FAECAL SLUDGE AND SEPTAGE MANAGEMENT

An Orientation Module

Part B: Presentation Slides

SCBP

Sanitation Capacity Building Platform

National Institute of Urban Affairs

Sanitation Capacity Building Platform

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TITLE
FAECAL SLUDGE AND SEPTAGE MANAGEMENT — AN ORIENTATION MODULE (PART B: PRESENTATION SLIDES)

PUBLISHER
NATIONAL INSTITUTE OF URBAN AFFAIRS, DELHI

RESEARCH PROJECT
SANITATION CAPACITY BUILDING PLATFORM

GRAPHIC DESIGN
Deep Pahwa, Kavita Rawat

Year Of Publishing: 2017

CONTENT
This module draws almost entirely from C-WAS, CEPT University on Training of Trainers (ToT) Module on Faecal Sludge and Septage Management

Content of the Behaviour Change Communication (BCC) and Information Education and Communication (IEC) part comes from UMC and NIUA

DISCLAIMER

The full module should be referenced as follows:
NIUA (2018) “Faecal Sludge and Septage Management: An Orientation Module”.
Text from this module can be quoted provided the source is acknowledged.

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Faecal Sludge and Septage Management

Orientation Training Module

VERSION 1, Dec 2017

National Institute of Urban Affairs

Credits:
CEPT University
CDD Society
EAWAG
CSE
and all partners of SCBP

Sanitation Capacity Building Platform - SCBP

- **Purpose** of the platform is to support and build the capacity of the states, cities and all stakeholders - to plan and implement **decentralized sanitation**.

Capacity Building	Planning	Implementation
• Orientation and exposure visits for understanding Septage and Faecal Sludge risks and challenges • Institutional capacity strengthening through training of trainer programmes • Capacity building activities for stakeholders involved in the FSM value chain - government officials, masons, private sector • Creating knowledge resources and advocacy material on FSM technology, institutional, legal and financial eco-systems	• Baseline data collection on FSM • FSM situation assessment • Diagnostic study of existing sanitation situation • Stakeholder mapping and analysis • Analysis of legal and institutional framework • Policy and guideline formulation	• Model DPRs for Faecal Sludge Treatment Plants and Decentralized Wastewater Treatment System • Planning for emptying and transport services • Transaction advisory for FSM • Designing of Behaviour Change Strategy

Partners of the Platform

- **Currently there are 10 partners delivering capacity building services on decentralized sanitation.**
- **Partners have extensive experience working in the sanitation sector in India and internationally.** They have worked closely with many cities in various states.

MODULE PURPOSE

- Basic understanding of Urban sanitation and Faecal Sludge and Septage Management
- Target audience/trainees: Staff of Urban Local Bodies, State governments, Training Institutes, Private Sector and NGOs, Consultants, Academia and students
- Handbook on FSSM Orientation provides the narrative context to this Module

Learning Objectives

- Urbanization trend in India and the urban sanitation challenge
- Understanding ODF and ODF+ concepts and experiences
- Decentralized septage, sludge and waste water treatment solutions are technically sound options for Indian towns and cities, and are not sub optimal solution as compared to centralized sewerage systems
- Assessment & Planning for FSSM at the city level
- Overview of policy, regulation and behaviour change communication
- Gender, caste and class dimensions of sanitation

Session 1

Fundamentals of Urban Sanitation and Faecal Sludge and Septage Management

Urbanisation

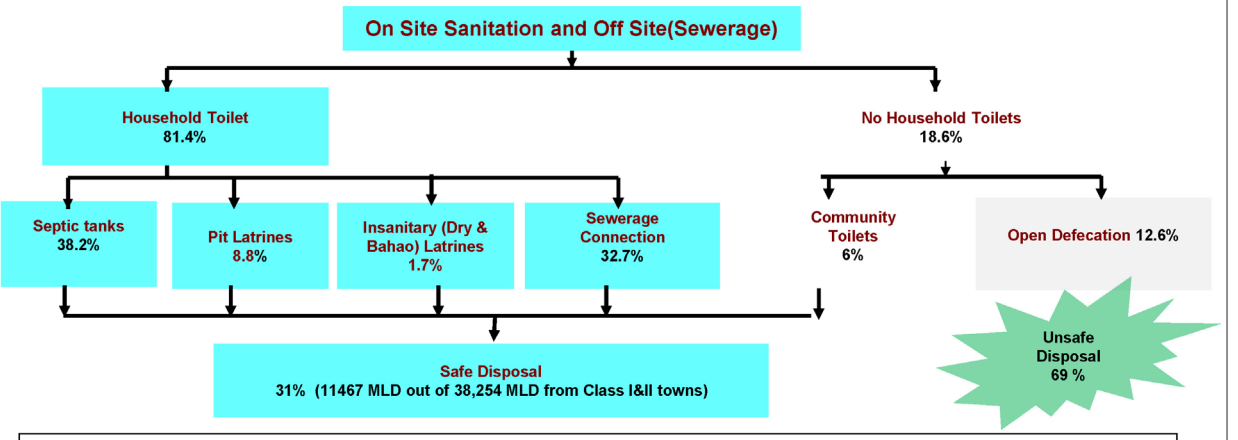
Urbanization trends in India

- Urban Population - 377 million (31.16 %)
- Total number of urban centers: 7935
- Statutory Towns (4041 nos.) are administered by Urban Local Bodies
- Census towns have trebled over a decade. Increase in Statutory Towns has been much slower.

Type of Urban Units	2011 Census	2001 Census
1. Towns:	7,935	5,161
(a) Statutory Towns	4,041	3,799
(b) Census Towns	3,894	1,362
2. Urban Agglomerations	475	384

Census Towns are administered via rural administration – provision of urban services not mandatory in these areas

Urban Sanitation Situation in India
(Census 2011)



- 75% of fresh water resource which is being used for drinking purpose is contaminated.
- Sewage contributes 60% of total pollution load.
- 93% of total domestic wastewater is generated in Class-I cities.

Ref.: CPCB Report, 2009

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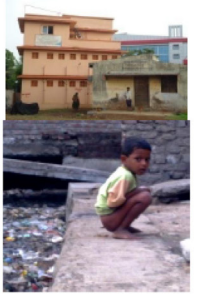
Key Sanitation facts from CENSUS 2011 - INDIA



18.6% URBAN HHs HAVE REPORTED **NO** TOILETS

32.7% OF URBAN HHs HAVE ACCESS TO **PIPED SEWER**

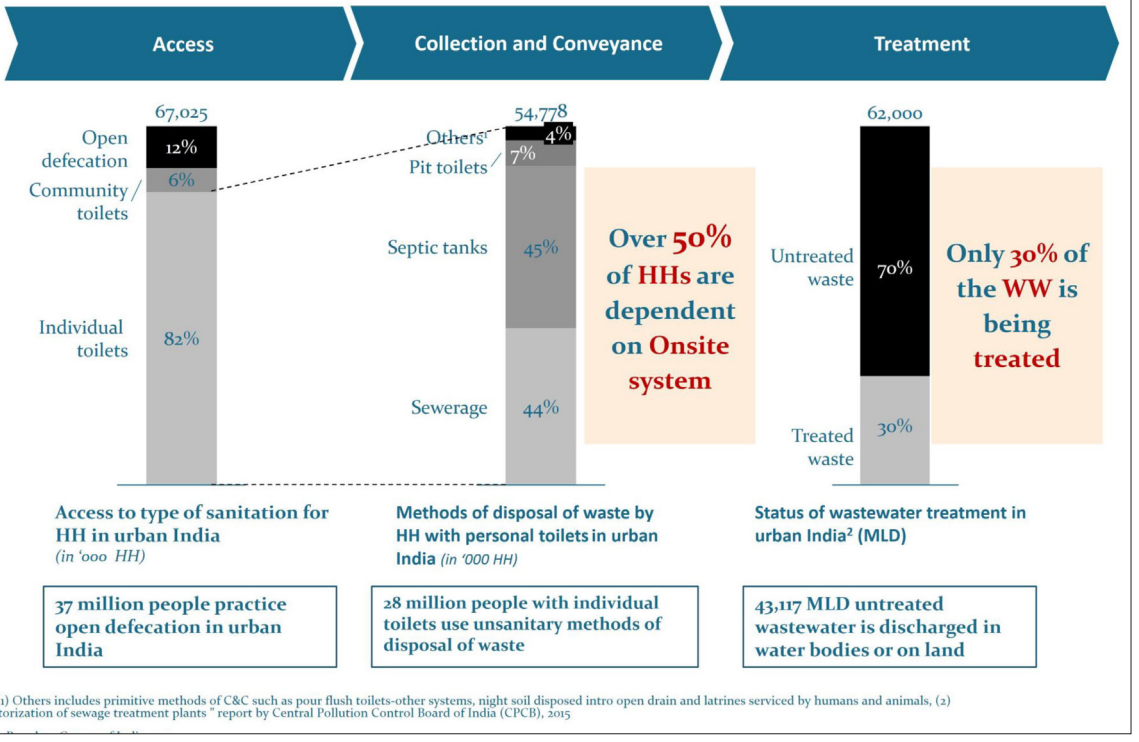
38.2% HHs HAVE **SEPTIC TANKS**

6% OF HHs DEPEND ON **PUBLIC TOILET**

12.6% OF HHs RESORT TO **OD**

Source: CEPT

Sanitation situation in INDIA . . .



Note: (1) Others includes primitive methods of C&C such as pour flush toilets-other systems, night soil disposed intro open drain and latrines serviced by humans and animals, (2) "Inventorization of sewage treatment plants " report by Central Pollution Control Board of India (CPCB), 2015

Recap

- What is the major sanitation challenge faced by India in this century
- What is the major sanitation challenge faced by your city/state

Understanding Terms

- **Black Water, Grey Water**
- **Sanitation**
- **Septage**
- **Faecal Sludge**
- **Sanitation Value Chain**
- **FSM Value Chain**
- **Faecal Sludge and Septage Management**

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Types of Liquid waste

Sewage:

Sewage is a waste water from a community, containing solid and liquid excreta, coming from houses, factories and industries.

→ **Black Water**

Sullage:

Sullage means waste water which does not contain excreta.

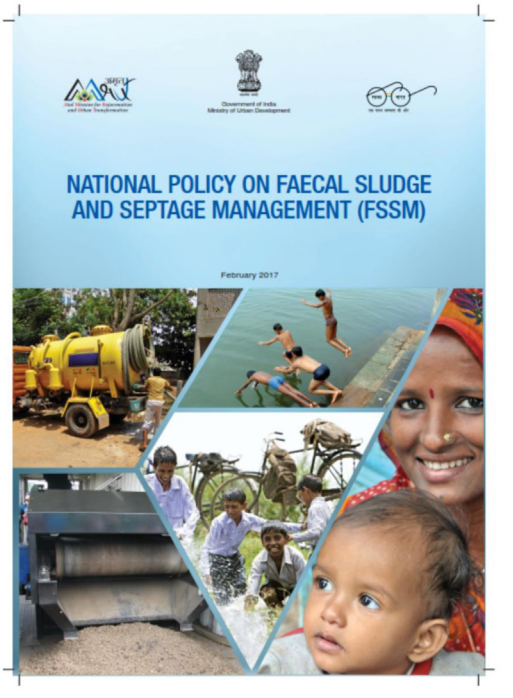
For example, waste water from kitchen and bathrooms.

→ **Grey Water**

What is Faecal Sludge . . .

"Faecal sludge is the solid or settled contents of pit latrines and septic tanks.

Faecal sludge (FS) comes from onsite sanitation system such as pit latrines, non-sewered public ablution blocks, septic tanks, aqua privies, and dry toilets."

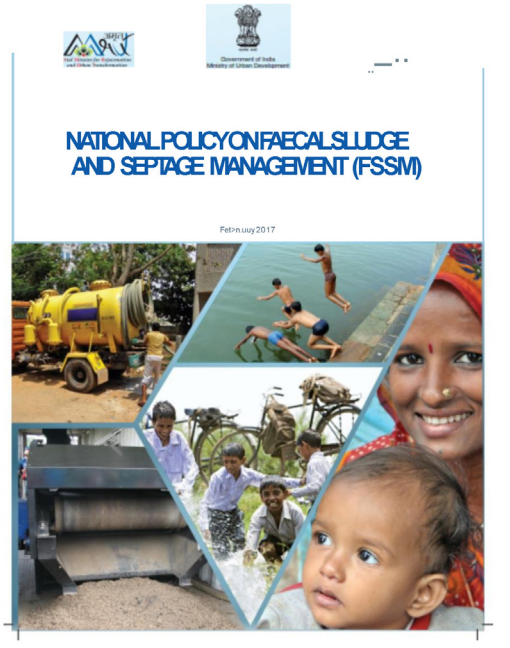


Source : http://amrut.gov.in/writereaddata/FSSM_Policy_Report_23Feb.pdf

What is Septage …

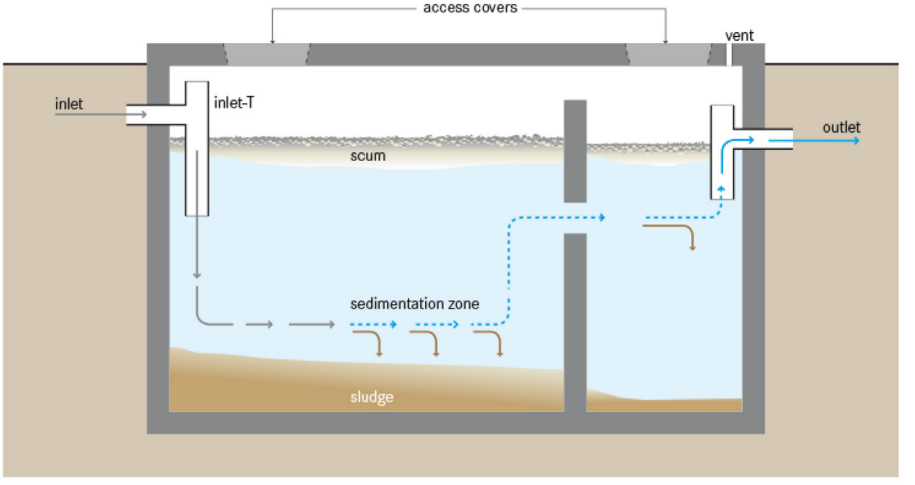
"It is the liquid and solid material that is pumped from a septic tanl<, cesspool, or such onsite treatment facility after it has accumulated over a period of time.

Septage is the combination of scum, sludge, and liquid that accumulates in septic tanl<s".



Source : http://amrut.gov.in/writereaddata/FSSM _Policy_Report _23Feb.pdf

Septic Tank



THIS is SEPTAGE – also called Faecal Sludge

Onsite sanitation and FSM – emerging questions

38.2% URBAN HHs HAVE SEPTIC TANKS

Are septic tanks linked to soak pits

Are they built as per Codes / Specifications ?

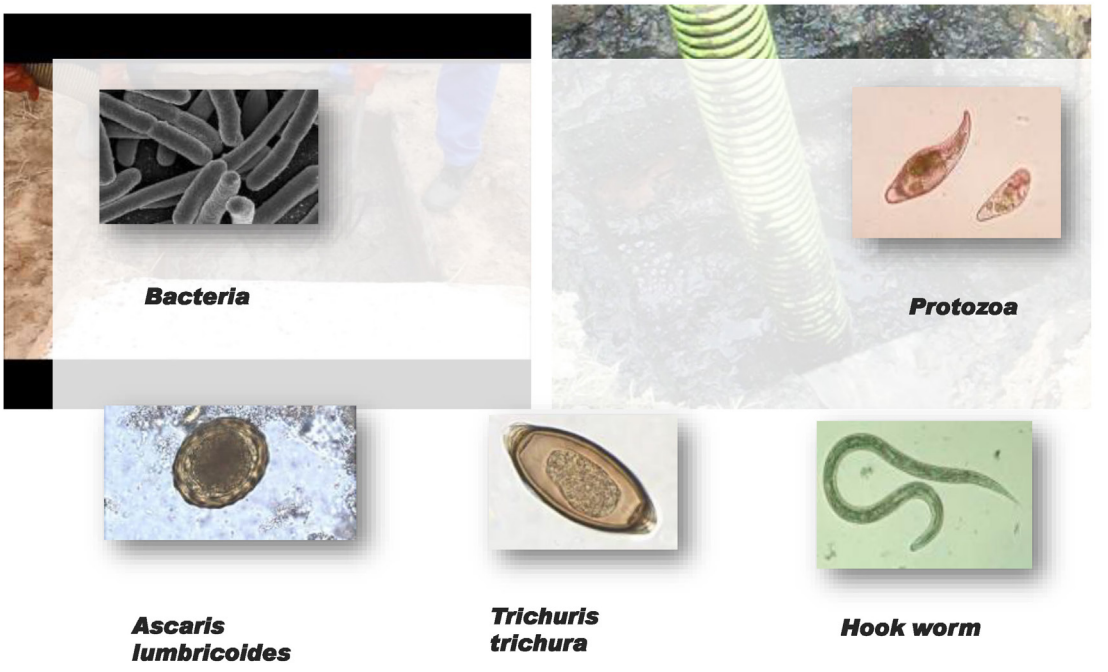
How often are they cleaned ?

Where does the effluent flow ?

What happens to the SLUDGE?

Source: CEPT

THIS is what is in SEPTAGE



1 truck of Faecal Sludge and Septage carelessly dumped = 5,000 people shitting in the open!

Source : Chary, Srinivas, (2017), "City Wide Approach to Sanitation - Operationalizing FSM Regulations A Case study of Warangal City", a Policy Workshop by Water Aid, ASCI *(mimeo)*

Sanitation Systems

Non-Sewered Sanitation System

Fecal Sludge

Sewered Sanitation system

Wastewater

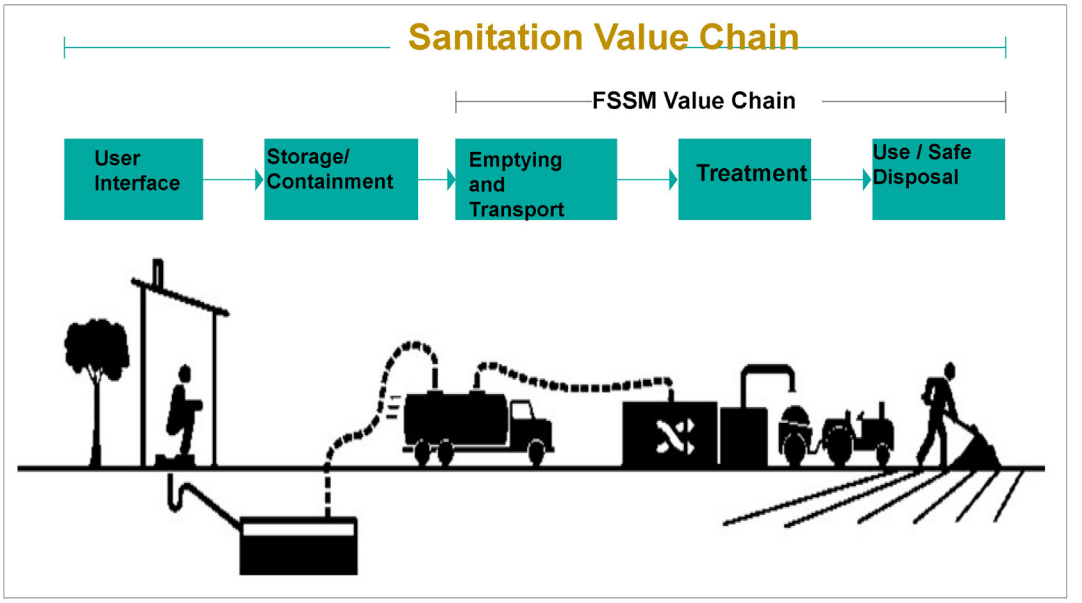
Fecal Sludge Management

De-Centralized Wastewater Treatment System (DEWATS)

Centralized Wastewater Treatment

COMPARISION OF CENTRALIZED AND DECENTRALIZED METHOD

		Centralized	Decentralized
Implementation	Capital costs	High cost	Low cost
	Skilled manpower	High requirement	Not required
Operations	Water needed	More than 135 LPCD	Less requirement of water compared to 135 LPCD
	O&M costs	High costs	Low on municipality / Low on households
Overall issues	Implementation challenges	High	Low on municipality / High on households
	Life Span	More than 20 years	Upto 10 years
	Treatment	Easier Centralized or DEWATS	Challenging for municipalities



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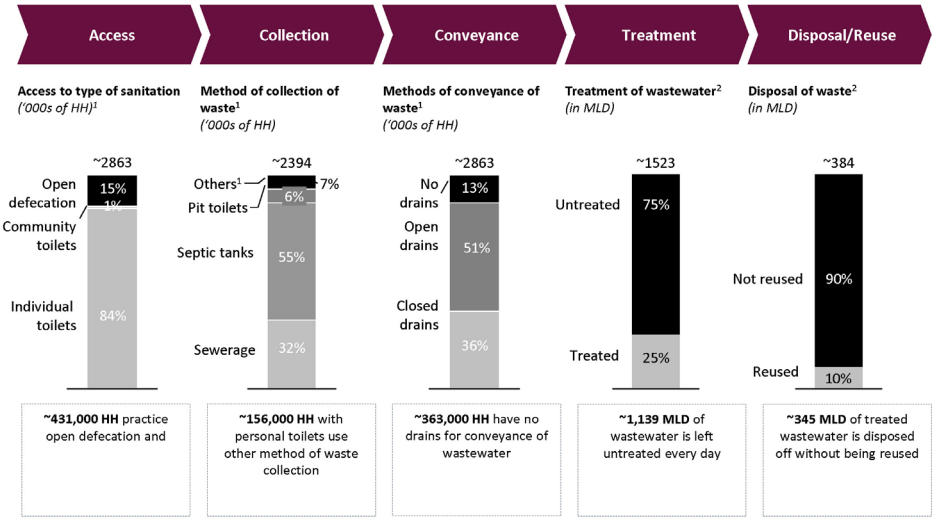
Recap : Challenges of Urban Sanitation and Waste Water

- Unlined and unscientific septic tank toilet system
- No treatment of septage waste

- Large number of small towns and cities without sewerage system
- A large volume of untreated waste water generated, not treated.

Significant gaps exist across the sanitation value chain in Urban Rajasthan

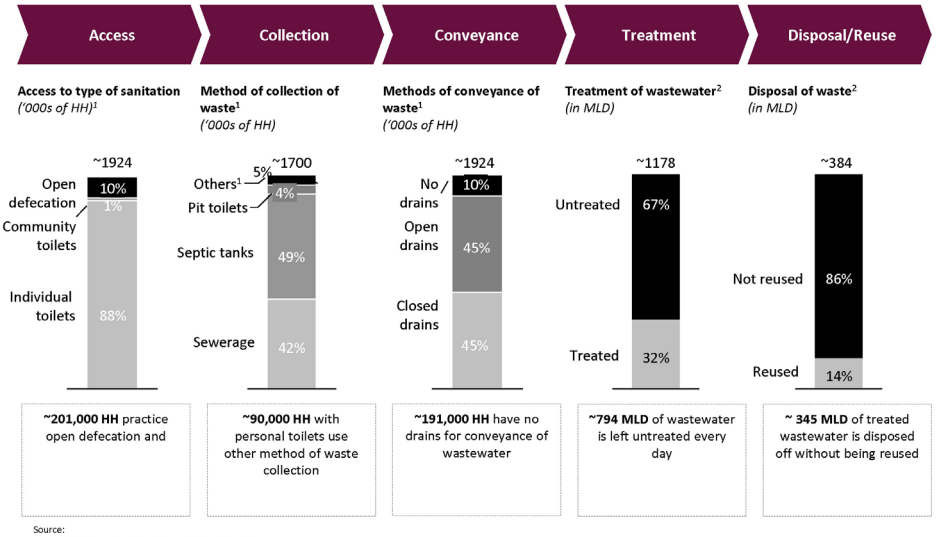
Number of ULBs[1] : 185



Source:
1. Census 2011 – Tables on Households Amenities
2. CEPT Analysis using information from (i) Draft Note on State Sewerage & Waste Water Policy – 2015, Department of Local Self Government, Government of Rajasthan (http://www.ruifdco.rajasthan.gov.in/Content/Water_Policy_Draft_CMAR_06102015.pdf) ; (ii) Inventorization of sewage treatment plants, Central Pollution Control Board -2015 (http://www.cpcb.nic.in/upload/NewItems/NewItem_210_Inventorization_of_Sewage-Treatment_Plant.pdf) ; (iii) Service Level Benchmarking Gazette Notification 2013-14, (http://cmar-india.org/Downloads.aspx?id=13)

Significant gaps exist across the sanitation value chain: AMRUT Cities of Rajasthan

Number of ULBs[1] : 29



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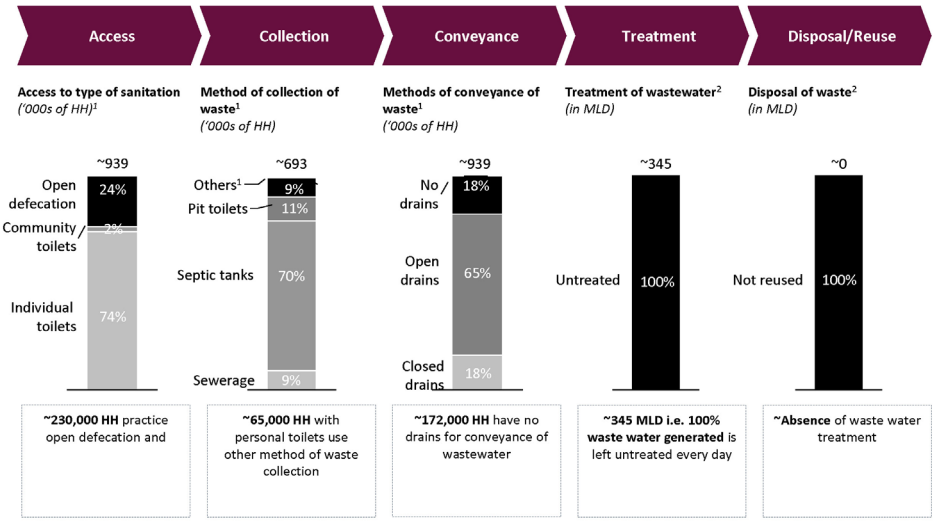
Significant gaps exist across the sanitation value chain: Non-AMRUT Cities of Rajasthan

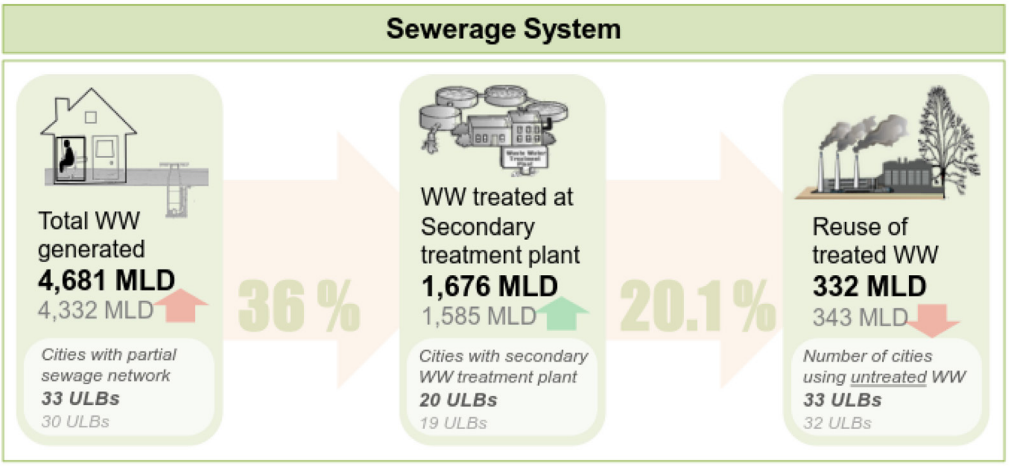
Number of ULBs[1] : 156



Source:
1. Census 2011 – Tables on Households Amenities
2. CEPT Analysis using information from (i) Draft Note on State Sewerage & Waste Water Policy – 2015, Department of Local Self Government, Government of Rajasthan (http://www.rulfdco.rajasthan.gov.in/Content/Water_Policy_Draft_CMAR_06102015.pdf) ; (ii) Inventorization of sewage treatment plants, Central Pollution Control Board -2015 (http://www.cpcb.nic.in/upload/NewItems/NewItem_210_Inventorization_of_Sewage-Treatment_Plant.pdf) ; (iii) Service Level Benchmarking Gazette Notification 2013-14, (http://cmar-india.org/Downloads.aspx?id=13)

Overview of sanitation situation in Maharashtra

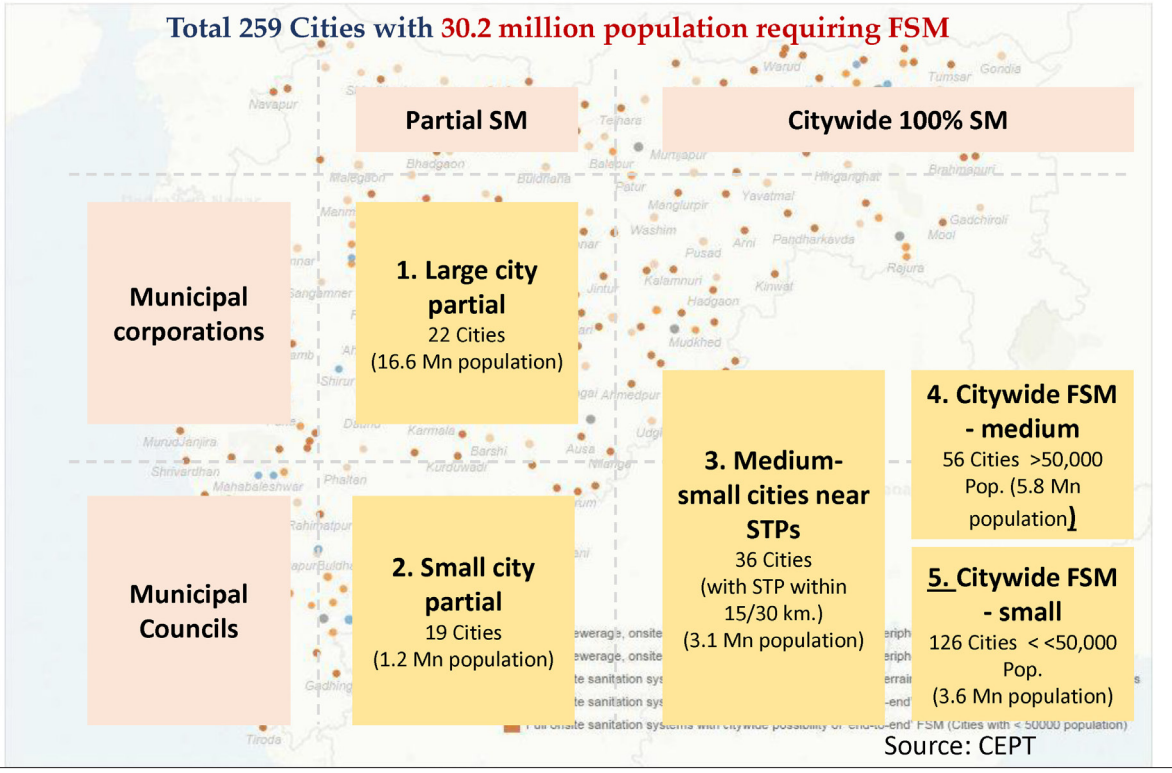
Septage Management Priority : Example of Maharashtra



- **Only 33** Cites out of 360+ cities have **partial sewer network**
- **Only 20** Cites have **wastewater treatment facility**
- **20%** of **treated wastewater** is **reused**

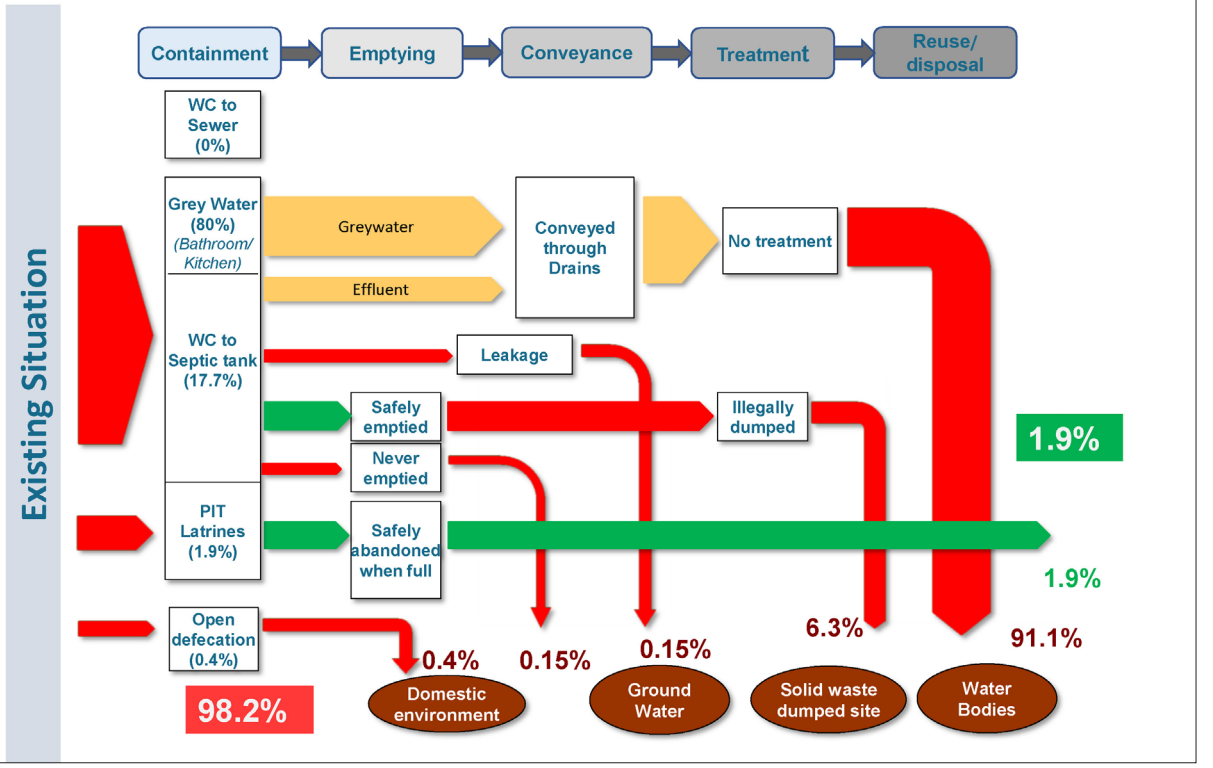
Source: CEPT

Extent of septage management (SM) required in Maharashtra

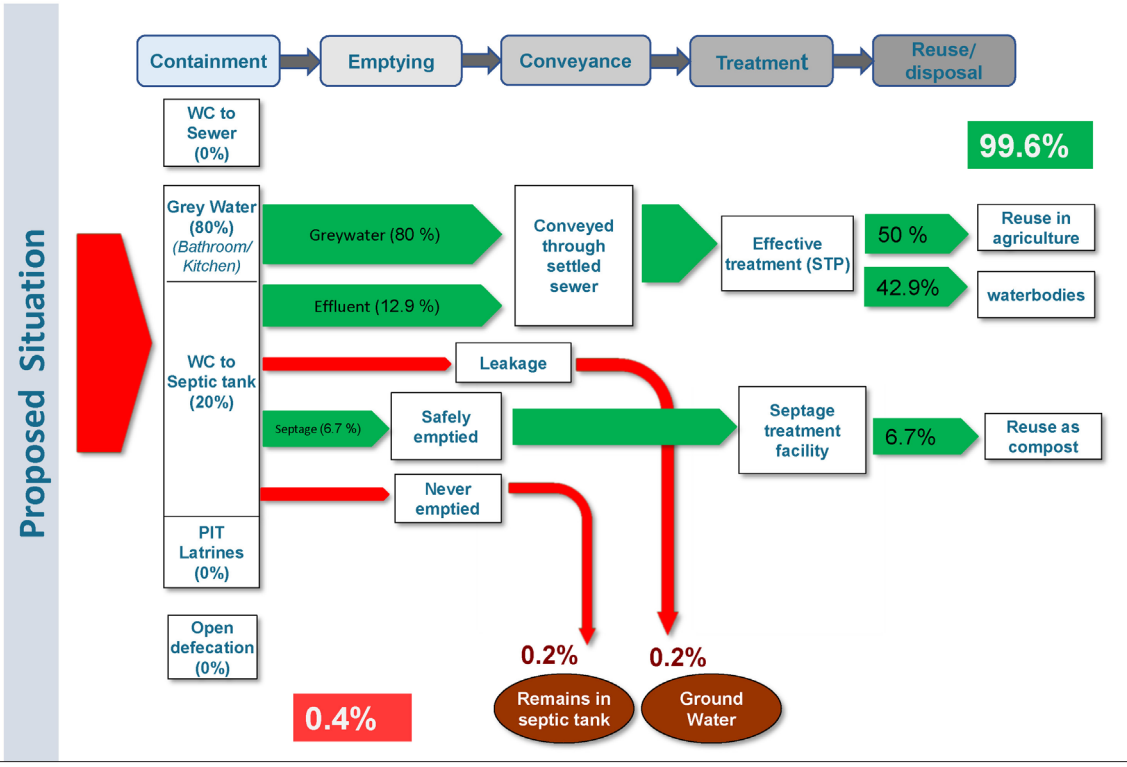


Source: CEPT

Wastewater flow diagram



Integrated FSM and Waste Water Planning



Policy and Programmes

- ODF Protocol
- ODF and ODF Plus
- NFSSM Policy

ODF City : Definition

A city / ward can be notified/declared as ODF city/ ODF ward if, at any point of the day, not a single person is found defecating in the open.

ODF Protocol

1) All households that have space to construct toilet, have constructed one.
2) All occupants of those households that do not have space to construct toilet have access to a functional community toilet within a distance of 500 meters.
3) All commercial areas have functional public toilets within a distance of 1 kilometer.
4) Details of all Individual household toilets (IHHL) constructed from 2011 onwards will have to mandatorily be uploaded on the SBM-Urban portal
5) Pictures of all functional community and public toilets in the city, irrespective of the date of construction, will have to mandatorily be uploaded on the SBM-Urban portal.

Maharashtra ODF and ODF Plus Protocol

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

Need for Faecal Sludge and Septage Management (FSSM)

- Facilities like **septic tanks**, dry latrines, community toilets, or other types **accumulate faecal sludge**
- **Septage needs to be removed periodically**. If this septage is **not properly managed**, **negative impacts** on the **urban environment** and on **public health** may result
- **Environmental pollution** is caused by **effluents of not regularly de-sludged septic tanks** or community toilets;
- **Improper handling of septage** regenerates the risks of faecal matter **re-entering the domestic environment**

Table 3: Pollutants in the effluent of on-site treatment Systems

Pollutant	Reason for concern
Total suspended solids	In surface waters, suspended solids can settle and form sludge deposits that smother benthic invertebrates, fish eggs and can contribute to benthic enrichment, toxicity and sediment oxygen demand. Colloidal solids can block sunlight, affect aquatic life and lower the ability of aquatic plants to increase the dissolved oxygen in the water.
Biodegradable organics (BOD)	Biological degradation of organics can deplete the dissolved oxygen i surface waters resulting in anoxic conditions, harmful to aquatic life.
Nitrogen	Nitrogen could lead to eutrophication and dissolved oxygen loss in surface waters. High levels of nitrate nitrogen in drinking water can cause methemoglobinemia in infants and pregnancy complications fo women. Livestock can also suffer from drinking water high in nitroger
Phosphorus	Phosphorus would also lead to eutrophication and reduction of dissolved oxygen in surface waters.
Pathogens	Parasites, bacteria and viruses can cause communicable diseases through body contact, ingestion of contaminated water or shellfish. Transport distances of some pathogens (bacteria and viruses) can be quite significant.

Effluent and septage from septic tanks systems impacts ground and surface water resources

Policy initiatives, Guidelines and Schemes for FSSM:

- **2017** National Policy on Faecal Sludge and Septage Management
- **2014** Smart City Mission, Swachh Bharat Mission and AMRUT
- **2013** Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013
- **2008** National Urban Sanitation Policy

Discussion
Challenges and Opportunities of FSSM

- **What are current practices and challenges from your state perspective?**
- **What are institutional and monitoring challenges in FSSM?**
- **Divergent Challenges faced by different stakeholders**
  - Households,
  - Private emptier,
  - City government
  - End Users
- **Links with SBM / AMRUT**

Session 2 : Challenges and Opportunities in FSSM

Challenges in Access

Individual Toilet	Community Toilet	Public Toilet
		
• Space issues • Affordability issues • Inadequate water supply in selected regions • Dilapidated/ Quality • Insanitary toilet -Unsafe toilet	• Poor condition • Lack of O&M • Water Supply and Electricity issue • Limited time access • Not adequate • Require huge space at prime location • Categorized as Unsafe toilet as per Joint Monitoring programme	

Challenges in collection system

Septic tanks are below the toilets and don't have access covers

Inaccessible septic tanks with sealed tops

Septic tanks located near drains and sealed from the top

Single pit toilets

Oversized septic tanks

Toilets directly connected to drains

Used in Maharashtra and Jharkhand

Plastic

RCC

Recommended sizes of septic tanks

Sl. No.	Number of Users	Length (m)	Breadth (m)	Liquid depth for Cleaning once/2 years	Liquid depth for Cleaning once/3 years
1	5	1.5	0.75	1.0	1.05
2	10	2.0	0.9	1.0	1.40
3	15	2.0	0.9	1.3	2.0
4	20	2.3	1.1	1.3	1.8
5	50	5.0	2.0	1.0	1.24
6	100	7.5	2.65	1.0	1.24
7	150	10	3.0	1.0	1.24
8	200	12	3.3	1.0	1.24
9	300	15	4.0	1.0	1.24

Source: CPHEEO Manual on Sewerage and Sewage Treatment, Part A – Engineering, 2012

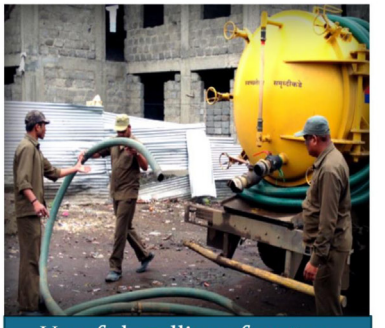
Recommended sizes of twin pits/leaching pits

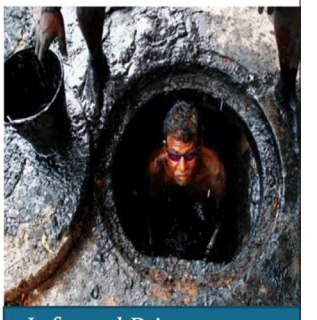
Pit type	5 users		10 users		15 users	
	Diameter in m	Depth in m	Diameter in m	Depth in m	Diameter in m	Depth in m
Dry pits	0.9	1.0	1.1	1.3	1.3	1.4
Wet pits	1.0	1.3	1.4	1.4	1.6	1.5

Source: CPHEEO Manual on Sewerage and Sewage Treatment, Part A – Engineering, 2012

Challenges in Conveyance system

Services mainly provided by city governments

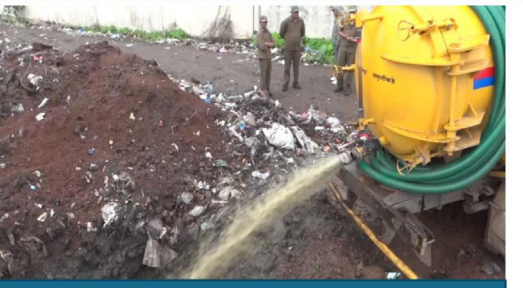

Unsafe handling of septage


Informal Private sector


Emptying when the tank is full

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, faecal matter along with effluents is released into the drains

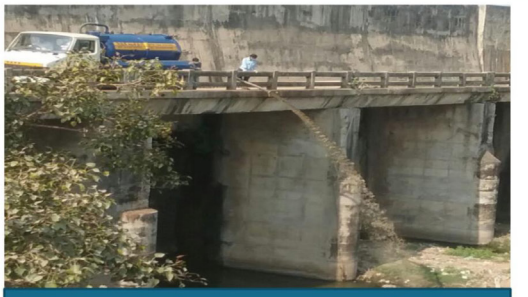
Challenges in Disposal system



Disposal of septage at dump site

NO TREATMENT OF FAECAL SLUDGE & SEPTAGE

Disposal of septage in open land



Disposal of septage in water bodies

Source : Chary, Srinivas, (2017), "City Wide Approach to Sanitation : Operationalizing FSM Regulations A Case study of Warangal City" at Ujjain Workshop by Water Aid, ASCI *(mimeo)*

Standards for Disposal

Effluent discharged standards for Sewage Treatment Plant are mentioned below:

Sl. No.	Industry	Parameters	Standards for New STPs (Design after notification date)*
	Sewage Treatment Plant	pH	6.5-9.0
		BOD	10
		COD	50
		TSS	20
		NH_4-N	5
		N-total	10
		Fecal Coliform (MPN/100ml)	<100
Note: (i) All values in mg/l except for pH and Coliform. (ii) These standards will be applicable for discharge in water resources as well as for land disposal. The standards for Fecal Coliform may not be applied for use			

Standards of disposal of septage

Source : Gazzate notification by MoEF, 24th November 2015
http://www.moef.gov.in/sites/default/files/Draft%20notification%20of%20Sewage%20Treatment%20plan.PDF

Actual quality of septage that is being disposed off

Sr.No.	Parameter	Faecal Sludge & septage
	Test results	
1	pH	7.6-9
2	BOD	6000 - 16500
3	COD	11408 - 27776
4	TSS	9000- 90000
5	Total Nitrogen (as N)	300-800
6	Faecal Coliforms (MPN/100ml)	>1600

Discussion
Challenges and Opportunities of FSSM

- **What are current practices and challenges from your state perspective?**
- **What are institutional and monitoring challenges in FSSM?**
- **Divergent Challenges faced by different stakeholders**
  - Households,
  - Private emptier,
  - City government
  - End Users
- **Links with SBM / AMRUT**

SESSION 3

FSSM Planning Process

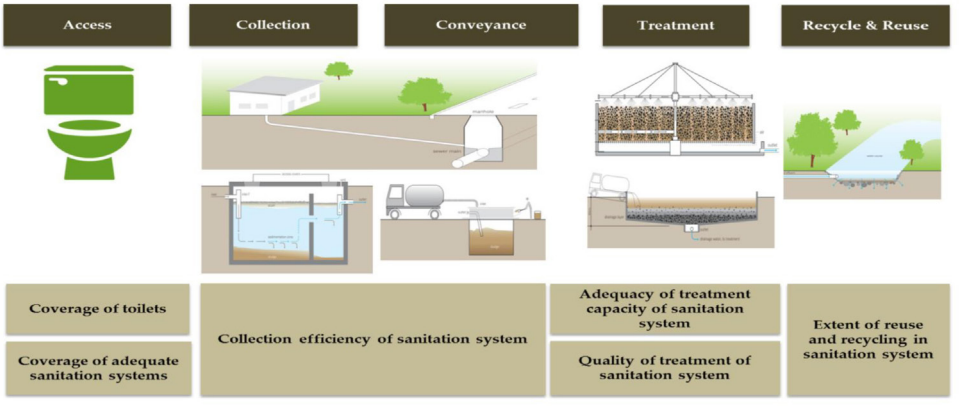
Five Stages of Assessment . . .

Stage 1 : Assessing Service Performance Across the Full Service Chain

Assessing service performance across the **service chain** through a city level assessment is the first step in planning process.

It is an important exercise, which provides an **initial sense** of the **state of FSM in the city**, help in understanding the context and **identifying gaps** in key services.

The **data collection** and **field assessments** in the city should start with a kick-off meeting with **key stakeholders**.



Stage 1: Assessment across sanitation Service Chain . . .

Access	Collection	Conveyance	Treatment / Disposal / Reuse

Identify Dependence on Various Toilet Facilities

Capture details of community / public toilets

Spatial Variations

Assess details of Septic Tanks related to location, size, design and access

Dependency on On-Site Systems

Assess available infrastructure and process for septic tank emptying

Details related to type / size of Trucks

Coverage in different parts of city

Number of Septic tank emptied annually

Private sector availability

Identify present location of septage disposal/treatment

Assess the capacity requirement / adequacy of a Septage Treatment Facility

Reuse of treated septage

Market and Demand for Reuse

Stage 1: Citywide Sanitation assessment through Indicators - SAN Benchmarks

Citywide Sanitation Indicators (Sewerage system + Onsite systems)	
1. Coverage of toilets	Percentage of properties with access to toilet facility in the city
2. Coverage of adequate sanitation system	Percentage of households with individual or group toilets connected with adequate sanitation systems (sewer network/ septic tank / double pit system) to total households in the city.
3. Collection efficiency of sanitation system	Weighted average of collection efficiency of each sanitation system, weighted by share of households dependent on each sanitation system.
4. Adequacy of treatment capacity of sanitation system	Weighted average of adequacy of treatment plant capacity available for each sanitation system, weighted by share of households dependent on each sanitation system.
5. Quality of treatment of sanitation system	Weighted average of quality of treatment of each sanitation system, weighted by share of households dependent on each sanitation system.
6. Extent of reuse and recycling in sanitation system	Weighted average of extent of reuse of treated wastewater and sludge after adequate treatment as a percentage of wastewater and sludge received at the treatment plant, weighted by share of household dependent on each sanitation system.

Stage 1 : Tools for Assessing Service Performance

- Sani Plan
- Rapid Assessment Tool
- Shit Flow Diagram

RAPID ASSESSMENT TOOL

SHOW ITS OPERATION

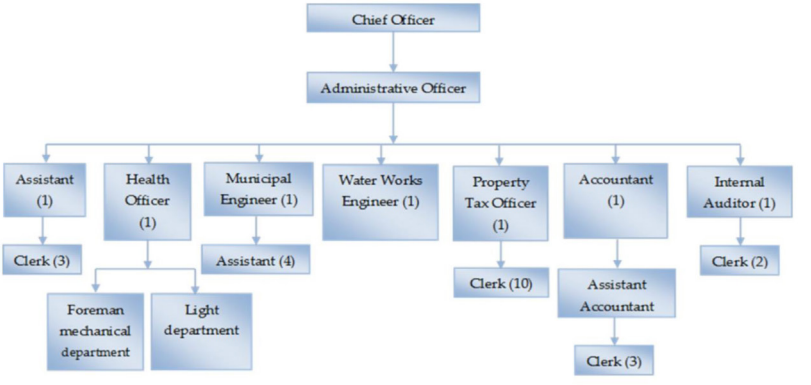
SFD FILM

https://www.youtube.com/watch?v=7a3VdJh2WAQ&feature=youtu.be

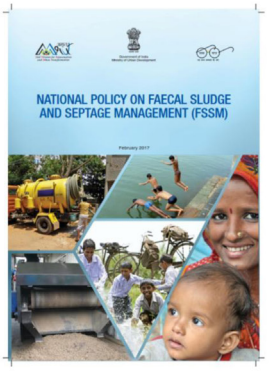
Stage 2: Assessment of enabling environment: Policy, Regulation and Institutions

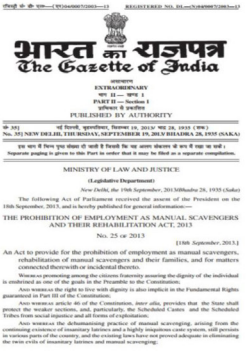
It is important to **understand** and **assess** the **prevailing enabling** and **regulatory environment** as well as **capacity** of local **stakeholders** to **manage** the citywide **FSM services**.

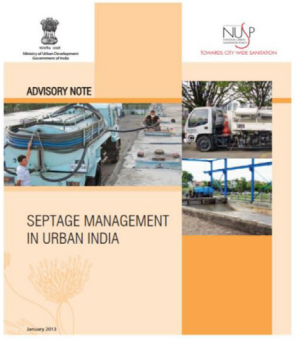
This can be **assessed** by a review of: a) **State/national policies** and guidelines on FSM, b) **Regulatory framework** for treatment, disposal, and reuse of faecal matter, and c) assessing **roles** and **responsibilities** of **local government** for FSM.

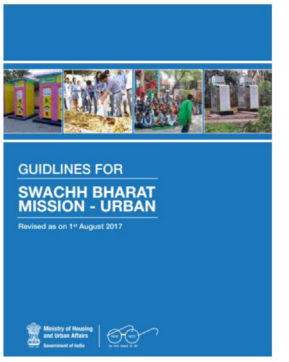


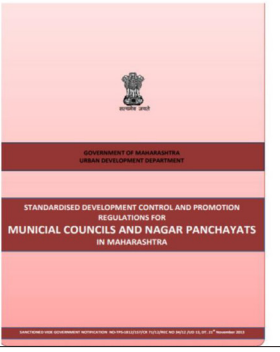
Stage 2: Review of state policies , acts & programmes that enable FSSM

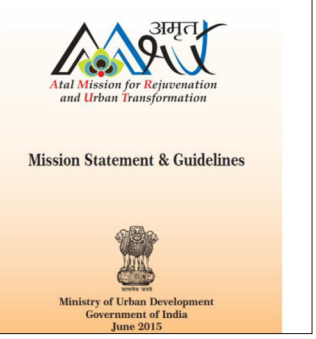












Stage 2: Tools for policy and governance assessment

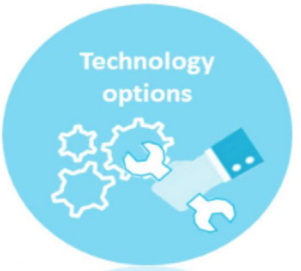
TOOLS available for ASSESSING policies, REGULATIONS and CAPACITY of Local government

Assessment areas		
National and state policy and guidelines	Regulatory regime for FSM and the institutional roles	Assessing local capacity for FSM

Assessment Tools	Download
5. Assessing policies and regulations affecting FSM at local levels	a. Sample policies and guidelines (NUSP , FSM guidelines GOI / GoM , GoTN , FSM in Urban Maharashtra , Other Sanitation Acts)
6. Assessing capacity at local level: local government and other stakeholders	a. Examples of Process mapping b. Examples of citizens charter c. Interview guide for local government to assess capacity for PSP

Source : IFSM toolkit - http://ifsmtoolkit.pas.org.in/

Stage 3 : Technology options for FSSM services



In designing a citywide IFSM service, it is important to **assess technology options** for each link in the **service chain**.

This ranges from **appropriate toilets** and **onsite systems** such as septic tanks to **conveyance** as well as **treatment** and reuse.

Toilets and its connectivity

Twin pit

Bio-digestor toilet

Emptying services

Conventional Vacuum Tanker

Mini-Vacuum Tanker (Vacutug)

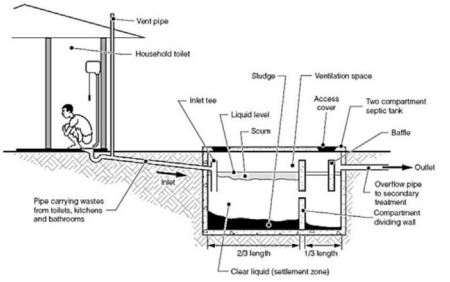
Treatment technologies

Sludge drying bed

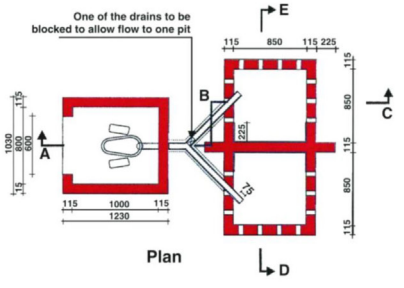
Co-composting

Stage 3: Assessing options for toilets and septic tanks

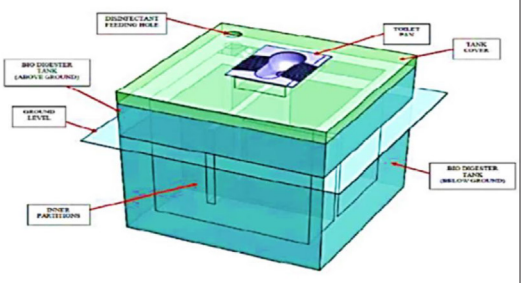
Twin pit toilets



2-3 Chambered septic tanks



Bio Digester toilets



Source : Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)

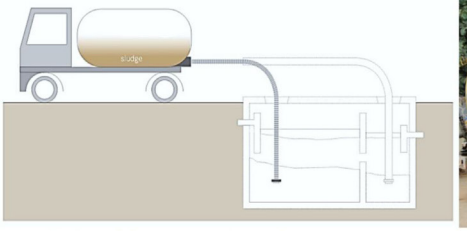
Stage 3: Assessing options for emptying services and conveyance

"When the pit is Full".

Often a tank is emptied when it is full. There is a tendency to use/build oversized septic tanks to avoid frequent emptying. It is important to assess how often a septic tank is emptied. Such information will need to be gathered through a household surveys.

Planning Decision

Demand desludging V/S **Scheduled desludging**



Sketch adopted from compendium of sanitation systems and technologies, Eawag

Example

In India: the Central Public Health Engineering and Environmental Organization (CPHEEO) suggests:

"***Yearly desludging of septic tank 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*"

Pg 9-22, CPHEEO Manual

Stage 3: Vehicular options for septage collection

Conventional Vacuum Tanker

For septic tanks which have proper access roads, a larger vehicle maybe used

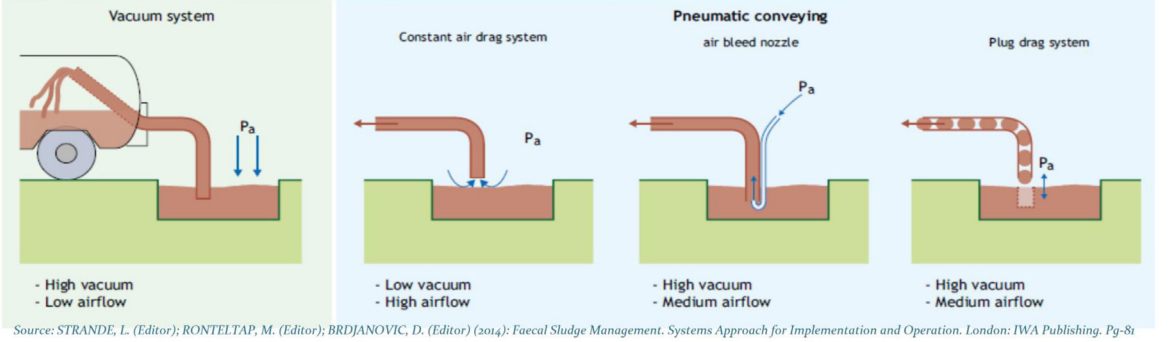
Mini-Vacuum Tanker (Vacutug)

For septic tanks located in narrow lanes or those that do not have proper access roads, smaller vehicles maybe used

Gulper

Smaller mechanized tricycle/ motorcycle mounted collection tanks of 20–40 litres

Four types of vacuum sludge removal techniques



Source: STRANDE, L. (Editor); RONTELTAP, M. (Editor); BRDJANOVIC, D. (Editor) (2014): Faecal Sludge Management. Systems Approach for Implementation and Operation. London: IWA Publishing. Pg-81

Stage 3: Assessing options for treatment and reuse of faecal sludge/septage

Treatment / Reuse / Disposal

- Treatment at **existing sewage treatment plants**
  - Septage addition at the **nearest sewer** manhole
  - Septage addition **at the STP**
  - Septage addition to **sludge digesters/sludge drying beds**
- Treatment at **independent septage treatment plants**
  - **Space is not a constraint** : Lime treatment, Sludge drying beds, Anaerobic baffled reactor, stabilization pond, Constructed wetland, co-composting with solid waste
  - **Space is a constraint** : Mechanical Dewatering system
- Properly **treated sludge** can generate energy and can be **reused** to reclaim parched land by application **as soil conditioner**, and/or as a **fertilizer**

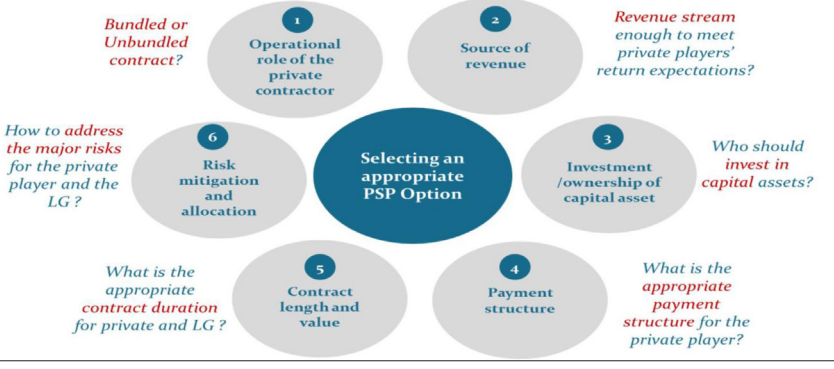
Source : Advisory note on Septage management in Urban India (2013), MoUD, GoI

Stage 4 : Exploring Potential private sector role across the service chain

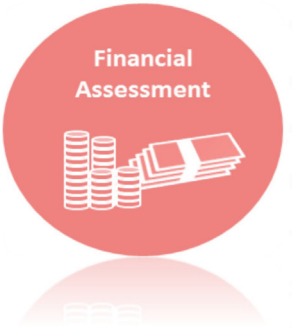
While the **city governments** generally **have** the **mandate** to **ensure service provision**, often there is an **active private sector** that provides FSM services in the city.

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 thus need to start with a quick **landscape analysis**, and can be followed by a **detailed assessment** after the FSM strategy is developed.



Stage 5 : Financial Assessment



To ensure financial **sustainability** of **FSSM services**, it is important to **assess capacity for financing** both capital and O&M expenditure over the plan period.

This can start with an **assessment** of **financial** requirements for both **capital** and **O&M expenditures**.

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

Assessment of Financing requirement across FSSM service chain

FS Flow Diagram		User Interface	Collection	Conveyance	Treatment/ Disposal
Financial Requirement	Capex	New septic tanks	Refurbishment of septic tanks	New Suction Emptier Trucks	**Treatment Facility-** Land cost, construction cost
	Opex			**Operation of Emptier trucks–** Fuel cost, salaries of truck driver, etc	**Operation of Treatment Facility-** staff salary, electricity bill, pumps replacement, etc

Stage 5: Potential sources of finance

A. Potential sources of finance for Capital Expenditure

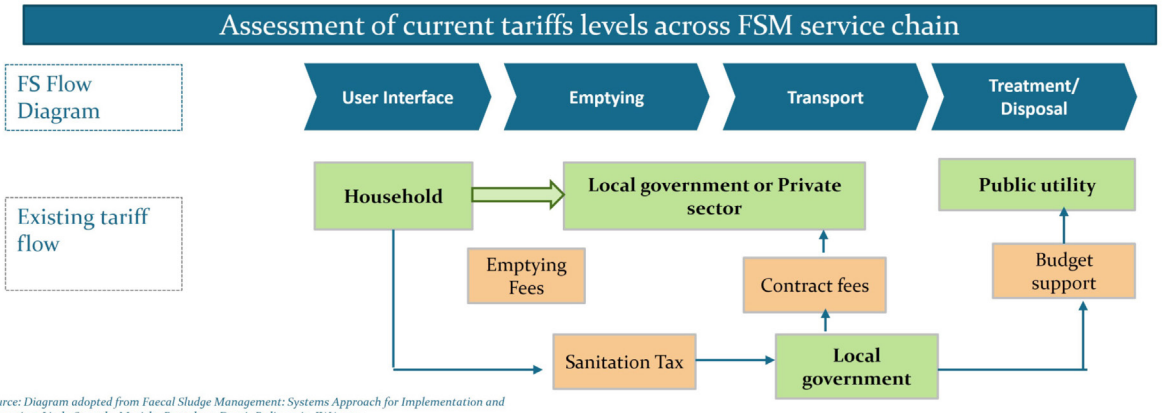
FS Flow Diagram	User Interface	Collection	Conveyance	Treatment/ Disposal
Financial Requirement	New septic tanks	Refurbishment of septic tanks	Suction Emptier Trucks	Treatment Facility
Potential Sources of Fund	Households	Households	Central/state Grants	Central/state Grants
	Government Subsidy	Government Subsidy	Private sector	Private sector
	CSR fund		Local government fund	Local government fund
				CSR fund

B. Potential sources of finance for O&M Expenditure

FS Flow Diagram	User Interface	Collection	Conveyance	Treatment/ Disposal
Financial Requirement			Operation of Emptier trucks	Operation of Treatment Facility
Potential Sources of Fund			Sanitation Tax/ tariff	Sanitation Tax/ tariff
			Emptying fees	Sale of Septage

Stage 5: Review of required tariffs

- Local government become financially sustainable by leving taxes and/or user charges so as to recover O&M costs of recent urban development programmes.
- It is therefore imperative that any proposed investment plan includes ways to recover O&M costs.
- Besides meeting operating expenses, the ULB is required to keep sufficient surplus to meet repayment obligations in addition to its committed capital expenses.



Source: Diagram adopted from Faecal Sludge Management: Systems Approach for Implementation and Operation, Linda Strande, Mariska Ronteltap, Damir Brdjanovic, IWA 2014

References

- Performance Assessment System Project, (2015)."*Assessment Tool for Citywide Integrated FSM Planning*",Mimeo, Retrieved 1 August 2016, from http://ifsmtoolkit.pas.org.in/
- Ministry of Urban Development (MoUD), (2013), "*Advisory note on septage management in urban India*". MoUD, GOI.
- Ministry of Urban Development (MoUD), (2017), "*National Policy on Faecal Sludge and Septage Management (FSSM)*". MoUD, GOI.
- Strande, L., Ronteltap, M., & Brdjanovic, D. (2014), "*Faecal sludge management Systems: Approach for Implementation and Operation*", IWA Publishing, London.
- Tilley, E., Ulrich, L., Lüthi, C., Reymond, Ph., Schertenleib, R. and Zurbrügg, C., 2014. "*Compendium of Sanitation Systems and Technologies*", 2 Revised Edition, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Switzerland.

Group Exercise

Prepare FSSM plan for a city

Participants will plan for infrastructure that is required for implementing a FSSM plan for a city.

FSSM PLAN		
Sr.No	**Description**	**No.**
	Input details	
A	Population	65251
B	Total households (HHs)	13112
C	HHs having toilets with septic tanks	9901
D	No. of community/ public toilets having septic tanks	21
E	Average volume of household and community toilet septic tanks (cum)	5
F	Septic tank cleaning cycle for HHs (Years)	3
G	Septic tank cleaning cycle for CT/PT (Days)	7
H	No. of working days in an year	300
I	No. of trips possible per emptying vehicle per day (trip/day/vehicle)	4

Key Outputs . . .

- **Number of tanks to be emptied daily = _____daily**
  - HHs toilets connected to septic tank / cleaning cycle for HHs = _____annually
    - HHs toilets to be cleaned daily = annual cleaning / number of working days = _____daily
  - CTs connected to septic tank / cleaning cycle for CTs = _____daily
- **Number of trucks required = _____ nos**
  - Number of tanks to be emptied daily / Number of trips per day = _____ nos
- **Volume of septage to be treated = _____ cum/day**
  - Average volume of HHs and CTs septic tanks x Number trips per day = ___ cum/day

FILM

DEVANAHALLI FAECAL SLUDGE TREATMENT PLANT

SESSION 4

PLANNNING AND TECHNOLOGY SELECTION FOR FSSM

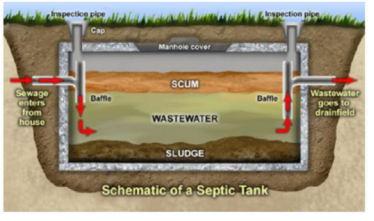
Objective of the Session

- In designing a citywide IFSM service, it is important to **plan** and **assess technology options** for each link in the **service chain**. This ranges from **appropriate toilets** and **onsite systems** such as septic tanks to **conveyance** as well as **treatment** and reuse.
- The session will give brief overview on how to plan FSSM services in a city.
- The session will also provide guidance on various parameters that need to be considered to select **appropriate technology** based on local conditions.

Planning and Technology selection for FSSM

- Planning and technology option for onsite systems
- Planning and technology selection for emptying and conveyance
  - Demand based desludging
  - Scheduled desludging
- Planning and technology option for treatment and reuse
  - Factors affecting identification of new Septage treatment site
  - Factors for selecting septage treatment technology

Septage Quantity calculation..



Schematic of a Septic Tank

Volume of Septic tanl{

- Requires detailed survey of each property (residential, community, commercial, institutional)
- Total volume of all types of collection system

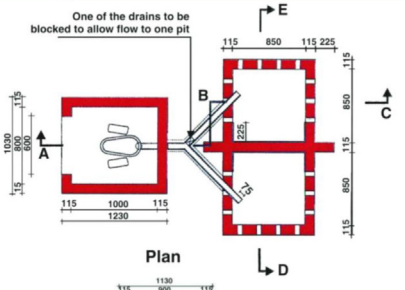
Per capita generation Standard

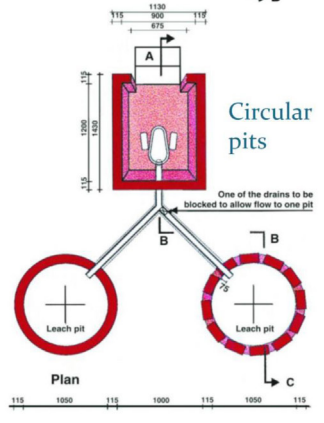
- Based on Std norm of 230 litres/capita/year (GOI septage guidelines)
- Septage quantity (litres/year)= population*230

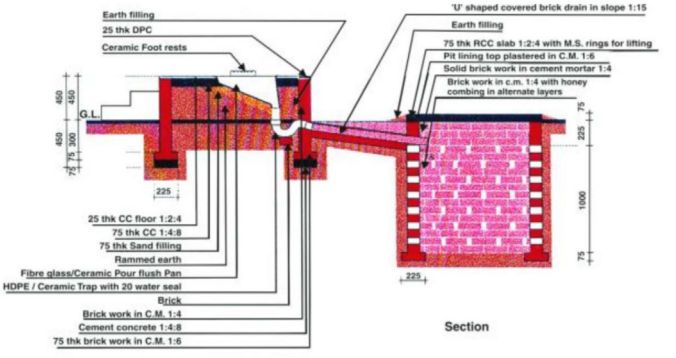
Planning and Technology selection for FSSM

- **Planning and technology option for onsite systems**
- Planning and technology selection for emptying and conveyance
  - Demand based desludging
  - Scheduled desludging
- Planning and technology option for treatment and reuse
  - Factors affecting identification of new Septage treatment site
  - Factors for selecting septage treatment technology

Technology option for onsite systems (1/3)





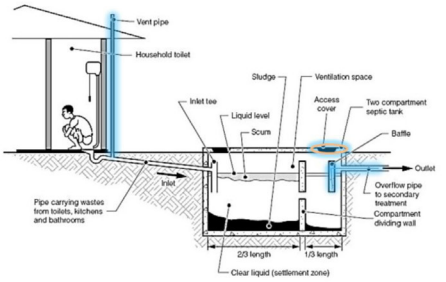


Applicability:	water use 25-50 lpcd
Soil characteristic:	Highly permeable soil
O&M Requirement:	1. Desludging, once pit is full 2. The undigested and unstabilized sludge must be treated and disposed of safely.
Limitation and risk:	1. Manual desludging of excreta and its indiscriminate disposal 2. Not Applicable if the bottom of the pit is < 2 m. above the groundwater table 3. Problems arise when water use increases 4. Not designed to cater for sullage water
Linked technologies:	Pit emptying and faecal sludge treatment

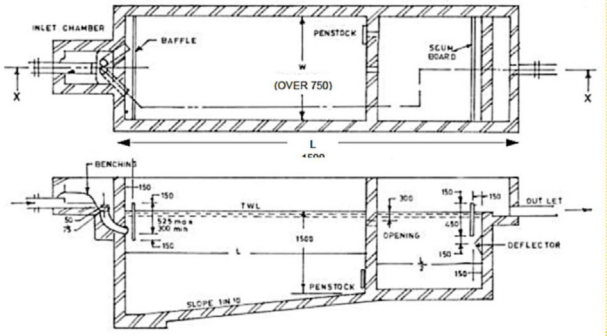
Source : Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)

TWIN PITS TOILETS

Technology option for onsite systems (2/3)

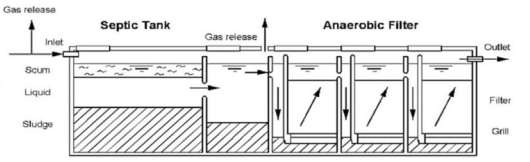


(Dimensions in mm)



Source: Manual on Sewerage and Sewage Treatment Systems, CPHEEO, 2013, Part A: Engineering: http://cpheeo.nic.in/WriteReadData/Cpheeo_Sewarage_Latest/PartA-HighResolution/Chapter%209.pdf

Toilet with Improved Septic tanks



Applicability:
1. Where there is no sewerage network.
2. Appropriate in peri-urban settlements as they do not require any centralized infrastructure.

Soil characteristic:
1. Must be suitable for infiltration of effluent
2. Micro wetland can help through increased evapo-transpiration losses and moisture uptake

O&M Requirement:
Septage must be removed and transported off-site for treatment prior to disposal.

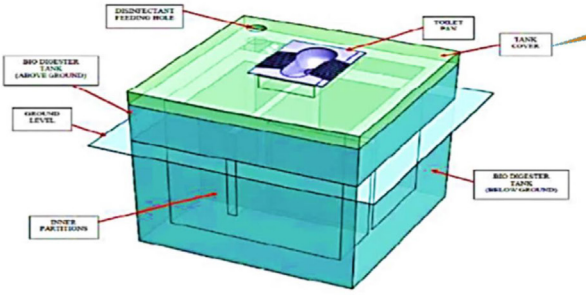
Limitation and risk:
1. High cost and space requirements for the soak away or drain field
2. Common practice is to discharge effluent directly into an open drain as leaching system is often not constructed
3. Retention time is insufficient if Septic tank receives too much wastewater
4. Commonly the householder bypasses the soak away and connects the overflow directly to a surface water drain
5. Performance monitoring of septic tanks is rarely undertaken
6. Regulation to control private desludging operators is problematic

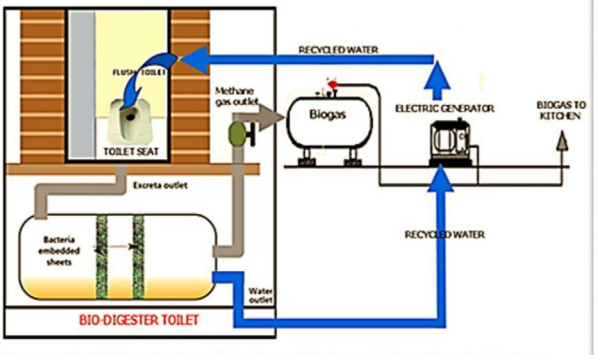
Linked technologies:
Periodic emptying

TOILET WITH SEPTIC TANKS

Technology option for onsite systems (3/3)

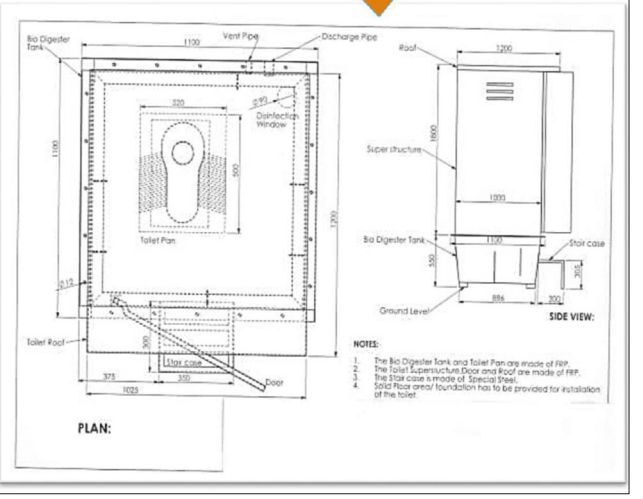
Bio-Digester toilets



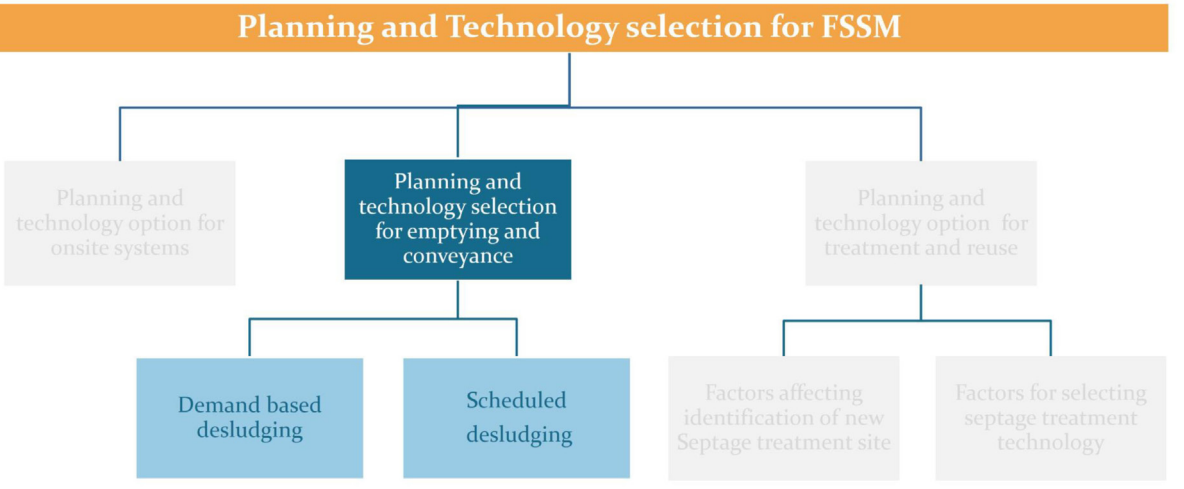


Source : Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)

Bio-toilet

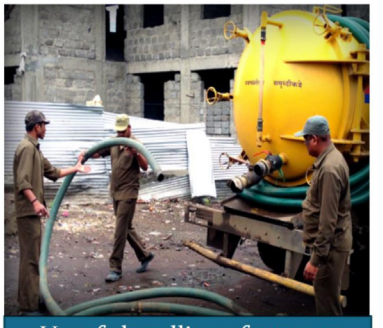


Planning and Technology selection for FSSM

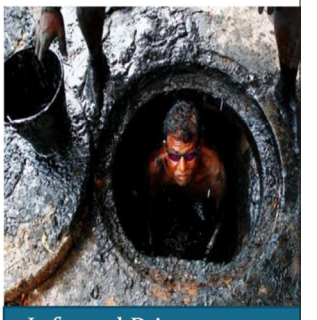


Existing types of emptying & conveyance systems. . .

Services mainly provided by city governments



Unsafe handling of septage



Informal Private sector

Emptying when the tank is full

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years by GoI advisory on Septage Management
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, faecal matter along with effluents is released into the drains

Manual Scavenging Act

Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

Came into force on Dec 6, 2013

"Prohibition of Insanitary Latrines and Employment and Engagement for cleaning of Sewers or Septic Tanks as Manual Scavenger

Prohibition of Activity

Local authorities to survey **Insanitary latrines and provide Sanitary community latrines.**

Survey of manual scavengers in urban areas by Municipalities.

Duty of local authorities and other agencies to use modern **mechanical technology for cleaning of sewers and onsite systems,** etc.

Rehabilitation

Rehabilitation of persons identified as Manual Scavengers by a Municipality. Housing and Financial Assistance to be given.

Technology options for emptying and conveyance

Conventional Vacuum Tanker	Mini-Vacuum Tanker (Vacutug)	Gulper
For septic tanks which have proper **access roads**, a **larger vehicle** maybe used	For septic tanks located in **narrow lanes** or those that do not have proper access roads, **smaller vehicles** maybe used	**Smaller mechanized tricycle/ motorcycle mounted collection** tanks of 20–40 litres capacity with gulper or smaller vacuum pumps at the primary level backed by a secondary transport system may work in the informal slum settlements.

Parameters for assessing conveyance options

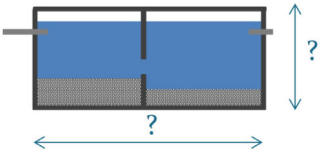
i. Distance of treatment site

ii. Road Width

iii Access to site

iv. Characteristics of septage

v. Size of septic tanks/pits



vi. Traffic congestion

vii Fuel requirement and its implication in opex

viii Financial budget of emptying services

Parameters for assessing conveyance options

Parameters	Mini Vacuum Truck (Vacutug)	Conventional Vacuum truck	Gulper
Distance of treatment plant from emptying point	Small-Haul distance	Long-Haul distance	No means of disposing the sludge off site
Road width	To be used where road widths are narrower	To be used where road widths are broader	Can be used in narrower road widths
Access to site	To be used where site access is difficult for large vehicles	To be used where site access is easy for large vehicles	Can access most locations
Type of onsite sanitation system (septic tanks/ pits) and characteristics of septage	Difficulty emptying high viscosity sludge	Can handle high viscosity sludge	Hand pumps can be used for liquid and, to a certain degree, viscous sludge
Size of septic tanks/pits	Applicable for Smaller volume (500-2000 litres)	Applicable for Larger size (3000-5000 litres)	Cannot empty entire pit (if pit is deep); Slow emptying times
Traffic congestion	To be used in areas with high traffic congestion	Difficulty in moving in areas with high traffic congestion	Not affected by traffic congestion
Fuel requirement and its implication in opex	Requires less fuel; low opex	Requires more fuel ; high opex	No fuel requirement; very low Opex
Financial budget of emptying services	Not financially viable for long-haul transport	Proves to be financially viable for long-haul transport	Not financially viable for large septic tanks/pit size and for long-haul transport

Occupational Safety

- Municipalities should provide workers with safety gear.
- Each worker should be made aware of the risks of the work through trainings.
- Workers should be held liable for not using available protective gear.

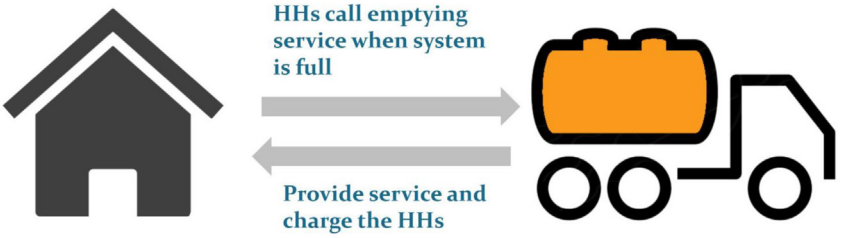
Safety Gears

Use of safety gears by a sanitation worker

Demand v/s Scheduled Emptying

On-Demand Basis	Scheduled Practice
Cleaning is done **on-call** by the household, who do not see the need for regular cleaning The **cleaning services** of the ULB are currently treated as a **complaint redressal** system for overflowing septic tanks rather than a regular cleaning and maintenance service.	Septic tanks will be cleaned on a **pre-determined schedule.** **Regulations** and **penalties** will be set in place to **ensure periodic cleaning** **Awareness generation** activities will educate households about the need for regular cleaning
The ULBs operates the trucks (either owned or borrowed) when the demand arises.	Each town will require an additional **number of trucks to meet service standards** (which can be **operated by a private player**)
Households generally pay a certain amount once in >8-10 years to get tanks cleaned during the time of overflow.	**Local taxes levied** by the ULB will be used to **recover** the **operating expenses** for regular cleaning.

Demand Based emptying services



If non-regulated,

- No regular cleaning
- Overflowing system pose environmental and health risk
- Private emptier may charge higher
- No safety precautions
- No monitoring of septage disposal

Plan for Regulated Demand based emptying services

- Awareness and regulations to HHs for regular desludging
- Empanelment and training of desludging operators
- Monitoring of emptying services through GPS enabled trucks
- Mandatory safety measures during desludging
- Regulations for emptying charge/tax system

Dakar Model

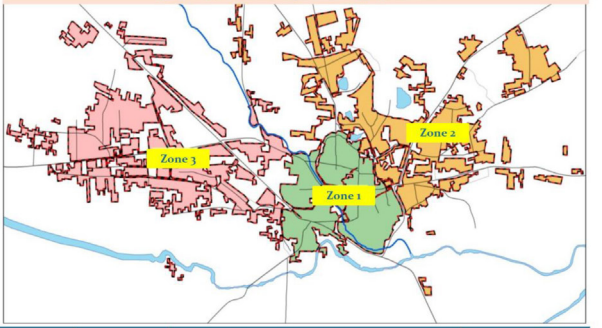
Schedule of emptying services

Septic tank cleaning cycle of 3 years

- To maintain a cycle of 3 years, roughly **2800 septic tanks** need to be **cleaned annually**
- **Each vehicle** needs to make **4 to 5 trips daily**
- Roughly **300 Working Days are required**
- To clean 2800 septic tanks, **2-3 nos of suction emptier trucks** of **5000 capacity** would be **required**

2-3 nos of trucks of 5000 litre capacity are required for cleaning HHs and non-residential septic tanks

Divide the city into zones and prepare a yearly plan



Year	Zones	No. of septic tanks to be cleaned annually (no)	No. of Days required
Year 1	Zone 1	1889	201
	Zone 2	947	101
	Total	2836	302
Year 2	Zone 2	1262	135
	Zone 3	1582	169
	Total	2844	303
Year 3	Zone 3	2762	294
	Total	2762	294

Regulating emptying services . . .

Licensing of septage transporters

Emptying services by ULB or by **private agencies**: management contracts. In case of private sector contract, **ULBs should certify** and **license private septage transporters** to **de-sludge** and **transport waste** to the designated **treatment facility.**

Septage Transporter Permit for _____ Municipality

In accordance with all the terms and conditions of the current _____ Municipality's Rates, Rules and Regulations, the special permit conditions accompanying this permit, and all applicable rules, laws or regulations of Government of Maharashtra, permission is hereby granted to:

NAME OF PERMITTEE: _____

ADDRESS:_____

For the disposal of septage from domestic septic tank or commercial holding tank at the_____ treatment facility.

This Permit is based on information provided in the Septage Transporter Permit application which constitutes the Septage Management Hauled Permit.

This Permit is effective for the period set forth below, may be suspended or revoked for Permit Condition Non Compliance and is not transferable. The original permit shall be kept on file in the Permittee's office. A copy of this Permit shall be carried in every registered vehicle used by the permittee.

EFFECTIVE DATE:

EXPIRATION DATE:

____ CHECK IF RENEWED PERMIT

Permit is liable to be cancelled in case of violations of any Acts, Rules and Regulations relating to the operation of Septage System or in cases of safety protocols not being adhered to or in case of non-permitted disposals.

Sample licensing format

Source: Operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)

Template Manifest form for emptying

Manifest forms are an integral part of a comprehensive septage management program. This completed document or documents with signatures of the household/property, suction truck operator and treatment plant operator should be submitted to the local government for their records. These records can be linked to the payment of the emptier operator in such a way that the emptier operator is only paid if there are signatures of all the stakeholders

Collection and transport records form / manifest forms[1]

Sample Form to be filled by Operator / Transporter of Septage

i. Identification of Waste:

a) Volume _____
b) b) Type: ____ Septic Tank ____ Others
c) c) Source: ____ Residential ____ Commercial ____ Restaurant ____ Portable Toilet ____Others

ii. Details of Waste Generator

a) Name:
b) Phone Number:
c) Address:
d) Pin:
e) Any kind of deficiencies, missing pipes or fittings, improper manholes or access covers, any other cracks or damage observed: _____

The undersigned being duly authorized does hereby certify to the accuracy of the source and type of wastewater collected and transported.

Date: _____ Signature: _____

iii. Details of Transporter / Operator

a) Company Name:
b) Permit:
c) Vehicle License:
d) Pump out date:

The above described wastewater was picked up and hauled by me to the disposal facility name below and was discharged. I certify that the foregoing is true and correct:

e) Signature of authorized agent and title: _____

iv. Acceptance by _____Municipality's authorized STP

The above transporter delivered the described wastewater to this disposal facility and it was accepted.

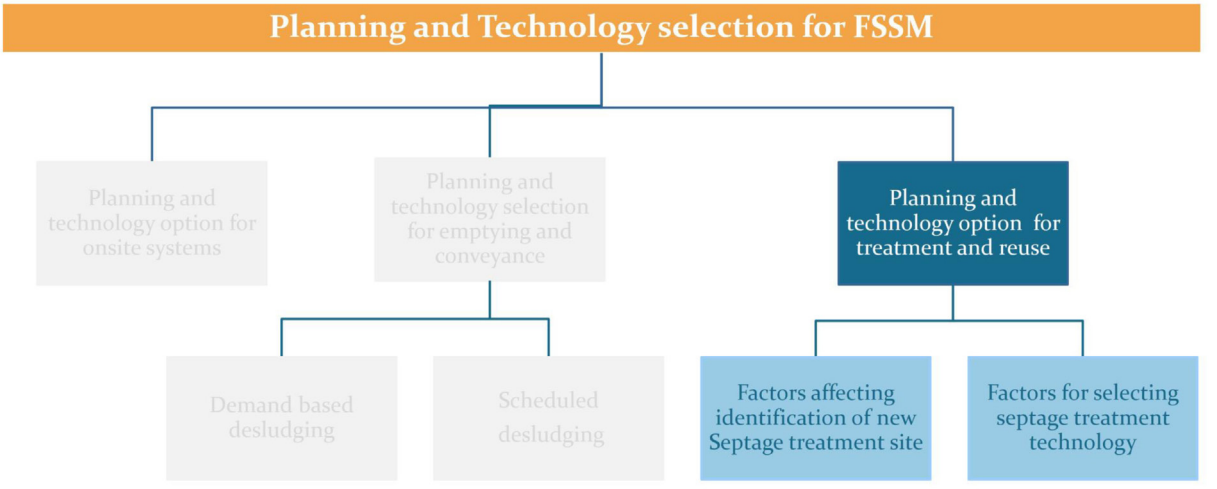
Disposal date: _____ Amount Collected from Transporter (if any):_____

Signature of authorized signatory and title: _____

NOTE: SUBJECT TO THE TERMS AND CONDITIONS OF _____ MUNICIPALITY.

[1] Adapted from operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)

Planning and Technology selection for FSSM



Septage quality results of cities. . .

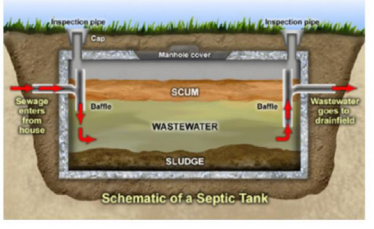
Sr.No.	Parameter	Unit	Wai		Sinnar	
			Household septage	Community - Public toilet septage	Household septage	Community - Public toilet septage
			Result	Result	Result	Result
Test results						
2	BOD5 at 20°c	mg/l	6000 - 16500	228 - 5400	336 - 39000	346 - 2533
3	COD	mg/L	11408 - 27776	395.2 - 9523	1000 - 88000	920 - 7200
4	Total Solids by volume	%	0.992 - 8.07	0.071 - 1.36	0.42 - 7.74	0.43 - 1.06
5	Total Nitrogen (as N) , by volume	%	0.044 - 0.0719	0.016-0.067	0.02 - 0.16	0.06 - 0.11
6	Phosphorus (as P), by volume	%	0.004 - 0.009	0.001 - 0.007	0.0002	0.0002
7	Pottasium (as K) by volume	%	0.004 - 0.014	0.005 - 0.015	0.006 - 0.027	0.017 - 0.029
8	Gross Calorific Value, on dry basis	cal/g	4148	*	3226 - 4817	1281 - 2732
9	Faecal Coliforms	/100ml	>1600	>1600	22 - 920	32 - 170

Note : * - Not analyzed due to insufficient quantity of sample

- **BOD and Total Solids are affected by emptying frequency**
  - ❑ **The more frequently the septic tank is emptied : Less is the BOD and Total solids and vice a versa**
- **The emptying frequency is also dependent on type of housing .**
  - ❑ **Flats are emptied more frequently as compared to bunglows / row houses**

Septage Quality differs City to City . . .

Septage Quantity calculation. .



Volume of Septic tank

- **Requires detailed survey of each property (residential, community, commercial, institutional)**
- **Total volume of all types of collection system**

Per capita generation Standard

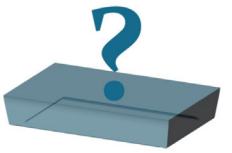
- **Based on Std norm of 230 litres/capita/year (GOI septage guidelines)**
- **Septage quantity (litres/year)= population*230**

Identify new Septage treatment site . . .

i. Distance of treatment site

- Long distance: costly
- A site that is too far away implies fewer trips per day, less revenue and more fuel costs to private operators.

ii. Land availability



- Government land availability
- ULB should also explore the possibility of developing septage treatment facility at solid waste dumping or treatment site.

iii. Reliability of electricity

- If treatment technology has mechanical operated parts.

iv. Neighborhood

- A treatment site may generate nuisance, especially bad odors.
- It should be located at an appropriate distance from the residential areas.

v. Geological Parameters

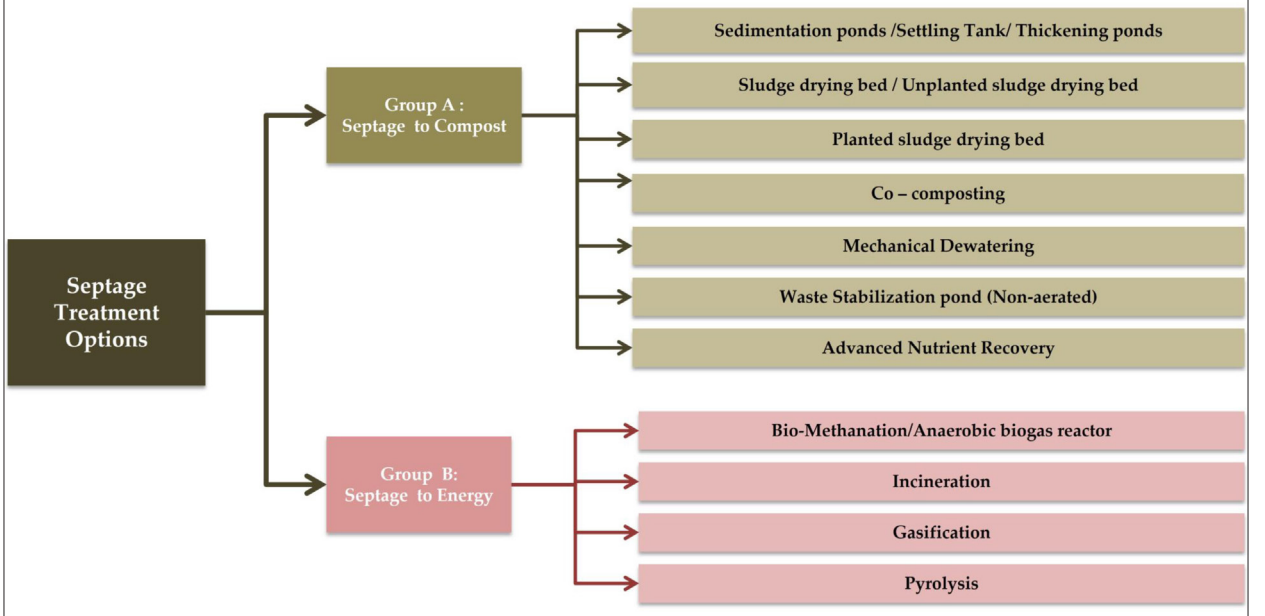
- Groundwater table
- Type of soil
- Prone to flooding

Source: Faecal Sludge Management: Systems Approach for Implementation and Operation, Linda Strande, Mariska Ronteltap, Damir Brdjanovic, IWA 2014

Identify and compare treatment Technology based on following factors...

- **Technical performance of treatment option:**
  - Technology providing required quality output,
  - Popularity in local context, advantages and disadvantages,
  - requirement of pre-treatment or post treatment,
  - level of difficulty in handling or discharging endproduct generated, etc.
- **Site condition:** Permeability, groundwater table, soil type etc
- **Capital and operating cost**
- **Simplicity in Construction & Operation**
- **Level of mechanization** required for its operation
- Efficiency of **energy recovery**

Various Septage treatment options are available. . .



Based on literature reviews and international case studies . . .

Group Exercise

Tariff requirement to recover O&M cost

Step 1: O& M cost for schedule septic tank emptying service

1	Fuel cost for schedule emptying service = (Number of septic tank to be emptied daily*300* Average distance * 2 * Fuel price/ Fuel efficiency) - *Assume Fuel efficiency for truck = 5 km per liter* - *Assume Fuel price = Rs 70 per liter*	
2	Repair and maintenance cost = (Number of suction emptier truck requirement* 12 * 2,000) - *Assume average repair & maintenance cost = Rs 2,000 per month*	
3	Establishment expenses = ((Number of suction emptier truck requirement* 12 * No of manpower* Monthly Salary) - *Assume, 2 manpower requirement per truck* - *Assume, Salary = Rs 10,000 per month*	
4	**Sub-total = (1+2+3)**	
5	Overhead + Insurance + other Miscellaneous cost = Sub-total(4)*X% - *Assume, other cost as X% of sub-total (4)*	
6 –A	**Total O&M cost for schedule septic emptying service = (4+5)**	

Tariff requirement to recover O&M cost

Step 2: O& M cost for septage treatment facility

1	Energy cost for Septage treatment facilities = (Energy cost per month * 12) **Energy cost** - *< 25 cum/day = Rs 5,000 per month* - *25-50 cum/day = Rs 10,000 per month* - *50-75 cum/day = Rs 15,000 per month* - *> 75 cum/day = Rs 20,000 per month*	
2	Repair and maintenance cost = (Avg. Repair & maintenance cost * 12) - *Assume average repair & maintenance cost = Rs 10,000 per month*	
3	Establishment expenses = (No. of manpower*Monthly Salary *12) - *Assume, 4 manpower requirement (in 2 shifts)* - *Assume, Salary = Rs 10,000 per month*	
4	**Sub-total = (1+2+3)**	
5	Overhead + Insurance + other Miscellaneous cost = (4*X%) - *Assume, other cost as X% of sub-total (4)*	
6-B	**Total O&M cost for managing Septage treatment facility = (4+5)**	

Key Outputs . . .

A. **Annual O&M Cost= 6-A + 6-B =**

B. **Per property tariff requirement for septage management =**

=(Annual O&M cost (A)/ total properties)* collection efficiency

- *Considering tax collection efficiency= 70%*
- *Note: Users may calculate differential tariff structure across property uses; properties with toilet facility v/s properties dependent on community toilet etc.*

SESSION 5

FINANCING for FSSM

Objective of the Session

- This session will highlight that to ensure financial **sustainability** of **FSM services**, it is important to **assess capacity for financing** of both capital and O&M expenditure over the plan period.
- The session will give brief overview on how to **assess financial** requirements for both **capital** and **O&M expenditures** for implementation of FSSM in a city.
- The session will also **provides guidance** on **potential sources** of **finance** for meeting these expenditures including through external **grants**, **private sector investments**, user contributions, external **debt** or through local government internal resources.

Financial Requirements for FSSM

Assessment of Financing requirement across FSM service chain

		Access	Collection	Conveyance	Treatment/ Disposal
Financial Requirements	Capex	New Toilets New septic tanks	Refurbishment of septic tanks	New Suction Emptier Trucks	Treatment Facility- Land cost, construction cost
	Opex			Operation of Emptier trucks– Fuel cost, salaries of truck driver, etc	Operation of Treatment Facility- staff salary, electricity bill, pumps replacement, etc

- The first step in Financial Assessment is to determine the financing requirements for proposals for the full service chain – starting with toilets in the user interface, to collection, conveyance and treatment or disposal.
- The finance requirements are essentially based on costs of achieving the various improvement activities planned.
- It is also important to ensure that both capital costs and O&M costs are assessed.

Potential sources of Financing

- For developing a financing plan for FSM, potential sources of funds for capital expenditures will be required and terms and conditions for each will need to be identified.
- The potential sources for capital expenditures may include grants from national/provincial government; own resources of local government, CSR funds from corporate sector or loan from financial institutions.
- In case of private sector participation, the willingness of private players to meet capital expenditure will also need to be assessed.
- Similarly, background assessment of various ongoing programmes at the state and national levels will provide an idea of the possibility of accessing such funds to meet the capital expenditure requirements.
- The potential sources for operating expenditure may include local government own fund, levy of user charge or tax, sale of treated sludge to end users.

Identify potential sources of Financing

	Access	Conveyance	Treatment/ Disposal
CAPEX	**New toilets and Refurbishment of septic tanks**	**Suction Emptier Trucks**	**Treatment Facility-** Land and construction cost
	Households	Central/State Grants	Central/State Grants, VGF
	Government Subsidy	Local Govt. funds	Local Govt. funds
	CSR fund, Crowdfunding, Credit	Private Sector/PPP	Municipal Bonds/Public Finance
			CSR, Crowdfunding
			Private Sector/PPP
OPEX	**Repair of toilets and septic tanks**	**Operation of Emptier trucks–** Fuel cost, salaries of truck driver,etc	**Operation of Treatment Facility-** Salary, electricity , pumps replacement, etc
	Households, Housing society fees	Sanitation Tax/Other Taxes	Sanitation Tax/Other Taxes
		User Charges (Emptying fees)	Sale of Compost

Assess sources for CAPEX....

Current Government Programmes and funds availability

(eg: SBM, AMRUT, 14th FC)

Own funds of Urban Local Body for capital financing

Willingness of Private sector to invest

Innovative financing
Eg: CSR, Crowdfunding, loans

CAPEX: Emptying & Conveyance

A. Potential sources of finance for Capital Expenditure

	Suction Emptier Trucks	Demand based FSM Services	Scheduled FSM Services
Central/state Grants/ Local Government Funds	Several states have earmarked funds/ grants for procurement of vacuum trucks for urban local governments.		
Private sector		Private sector is already investing as per demand	Private sector is generally willing to bring investment for vacuum trucks

CAPEX: Treatment system

A. Potential sources of finance for Capital Expenditure

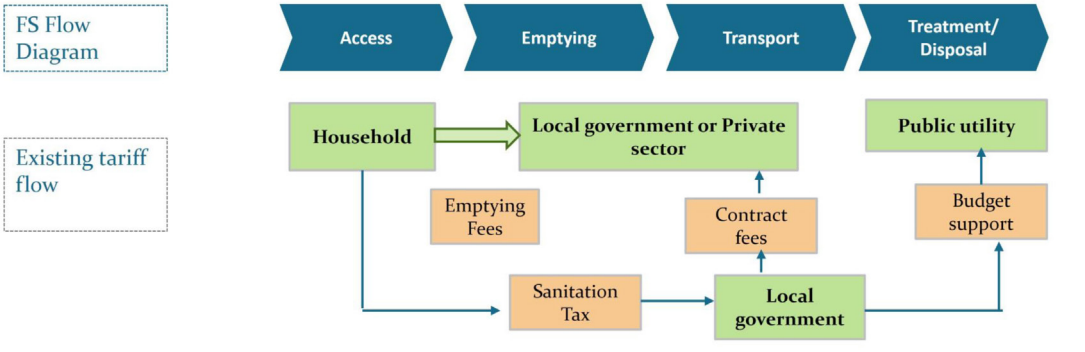
FSSTP	Demand based FSM Services	Scheduled FSM Services
Central/state Grants Local governments	Size of treatment units is relatively small. Large cities may mobilize from own funds. Small cities may mobilize from 14th FC funds/ AMRUT.	-Large cities may use ongoing national level programmes - Small cities may require small size of grant from state programme or mobilize from 14th FC funds.
Private /VGF	Private sector is willing with VGF	
Innovative Finance	CSR, Social Impact Investor, Donor funding etc	

Identify Existing Revenue sources

To make FSM activities sustainable, assessing the revenue sources is very important

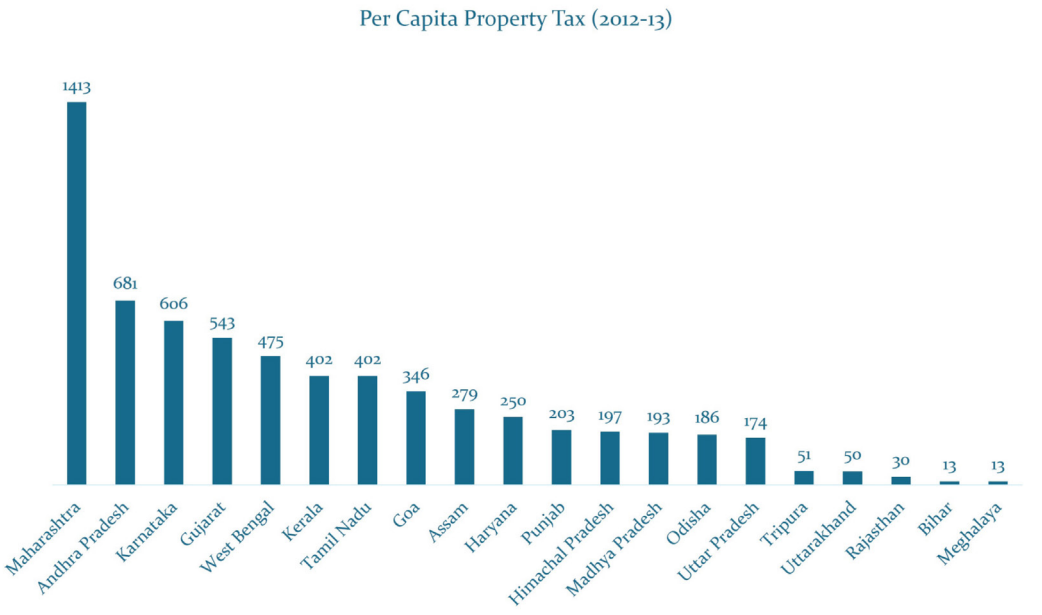
- Local government become financially sustainable by leving taxes and/or user charges so as to recover O&M costs of recent urban development programmes.
- It is therefore imperative that any proposed investment plan includes ways to recover O&M costs.
- Besides meeting operating expenses, the ULB is required to keep sufficient surplus to meet repayment obligations in addition to its committed capital expenses.

Assessment of current tariffs levels across FSM service chain



Source: Diagram adopted from Faecal Sludge Management: Systems Approach for Implementation and Operation, Linda Strande, Mariska Ronteltap, Damir Brdjanovic, IWA 2014

Per capita Property Tax



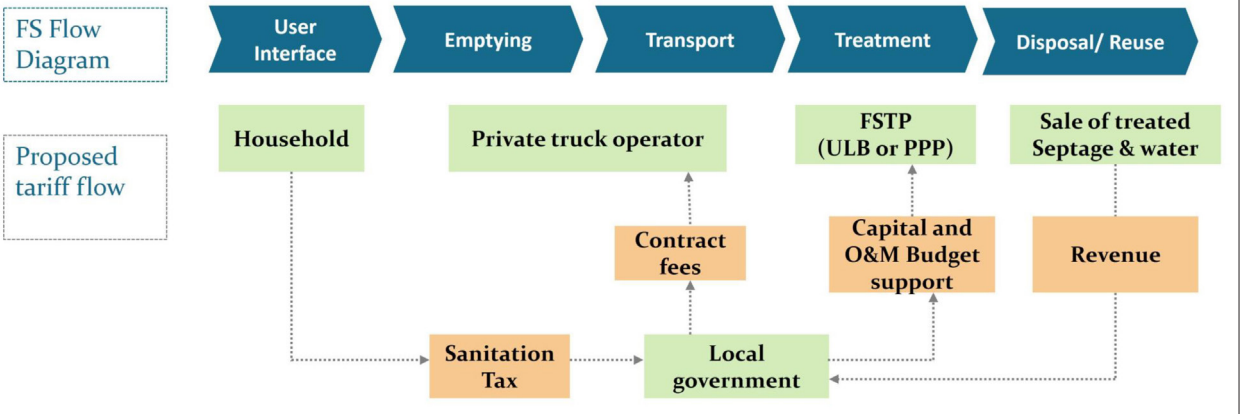
Source: Municipal finances and service delivery in India (2014), ASCI

Potential Revenue structure

Scheduled Desludging through Sanitation Tax

Basis - a) sanitation tax collected from owners of OSSs, and
b) mandatory scheduled desludging of tanks/pits.

Sanitation tax is collected by the local authority either as a percentage of property tax or by the public utilities as a surcharge on water bills.



Discussion points

- **What are key issues in financing FSSM?**
- **Emptying charge or Sanitation tax?**
- **Potential Sources for CAPEX and OPEX in your state?**
  - Emptier trucks
  - Treatment plant

Session 6

Behaviour Change Communication and Sanitation

Learning Objectives

- Behaviour Change Communication in sanitation is more than just conveying a message through mass media campaigns, films and posters.
- Messaging for urban sanitation should be proof tested for any gender, caste and class stereotyping. Negative messaging can strengthen status quo of a deprived social group or class, and gains made in behaviour change may be short lived at best.
- Understanding the audience amounts to understanding deeper level self-perception barriers that prevent adoption of improved behaviours at the individual and community level.
- BCC in the containment and access (individual and public toilets) has been researched. Lessons learnt need to be tested for other parts of the FSSM value chain.

Behaviour Change : Some Key Learnings

- Lack of knowledge and awareness of negative health impacts are not the primary barriers to behaviour change in rural sanitation and are unlikely to be a case in urban sanitation as well.
- Lack of public toilet/sanitation infrastructure particularly in slums and poor settlements needs to be addressed first, before addressing behaviour change.
- Behaviour change in urban sanitation comes with systemic change to address toilets, solid waste, drainage and FSSSM.
  - As long as there is a lack of public individual and toilet infrastructure in slums (adequate, functional and clean toilets and urinals for women and men that are connected to sewerage systems) as long as there are waste dumps in poor settlements and along market yards, public bus stands and hospitals that are not cleaned up by public authorities on a regular basis - no amount of individual awareness and motivation can address urban sanitation challenge.

- Before initiating a general BCC-IEC mass media or a community wide awareness campaign for construction and usage of toilets:
  - An assessment needs to be done to find out if there are any deeper individual and community level self-perception barriers of gender, caste and class – for not using toilets or keeping them clean. BCC research in rural sanitation has shown that there are major barriers to adoption at individual level.
  - Whether gender, caste and class impact on the access to public toilets in poor settlements need to be explored.
  - Whether administrative bottlenecks (contractual employment of sanitary staff, SBM subsidy release issues,etc.), are a constraint.

Behaviour Change Messaging for sanitation

- BCC messaging through mass media needs to be gender sensitive and not re-enforce the stereotype role of men (as earners and decision makers) and women (as care givers).
- BCC messaging should recognize and honour the hard lives and work that the working poor do, and gently motivate them to also improve their sanitation and hygiene behaviours.
  - Mocking people or making fun of their habits or using threats and coercion, without understanding deeper self-perception barriers, may fall on deaf ears and at best bring temporary change in sanitation behaviours.
- A more incremental and long lasting approach can be to address practical infrastructure and O&M challenges that impede toilet usage first, and then address behaviour change and affordability challenges of individual and community/public sanitation.

BCC Messaging for FSSM

- Behaviour Change priorities for FSSM can be for:
  - Understanding the barriers to adopting toilet usage
  - Construction of a standard septic tank
  - Regular scheduled desludging and
  - Preventing indiscriminate disposal and dumping of septage waste.
- BCC strategies for FSSM need to reach out to multiple stakeholders – HHs, community, masons, emptier operators, ULB officials, elected representatives, policy makers…
- Key BCC Messaging for FSSM :
  - Safe containment systems : septic tank design and construction norms
  - Health safety of sanitary workers : empyting and transportation of sludge
  - Incremental improvements : start dumping faecal sludge in trenches or in designated disposal area or into sewer networks
  - Option of treatment in farmers fields through trenching : advocate for Farmers health safety
  - Different technological solutions available in the market : advocate all solutions

THANK YOU

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