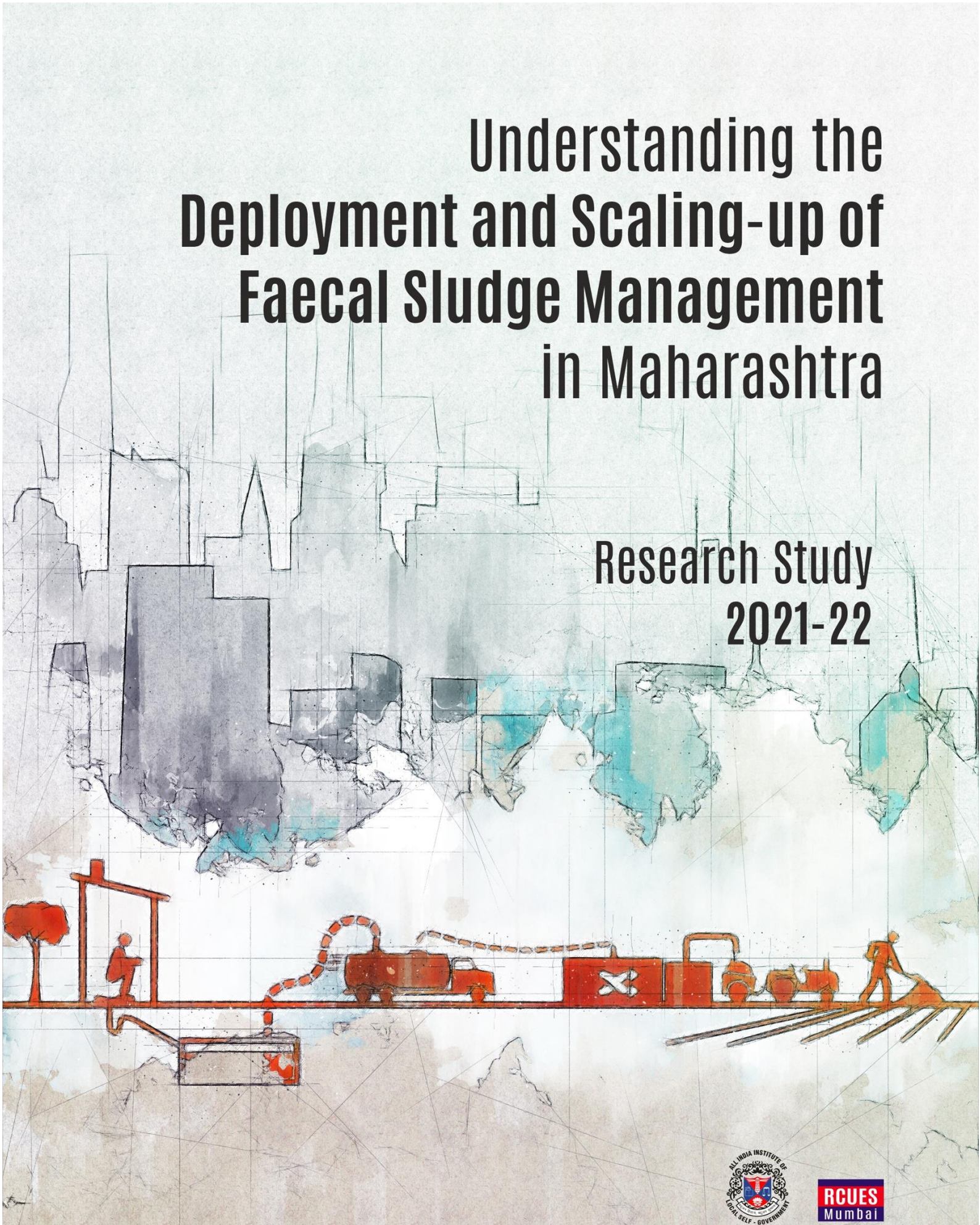
Understanding the Deployment and Scaling-up of Faecal Sludge Management in Maharashtra

Research Study 2021-22



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Preface

Management of wastewater and excreta continues to be a challenge across urban areas in countries of the Global South. As much as 95% wastewater is disposed without any treatment in some countries. While the conventional sewerage systems worked wonders in industrialised world, they are resource intensive and take a long time to implement. cites in the Global South will not be able to meet the SDG sanitation target if they were to rely only on the conventional solution. Faecal sludge management (FSM) has emerged as a solution for excreta management that offers comparable performance and is much economical and faster to implement.

In the last decade or so, India has made remarkable progress in implementing FSM, especially after the first faecal sludge treatment plant became operational in 2015. The progress is not uniform though, while some states have progressed from testing in a few towns to scaling it up across the state, others are struggling for varied reasons. Maharashtra, one of the most urbanised and industrialised states has been at the forefront in implementing FSM. The state recently commissioned its 200th FSTP. This study aimed to document and understand the developments in the state.

This qualitative study involved analysis of developments at both the state and the urban local body (ULB) levels. At the state level, various guiding documents, government resolutions and other material available in public domain were reviewed and analysed to understand the efforts of the Government of Maharashtra (GoM). The response at the ULB level was studied through case studies of cities selected to cover as much diversity as possible. The selected 4 cities are all from different districts and fall in three different divisions. They also vary in arrangements for emptying, treatment and technology used for treatment. The status of services provided in these cities was analysed based on observations the operations of the services, documents like detailed project reports, council resolutions, etc., and interviews of key personnel involved in planning process and operations of the services.

The analysis revealed the systematic and multi-pronged approach of the state government to promote FSM. It was accompanied by clear communications with expected results. The study Ialso helped understand the variety in response at the city level as well innovations being tried. While all of them have taken measures to manage faecal sludge, 3 of the 4 cities view it as a temporary solution only till, they secure funding for implementing a sewerage system. More clarity from GoM on its view of FSM vis-à-vis sewerage systems could clear the air. Nonetheless, the developments at the state level can be useful for other states to emulate for promoting FSM.

Acknowledgement

I take this opportunity to put on record our deep appreciation for the Ministry of Housing & Urban Affairs (MoHUA), Government of India (GoI) for providing us an opportunity to working for this study.

I also take this opportunity to express my gratitude towards Shri. Ranjit Chavan, President, All India Institute of Local Self Government for providing valuable guidance and support to complete this report. I also express my sincere thanks to Dr. Jairaj Phatak, IAS (Retd.), Director General, All India Institute of Local Self Government for his continued support in completing this report.

This Research Study was undertaken by Mr. Paresh Chhajed-Picha, an Independent Researcher with RCUES, AIILSG, Mumbai. I truly appreciate his efforts in timely completion of this study. I also thank the research participants - officials of Alandi, Karjat, Sangamner and Sinnar Municipal councils for agreeing to participate in the study and providing all the requested information.

I am thankful to the RCUES's Research team for their continued support in completion of this research study report.

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1. Introduction

1.1. Background

Safely managed sanitation remains a challenge across the world. Globally, nearly 80% wastewater returns to the environment without any treatment, the proportion is as high as 95% in some countries of the Global South(WWAP, 2017). The sanitation targets under goal 6 of the sustainable development goals (SDGs) go beyond access to toilets and explicitly recognise the normative goal of safe management of wastewater and excreta. The SDG framework recognises the necessity of ensuring access to safely managed sanitation to all to achieve other targets under goal 6 as well as other SDGs like ending poverty (SDG 1), improving nutrition (SDG 2), health (SDG 3), education (SDG 4), gender equality (SDG 5), urban resilience and sustainability (SDG 11), conservation of marine (SDG 14) and terrestrial (SDG 15) environments (Hyun et al., 2019; Schertenleib et al., 2021).

India has made remarkable progress in extending access to sanitation in the last few years. Since 2014, under the Swachh Bharat Mission, more than 6 million[1] households in urban areas across the country have been provided with subsidy for construction of toilets. Treatment of wastewater, however, remains a challenge. According to the inventory of sewage treatment facilities (CPCB, 2021), the country treats less than 30% of the wastewater generated in urban areas. The infrastructure is concentrated in big cities with most wastewater in small and medium towns disposed without any treatment. Further, the existing facilities are not used at their full capacity for various reasons including lack of connections, inadequate coverage of network, lack of continuous power supply, and unaffordability of operations(CPCB, 2015, 2021).

As indicated above, only a select few cities in India have sewerage systems and consequently most toilets in urban India are connected on-site systems (OSSs) like septic tanks and pits. Even in cities that have sewer network, at least a part of the population relies on OSS(Peal et al., 2014; Sahoo et al., 2020) According to a database[2], only 5 cities in the country claim to have 100% coverage of sewerage system. The National Urban Sanitation Policy (NUSP) acknowledges this fact and calls for a more inclusive, city-wide approach that takes into consideration the entire sanitation service chain, for both offsite and onsite systems (GoI, 2008). Breaking away from considering sewerage as the only solution to managing wastewater, NUSP encourages alternative, contextually appropriate solutions and coexistence of different systems appropriate to local contexts and serve varied needs within the city (GoI, 2008).

[1] Source: http://swachhbharaturban.gov.in/ last accessed on 30th August, 2021
[2] Ref: Service Levels in Urban Water and Sanitation Sector - A Status Report (2010-2011) published by the Ministry of Urban Development in 2012.

According to the census 2011, nearly 50% toilets in urban India were connected to some form of OSS. The share of has only increased as most of the toilets constructed under the SBM are also connected to either pits or septic tanks. While the OSSs safely contain faecal sludge (depending on their appropriateness to the context), they were considered a stop-gap arrangement and thus handling of faecal sludge emptied from them was overlooked in the past. For example, the high-powered expert committee (HPEC, 2011) tasked with calculating investment requirements for urban infrastructure considered only sewerage as an alternative for all cities irrespective of their size. Recent research indicates that safe handling of faecal sludge through its service chain, that is, faecal sludge management (FSM) is comparable to handling excreta through the conventional sewerage system[3] (Strande et al., 2014). It can also elevate millions of toilets connected to OSS from 'basic' to 'safely managed' sanitation, the final step towards achievement of target 6.2 of the SDGs.

Over the last decade or so, policies in India have gradually come to include non-sewered sanitation options along with conventional sewerage systems. The National Urban Sanitation Policy adopted in 2008 made no distinction between the two. The National faecal sludge and septage management (NFSSM) policy adopted in 2017 went a step further and highlighted the need and stressed on the urgency of implementing FSM in towns that rely on on-site systems (GoI, 2017). Related details have been gradually made available - the manual (CPHEEO, 2013) referred to by facility designers now includes a chapter on on-site sanitation. An advisory note (GoI, 2013)for FSSM was made available in 2013 and the revised service level benchmarks included in the NFSSM policy added indicators for on-site sanitation and FSM. Septage management has also been included in GoI's infrastructure financing programmes such as AMRUT (GoI, 2015).

Thus, there are many more options and pathways for the states and cities to improve sanitation services today than in the past. FSM particularly has emerged as an acceptable, economical and a rapidly implementable alternative. Its acceptance and implementation however vary, though the same knowledge and technologies are available to all the states. Some states like Maharashtra, Odisha, and Tamil Nadu amongst others have recognised its significance and have successfully moved from piloting FSM in a town to two to rapidly scaling it up (NITI Aayog and NFSSM Alliance, 2021). On the other hand, states like Kerala have announced their desire to adopt and implement FSM but are yet to make any significant progress (Chhajed-Picha and Narayanan, 2021; Chhajed-Picha and Narayanan, 2020).

Maharashtra, the second most populous and third most urbanised state in India has an urban population of almost 51 million and is home to nearly 14% of the country's urban population. Under

[3] FSM needs to be accompanied by greywater management for it to be equivalent to a sewerage system

the Swachh Bharat Mission (SBM), more than 6 lakh households received support to construct household level toilet and urban Maharashtra was declared open defecation free (ODF) on 1st Oct 2017. Thereafter, the state has been stressing on the need of management of faecal sludge to move towards making towns ODF+ and ODF++. The state Government of Maharashtra (GoM) has been taking measures to encourage other towns to rapidly implement FSTPs and co-treat faecal sludge where possible. As on date, nearly 200 FSTPs have been constructed or nearing completion, and many others are at various stages of planning. The state's efforts to rapidly scale up FSM has been receiving recognition at various national and international fora. Notably, the government of India has adapted the ODF, ODF+ and ODF++ framework developed by the state and its experiences have also shaped the NFSSM Policy adopted by the GoI in 2017.

1.2. Introduction to the study

Most of the developments in the state have been documented by CEPT University; their Centre for Water and Sanitation (C-WAS) has been supporting the state government since 2009 under its performance assessment system (PAS) and other projects.[4] Some other developments are documented in related resolutions of the state government (discussed in chapter 2). This study aims to independently document the various efforts at the state level and the response at the local level. It also aims to understand the challenges faced at the local level. Such a study would be useful for other towns in the state and in other parts of the country planning to deploy FSM services. It would also be useful for the State government to understand the support needed at the local level. Further, the lessons from rapid scaling-up would be useful for other departments in the state as they all strive to reach their respective targets towards achievement of the SDGs. They would also be useful for others states and countries of the Global South.

1.3. Objectives

In this context discussed above, the objectives of this research are

1. To document and assess approach to FSSM adopted by the Government of Maharashtra
2. To document the response at the local level in select towns.

The two objectives together will help understand both the State's and cities' approaches and attitude towards FSM. They will also help understand limitations (if any) that need to be addressed to make FSM services sustainable in the long run.

[4] See the Swachh Maharashtra page on PAS's website to understand the breadth of support offered to GoM and ULBs in the state

1.4. Methodology

The study is qualitative in nature. For objective 1, various documents published by the GoM after initiation of the Swachh Maharashtra Mission will be summarised and analysed to understand the support they provide to the local governments. For objective 2, developments in three to four towns will be documented. Cities with variation in approach to planning FSM, emptying services, and treatment will be selected to cover as many aspects as possible. In each city, information will be collected through qualitative interviews of key officials and related documents will be reviewed.

1.5. Structure of the report

The following chapter summarises the major documents that give an insight into the State's approach after which response of the select towns is documented. The report concludes with major findings and recommendations for the local and state governments.

2. State Government's Efforts to Promote FSSM

2.1. Introduction

According to Census of 2011, more than 45% of the population of Maharashtra lives in urban areas. Amongst the larger states in the country, it is the third most urbanised, behind Tamil Nadu (48.5%) and Kerala (47.7%). In absolute terms, 50.8 million people live in urban areas in the state, accounting for more than 10% of the country's urban population. The state has 36 districts and is divided into six administrative divisions, viz; Konkan, Nashik, Pune, Aurangabad, Amravati, and Nagpur (see Figure 1). The urban areas include 403 urban local bodies - 27 Municipal Corporations, 7 Cantonment Boards, and 17 Class A, 73 Class B, 141 Class C municipalities, and 138 Nagar Panchayats.

Figure 1 Districts and administrative divisions of Maharashtra

Source: Maps of India

According to the census of 2011, more than 92 percent of urban households in Maharashtra had access to toilets, much higher than the national average (~82%). Further, according to CPCB (2021), cities in the state have a cumulative capacity to treat 75% of the wastewater they generate. However, the state observes the highest dependence on community toilets (21%) and treatment facilities are concentrated in largest cities. As indicated in the previous chapter, the state has taken huge strides, both in constructing toilets and promoting and implementing FSM. This chapter attempts to document these various efforts through a review of documents and government resolutions (GRs) of the Government of Maharashtra (GoM) since 2015. The following sections chronologically summarise and review the major initiatives. They were identified based on the authors judgement, information

available on the websites of the NFSSM Alliance (https://nfssmalliance.org), and the performance assessment system (https://www.pas.org.in) and discussions with the AIILSG team. The initiatives have been clubbed based on the functions they served.

2.2. Strategic and technical support

In July 2015, GoM signed a memorandum of understanding with CEPT to provide strategic and technical inputs to the state government in implementing the SMMU with an aim of making all the ULBs open defecation free (ODF).[5] The guiding documents and policies discussed below were prepared as part of this support. Region-wise capacity development workshops (also discussed below) were conducted for all the ULBs to progressively guide them become ODF, ODF+ and ODF++. Besides personnel were posted at the state and divisional levels to support monitoring of the mission and ensure timely implementation.

In 2018, the UDD signed a memorandum of understanding with the Bill and Melinda Gates Foundation (BMGF) for supporting implementation of the SMMU. Accordingly, a technical support unit (TSU) was established by CEPT University. As all the urban areas were already ODF, the TSU is therefore tasked to support preparation and implementation of FSM plans in all cities of the state. A programme advisory committee (PAC) chaired by the Principal Secretary, UDD and includes representation from DMA, Mission directorate, BMGF, and CWAS, CEPT University was formed in January 2020 to advice and guide the TSU.[6]

2.3. Guiding documents

ODF Handbook

The ODF handbook (SMMU, 2016) was published by the GoM in February 2016. It includes a foreword by the Chief Minister, Key message by the Minister of State which highlights the importance of the mission and priority accorded by the state's political leadership. The handbook lists the initiatives of the State government to facilitate cities implement SMMU with a focus on increasing coverage of toilets. It provides an overview of the processes adopted for planning, involving the community, implementation, monitoring, and validation of ODF status. It also lists the achievements at the state level and describes innovative practices adopted by various cities.

Most importantly, it includes the ODF, ODF+ and ODF++ framework that encourages household level toilets and faecal sludge management. That is, cities are required to increase coverage of household level toilets and establish systems for management of faecal sludge, greywater, and effluent from

[5] Available at https://www.pas.org.in/Portal/document/UrbanSanitation/uploads/MoU_GoM.PDF accessed on 1st of March 2022

[6] Ref: GoM GR SMU 2020/ Cr no. 13/ UD – 34 dated 17thJanuary 2020

septic tanks to move from simply ODF to ODF+ and ODF++ (see Table 1). The former is particularly important as 21% of the state's urban population relies on community toilets, their upkeep and maintenance are a continuous financial burden on the ULBs. This framework has also been adopted by the Ministry of Housing and Urban Affairs (MoHUA) at the national level.

Table 1 The ODF, ODF+ and ODF++ framework adopted by GoM

	Elimination of OD practices	Access to toilets	Conveyance and treatment of faecal waste
ODF City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• All the properties in the city have access to either own toilet or functional community/ public toilet • Floating population in the city has an access to sufficient and functional public toilets	• All toilets are connected to a disposal system
ODF+ City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• At least **80%** of residential properties in the city have access to own toilets • Remaining properties and floating population in the city have access to functional community/ public toilets	• All toilets are connected to a disposal system • Regular and safe **collection, conveyance and treatment of all the feacal matter**
ODF++ City	• Not a single person found defecating in the open • No traces of faeces are visible in the city at any time of the day.	• At least **95%** of residential properties in the city have access to own toilets • Remaining properties and floating population in the city have access to functional community/public toilets	• All toilets are connected to safe disposal system • Regular **safe collection, conveyance and treatment of all feacal matter and waste water** including septic tank effluent and grey water

Source: (SMMU, 2016c)

Guidelines for septage management in Maharashtra

The guidelines (SMMU, 2016b) prepared by CEPT and published by the SMMU in February 2016 are aimed to equip the ULBs to prepare an integrated FSM plan and provide or facilitate FSM services. It makes available the technical and procedural knowledge required for the purpose. It covers all components of the FSM service chain, viz; containment, emptying, transport, treatment, and disposal/reuse in terms of likely existing situation and goals for each component (see Figure 2).

Technical guidance for planning FSM includes data collection and household survey templates, technical details related to OSS, deciding on the capacity and the number of emptying vehicles needed, identifying land parcels that meet regulatory requirements, and various technological alternatives for treatment. Guidance for operations include safety measures to protect the workers, inspection of OSS

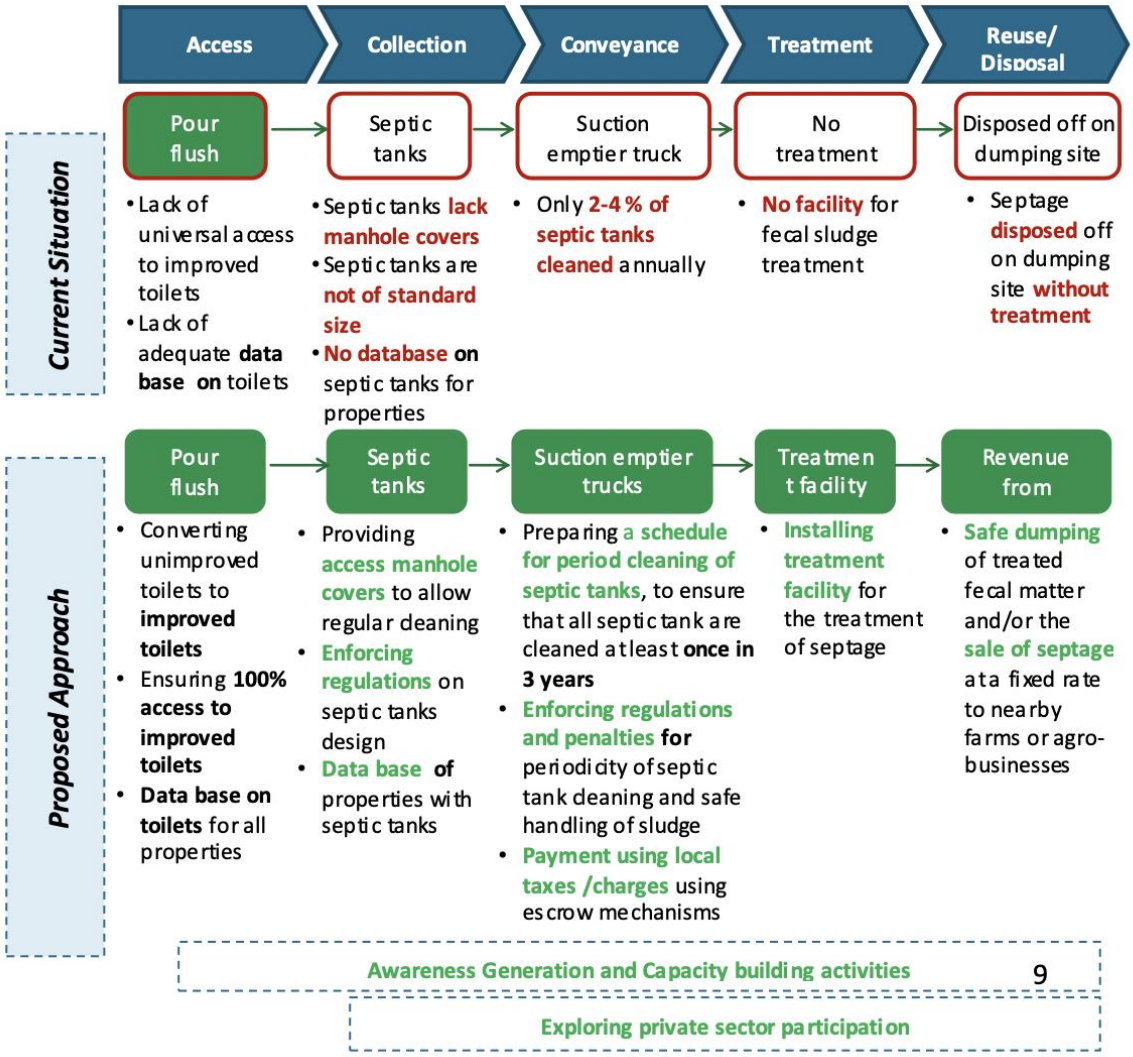

Figure 2 Goals for each component of the FSM service chain

Source: SMMU (2016a)

before and after emptying, manifest forms for record keeping, and monitoring and feedback mechanisms

In addition, guidance for overarching elements like involving the private sector in providing emptying services and operations of the treatment facility, mechanisms for monitoring services, generating awareness, mobilising financial resources to sustain the services is also included.

Guidebook for Urban Local Bodies to Implement Septage Management Plan

The guidebook (SMMU, 2016a) was prepared by CEPT and published by the SMMU in September 2016, approximately 7 months after publication of the guidelines. Like the ODF handbook, the guidebook also includes a foreword by the Chief Minister and a Key message by the Minister of State. Both the foreword and key message stress on the key role of the ULBs and the facilitative role of the State Government in implementing the mission.

The guidebook starts with globally acclaimed best practices. Policies and clearly spelt out institutional roles, engagement of the private sector turned around the situation in Malaysia in a period of one and a half decade. Local regulation in the Philippines focused on quality of OSS to ensure safe containment of FS thereby arrest groundwater pollution. It was accompanied by heavy penalties for violations. They also insisted on periodic desludging and ensured emptied FS reaches treatment facilities through robust monitoring systems. In Vietnam, a new legislation in 2014 emphasised on FSM, and resource recovery. Participation of the private sector was encouraged with support from international financial institutions. Successful demonstrations in three large cities led to other cities following their footsteps. Research to identify appropriate technologies, acceptance of treated FS products, business models was conducted. Importantly, cost-recovery was aimed at, and tariffs increased gradually.

Taking cues from the best practices, the guidebook expands substantially over the guidelines. It emphasises on a wider situational assessment that covers the service chain, historical and existing practices of construction of OSS and emptying, existing formal and informal service provision arrangements, the regulatory arrangements that need to be conformed with, and the ability of the city to mobilise funds for capital expenditure and meet operational expenses from a regular revenue stream. It includes guidance on assessment of all these aspects.

The guidebook stresses on sub-structures that safely contain faecal sludge and their periodic emptying through scheduled desludging. Regulatory criteria that need to be met by land parcels where treatment facilities are proposed are summarised. The potential role of the private sector in both emptying and operating treatment facilities as well as various contractual arrangements are also discussed. Information that needs to be recorded for regular monitoring of performance is pointed out and, manifest forms for record keeping included. Other systems such as MIS, grievance redressal system, use of GIS for planning routes and GPS for monitoring movement of vehicles are also presented. The guidebook stresses on creation of a property level database of OSS, their type, size, emptying details and link it with property tax database of the city.

ULBs can gradually implement and improve performance of FSM services in phases. Resolutions of the council can be enacted as and when there is consensus amongst the leadership. Unlike the guidelines, the guidebook is more graphical, and the text is not as dense to make it easy to refer for officials overwhelmed by English language.

2.4. Government resolutions

Initiating the Swachh Maharashtra Mission (Urban)

In May 2015, approximately 8 months after the launch of the Swachh Bharat Mission (SBM), the Government of Maharashtra resolved to implement Swachh Maharashtra Mission (urban) (SMMU) on

the lines of SBM. It was decided that the Urban Development department (UDD) would oversee construction of toilets including capacity development, making available the required resources, publicising, and awareness generation in class A and class B municipalities while the Water Supply and Sanitation department (WSSD) would do the same in class C municipalities and Nagar Panchayats. UDD was solely responsible for SWM across all the ULBs.

The two main objectives of the mission were to eradicate open defecation, and eliminate the social, environmental and health hazards from insanitary and single pit toilets; and improve solid waste management in the urban areas. ULBs were advised to conduct surveys to identify households practicing open defecation or using insanitary or single pit toilets for more accurate estimation, till then the census 2011 numbers could be used. GoM increased the subsidy by Rs 8,000 (except for Brihan Mumbai Corporation where it was Rs 5,000) for individual household level toilets. Later it also suggested ULBs to provide an additional subsidy of upto Rs 5,000 through the 14th Finance Commission grants received by them. For management of solid waste, ULBs were suggested to prepare a detailed project report (DPR) ensuring compliance with the MSW rules 2000 and its subsequent amendments. While the costs of DPR preparation were to be borne by the Union Government, a total of 25% of the total cost as viability gap funding was to be made available jointly by the State and the Union Governments. The ULBs were advised to mobilise funds through corporate social responsibility, private sector participation, and other innovative mechanisms (listed in paragraph 3.4 in the GR) for implementation of the mission.

The State Mission Directorate headed by an officer of the Joint Secretary or Deputy Secretary rank and formation of a project Management Unit (PMU) to support the Mission Director was already approved in April 2015[7]. The Director was tasked with coordinating with implementing departments, overseeing daily functioning, and ensuring timely implementation. Appointment of experts on contractual basis for the PMU; one each for capacity development; information, education, and communication (IEC), SWM, monitoring and evaluation (M&E), information technology was also approved.

Through this GR, three committees to oversee the implementation of the mission were constituted, viz; the State Regulatory Board (राज्य नियामक मंडळ), High Powered Committee (उच्चाधिकार समिति), and Monitoring and Implementation Committee (संनियंत्रण आणि अंमलबजावणी समिती). The

[7] GR SMU 2015/ Cr no. 23/ UD - 34 dated 24th April 2015

Regulatory board is highest of the three committees and chaired by the Chief Minister; it includes Ministers of Finance, Women and Child Development, WSSD, UDD, and Commerce; Secretaries of the concerned departments, Directorate of Municipal Affairs, representatives of ULBs, civil society, and industry. It is tasked with providing guidance to the other committees and periodically review progress. The High-powered committee is chaired by the Principal Secretary and consists of Secretaries of relevant departments and representative of the Ministry of Urban Development (now MoHUA). It is tasked with policy making, mobilising additional resources, ensuring coordination between the various departments and approving plans and consultants suggested by the by the implementation committee. The monitoring and implementation committee is chaired by the Secretary, UDD and includes Secretaries or representatives of concerned departments. It is mandated to strategize and approve plans and DPRs submitted by the ULBs.

Incentive grant to cities for achieving and sustaining ODF status

In March 2016, GoM announced incentive grants of amounts ranging from 1 to 2 crores for ULBs achieving ODF status and sustaining it (see Table **2**). A city was eligible for 30% of the grant after an inspection by a state level committee. The remaining 70% would be disbursed after a third-party assessment confirming sustenance of the ODF status after a period of 6 months. Similarly, ULBs would also be also for an additional grant of the same amount disbursed in the same way for becoming clean (implementing improved SWM system).

Table 2 Amount of incentive grant to ULBs for achieving and sustaining ODF status

Municipality type	**Incentive grant**
Class A	Rs 2.0 Cr
Class B	Rs 1.5 Cr
Class C and Nagar Panchayat	Rs 1.0 Cr
Ref: SMU 2016/ Cr no. 23/ UD – 34 dated 16th March 2016	

The GR sanctioned the grants to be paid from the UDD's budget as special grants for featured projects. The GR also sanctioned use of the grants for projects for sustenance and improvement of the city's status in both ODF and cleanliness ladders. Projects like decentralised treatment, FSM, support households currently using community toilets build their own toilets, development and conservation of green zones, conservation and beautification of water sources, aspects related to SWM could be implemented.

Earlier, GoM had also made it compulsory for ULBs to spend 50% of the basic grant received from the 14th Finance Commission on aspects related to SMMU (TFC – 8015/Cr no. 106/ UD – 04 dated 3rd August 2015)

Sustaining ODF status

This GR published on 17th March 2017, approximately 6 months before all the ULBs were declared ODF refers to the ODF, ODF+ and ODF++ framework proposed through ODF Handbook to suggest to cities to encourage more households to build their own toilets and take measures to manage faecal sludge contained in on-site systems. This was felt necessary to sustain ODF status and deepen the environmental and public health benefits of the same. It allows ULBs to utilise the incentive grant awarded by the state for becoming ODF as well as grants of the 14th Finance Commission for the purpose. Further, cities claiming to achieve ODF+ and/or ODF++ status would be certified after inspection.

Cotreatment of FS

In December 2018, a litter over a year after the state was declared ODF, a GoM GR (SMU 2018/ Cr no. 351/ UD – 34 dated 15th December 2018) ordered all the cities that have sewage treatment facilities to co-treat faecal sludge from OSS in parts of the city not served by the sewerage network. The GR identified 35 such cities including 20 Municipal Corporations, 15 Municipalities. Further, the GR orders cities that do not have their own STP but lie in 20 km radii of a city which has a STP to cotreat their FS at the STP. The GR identifies 36 towns that would need to cotreat their FS at STPs belonging to 21 cities. While the GR makes it mandatory for the host cities to accept FS from these towns, it also disallows levying any charge for the service.

The CPHEEO manual and GoI's Advisory note (related extracts added as annexure to the GR) considers co-treatment viable provided the STP has spare capacity. As the population connected to sewerage network increases, the spare capacity will reduce; co-treatment therefore is a temporary solution unless the STP's capacity is augmented. Further, a septage receiving station which includes an unloading area, a storage tank and grinder pumps is needed at STPs to ensure the FS can be gradually released for treatment. Further, while volume of FS is unlikely to be a challenge, the high BOD of FS needs to be considered to calculate the quantum of FS it can receive. It is not clear from the GR if the ability of the STP's to receive FS was assessed.

Approval of independent FSTPs

In November 2019, GoM pre-approved FSTPs for 311 towns through a GR (SMU 2019/ Cr no. 124/ UD – 34 dated 8th November 2019) using sludge drying bed (SDB) technology. CEPT had earlier suggested four technological alternatives for treatment, viz; sludge drying bed (SDB), planted sludge drying bed (PSDB), moving bed biofilm reactor (MBBR), and Upflow anaerobic sludge blanket (UASB). All the four technologies were assessed and approved by the National Environmental Engineering Research Institute (NEERI). SDB was selected for its simplicity in both construction and operations, and local

availability of the required material and capacity for construction. Further, it can be designed to use gravity for flow and thus not depend on power supply or add to power bills of the ULBs.

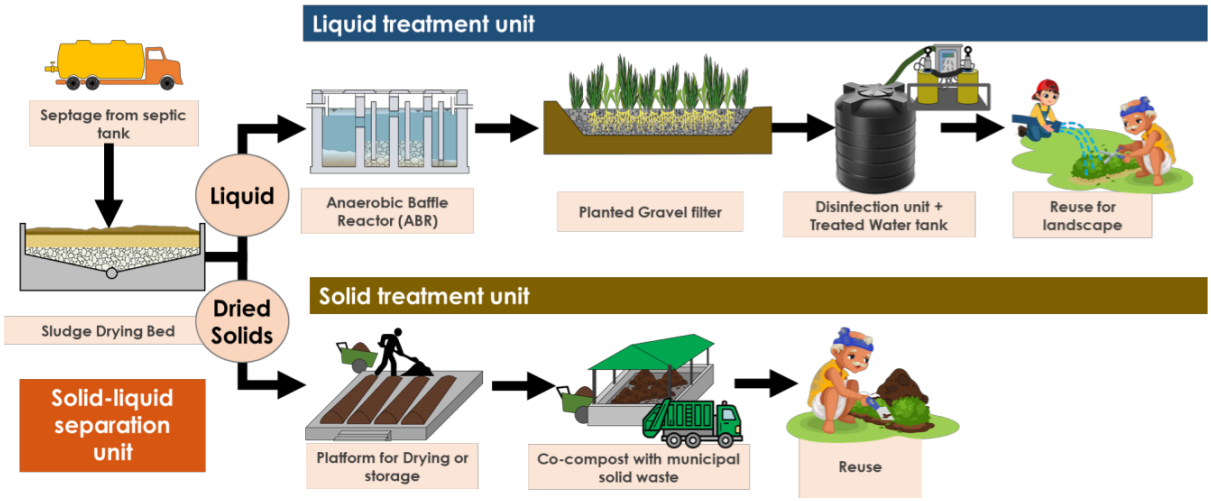

Figure 3 Process and flow diagram of a SDB based FSTP

Source: C-WAS (2020)

Based on population, cities were categorised into 5 classes and a standard capacity was determined for each class of cities. Type plans and type estimates based on regional schedule of rates were already approved by the Maharashtra Jeevan Pradhikaran (MJP), the state's nodal technical agency. An additional lead charges for materials of up to 5% of the approved costs were also allowed. Any escalation in the project cost was also to be borne by the respective ULB. Measurement sheets and abstract sheets used for estimating the costs are added as annexure in the GR.

The capital expenditure was to be met by the ULB through the grant received from the 14th Finance Commission, 50% of which was reserved for implementation of the SMMU. The ULBs were directed to carve out a piece of land from the land parcel used for management of solid waste management (dumping or landfill). ULBs were suggested to advertise a short-term invitation for bids, finalise the bid by 20th November (less than 2 weeks after the publication of this GR), sign an agreement and issue a work-order by the 30th of November (in another 10 days). The publication of a short-term invitation (7 days) for bids was also approved by the GR.

The ULBs were required to strictly adhere to the pre-approved type plan. Particularly, not altering dimensions of the components and maintaining gravity flow are stressed in the GR. Further, the ULBs were required to submit an undertaking signed by their Chief Officer stating that the land parcel has a clear title and meets CPHEEO's conditions for locating such facilities, shall ensure quality control, ensure gravity flow, and implement the project within 45 days after approval. By signing the

undertaking, the ULBs also agreed to operate the FSTP from its own human and financial resources, allow private emptying service providers to deposit FS, conduct quality tests on influent and effluent, and develop and maintain a robust record keeping system.

Table 3 Division-wise approved cost of FSTP and number of cities in each size-class

Division (# cities)	Population	< 15K	15-25k	25-50k	50-75k	> 75k
	Approved capacity (KLD)	3	5	10	15	20
Amravati (50)	Approved cost (Rs)	9,09,275	11,13,325	17,06,918	21,61,964	25,39,156
	Number of cities	10	13	15	8	4
Nagpur (60)	Approved cost (Rs)	9,09,275	11,13,325	17,06,918	21,61,964	25,39,156
	Number of cities	33	8	12	2	5
Konkan (38)	Approved cost (Rs)	9,52,087	11,70,904	18,07,415	22,95,571	27,00,136
	Number of cities	21	9	3	4	1
Nashik (50)	Approved cost (Rs)	9,20,767	11,28,940	17,34,194	21,99,021	25,84,520
	Number of cities	6	10	20	5	9
Pune (39)	Approved cost (Rs)	9,45,379	11,61,091	17,89,207	22,69,533	26,67,253
	Number of cities	11	12	11	3	2
Aurangabad (74)	Approved cost (Rs)	9,18,560	11,25,701	17,28,404	21,90,253	25,72,962
	Number of cities	18	18	26	4	8
Maharashtra (311)		99	70	87	26	29

Source: Compiled by the author

Approval of hybrid core technology

In April 2021, GoM vide GR (SMU 2020/ Cr no. 85/ UD – 34 dated 19th April 2021) approved hybrid core technology (HCT) as an alternative technology that ULBs could employ in their FSTPs. Compared to SDBs, this technology requires smaller land area and hence could accommodate a larger FSTP which would in turn allow the ULB to deploy scheduled desludging services. Further, some ULBs had reported

lack of owned land, HCT would save them money in acquisition of land. The capital cost of HCT based FSTP ranges from Rs 98 lakhs for 5KLD to Rs 1.5 crore for a 20 KLD unit. That is, depending on the size, the HCT based FSTP costs 5 to 8 times than that based on SDB.[8]

While designs and technical details as well as measurement sheet and abstracts for plants of 5, 10 and 20 KLD were added as annexure to the GR, the ULB would need to hire a technical service provider for designing a plant that meet the treatment norms. Further, the cost calculations are based on DSR for Konkan division, ULBs in other divisions would need to prepare an estimate. FSTPs using HCT are also required to follow the standard administrative and technical sanctioning process. Also important to note that HCT was not among the four technologies that was assessed by NEERI.

GR: Administrative Sanction for revised capacity of FSTPs

Through this GR (SMU 2020/ Cr no. 85/ UD – 34 dated 6th May 2021), administrative sanction was accorded to FSTPs for 311 cities[9], ULBs could choose either SDB or HCT for treatment. Approval was also accorded for ULBs to invite tenders by adhering to prevalent rules. The capital expenditure could be funded from the grant of the Finance Commission, or the incentive grant received for achieving ODF status, or own funds, or special projects scheme (वैष्ट्यपूर्ण योजना), or funds approved for implementation of the detailed project report for SWM.

Table 4 Range of FSTP capacities in KLD and number of cities for which FSTPs are approved for each FSTP capacity range

FSTP capacity (KLD)	Number of cities
< 5	6
6 – 10	36
11 – 20	85
21 – 30	70
31 – 40	46
41 – 50	33
51 – 75	20
76 – 100	12
>100	5
Total	**313**

Source: Prepared by the author based on Annexure A of the corrigendum dated 5th July 2021

[8] Important to note that the drawings included in the annexure and the measurement sheets indicate expenses related to ancillary facilities including guard room and access roads in addition to the treatment plant. For SDB, only cost of treatment plant was calculated.

[9] The original GR lists 307 cities. The list and capacities were corrected through a corrigendum (SMU 2020/ Cr no. 85/ UD – 34 dated 5th July 2021). The corrigendum lists capacities for 311 cities, 40 of which were not included in the GR dated 15th December 2018 indicating these to be new ULBs. The GR also mentions that FSM is practiced in 73 cities.

Importantly, the capacities for the FSTPs are calculated for scheduled desludging services for its population in the year 2030. The capacities range from 3 KLD for Panhala in Kolhapur district to 267 KLD for Parbhani. The change in capacities compared to those included in the GR dated 8th November 2019 ranged from 10 – 1235 percent. For 265 cities, the change in capacity was more than 100%.

2.5. Capacity development workshops

CEPT university as part its MoU and later as part of TSU conducted division-wise capacity development workshops for all ULBS in the state. They were conducted in partnership with All India Institute of Local Self-Government, their long-standing partner. The workshops were conducted in three stages based on the needs of the respective stage. The first focused on implementation of the sanitation component of the SMMU, that is becoming open defecation free through construction of individual household level latrines, community, and public toilets (PAS Project, n.d.). The presentations focused on good practices related to construction of toilets and OSS including their design, raising awareness to increase demand, organisational arrangements for timely processing of applications and disbursal of subsidy, calculating financial requirements and mobilising funds for additional subsidy, and strategies for sustaining the use of toilets. Stories of cities that observed no or very low open defecation according to the census 2011 were shared and discussed to demonstrate the possibility. Later, success stories including the strategies adopted by the 19 cities that became ODF in the first phase were documented for dissemination.

In the second stage, as more and more cities became ODF, the focus moved on sustaining the status and facilitating them to gradually achieve ODF+ status (C-WAS, n.d.). The key components of the presentations at this stage were definitions of ODF, ODF+ and ODF++ cities, validation framework adopted by the state to certify ODF status, ensuring quality of construction of toilets as well as the septic tank while increasing coverage of household level toilets, and integrated faecal sludge management.

In August - September 2018, the TSU in partnership with the sanitation capacity building platform (SCBP), an initiative of the NIUA conducted out one-day capacity development workshops for 134 cities to guide them become ODF++ (C-WAS, 2018a). In this workshop, the FSM service chain, and its necessity where toilets are connected to OSS was emphasised (C-WAS, 2018b). Its necessity to sustain and extend benefits accruing from becoming ODF was also stressed. These workshops were hosted by small cities that had already become started planning for citywide FSM services.

Various aspects of planning integrated FSM covered during the workshop include - technological alternatives for emptying and treatment, relevant statutes and standards that need to be met, scheduled v/s on-demand emptying, various factors that influence and impact service provision,

possible contractual arrangements for involving the private sector in emptying operations of FSTP, occupational safety of workers, mechanisms for raising awareness to ensure compliance, monitoring mechanisms including formats that could be used, and potential sources for financing capital and operating expenses. These were demonstrated through relevant case studies from the state and other parts of the country. The host city also made a presentation about its plan and on-going work towards becoming ODF++. The officials and elected representatives from each city also prepared plans for scheduled desludging in terms of equipment and treatment capacity required, estimated operating expenses, and deliberated on suitable treatment technology, implementation mechanisms, potential challenges in implementing the plan.

2.6. Conclusion

This chapter aimed to document the efforts of the State Government of Maharashtra for promoting FSM especially in smaller cities. It finds that GoM has made the necessary technical, managerial, and procedural knowledge available to local governments. Arrangements for monitoring the implementation of the mission have also been made to keep pace. Further, it has made efforts to ensure the knowledge reaches the officials and elected representations at the ULB level through successive capacity development workshops. The workshops have also been conduits to convey the arrangements for certification and validation. GoM did not make any financial arrangements instead prioritised implementation of FSTPs through ULB's own funds. Table 5 lists the major initiatives of GoM and the significance of each of them.

The support of the political leadership is the most striking feature of the development in the state. The chief minister with other ministers oversees the mission through the regulatory board formed for the purpose. Some of the key documents include forewords by the CM and MoS which also exhibits the priority accorded to the mission by the political leadership. Through its resolutions, GoM ensured the local administration and leadership accorded to the mission the same priority. All the various arrangements discussed in this chapter were possible only because of the priority accorded to it by the political leadership.

Table 5 GoM's major initiatives to promote FSM in urban areas

Date	Event	Significance
15th May 2015	GR: Initiating Swachh Maharashtra Mission Urban (SMMU)	• Additional subsidy from of Rs 8000 for construction of an IHHL • Institutional arrangements for implementation and monitoring progress of the mission
	Capacity development workshop – Stage 1	• Focus on timely construction of IHHLs and community and public toilets to become ODF

Feb 2016	ODF Handbook	• Proposes the ODF, ODF+ and ODF++ framework which places emphasis on FSM to rise in the ladder
Feb 2016	Septage Management Guidelines	• Makes available technical and procedural knowledge for planning and implementing FSM
28 March 2016	GR: Incentive grant for becoming and sustaining ODF	• GoM offers Municipal councils and nagar panchayats an incentive grant ranging from 1 to 2 Cr for achieving and sustaining ODF status • Also lists works that can be implemented from the grant
September 2016	Guidebook for Urban Local Bodies to Implement Septage Management Plan	• Expands on guidelines to include legal, organisational, and financial aspects of planning and implementing FSM
17 March 2017	GR: Sustaining ODF	• Conveys to ULBs the necessity to build more household level toilets and implementing FSM are necessary for sustaining ODF status • Allows cities to use incentive received for achieving ODF status and grants from the 14th FC for the purpose • Certification after assessment by a state level committee
August-September 2018	Stage 3 capacity development workshops	• Focus on implementing scheduled emptying and ensuring treatment in 134 cities
15th Dec 2018	GR: Co-treatment of FS	• Mandates cities with STPs to co-treat FS; identifies 35 such cities • For cities that have a STP in 20 km radii, mandates co-treatment at such STP; identifies 36 such cities • Provides necessary information form the CPHEEO manual and the Advisory (GoI 2013) as annexes)
8th Nov 2019	GR: Approval of Independent FSTPs	• Approval of FSTPs for 311 cities • Includes capacity for each city and technical details
19th April 2021	GR: Approval of hybrid core technology for treatment	• Allows cities to choose between SDB and HCT based on availability of land
6th May 2021	GR: Revised capacity of independent FSTPs and Corrigendum dated 5th July 2021	• Capacity of independent FSTPs revised to accommodate scheduled desludging and population projected for 2030

3. Response of the cities

3.1. Introduction

The previous chapter presented the various initiatives of the State Government of Maharashtra to promote and encourage urban local governments to plan and implement faecal sludge management. It included providing guidance for planning, capacity development, and accessing resources. This chapter attempts to understand the response at the local level. It documents developments and key features in 4 cities that have initiated FSM, viz; Sinnar, Sangamner, Alandi, and Karjat. The cities were selected to cover as many variations as possible in terms of geography, size, emptying practice, treatment technology (based on GRs), etc. The 4 cities together represent three divisions and all fall in different districts (see Figure 4). While Alandi has been directed to co-treat its faecal sludge, Sangamner and Karjat were directed to build FSTPs. Sinnar had a FSTP even before the GR was published. All the cities are not very far from Mumbai, necessitated due to the evolving covid situation. Further, the field work was delayed due to the third wave of covid in the state. Important to note that while developments in Sinnar have been documented and presented at various fora, little information about sanitation practices and recent developments in other towns is available in public domain.

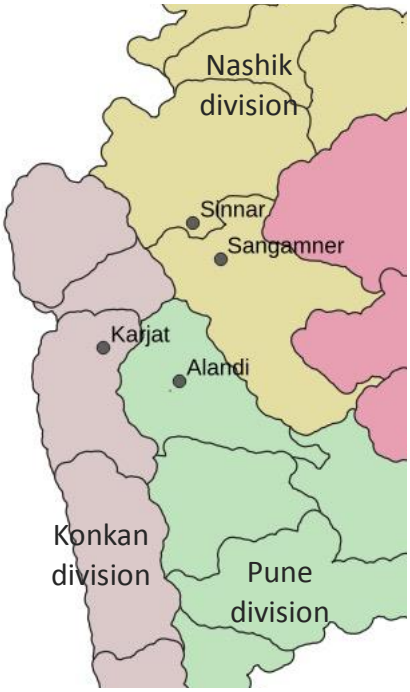

Figure 4 Location of cities selected for the study

Information for all the cities was collected through informational interviews with key officials and other personnel they directed to (see Table 6). The intent of the interviews was to understand the status of the FSM service chain, the service provision process, and the planning process. Unique features of the cases (if any) were also captured in the process. Documents such as detailed project reports, resolutions of the council, advertisements, logbooks, digital dashboards, etc. were also accessed. They were accompanied by observations of the facilities, and service provision process in Sinnar and Karjat. If needed, the officials were telephonically contacted later for clarifications and follow-up questions. The following sections present the findings in each of the four cities followed by common observations.

Table 6 City-wise list of personnel interviewed for this research

City	Personnel interviewed	Designation
Karjat (1st and 8th Feb)	Mr Sudam Mhase	Sanitary Inspector
	Mr Dinesh Hiray	Incharge - Dumping ground (additional charge)
	Mr Varun Salunke	Owner and Operator, Construction and demolition waste processing unit
Sinnar (15-16 Feb)	Mr Ravikant Deshmukh	Sanitary Inspector
	Mr Arfaat Attar	Research Associate, C-WAS, CEPT University
Sangamner (17-18 Feb)	Mr Rahul Wagh	Chief Officer
	Mr Amjad Pathan	Sanitary Inspector
	Mr. Ashwin Pund	Supervisor, Health Section
Alandi (22 Feb)	Ankush Jadhav	Chief Officer
	Ms Sheetal Jadhav	Supervisor, Health Section
	Mr Gaikwad	Planning Assistant, Civil works section

3.2. Sinnar

Sinnar is a class B municipality in Nashik District and headquarters of Sinnar Taluka. Located on the banks of River Saraswati, it lies 30 km southeast of Nashik on the Nashik-Pune highway. According to the Census 2011, the town has a population of more than 65 thousand. Two industrial estates, viz; Malegaon and Musalgaon established by the Maharashtra Industrial Development Corporation (MIDC) are major contributors to its economy and rapid growth. The 51 sq. km town is administered by the Sinnar Municipal Council (SMC).

The town commissioned its FSTP in March 2019, almost 3 quarters before the state's GR. It is one of the two towns receiving support from C-WAS, CEPT University through funding from the Bill and Melinda Gates Foundation (BMGF) for testing and implementing FSM. CEPT's association with the town began in 2012; it was one of the 4 towns for which CEPT prepared CSP at the behest of water and sanitation department (WSSD) of the GoM. The CSP was prepared through a comprehensive planning process in close collaboration with all the local stakeholders.[10] Stage-wise presentations of the situational assessment, technological and financial alternatives, and inputs of local stakeholders were periodically sought and incorporated in the plan. The CSP stressed on the need for increasing coverage of toilets and management of wastewater. Thereafter, C-WAS has continued to support the

[10] The author was part of the CEPT team involved in preparation of the CSP.

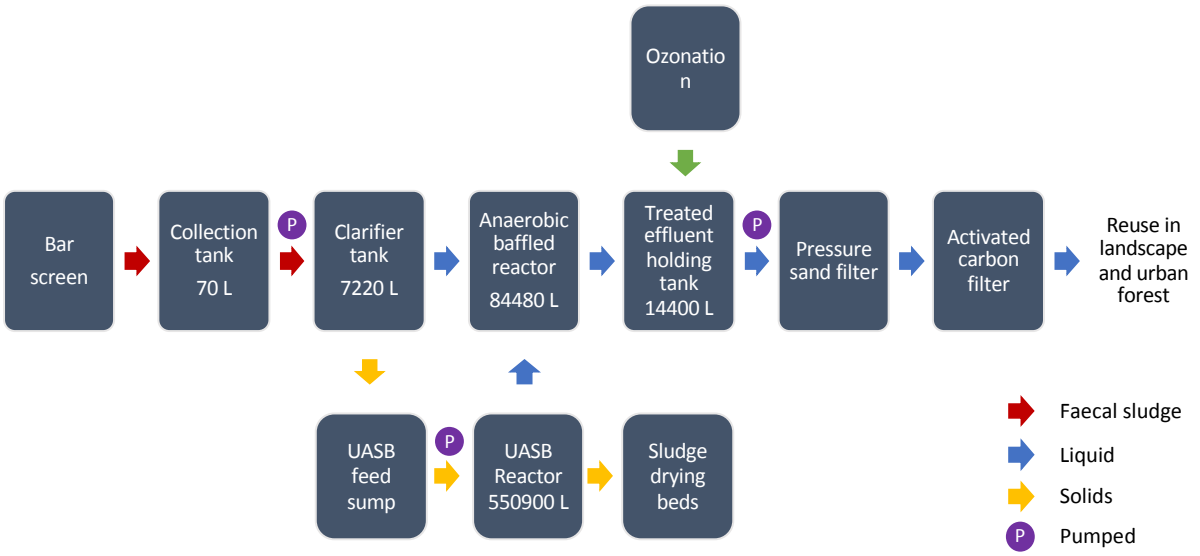

Figure 5 Treatment process and flow diagram of the FSTP in Sinnar

Source: Created by the author based on information collected from the site

town in implementation of various sanitation related initiates including the Swachh Bharat Mission, improving the toilet block in a Zilla Parishad school through crowdfunding, decentralised grey water treatment, continuing service provision through the covid crises, etc.

CEPT also prepared the detailed project report for a 70 KLD FSTP using up flow anaerobic sludge blanket (UASB) and anaerobic baffled reactor (ABR). According to the DPR, Sinnar had decided to initiate scheduled desludging wherein, every OSS in the town was to be emptied once every three years. A private service provider had already been identified through competitive bidding and a contract awarded. However, the city was then simply dumping the emptied FS on its dumping ground and scheduled desludging could not be initiated till a treatment facility was put in place. Since the town has been and continues to seek funding from the State Government for sewerage system, UASB technology was preferred as it can also be used for treating organic solid waste. The DPR of the FSTP clearly states as and when the city's proposal for network and STP is approved and commissioned, the FSTP would be deployed managing organic solid waste. Whether the DPR for SWM takes cognisance of this could not be ascertained.

In May 2017, Sinnar floated a design, build, operate, and transfer (DBOT) based tender. The successful bidder would be required to get the required approvals and operate the facility for a period of 3 years after commissioning. In August 2017, the contract was awarded to a Pune based firm with experience of operating STPs in different parts of the country. All the capital expenditure of more than Rs 2 Crore was borne by the ULB through its own funds. Further, it also had to procure a parcel of land for the

facility. Though a part of its dumping ground was allocated for the FSTP[11], implementation of projects identified in the SWM DPR including a slab for windrow composting, shed for secondary segregation, and preparing inorganic waste for recycling were also being planned on the same piece of land. The council therefore purchased an adjacent land parcel for the FSTP.

After the FSTP was commissioned in March 2019, scheduled desludging services were initiated. Though, the PSP had promised to employ three vehicles it has been operating only two, one each of 3000L and 5000L capacity. The ULB's trolley mounted 3000L emptier is used to empty OSS of public and community toilets as well as emergency services. The town has been divided into three zones and a zone is focused upon every year. Based on the property tax database, properties are identified on a weekly basis and informed in advance so that they can keep the access covers open. According to its dashboard, 98% of the times scheduled desludging could be executed and 84% households had removed or loosened their access covers to provide the emptier easy access.

All the FS emptied in the town is delivered to the FSTP, an elaborate system (discussed later) to ensure the same has been developed. Till date, more than seventeen thousand kl faecal sludge collected through 4,358 trips has been treated at the facility.[12] The treated liquid component is reused for landscaping and watering the urban forest. The dried solids are provided to farmers free of cost. A self-help group (SHG) was awarded a contract through a competitive bidding process (restricted to SHGs) to manage and maintain the landscape and the urban forest.

An elaborate monitoring system has been developed to oversee operations handled by multiple parties. All the emptier vehicles have GPS installed and personnel from the ULB accompany vehicles operated by the PSP. Details of the vehicle, in and out times, the volume of FS collected is recorded along with other details of the property and the OSS. The form is signed by the owner, and they retain a copy of the same. A copy of the form is submitted to the treatment facility operator when the FS is delivered. A

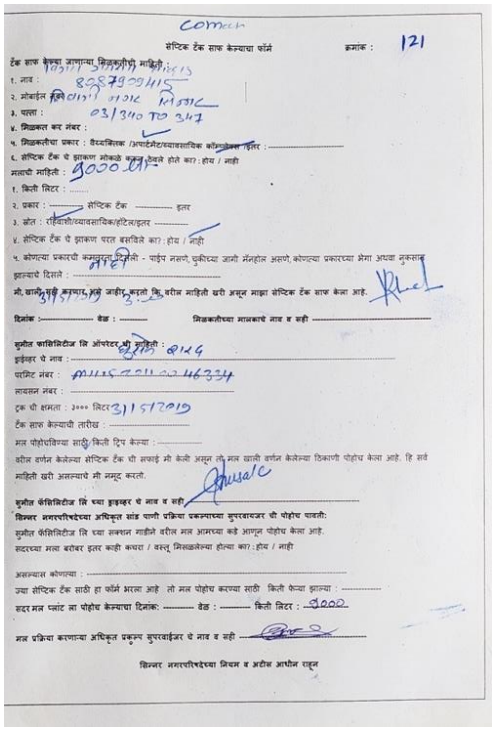
सेप्टिक टँक साफ केल्याचा फॉर्म

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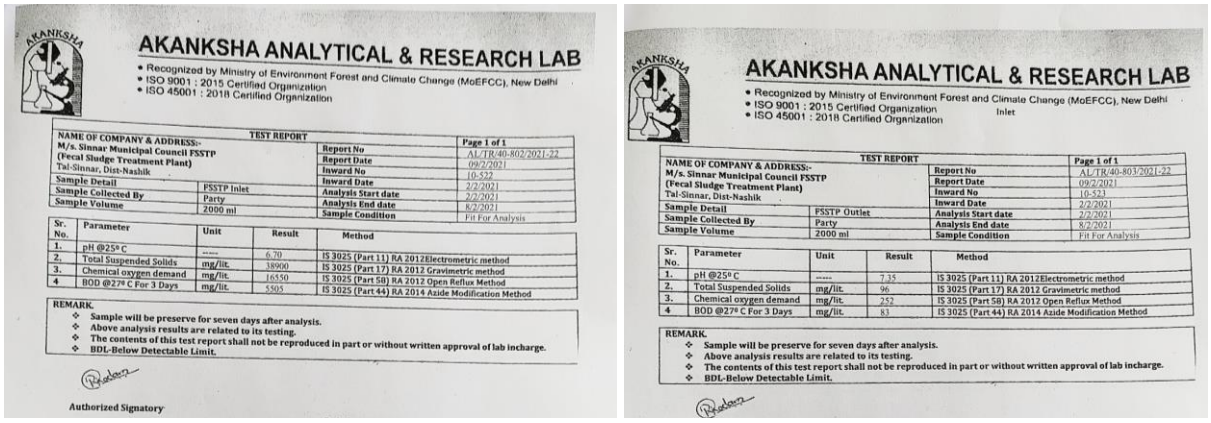
Figure 6 Copy of the physical form created when an OSS is emptied

[11] Ref: Council resolution dated 19th December 201

[12] According to the digital logbook shared by the city official. It contains details of trips made to empty OSS in private properties till 6th Feb 2020. Details of trips made to empty FS from public and community toilets maintained separately and could not be accessed.



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• ISO 9001 : 2015 Certified Organization
• ISO 45001 : 2018 Certified Organization

TEST REPORT

NAME OF COMPANY & ADDRESS:- M/s. Sinnar Municipal Council FSSTP (Fecal Sludge Treatment Plant) Tal-Sinnar, Dist-Nashik		Report No	AL/TR/40-802/2021-22
		Report Date	09/2/2021
		Inward No	10-522
Sample Detail	FSSTP Inlet	Inward Date	2/2/2021
Sample Collected By	Party	Analysis Start date	2/2/2021
Sample Volume	2000 ml	Analysis End date	8/2/2021
		Sample Condition	Fit For Analysis

Sr. No.	Parameter	Unit	Result	Method
1.	pH @25° C	.....	6.70	IS 3025 (Part 11) RA 2012Electrometric method
2.	Total Suspended Solids	mg/lit.	38900	IS 3025 (Part 17) RA 2012 Gravimetric method
3.	Chemical oxygen demand	mg/lit.	16350	IS 3025 (Part 58) RA 2012 Open Reflux Method
4	BOD @27° C For 3 Days	mg/lit.	5505	IS 3025 (Part 44) RA 2014 Azide Modification Method

REMARK

- Sample will be preserve for seven days after analysis.
- Above analysis results are related to its testing.
- The contents of this test report shall not be reproduced in part or without written approval of lab incharge.
- BDL-Below Detectable Limit.

Authorized Signatory

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Inlet

TEST REPORT

NAME OF COMPANY & ADDRESS:- M/s. Sinnar Municipal Council FSSTP (Fecal Sludge Treatment Plant) Tal-Sinnar, Dist-Nashik		Report No	AL/TR/40-803/2021-22
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Sample Detail	FSSTP Outlet	Inward Date	2/2/2021
Sample Collected By	Party	Analysis Start date	2/2/2021
Sample Volume	2000 ml	Analysis End date	8/2/2021
		Sample Condition	Fit For Analysis

Sr. No.	Parameter	Unit	Result	Method
1.	pH @25° C	.....	7.35	IS 3025 (Part 11) RA 2012Electrometric method
2.	Total Suspended Solids	mg/lit.	96	IS 3025 (Part 17) RA 2012 Gravimetric method
3.	Chemical oxygen demand	mg/lit.	252	IS 3025 (Part 58) RA 2012 Open Reflux Method
4	BOD @27° C For 3 Days	mg/lit.	83	IS 3025 (Part 44) RA 2014 Azide Modification Method

REMARK

- Sample will be preserve for seven days after analysis.
- Above analysis results are related to its testing.
- The contents of this test report shall not be reproduced in part or without written approval of lab incharge.
- BDL-Below Detectable Limit.

Figure 7 Quality report of faecal sludge at inlet (left) and treated wastewater at the outlet of FSTP (right) in Sinnar

copy is submitted to the ULB while the operator retains the 4th copy. The ULB tallies them before making the monthly payments to the service provider.

A mobile based application called *Sanitrack* has also been developed. The driver and the accompanying personnel can login to the application and access their emptying schedule. Details related to OSS, the volume of FS collected, and the emptying process including use of personal protective equipment (PPE) by the workers are captured and signed by the property owner. The site supervisor confirms receipt of the FS for treatment. The screen related to receipt of the FS at the FSTP is geo-locked and opens only when the vehicle reaches the FSTP. The ULB can monitor the performance through a dashboard (see Figure 8).

The FSTP operator is required to test the quality at influent and effluent every month and submit the report with the monthly bill. Parameters tested include pH, total suspended solids (TSS), chemical oxygen demand (COD) and biological oxygen demand (BOD) at 27 degree C for 3 days. The latest report provided by the ULB dated 9th Feb 2021 is approximately year old. An automated monitoring system (see Figure 9) to monitor key parameters, viz; BOD, COD, NO3, TOC, and TSS has also been installed. It was financed by HSBC under their corporate social responsibility (CSR) with an aim to enhance the quality of existing FSM related infrastructure. When it was functional, samples were tested twice every day. The results are displayed on a small screen on the testing unit and were also automatically relayed to C-WAS for real-time monitoring.

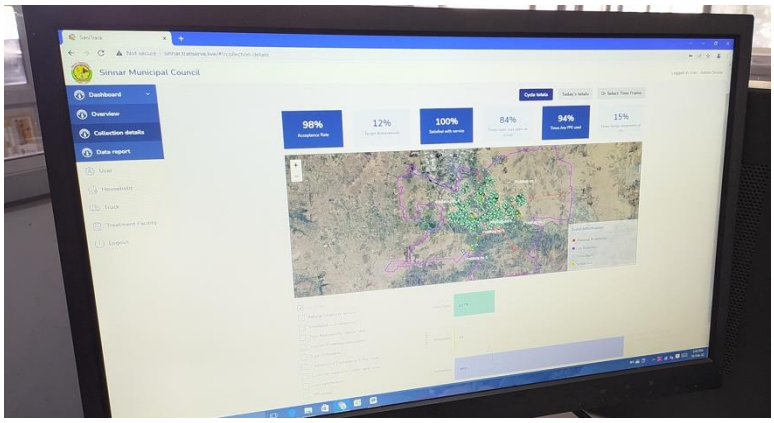

Figure 8 A snapshot of the dashboard developed to oversee FSM operations in Sinnar

Financial sustainability of the system has been a major consideration throughout the planning and implementation process. The operational expenses of the city include monthly payments of RS 70 thousand to the FSTP operator, Rs 35 thousand to the SHG for maintenance of landscape and urban forest and a payment to the emptying service provider based on the number of OSS emptied at the rate of Rs 900 per OSS. The city decided to levy sanitation tax that could be billed and collected with property tax instead of charging at the time of emptying. Since FY 2017-18, sanitation tax at a flat rate of Rs 300 per year for residential properties and commercial properties that have toilets is levied and a flat rate of Rs 100 is levied on commercial properties that do not have a toilet. The ULB provides scheduled desludging service against sanitation tax. Emergency emptying if required is charged only if the OSS was already emptied as per the schedule. The collection efficiency for sanitation tax was observed to be 99% and 97% in FY 2018-19 and 2019-20 respectively. To ensure timely payments to the PSPs, the money from sanitation tax is transferred to an escrow account[13]. According to the agreement, the ULB is required to maintain reserves to cover payment of at least three months. However, one of the reasons the pace of scheduled desludging is not as it was planned is delay in payments to the emptying service provider. The PSP was forced to pause services due to the delays.

Figure 9 The automated system for monitoring treatment quality in Sinnar

3.3. Sangamner

Sangamner is a class B municipality in Ahmednagar district and headquarters of Sangamner Taluka. It is located near the confluence (sangam) of three rivers, viz; Mhalungi, Pravara, and Adhala. According to the Census of 2011, it has a population of more than 65 thousand. The jurisdiction of Sangamner Municipal council is spread over 6.31 sq. km, and it is surrounded by large and densely populated villages, viz; Ghulewadi, Kuran, Sangamner Khurd, Samnapur, Gunjalwadi, amongst others.

The municipal council of Sangamner resolved to establish a 20 KLD STP for decentralised treatment of wastewater in April 2018, more than a year and a half before the November 2019 GR which required the town to establish a 15 KLD FSTP. The decision was triggered by the needs of the Swachh Survekshan and the city's desire to be recognised as ODF+. The council proposed to utilise a part of Rs 1.5 crore incentive grant it was to receive from GoM for achieving ODF status. Accordingly, tender for an estimated cost of Rs 19,89,480 (approx. 19.89 lakhs) was floated in May 2018 but no bids were

[13] Created through a tripartite agreement between the Sinnar Municipal Council, the PSP and the bank signed on 16th June 2017

received. After the proposal was technically sanctioned by MJP in September 2018, it was readvertised. Three bids were received in this round. The contract was awarded to a Pune based firm and the contract was signed in June 2019. The firm proposed a fixed bed bio reactor (FBBR) based STP (see Figure 10) at a cost of 17.9 lakhs (approximately 10% lower than the ULBs estimate). In September 2019, the plant was ready and defect liability bond and contract for operating the plant for two years was signed. The contract does not mention anything about assessing performance of the STP nor frequency of testing.

Table 7 Timeline of STP construction process in Sangamner

Date	Activity
26/4/2018	Resolution for construction of STP
19/5/2018	Advertisement inviting bids for supplying, construction, and installation of a 20 KLD Packaged STP
18/9/2018	Technical approval by MJP
7/3/2019	Readvertisement inviting bids for installing STP till 13th March
4/6/2019	Technical bids opened. Paperwork for all the three bids found adequate
17/6/2019	Financial Bids opened – works awarded to Vasudha Business Solutions (provider) at 9.99% lower than estimated cost
27/6/2019	Agreement with the provider to complete installation in 6 months
11/9/2019	STP construction complete
24/9/2019	Third party audit by COEP
25/9/2019	Defect liability bond was signed

Source: Compiled by the author based on review of documents provided by the ULB

The municipality provides an on-demand emptying service using its 3000 L vehicle and levies a fixed charge of Rs 1000 per trip for the same. For serving outside its limits, the ULB levies a fixed charge of Rs 2000 and a variable charge of Rs 100 per km for the distance the emptying vehicle is required to travel. In FY 2020-21, the vehicle made 1500 trips or collected 4500 KL faecal sludge all of which was treated at the STP. This amounts to capacity utilisation of a little over 75%. However, the BOD load on the plant is likely to be higher as it was designed to treat sewage and not FS.

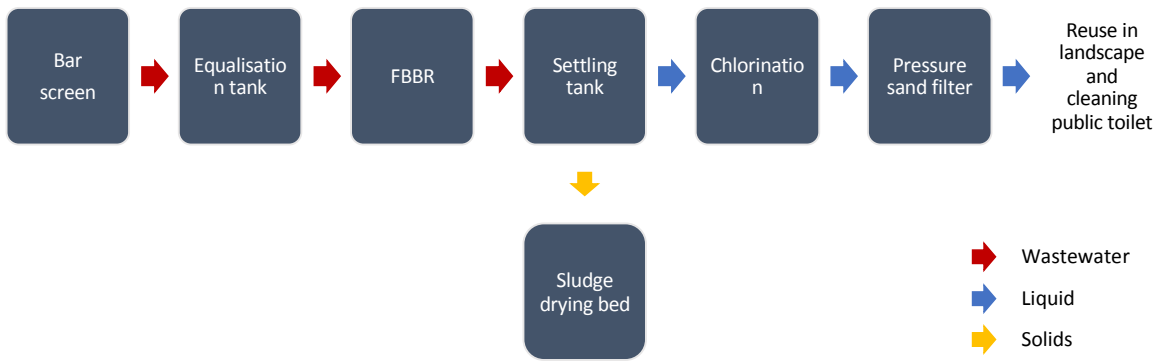

Figure 10 Wastewater flow and process diagram for the STP in Sangamner

Source: Constructed by the author based on discussion with the SI

The town is currently laying sewerage network and the centralised STP is proposed near the same location. The estimated cost of the project is Rs 100 Cr. However, residents in the vicinity of the proposed STP have been protesting. Approximately couple of months before the author's visit, a team of visiting researchers and local officers were gheraoed by people residing in its vicinity. The author was suggested to not visit the facility. The work on STP has been put on hold till local body elections are conducted. Important to note that the ULB was able to transform its dumping ground in the recent past. The compost from organic solid waste is branded as 'Harit compost' is tested every month by Mahatma Phule Agriculture University, Rahuri. People in the vicinity earlier complained and protested due to smell and vectors due to crude dumping. After the transformation, the same people felicitated the chief officer who brought about the change and are also buyers of the compost.

3.4. Karjat

Karjat is a class C municipality located along the river Ulhas in Raigad district in Konkan division. It lies at approximately 90 km from Mumbai. The town is part of the Mumbai Metropolitan Region (MMR) and connected to the metropolitan city by the suburban train network. Pune, the second largest city in the state is located approx. 100 km away. The town is also headquarters of the Karjat taluka. The jurisdiction of Karjat Municipal council is spread over 7.53 sq. km.

Karjat is one of the cities that constructed a FSTP immediately after the first resolution of the GoM. The ULB owns and operates a 3000L tractor trolley mounted vacuum emptier truck and another truck of the same capacity is operated by a private service provider (PSP). Both the ULB and the PSP charge Rs 1600 per trip for emptying. Before the FSTP was constructed, emptied FS was disposed at the dumping ground.

After attending one of the regional workshops organised by the state government in September 2018, the council had resolved to construct a FSTP. GoM resolution dated 8th November 2019 provided administrative and technical sanction

Table 8 Timeline of FSTP construction process in Karjat

Date	Activity
26/8/2019	KMC Resolution for construction of FSTP
8/11/2019	GoM resolution provided administrative and technical sanction for 10 KLD FSTP
11/11/2019	Advertisement inviting bids for construction till 19th November – no bids received
19/11/2019	3-day extension for submission of bids – 3 bids received, all local firms
25/11/2019	Bids opened
5/12/2019	Work order issued
31/12/2019	Council's post-facto approval of the work-order
31/1/2020	FSTP construction completed
27/2/2020	Quality of construction inspection by Government Polytechnique, Mumbai
27/2/2020	First load of FS received

Source: Compiled by the author based on review of documents provided by the ULB

for a 10 KLD FSTP with sludge drying beds and anaerobic baffled reactor. A parcel of land on its dumping site was identified for the purpose.[14] The general arrangement drawing (GAD), and instructions provided by the state government were found adequate for execution.[15] The natural slope of the site was found to be adequate to ensure flow of the liquid component using gravity only. The administration also made swift moves to get a contractor for construction of the FSTP through an expedited competitive bidding process as also suggested by the GR (see Table **8**). The lowest bidder, a local firm was awarded the construction contract at half a percent less than the approved cost. The workorder was issued in the first week of December and it was approved by the council post-facto. The construction of the complete and its quality was inspected and approved in the last week of January.

As seen in Table **8**, the entire process from inviting bids to commissioning of the plant was completed within 10 weeks. In comparison, Sinnar needed almost 2 years and Sangamner approximately 16 months for the same. The key reasons the ULB was able to swiftly construct the FSTP include availability of land and funds, and the pre-approved FSTP design with all the relevant technological details included in the GR. This was off course accompanied by a proactive administration and very supportive local leadership. Important to note that the parcel of land could be made available because of the improvements in management of SWM in the town. In 2018, the then chief officer initiated and implemented the zero-landfill project under which only segregated waste is collected, organic waste is composted, inorganic waste sold to recyclers, and hazardous waste like sanitary napkins is incinerated. Prior to that, unsegregated waste was simply dumped, and the pile had already covered the entire parcel of land right till the entrance gate.

According to an official, the FSTP uses simple technology and includes no mechanical component which makes it easy for the ULB to operate. No new manpower for its operations was needed. The supervisor and workers involved in managing solid waste also work at the FSTP as and when needed. Interestingly, all the operations related to SWM and FSTP at the dumping site are overseen by the Fireman who also has additional charge.

According to the logbook, the FSTP received first load of FS on the 27th of January 2020. The numbers tallied from the logbook, a total of 467 truckloads or 1401 KL of FS has been received and treated at

[14] The dumping site is in the periphery of the town on a hill with no habitation in its vicinity.
[15] The components of the FSTP and the GAD were designed by Arise Enviro Consultants, an Ahmedabad based firm in collaboration with C-WAS, CEPT University for the SMMU.

the FSTP till 6th of February 2022. In FY 2020-21, a total of 283 truckloads or approximately 850 KL of FS was processed averaging less than 3 KLD. That is, less than 30 percent of the treatment capacity is currently utilised.

The treated wastewater is stored and used for watering plants on the dumping ground. The dried sludge is mixed with organic municipal waste for composting. A sizeable demand for compost was reported, much of the compost recovered by bio-mining of the legacy waste has been sold. However, the compost has never been tested, crucial especially when dried sludge is mixed with organic solid waste.

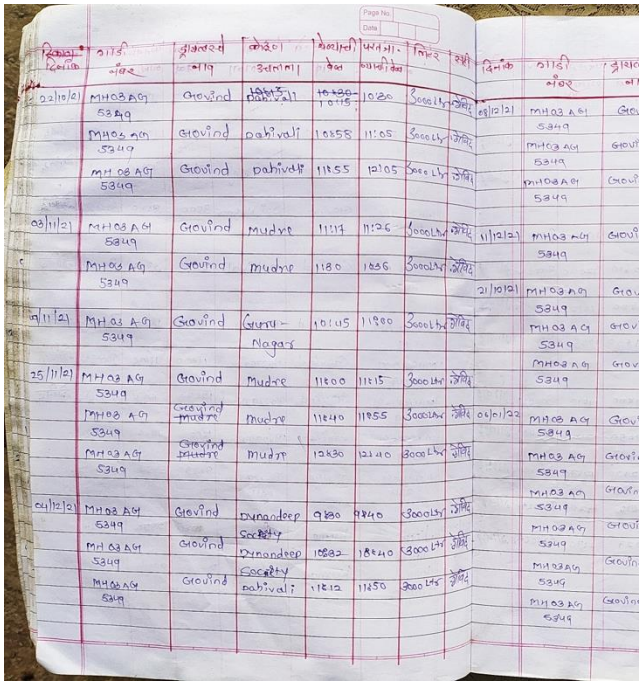

Figure 11 snapshot of the logbook maintained at the Karjat FSTP. Columns (L-R): Date, Vehicle number, Driver's name, Area from which FS was collected, In-time, Out-time, Volume of FS, and signature

Source: The author

The ULB is planning to initiate scheduled desludging services with an emptying cycle of 4 years; the council has already passed resolution to that effect. It will need to employ more emptying vehicles and expand capacity of the FSTP. According to the latest GR, the town will need a cumulative capacity of 34 KLD to provide scheduled desludging services. It also plans to charge a tipping fee of Rs 200 per trip to the PSP in an attempt to gain some control over their operations. According to an official, the question of indiscriminate disposal by PSPs is not relevant in the town as there are no convenient spots in the vicinity. Further, people in the town are aware and will raise alarms if they notice indiscriminate dumping. As the sanitary inspector said:

"कर्जतच्या लोकांचे लक्ष्य असते." (Karjat's residents keep a watch)

3.5. Alandi

Alandi, the resting place of Saint Dnyaneshwar is a well-known pilgrim town in Pune district. According to the Census 2011, the class C municipal council has a population of nearly 29 thousand. The jurisdiction of Alandi Municipal Council is spread over 2.73 sq. km. It shares boundaries with Pimpri Chinchwad Municipal Corporation (PCMC) in the south.

Alandi is divided into two parts by river Indrayani; the southern portion (3 wards) is part of Haveli taluka while that to the north (6 wards) is part of Khed taluka. The Southern portion is surrounded by

peripheral region of PCMC which is served by sewerage system with its STP located in Chahroli[16]. Due to geography, the PCMC's sewer network in this part passes through the southern part of Alandi. While the network was being laid, PCMC agreed to allow properties in this portion of Alandi to connect to its network. However, the ULB does not have any numbers regarding properties connected to the network; it has 0% coverage of network according to the city's service level benchmarks for FY 2020-21. The ULB still claims to convey 2 MLD of the 4.8 MLD wastewater generated in the town to the Chahroli STP.

Alandi Municipal Council provides OSS emptying services through a contractual arrangement with a private service provider and charges Rs 1200 per trip. The faecal sludge so emptied is conveyed to the Chahroli STP or released into the sewer network through any of the manholes in its boundary. While officials of both the ULBs are aware of this arrangement, formal paperwork for the same could not be assessed.

The co-treatment resolution of the GoM dated 15th December 2018 required septage from three ULBs, viz; Chakan, Talegaon and Alandi to be treated at STPs owned and operated by PCMC. Accordingly, in a meeting held on 15th June 2021 and attended by representatives of all the 4 ULBs, PCMC agreed to treat faecal sludge from all the three ULBs at its Kasarwadi STP.[17,18] Other STPs, PCMC claims do not have spare capacity[19]. The key conditions the ULBs need to meet are listed below: they were conveyed to all the ULBs through a letter dated 16th June 2021.

1. Faecal sludge only from residential properties will be treated
2. Information related to vehicles used to convey the FS to the STP including the service provider, vehicle registration number, driver's details to be provided. The ULBs also need to submit copies of vehicle registration, vehicle insurance and driver's licence.
3. ULBs shall maintain a logbook and periodically (monthly report) share with PCMC
4. Violation of any of the conditions would lead to non-acceptance of FS from the respective ULB.

[16] The STPs at Chahroli were commissioned in two phases. In the first phase a STP of 21 MLD was commissioned in 2013 while another STP of 20 MLD was commissioned in 2019. Both the STPs employ sequencing batch reactor technology. While capacity of the first STP is almost completely utilised, a little less than 75% capacity of the second one is utilised. (Ref: CPCB 2021)

[17] Kasarwadi STP complex includes 3 plants of 40 MLD capacity each. One each was commissioned in 1999, 2003 and 2010. The first two employ Activated sludge process while the last employs SBR technology. Cumulatively, approximately 70 percent of the capacity is currently utilised.

[18] Talegaon has not initiated delivering faecal sludge to the Kasarwadi STP (Source: Telephonic discussion with Shri Bansode, an Engineer at Talegaon Municipal Council dated Feb 03, 2022)

[19] According to CPCB 2021, capacity utilisation of other STPs (capacity in MLD in brackets) - Chikhali (32) – 82%, Chinchwad (60) – 95%, Sangvi (10) – 60%, Pimple Nilakh (20) – 94%, Ravet (20) – 63%, Akurdi (30) – 88%, Sangvi-Bopodi (20) – 69%. Chichwad STP commissioned in 2 phases of 16 MLD each.

The distance between Alandi and Kasarwadi STP is atleast twice than that between Alandi and Chahroli. Further, roads leading to Kasarwadi experience more traffic as it is more central part of PCMC. According to an official, AMC has requested PCMC to allow discharge of FS at Chahroli STP. A formal letter agreeing to this request is currently awaited. Further, this is only a temporary arrangement; sewer network and a STP of 4.5 MLD at an estimated cost of INR 18 crores for the Northern portion of the town has been approved under Teerthkshetra Vikas Arakhada, a GoM scheme for pilgrim places. The network has already been laid. A land parcel of 0.6 acre is being acquired for the STP, the process is in the final stages.

3.6. Common observations

This section of the chapter presents some of the common observations across all the four cities. They are related the status of the FSM service chain, arrangement for service provision, and systems that support service provision.

Officials in all the towns claim that most if not all the on-site sanitation systems to be septic tanks and therefore safely containing faecal sludge. This is largely based on their understanding of the construction practices followed in the towns. Except in Sinnar, where a small sample survey by CEPT found most OSS to be septic tanks.

All cities had arrangements for emptying OSS even before the treatment facilities were commissioned. Except for Sinnar, cities continue to provide the service on-demand. Consequently, OSS are emptied infrequently. Sinnar's awareness generation efforts have ensured almost 100 percent compliance for scheduled desludging. It demonstrates the need of attention to awareness generation to increase demand. Yet the slow pace of scheduled desludging indicates towards other challenges including inadequate equipment and capacity.

Earlier, all the cities dumped the emptied FS at their respective solid waste dumping grounds. With treatment facilities in place, the FS is now treated. Cities claim that all the FS that is emptied gets treated through their existing arrangements. However, capacities of the FSTPs are highly underutilised. This points to the need of increasing demand for periodic emptying as well as an opportunity to allow faecal sludge from nearby villages to be treated at these facilities. However, except in Sinnar performance of the treatment facility could not be known as treated wastewater was never tested or test results weren't available.

In the three towns that have their own facility, treated wastewater is getting reused for landscaping mostly within the site and in its vicinity. The dried solids are either co-composted with organic solid waste or simply stored. However, none of the cities report to have tested them. Considering the

Table 9 Summary of the status of the FSM service chain in the 4 towns

City	Sinnar	Karjat	Sangamner	Alandi
Class	B	C	B	C
Area (Sq km)	51	7.53	6.31	2.73
Population (Census 2011)	65,299	29,663	65,804	28,645
Households (Census 2011)	16,436	6,503	12,856	6,385
Emptying	Scheduled	On-demand	On-demand	On-demand
Trips made by emptier vehicles in FY 20-21	1260	283	1500	800
Charges per trip	300*	1600	1000	1200
Treatment facility	Own FSTP	Own FSTP	Own STP (decentralised)	PCMC's Chahroli STP
Capacity of the treatment facility (Approved FSTP capacity in KLD)#	70 KLD (NA)	10 KLD (34)	20 KLD (70)	21 MLD (30)
Capacity Utilisation ##	>35%	28%	75%	ND
Reuse – liquid	Landscape and urban forest	Landscape	Landscape and cleaning public toilet	ND
Reuse – solids	Agriculture	Co-compost		ND
Cost recovery ** **(FY 20-21)**	78%	12%	14%	13%

ND = no data

*Sinnar levies sanitation tax of Rs 300 per year and provides scheduled emptying once every three years against it.

Reference: SMU 2020/ Cr no. 85/ UD – 34 dated 5th July 2021

Calculated using the formula – capacity utilisation = (volume of FS received)/(capacity x 300). The volume of FS received in case of Sinnar was made available from its digital logbook which did not include faecal sludge emptied from community and public toilets.

** Ref: Service level benchmarks

Source: Compiled by the author based on information provided by officials from the respective city and other information available in public domain.

demand for compost, co-composting and reuse as soil conditioner offer potential solutions. However, its safety needs to be assessed for deactivation of helminth eggs before its reuse in agriculture. Table **9** presents a summary of the status of FSM service chain in the four towns.

All the cities also levy a charge for emptying and hence able to recover atleast a part of the costs incurred in service provision. However, except in Sinnar, the cost recovery is abysmal. Research is needed to understand the reasons and suggest remedial measures to improve cost recovery.

Cities seem amenable to involvement of the private sector players either for emptying or operations of the treatment facility or both. This may partly be due to lack of capacity within the ULB and partly due to reforms in wider urban development sector where successful bidder is also required to operate the facility for a few years. However, except in Sinnar, arrangements to monitor their performance are either absent or inadequate.

The information system currently employed are rudimentary at best. The logbook in Karjat for example simply records when the emptier arrives and leaves the facility. The numbers are never aggregated. Further, information that would be required (property details) needed when the city moves to scheduled desludging are not captured. In comparison, the logbook for SWM in Sangamner included space for collation of information on a daily basis.

The developments in FSM have been preceded or followed by improvement in SWM systems in three of the 4 cities also largely due to directives from the state government. Facilities are col-located as also suggested by the government. The improvements in SWM ensured availability of land for FSTP in Karjat, while Sinnar needed to buy adjacent land parcel to allow implementation of SWM projects In Sangamner, improvements in SWM positively changed the perception among residents in the vicinity of its dumping site. The functioning of the SWM and FSM services and maintenance is overseen by the same personnel in respective health sections. Yet opportunities for integrated management have not been explored much except in Karjat..

Finally, identifying and procuring land for setting up treatment facilities is challenging for local governments. The challenge delayed establishment of STP in Alandi and Sangamner. While decentralised treatment by locating facilities in public parks or other such public spaces is suggested, such facilities are prone to vandalism and thefts. Awareness amongst the masses is necessary to ensure such facilities survive and continue to function.

Figure 12 The missing valves of a yet to be commissioned greywater treatment facility located in a park in Sinnar

4. Conclusion

This research aimed to document the various efforts of the State Government of Maharashtra towards promoting FSM and the response at the city level. It finds GoM's approach to be very systematic and pragmatic. It has identified cities that have STPs and promoted co-treatment of FS including of cities in its vicinity and proposed new facilities only where such a possibility is either absent or not feasible. GoM's approach is also multi-pronged which covers knowledge management, institutional and financial arrangements, capacity development, and arrangements for monitoring implementation. It acted as a conduit in passing the required knowledge to the local level through publications, and capacity development workshops. Institutional arrangements to guide and monitor implementation of the mission at the state level were formed right at the onset. Its resolutions based on evolving experiences from within the state and outside provided clear instructions to ULBs regarding capacity of FSTP required, selected technology and design of the FSTP including measurement sheets saved duplication of efforts by ULBs. GoM's approach of mandating ULBs spend a share of grants received from Finance Commission and the relatively small capital expenditure for FSTP meant funding wasn't a challenge for ULBs. The pre-approved designs enabled cities that had land to quickly implement FSTPs. The co-treatment GR also pushed cities to formally accept faecal sludge and institutionalise the practice. The lack of financial incentive to the host city for the arrangement however needs a rethinking.

However, the haste also meant that some of the lessons that were still emerging or emerged immediately after (scheduled desludging for example) could not be incorporated early in the scaling-up process. It leaves cities like Karjat that implemented FSTPs immediately after and according to the 8th November 2018 GR with capacity that is adequate for demand based emptying but highly inadequate for scheduled desludging. It may be challenging to expand capacity of such plants if additional land is needed. Further, on-going sewerage or decentralised treatment projects have also not be considered in listing cities that need new facilities and calculating capacities they need. For example, Sangamner and Alandi already had sewerage projects approved. Yet, the GRs approve FSTPs for the two cities. Alandi is included in both, the GR for co-treatment as well as the latest GR for FSTP with revised capacities. Similarly, Sangamner had already implemented decentralised 20 KLD treatment unit before the first GR dated 8th November 2019. Yet the GR lists it amongst the cities that need 15 KLD FSTP. Perhaps a common database of all the approved projects with the state level could have alerted the issue. The author is unaware of existence of such a database.

Three of the 4 cities studied here view FSM as a stop-gap arrangement till a sewerage system can be installed. As stated above Sangamner and Alandi are already implementing sewerage projects. In the

meantime, Sangamner uses its decentralised STP while Alandi cotreats FS. Sinnar, chose UASB technology as it is also pursuing sewerage project. Thus, how the State government views FSM needs to be clearly conveyed to the ULBs. If it views FSM as a stop-gap arrangement, guidance to repurpose FSTPs once STPs are commissioned will be needed. Since infrastructure for SWM is also being implemented in parallel, the spare capacity these FSTPs will create also need to be factored in. If GoM views FSTPs to be a long-term solution, ULBs could save time and money on pursuing sewerage systems.

While scheduled desludging in all the cities is envisaged and efforts to implement it gather steam, the challenges faced in Sinnar need to be understood and possible solutions need to be conveyed. Even with scheduled desludging, the FSTPs are likely to have spare capacities till the desired frequency and design population is reached. The opportunity to use this spare capacity to serve nearby villages needs to be explored. This will save the state valuable resources while still meeting the SDG targets in such rural areas. This will also afford the gram panchayats time for decision making, forming partnerships with nearby towns and/or villages if needed and building their capacities to build and operate the facilities.

Finally, two areas that need more attention are monitoring treatment quality and safety of workers. The latter seems to be the most neglected including by the workers themselves. While workers were seen to use gloves and boots while handling dried sludge in Sinnar and Karjat, they were seen not using PPE while during emptying in Karjat. The awareness generation efforts have focused on generating demand for services, they also need to stress on workers' safety. While regimes for testing liquid component exist, cities that are treating waste for the first time likely need support to understand and implement the regime. Presence of agricultural fields around smaller cities and the improvements in SWM being implemented simultaneously affords opportunity to reuse the solids by co-composting them. However, they need to be tested for helminth eggs, the most resistant of the pathogens for safety. Further, municipalities are likely to need regimes, guidance, and capacity development support for co-composting dried sludge.

The analysis of the State Government's efforts is based solely on secondary sources of information. It could have been better informed with an understanding of the working of the mission directorate, and other institutions created to monitor progress, perspectives of the key officials and personnel of C-WAS. It would have also helped appreciate the role of a supporting organisation in rapid rollout of non-conventional solutions such as FSM. 3 of the 4 cities had initiated deployment of FSM services even before the GRs were promulgated and hence the impact of GRs could not be adequately analysed. Primary data related to commissioning of FSTPs could have led to informed selection of

cities which could have avoided this. Further, the timeline of the project did not afford a prolonged engagement at the city level. Such an engagement would have allowed understanding the perspective of the elected representatives, and the circumstances, push and pull factors that led to acceptance of FSM at the local level.

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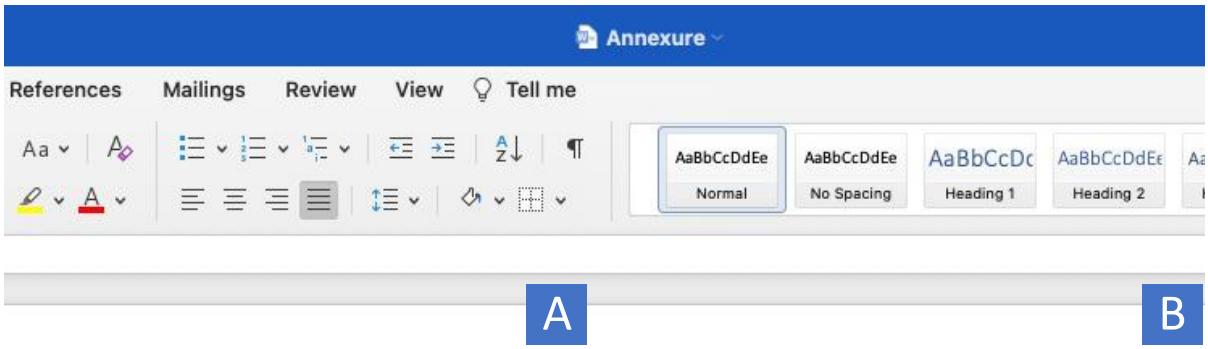
Annexures: Pictures from field visits

Annexure 1: Interviews with local officials

A Shri Amjad Pathan, SI, Sangamner
B Shri Ravindra Deshmukh, SI Sinnar
C Ms Shital Jadhav, Health Supervisor, Alandi
D Shri Gaikwad, Planning Asst. Alandi



Annexure 2: FSM service provision in Karjat

A KMC's tractor mounted vacuum emptier reaching a public toilet to empty its septic tank
B Vacuum emptier stationed for emptying a septic tank
C A worker lowering the pipe for emptying the septic tank. Notice the use of gumboots and absence of gloves
D The level indicator on the tanker
E The Tractor is parked and workers preparing to discharge the faecal sludge into the SDB
F Workers holding the pipe with bare hands while FS is discharged into the SDB. Splashing of the FS was observed
G *A worker removing the dried sludge from the SDB. Note the use of gloves and boots*
H The treated effluent. It is pumped to a storage tank and used for watering the landscape on the site


C


D

E


F


G


H

Annexure 3: FSM service provision in Sinnar

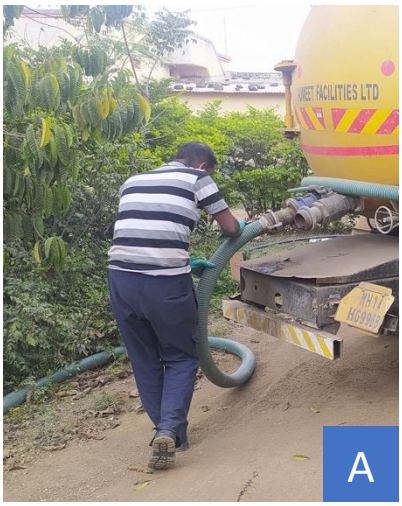
A The private service provider in the process of emptying the septic tank of a residential property. Notice the use of gloves and boots by the workers .

B Decanting the faecal sludge into collection tank. Notice the worker using gloves and boots

C Components of the UASB based FSTP

D The landscaping (top) and urban forest (bottom) near the FSTP. Treated wastewater is reused here

E Workers loading tractor with dried sludge. The sludge is getting transported to a nearby farm. Notice the workers using gloves and boots



C

D

E

Annexure 4: Solid waste management at the dumping ground in Karjat

A

B

GARBAGE SEGREGATION
IN
36 CATEGORY

Daily	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1.wet waste 2.plastic 3.paper 4.chicken waste 5.hair 6.coconut 7.Coconut Residue 8.Dry leaves 9.Diaper 10.Sanitary napkin 11.Egg shell 12.Dead animal 13.Mutton,market waste	14.Plastic bottle	15.glass 16. tube light 17. bulb 18.broken glass 19. bangle glass	20.cardboard 21.clothes 22.regsin bag 23.paper dishes	24.electronic waste 25.wire 26.mobile charger 27.tv, computer part	28. rubber 29.Tier 30.chhapal, sandal 31. boots 32.ceramic 33.foam 34.scrap furniture	35.Tharmacol 36.metal

C

A: The inorganic waste is deposited in the shed. Also note the bailed waste plastic

B: Secondary segregation of the inorganic waste

C: The categories in which waste is segregated at source and collection schedule

D: The organic waste is dumped for windrow composting. Note that only one flap of the vehicle is open.

D

Annexure 5: Solid waste management and treatment in Sangamner

The operations and management of the dumping ground in Sangamner is similar to that in Karjat, similar pictures not added here to avoid repetition.

A A map of the dumping ground
B Weigh bridge on the left and legacy waste on the right
C Biogas plant
D The compost is bagged and branded as 'Harit compost'. It is sold at Rs 8 per kg. The walls of the site are painted for branding.


B


Sludge
Drying Bed


C


संगमनेर
हरित कंपोस्ट
D

Annexure 6: Other observations

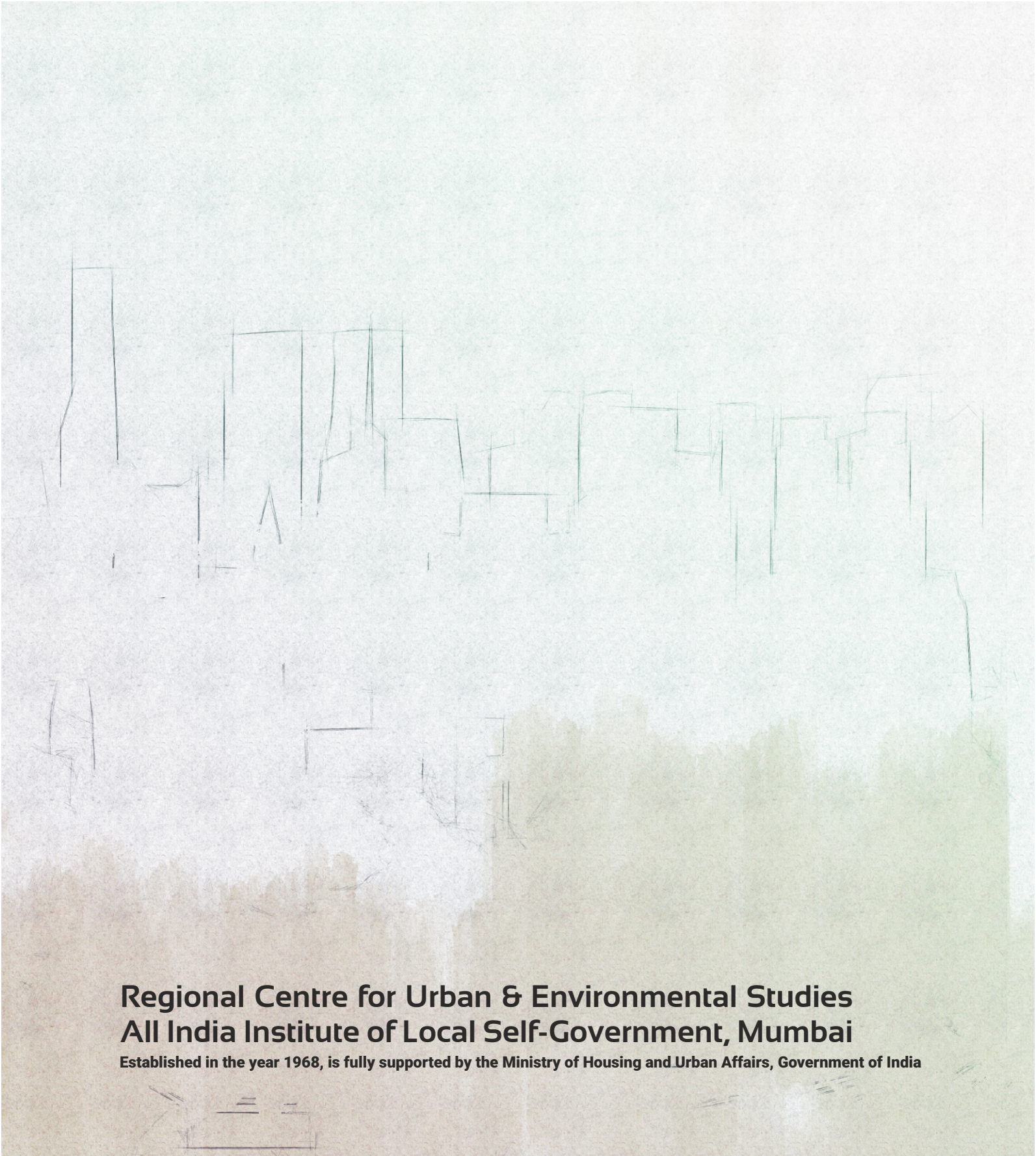
Awareness generation for cleanliness and Swachhta Survekshan find important place at the local level. In Alandi (top left), the exterior of the council's office is painted while related messages find prominent place in Karjat (bottom left) and Sangamner (right)

The office of the Karjat municipality was exceptionally clean. Typically, such corners in public buildings are either littered or stained or both.

Cleanliness related certificates (ODF, Swachh Survekshan, star rating) are proudly displayed in the Chief officer's office in Sangamner (top) and in the Sanitary inspector's cabin in Sinnar (bottom)

The implementation of SWM DPR is currently on-going in Sinnar. The slab (for windrow composting) and a shed for housing machinery are ready. Legacy waste in the behind theshed in the middle of the picture. Important to note that the ULB does not own the parcel of land where waste is currently dumped..

Sinnar is also implementing a decentralised greywater treatment facility located in a park. The 60 KLD moving bed bio-reactor plant is ready for commissioning



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