions with regard to the sewerage system and the STPs are still being overseen by the Public Health Engineering Department which also is responsible for water supply.

Fig. 11: Organogram of Ajmer Municipal Corporation Related to Sanitation



The staff strength of the Health and Sanitation Department of the Ajmer Municipal Corporation is grossly inadequate. The sanctioned strength and the actual employment is given in Table 11 below. Clearly there is severe understaffing of the sanitation department which is affecting the provision of sanitation services, especially to the slum areas as mentioned by the women in Pilikhan earlier.

Table 11: Staffing of Health and Sanitation Department of Ajmer Municipal Corporation

Post	Sanctioned Staff	Actual Posting
Chief Health Officer	01	-
Gen Health Officer	02	-
Chief Sanitation Inspector	02	-
Sanitation Inspector 1	05	02
Sanitation Inspector 2	06	02
Assistant Sanitation Supervisor (Jamadar)	57	31
Sanitation Workers (Permanent)	1847	501

Source: Ajmer Municipal Corporation

There has been under posting of staff for quite some time now and what little posting is there is getting reduced further as no new appointments are being made as the staff retire. Consequently, contractual workers are also employed in accordance with requirements of the work. Presently the STPs are being run by private contractors and so the municipal corporation does not have any staff for this purpose.

Since the funds for the house connections to the sewers have been given to the special purpose vehicle formed to carry out the Smart City projects, the municipal corporation has lost all interest in this crucial programme required to activate the sewerage system and the treatment of wastewater in STPs. Thus, the major function of wastewater management of the municipal corporation is hamstrung and the wastewater situation will continue to deteriorate.

Review of Finances of Ajmer Municipal Corporation

The overall Finances of the Ajmer Municipal Corporation for the years 2016-17 and 2017-18 are given in Table 12 below.

Table 12: Overall Finances of Ajmer Municipal Corporation 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)	Per Capita for 2017-18* (Rs)
Revenue Receipts	16121.00	9266.73	42.5	16358.00	2742
Revenue Expenditure	18166.00	11432.12	37.1	21558.00	3614
Revenue Surplus	-2045.00	-2165.39		-5200.00	
Cap Receipts	12390.00	9567.15	22.8	15880.00	2662
Cap Expenditure	9367.00	1733.46	81.5	10983.00	1841
Cap Surplus	3023.00	7833.69		4897.00	

Source: Ajmer Municipal Corporation

*Calculated by assuming a cumulative population growth rate of 10% from 2011-2017

There was a high budget estimate for Revenue Receipts in 2016-17 which was not met by actuals which fell short by 42.5 Per cent. Nevertheless, the budget estimate of revenue receipts has been kept at an unrealistically high level for 2017-18. The lower actual revenue receipts have led to a much lower actual revenue expenditure for 2016-17. There is a budgeted revenue deficit of Rs 2045 lakhs which is indicative of bad financial planning and resource mobilisation by the AMC. The Capital Receipt estimates for 2016-17 too are not met by the actual receipts which are 22.8 per cent less. The actual capital expenditure for 2016-17 is a huge 81.5 per cent less than the estimates. The per capita revenue and capital expenditures are on the low side. A break up of the revenue receipts is given in Table 13 below.

Table 13: Revenue Receipts of Ajmer Municipal Corporation 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Taxes	540.00	394.89	26.9	540.00
Leases & Cesses	6916.00	1805.27	73.9	6270
Sales	1715.00	356.39	79.2	1640.00
Octroi Compensation	6292.00	6250.08	0.7	6930.00
Others	658.00	460.10	30.1	978
Total	**16121.00**	**9266.73**	**42.5**	**16358.00**

Source: Ajmer Municipal Corporation

Leases of Municipal property and various cesses like that on transfer of land constituted the biggest component of revenue receipts. Octroi compensation given by the State Government in lieu of the municipal corporation foregoing the levying of Octroi is a close second. Taxes constitute a very low 4.2 per cent of receipts primarily because in Rajasthan urban local bodies have limited powers to collect property tax. An urban development tax is levied only on residential plots of area greater than 2700 square feet, residential flats of area greater than 1500 square feet and commercial plots of size greater than 900 square feet. This is far below the recommendation of 25 per cent collection of revenue by urban local bodies from property taxes as mandated by the guidelines that had been prescribed by the Jawaharlal Nehru Urban Renewal Mission.

The operation and maintenance of the water supply, sewerage and sewage treatment systems are also not with the Ajmer Municipal Corporation but with the Public Health Engineering Department and the Ajmer Development Authority. This too is in clear violation of the guidelines of JNNURM and constrict the powers of the AMC. The proposal for house connections to the sewerage system is also to be implemented by the Smart City Special Vehicle and not the AMC. The AMC is currently levying the sanitation tax as an appendage of the water bill being collected by the PHED because it does not have the administrative set up to do it by itself. This is consequently off budget and amounts to an income of Rs 1572.89 lakhs. The operational sanitation costs on the other hand were Rs 3163 lakhs excluding the salaries of the permanent staff. Thus, there is a huge deficit even at present when the sewerage management services are not being provided. The revenue expenditure details are given in Table 14 below.

Table 14: Revenue Expenditure of Ajmer Municipal Corporation 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Establishment	8184.00	4834.39	40.9	9180.00
Administration	463.00	315.11	31.9	507.00
Operation & Maintenance	7625.00	5174.96	32.1	10301.00
City Development (BSUP, Smart City etc.)	1460.00	826.32	43.4	1010.00
Others	434.00	281.34	35.2	560.00
Total	**18166.00**	**11432.12**	**37.1**	**21558.00**

Source: Ajmer Municipal Corporation

Most notable here is the substantial shortfall of 32.1 per cent in the O&M expenditures and the 40.9 per cent shortfall in the Establishment expenditures indicating that there is heavy understaffing of the leadership of the organisation accompanied by poor operation and maintenance. The lack of financial sustainability due to insufficient revenue mobilisation leading to a revenue deficit and shortfalls in revenue expenditure are a matter of concern. The budgeting has been done in a very unprofessional manner so that the administration cannot easily draw any conclusions for better financial performance. The above data clearly show that the finances of the corporation are unsustainable and inadequate. Since the poor are unable to pay for services from private sources to improve their sanitation, this under spending by the municipal corporation adversely affects their well-being and so it is inequitable also.

Table 15: Capital Receipts of Ajmer Municipal Corporation 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
State Govt. Grants	3990.00	3982.37	0.2	4530.00
Central Govt. Grants	6050.00	5057.50	16.4	8950.00
Loans	2000.00	0.00	100.0	1500.00
Others	350.00	527.28	-50.7	900.00
Total	**12390.00**	**9567.15**	**22.8**	**15880.00**

Source: Ajmer Municipal Corporation

Capital receipts are heavily dependent on grants from the Central and State Governments and there is not much shortfall in actual receipts from estimates. However, the high estimates of loans were not met at all.

Table 16: Capital Expenditure of Ajmer Municipal Corporation 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Buildings	1650.00	63.25	96.2	1650.00
Gardens	100.00	22.98	77.0	100.00
Roads	550.00	390.81	28.9	550.00
Drains	300.00	244.89	18.4	350.00
Lighting	200.00	71.11	64.4	250.00
Vehicles	150.00	18.35	87.8	150.00
City Development (AMRUT, Smart City etc.)	5800.00	600.83	89.6	7000.00
Others	617.00	321.24	47.9	933.00
Total	**9367.00**	**1733.46**	**81.5**	**10983.00**

Source: Ajmer Municipal Corporation

There is a huge shortfall in capital expenditures from the estimates for 2016-17 and so a substantial amount of the grants received from the central and state governments have remained unspent mainly under the crucial city development head.

The budget does not present the slippage points in revenue mobilisation and expenditures easily for financial planning to be done well. Consequently, despite heavy shortfalls in resource mobilisation and expenditure from estimates to actuals for 2016-17, these aren't addressed in the budget estimates for 2017-18.

Conclusions

We can conclude as follows from the foregoing review of the overall sanitation situation in Ajmer Municipal Corporation Area -

1. There is inadequate provision of sanitation services especially with regard to septage and faecal sludge management. There is gross violation of both the Water (Prevention and Control of Pollution) Act 1974 and The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 as mostly the septic tanks are being cleaned manually and the

septage being disposed of into nalas and surface water bodies and open drains the wastewater is also seeping into the ground.

2. The slums are badly served or not served at all. The pit latrines that have been built are all single pit ones that will not last very long.
3. The tests carried out on water samples clearly indicate that both the surface water and ground water are highly contaminated and so unhealthy. Even the water supply from the PHED is contaminated probably due to seepage from open drains and sewers. The situation may improve with the implementation of the sewerage project but it is unlikely that the new system will be properly maintained or even operationalised. Thus, the septage and faecal sludge management systems currently in place are environmentally unsustainable.
4. The finances of the Ajmer Municipal Corporation are in a precarious state and are highly unsustainable being reliant on grants from the Central and State Governments for both capital and revenue expenditure. This has led to the provision of inadequate sanitation services and also as a result, an inequitable situation for the poor who are unable to procure sanitation services themselves from private operators by paying for them.
5. The method of maintaining accounts of the municipal corporation is unprofessional so that it is not possible to get information immediately as to whether revenues and expenditures are sustainable and equitable or not. Consequently, budgeting is done mechanically without considering the actual performance in revenue mobilisation and the ways in which it can be improved.
6. There is little coordination between the different agencies that are involved in the wastewater management system in Ajmer - the municipal corporation, the Ajmer Development Authority, the Public Health Engineering Department and the newly constituted Smart City Special Purpose Vehicle. There is also a lack of holistic understanding of the wastewater system and the importance of proper collection, treatment and reuse of wastewater.
7. Public awareness is extremely low and most households are releasing their untreated wastewater into the open drains or into the ground violating the CPHEEO norms for the construction and maintenance of septic tanks and soak pits. The few house connections to the sewerage system that have been made are from the septic tank outlets and so the flow is only of the wastewater and not of the sludge resulting in inadequate supply to the STPs that are already functional.

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Annexure II
Septage Management in **Rajsamand**

I. INTRODUCTION

The general information about the town of Rajsamand, Rajasthan is as follows -

1. **Location:** Rajsamand is situated in the Sub-humid Southern Plains and Aravali Hills agro-climatic region of Rajasthan which consists of the districts of Udaipur, Rajsamand, Sirohi, Bhilwara and Chittorgarh. It is located at $25^0$24'N latitude and $73^0$52'E longitude at a height of 532m above mean sea level and is situated 352 kms away from the capital city of Jaipur and is connected to it by road and rail. It is the district town of the eponymous district. It gets its name from a lake situated above the town.

2. **Terrain, Geology and Climate:** Rajsamand town is situated in the Mewar region in the basin of the Banas river which is a tributary of the Chambal and so a part of the Ganga Basin and has an area of 7.75 square kilometers. Geomorpholgically, there are intermontane plateaus, structural hills, pediment, buried pediment, aggradational plains, denudational plains, valley fills and flood plains. It is a gneissic plain bearing irregularly carved off gneisses and granites with low alluvial cover. The soil is clayey loam. The principal water bearing formations are quartzite, phyllite, gneisses, schist and dolomitic marble. Pre-monsoon depth of water table is 2.25m while post-monsoon depth is 0.7m

   Mean annual rainfall is 550 mm. Almost 93% of the total annual rainfall is received during the southwest monsoon, which enters the area in the last week of June and withdraws in the middle of September. Drought analysis based on agriculture criteria indicates that the area is prone to mild and normal type of droughts. Severe and very severe type of drought is very rare. January is the coldest month with mean maximum and minimum temperatures being lowest at 38.60 C and 7.80 C. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity of 81%.

3. **Demography:** The population characteristics of Rajsamand town for all the 35 wards are given in Table 1 below.

Table 1: Demographic Characteristics of Rajsamand Municipality Area 2011

Area	Number of House-holds	Total Popula-tion	Male (%)	Female (%)	SC (%)	ST (%)	Literate (%)	Male Literate (%)	Female Literate (%)	Workers (%)	Male Workers (%)	Female Workers (%)
Rajsamand Municipality	13765	67798	51.7	48.3	12.6	5.4	84.2	92.5	75.4	33.0	51.4	13.2

Source: Census 2011

The decadal growth rate of population is 21.7% which is on the high side and higher than the average population growth rate for Rajsamand district of 17.7%. The proportion of Scheduled Castes in the population is 12.6 Per cent which is less than the 17.8 Per cent for the whole of Rajasthan. There are less Scheduled Tribes in the population at 5.4 Per cent whereas for Rajasthan the proportion is 13.5 Per cent. The literacy rate is high but there is a gender gap in it. There is, however, significant difference in the work participation rate among males and females. The overall work participation rate is low at 33.0 Per cent as compared to the National rate of 35.3 Per cent.

Rajsamand is a low-density town with average density of 87 persons per hectare. Most of the town has a population density of less than 50 persons/ hectares and only the central area of the town has a density more than 200 persons/hectares.

The Scheduled Caste population is there in all wards but more highly concentrated in 9 of them in slums with ward 7 having the highest population of 1602 people. There are only three wards with high concentrations of Scheduled Tribes with ward 19 having the highest population of 519 persons. The map of Rajsamand is shown in Fig. 1 below.

Fig. 1: Map of Rajsamand

4. **Drainage:** There are lined and covered drains in the town which cover the whole of the municipal area. These drains empty into two main nalas, Bandya and Taledi, flowing from west to east and finally meeting up to form the bigger Taledi nala. Eventually this drains into the Banas river which is at a distance of 7kms to the south of the town. A sewerage system has also been implemented but only about 1200 households have been connected to it and so most of the wastewater still flows in the drains.

II. SANITATION SITUATION

The Census 2011 Household data related to sanitation are given in the charts below.

Fig. 2. Type of Sanitation Available in Rajsamand Municipality Area 2011

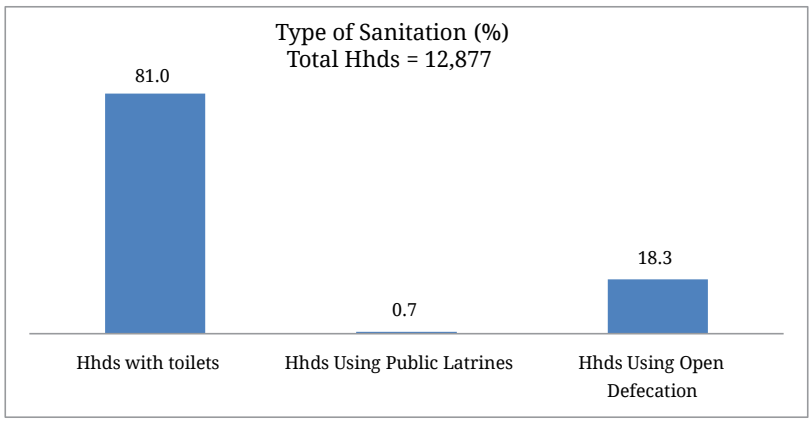
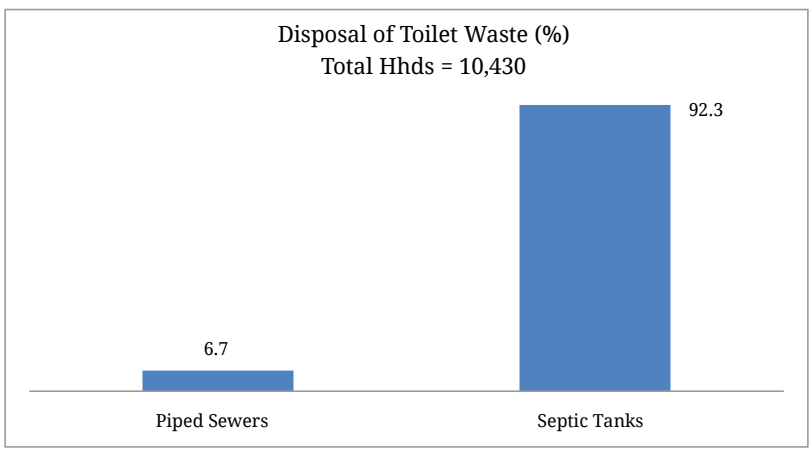


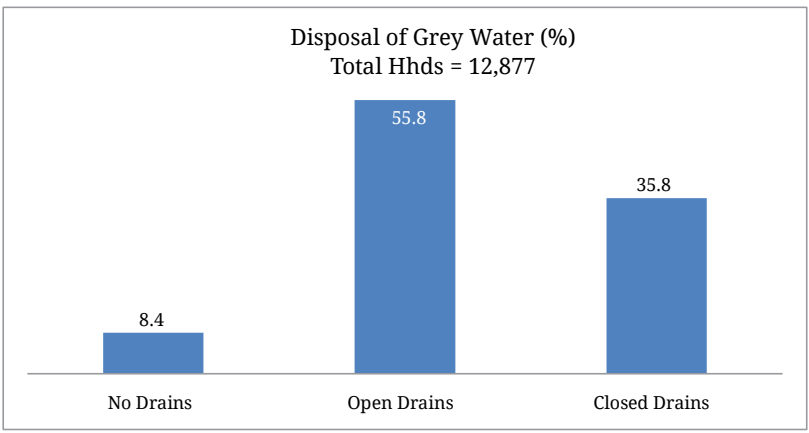
Fig.3: Disposal of Toilet Waste in Rajsamand Municipality Area 2011



A very high proportion of 81.0 Per cent of households was being served by toilets in 2011 and this proportion has increased due to the implementation of the SBM since 2015 with the construction of many household toilets. The data with regard to the disposal of the wastes from the households that have toilets is given in Fig. 3 below. A high proportion of 92.3 Per cent of the households relied on septic tanks whose outlets were emptying into open drains while sewerage was being used by 6.7 Per cent of households only as some sewerage lines have been laid under a project.

Fig. 4 below gives the data on the disposal of the wastewater from the kitchen and bathroom. Only 19.7 Per cent of households was disposing their wastewater into closed drains. Most households, 72.2 Per cent, were disposing the wastewater into open drains while 8.1 Per cent had no drains for disposing their wastewater and it was collecting near their houses to seep into the ground. These drains as mentioned earlier are also carrying away the septic tank effluent outflow.

Fig. 4: Disposal of Grey Water in Rajsamand Municipal Corporation Area 2011



The sanitation situation in Rajsamand is thus a matter for concern and needs appropriate interventions for its proper amelioration.

III. EXISTING SANITATION PLANNING

The Rajsamand Town Plan 2031 (TPDR, 2013) mentions that the town does not have a proper wastewater disposal system and that one should be planned and implemented in future. However, there are no details provided regarding what should be done. A sewerage system and sewage treatment plant have been built under the Rajasthan Urban Infrastructure Development Programme with a loan from the Asian Development Bank but this system is operating well below capacity.

IV. SEPTAGE MANAGEMENT

The ground survey of septage management was done by conducting group discussions with the residents and inspecting the septage management procedures in a selected sample of eight wards. These wards were selected in consultation with local activists. There is a total of 14 slums in the town accounting for a population of about 12000. Therefore, care was taken to

include these areas also in the sample. Wards were chosen keeping in mind the following criteria –

a. They are located in the main congested areas of the town
b. There is a high concentration of Scheduled Castes living in the slums

Discussions were held with people living in slums and also in regularised built up colonies. The wards chosen were as follows –

Table 2: Sample Wards Chosen for Survey

Ward No.	7	25	27	28	29	30	33
Locality Name	Dhani Chabutara	Dwarkadheesh Mandir	Salus Road	Surajpol	Chandpol	Rajnagar	Yadav Basti

The slums had mostly single pit latrines which had been built recently with grants from the municipal corporation under the Swachch Bharat Mission and which are not likely to last very long given their small size. There were also complaints regarding the inadequacy of water supply which was causing some of the slum dwellers to opt for open defecation despite toilets having been built. Part of the town is situated on a hill and the slums in this area have little place for latrines to be built. Under the Swachh Bharat Mission some latrines have been built but without any pits as it is difficult to dig pits in the rock of the hill. So, the seat and the latrine is left hanging over the cliff and the faeces drop directly down below some 8 meters on to the ground where there is a sports complex and a school as shown in Fig. 5 below.

These illegal toilets are there in the following localities given in Table 3 below. Immediate action needs to be taken to remedy this serious violation of pollution norms right in the city centre close to a school and a playground.

Table 3: Wards with Violation of Pollution Norms due to open release of Faeces

Ward No.	1	2	4	5	22	23	24	29	30
Locality Name	Sawed	Gariawas	Nayakwadi	Palevamgiri	Asotia	Koyad	Gudli	Santoshi Nagar	Bhilmagri

Most households had septic tanks with the untreated outflow flowing into the open drains. The design and construction of these tanks is arbitrary and do not follow the CPHEEO norms. The septic tanks are cleaned only when they become full with sludge and the water stops flowing instead of every two years as mandated by the CPHEEO. Nowhere are soak pits provided for treating and releasing the water into the ground. Some households had no septic tanks and the wastewater was being emptied directly into the drains which were

consequently flowing with contaminated water and eventually emptying into small ponds and the Banas river which flows about 7 kms from the city.

Fig. 5: Toilets Built Hanging Out and Releasing Faeces on to the Ground below

The Rajsamand Municipality has one septic tank cleaning vehicle and it charges Rs 2000 per trip. It operates on demand. There is one private operator also giving this service who has recently purchased a tanker of 4000 litres capacity. He charges between Rs 2000 and 3000 for the first trip depending on the location and Rs 1500 for subsequent trips. He gets about 10 trips a month but this increases to about 15 trips a month during the monsoons. Both the municipal vehicle and the private operator empty the sludge in the Taledi drain without any treatment. The private operator has made an investment of Rs 11 Lakhs on his vehicle and earns a net income of Rs 15000 a month in the monsoon season from Rajsamand. However, this is not enough to recover his investment and so he services nearby towns also. Additionally, he has the contract for the cleaning of the community septic tanks in the residential colony of the JK Tyre factory near Rajsamand. A picture of his cleaning machine in operation is given below in Fig. 6.

Fig. 6: A Private Septic Tank Cleaning Machine in operation

A sewerage system to serve a population of about 50,000 in an area of 1,440 hectares encompassing 26 municipal wards has been put in place with a loan from the Asian Development Bank by the Rajasthan Urban Infrastructure Development Programme (RUIDP) and has been formally handed over to the Municipality on paper. However, all these wards have not been covered by the sewerage system including branches and laterals but have been provided with only trunk and interceptor sewers. The problem is that house connections have been provided to only about two hundred houses. The Municipality has been given funds by RUDIP to connect 2500 more houses to the sewer but this is still in the tendering stage. There is a plan to connect 1600 more houses in the future to the sewerage system.

Due to lack of awareness there is reluctance on the part of the citizens to connect their toilets or septic tanks to the sewers. The Municipal staff have not been augmented to take care of the new sewerage system even though they have been provided with sewer cleaning machines and so the sewerage system is not operating properly. There is a sewage pumping station in the Taledi nala to pump the sewage outfall from the sewerage system to the Sewage Treatment Plant but it is only pumping the water and dumping the sludge in the Taledi Nala as shown below in Fig. 7 below.

Fig. 7: Sewage Pumping Station at Taledi Nala in Rajsamand

The polluted water from the open drains and the septage, cumulatively amounting to about 5 million litres per day, flows through the nalas. The Sewage Treatment Plant built under the RUIDP is also not operating properly as will be detailed later and so the untreated water flows in the drain and into the Banas river as shown in Fig 8. below.

The untreated wastewater is contaminating both the surface and the ground water and tests were conducted to determine the extent of this contamination as follows –

1. BOD – Biochemical Oxygen Demand
2. TDS – Total Dissolved Solids
3. DO – Dissolved Oxygen
4. TC – Total Coliform
5. FC – Faecal Coliform
6. FS – Faecal Streptococci
7. AN – Ammoniacal Nitrogen
8. TN – Total Nitrogen

Fig. 8: Untreated Sewage Flowing in Taledi Nala

The results of these tests are given below -
Table 4 gives the water test results for the Sadhana Shikhar Lake

Table 4: Test Results of Sadhana Shikhar Lake Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	69.7	270	4.9	>1100	>1100	<0.3	4.9	1.386
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The water of the Lake which is the source of water supply for the town is contaminated as the BOD, DO, TC and FC levels are well above the prescribed limits as are the AN and TN levels. The TDS and and FS are within permissible limits but overall the water quality is bad.

The Sadhana Shikhar Lake Filtration Plant water test results are given in Table 5 below.

Except for the FS all other parameters are beyond the limits and the water is contaminated.

Table 5: Test Results of Sadhana Shikhar Lake Filter Plant

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	49.7	1530	4.65	>1100	>1100	<0.3	1.35	2.863
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The water quality parameters for the Chhota Talab water are given in Table 6 below

Table 6: Test Results of Sadhana Shikhar Lake Treated Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	29.7	280	4.99	>1100	>1100	<0.3	1.11	2.11
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The Sadhana Shikhar Lake treated water is also polluted and this is a cause for concern because this is being supplied to the citizens.

The test results for the Bandya Nala are given in Table 7 below.

Table 7: Test Results of Bandya Nala

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	120	2090	0.5	>1100	>1100	<0.3	3.171	2.916
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

As is to be expected the water is highly polluted with only the FS within permissible limits.

The results of the testing of water from a hand pump in downtown Rajsamand are given in Table 8 below.

Table 8: Test Results of Hand pump Water Near Salus Road

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	39.7	939	3.45	>1100	>1100	<0.3	3.7	11.7
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The deep aquifer water is highly polluted with very high levels of BOD, TDS and TN which are very harmful for health. This means that the untreated water flowing in the Taledi Nala is seeping into the deep aquifer and polluting it.

The results of the testing of the water being supplied by the Public Health Engineering Department in Rajsamand are given in Table 9 below.

Table 9: Test Results of Water from the PHED supply in Rajsamand Town

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	8.9	293	4.9mg	>1100	>1100	<0.3	1.4	2.06
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The potable water being supplied by the PHED surprisingly has a very high level of BOD and a low level of DO along with high levels of TC, FC, AN and TN indicating that contamination is taking place in the supply line which is not surprising given the fact that these lines are situated close to the open drains.

V. SEWAGE TREATMENT

A Sewage Treatment Plant with the Up flow Anaerobic Sludge Blanket (UASB) technology of 5 Million Litres per Day capacity has been constructed at village Bhawa on the Bhilwara Road on the side of the Taledi Nala under the Rajasthan Urban Infrastructure Development Programme. The contract for constructing the sewerage system and the sewage treatment plan was given to Khilari Inftrastructre of Mumbai. They also have the contract for running the plant for five years after commissioning. The advantage of the UASB technology is that it does not require external chemicals and uses the bacteria in the sludge in the wastewater to treat it. The residual sludge is much less as a consequence and biogas is produced that can be burnt to generate electricity to run the plant further cutting down on costs. The pre-filtration plant is shown in Fig. 9 below

As mentioned earlier the sewage from the town that is collected at the Taledi pumping station has to be pumped to the STP which is at a greater height and at

a distance of a few kilometers. Instead of pumping the whole sewage, the sludge is disposed of in the Taledi Nala and only the wastewater of about 1.6 MLD is pumped to the STP. This severely affects the operation of the STP as the UASB technology requires full flow of water and sludge to be successfully operational. As a consequence, the wastewater after pre-treatment is being released into the nala without the operation of the UASB reactor and the generation of biogas. Consequently, the biogas dome is empty and electricity is not being generated as shown below in Fig. 10. Thus, there is gross mismanagement of the sewage collection and treatment process. The plan and its implementation of the sewerage and STP has been good but the operation is badly deficient because the house connections to the sewers have not been made, the sewage pumping station is not operating properly and the STP is not functioning because of a lack of adequate sludge supply. Consequently, the possibility of the STP generating energy to run both itself and the sewage pumping station and thus become self-sufficient is not being actualised and the wastewater and sludge is being released untreated into the nalas.

Fig. 9: Pre-filtration Unit of STP at Rajsamand

Fig. 10: Unused Gas Holder at the STP in Rajsamand

VI. STAFFING OF SANITATION DEPARTMENT OF RAJSAMAND MUNICIPAL CORPORATION

The Rajsamand Municipality is headed by an Executive Officer. A health inspector should be in charge of the sanitation department but this post is vacant and currently this is overseen directly by the Executive Officer. This has been shown in an organogram in Fig.8 below. The engineering functions with regard to the water supply are being overseen by the Public Health Engineering Department while there are no engineering functions with regard to sewerage.

Fig. 8: Organogram of Rajsamand Municipality Related to Sanitation

The staff strength of the Health and Sanitation Department of the Rajsamand Municipality is grossly inadequate. The sanctioned strength and the actual employment is given in Table 10 below.

Table 10: Staffing of Health and Sanitation Department of Rajsamand Municipality

Post	Sanctioned Staff	Actual Posting
Chief Health Inspector	1	0
Sanitation Inspector 2	02	1
Assistant Sanitation Supervisor (Jamadar)	10	2
Sanitation Workers (Permanent)	220	186

Source: Rajsamand Municipality

There has been under posting of staff for quite some time now and what little posting is there is getting reduced further as no new appointments are being made as the staff retire. Consequently, contractual workers are also employed throughout the year their numbers depending on the workload. Clearly there is severe understaffing of the sanitation department which is affecting the provision of sanitation services, especially to the slum areas.

What is of greater concern is that the old staff of the municipality do not have the capacity to run the newly built sewerage system and STP which has been handed over to them by the RUDIP. Several meetings have taken place between the municipality staff and RUDIP staff for training the former in the running of the wastewater system as per the records maintained by RUDIP but the municipality staff deny this. There is no understanding in the municipal staff about the nature of the STP which requires constant flow of adequate sewage to operate properly and generate gas and electricity to make the whole system energy wise and financially self-dependent. The chairperson of

the municipality too is unaware of the nature of the sewerage and treatment system and is not interested in ensuring its proper functioning thus further compounding the problem of operation and maintenance. More qualified staff need to be appointed by the municipal corporation and a massive awareness campaign needs to be conducted but this is not getting enough importance.

RUDIP has now prepared a proposal for building more sewers and STPs with the loan funds from Asian Development Bank to cover those areas of the town that are still left uncovered by the sewerage system. without resolving the problem of the operation and maintenance of the system that has already been installed.

VII. REVIEW OF FINANCES OF RAJSAMAND MUNICIPALITY

The overall Finances of the Rajsamand Municipality for the years 2016-17 and 2017-18 are given in Table 11 below.

Table 11: Overall Finances of Rajsamand Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)	Per Capita for 2017-18* (Rs)
Revenue Receipts	4701.70	1968.01	58.1	6258.70	8392.2
Revenue Expenditure	2847.10	1406.16	50.7	3561.60	4775.7
Revenue Surplus	1854.6	561.85		2697.10	
Cap Receipts	1758.10	1640.95	6.7	2458.10	3296.0
Cap Expenditure	3608.70	1754.46	51.4	5139.20	6891.0
Cap Deficit	-1850.60	- 113.51		-2681.10	

Source: Rajsamand Municipality

*Calculated by assuming a cumulative population growth rate of 10% from 2011-2017

There was a high budget estimate for Revenue Receipts in 2016-17 which was not met by actuals which fell short by a substantial 58.1 Per cent. Nevertheless, the budget estimate of revenue receipts has been kept at an unrealistically high level for 2017-18. The lower actual revenue receipts have led to a much lower actual revenue expenditure for 2016-17. The actual revenue surplus for 2016-17 is only Rs 561.85 Lakhs as opposed to the estimate of Rs 1854.60 lakhs. The Capital Receipt estimates for 2016-17 too are not met by the actual

receipts which are 6.7 per cent less. The actual capital expenditure for 2016-17 is 51.4 per cent less than the estimates. Despite the heavy shortfalls in actual expenditure the estimates for 2017-18 have once again been made very big. The actual per capita revenue and capital expenditures are on the low side even though the estimates are fairly high. A break up of the revenue receipts is given in Table 12 below.

Table 12: Revenue Receipts of Rajsamand Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Taxes	5.00	24.19	383.8 excess	25.00
Leases & Cesses	2105.05	649.23	69.1	2163.05
Sales	1212.80	310.78	74.4	2352.80
Octroi Compensation	860.55	860.55	0.0	946.00
Others	518.30	123.26	76.2	771.85
Total	4701.70	1968.01	58.1	6258.70

Source: Rajsamand Municipality

Octroi compensation given by the State Government in lieu of the municipal corporation foregoing the levying of Octroi constituted the biggest component of actual revenue receipts. Leases of Municipal property and various cesses like that on transfer of land came second even though they had been budgeted to be the highest source of revenue. Particularly of note is the huge shortfall in the sewerage and drainage cess in 2016-17 from the estimate of Rs 450 lakhs to the actual recovery of just 74.25 lakhs. Taxes constitute a very low 1.2 per cent of the actual revenue receipts primarily because in Rajasthan urban local bodies have limited powers to collect property tax. An urban development tax is levied only on residential plots of area greater than 2700 square feet, residential flats of area greater than 1500 square feet and commercial plots of size greater than 900 square feet. This is far below the recommendation of 25 per cent collection of revenue by urban local bodies from property taxes as mandated by the guidelines that had been prescribed by the Jawaharlal Nehru Urban Renewal Mission. There is a considerable excess in tax collection in 2016-17 over the estimates due to better revenue mobilisation from the urban development tax. The operation and maintenance of the water supply system are also not with the Rajsamand Municipality but with the Public Health Engineering Department. This too is in clear violation of the guidelines of JNNURM and constrict the powers of the Rajsamand Municipality. The revenue expenditure details are given in Table 13 below.

Table 13: Revenue Expenditure of Rajsamand Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Establishment	970.00	854.72	12.1	1066.00
Administration	164.10	156.06	4.9	192.60
Operation & Maintenance	1418.00	390.14	62.5	1908.00
Others	295.00	5.24	98.2	395.00
Total	2847.10	1406.16	50.7	3561.60

Source: Rajsamand Municipality

Most notable here is the substantial shortfall of 62.5 per cent in the O&M expenditures indicating poor operation and maintenance by the municipality. The lack of financial sustainability due to insufficient revenue mobilisation leading to a low revenue surplus and shortfalls in revenue expenditure are a matter of concern. The earnings from cleaning of septic tanks was Rs 1,24,675 in 2016-17 which means that roughly 5 tanks were cleaned a month and this fell to Rs 62,150 in 2017-18 which is a matter of concern. Also, there is no provision for the running of the STP even though it is mentioned in the budget which goes to show how serious the municipality about this crucial function. The budgeting has been done in a very unprofessional manner without separating the revenue and capital sections so that the administration cannot easily draw any conclusions for better financial performance. The above data clearly show that the finances of the municipality are unsustainable and inadequate. Since the poor are unable to pay for services from private sources to improve their sanitation, this under spending by the municipality adversely affects their well-being and so it is inequitable also.

Table 14: Capital Receipts of Rajsamand Municipality 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
State Govt. Grants	350.00	411.19	17.5 excess	350.00
Central Govt. Grants	550.00	751.69	36.7 excess	750.00
Loans	540.00	28.71	94.7	1000.00
Others	318.10	449.36	41.3 excess	358.10
Total	1758.10	1640.95	6.7	2458.10

Source: Rajsamand Municipality

There is a slight shortfall in actual Capital receipts mainly because loans have not materialised. This is not surprising because given the state of its finances the municipality will hardly be able to convince any lender to give it funds.

Table 15: Capital Expenditure of Rajsamand Municipality 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Buildings	1090.50	243.02	22.3	1651.00
Roads	510.00	688.36	35.0 excess	550.00
Drains & Toilets	300.00	4.99	98.3	430.00
Slum Development	95.00	112.06	18.0 excess	95.00
NULM	150.00	33.48	22.3	150.00
Others	1463.20	672.55	54.0	2263.20
Total	3608.70	1754.46	51.4	5139.20

Source: Rajsamand Municipality

There is a huge shortfall in capital expenditures from the estimates for 2016-17 as a substantial amount of the loans estimated to be receivable from the central and state governments have not materialised. It is notable that the biggest shortfall is in the construction of drains and toilets which is why the sanitation situation in the town is in such a bad state.

The budget does not present the slippage points in revenue mobilisation and expenditures easily for financial planning to be done well. Consequently, despite heavy shortfalls in resource mobilisation and expenditure from estimates to actuals for 2016-17, these aren't addressed in the budget estimates for 2017-18.

VIII. CONCLUSIONS

We can conclude as follows from the foregoing review of the overall sanitation situation in Rajsamand Municipality Area -

1. There is inadequate provision of sanitation services especially with regard to septage and faecal sludge management. There is gross violation of both the Water (Prevention and Control of Pollution) Act 1974 and The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 as mostly the septic tanks are being cleaned manually and the septage being disposed of into nalas and surface water bodies and open drains the wastewater is also seeping into the ground.
2. The sewerage system that has been implemented is not functional as only a very few households have connected their toilets or septic tanks to the sewers and the municipality is not doing anything to proactively increase

this number. The sewage pumping station and the sewage treatment plant are not fully operational and the wastewater is being released untreated into the Taledi Nala and flowing into the River Banas. This is a major failure of the municipality because the sewerage and sewage treatment system has been so designed that if it operates at full capacity then it can be self-sustaining financially without putting a load on the municipality.

3. The slums are badly served or not served at all. The pit latrines that have been built are all single pit ones that will not last very long. Water supply is inadequate. Moreover, in many cases in the city centre the toilets are releasing faeces directly into the open creating a serious health hazard.
4. The tests carried out on water samples clearly indicate that both the surface water and ground water are highly contaminated and so unhealthy. The septage and faecal sludge management systems currently in place are environmentally unsustainable.
5. The finances of the Rajsamand Municipality are in a precarious state and are highly unsustainable with regard to both capital and revenue income and expenditure. This has led to the provision of inadequate sanitation services and also as a result, an inequitable situation for the poor who are unable to procure sanitation services themselves from private operators by paying for them.
6. The method of maintaining accounts of the municipal corporation is unprofessional so that it is not possible to get information immediately as to whether revenues and expenditures are sustainable and equitable or not. Consequently, budgeting is done mechanically without considering the actual performance in revenue mobilisation and the ways in which it can be improved.
7. The level of awareness among all the stakeholders from citizens to the elected representatives and staff of the municipality is extremely low regarding the need for proper treatment and disposal of waste water. This is compounded by the fact that RUDIP just constructs the wastewater infrastructure and hands it over without training the municipal staff in operation and maintenance.
8. There is thus a need for training of municipal staff and awareness building among the citizens to explain to them the need for an efficient wastewater management system and the technical and social knowhow to run it properly.

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Annexure III
Septage Management in **Kekri**

I. INTRODUCTION

The general information about the city of Kekri, Rajasthan is as follows -

a. **Location:** Kekri is situated in the Eastern Arid Plain agro-climatic region of Rajasthan which consists of the districts of Jaipur, Ajmer and Tonk. It is located at $25^0$97'N latitude and $74^0$15'E longitude at a height of 347m above mean sea level and is situated 136 kms away from the capital city of Jaipur and is connected to it by road. It is a tehsil town in Ajmer district.

b. **Terrain, Geology and Climate:** Kekri town is situated in the plains of Marwar in the basin of the Banas river which is a tributary of the Chambal and so a part of the Ganga Basin and has an area of 8.18 square kilometers. The major water bearing formations are gneiss and granites with a poor yield of 30 - 90 m3 per day. Ground water occurs under unconfined to semi-confined conditions in weathered and fractured part of the consolidated formation. These form generally poor aquifers compared to alluvium. The pre-monsoon depth of the water table is between 10 and 20 m below ground level whereas the post monsoon depth is between 5 and 10 m below ground level.

   Mean annual rainfall is 500 mm. Almost 95% of the total annual rainfall is received during the southwest monsoon, which enters the area in the last week of June and withdraws in the middle of September. Drought analysis based on agriculture criteria indicates that the area is prone to mild and normal type of droughts. Severe and very severe type of drought is very rare and occurred only twice during 1987 & 2002. January is the coldest month with mean maximum and minimum temperatures being lowest at 22.70 C and 7.60 C. Temperature in summer month, June, reaches up to 39.50 C. There is drop in temperature due to onset of monsoon and rises again in the month of September. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity of 80%. The annual potential evapotranspiration is 1565.6 mm.

c. **Demography:** The population characteristics of Kekri town for all the 30 wards are given in Table 1 below.

Table 1: Demographic Characteristics of Kekri Municipality Area 2011

Area	Number of House-holds	Total Population	Male (%)	Female (%)	SC (%)	ST (%)	Literate (%)	Male Literate (%)	Female Literate (%)	Workers (%)	Male Workers (%)	Female Workers (%)
Kekri Municipality	7577	41890	50.9	49.1	18.1	0.9	78.7	89.2	67.8	33.4	51.8	14.4

Source: Census 2011

The decadal growth rate of population is 22.7% which is on the high side and higher than the average population growth rate for Ajmer district of 18.4%. The proportion of Scheduled Castes in the population is 18.1 Per cent which is more or less the same as the 17.8 Per cent for the whole of Rajasthan. There are very few Scheduled Tribes in the population at 0.9 Per cent whereas for Rajasthan the proportion is 13.5 Per cent. The literacy rate is high but there is a gender gap in it. There is, however, a very significant difference in the work participation rate among males and females. The overall work participation rate is slightly lower at 33.4 Per cent as compared to the National rate of 35.3 Per cent.

Kekri is a low-density town with most of the town having a population density of less than 125 persons/hectares and only the small central area of the town around the Ghantaghar with density of 500 persons/hectares as shown in Fig. 1 below.

Fig. 1: Congested City Centre of Kekri

The Scheduled Caste population is there in all wards but more highly concentrated in 8 of them in slums with ward 25 having the highest population of 1050 people. The map of Kekri is shown in Fig. 2 below.

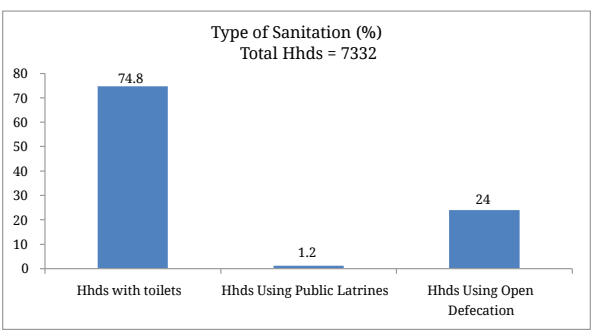
Fig. 2: Map of Kekri

d. Drainage: There are lined open drains in the town which cover the whole of the municipal area except for the slums where there are unlined drains. These drains empty into nalas. Some of the nalas towards the south of the town drain into the ponds there. The overflow from these ponds flows out through nalas towards the south of the town and eventually drains into the Banas river which is at a distance of 22 kms.

II. SANITATION SITUATION

The Census 2011 Household data related to sanitation are given in the charts below.

Fig. 3. Type of Sanitation Available in Kekri Municipality Area 2011



A very high proportion of 74.8 Per cent of households was being served by toilets in 2011 and this proportion has increased due to the implementation of the SBM since 2015 with the construction of 542 household toilets. The data with regard to the disposal of the wastes from the households that have toilets is given in Fig. 4 below. A high proportion of 89.6 Per cent of the households relied on septic tanks whose outlets were emptying into open drains while sewerage was being used by 5 Per cent of households only as some sewerage lines have been laid in a few slums.

Fig.4: Disposal of Toilet Waste in Kekri Municipality Area 2011

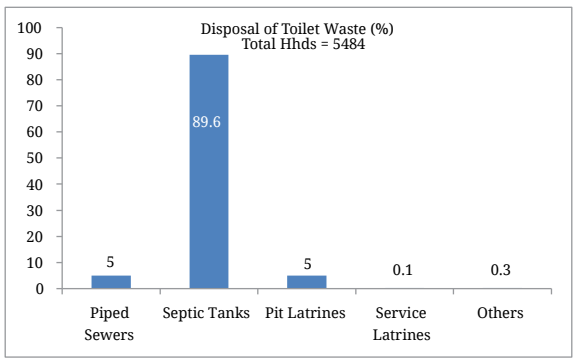
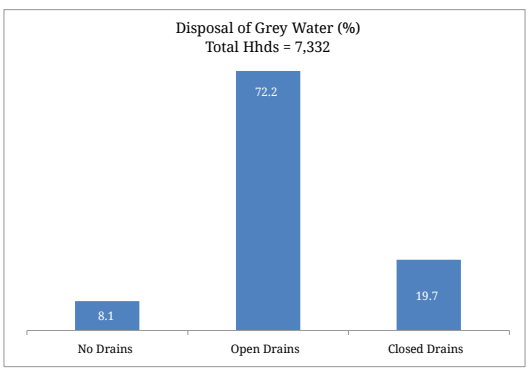


Fig. 5 below gives the data on the disposal of the wastewater from the kitchen and bathroom. Only 19.7 Per cent of households was disposing their wastewater into closed drains. Most households, 72.2 Per cent, were disposing the wastewater into open drains while 8.1 Per cent had no drains for disposing their wastewater and it was collecting near their houses to seep into the ground. These drains as mentioned earlier are also carrying away the septic tank effluent outflow.

Fig. 5: Disposal of Grey Water in Kekri Municipal Corporation Area 2011



The sanitation situation in Kekri is thus a matter for concern and needs appropriate interventions for its proper amelioration.

III. EXISTING SANITATION PLANNING

The Kekri Town Plan 2031 (TPDR, 2013) mentions that the town does not have a proper wastewater disposal system and that one should be planned and implemented in future. However, there are no details provided other than the advice to the Municipal Corporation to collaborate with the Public Health Engineering Department in preparing a wastewater conveyance and treatment plan.

IV. SEPTAGE MANAGEMENT

The ground survey of septage management was done by conducting group discussions with the residents and inspecting the septage management procedures in a selected sample of eight wards. These wards were selected in consultation with staff of the NGO, Mahila Jan Adhikar Samiti, which is involved in implementing various awareness and training programmes for women residing in the town and nearby rural areas. There is a total of 8 slums in the town accounting for a population of about 10000. Therefore, care was taken to include these areas also in the sample. Wards were chosen keeping in mind the following criteria -

1. They are located in the main congested areas of the town
2. There is a high concentration of Scheduled Castes living in the slums

Discussions were held with people living in slums and also in regularised built up colonies. The wards chosen were as follows –

Table 4: Sample Wards Chosen for Survey

Ward No.	2	5	8	10	20	21	25
Locality Name	Jagdish-pura	Durga-pura	Regar Mohalla	Surajpol Gate	Kanjar Basti	Bheru Gate	Kaazipura

The slums had mostly single pit latrines which had been built recently with grants from the municipal corporation under the Swachch Bharat Mission and which are not likely to last very long given their small size. There were also complaints regarding the inadequacy of water supply which was causing some of the slum dwellers to opt for open defecation despite toilets having been built. Most households had septic tanks with the outlet flowing into the open drains. which were consequently flowing with contaminated water as shown below. The drain is right next to the water supply line and is choked with solid waste.

Fig. 6. Open drain in Kekri Town

The Kekri Municipality does not have any septic tank cleaning vehicles and so it is left to private operators to give this service. There is one private septic tank cleaner who charges between Rs 1500 and Rs 3000 depending on the size of the septic tank and its location. This operator disposes of the septage in a pit dug near the trenching ground outside the city in the Vaghera Road area where the solid waste is disposed of by the Kekri Municipality. Farmers nearby pump the contaminated water from this pit and also from a pond nearby to irrigate their fields to produce vegetables.

A sewerage system was implemented at an expense of Rs 19 crores in some of the slum areas but this has not been operationalised because the people claim that it has not been properly built and so fear that it will choke up and lead to flooding of their houses with sewage water. Many of these slums have unlined drains which overflow during the monsoons creating a very unhealthy situation in these low-lying slums. The polluted water from the open drains and the septage, cumulatively amounting to about 3 million litres per day, flows through nalas, in which pig's feast on the floating faeces, into the two big ponds towards the south of the city polluting these water bodies severely as shown below in Fig. 7.

Fig. 7: Drain flowing into the Bada Talab Pond in Kekri

Eventually the untreated water flows out of these ponds in two ditches constructed along Deoli highway and finally into the Banas River as shown in Fig 8. below.

Fig. 8: Untreated Wastewater flowing along the Highway in Kekri Town

The untreated wastewater is contaminating both the surface and the ground water and tests were conducted to determine the extent of this contamination as follows -

1. BOD – Biochemical Oxygen Demand
2. TDS – Total Dissolved Solids
3. DO – Dissolved Oxygen
4. TC – Total Coliform
5. FC – Faecal Coliform
6. FS – Faecal Streptococci
7. AN – Ammoniacal Nitrogen
8. TN – Total Nitrogen

The results of these tests are given below –
Table 5 gives the water test results for the Machhola Talab pond

Table 5: Test Results of Machhola Talab Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	30	272	2.10mg	0.35x103	1.5x103	<0.3	0.85	9.46
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The water of the pond is contaminated as the BOD, TC, FC and TN levels are well above the prescribed limits and the DO level is much lower than the prescribed level. The TDS and FS are within permissible limits but overall the water quality is bad

The Bada Talab Pond water test results are given in Table 6 below.

Table 6: Test Results of Bada Talab Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	200	564	1.5	1100	2.4x104	<0.3	62.0	11.186
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The major nalas in the town flow into the Bada Talab pond and so it is not surprising that the water is highly polluted with only the FS being within permissible limits and AN being exceptionally high.

Fig.7: Bada Talab Pond in Kekri Town

The water quality parameters for the Chhota Talab water are given in Table 7 below

Table 7: Test Results of Chhota Talab Water

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	110	398	1.21	<0.3	1.5x103	<0.3	3.77	9.62
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The Chhota Talab is right in the downtown area and is flanked by houses which empty their wastewater directly into it as shown in Fig. 8 below. Consequently, the water here too is highly polluted.

Table 8: Test Results of Open Well Water near Ghanta Ghar

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	120	289	3.4	<0.3	<0.3	<0.3	1.34	7.36
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The test results for the open well water near Ghanta Ghar are given in Table 8 below.

Fig. 8: Chhota Talab in Kekri Town

Here too the water is highly polluted even though TDS, TC, FC and FS are within permissible limits the BOD, DO, AN and TN aren't. This indicates that the groundwater is also being contaminated due to the release of untreated wastewater into the surface water bodies and soil.

The results of the testing of water from a hand pump in downtown Kekri are given in Table 9 below.

Table 9: Test Results of Hand pump Water in Downtown Kekri

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	30	2.16	4.3	<0.3	4.6x103	<0.3	1.71	14.31
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The values for BOD, FC, AN and TN are higher than permissible while DO is less than permissible thus indicating that the deep aquifer water too is contaminated. Of especial concern is the very high level of AN.

The results of the testing of water from a hand pump in downtown Kekri are given in

Table 10: Test Results of Water at the Trenching Ground in Vaghera Road and the final drain near the Deoli highway

Test		BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml					
Observed Value	Trenching Ground	110	420	2.1	<0.3	4.6x103	<0.3	6.8	8.48
	Nala on Deoli Highway	30	684	1.52	2.1x104	>1100	<0.3	3.88	8.07
Permissible Value for Class A Water Sources (IS:2296) except for TSS		3	500	>5	50	50	50	Absent	Absent

The water at the trenching ground and the final nala leaving the town along the Deoli highway is also contaminated, especially so in the former area.

The results of the testing of the water being supplied by the Public Health Engineering Department from Bisalpur are given in Table 11 below.

Table 11: Test Results of Water from the PHED supply in Kekri Town

Test	BOD mg/l	TDS mg/l	DO mg/l	TC	FC	FS	AN mg/l	TN mg/l
				Most Prob. No./100 ml				
Observed Value	100	206	4.48	<0.3	<0.3	<0.3	1.71	3.36
Permissible Value for Class A Water Sources (IS:2296)	3	500	>5	50	50	50	Absent	Absent

The potable water being supplied by the PHED surprisingly has a very high level of BOD, AN and TN and a low level of DO indicating that some contamination is taking place in the supply line which is not surprising given the fact that these lines are situated close to the open drains as shown earlier.

V. STAFFING OF SANITATION DEPARTMENT OF KEKRI MUNICIPAL CORPORATION

The Kekri Municipality is headed by an Executive Officer. A health inspector should be in charge of the sanitation department but this post is vacant and currently this is overseen directly by the Executive Officer. This has been shown in an organogram in Fig.9 below. The engineering functions with regard to the water supply are being overseen by the Public Health Engineering Department while there are no engineering functions with regard to sewerage.

Fig. 9: Organogram of Kekri Municipality Related to Sanitation

The staff strength of the Health and Sanitation Department of the Kekri Municipality is grossly inadequate. The sanctioned strength and the actual employment is given in Table 12 below. Clearly there is severe understaffing of the sanitation department which is affecting the provision of sanitation services, especially to the slum areas.

Table 12: Staffing of Health and Sanitation Department of Kekri Municipality

Post	Sanctioned Staff	Actual Posting
Sanitation Inspector 2	01	0
Assistant Sanitation Supervisor (Jamadar)	5	3
Sanitation Workers (Permanent)	100	32

Source: Kekri Municipality

There has been under posting of staff for quite some time now and what little posting is there is getting reduced further as no new appointments are being made as the staff retire. Consequently, contractual workers are also employed and their numbers vary according to the workload.

VI. REVIEW OF FINANCES OF KEKRI MUNICIPALITY

The overall Finances of the Kekri Municipality for the years 2016-17 and 2017-18 are given in Table 13 below.

Table 13: Overall Finances of Kekri Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)	Per Capita for 2017-18* (Rs)
Revenue Receipts	1870.60	506.15	72.9	1963.95	4262
Revenue Expenditure	734.80	445.11	39.4	787.20	1708
Revenue Surplus	1135.80	61.04		1176.75	
Cap Receipts	3221.00	405.30	87.4	2195.00	4764
Cap Expenditure	4147.00	444.35	89.3	3290.00	7140
Cap Deficit	-926.00	-39.05		-1095.00	

Source: Kekri Municipality

*Calculated by assuming a cumulative population growth rate of 10% from 2011-2017

There was a high budget estimate for Revenue Receipts in 2016-17 which was not met by actuals which fell short by a substantial 72.9 Per cent. Nevertheless, the budget estimate of revenue receipts has been kept at an unrealistically high level for 2017-18. The lower actual revenue receipts have led to a much lower actual revenue expenditure for 2016-17. The actual revenue surplus for 2016-17 is only Rs 61.04 Lakhs as opposed to the estimate of Rs 1135.80 lakhs. The Capital Receipt estimates for 2016-17 too are not met by the actual receipts which are 87.4 per cent less. The actual capital expenditure for 2016-17 is a huge 89.3 per cent less than the estimates. The actual per capita revenue and capital expenditures are thus on the low side even though the estimates are fairly high. A break up of the revenue receipts is given in Table 14 below.

Table 14: Revenue Receipts of Kekri Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Taxes	50.00	65.53	31.1 excess	140.00
Leases & Cesses	366.10	127.81	65.1	357.10
Sales	860.00	3.15	99.6	860.00
Octroi Compensation	424.50	283.52	33.2	466.85
Others	170.00	26.14	84.6	140.00
Total	1870.60	506.15	72.9	1963.95

Source: Kekri Municipality

Octroi compensation given by the State Government in lieu of the municipal corporation foregoing the levying of Octroi constituted the biggest component of revenue receipts. Leases of Municipal property and various cesses like that on transfer of land is a distant second. Taxes constitute a very low 12.9 per cent of the actual revenue receipts primarily because in Rajasthan urban local bodies have limited powers to collect property tax. An urban development tax is levied only on residential plots of area greater than 2700 square feet, residential flats of area greater than 1500 square feet and commercial plots of size greater than 900 square feet. This is far below the recommendation of 25 per cent collection of revenue by urban local bodies from property taxes as mandated by the guidelines that had been prescribed by the Jawaharlal Nehru Urban Renewal Mission. There is some excess in tax collection in 2016-17 over the estimates due to better revenue mobilisation from the urban development tax. The operation and maintenance of the water supply system are also not with the Kekri Municipality but with the Public Health Engineering Department. This too is in clear violation of the guidelines of JNNURM and

constrict the powers of the Kekri Municipality. The revenue expenditure details are given in Table 15 below.

Table 15: Revenue Expenditure of Kekri Municipality 2016-17 & 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Establishment	392.30	330.47	15.8	486.70
Administration	47.50	35.13	26.0	60.50
Operation & Maintenance	275.00	56.19	79.6	190.00
Others	20.00	23.31	-16.6	50.00
Total	734.80	445.11	39.4	787.20

Source: Kekri Municipality

Most notable here is the substantial shortfall of 79.6 per cent in the O&M expenditures indicating poor operation and maintenance by the municipality. The lack of financial sustainability due to insufficient revenue mobilisation leading to a low revenue surplus and shortfalls in revenue expenditure are a matter of concern. The budgeting has been done in a very unprofessional manner so that the administration cannot easily draw any conclusions for better financial performance. The above data clearly show that the finances of the municipality are unsustainable and inadequate. Since the poor are unable to pay for services from private sources to improve their sanitation, this under spending by the municipality adversely affects their well-being and so it is inequitable also.

There is a huge shortfall in actual Capital receipts primarily because grants from the Central and State Governments have not materialised. The high estimates of loans were not met at all and this is not surprising because given the state of its finances the municipality will hardly be able to convince any lender to give it funds.

Table 16: Capital Receipts of Kekri Municipality 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
State Govt. Grants	650.00	13.60	97.9	770.00
Central Govt. Grants	1761.00	250.87	85.8	565.00
Loans	500.00	0.00	100.0	500.00
Others	310.00	140.83	54.6	360.00
Total	3221.00	405.30	87.4	2195.00

Source: Kekri Municipality

Table 17: Capital Expenditure of Kekri Municipality 2016-17 to 2017-18

Item	2016-17 Estimates (Rs Lakhs)	2016-17 Actuals (Rs Lakhs)	2016-17 Shortfall of Actuals to Estimates (%)	2017-18 Estimates (Rs Lakhs)
Buildings	500.00	32.58	93.5	500.00
Gardens	20.00	0.09	99.6	20.00
Roads	400.00	0.09	100.0	400.00
Drains & Toilets	150.00	0.09	99.9	200.00
Slum Development	660.00	121.29	81.6	465.00
Town Development	1091.00	0.00	100.0	755.00
Others	1326.00	290.21	78.1	950.00
Total	4147.00	444.35	89.3	3290.00

Source: Kekri Municipality

There is a huge shortfall in capital expenditures from the estimates for 2016-17 as a substantial amount of the grants estimated to be receivable from the central and state governments have not materialised, mainly under the crucial city development head.

The budget does not present the slippage points in revenue mobilisation and expenditures easily for financial planning to be done well. Consequently, despite heavy shortfalls in resource mobilisation and expenditure from estimates to actuals for 2016-17, these aren't addressed in the budget estimates for 2017-18.

VII. CONCLUSIONS

We can conclude as follows from the foregoing review of the overall sanitation situation in Kekri Municipality Area -

1. There is inadequate provision of sanitation services especially with regard to septage and faecal sludge management. There is gross violation of both the Water (Prevention and Control of Pollution) Act 1974 and The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 as mostly the septic tanks are being cleaned manually and the septage being disposed of into nalas and surface water bodies and open drains the wastewater is also seeping into the ground.
2. The slums are badly served or not served at all. The pit latrines that have been built are all single pit ones that will not last very long. Water supply is inadequate.
3. The tests carried out on water samples clearly indicate that both the surface water and ground water are highly contaminated and so unhealthy. The septage and faecal sludge management systems currently in place are environmentally unsustainable.
4. The finances of the Kekri Municipality are in a precarious state and are highly unsustainable about both capital and revenue income and expenditure. This has led to the provision of inadequate sanitation services and thus, an inequitable situation for the poor who are unable to procure sanitation services themselves from private operators by paying for them.
5. The method of maintaining accounts of the municipal corporation is unprofessional so that it is not possible to get information immediately as to whether revenues and expenditures are sustainable and equitable or not. Consequently, budgeting is done mechanically without considering the actual performance in revenue mobilisation and the ways in which it can be improved.

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