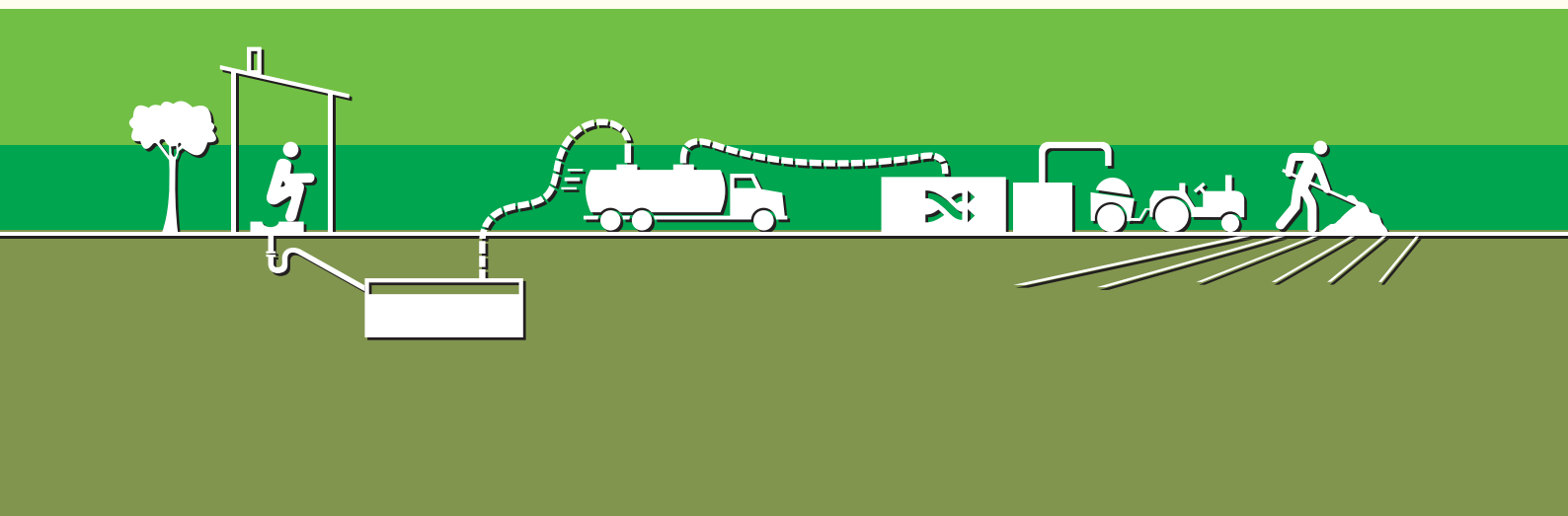




Primer on Faecal Sludge and Septage Management



Foreword



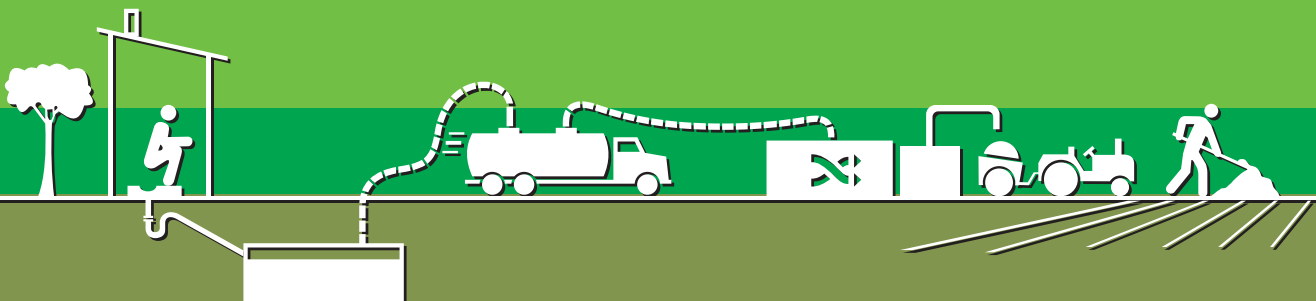
Shri M. Venkaiah Naidu

Hon'ble Minister for Urban Development,
Government of India

I am glad to see the primer on FSSM that has been brought out. It is indeed heartening to note that there is increasing interest and effort to address the pressing issue of managing faecal waste in towns and cities across India. This primer on FSSM complements our country's efforts towards becoming Swacch and open defecation free. While sewerage systems serve parts of our large cities, a large portion of faecal waste generated elsewhere is disposed indiscriminately on open grounds and water systems, contributing to disease burden and pollution of critical water resources. Adopting safe treatment of septage and faecal waste provides cities an opportunity to address this challenge.

I am encouraged to note that through this effort to address faecal sludge management, we would also be making direct contributions to two other critical ongoing Missions - the Swacch Bharat Mission and the Namame Gange Mission.

The Ministry of Urban Development looks forward to supporting cities and states in their efforts to improve faecal waste management across the country. I am confident that the primer on faecal sludge management would be of value to all officials in cities and states to initiate efforts towards addressing this issue of critical importance to our country. I appeal to all officials in cities and states and others working in the sector to put their best efforts forward to implement faecal sludge management initiatives. I wish all the states and cities the very best in their endeavours towards a "Swachh Bharat".



Preface



Shri Rao Inderjit Singh

Hon'ble Minister of State,
Ministry of Urban Development,
Government of India

The Ministry of Urban Development (MoUD) is committed to helping states and cities in India to make rapid improvements in managing their faecal waste. The issue of faecal waste has become a pressing challenge in our cities, characterised by low levels of sewerage system coverage and high population densities.

We know that on-site sanitation systems along with faecal waste/septage treatment plants have been successfully implemented in cities across Africa and the South East Asia. To bring about quick improvements in sanitation levels across urban areas in India and stop dangerous practices such as dumping of faecal waste management in open grounds and water bodies, it is important that our cities mandatorily adopt a set of safe practices in faecal waste and septage management (FSSM).

Adopting these practices would require our cities to and states to be innovative and take a lead in identifying appropriate technology options and institutional arrangements. Implementing FSSM would also provide our cities an opportunity to ensure that the workers involved in cleaning on-site sanitation systems have instructions in and actually practice - safety norms. Thus, FSSM presents an opportunity to bring about multi-dimensional improvements.

We at the Ministry of Urban Development look forward to supporting initiatives across the country through facilitating peer learning between cities and making available technical expertise that states and cities can draw on. I am confident that this primer on FSSM will be a valuable document that complements the Septage Management Advisory released by the Ministry in 2013. I wish states and cities all success in their efforts to improve faecal waste management and raise the sanitation level in their areas.

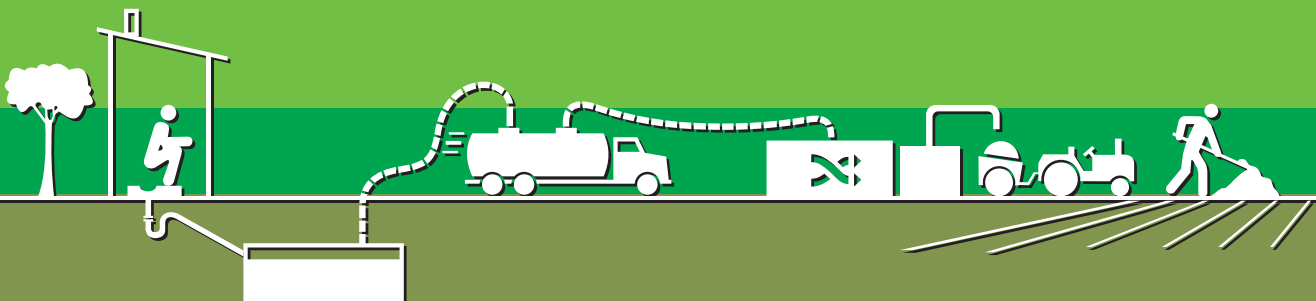
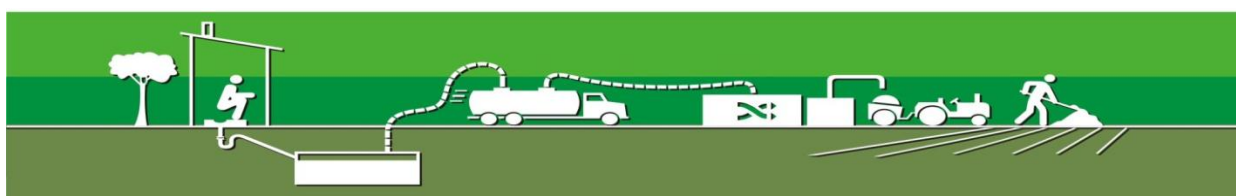
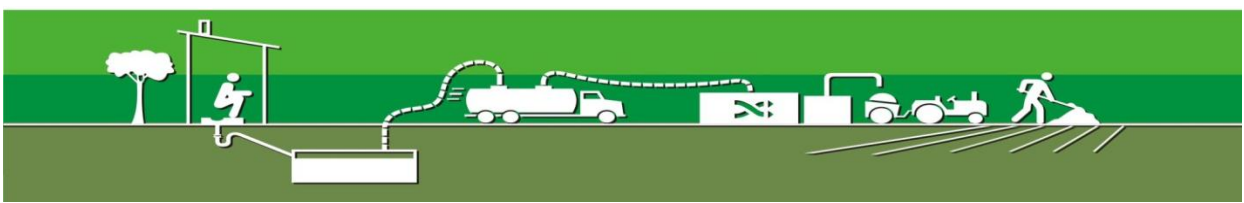


Table of Contents

1. The Need for Faecal Sludge Management?	1
1.1 The shit flow situation today	1
1.2 Scale of the Problem	3
2. Need for operative guidelines for FSM by states	4
3. Elements of FSM	4
3.1 On-site Sanitation Systems	4
3.2 Nature of Faecal Sludge	5
3.3 Collection and Transportation of Faecal Sludge	5
3.4 Disposal of Faecal Sludge	5
4. Planning for FSM: Key Activities and Toolkit	6
4.1 FSM Toolkit	6
i. Assessing Service Performance Across the Full Service Chain	7
ii. Enabling Environment: Policy, Regulation and Institutions	8
iii. Technology Options for FSM Services	8
iv. Potential of Private Sector Role across the Service Chain	9
4.2 Financial Assessment	10
5. Guidelines on FSM	11
5.1 Safety Guidelines	11
i. Collection and Transportation	11
ii. Treatment Plant	12
iii. Reuse	12
5.2 IEC and Capacity Building	13
i. Toilet users/citizens	14
ii. ULB Officials	14
iii. Policy/ Decision Makers	14
iv. Desludging operator	15
v. Reuse Stakeholder	15
5.3 Matrix of technology options for decision makers	16
i. Containment	16
ii. Conveyance	16
iii. Faecal Sludge Treatment	17



5.4	Regulation	18
i.	Desludging service providers	18
ii.	Transfer Stations	18
iii.	Disposal	18
iv.	Reuse	19
5.5	Operations and Maintenance	19
i.	Collection and Transportation	19
ii.	Treatment plant	20
5.6	Monitoring, Learning and Evaluation	20
i.	Performance Monitoring	20
ii.	FSTP Monitoring protocols	20
5.7	Sustainability / Operating models for FSM	21
i.	Revenue Streams	21
ii.	Cost Benchmarks	21
iii.	Demand Management (scheduled vs on-demand)	21
iv.	ULB Level Resolutions	22
6.	Bibliography	23
	Annexure I	24
	Annexure II	25
	Annexure III	26



1. The Need for Faecal Sludge Management?

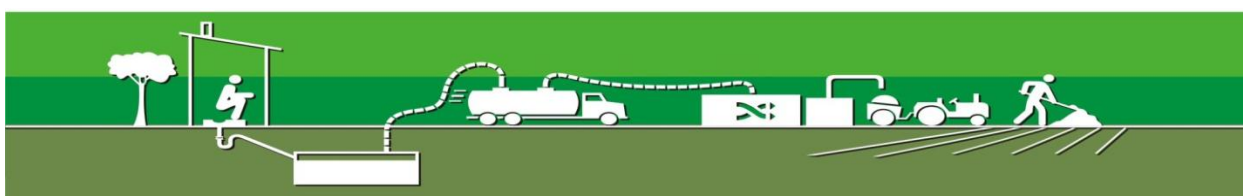
1.1 The shit flow situation today

India's largest cities have large, centralized sewerage systems with vast underground pipelines, pumping stations and huge treatment plants. These systems are expensive to build and even more expensive to operate as they require continuous power, skilled operators and extensive electro-mechanical maintenance. It is for this reason that India's 7,000+ smaller towns (most urban and peri-urban areas across the world for that matter) do not have such systems.

In the absence of proper sanitation, many Indian cities are on the verge of drowning in their own sewage. According to a Central Pollution Control Board report, less than 50% of the urban sewerage systems work effectively in India. Sewage has clearly been identified as the leading polluter of water sources in India, causing a host of diseases including diarrhoea (which kills 350,000 children each year), agricultural contamination and environmental degradation.

A study on Faecal Sludge Management conducted by Water Aid India in 2015 (WaterAid India, 2016) found that:

- **Only 32%** of all the **urban households** having access to sanitation are connected to a **sewerage network**.
- 48% of urban households depend on on-site facilities
- The **rest** are dependent upon **septic tanks** and **pit latrines**.
- Only 30% of the sewage generated is actually treated.
- The rest **70% flows untreated** into its rivers, lakes and ponds, making the water sources extremely polluted.
- Up to **80% of water bodies** could be **polluted** due to this.
- About 17 million urban households lack adequate sanitation facilities in India, with 14.7 million households having no toilets
- Around five million (**7.1%**) **urban households** have **pit latrines** that have no slabs or are open pits
- As many as 30 million urban households (38.2%), of the 79 million households with septic tanks, have no clear method for sewage disposal
- Among the 18% of urban household that don't have access to individual toilets, more than 12% resort to open defecation and 6% use community toilets.



According to the data released in the Central Pollution Control Board 2015 report (CPCB, 2015):

- There is capacity to treat only 37% out of the 62,000 MLD (million litres per day) sewage generated by urban India.
- Out of the 816 municipal sewage treatment plants (STPs) listed across India, 522 work (only 64% are functioning), 79 STPs Non Operational, 145 STPs under construction and 70 STPs are proposed (Figure 1).

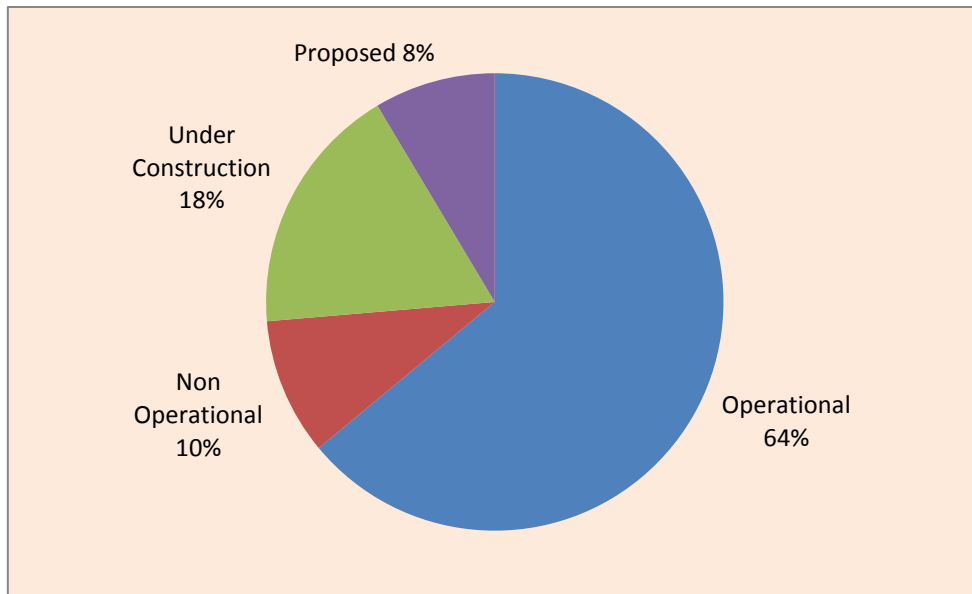
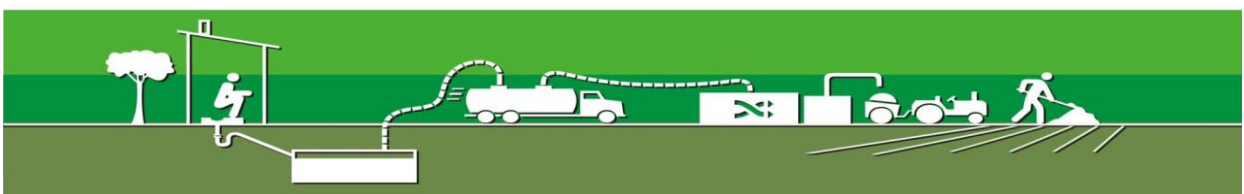


Figure 1: Distribution of STPs in India (CPCB, 2015)

The major part of urban India has not been connected to municipal sewer system thereby making people dependent on septic tanks (one of the most common forms of urban sanitation facilities in India) (Singh, 2014).

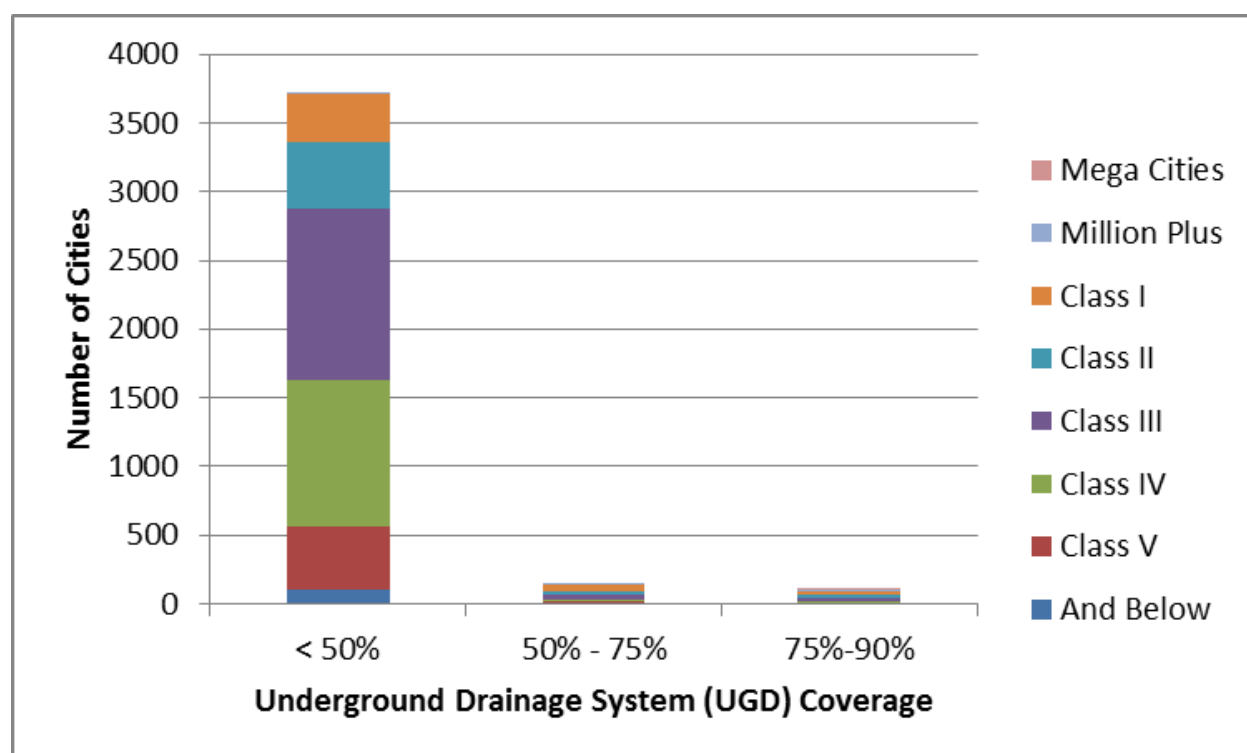
With the Swachh Bharat Mission's aim to make India an open defecation free country by 2019, we will be seeing a dramatic increase in number of toilets being constructed. This will certainly help in reducing open defecation but without proper collection, transportation and treatment processes, faecal waste from these additional toilets will only amplify the current problem. This is clearly an area that needs urgent attention.



1.2 Scale of the Problem

According to the 2011 census, approximately 92% of the urban centres in India have less than 50% Underground Drainage (UGD) coverage. Close to 74% of these urban centres have a population of 50,000 and lower. These are the very places that have the least sanitation infrastructure provided. The following table helps understand the current situation of sanitation infrastructure in India.

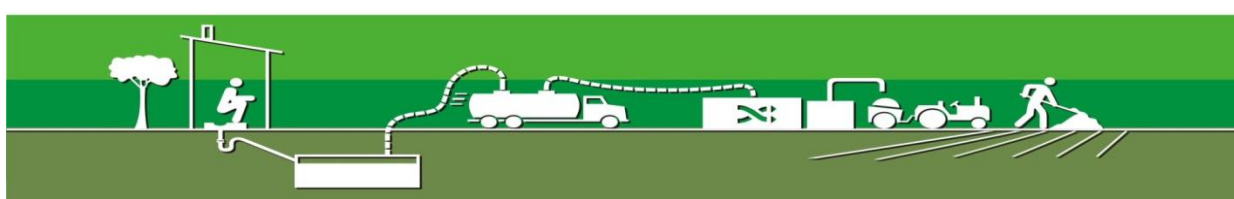
Table 1: Underground Drainage Coverage in Urban India (Census, 2011)



Population Interval – Classification as per Census definitions.

UGD coverage refers to the cities with < 50%, < 75% and <90% households having a connection to Underground Drainage (UGD) System.

Figure 2: Underground Drainage System Coverage in Urban India (Census, 2011)



2. Need for operative guidelines for FSM by states

The National Urban Sanitation Policy (NUSP) creates a conducive environment for the adoption and implementation of the idea of Faecal Sludge Management. The NUSP calls for the creation of community driven, totally sanitized, healthy and liveable cities. This can be implemented by providing toilet facilities along with a worm's eye focus on safe disposal post treatment. The NUSP envisages a multi-stakeholder City Sanitation Task Force (CSTF).

The Septage Advisory issued by MoUD focuses primarily on the development of a Septage Management Sub-Plan as a part of the City Sanitation Plans. This is a step to take the concept from ideation to execution. Faecal sludge management combines the stakeholder approach advocated by NUSP with a centralised sewer solution to optimally address the gaps in sanitation services.

In continuation to the above national mandates, each state should then have a faecal sludge management policy directive in place to enable bridging policy with practice and make FSM a reality. The ULBs should have resolutions to implement this policy directive. The parastatal bodies can monitor planning, DPR preparation and tendering of services.

3. Elements of FSM

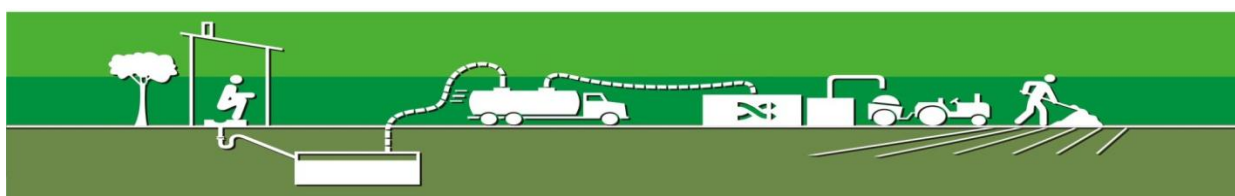
3.1 On-site Sanitation Systems

By the year 2020 we will have close to 1.45 Crore toilets in Urban India. As stated in the section above, 31% households are not currently connected by a sewer network. Such households build on-site sanitation systems (OSS) for containing the waste from toilets and to prevent it from contaminating the environment.

OSS retain waste in either a pit, tank or vault connected to the toilet. The containment system ranges from a basic sanitary facility such as twin-pit latrines, to a treatment system that connects a septic tank with a soak pit, or a bio-digester toilet (aerobic and anaerobic).

In reality, the vast majority of OSS are unlined pits or tanks, built much larger than prescribed, which fill up over several years since the water percolates away leaving only solids behind. However, these solids remain in a partially digested state and cause environmental and health hazards if disposed of while untreated.

To make OSS effective and easy to maintain, States should choose an appropriate OSS, the materials and method of construction according to the climatic and geographic conditions. The State, based on the OSS technology adopted should also determine the appropriate servicing intervals. This will ensure



that the containment of septage is hygienic and also eases servicing of the OSS. The following design standards also contribute to the assessment of the quantum of the faecal sludge generated.

3.2 Nature of Faecal Sludge

What the OSS contains is called Faecal Sludge, which is the general term given to undigested or partially digested slurry or solids resulting from storage or treatment of black-water or excreta. It has a much greater pollution load and hence is much stronger than sewage in terms of its chemical and physical characteristics. Faecal sludge is very different from sewage in its degradation characteristics.

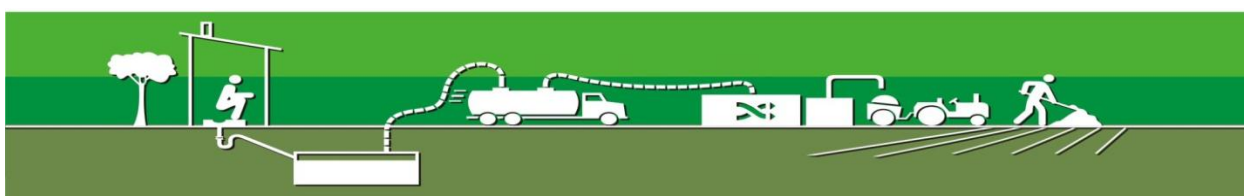
3.3 Collection and Transportation of Faecal Sludge

In most parts of the country entrepreneurs are providing the service to de sludge or empty the OSS when it is full. These are called by many names - cesspool vehicles, vacuum trucks or honey suckers. They have been instrumental in eradicating manual scavenging in the country. Many types of equipment are available to cater to the needs in different terrains and street typologies. This is the critical service in the FSM value chain yet it is the most vulnerable. They are the missing link in non-networked sanitation, conveying sludge on wheels.

3.4 Disposal of Faecal Sludge

In most cases the Desludging Service Providers dump this faecal sludge in water bodies, barren or wastelands, storm drains, or sewer lines when manholes are accessible. Some Sewage treatment plants accept faecal sludge, for example, Bangalore allows licensed operators to dispose in STPs.

Faecal sludge should not be discharged into surface waters or be treated like wastewater because its pollutant concentrations are very high. It cannot be used for direct land disposal or treated like solid waste because its moisture content is very high. It cannot be directly used for crop fertilising because its pathogen content is very high. Faecal sludge treatment therefore requires a separate process.



4. Planning for FSM: Key Activities and Toolkit

Citywide assessment of FSM is the first key step for IFSM planning. This is organized around five key areas. Assessing the current situation of FSM in the five areas detailed out below is important to develop a FSM plan that is technically appropriate and financially feasible at local level. Assessment in each area entails a review of the available information at city level, identifying information gaps, and conducting field studies where necessary.

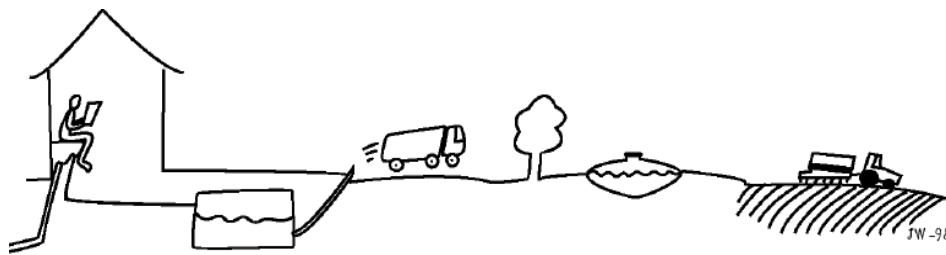


Figure 2: FSM Service Chain

4.1 FSM Toolkit

The FSM planning process described below covers the entire service chain. In order to achieve all the steps, various tools are available in the web-based toolkit developed by the PAS Project (Performance Assessment System) at CEPT University: **SaniPlan – IFSM Tools for Citywide Assessment and Planning**.

The tools consist of relevant lists, sample templates, manuals, assessment and calculation methods etc.

They are described in more detail and can be accessed at

<https://sites.google.com/site/pasprojectifsmguide>.

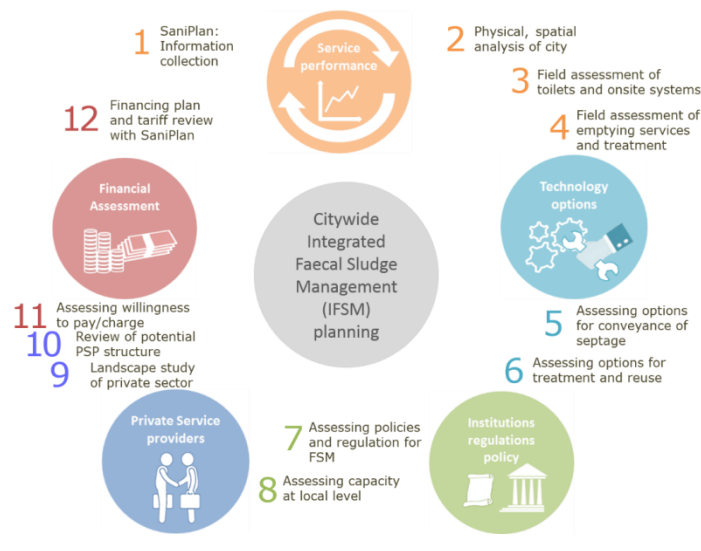
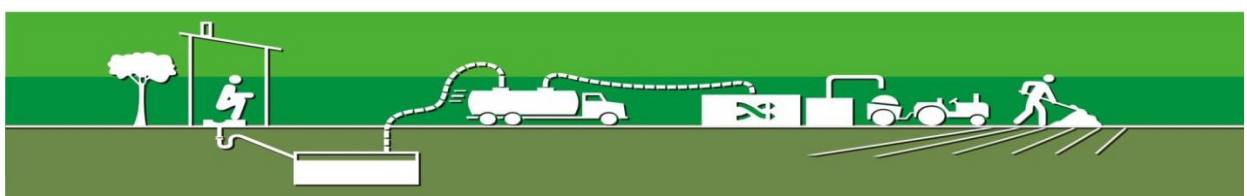


Figure 3: Steps for FSM Planning



i Assessing Service Performance Across the Full Service Chain

Assessing performance across the sanitation service chain through a city level assessment is the first step. It is an important exercise, which provides an initial sense of the state of FSM in the city, as it helps in understanding the context and identifying gaps in key services.

The following figure depicts the existing situation assessment of on-site sanitation status across the service chain in the majority urban local bodies of Maharashtra and a framework for action to achieve improved sanitation through Septage management.

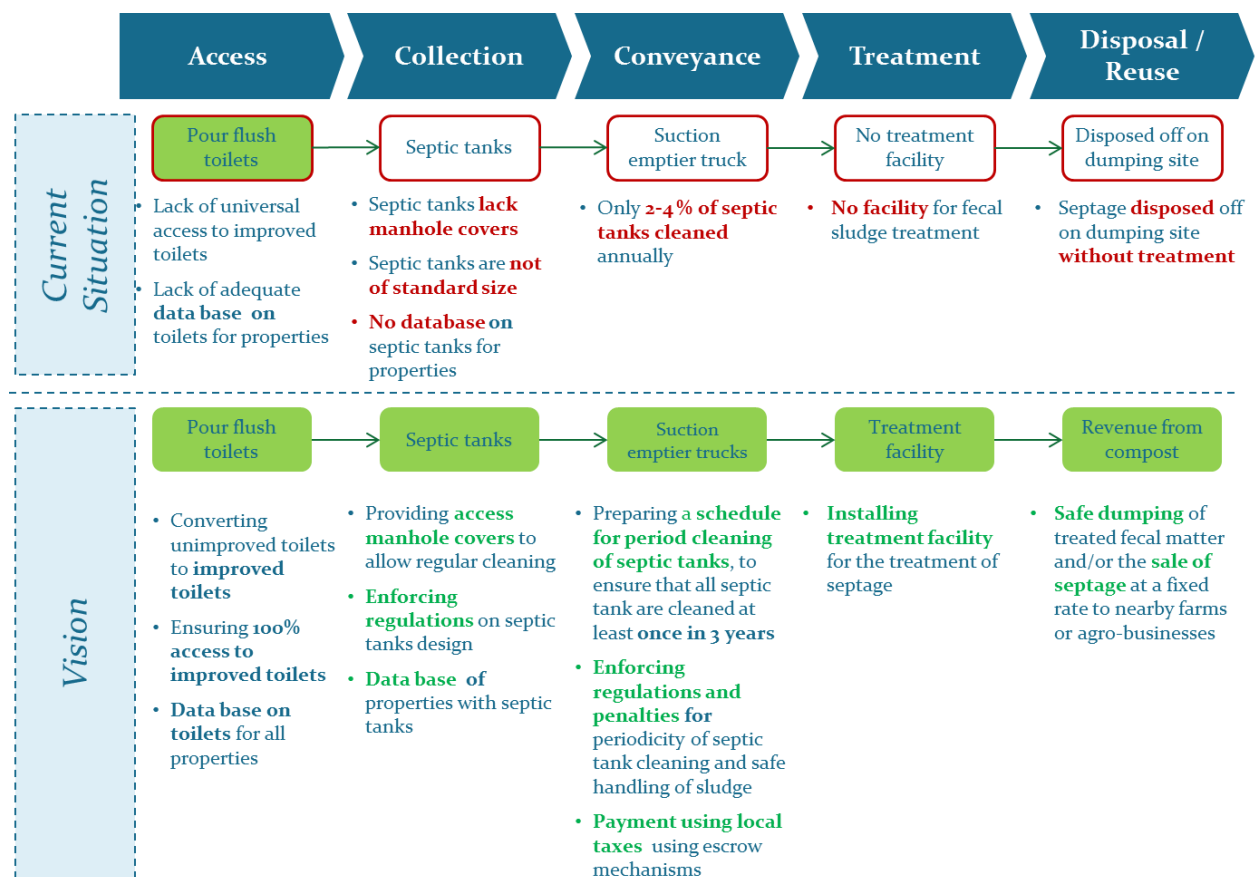
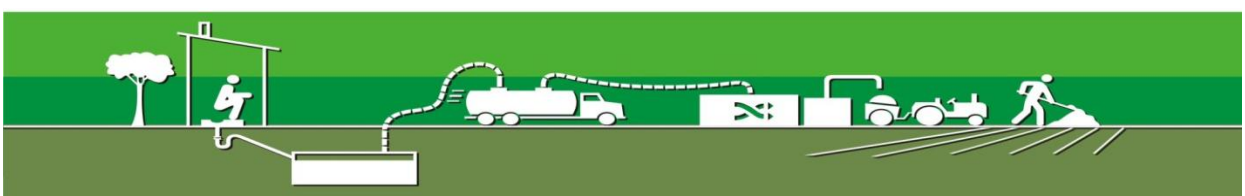


Figure 4: Current situation and vision for FSM in an ULB



ii. Enabling Environment: Policy, Regulation and Institutions

Sanitation is increasingly seen as a key issue in environmental protection. Improper disposal of human waste can pollute water bodies, groundwater, and land surfaces and affect the quality of life for those living in the area. In this context, it is important to understand and assess the prevailing enabling and regulatory environment, as well as capacity of local stakeholders to manage the citywide FSM services. This can be assessed by a review of: a) State/national policies and guidelines on FSM, b) Regulatory framework for treatment, disposal, and reuse of faecal matter, and c) assessing roles and responsibilities of local government for FSM.

iii. Technology Options for FSM Services

In planning a citywide IFSM service, it is important to assess technology options for each link in the service chain - from appropriate toilets and onsite systems (such as septic tanks and conveyance) to treatment and reuse. For toilets and septic tanks, assessment of these systems is necessary. For emptying services, options such as scheduled emptying of pits/septic tanks and assessing infrastructure requirements need to be assessed. Finally, many technologies are available for septage treatment, and these need to be assessed using a framework for choosing an appropriate option for treating septage at a city level. The possibility of reuse will also need to be assessed.

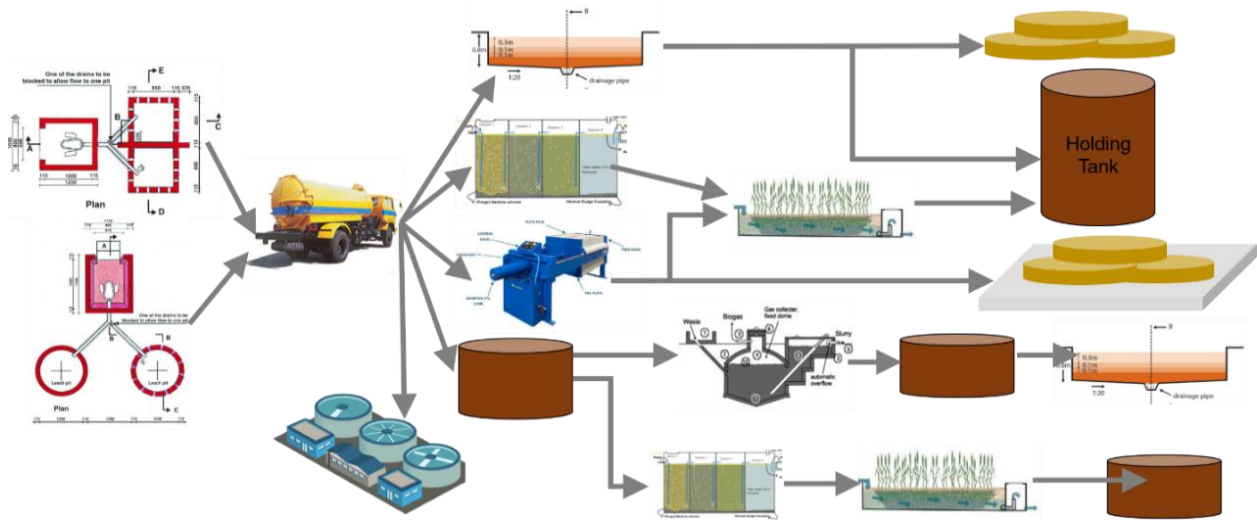
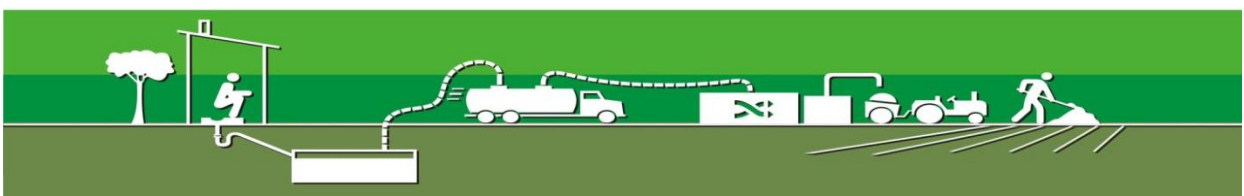


Figure 5: Technology Options for FSM



iv. Potential of Private Sector Role across the Service Chain

While city governments generally have the mandate to ensure service provision, often there is an active private sector that provides FSM services within any city. It is necessary to assess the current role of private sector providers as well as their potential role in a citywide service provision. The assessment will start with a quick landscape analysis, and can be followed by a detailed assessment after the FSM strategy is developed. Interviews with the city government officials will be needed to assess their views and perceptions of various options for private sector engagement.

There are six decision area processes involved in structuring and assessing a private sector options for septage management.

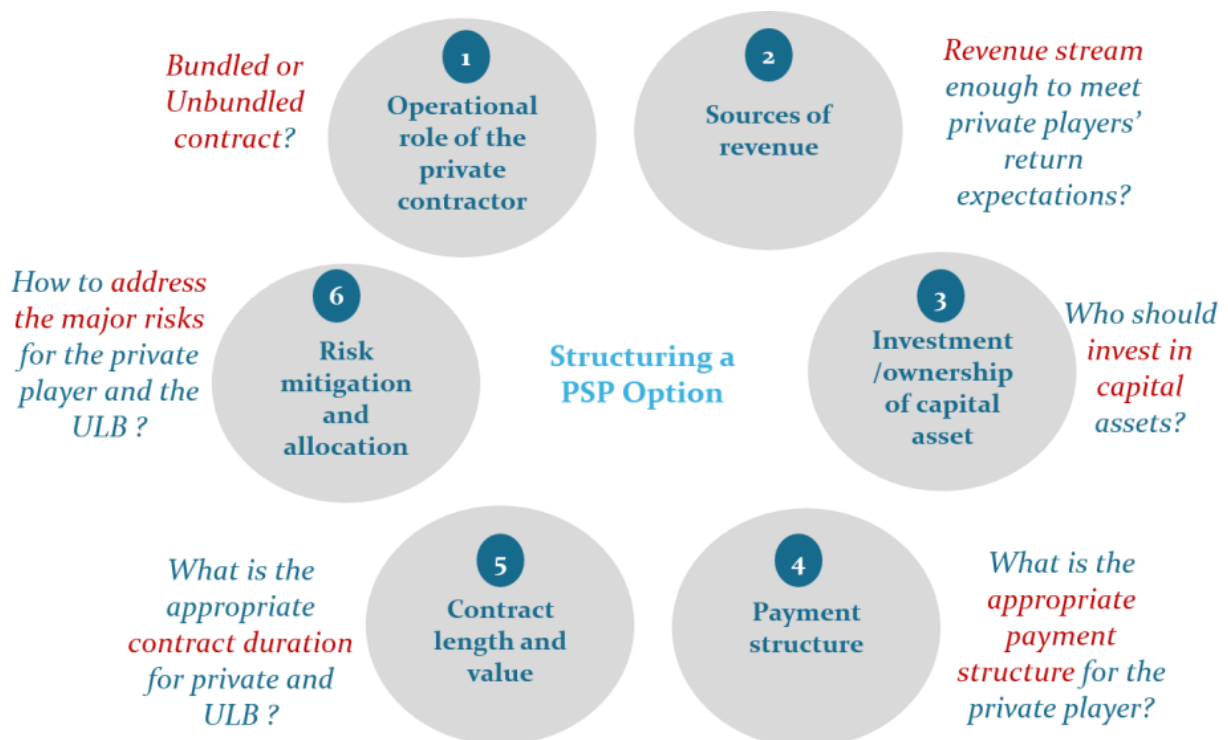
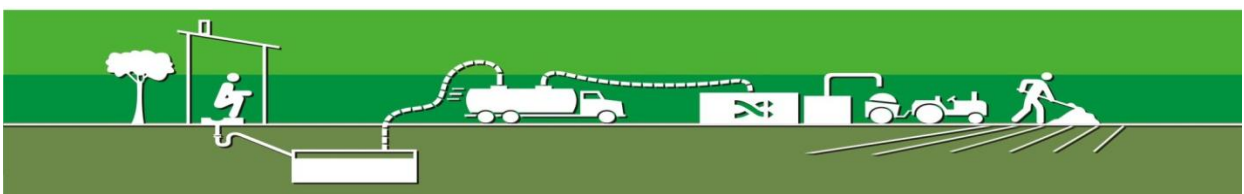


Figure 6: Six decision areas for structuring PSP in FSM



4.2 Financial Assessment

To ensure financial sustainability of FSM services, it is important to assess capacity for financing of both capital and O&M expenditure over the planned period. This can start with an assessment of financial requirements for both capital and O&M expenditures, along with subsequent tariff restructuring, to make the system sustainable.

The assessment also provides guidance on potential sources of finance for meeting these expenditures including funding through external grants, private sector investments, user contributions, external debt or through local government internal resources.

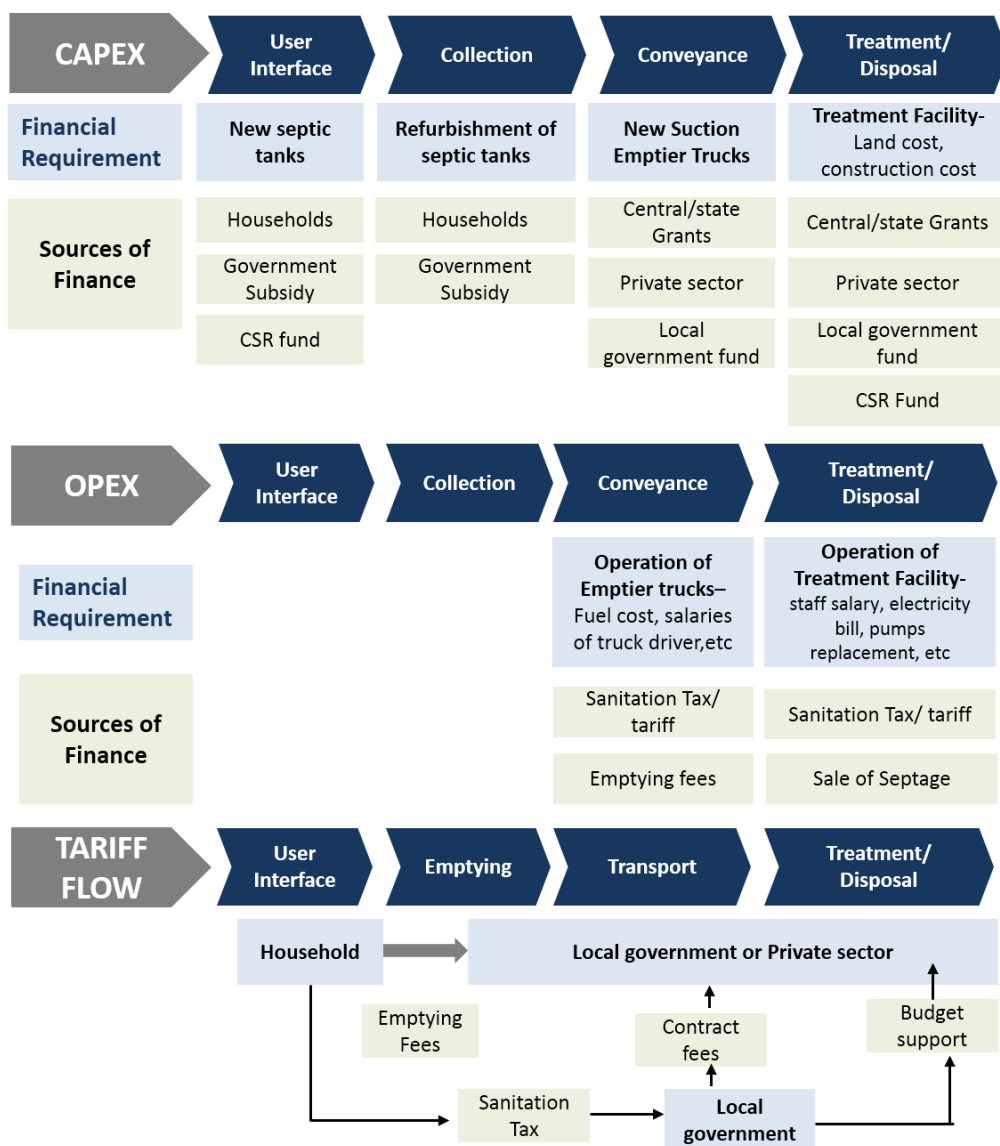
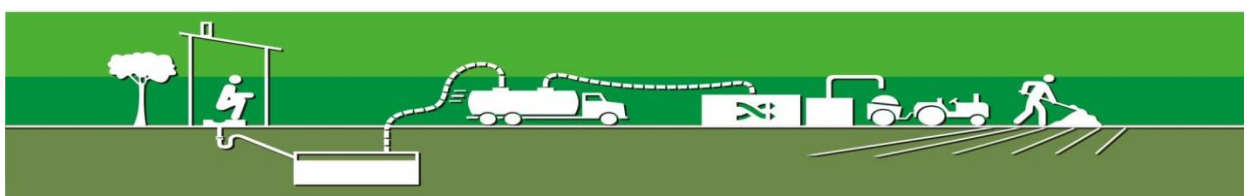


Figure 7: Financial Assessment and structuring



5. Guidelines on FSM

5.1 Safety Guidelines

The responsibility of septage management lies with the concerned Urban Local Bodies (ULBs). The following are the key components of a Septage Management Plan:

- Collection
- Transportation
- Treatment
- Reuse or Safe Disposal

i. Collection and Transportation

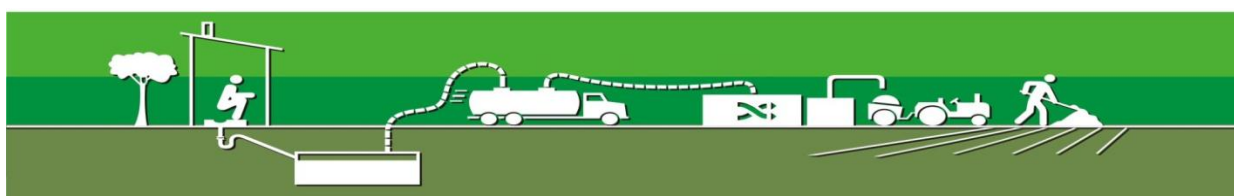
Proper collection and transportation of septage is one of the most important components of septage management. 65% of the 423 Class I Indian Cities have reported unsatisfactory arrangements for safe collection of human excreta (whether on-site or sewerage) (WSP, 2012).

As per the CPHEEO Manual on Sewerage and Sewage Treatment, 2013 “yearly desludging of septic tanks is desirable, but if it is not feasible or economical, then septic tanks should be cleaned at least once in two - three years, provided the tank is not overloaded due to use by more than the number of persons for which it is designed.”

Under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 desludging / emptying of septic tanks is to be undertaken by mechanical devices like suction emptier trucks / vacuum tankers. These desludging trucks collect septage at the household level and transport it to treatment or disposal sites. ULBs need to assess the following aspects of septic tank emptying (UDD, 2016):

- The number of septic tanks required to be emptied annually as per CPHEEO norm versus the number that are emptied in a year
- The number of vacuum emptying trucks/ capacity of trucks that are required if number of septic tank emptied as per CPHEEO norm versus the number of trucks that are available/working with capacities of emptier trucks
- Cost assessment per emptying visit
- Method of register maintenance for septic tank emptying services database etc.

It is important to ensure that the septage transportation vehicle operators (whether from the ULB or private sector) are well trained and equipped with protective safety gears (such as gloves, boots, hat, face mask, Davy’s lamp), uniforms, tools and proper vacuum trucks, for safe handling of septage (UDD,



2016). Also, all septage transporters need to maintain a collection and transport receipt system that needs to be duly filled by the private / ULB service provider and submitted to ULB office (UDD, 2016).

ii. Treatment Plant

Once collected, the septage needs to be treated as per the CPCB and MPCB norms before disposal (CSE, 2011). Septage has constituents similar to municipal wastewater, which make the co-treatment of septage along with sewage feasible. If the Sewage Treatment Plants (STP) are not designed to deal with the septage, the plants can increase their aeration capacity and in some cases also expand their facility to cater to the excess waste (CSE, 2011). For septage to be treated at STPs, the following approaches can be adopted (CSE, 2011):

- Septage addition to nearest sewer manhole
- Septage addition to STP
- Septage addition to sludge digesters/sludge drying beds

However, in the absence of an STP, ULB should plan a new septage treatment facility taking the following parameters into consideration (UDD, 2016)- accessibility of the treatment site; availability and reliability of electricity; appropriate distance from residential areas; geological conditions.

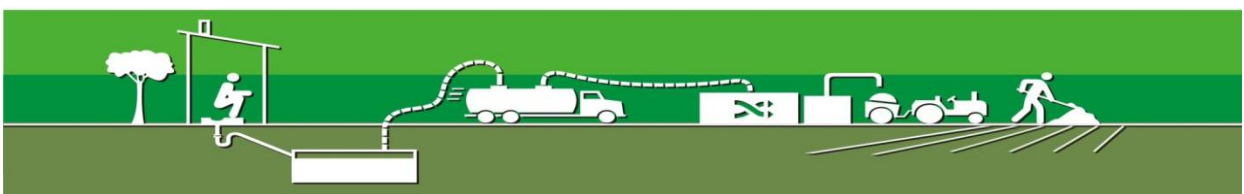
iii. Reuse

Reusing refers to the act of returning the products to the environment as either useful resources or reduced-risk materials (UDD, 2016). The treated septage can be used as a soil enricher or as filling material at construction sites (UDD, 2016).

Properly treated sludge can be reused in the following ways (CEPT, 2015):

- **Soil Conditioner**- It can be applied on parched land as a soil conditioner, or as a fertilizer in agriculture. Crops which could be safely grown are corn, fodder, cotton, trees including fruit trees, eucalyptus and poplar.
- **Aquaculture**- Settled septage effluent can be applied to freshwater where it is possible to achieve dilution to ensure dissolved oxygen is above 4 mg /l. Fish species of tilapia and carp are preferred since they tolerate low dissolved oxygen.

ULBs should carry out a primary assessment for the availability of markets for treated sludge and the demand for reuse (UDD, 2016). However, for dewatered septage to be used as a fertilizer it should satisfy the following criteria of Class A Bio-solids of US EPA (CEPT, 2015):



Faecal coliform density < 1000 MPN/g total dry solids

- Salmonella sp. Density < 3 MPN/ 4 g of total dry solids
- Helminth egg concentration of < 1/g total solids (WHO,2006)
- E coli of 1000/g total solids (WHO,2006)

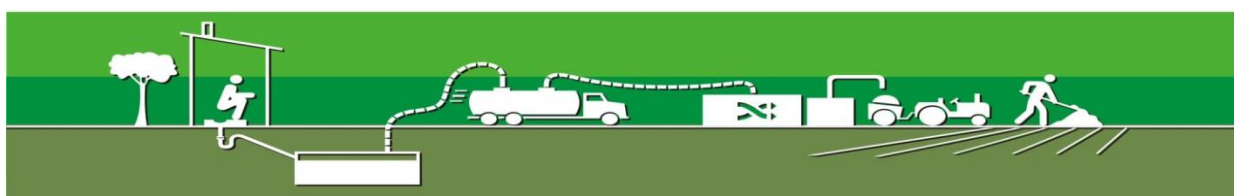
The operator of the treatment plant is responsible for ensuring compliance with the treatment and discharge norms in order to reuse treated wastes as a fertilizer or soil conditioner in agriculture (GWMC, 2016). Table 1 represents the MSW Rules (2000) for the acceptable compost quality (CEPT, 2015).

Table 2: Compost Quality as per MSW Rules, 2000 (CEPT, 2015)

Parameter	Concentration not to exceed (mg/kg dry basis, except for pH and carbon to nitrogen ratio)
Arsenic	10
Cadmium	5
Chromium	50
Copper	300
Lead	100
Mercury	0.15
Nickel	50
Zinc	1000
C/N ratio	20-40
pH	5.5-8.5

5.2 IEC and Capacity Building

For successful implementation of Faecal Sludge Management Plan, awareness about septage management and its linkages with public and environmental health needs to be created via popular and cost-effective channels (hand bills, notices, announcements in radio/TV, as information on consumers' water bills etc.); and it is important to consider the various stakeholder: the authorities, households, communities and institutions, farmers etc. (WSP, 2012).



i. Toilet users/citizens

The disposal of sludge by dumping it in open drains, or water bodies or near garbage dumps is known to have considerable health and environmental risks. Awareness generation activities to sensitize the general public about the health hazards that arise from the indiscriminate disposal of septage, need to be carried out by the members of the Resident Welfare Associations, community organizers and self-help groups. The general public also needs to be made aware of the ill-effects of sewage discharge into fresh water/storm water drains and the need for a sound faecal sludge management system, including a 3-year cycle (UDD, 2016).

ii. ULB Officials

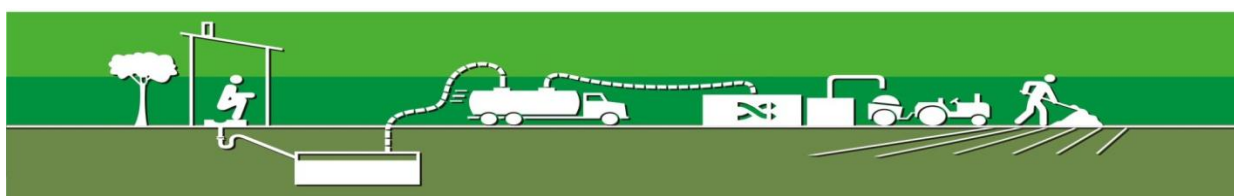
ULBs need to take steps to increase community awareness on the importance of septic tank design. The existing poorly designed septic tanks also need to be improved. Plus, ULBs need to:

- Involve private septage collectors, community-based organisations (CBOs) and sanitation workers early in the planning process in order to ensure effective utilisation of the treatment facilities (WaterAid India, 2016).
- Attend training sessions on safe collection, treatment and disposal of septage and disseminate information about the standard septic tank design, the need for periodic inspection and desludging of septage etc. Also, the trainings should involve regional peers who have successfully provided septage management through a variety of modalities (WaterAid India, 2016).
- Ensure that all safety norms are clearly explained to the septage transporters. Private Operators and Transporters should be well trained in safe collection and transportation of sewage including vehicle design, process of desludging, safety gears and safe disposal at the nearest treatment facility (UDD, 2016).
- Fix the rate for desludging/emptying septic tank services by public and private service providers to motivate the public to utilise their services and also identify and allocate land for septage management (WaterAid India, 2016).

iii. Policy/ Decision Makers

Authorities need to be made aware of the social, economic and environmental benefits involved in effective septage management in order to increase their involvement in this issue and to make it an integral part of sanitation planning. Apart from this the following activities should be performed: (WaterAid India, 2016):

- A Public Promotion Programme needs to be developed to educate households on the value and importance of regular desludging



- Central and state governments need to evolve financial mechanisms in order to support bio solid manufacturers.
- State governments need to ensure that the National Building Code (NBC) guidelines for septic tank design, construction, installation, operation and maintenance are being followed for newly submitted individual and group housing plans
- Subsidies need to be provided to BPL (below poverty line) households by the state governments for reconstruction or replacement of poorly designed septic tanks

iv. Desludging operator

To ensure effective FSM, it is essential for us to strengthen and empower desludging service providers as they constitute the most vulnerable link in the sanitation value chain. Starting with safety training, service providers should be sensitized to the hazards of unsanitary desludging, legal provisions governing desludging and indiscriminate disposal. Service providers should also be trained in soft skills to improve customer perception and hence build perceptions of dignity.

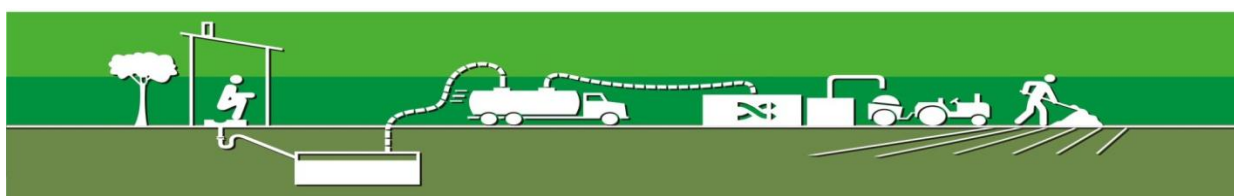
Training and awareness of standard operating procedures designed by experts suited to agro-climatic zones should be conducted on a regular basis. Benefits of registration and licensing should be explained in trainings so that the service providers may understand their obligations.

Provisions for awareness which may help their business such as access to credit and latest technology should also be included in the IEC modules.

v. Reuse Stakeholder

Faecal sludge is a lot more than just human waste. When properly managed, the essential nutrients (nitrogen and phosphorus) present in it are beneficial as fertilisers for plants. Therefore, it is important to address the stigma attached to the use of bio solids as a manure (WaterAid India, 2016). This can be done by:

- Creating marketing models for bio solids
- Facilitating networking between farmers and other stakeholders
- Using appropriate IEC materials to generate awareness among farmers regarding bio solids and its use in farming.
- Generating awareness among the general public in order to create a demand for agricultural produce that uses bio solid manure.



5.3 Matrix of technology options for decision makers

There are many technology options to choose from across the sanitation value chain for implementing FSM. The below mentioned are technologies available for the collection and transportation of faecal sludge from OSS to FSTP.

i Containment

The containment technology options according to Swachh Bharat Mission Guidelines are:

- Twin pit system
- Septic tank
- Aerobic bio-digester
- Anaerobic bio-digester

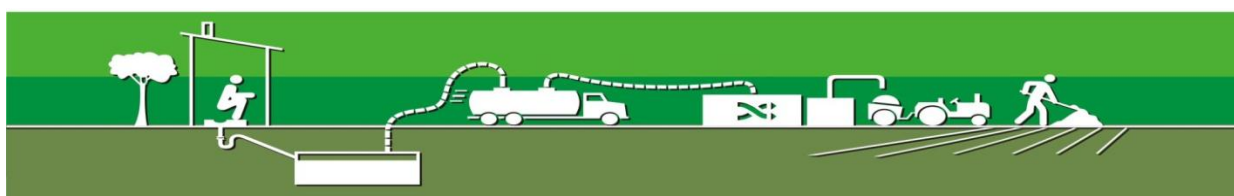
ii Conveyance

In any given context, the technology choice for conveyance system generally depends on the following factors:

- Type and quantity of products to be transported
- Distance to cover
- Accessibility
- Topography
- Soil and groundwater characteristics
- Financial resources
- Availability of a service provider
- Management considerations

The options available are:

- Gulper system
- Portable Pump
- Vaccutug (TANK)
- Vaccutug (Tractor)
- Dung Beetle
- Vacuum Tanker
- Human Powered
- Small Volume Transport (Capacity- 1,500 - 3,000 litres)
- Large Volume Transport (Capacity- 3,000 - 10,000 litres)



iii Faecal Sludge Treatment

For faecal sludge, the main treatment objectives are listed as below:

- i. Solid liquid separation
- ii. Dewatering
- iii. Stabilisation
- iv. Reuse applications

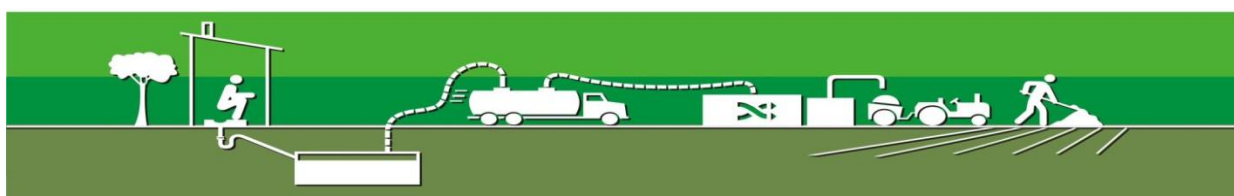
Technologies to treat Faecal Sludge* according to the objectives can be adopted to suit the local conditions and criteria as highlighted in the Table 3 adopted from IWA publication *Faecal Sludge Management Systems Approach for Implementation and Operation, IWA Publications, 2014*

Table 2: Faecal Sludge Treatment Options

Solid/Liquid Separation	Dewatering	Stabilisation/Further Treatment	End Product/End use
Imhoff Tanks	Mechanical	Co-composting	Soil conditioner
Settling /Thickening Tanks	Unplanted drying beds	Deep row entrenchment	Irrigation
		Lime/Ammonia addition	
		Sludge incineration/pyrolysis	Building Material
		Anaerobic digestion	Biofuel
		Black soldier flies/vermicomposting	Proteins
		Thermal Drying	
		Solar Drying	
		Planted Drying beds	
		Co-treatment with wastewater upto 3% FS of current STP load*	

At present in India, a few faecal sludge treatment plants that use different technologies are functioning. They are:

1. Co-treatment at STP (Nesapakkam and Perungudi, Chennai)
2. Anaerobic digestion using Upward Aerobic Sludge Blanket with unplanted drying beds (Bramhapur FSTP at Cochin), and
3. A combination of settling tank and anaerobic digestion with unplanted drying beds for solid components and DEWATS for liquid component (Devanahalli FSTP, near Bangalore)



5.4 Regulation

i. Desludging service providers

Assuming a designated disposal site is available, the next enabler to eliminate indiscriminate disposal of sludge is registration of desludging service providers. This resolves the issue of indiscriminate dumping and exposure of raw faecal sludge to the environment.

As a next step, licenses can be issued, which will help in regulations around safety of operator, training, equipment quality and access to designated disposal site. Licensing further allows tracking and monitoring of desludging service providers and ensures adherence to set regulations, protocols and policy. Licensing also enables credit availability for service providers and estimation of market potential for the city/town.

However, the biggest benefit of licensing service providers is to bring them into the formal sector, recognise their contribution for serving the unserved and giving them the dignity they deserve.

ii. Transfer Stations

For large cities and towns desludging service providers cover a larger distance (more than 10-15 Km.) for disposal of faecal sludge. This translates to higher operating costs and lower revenues due to time lost in travel which may encourage indiscriminate dumping. This can be addressed simply by introducing transfer stations at convenient locations from where dewatered sludge can be transferred to the FSTP/STP at regular intervals. The policy document for national FSM should have provisions for creation of such Transfer Stations and their regulation.

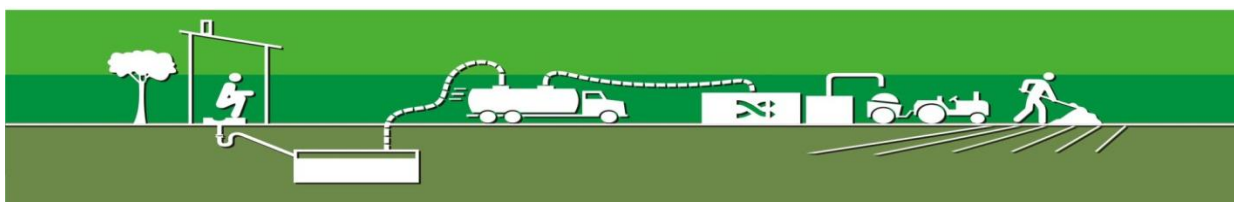
iii. Disposal

The final disposal point for faecal sludge must be a designated site or location authorised by the ULB for this specific purpose in compliance with the Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974.

The disposal site may be:

1. A designated manhole of a sewer network
2. A designated STP or FSTP
3. A recognized composting facility either in an agricultural field or MSW processing site.

The location for disposal site should be finalized by the ULB in consultation with the Pollution Control Board and District Collectorate.



iv. Reuse

Reuse of treated faecal sludge in India is currently unregulated, but the 2006 WHO Guidelines for Safe Use of Wastewater, Excreta and Greywater provide a comprehensive framework for managing health risks associated with the use of human wastes in agriculture and aquaculture. These guidelines are eminently suitable for application in Indian conditions and may be adopted.

5.5 Operations and Maintenance

Standard operating procedures (SOPs) are needed for desludging operations which comply with the geographic and climatic conditions of respective agro-climatic zones. This would be a major step towards standardising the ways of desludging service providers' work within an agro-climatic zone. SOPs are also required for plant operations in an FSTP.

Operation & Maintenance of any equipment used needs regulation to guarantee certain minimum standards. Road transport guidelines, OSHA guidelines and other occupational safety guidelines may be included in the policy.

Operation and Maintenance (O&M) of on-site sanitation systems is essential to ensure safe and efficient sludge management practices. The O&M responsibilities of sanitation infrastructure for property owners include (UMC, 2015):

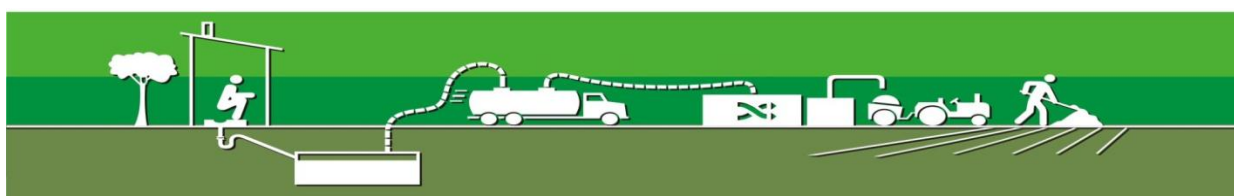
- Repair and maintenance of toilets, septic tank, soak pit and piping
- Clearing pipe blocks
- Getting faecal sludge emptied using private or municipal vacuum emptier at an interval of 2-3 years.

i. Collection and Transportation

ULBs are responsible for ensuring safe emptying of on-site treatment units at regular intervals. They need to schedule septic tank desludging services and carry out extensive awareness campaigns to ensure that the septic tanks are cleaned at least once in three years (UMC, 2015). They can perform this task either on their own or by entering into service contracts with private agencies (UDD, 2016).

However, it is the responsibility of ULB to review the role of private septic tank emptier and assess their capacity in lines with the number of septic tank emptying annually, charges/fees for emptying services, location of disposal, registration/licensing with ULB or not etc. (UDD, 2016).

Also, since the households would be unlikely to pay for the scheduled services, ULBs can compensate the private sanitation providers by either raising their local taxes or by charging a fixed amount as user charges for sanitation every year.



The private contractors are selected on the following grounds (UMC, 2015):

- Provision of safety and protective gear to the cleaners
- Availability of mechanical cleaning equipment (Vacuum emptiers)
- Availability of a doctor on call
- Adequate number of trained staff
- Agreement to follow procedures listed in SOP

ii. Treatment plant

The ULBs need to facilitate the construction and operation of a Septage treatment plant that should meet all the environmental requirements and standards. An appropriate financing model including PPP for construction and O&M of Septage treatment and disposal facilities needs to be adopted that shall levy user charges as appropriate for meeting capital and O&M expenditure (GWMC, 2016). The septage treatment plant shall adopt appropriate technology for treating septage and the disposed sludge and waste water after treatment shall strictly comply with the norms as per the relevant legislations (GWMC, 2016).

5.6 Monitoring, Learning and Evaluation

i. Performance Monitoring

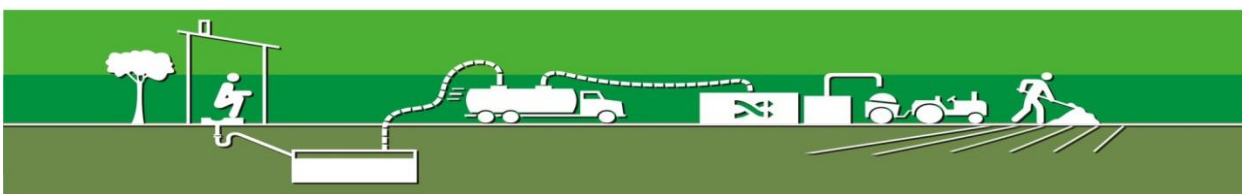
For effective implementation of FSM or monitoring the overall performance of FSM, various tracking elements and monitoring parameters need to be established. These include:

- a. Tracking user demand through a centralised call centre/service centre
- b. Cesspool Vehicles through GPS to identify indiscriminate dumping and enable penalising
- c. Tracking and recording the data for each OSS to enable effective desludging
- d. Tracking of backend processes to ensure adherence to service level benchmarks
- e. User perception through feedback for continuous improvement of service provided

ii. FSTP Monitoring protocols

It is essential to understand the performance of the FSTP for effective operations and treatment of faecal sludge. Protocols need to be established to track the following:

- a. Volume of faecal sludge treated
- b. Sludge Characteristics at inlet and outlet
- c. End By-product quality to WHO standards
Treated wastewater characteristics at outlet



5.7 Sustainability / Operating models for FSM

i. Revenue Streams

- a. Desludging Charges paid by users to the service provider
- b. Property tax designated for FSM related activities
- c. Tipping Fees from Private operators may be charged at designated disposal sites
- d. Registration and licensing charges/deposits to be paid by the desludging operators.
- e. Fines for faulty containment system construction and illegal disposal of faecal sludge.
- f. Sale of by-products – e.g. compost, fuel pellets, ash, biogas etc. To ensure the financial sustainability of the FSTP, the treated wastewater can be used by industries, watering the local parks.
- g. Other sources (e.g. advertisements)

ii. Cost Benchmarks

The manner in which truck operations or treatment takes place will vary based on the geography, administrative arrangement, financial robustness of the ULB, technology to be used, initial investment available and many such factors. Every ULB will have to set benchmarks for the following:

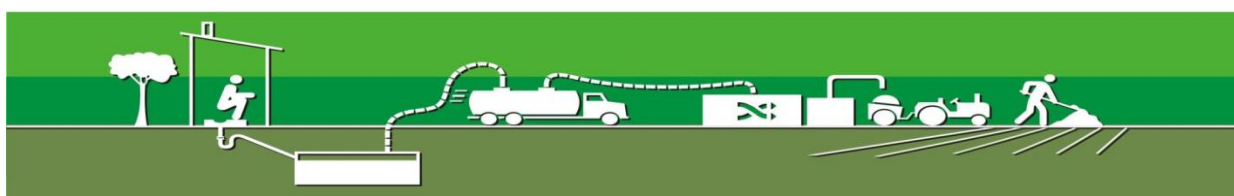
1. Capital and O&M cost based on technology selection
2. Desludging Services based on desired service levels

iii. Demand Management (scheduled vs on-demand)

Currently, desludging operators respond to calls for service from households (“on-demand” desludging). Typically, this happens when the OSS is full and is causing the toilet to backflow. However, by this time the OSS is usually overloaded (especially in the case of Septic tanks) and is not performing optimally. Even in pits, lids get compacted and create hard layers at the bottom thus making servicing much more difficult. Therefore, it can be prudent to schedule desludging services for households with OSS in most agro-climatic zones. In addition to ensuring proper maintenance and optimal performance of the OSS, “scheduled desludging” would also ensure levelled revenues to desludging operators and a steady supply of faecal sludge for a faecal sludge treatment plant which is elaborated further in this section.

The following are the ways of demand management in an effective FSM system:

- a. Scheduled Desludging- Services received by customers at predefined regular intervals - e.g. once in 3 years
- b. On-Demand Desludging- Services received by customers upon request.



- c. Repeat/Emergency Desludging- Services received by customers upon request well before next scheduled desludging.
- d. Responsive Desludging- Services received by non-customers e.g. Hotels, factories. This will usually entail an on-the-spot payment.

iv. ULB Level Resolutions

For ULBs to implement new policies or directives, they need a comprehensive set of resolutions to be passed by elected representatives of the ULB. For effective implementation of FSM policy detailed resolutions are needed for:

- i. Design and construction for OSS for new homes
- ii. Schedule desludging of OSS (optional)
- iii. Tariff setting for desludging services (optional)
- iv. FSTP construction - Land provision and permission to construct (optional)
- v. Operation and maintenance of truck operations and FSTP - government owned (optional)
- vi. Licensing of desludging service providers
- vii. Designating appropriate FS disposal sites
- viii. Property Tax - earmarked for FSM operational costs (optional)



6. Bibliography

CEPT, 2015. *FSM Policy Guidelines*, Bengaluru: CEPT University.

CPCB, 2015. *Inventorization of Sewage Treatment Plants*, Delhi: Ministry of Environment and Forests, Govt. of India.

CSE, 2011. *Policy Paper on Septage Management in India*, Delhi: Centre for Science and Environment.

GWMC, 2016. *Septage Management (Capture to Disposal)- Regulations 2016*, Warangal: Greater Warangal Municipal Corporation (GWMC).

Singh, A., 2014. Urban Sanitation and Rehabilitation of Scavengers in India. *Urban Panorama*, 1(XIII).

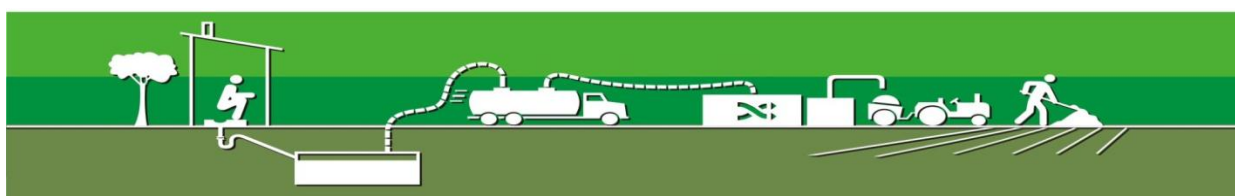
UDD, 2016. *Guidelines for Septage Management in Maharashtra*, s.l.: Government of Maharashtra.

UMC, 2015. *Standard Operating Procedure (SOP) for Fecal Sludge Management for Municipalities in Gujarat*, Ahmedabad: Urban Management Centre.

WaterAid India, 2016. *FSM - Urban Wash: An Assessment of Faecal Sludge Management Policies and Programmes at the National and Select States Level*, s.l.: WaterAid India.

WHO and UNICEF, 2015. *Progress on Sanitation and Drinking Water*, United States of America: The World Health Organisation and UNICEF.

WSP, 2012. *Septage Management in Urban India*, s.l.: Water and Sanitation Programme .



Annexure I



Guidelines for Septage Management in Maharashtra

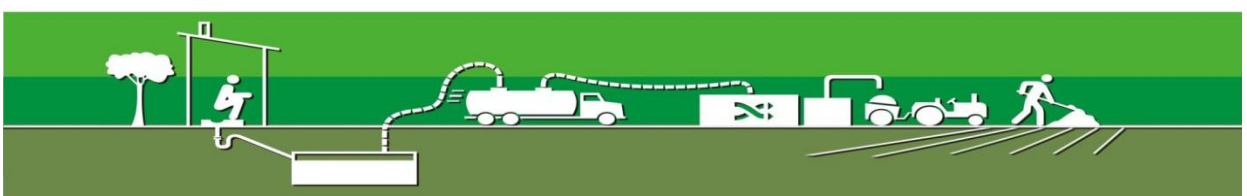
February, 2016

Swachh Maharashtra Mission (Urban)

Urban Development Department, Government of Maharashtra

For Maharashtra Septage management Detail guidelines, please use the link below:

https://swachh.maharashtra.gov.in/Site/Upload/GR/Septage_Management_Guidelines_UDD_020216.pdf



Annexure II

579



Government of Odisha
Housing & Urban Development Department

Letter No. 9395 /HUD,
HUD-SAN- 123/2015

Date : 20.4.16

From

Dr. Ajit Kumar Mishra
State Mission Director, SBM &
Joint Secretary to Govt.

To

The Commissioner, BMC/CMC/BeMC/SMC/RMC
Executive Officer of all Municipalities and NACs


Sub : Odisha Urban Septage Management Guidelines-2016.

Madam/Sir,

I am directed to invite a reference to this Deptt. letter No.1007 dtd. 12.01.16 on the above noted subject and to say that Government have been pleased to formulate Odisha Urban Septage Management Guidelines-2016 to regulate construction, cleaning, maintenance, treatment and disposal of septage in urban areas of the State with an objective to make cities/towns healthy and livable with smart/efficient sanitation services at ULB level. A copy of the said guideline is enclosed for ready reference.

You are, therefore, requested to ensure that all activities relating to septage shall be managed scrupulously adhering to the "Odisha Urban Septage Management Guidelines-2016" at ULB level.

Yours faithfully,



State Mission Director, SBM &
Joint Secretary to Govt.

Memo No.

9396

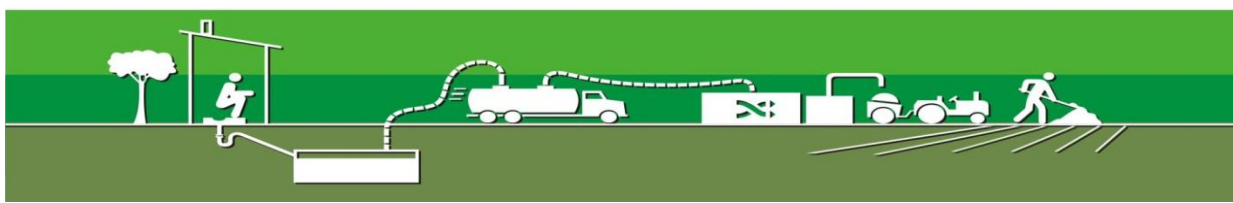
/HUD Date : 20.4.16

Copy along with enclosures forward to all Collectors/PD, DRDA-cum-DUDA/ MS, OWSSB/ Under Secretary to Govt., (i/c Project Section)/Team Leader, SBM-PMU/ Team Leader, OSUIP, (Email: osuip.dfida@gmail.com/ hkothari@deloitte.com) for information and necessary action.


State Mission Director, SBM &
Joint Secretary to Govt.

For Odisha Septage management Detail guidelines, please use the link below:

<http://www.urbanodisha.gov.in/Handler3.ashx?ID=1050>



Annexure III

**ABSTRACT**

Septage Management – Operative Guidelines for Septage Management for Urban and Rural Local Bodies in Tamil Nadu – Approved - Orders – Issued.

Municipal Administration & Water Supply (MA. 3) Department.

G.O.(Ms) No. 106.

Dated : 01.09.2014

Read:

From the Commissioner of Municipal Administration Letter
Roc. No. 47718/2013/UGSS-2, dated 31.07.2014.

ORDER:

Sanitation is one of the important works of the Urban Local Bodies. However due to absence of Under Ground Sewerage Scheme in many of the Local Bodies in the State, untreated sewage and waste is disposed on unscientifically, resulting in large scale population and environmental degradation. Vision 2023 of the Hon'ble Chief Minister envisages to ensure that all have access to safe sanitation including open defecation free and garbage free environment which includes the implementation of underground sewerage scheme and waste water Treatment Plants across local bodies in order to provide better sanitation facilities.

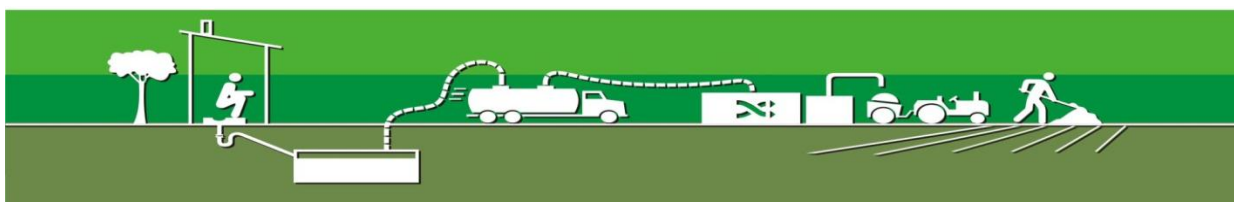
2) The Commissioner of Municipal Administration, in his letter read above, has stated that adequate attention needs to be given to septic tank design, operation and even to collection of sewage from their tanks, their transportation and processing and he has prepared a draft Operative Guidelines on Septage Management, which can regulate periodical cleaning of septic tanks, Transport, Treatment, Re-use and scientific disposal.

3) The Commissioner of Municipal Administration has requested the Government to issue orders to implement the Operative Guidelines for Septage Management in Urban and Rural Local Bodies in Tamil Nadu.

4) The Government, after careful examination of the above proposal, approve the Operative Guidelines for Septage Management in Urban Local Bodies and Rural Local Bodies in Tamil Nadu. The Operative Guidelines for Septage Management is annexed to this order.

For Tamil Nadu Septage management Detail guidelines, please use the link below:

http://www.tn.gov.in/virtual_directory/dtp/gorders/maws_e_106_2014_Ms.pdf





एक कदम स्वच्छता की ओर



**Ministry of Urban Development
Government of India**

www.moud.gov.in
www.swachhbharaturban.gov.in
www.swachhbharat.mygov.in

