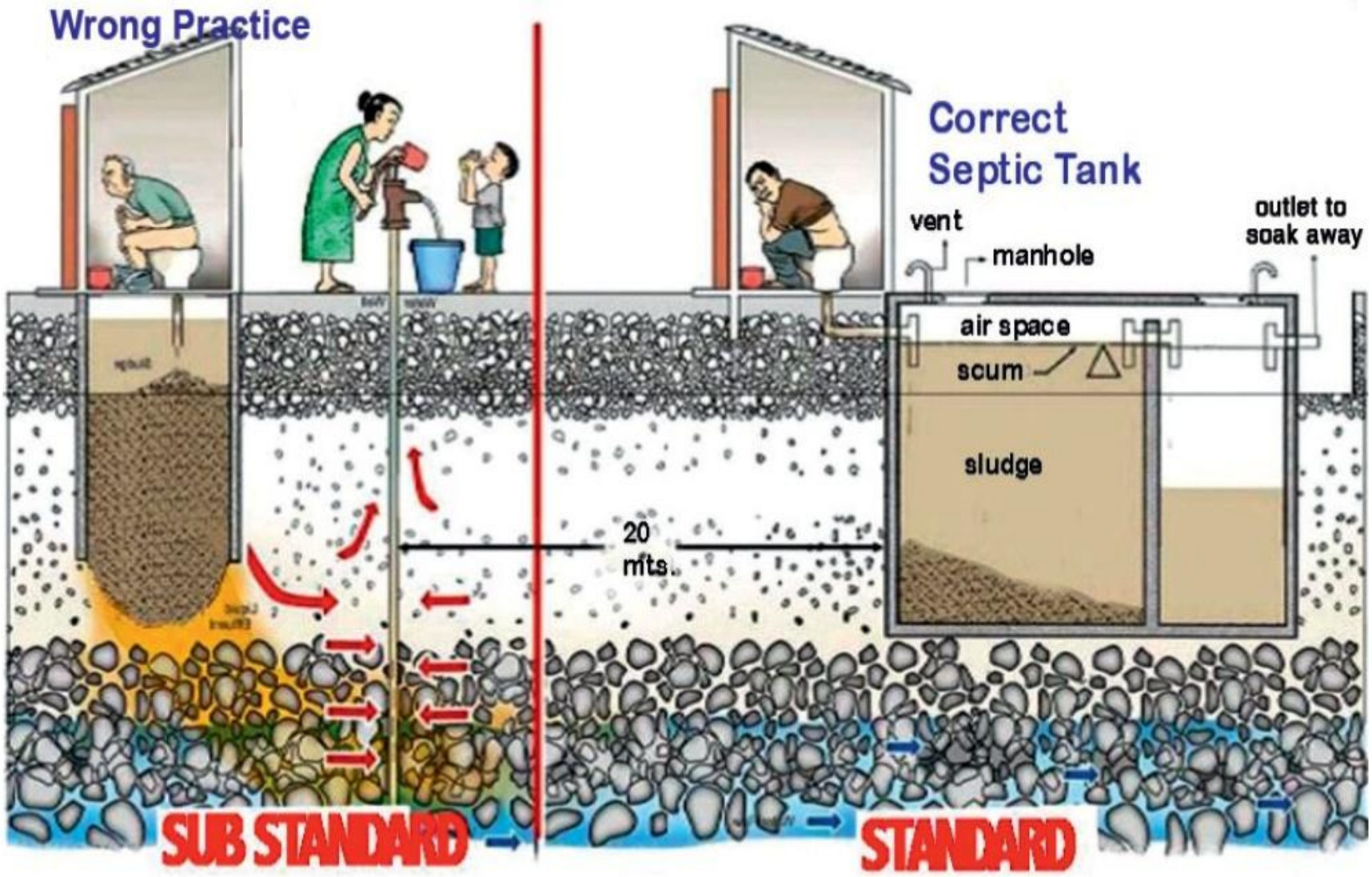
Septage Management

SEPTIC TANK

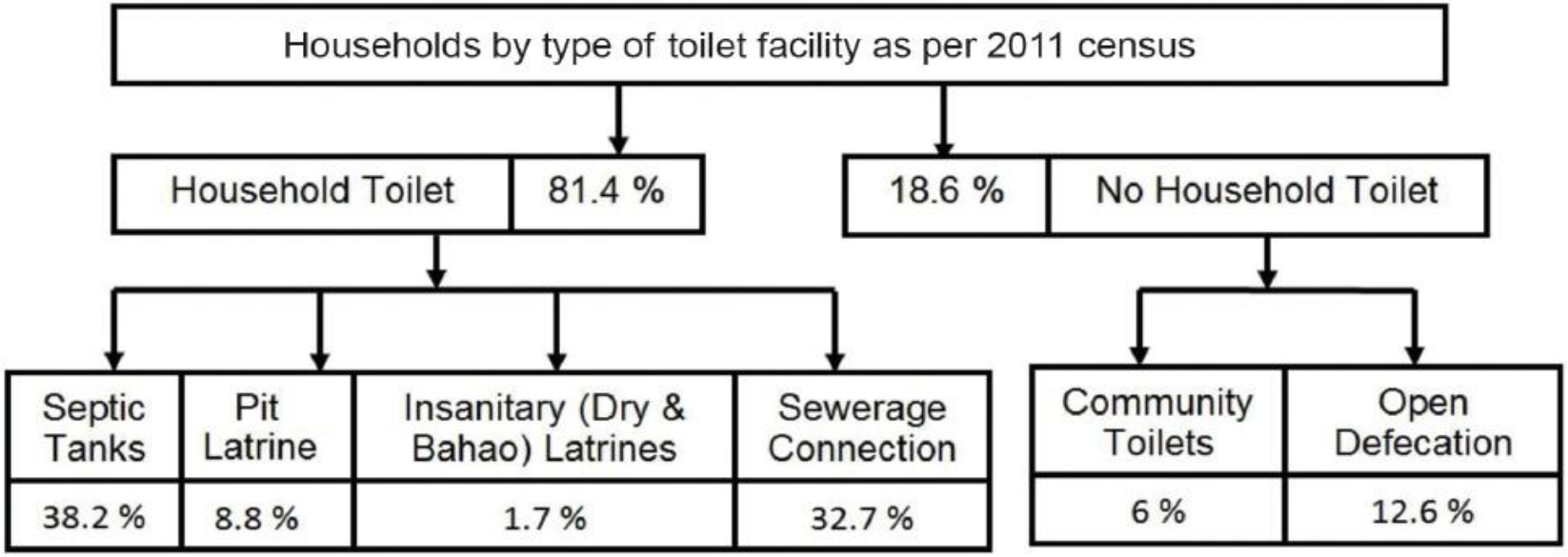

Wrong Practice
Correct
Septic Tank
vent
manhole
outlet to
soak away
air space
scum
sludge
20
mts.
SUB STANDARD
STANDARD

Overall sanitation status

According to the report of the Central Pollution Control Board (2009), the estimated sewage generation from Class - I Cities and Class - II towns is 38254.82 million litres per day (MLD) out of which only 11787.38 MLD (31%) is being treated and the remaining is disposed into the water bodies without any treatment due to which three-fourths of surface water resources are polluted.

In recognition of the need for a special focus on sanitation, the National Urban Sanitation Policy (NUSP) was adopted in October 2008 with a focus on elimination of open defecation, integrated city wide sanitation, proper O&M of all sanitary installations etc. The initiatives under the policy include rating of cities, awareness generation and support to cities for preparation of city sanitation plans. The Ministry of Urban Development conducted a rating of class I cities on sanitation related parameters in 2009-10. Out of 423 cities, only four were in the blue category scoring more than 66 points out of 100. No city achieved the distinction of being a green city i.e. a city scoring more than 90 out of 100.

Status as per 2011 Census



Poor Sanitation Costs

No.	Impact	Loss ($ billion)
1.	Health	38.5
2.	Access time (safe WSS)	15.0
3.	Tourism	0.5
	Total	54.0

Source: World Bank, 2006

Sewage management (Sanitation and sewerage) Benchmarks

No.	Proposed Indicator	Benchmark
1.	Coverage of toilets	100%
2.	Coverage of sewage network services	100%
3.	Collection efficiency of sewage network	100%
4.	Adequacy of sewage treatment capacity	100%
5.	Quality of sewage treatment	100%
6.	Extent of reuse and recycling of sewage	20%
7.	Efficiency of redressal of customer complaints	80%
8.	Extent of cost recovery in sewage treatment	100%
9.	Efficiency in collection of sewage charges	90%

Source: MoUD, 2011

Septage management status

- A major part of Urban India is yet to be provided with sewer system and the people are mainly dependent on conventional individual septic tanks. Census of India 2011 results show 30 million urban households (38 percent of urban households) have septic tanks. USAID (2010) estimates, that by 2017, about 148 million urban people would have septic tanks. Although the number of septic tanks will grow steeply in the next few years, there is no separate policy or regulation for septage management in India at present.

Some definitions

- **Scum: The extraneous or impure matter like oil, hair, grease and other light material that floats at the surface** of the liquid, while the digested sludge is stored at the bottom of the septic tank.
- **Septage: The settled solid matter in semi-solid condition usually a mixture of solids and water settled at** the bottom of septic tank. It has an offensive odour, appearance and is high in organics and pathogenic microorganisms.
- **Septic tank: An underground tank that treats wastewater by a combination of solids settling and anaerobic** digestion. The effluents may be discharged into soak pits or small-bore sewers, and the solids have to be pumped out periodically.
- **Sludge: The settled solid matter in semi-solid condition – it is usually a mixture of solids and water deposited** on the bottom of septic tanks, ponds, etc. The term sewage sludge is generally used to describe residuals from centralized wastewater treatment, while the term septage is used to describe the residuals from septic tanks.
- **Soak Pit: A porous-covered chamber that allows wastewater to soak into the ground. It is also known as a** soak-away or leach pit.
- **Sullage: Domestic dirty water not containing excreta. Sullage is also called grey water.**

ODF city status

- **Open defecation free cities**
- **Achieving open defecation free cities**
- All urban dwellers will have access to and use safe and hygienic sanitation facilities and arrangements so that no one defecates in the open. In order to achieve this goal, the following activities shall be undertaken:
- a. Promoting access to households with safe sanitation facilities (including proper disposal arrangements);
- b. Promoting community-planned and managed toilets wherever necessary, for groups of households who have constraints of space, tenure or economic constraints in gaining access to individual facilities;
- c. Adequate availability and 100% upkeep and management of public sanitation facilities in all urban areas, to rid them of open defecation and environmental hazards.

Sewerage status

- Sewerage systems only partially cover Indian cities – a NIUA (2005) study of 300 Class-I and Class-II cities noted that… "while all the metropolitan cities have a sewerage system, only a third of the Class-I cities and less than one-fifth of the smaller sized urban centers have a sewerage system.
- However, the coverage by sewerage systems is partial in all these urban centers".
- it is likely that many will acquire on-site arrangements like pit latrines and septic tanks in cities at locations where sewerage systems are not available.

Ignorance to on site sanitation

The National Rating of 423 Class-I Indian Cities (covering 72% of Indian urban population) on Sanitation (MOUD, Govt. of India, May 2010) found that 65% (274) of these cities had unsatisfactory arrangements for safe collection of human excreta (whether on-site or sewerage).

Urban India has limited sewage treatment facilities and little experience of septage treatment facilities

Reasons

- Insufficient knowledge/capacity/awareness and public involvement
- Inappropriate system design and selection processes
- Poor O&M
- Poor inspection, monitoring, program evaluation and regulatory components:

Physical and chemical characteristics of septage

Constituents	Average	Range
BOD in mg/l	6480	440---78600
COD in mg/l	31900	1500---703000
TS	34106	1132--103732
TVS	23100	350--71402
TSS	12862	310--93378
VSS	9027	95--51500
Total Kjeldahal Nitrogen	588	66--1060
Ammonia Nitrogen	97	3--116
Total Phosphorus	210	20--760
Alkalinity	970	522--4190
Grease	5600	208--23368
pH		1.5—12.6

Fresh sludge is highly concentrated than that from the septic tank.

Practices vary

- The National Building Code of India (NBC, 2005) has published guidelines for septic tank design, construction, installation, their operations and maintenance. But in reality, the sizes and designs of septic tank vary from one place to another and are influenced largely by the local construction practices, material and skill of masons.
- "Septic tanks should be cleaned when a large quantity of septage has collected in the bottom of the tank." But 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. As septic tanks fill with sludge, the effluent begins to resemble septage with dramatically higher pollution values.

Desludging of septic tanks

- In Indian cities, most of the septic tanks are desludged manually. This is considered as an unpleasant and repulsive job, precipitates human contact with faecal matter, and since the sludge (including fresh excreta) generally gets spilled around the tank during emptying, this poses a risk of transmission of diseases of faecal origin – in any case, this is tantamount to manual scavenging. The Government of India has enacted the Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993.
- The most satisfactory method of sludge removal is by vacuum tankers. Though desludging frequencies vary, it is generally recommended to desludge tanks once every two to three years, or when the tank becomes one third full.
- The vehicles are available in different capacities from 2,000 up to 12,000 litres. Small scale vacuum trucks called Vacutug (from 200 up to 2,000 litres capacity) are also recommended for use in areas inaccessible to large desludging vehicles.

Pumping septage

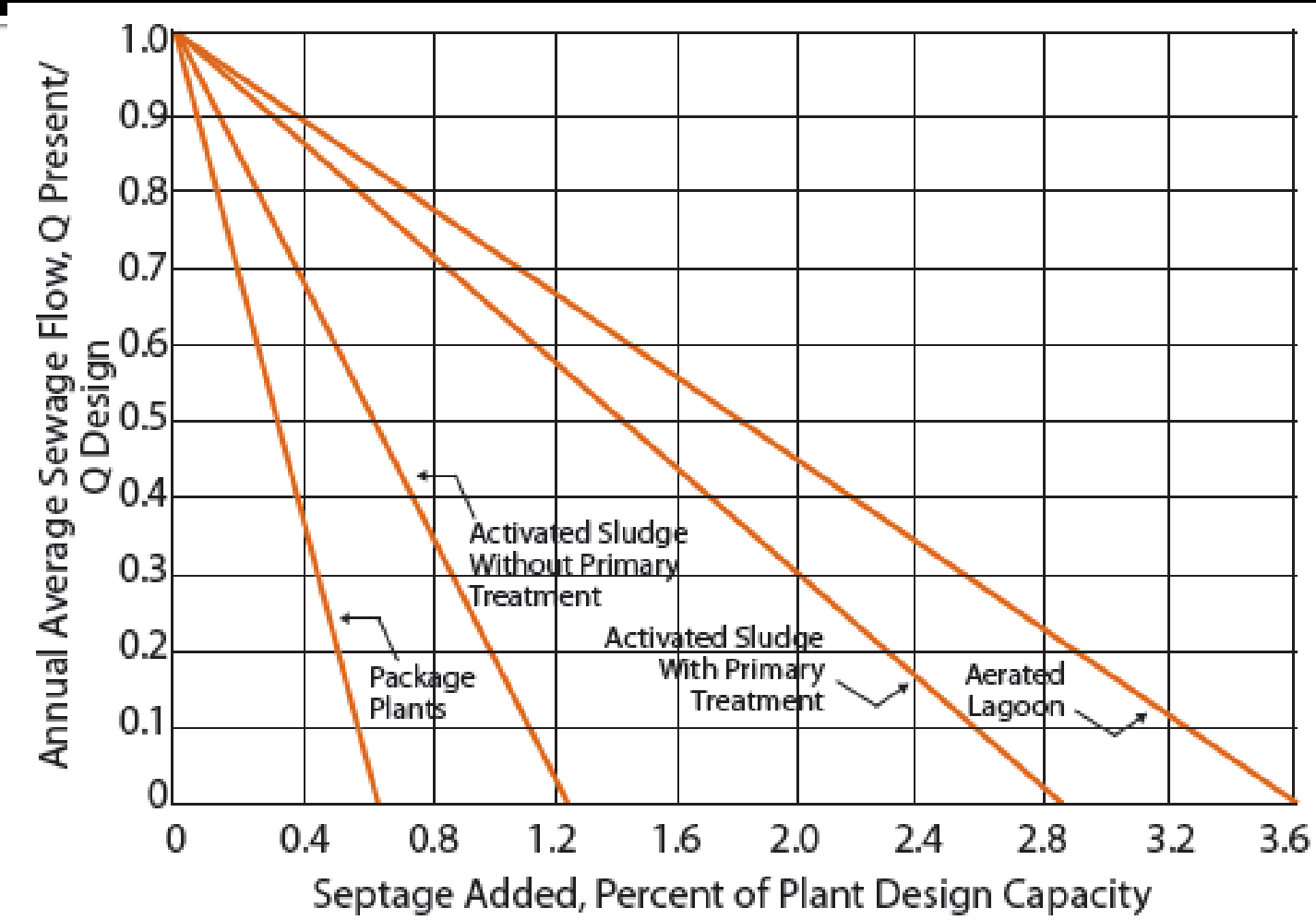
Transportation of sludge

- Desludging trucks act as a "mobile sewer network" for on-site sanitation systems. They collect the septage at the household level and transport it to treatment or disposal sites, thereby complimenting the functions of an underground sewer network.

Scheduling and routing for trucks

- Customer service protocols
- Locating tanks and cleanouts
- Proper pumping equipment operation and worker safety
- Site control, including post-pumping clean-up
- Transportation requirements, including rules of the road
- Disposal procedures at the treatment facility
- Routine service of equipment – greasing and oiling, minor repairs
- Recordkeeping for all tanks pumped and wastes discharged at the disposal facility

Allowable septage loadings to a sewage treatment plant having septage-holding tank



Operational parameters for dewatered septage composting

Parameter	Optimum range	Control mechanisms
Moisture content of compost mixture	40-60%	Dewatering of septage to 10 to 20% solids followed by addition of bulking material (amendments such as sawdust and woodchips) – 3:1 by volume amendment: dewatered septage.
Oxygen	5-15%	Periodic turning (windrow), forced aeration (static pile), mechanical agitation with compressed air (mechanical).
Temperature	55-65 degree C	Natural result of biological activity in piles. Too much aeration will reduce temperature.
pH	5-8	Septage is generally within this pH range, adjustments not normally necessary.
Carbon /nitrogen ratio	20:1 to 30:1	Addition of bulking material.

Dewatered septage sludge reuse

- Properly treated sludge can be reused to reclaim parched land by application as soil conditioner, and/or as a fertilizer. Deteriorated land areas, which cannot support the plant egetation due to lack of nutrients, soil organic matter, low pH and low water holding capacity, can be reclaimed and improved by the application of treated septage.

Implementation

- The septage management program for the cities should provide for issuing licenses to private operators providing desludging services. All public and private sector staff should adhere to safety norms as provided in the Manual on Sewerage and Sewage Treatment published by the Ministry of Urban Development and such other safeguards that the ULB may provide under its own rules. For disposal of septage, the ULB will need to follow the standards set out in the Environment (Protection) Act, 1986, depending on the mode of disposal.
- Following the design norms adapted to local conditions that are notified under the Septage Management Rules, the ULB should carry out regular inspection of properties with on-site systems.
- Reuse of treated sludge for agriculture application should comply with the standards notified for compost under US EPA /WHO guidelines and MSW Rules.

Table A.1: Basic assumptions for calculation for sludge drying bed

No.	Component	Norm
A	**Household sanitation infrastructure**	
1	Latrine connected to septic tank	1 per household
2	Grit and grease trap	1 per household
B	**Septage cleaning, treatment and disposal**	
1	No. of septic tanks cleared per vehicle per day	3 tanks per day per vehicle
2	Frequency of septage cleaning from septic tank	Once in 2 years (Norms 2-3 years)
3	Septage volume removed per tank	2 m^3
4	No. of operational days per annum	300 days

Table A.2: Computations: septic tanks cleared, septage volume and sludge drying beds

No.	Component
Septage clearance vehicles	• A total of 11 septage clearance vehicles will be needed. The ULB currently has one septage clearance vehicle • To efficiently manage septage clearance, 10 additional vehicles will have to be purchased • Out of this, 9 vehicles will be purchased in year-1, whereas 10th vehicle can be purchased in year-4
Tanks cleared per year	• No. of septic tanks cleared per year = 11 trucks x 3 tanks x 300 days • No. of septic tanks cleared per year = 9900
Daily septage volume	• Daily septage volume = 11 trucks x 3 tanks x 2 cum/day • Daily septage volume = 66 m^3
Septage drying (SD) bed	• Single drying bed area = 12 x 12 m = 144 m^2 • Max. septage depth = 0.30 m = 30 cm = 300 mm • Capacity per bed = 144 x 0.3 = 43 • Daily requirement of beds (Nos) = 66 m^3/43 m^3 = 2 • Considering a drying cycle of 10 days, a total of 20 drying beds are suggested
Indicative site area	• Total site area = SD bed area + 10 % SD bed area + area for office and dried storage + area for ancillary units. • Total site area = (2,880 + 288 + 5,000 + 2,250) m^2 • Total site area = 10,418 m^2

Sludge drying bed

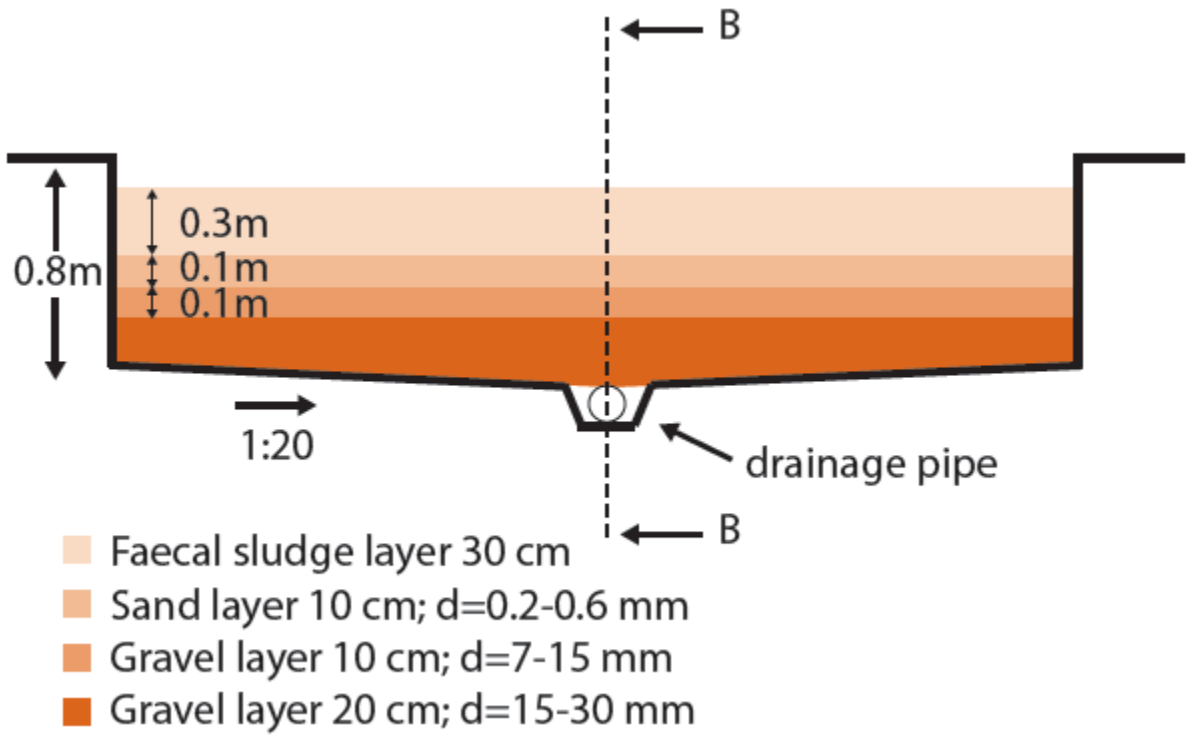
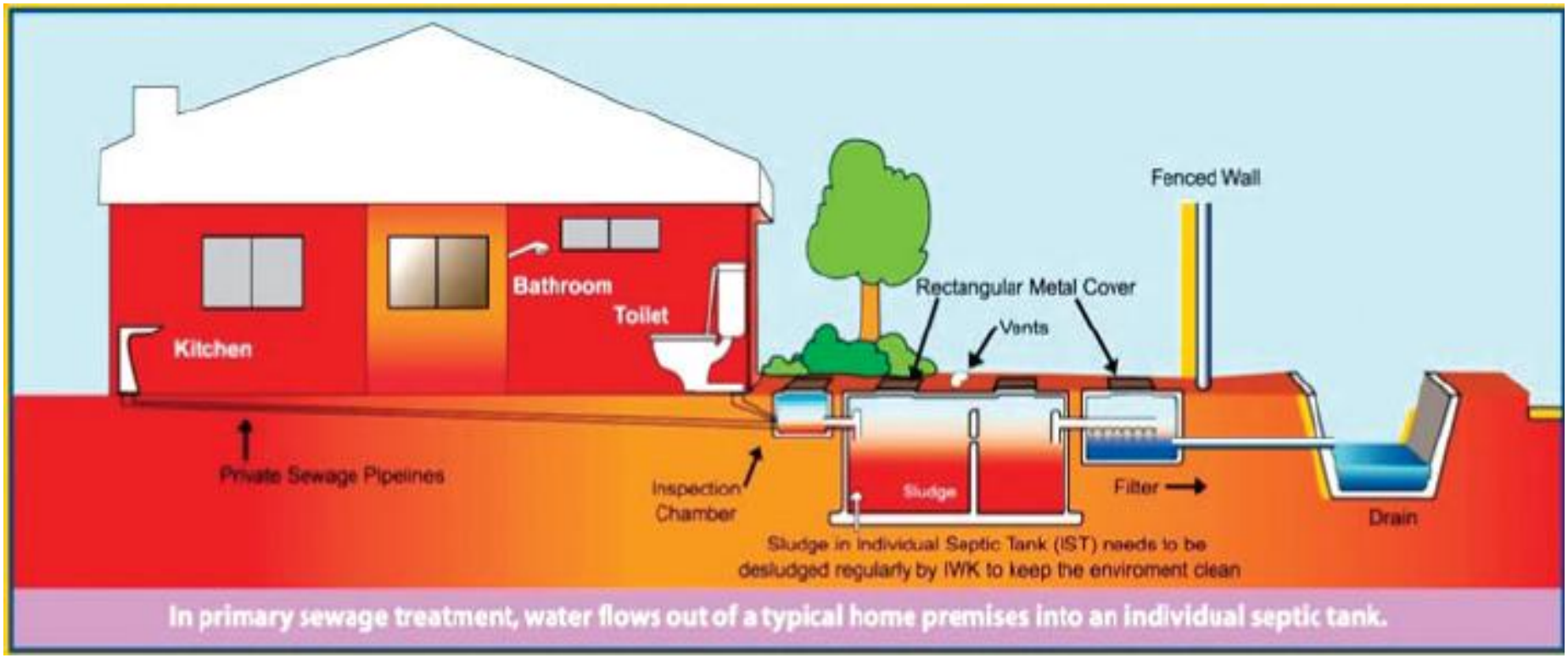


Table B2 : Model format for calculating number of trucks required for servicing100,000 population

S. No.	Parameters	Calculation	Remarks
1	Nos. of people per household	5	(A)
2	Nos. of houses	20,000	(B=100,000/A)
3	Frequency of desludging, once every	2 years	(C)
4	Nos. of houses to be desludged per annum	10,000	(D=B/C)
5	Coverage with septic tank	100%	(E)
6	Average sludge volume per house, cu.m.	2.00	(F)
7	Volume to be desludged per annum, cu.m.	20,000	(G=D*E*F)
8	Nos. of working day per annum	300	(H)
9	Volume to be desludged, cu.m./day	66.67	(I=G/H)
10	Size of each desludging truck, cu.m.	2	(J)
11	Nos. of houses per trip	1	(K=J/F)
12	Nos. of trip per day (depends on the distance)	3	(L)
13	Volume desludged per truck per day, cu.m.	6	(M=J*L)
14	Nos. of truck required	11.11 say 11	(N=I/M)
15	Standby (Range 10%-25%)	1.25	(O)
16	Total no. of trucks required	13.75 say 14	(P=NxO)

It should look like …….



THANKS