Faecal Sludge Treatment Plant Detailed Project Report, Jhansi

INTRODUCTION

The waste generation in India has increased sharply owing to rapid population growth and urbanization over the past couple of decades. According to a study conducted by World Bank in 2006, it was estimated that approximately 50% of the Indian population lives in unhygienic conditions. Among the 350 million urban residents in India, 206 million (58.8 %) urban households do not have access to a drainage network, of which 102 million (29 % of the urban population) are connected to septic tanks, and 60 million (17%) use pit or vault latrines. Though the number of people in India practicing open defecation has marginally reduced, the management of onsite sanitation facilities such as septic tanks and pits remain a neglected component of provision of safe sanitation facilities. With around 102 million septic tanks and 60 million pits in the country (World Bank, 2006), India is yet to establish FSM as a main stream sanitation approach.

Faecal sludge is a fluid mixture of untreated and partially treated sewage solids, liquids and sludge of human or domestic origin. In other words, faecal sludge is sludge from onsite sanitation systems that is a combination of raw primary sludge and anaerobically digested sludge. Generally, faecal sludge has three main components as follows:

- Scum – floats on top and is generally where the bacteria that live treat the waste
- Effluent – the semi-treated liquid that comprises the majority of the material in the septic tank
- Sludge – solids which collect at the bottom of the tank

The physio-chemical characteristics of the faecal sludge can vary depending on the characteristics namely the size and type of onsite sanitation system, design, desludging interval and the local climatic conditions of the place where the tank is located, the quantity and quality of water supplied and the type of wastewater originating from the household (which is user specific).

Faecal Sludge when not managed properly can cause pollution of waterways including groundwater. Such situations have serious implications on health and environment. It is projected that by 2015, the proportion of urban Indian population with access to improved sanitation facilities will increase to 80% (from 43% in 1990) and for rural population, the projection is 48% (from 1% in 1990). As per projections made by United States Agency for International Development in 2010, by 2017 it is expected that 148 million urban population in the country would have septic tanks and about 425 million rural population would have gained access to improved sanitation facilities. Thus, it is clear that the number of onsite sanitation systems will only grow over the next few years.

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Though faecal sludge management poses a national problem, it can also be viewed as a potential resource. When properly managed, faecal sludge can be a useful resource than a waste. Faecal Sludge contains plant nutrients such as nitrogen, phosphorous which is contributed by human urine and faeces. Faecal sludge can reduce reliance on chemical fertilizers, and when combined in adequate amounts with fertilizers can provide the requisite nutrients for crop production.

Majority of onsite sanitation systems such as septic tanks and pits require frequent desludging which should be in accordance with the design and capacity of the system. Desludging however takes place only when there is odour and overflow of the contents from the tanks, which is much after the treatment efficiency of such systems have fallen. The overflow of the tank then finds its way into the nearest waterways and pollutes it. Faecal sludge, which is rich in nutrients such as nitrogen and phosphorous, disposed untreated into surface water bodies, could pose a threat of eutrophication.

Adequate facilities and services for collection, transportation, treatment and disposal of urban domestic faecal sludge are non-existent in majority of Indian cities. Most OSSs are emptied manually in absence of suitable equipment by scavengers. Ideally a septic tank system should be desludged regularly every 2-5 years. But ignorance towards Operation and Maintenance (O&M) procedures often results in accumulation of sludge at the bottom reducing the effective tank volume which leads to an overflow. This sequence of events ultimately causes failure of the system and release of partially treated or untreated faecal sludge from the septic tank. Private cesspool vehicle operators often do not transport and dispose of faecal sludge several kilometres away from human settlements or in a Sewage Treatment Plant (if existing) and instead dump it in drains, waterways, open land, and agricultural fields.

NEED FOR FAECAL SLUDGE MANAGEMENT

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 and maintain as they require continuous power, skilled operators and extensive electro mechanical maintenance and a huge tract of land. It is for this reason that India's 7000+ smaller towns (most urban and peri-urban areas) 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 sewage systems work effectively in India. Sewage has clearly been identified as the leading polluter of water

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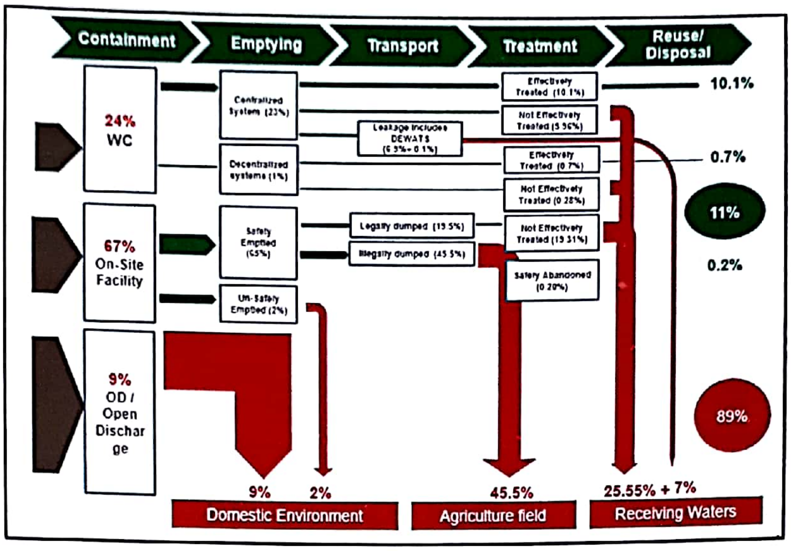

sources in India, causing a host of after effects including diarrhoea (which kills 3,50,000 children each year) agricultural contamination and environmental degradation.

Out of the 3.4 million plus households that make up urban Uttarpradesh, 24% are connected to the underground drainage system, while 67% are still dependent on on-site sanitation systems. 9% of these households do not have access to any form of toilet facilities and thus resort to open defecation or the toilets are directly connected to open drains. Only about 11% of sewage gets transported and effectively treated. The remaining 89% is dumped into water bodies, onto agricultural land or in the domestic environment. The absence of post-toilet infrastructure poses a huge risk to public health and the environment at large.

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JHANSI: AN OVERVIEW

TOWN PROFILE

Jhansi is a historic city in the Indian state of Uttar Pradesh. It lies in the region of Bundelkhand on the banks of the Pahuj River, in the extreme south of Uttar Pradesh. Jhansi is the administrative headquarters of Jhansi district and Jhansi division. Called the Gateway to Bundelkhand, Jhansi is situated between the rivers Pahuj and Betwa at an average elevation of 285 metres (935 feet). It is about 415 kilometres (258 mi) from New Delhi and 99 kilometres (62 mi) south of Gwalior.

According to the 2011 census, Jhansi has a population of 505,693, its urban agglomeration a population of 547,638. The literacy rate of Jhansi is 83.02%, higher than the state average of 67.68%. The sex ratio is 905 females for every 1000 males Jhansi city has 57th rank among the most populated cities of India, according to the 2011 census.

Jhansi is located at 25.4333 N 78.5833 E. It has an average elevation of 284 metres (935 feet).Jhansi lies on the plateau of central India, an area dominated by rocky relief and minerals underneath the soil. The city has a natural slope in the north as it is on the south western border of the vast *Tarai* plains of Uttar Pradesh and the elevation rises on the south. The land is suitable for species of citrus fruit and crops include wheat, pulses, peas, and oilseeds. The region relies heavily on Monsoon the rains for irrigation purposes. Under an ambitious canal project (the Rajghat canal), the government is constructing a network of canals for irrigation in Jhansi and Lalitpur and some part of Madhya Pradesh. The trade in agricultural products (including grain and oilseeds) is of great economic importance. The city is also a centre of brassware manufacture.

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SITUATION ANALYSIS

To understand the existing sanitation situation in Jahnsi, faecal sludge value chain approach was used. Faecal sludge value chain is the linear linkage of dependent components in the pathway of faecal sludge generated from onsite sanitation system. The value chain has components such as user interface, containment, collection and conveyance, treatment and reuse. Figure 2 shows a schematic representation of the value chain.

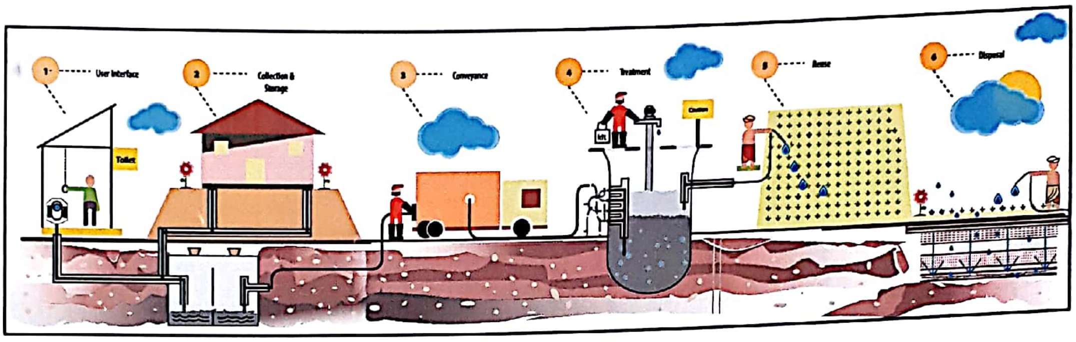

Figure 1: FSM value chain

The management of this value chain is termed as Faecal Sludge Management (FSM). FSM is an important and incremental approach catering to improved sanitation. In the past, faecal sludge management from onsite facilities has not been a major priority for engineers or municipalities, and has traditionally received little attention. Several generations of engineers have considered waterborne, sewer-based systems as the optimum, long-term solution to fulfill sanitation needs. Onsite technologies have been looked upon as only temporary solutions until sewers could be built. It is a common perception that onsite technologies fulfill sanitation needs for rural areas, but in reality, around one billion onsite facilities worldwide are in urban areas. In many cities, onsite technologies have much wider coverage than sewer systems. Given that cities are expanding at an incremental rate and that the scope of funding from public sector remains unchanged, the plan to have all households connected to a sewer network remains a distant goal to be achieved. It is the cost and effort involved in constructing sewerage networks and associated treatment plants which lead practitioners and researchers in the field to think about a novel approach, thus mainstreaming FSM.

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FSM GAP IDENTIFICATION

From the above situation analysis, gaps across the sanitation value chain as well as in the management framework can be highlighted as mentioned in the table below:

Table: FSM gap identification

	1.User Interface	2.Storage	3.Transport	4.Treatment	5.Reuse
Current Situation	Toilets connected to pits/septic tanks or in some instances directly to open drains	The containment systems are mostly septic tanks.	The ULB doesn't own a desludging truck, the people mostly depend on private desludging operators .High time requirement for desludging No protocols or regulation on O&M or safety regulation	Partial Digestion in septic tank. Direct disposal in the open.	No usage of raw faecal sludge
Corrective Measures	Toilets have to be connected to scientifically designed septic tanks/pits	Training of masons for scientific construction of Septic tanks Build awareness regarding improper design and operational procedures	ULB to provide desludging services by buying appropriate desludging vehicles to access majority of the lanes in the town. Training for desludging service providers to scientifically empty septic tanks. Post construction of treatment plant, ensure disposal only happens in the treatment plant	Build a faecal sludge treatment plant to effectively treat all the Faecal sludge collected in the town	Spread awareness on usage of end product and elimination of stigma regarding usage of treated faecal sludge. Trainings for farmers using wastewater for safer reuse of treated wastewater and discourage use of raw wastewater

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CRITERIA TO BE ADOPTED FOR FAECAL SLUDGE COLLECTION & 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)

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TREATMENT CONCEPT

The treatment concept proposed for faecal sludge treatment in Jhansi has been developed considering mainly

a) Area of treatment plant
b) Reusability of by-products
c) Implementation cost
d) Operations and Maintenance
e) Aesthetics

As manpower and electricity is limited in Jhansi the design has taken into consideration minimum energy and minimum operation and maintenance requirement.

TREATMENT STAGES AND MODULES ADOPTED

Table: Different Faecal sludge Treatment Stages and Modules

Sl. No	Treatment Stages	Treatment modules
1	Sludge Stabilisation/ Dewatering	Planted Drying Beds
2	Liquid Wastewater Treatment	Integrated Settler and Anaerobic Filter
		Horizontal Planted Gravel Filer

FSTP CONCEPT PROPOSED FOR JHANSI

This feacal sludge treatment unit is designed for 6 cum capacity.. The liquid sludge would be conveyed to PDBs (6 nos) where they are allowed to degrade naturally with the help of specific plant. The planted sludge drying beds are structures with sloped base for holding graded filter media. The sludge undergoes liquid-solid separation and also drying. The dried sludge from the planted drying beds are removed once in 1 or 2 years depending on rate of feeding and the rest of the part which is the liquid percolate or effluent wastewater is conveyed to the separate treatment units.

The effluent wastewater is then treated in two stages (primary and secondary stage) in DEWATS modules. The primary stages i.e. Settler is mainly meant for Sedimentation of any solids that have entered the modules along with the percolate. The secondary stage i.e. Anaerobic Filter is for the anaerobic degradation of any dissolved and suspended organic matter. The partially treated wastewater from the secondary treatment unit would be conveyed into the horizontal planted gravel filter takes place. The treated wastewater from the planted gravel filter is collected in the collection tank and can be reused for irrigation purpode for the garden

In future if the quantity of faecal sludge is expected to increase significantly the same system can be replicated in the selected location to accommodate the extra loads.

Figure : Proposed FSTP Site

Figure : Topography survey at the site

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PROPOSED TREATMENT MODULES

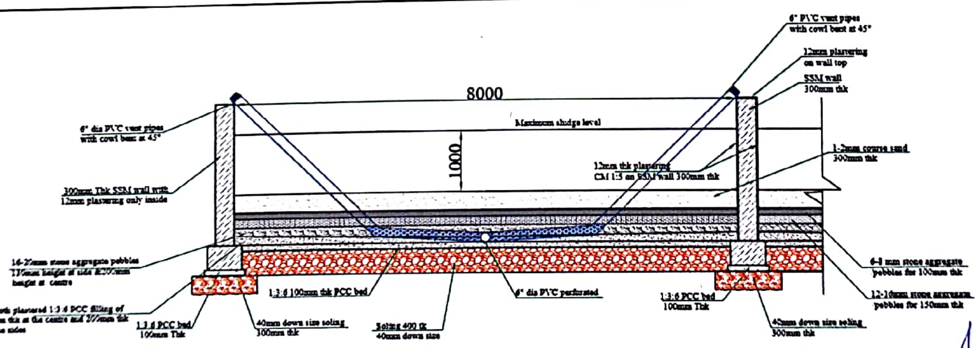
PLANTED DRYING BEDS

The screened faecal sludge is applied on to Planted drying beds (PDBs), also sometimes referred to as planted dewatering beds, vertical-flow constructed wetlands and sludge drying reed beds, are beds of porous media (e.g. sand and gravel) that are planted with emergent macrophytes. PDBs are loaded with layers of sludge that are subsequently dewatered and

stabilized through multiple physical and biological mechanisms. FS is repeatedly loaded onto PDBs, with up to 10 cm of FS per loading where it accumulates for several years depending on the loading rate, the capacity of the system and mineralization rates and meanwhile the percolated water is treated separately in DEWATS modules. The volume of sludge on the PDB reduces continuously (through moisture loss and degradation), and the plants maintain porosity in the sludge layer thereby significantly reducing the need for sludge removal ompared to unplanted drying beds (which require sludge removal every two to three weeks).

Table: Specifications of Planted Drying Bed

Parameters	Unit	Values
Total number of beds	-	6
Treatment volume of each bed	m^3	6
Area required per bed	m^2	36 m^2
Slurry feeding frequency	days	6 days
Maximum sludge filling height	m	1
BOD outlet (percolate)	mg / L	600
COD outlet (percolate)	mg / L	1200



Cross section B-B

Figure: Cross Section of Planted Drying Bed

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INTEGRATED SETTLER AND ANAEROBIC FILTER (AF)

The percolate from the Planted Drying Bed is further subjected to treatment in the Integrated Settler and Anaerobic Filter (AF). Faecal sludge by its own characteristics has very high amount of solids. Although most of the solids will be retained on the top of the planted drying bed, a small percentage of some of the solids may infiltrate the percolate. Therefore, it is proposed to provide a Settler for sedimentation before it enters into the Anaerobic Filters. A settler is a primary treatment technology for wastewater; it is designed to remove suspended solids by anaerobic digestion.

The AF consists of 3 chambers in series in which the wastewater flows through down take pipes enabling water to reach the bottom of tank. Here, the suspended and dissolved solids present in the wastewater undergo anaerobic degradation. As wastewater flows through the filter media, particles are trapped and organic matter is degraded by the biomass that is attached to the filter material.

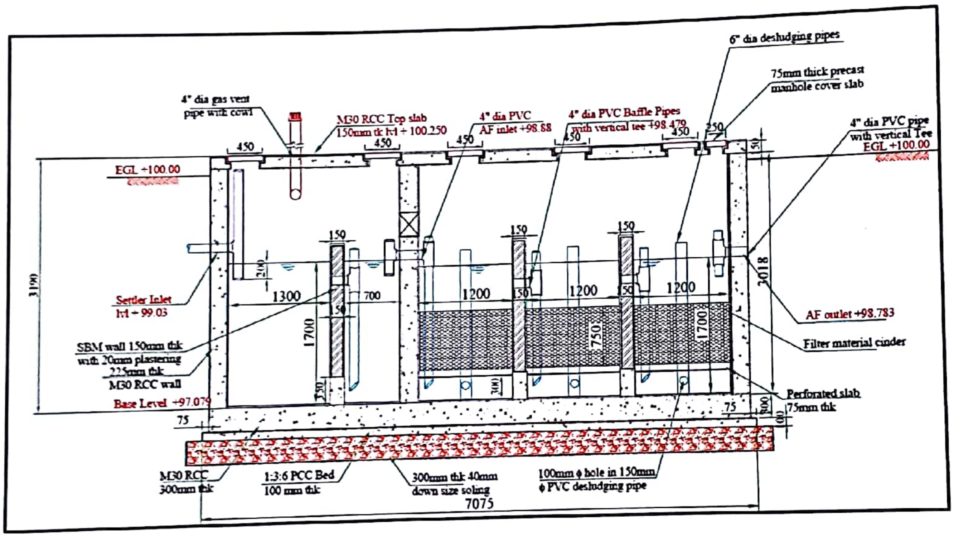

Figure: Cross section of Integrated Settler and Anaerobic Filter

HORIZONTAL PLANTED GRAVEL FILTER

The Planted Gravel Filter is used as an aerobic tertiary treatment unit where the pollutants (mostly nutrients) present in the wastewater are degraded aerobically. In order to remove the odour and colour and to enrich the wastewater with oxygen it is necessary to allow the wastewater to pass through aerobic treatment. HPGF is made of planted filter materials consisting of graded gravel bed. The bottom slope is 1% and the flow direction is horizontal. The main plants used in this filter bed are Canna Indica, Reed juncus, Papyrus and Phragmites. The plant selection is mainly based on their

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Table : Specifications of PGF

Parameters	Unit	Values
Percolate treatment quantity	m^3/Day	4
Total number of PGF	-	1
Hydraulic Retention Time per PGF	Days	2.1
Area required per PGF	m^2	75.48
BOD outlet	mg / l	15
COD outlet	mg / l	50

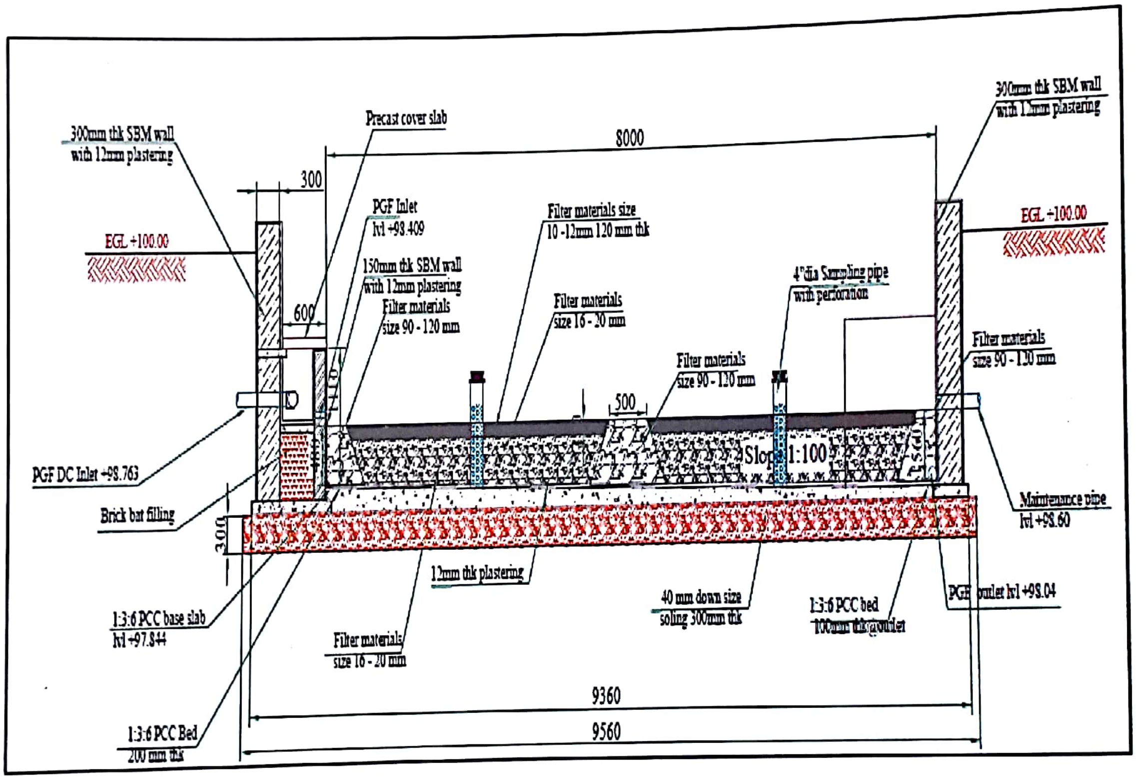

Figure : Cross section of Planted Gravel Filter

Technology Options

Screen and Grit chamber

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Design and description: It is a physical method for separation of solid waste and inorganic solids like plastic, cloth, sand, slit etc. from the faecal sludge to prevent clogging of subsequent treatment

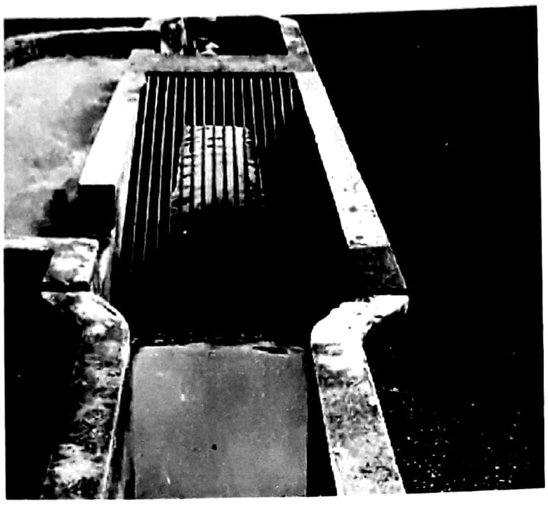

Figure 2: Screen and Grit Chamber

modules and also enhancing the value of treated end products. Screen chamber uses a series of vertical screens made from mild steel and coated with anti-corrosive elements for this purpose. The trash is collected by manually scrapping the screen with a rake or similar arrangement. The collected trash will be stored and disposed along with municipal solid waste collection facility of the Municipality.

Grit chambers are like sedimentation tanks, designed to separate the intended heavier inorganic materials and to allow the lighter organic materials to pass through to the next treatment unit. Hence, the flow velocity is a decisive design consideration. The velocity should neither be too low as to cause the settling of lighter organic matter, nor should it be too high as to preclude the settlement of the silt and grit present in the sludge. A horizontal velocity of flow of 15 to 30 cm /sec is used at peak flows. The detention time proposed in the grit chamber is 3 minutes.

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Stabilisation Reactor

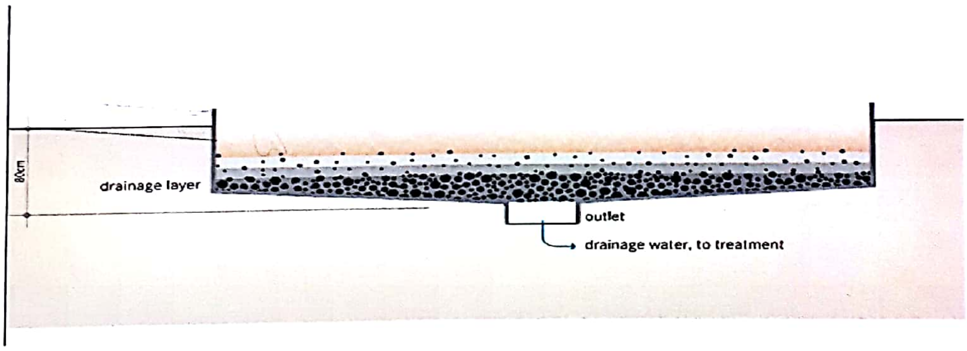
The main objective of the stabilization reactor is to allow the sludge to digest anaerobically which leads to reduced organic load and better dewater-ability. The stabilization reactor has 3 chambers. The first chamber has a retention time of 2 days and assists in homogenization of sludge. During the discharge of sludge from the desludging vehicle high turbulence is created in the chamber with an up-flow velocity of 4-5 m/hr.The second chamber has a retention time of 10 days and is designed to stabilize the sludge through aiding the process of anaerobic digestion. The length of the chamber is kept low to prevent dead zones and liquid funnels that may be created at the outlet. A baffle wall is also designed for similar purpose. The up-flow velocity in this chamber is kept at 1.5 -2 m/hr., this is to disturb the sludge and help entrapped bio-gas to escape, thereby aiding liquid solid separation.

The third chamber retains the sludge for 1 day; this is used as an intermediate collection tank to empty the contents into the drying bed every day

Sludge Drying Beds

Unplanted Drying Bed is a simple, permeable bed filled with several drainage layers. When loaded with sludge, it collects percolated leachate and allows the sludge to dry by percolation and evaporation.

Approximately 50–80% of the sludge volume drains off as liquid or evaporates. This sludge needs additional treatment by composting before it can be safely disposed off or used as a nutrient-rich soil conditioner in agriculture. The percolate, however, still contains pathogens and needs to be further treated.



Design and description: Unplanted drying beds are one of the simplest and oldest techniques to dewater sludge. It includes a simple technique to reduce the volume of the sludge and prepare its reuse as fertiliser. The bottom of the drying bed is lined with perforated pipes to drain away the leachate that percolates through the bed. On top of the pipes are layers of gravel and sand that support the sludge and allow the liquid to infiltrate and collect in the pipe. While the solid fraction remains on the filter surface and is dried by natural evaporation, the liquid percolates. Sludge is applied in layers on top of the gravel beds and is naturally dried. It should not be applied in layers that are too thick as this will deter drying. The final moisture content after 10 to 15 days of drying should be approximately 60%.

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When the sludge is dried, it must be separated from the sand layer and transported for further treatment, end-use or final disposal. The leachate that is collected in drainage pipes must be treated further.

Application: Sludge drying beds are a secondary treatment for all kinds of sludge, including faecal sludge from on-site sanitation systems, anaerobic digesters. Sludge drying is an effective way to decrease the volume of sludge, which is especially important when it has to be transported elsewhere for further treatment, end- use or disposal. The technology is not effective at stabilizing the organic fraction or decreasing the pathogenic content. Further storage or treatment of the dried sludge might be required before use in agriculture.

Unplanted drying beds are appropriate for small to medium communities with populations up to 100,000 people, but larger ones also exist for huge urban agglomerations. They are best suited for rural and peri-urban areas where there is inexpensive, available space situated far from homes and businesses

Operation and maintenance: Trained staff for operation and maintenance (application of sludge, desludging, control of drainage system and the control of the secondary treatments for percolate or dried sludge) is required to ensure proper functioning. Even though experts are not compulsory for the operation and maintenance, a well-organised community group, which has experience in organic fertiliser use and preparation should be involved.

Dried sludge can be removed after 10 to 15 days, but this depends on the climate conditions. Because some sand is lost with every removal of sludge, the top layer must be replaced when it gets thin. The discharge area must be kept clean and the effluent drains should be regularly flushed.

Supplementary infrastructure and treatment requisite: The leachate collected from the beds needs further treatment.

Advantages:

- After composting dried sludge can be used as fertiliser
- Good dewatering efficiency, especially in dry and hot climates
- Can be built and repaired with locally available materials
- Relatively low capital costs; low operating costs
- Simple operation, only infrequent attention required
- No experts, but trained community required

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- No electrical energy is require

Disadvantages:

- Requires a large land area
- Labour intensive removal
- Limited stabilization and pathogen reduction
- Requires expert design and construction supervision
- Leachate requires further treatment

Note: Dried sludge and effluent may require further treatment or storage, depending on the end-use. Sludge can be composted before reuse

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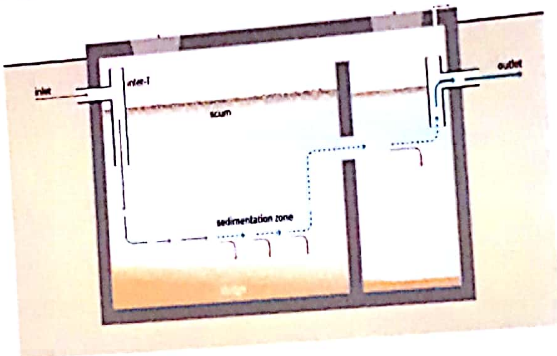
Settler

Settling tanks are rectangular tanks, where faecal sludge is discharged into an inlet at the top of one side and the effluent leaves through an outlet on the opposite side, while solids settleto the bottom of the tank, and scum floats on the surface.

Design and description: Settling tanks are watertight chambers which provide primary treatment for wastewater. The liquid flows through the tank and heavy particles (sludge) sink to the bottom, while scum (mostly oil and grease) float at the top. The biochemical oxygen demand (BOD) reduction is about 30 to 50% and TSS reduction is about 40 to 60. The Hydraulic Retention Time is about one day. This technology is not efficient at removing nutrients and pathogens.



The settling tanks should be appropriately sized and the accumulated sludge and scum must be removed every 2-3 years. At least two settling-thickening tanks should be operated alternately in parallel, in order to allow for sludge removal without overloading the tanks in the process. The loading of FS, and the compaction and removal of the thickened sludge and scum comprise the main phases of an operating cycle. These periods allow for the expected solids-liquid separation and thickening operations.

Application: This technology can be used at household level or cluster level.

Operation and maintenance: The settling tanks should be regularly checked to ensure it is watertight, and it regular checks for scum and sludge levels should also be done. Sludge needs to be dug out every 1-5 years and discharged properly. Settling tanks need to be vented

Supplementary infrastructure and treatment requisite: Effluent from Settlers need further treatment of wastewater in ABR or any other further treatment of effluent is required for safe disposal or reuse.

Advantages:

- The settler has a low operation cost
- Requires little space due to underground construction
- Can be built and repaired with locally available materials
- Has no real issues with flies or odours if used correctly
- Does not require electrical energy

Disadvantages:

- Settlers have a long start-up phase

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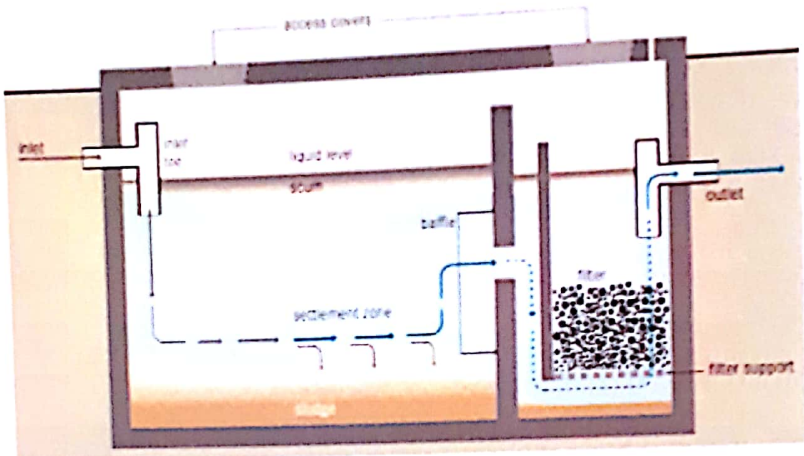
- There is a lack of experience in operating with FS
- Lack of empirical data and results on which to base designs for pathogen removal is low
- Effluent and sludge require further treatment

Anaerobic Filter

Anaerobic filters are also known as fixed bed or fixed film reactors. Anaerobic filter tanks are underground or closed watertight tanks with chamber in series with a fixed filter media as shown in



Design and description: They are generally used as a secondary treatment module for pre-treated wastewater. AF includes the treatment of non settleable and dissolved solids besides treatment through sedimentation and sludge digestion. Filter material such as gravel, rocks, cinder or specially formed plastic pieces provide additional surface area for bacteria to grow. The pre-settled wastewater is made to pass through active bacteria mass growing on the filter media. The larger the surface area of the filter media, the higher the treatment efficiency.

An important design criterion is equal distribution of wastewater upon the filter area. The baffle walls or pipes ensure the direction of wastewater flow within the tank; it forces the wastewater to flow through the filter media in each chamber. Each of the chambers is designed to take care of the required hydraulic and organic loading. Through intensive contact between wastewater and bacterial biomass, organic matter is digested with short retention times. The HRT of the tank will be 12-36 hrs.

Anaerobic filters are suitable for domestic wastewater with low content of suspended solids. In any case pre-treatment is necessary to prevent clogging. Suspended solids and BOD removal of 85-90% can be achieved.

Figure Anaerobic Filter

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Application: This technology can be used at household level or cluster level. AF is also used as secondary treatment module in DEWATS, which enhances the overall wastewater treatment efficiency.

Operation and maintenance: The filter media needs to be cleaned by back washing or flushing or may have to be washed and placed back periodically (filter media cleaning every 3-5 years, desludging of tanks every 2-3 years). The baffle pipes needs to be checked for clogging and cleaned regularly. On accumulation of sludge in the AF chambers, desludging needs to be done periodically. Protective gear has to be used and appropriate safety precautions have to be taken while desludging and cleaning filter material.

Supplementary infrastructure and treatment requisite: If AF is used as a standalone system, then pre-treatment of wastewater in septic tank or ABR is necessary and further treatment of effluent is required for safe disposal or reuse.

Advantages:

- Resistant to organic and hydraulic shock loadings
- No electrical energy is required
- Low operating costs
- Long service life
- High reduction of BOD and solids
- Low sludge production; the sludge is stabilized
- Low reduction of nutrients, thus outflow adapted for reuse in agriculture

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- Moderate area requirement (can be built underground)

Disadvantages:

- Piped water required to bring the wastes to the treatment unit
- Requires expert design and construction
- Low reduction of pathogens and nutrients
- Effluent and sludge require further treatment and/or appropriate discharge
- Risk of clogging, depending on pre- and primary treatment
- Removing and cleaning the clogged filter media is cumbersome
- Only suitable for low-density housing in areas with low water table and not prone to flooding
- Long start-up time

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Vertical Planted Gravel Filter

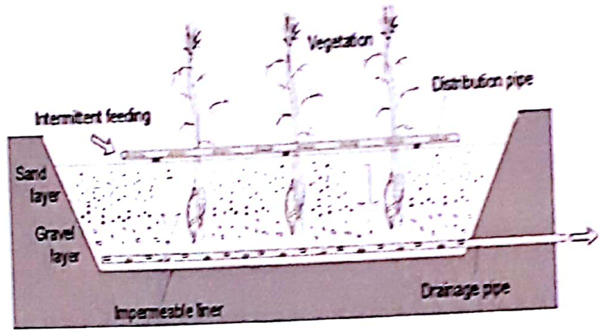
A vertical flow constructed wetland is a planted filter bed for secondary or tertiary treatment of wastewater that is drained at the bottom. Pre-treated Wastewater (e.g. from a septic tank or an Imhoff tank) is poured or dosed onto the surface from above using a mechanical dosing system. The water flows vertically down through the filter matrix to the bottom of the basin where it is collected in a drainage pipe. The water is treated by a combination of biological and physical processes. The filtered water of a well functioning constructed wetland can be used for irrigation, aquaculture, groundwater recharge or is discharged in surface water.

Design description

A typical VF constructed wetland consists of the following components

- Distribution pipe network
- Filter substrate with plantation
- Liner
- Drainage pipe network

Figure Vertical Planted Filter



In vertical filter beds wastewater is intermittently applied (either by pump or self-acting syphon device) onto the surface and then drains vertically down through the filter layers towards a drainage system at the bottom. In some cases, the distribution pipes are covered with gravel to avoid open water puddles. The treatment process is characterized by intermittent short-term loading intervals (4 to 12 doses per day) and long resting periods during which the wastewater percolates through the unsaturated substrate, and the surface dries out. The intermittent batch loading enhances the oxygen transfer and leads to high aerobic degradation activities. Therefore, vertical filters always need pumps or at least siphon pulse loading.

Usually the VF CW is implemented right after a primary treatment using a settler or septic tank. But in this FSTP infrastructure we intend to implement it after settler and anaerobic filter as the source of the FSTP is fecal sludge from pit latrines and septic tanks which are very different from domestic wastewater

Application: Because of the mechanical dosing system, this technology is most appropriate where trained maintenance staff, constant power supply, and spare parts are available. Since vertical flow constructed wetlands are able to nitrify, they can be an appropriate technology in the treatment process for wastewater with high ammonium concentrations. Vertical flow constructed wetlands are best suited to warm climates, but can be designed to tolerate some freezing and periods of low biological activity. Shade from plants and protection from wind mixing is limiting the dissolved oxygen in the water. Constructed wetlands allow for the combination with aquaculture and agriculture (irrigation) what contributes to the optimisation of the local water and nutrient cycle.

Depending on the volume of water, and therefore the size of required land surface, wetlands can be appropriate for small sections of urban areas or more appropriate for peri-urban and rural communities. It is a good treatment technology for communities that already have a primary treatment facility.

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Operation and maintenance: Emptying of pre-settled *sludge* should be ensured. Regulare removal of unwanted vegetation and cleaning of inlet/outlet systems should also be done on time.

Supplementary infrastructure and treatment requisite: In order to avoid clogging of filter media, pre-treatment system should be provided before VPGF.

Advantages:

- Utilisation of natural processes
- High reduction of BOD, suspended solids and pathogens
- Ability to nitrify due to good oxygen transfer
- Does not have the mosquito problems of the Free-Water Surface or Horizontal Wetland
- Less clogging than in a Horizontal Subsurface Flow Constructed Wetland
- Requires less space than a Free-Water Surface or Horizontal Flow Wetland
- Low operating cost

Disadvantages:

- Requires expert design and construction, particularly, the dosing system
- Requires more frequent maintenance than a Horizontal Subsurface Flow Constructed Wetland
- A constant source of electrical energy may be required
- Long start-up time to work at full capacity
- Not all parts and materials may be locally available
- High quality filter material is not always available and expensive
- Pre-treatment is required to prevent clogging
- Not very tolerant to cold climates

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- Faecal Sludge feeding into the tank (peak flow)
- It is of utmost important to clearly define the rate at which the faecal sludge will be fed into the treatment system. The faecal sludge feeding into the treatment system depends on the capacity and discharge arrangement of the desludging trucks. The treatment modules are designed considering a flow rate generated by discharging 5000 litres of faecal sludge from the truck into the treatment plant in 8-10 minutes time. Low flow has also been taken into account when designing the plant can cope with lower flow rates.
- Hydraulic Retention Time
- In order to ensure the effective treatment of sludge as well as sludge water, it is necessary to provide adequate sludge and hydraulic retention time for each of the treatment module proposed. The proposed Solids and Hydraulic Retention Time for each of the treatment modules are explained in further sections.
- Climatic Conditions
- It is necessary to consider the climatic conditions for design of treatment modules to ensure the effective treatment process: Temperature, to ensure treatment efficiency; rainfall, to ensure the drying of solids in the sludge drying beds and consider the quantity of sludge due to infiltration and frequent emptying resulting in dilute sludge; humidity, to assess the drying time. The design and detailing of the treatment modules are carried out taking the aforementioned factors into consideration.
- Due to the outer temperature, the process will be run in a temperature range of 25 to 40 °C which is a mesophilic range favourable to many beneficial bacteria.
- Odours
- The handling of faecal sludge has been associated with odour problems at the treatment facility. The most characteristic odours of faecal sludge is that of rotten egg which indicates presence of hydrogen sulphide and other gases. The real concern with odours is often not recognized during the design and only becomes apparent after the treatment plant becomes operational. In order to minimize the odour-related issues, it is necessary to consider the same in the design details e.g. by using vent pipes and also develop good housekeeping practices in the facility during operation. Additionally, there is no habitation in immediate 200m of the proposed plant which also provides reasonable buffer.
- Proposed Concept for Implementation of Faecal sludge Treatment System

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- Many treatment options have been considered in the course of developing this concept. An overview of the option considered can be found in the Annexure - 1.
- The treatment concept proposed for faecal sludge treatment in Chirkunda has been developed considering mainly:
- Maximum treatment efficiency.
- Hygiene and safe operation.
- Minimum operations and maintenance requirements
- The faecal sludge received at the treatment facility would be treated in various stages using different treatment modules as described in the following sections.
- Pre-treatment
- The desludging truck carrying faecal sludge will be directed to a receiving point inside the treatment facility. The faecal sludge received at the treatment facility will be discharged into the screen and grit chamber by means of gravity where it undergoes pre-treatment without any exposure to the desludging operator. Large and inorganic solids are trapped in this using a vertical screen and grit chamber.
- The solids collected in this chamber are removed regularly and dumped along with municipal solid waste arrangement made by Municipality.
- Sludge drying
- The sludge in the form of slurry from screen and grit chambers are transferred to sludge drying beds by gravity and a pipe. The sludge drying beds are structures with sloped base for holding graded filter media. The sludge undergoes solid-liquid separation and drying. The percolate from the sludge drying bed is collected and conveyed to the Integrated Settler and AF for further treatment. The dried sludge from the drying beds are removed periodically and transferred to the sludge storage shed located within the premises.
- Sludge Percolate Treatment
- The percolate from the sludge drying bed is subjected to anaerobic treatment in the settler integrated with an Anaerobic Filter. It is proposed to provide a settler before the anaerobic treatment to trap solids. Anaerobic Filter is used for removal of organic matter in the percolate.
- Tertiary treatment

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- As a tertiary treatment module a sand and carbon filter is planned for post treatment of water coming out of the AF, however use of sand and carbon filter depends on the desired quality of treated wastewater. For BOD of 30mg/l there is no necessary to use the sand and carbon filter, settler integrated with an anaerobic filter alone can treat it but for quality of BOD less than 10mg/l use of sand and carbon filter unit becomes necessary. Proper arrangement is made in concept preparation for use and non-use of sand and carbon filter.

CONCEPT – PLANTED DRYING BED METHOD

- This faecal sludge treatment unit is designed for 6 cum capacity. The area proposed is calculated based on Total Solids content and Loading Rate of the sludge. The septage shall first be made to pass through the screen and the grit chamber for the retention of coarse materials/ solid waste present in the septage. Then the septage would be conveyed to Planted Drying Bed (PDB).
- The Planted Drying beds are loaded with layers of sludge that are dewatered and stabilised through multiple physical and biological processes. When the sludge is deposited on the Planted Drying Bed the solids (which form about 50% of the septage) are retained on the bed and the rest of the part which is the liquid percolate or effluent wastewater is conveyed to the registers by gravity. The final registers collects effluents from all the drying beds and the wastewater is conveyed to integrated settler with anaerobic filters by gravity.
- Here 6 Planted Drying beds are provided in treatment plant in two set (6 beds for each set) however only one set of planted drying beds will be actively in operation for a year period, this means per day 6cum of Septage is provided to a single bed, the next day's load of septage application should be on the second bed and then the third and so on. Considering Sunday as rest day (no desludging happens) the 6 drying beds for remaining days are made consecutively, so one drying bed gets a load after a gap of six days..
- After a period of one year the second set of drying beds is used for feeding septage and first set of drying beds is kept as it is for complete drying and treatment of septage already fed. After 8 months the sludge from this set will be removed and stored in sludge storage room. Considering two months period is needed for replacement of filter media and two months period for complete growth of plants, this set should be ready for septage feeding after a gap of a year.
- Once the feeding for this set of beds begins, other set is kept as it is for 8months and after the sludge from this set will be removed and stored in sludge storage room. Again 4 months

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can be taken for repairing the beds for next feed. This process will be continued year after year, thus giving two years as a desludging period for each set.

- The effluent wastewater is then treated in two stages (primary and secondary stage) in integrated settler with anaerobic filter module. The primary stages i.e. Settler is mainly meant for Sedimentation of any solids that have entered the modules along with the percolate. The secondary stage i.e. Anaerobic Filter is for the anaerobic degradation of any dissolved and suspended organic matter. The partially treated wastewater from the secondary treatment unit would be conveyed into the tertiary treatment unit Planted Gravel Filter in order to remove the odor and color and to enrich the wastewater with oxygen. Then for the post treatment the wastewater is conveyed to collection tank with Sand and Carbon filter as explained in earlier sections the use of this unit depends on desired quality of treated wastewater.
- Proper arrangement is made for use and non-use of sand and carbon filter. The treated wastewater from the Planted Gravel Filter will flow to Collection Tank via gravity. The collection tank is divided in two parts by having a baffle wall in between. During non-usage years of sand and carbon filter the wastewater stored in collection tank can be diverted to polishing pond directly through control of valve which is provided for a pipe connecting first part of collection tank and polishing pond.
- If sand and carbon filter is used then the valve will be closed thus disconnecting the first part of collection tank and polishing pond. The wastewater is pumped to sand and carbon filter from first part of collection tank and then outlet of sand and carbon filter will be connected to second part of collection tank. The treated wastewater stored in second part of collection tank will flow to polishing pond by gravity through arrangements made.
- The final water from polishing pond can be reused for agriculture or feeding to plants for inactive set of draying beds or gardening purpose in treatment plant itself

Septage Characteristics

- Septage characteristics vary widely from one location to another. This variation is due to several factors, which includes number of users of the septic tank at the household, kind of waste disposed in the septic tank, size of the tank and desludging frequency, climatic conditions and the construction specifications of the septic tank.

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- Knowledge of the septage characteristics and its variability is very important in designing the treatment facility. Since the septage characteristics from a tested sample were unavailable, based on experience, existing engineering knowledge and literature review the septage characteristics considered for designing the facility are as follows:

Table Characteristics of the Septage used for design

Sl.No	Parameters	Concentration
1	Biochemical Oxygen Demand (BOD), mg/l (average)	~20000
2	Chemical Oxygen Demand (COD), mg/l (average)	~40000
3	Total Solids (TS), mg/l (average)	45000

Faecal sludge characteristics are very variable even within one town or city as they depend on many factors such as the type of sanitation facility from which the sludge is removed, the intervals of emptying, the technique of emptying, etc. Poor knowledge and lack of maintenance services often results in accumulation of organic sludge which reduces effective volume, lower retention times and affects the system performance. However, desludging of pits or septic tanks is perceived as a burden by many home-owners and hence they postpone cleaning until the tanks start overflowing.

In the toilets in the residential households utilise pour flush facility followed by septic tanks. In , the local population can be classified as *washers*, therefore water is always used in the toilets. Kitchen wastewater and other grey water do not enter the pits or septic tanks except in cases of a few houses or hotels where the black water and grey water lines are not separated. Cleaning agents used to clean the toilets also end up in the faecal sludge.

In the survey claims that the septic tanks and pits are water tight structures. But, water may leache out and also enters during rainy season into the pits or septic tanks. The soil in is quite permeable. Therefore depending on the season the faecal sludge might be concentrated or diluted.

The storage time in the pit or tank also determines the degree of digestion that would have occurred in the storage unit. In general faecal sludge from public toilets is found to be less digested or stabilized, whereas the sludge from household pits or septic tanks is found to be more stabilized as it has been stored for a longer time. The sludge from pits is less stabilized than sludge from septic tanks as it has been stored for a shorter duration in a pit. The faecal sludge at the bottom of tanks or pits is also found to be more compact and better digested than the sludge at the top.

Mechanical desludging is the most common method of desludging in . In case of mechanical desludging, if the sludge is too thick, water is mixed with sludge to allow for the pumps to suck out the sludge from the pit or septic tank. In case of septic tanks, the sludge at the bottom is usually not removed. Therefore the contents removed are more liquid like than sludge removed from pits. In general faecal sludge characteristics from on-site sanitation facilities have been reported as listed in Table 17 below.

Faecal sludge is in general much more concentrated than municipal wastewater (10 to100 times higher contents of organic pollutants and suspended solids). Faecal sludge in pits or septic tanks with appreciable levels of organics, nitrogen and pathogens, disposed without proper treatment are a

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cause of concern on account of the organic carbon (measured as BOD_5), nitrogen, phosphorus and pathogens in the effluent.

To get an understanding of the sludge characteristics from , faecal sludge sample was collected from a septic tank (having one partition wall) and analysed using standard methods for various parameters that would provide an overview of the organic load, solid concentration, and nutrient levels. The sludge in the septic tanks was 8 years old and was collected at the disposal point i.e. from the cesspool vehicle outlet at the reuse point of an agriculture field. Physical appearance, colour and odour were noted (detailed description provided in Annexure 2). Physical, chemical and biological parameters were then analysed in the laboratory at CDD Society.

The characteristics ofa faecal sludge .

Table: Physical and Chemical Characteristics of faecal sludge from one Sample

Parameters	Feacal Sludge Sample (30/09/2016)
pH	7.5
Alkalinity	10008
Ammonium	<500
Phosphates	240
COD	38650
Total Solids	58163
Volatile Solids	20745

The characteristics of the sample analysed, show that the faecal sludge has high Total Dissolved Solids content which is why there is a large difference between the COD values and Total Solids Content. This sample also had high pathogen content and has high nutrient content. The faecal sludge would therefore need stabilization and digestion as well as reduction of pathogen content before it can be disposed or reused in farmlands.

Septage feeding (peak flow)

It is of utmost important to clearly define the rate at which the faecal sludge will be fed into the treatment system. The faecal sludge feeding into the treatment system depends on the capacity and discharge arrangement of the desludging trucks. The treatment modules are designed considering a flow rate generated by discharging 4 Kilo litres of faecal sludge being discharged from the truck into the treatment plant in 8-10 minutes time.

Hydraulic Retention Time

In order to ensure the effective treatment of sludge as well as sludge water, it is necessary to provide adequate sludge and hydraulic retention time for each of the treatment module proposed. The proposed Solids and Hydraulic Retention Time for each of the treatment modules are explained in the next section.

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Climatic Conditions

In order to ensure the effective treatment process, it is necessary to consider the climatic conditions for design of treatment modules, necessarily the temperature to ensure treatment efficiency, rainfall to ensure the drying of solids in the drying beds. The design and detailing of the treatment modules are carried out taking the aforementioned factors into consideration.

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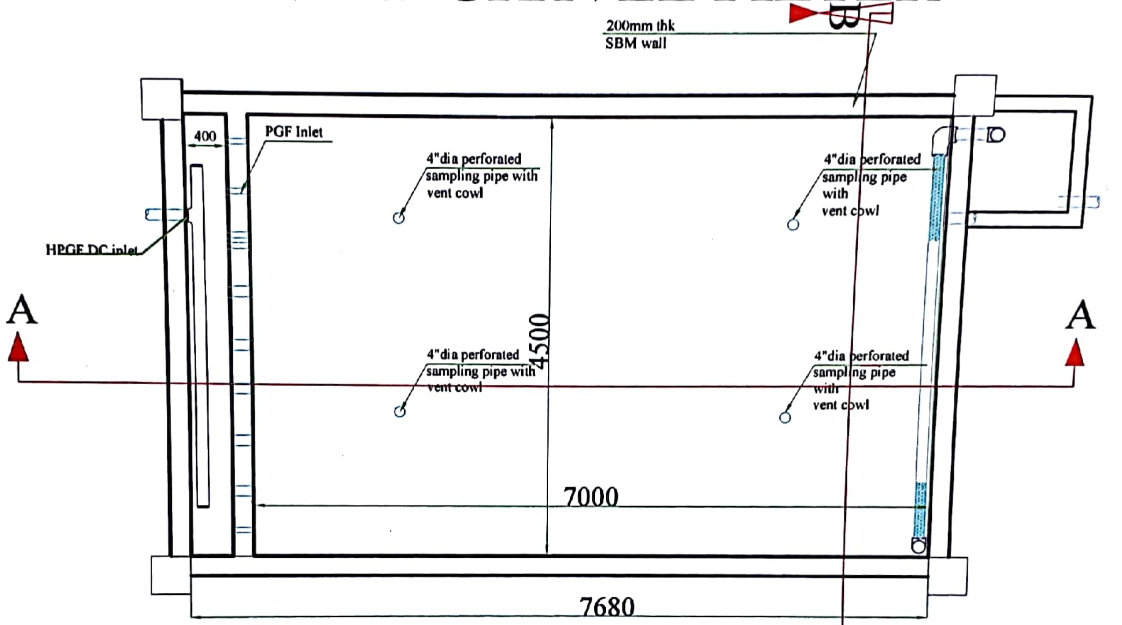
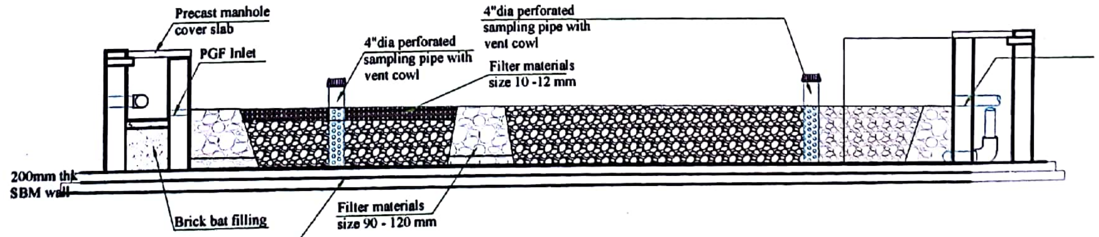
PLANTED GRAVEL FILTER



Sectional Plan of Planted Gravel Filter



Section @ A-A

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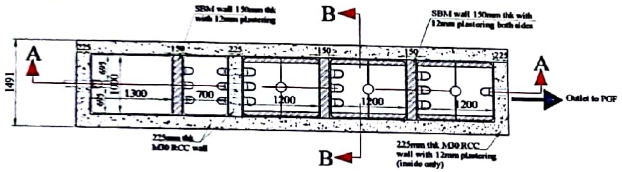
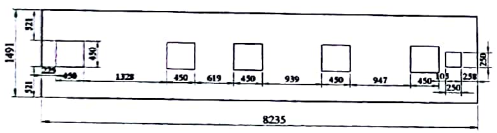
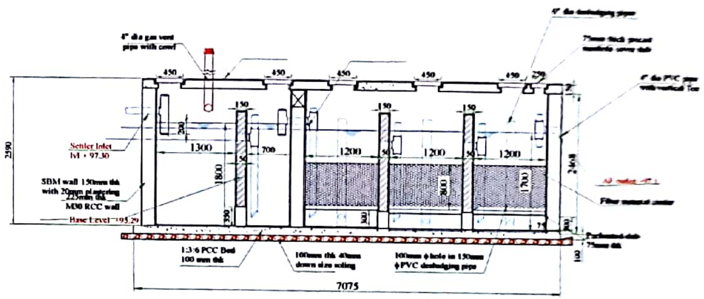


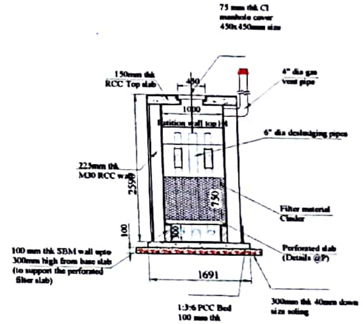
Sectional Plan



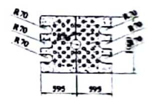
Manhole layout



Cross Section @A-A



Cross section @ B-B



Details @P
Perforated slab

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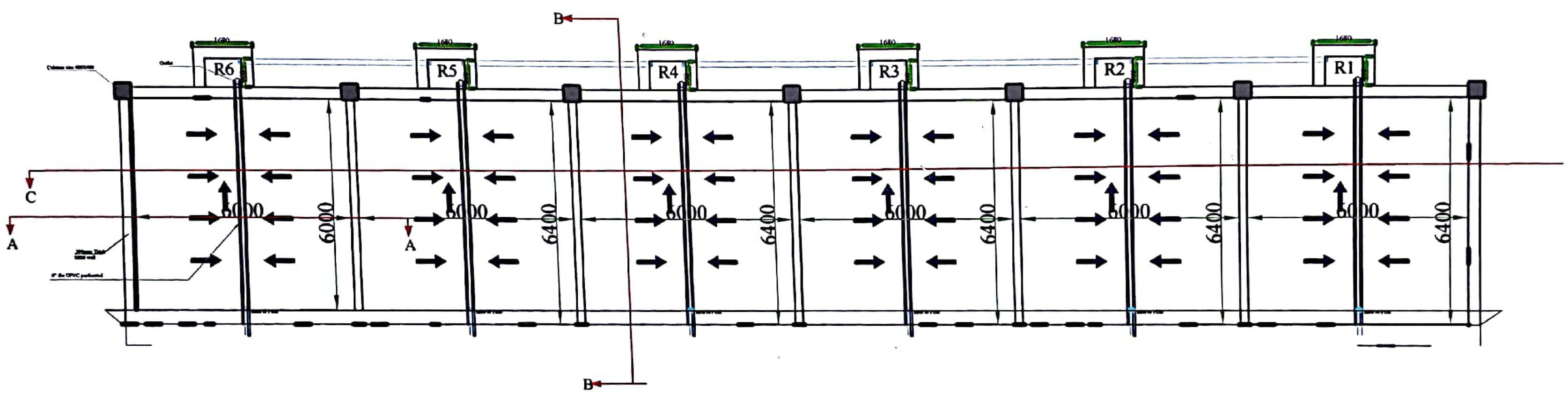
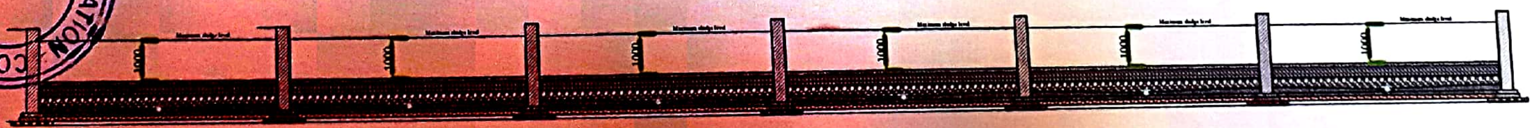
CONSORTIUM FOR DEWATS DISSEMINAT
BENGALURU

PLANTED DRYING BED





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JHANSI

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नगर निगम, झांसी

CONSORTIUM FOR DEWATS DISSEMINATION
BENGALURU

ESTIMATED COSTING

ESTIMATED COSTING FOR IMPLEMENTATION

Table : Estimated Costing for implementation

Abstract Costing			
Sl No	Description	Nos	Actual cost in INR
A	**Treatment modules**		
1	Technology Partner Fees		15,00,000
2	Sludge drying bed	6	4,224,454
3	Integrated settler and anaerobic filter	1	6,98,285
4	Planted Gravel Filter	1	866,644
5	Bondarry Wall		4,50,000
6	Machine & Pump		17,50,000
	Total A		**94,89,383**
B	**Other civil, mechanical and electrical works**		
1	Flexible Pavement		1669,766
2	Operator's room		380,302
3	Transportation and accomaodation charges		650,000
4	Tools		431,200
5	Collection tank (PVC Water Tank)		350,000
6	Land scaping		7,50,000
	Total B		**42,31,268**
	Sub Total (A+B)		**1,37,20651**
	Contingencies and unforeseen charges (20% of A+B)=C		27,44,130
	Sub Total(A+B+C)		**1,64,64781**
	Proposed GSTTax & other charge		46,10138
	Grand Total		**2,10,74919**

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CONSORTIUM FOR DEWATS DISSEMINATION BENGALURU

OPERATION AND MAINTAINENCE COSTING

Operation and Maintenance costing of FSTP at Jhansi									
Sr. No.	**Description**	**No**	**Rate**	**I Year**	**II Year**	**III Year**	**IV Year**	**V Year**	**Remarks**
A	Human resource								
1	Operator - For regular operations	7	Rs. 96,000	Rs. 6,72,000	Rs. 672000	Rs. 672000	Rs. 672000	Rs. 672000	10% Increase every year
2	Labour- Full time for emptying Planted sludge drying beds			Rs . 50,000	Rs. 50,000	Rs. 50,000	Rs. 50,000	Rs. 50,000	
B	**Miscellaneous**								
1	Water and electricity for FSTP- per month	1	Rs. 10,000	Rs. 120,000	Rs. 120000	Rs. 120000	Rs. 120000	Rs. 120000	Connection provided by municipal corporation
2	Protective gears (gloves, mask, overall, etc.) - per month	4	Rs. 2,000	Rs. 8000	Rs. 8,000	Rs. 8,000	Rs. 8,000	Rs. 8,000	Consumables to be procured once in a month
C	**Incidental maintenance activities (contingency fund)**								**Remarks**

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DRUSTI DISSEMINAT OR CONSORTIUM FOR DEWATS

1	Purchase of tarpaulin sheet (2 sheets are used)			Rs. 8,000	Rs. 8,000	Rs. 8,000	Rs. 8,000	Rs. 8,000
2	Replacement of tools and equipment (if broken)	LS	Rs. 180,000	Rs. 180,000	Rs. 180,000	Rs. 180,000	Rs. 180,000	Rs. 180,000
3	Plumber and labour Charges for repairing piping (if damaged)	LS	Rs. 80,000	Rs. 80,000	Rs. 80,000	Rs. 80,000	Rs. 80,000	Rs. 80,000
D	**Maintenance activities**							
1	Filter Material Replacement in PDB- once in 1 years		Rs. 1616,979	Rs. 1616,979	Rs. 1616,979	Rs. 1616,979	Rs. 1616,979	Rs. 1616,979
2	Labour cost for filter material cleaning and replacement in PDB- once in 1 year - 3 labors for 3 days/bed	54	Rs. 600	Rs. 12,000	Rs. 12,000	Rs. 12,000	Rs. 12,000	Rs. 12,000
4	Cleaning filter and plantation of PGF- once in 1 year (4 People in 3 days)	12	Rs. 600	Rs. 8,000	Rs. 8,000	Rs. 8,000	Rs. 8,000	Rs. 8,000
5	Cleaning AF- once in 1 year	1	Rs. 8,000	Rs. 8,000	Rs 8000	Rs 8000	Rs. 8,000	Rs 8000
O & M Budget required				**Rs. 2762979**	**Rs. 2762979**	**Rs. 2762979**	**Rs. 2762979**	**Rs. 2762979**

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Ministry of Urban Development
Government of India

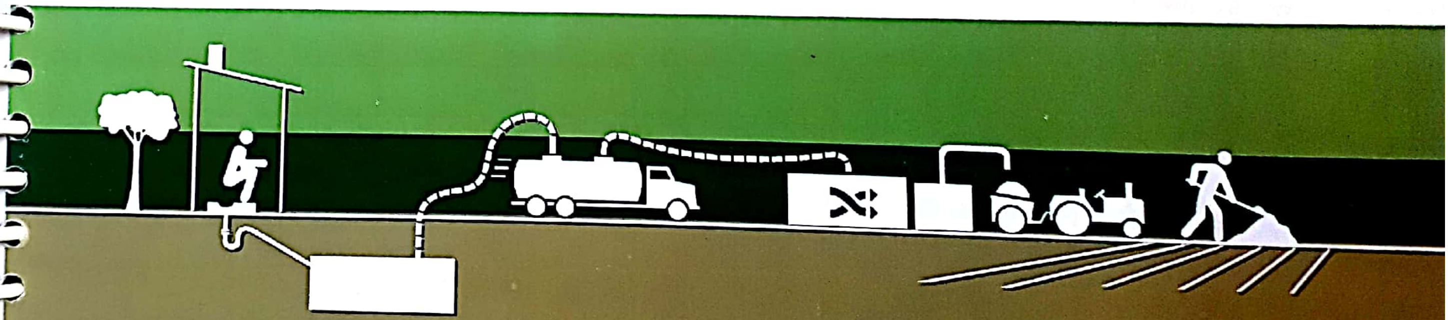
Smart City

NFSSM

नगर निगम
झाँसी

Dated 05-10-2016 and House Meeting Dated 08.05.2016 Policy Adopt By Nagar Nigam Jhansi Executive Body Meeting

Primer on Faecal Sludge and Septage Management



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DEWATS DISSEMINATION

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.

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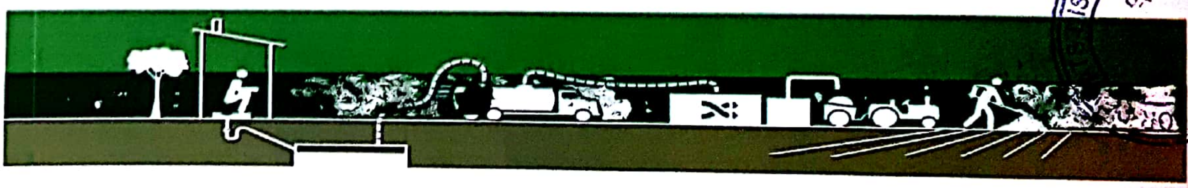

According to the data released in the Central Pollution Control Board 2015 report (CPCB, 2015):

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).

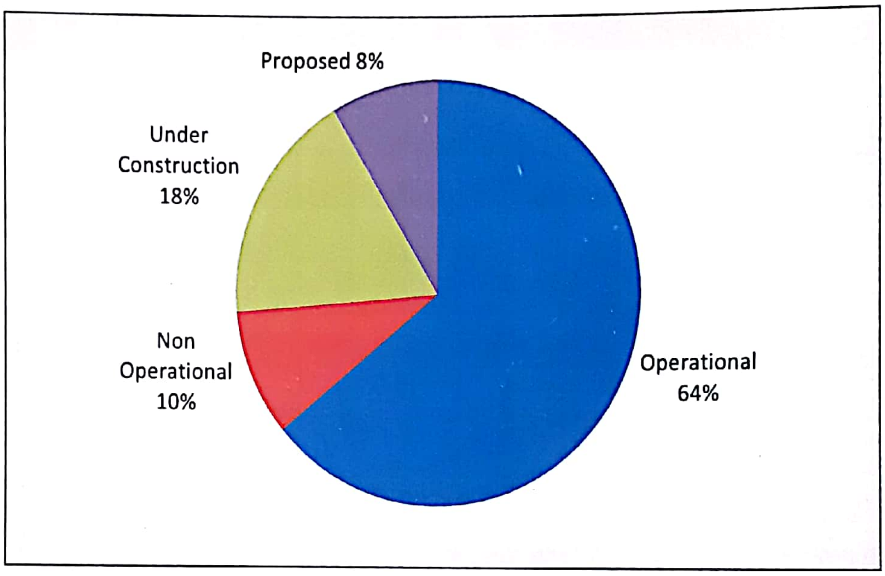

Figure 1: Distribution of STPs in India (CPCB, 2015)

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.

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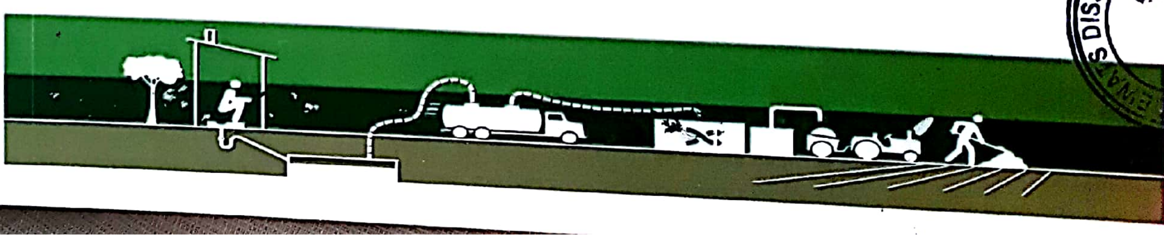
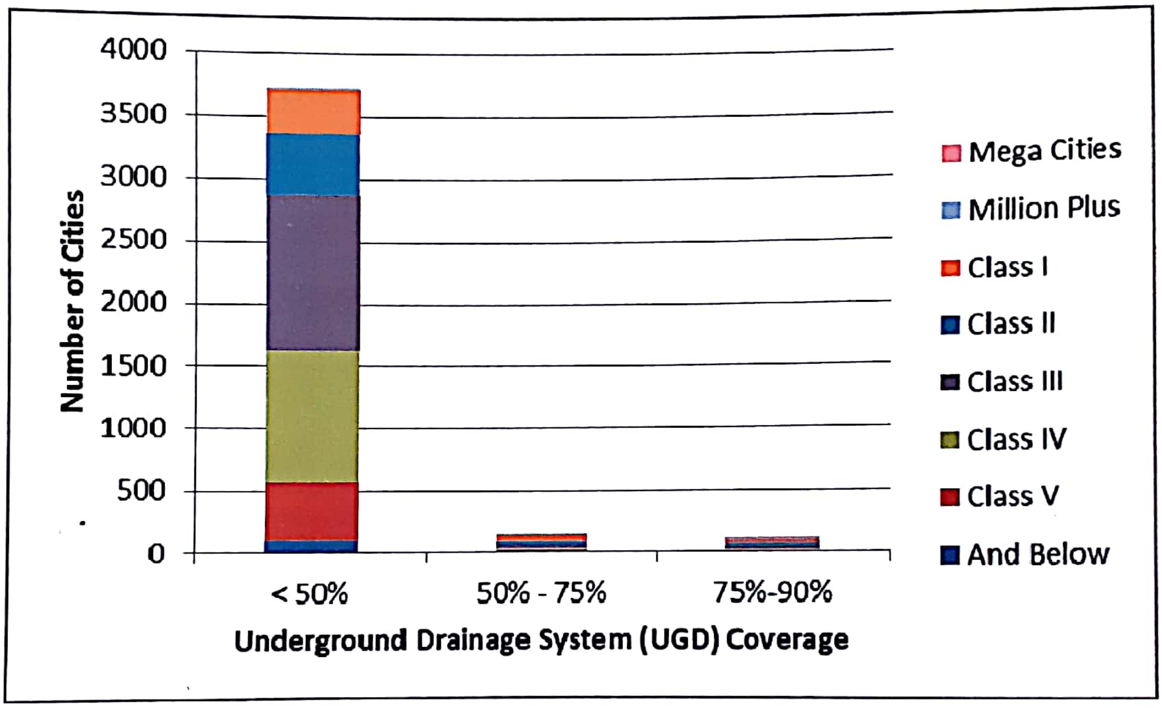


1.2 Scale of the Problem

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)

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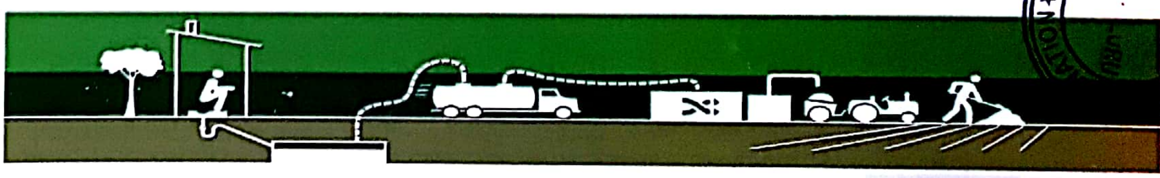
CONSORTIUM FOR DEWATS



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

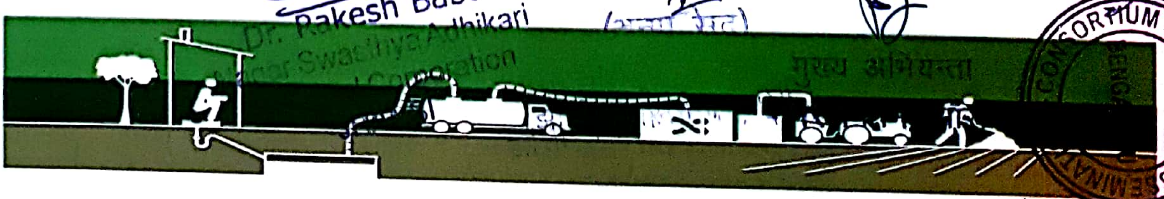
3.1 On-site Sanitation Systems

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.

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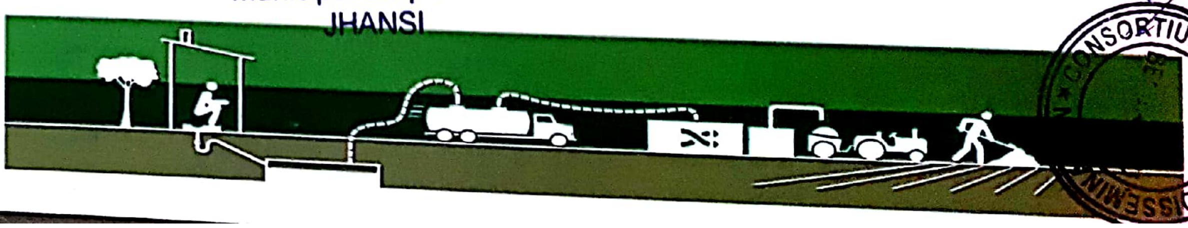

4. Planning for FSM: Key Activities and Toolkit

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.

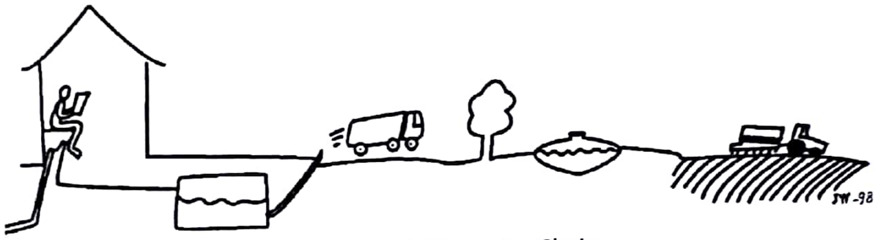

Figure 2: FSM Service Chain

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.

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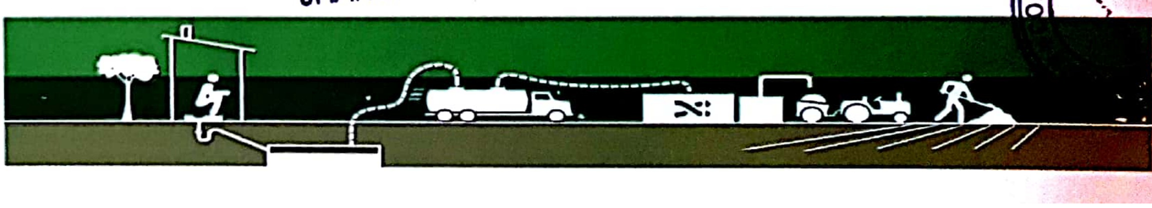

Figure 3: Steps for FSM Planning

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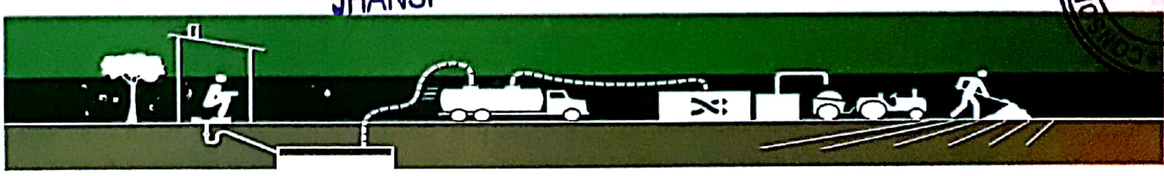

i Assessing Service Performance Across the Full Service

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.

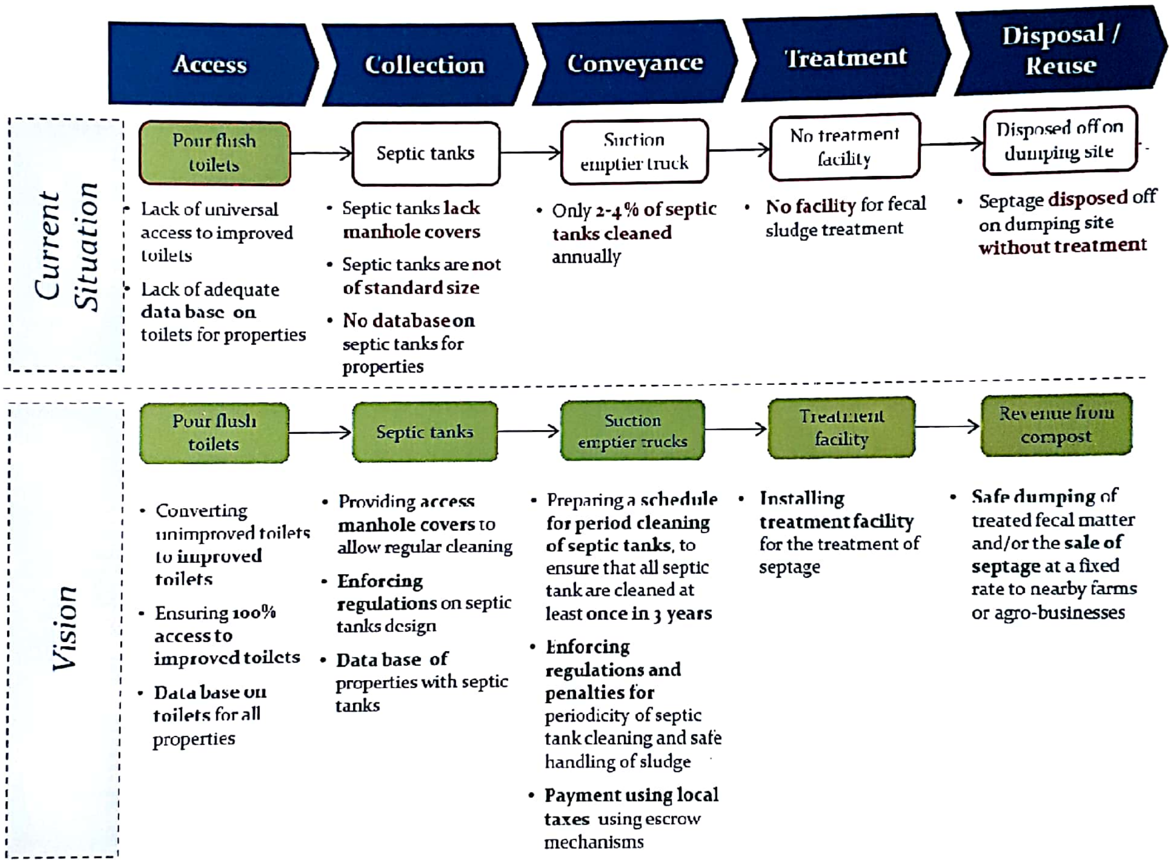

Figure 4: Current situation and vision for FSM in an ULB

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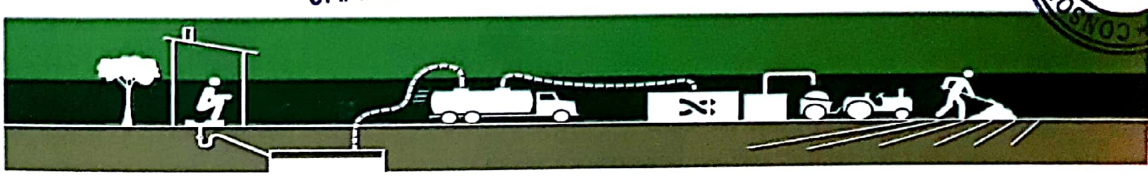

i Assessing Service Performance Across the Full Service

ii. Enabling Environment: Policy, Regulation and Institutions

Sanitation is increasingly seen as a key issue in environmental protection. Improper disposal of human wast 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.

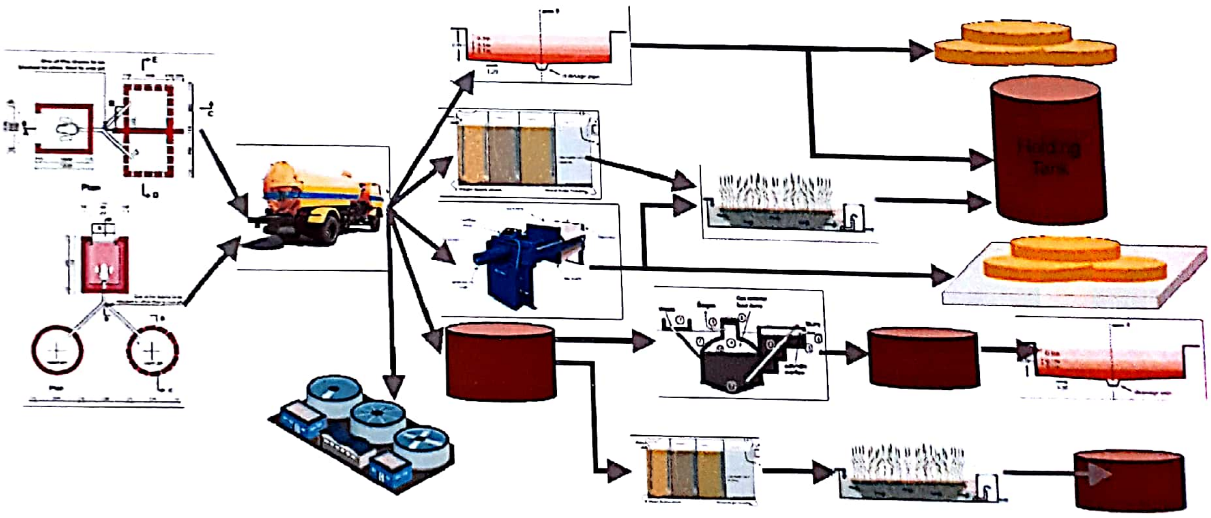

Figure 5: Technology Options for FSM

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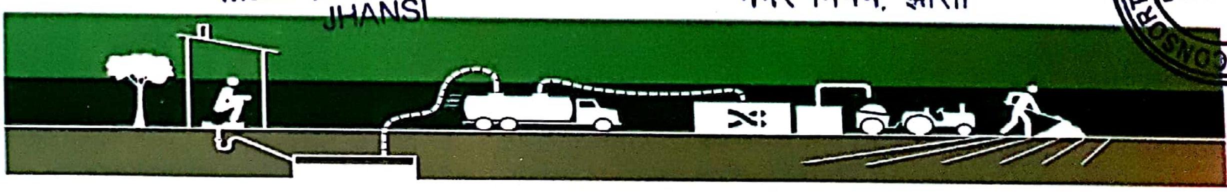

iv. Potential of Private Sector Role across the Service Chain

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.

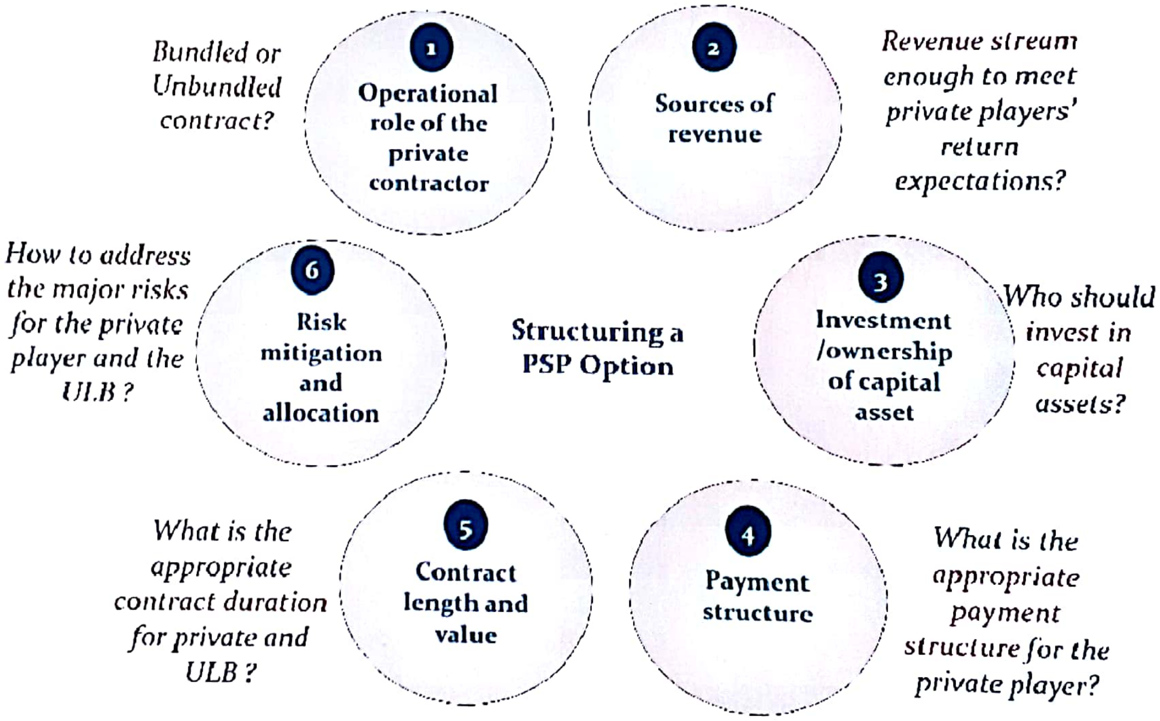

Figure 6: Six decision areas for structuring PSP in FSM

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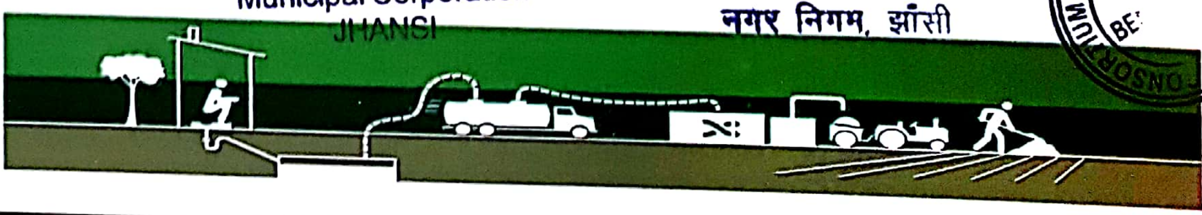


4.2 Financial Assessment

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.

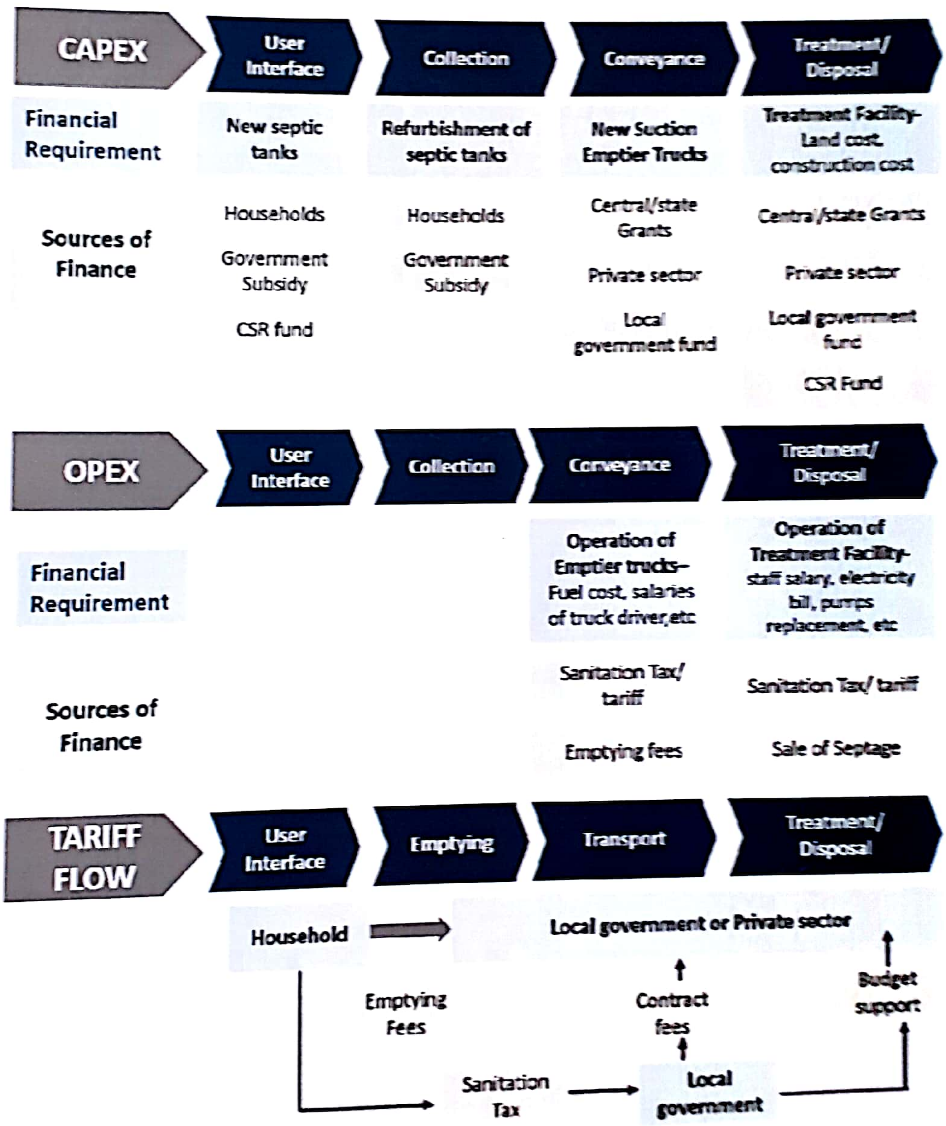
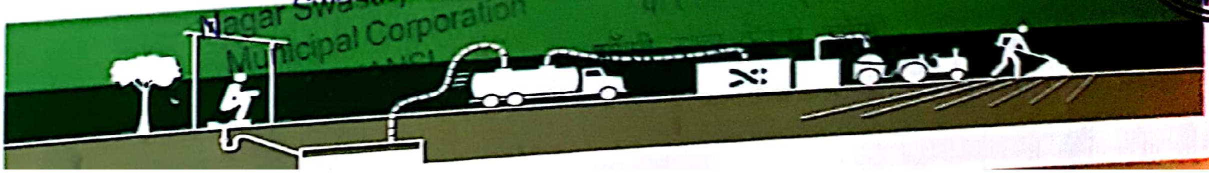


Figure 7: Financial Assessment and structuring



4.2 Financial Assessment

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 vaccum 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,

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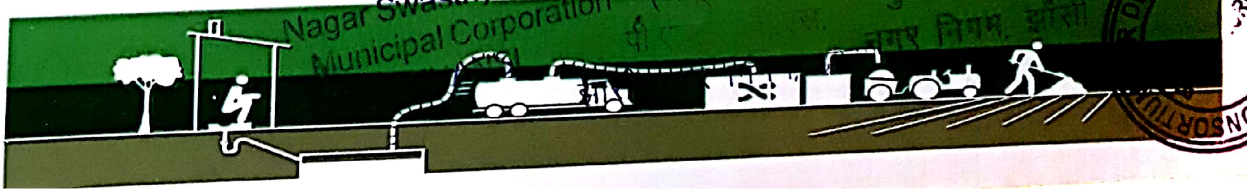

2016). Also, all septage transporters need to maintain a collection and transport receipt system that needs to be duly filled by the private / ULB service provider and submitted to ULB office (UDD, 2016).

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):

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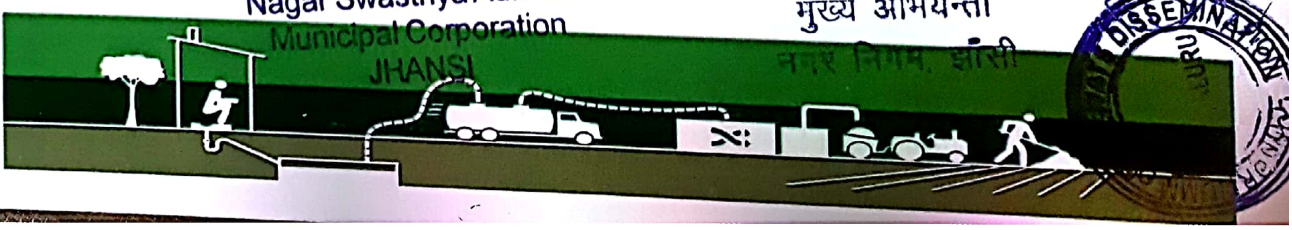

Faecal coliform density < 1000 MPN/g total dry solids
Salmonella sp. Density < 3 MPN/ 4 g of total dry solids
Helminth egg concentration of < 1/g total solids (WHO,2006)
E coli of 1000/g total solids (WHO,2006)

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).

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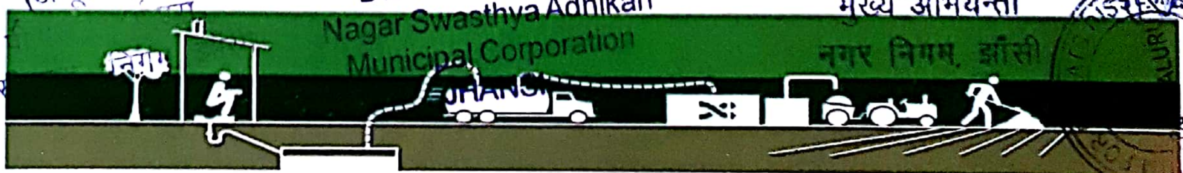

i. Toilet users/citizens

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

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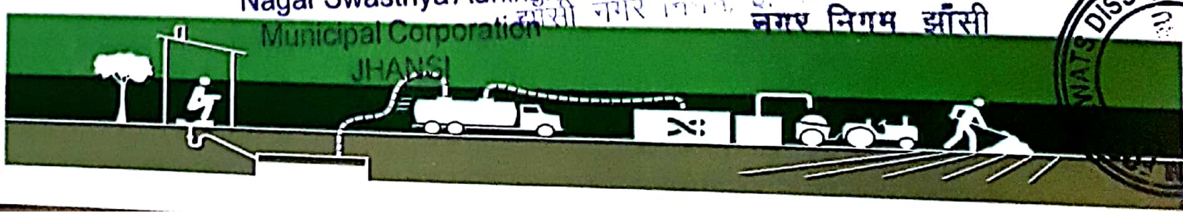

i. Toilet users/citizens

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.

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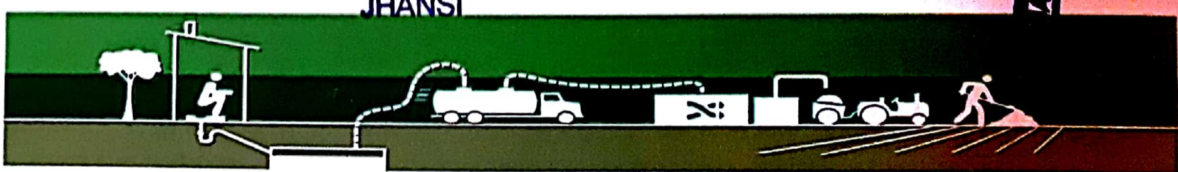

5.3 Matrix of technology options for decision makers

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)

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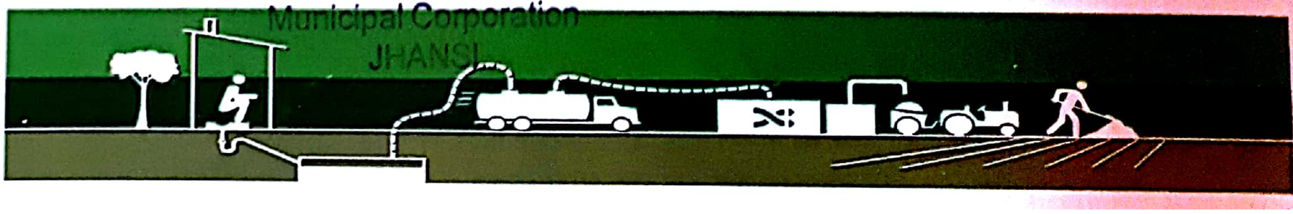

5.3 Matrix of technology options for decision makers

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)

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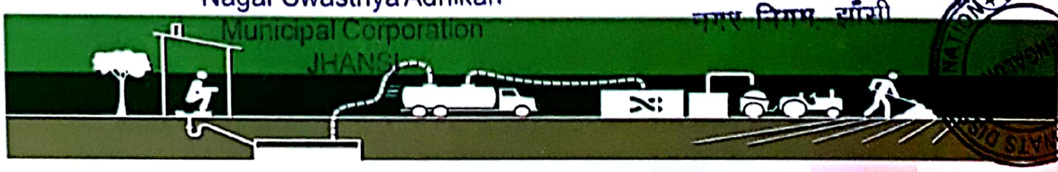

iv. Reuse

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.

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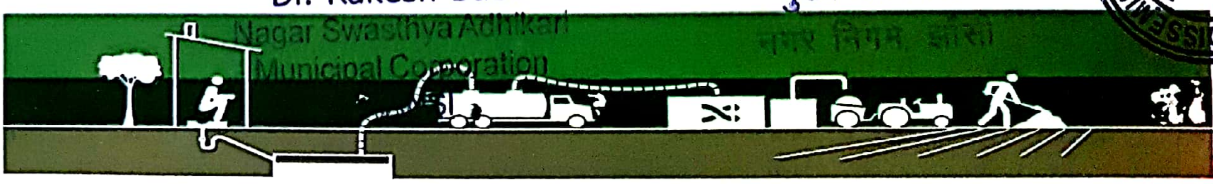

iv. Reuse

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 empting annually, charges/fees for empting 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.

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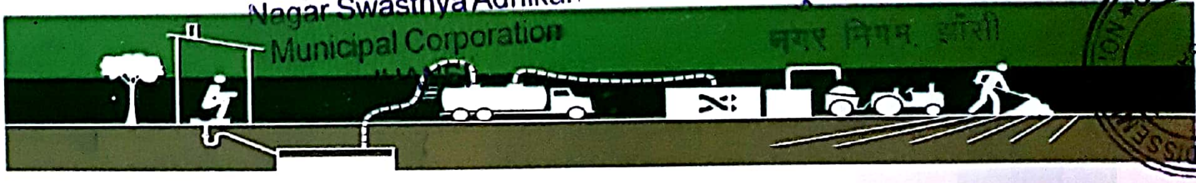

The private contractors are selected on the following grounds (UMC, 2015):

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

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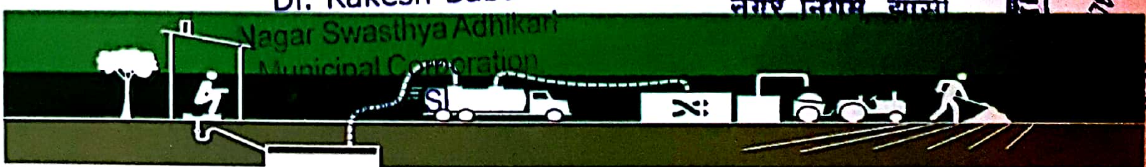

5.7 Sustainability / Operating models for FSM

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.

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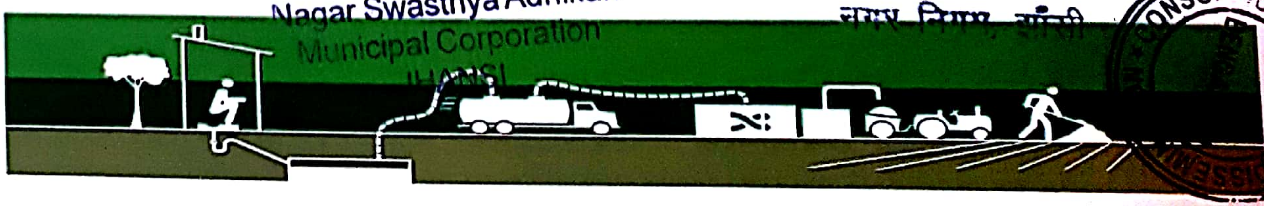

c. Repeat/Emergency Desludging- Services received by customers upon request well before next scheduled desludging.

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)

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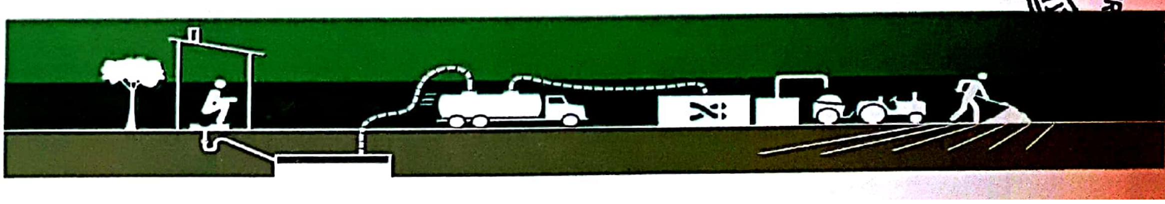

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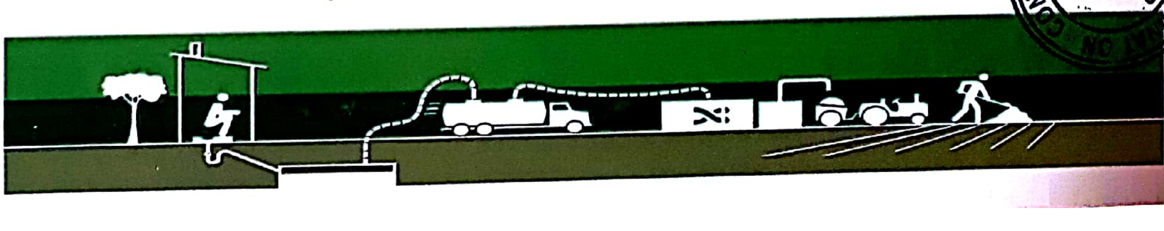

Annexure I

Guidelines for Septage Management in Maharashtra

February, 2016

CONSORTIUM FOR DEWATS DISSEMINATION + BENGALURU

Swachh Maharashtra Mission (Urban)

Urban Development Department, Government of Maharashtra

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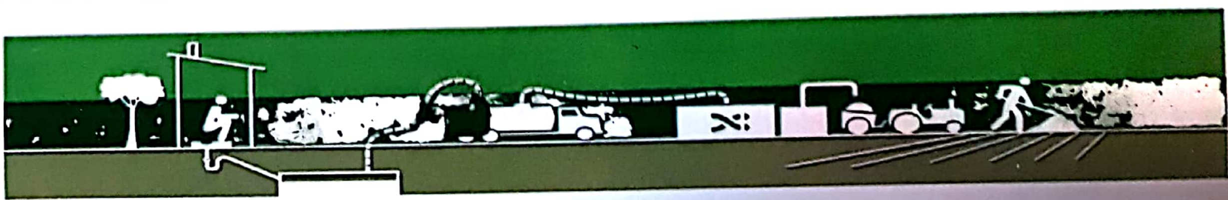
For Maharashtra Septage management Detail guidelines, please use the link below:

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



Annexure

Annexure II

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Government of Odisha

Housing & Urban Development Department

Letter No. 935 /HUD. Date : 20.4.16

HUD-SAN- 123/2015

From

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

To

<u>The Commissioner, BMC/CMC/BeMC/SMC/RMC</u>
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 **<u>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</u>** 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 ***<u>all activities relating to septage shall be managed scrupulously adhering to the "Odisha Urban Septage Management Guidelines-2016" at ULB level</u>***.

Yours faithfully,

State Mission Director, SBM &
Joint Secretary to Govt.

Memo No. 936 /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.dfidta@gmail.com/ hkothari@deloitte.com) for information and necessary action.

State Mission Director, SBM &
Joint Secretary to Govt.

CONSORTIUM FOR DEWATS DISSEMINATION BENGALURU

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

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

Dr. Rakesh Babu
Nagar Swasthya Adhikari
Corporation
JHANSI

(अनूप सूद)
पी.एच.ई./ ई.एस.
मुख्य अभियन्ता
झाँसी नगर निगम, झाँसी

Annexure

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.

CONSORTIUM FOR DEWATS DISSEMINATION SOCIETY BENGALURU

(अनूप सूद)
पी.एच.ई. / ई.एस.
झाँसी नगर निगम, झाँसी

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

Dr. Rakesh Babu