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TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

iihs™

INDIAN INSTITUTE FOR HUMAN SETTLEMENTS

In Association With:

Keystone
A GROUP FOR ECO-DEVELOPMENT INITIATIVES

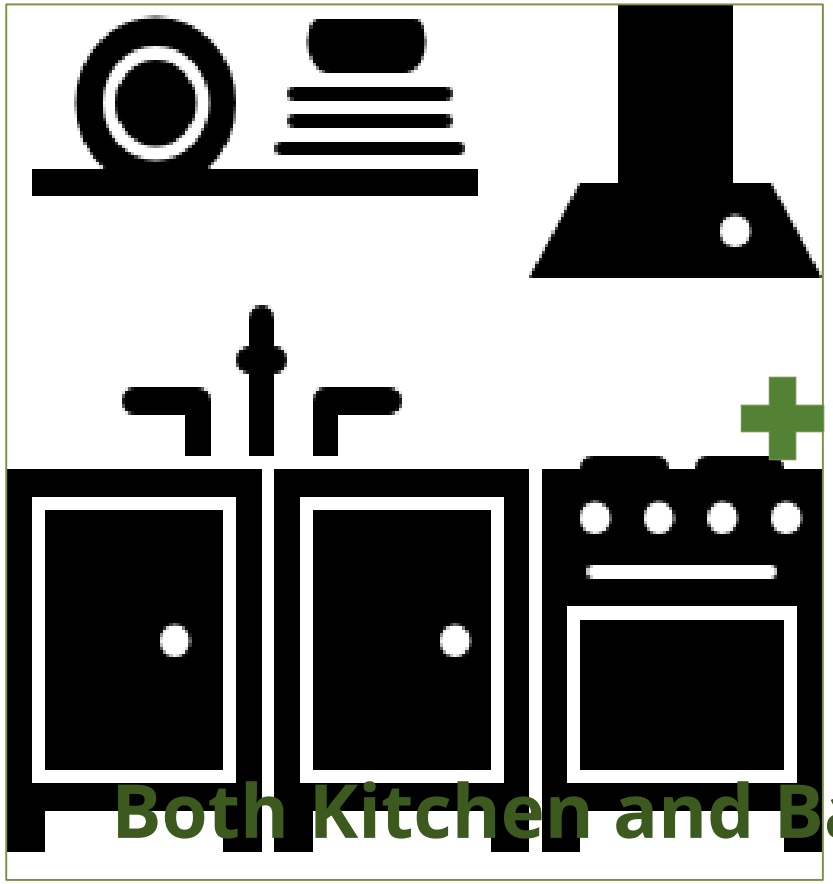
Gramalaya

CDD Consortium for DEWATS Dissemination Society

Training programme on Fecal Sludge Management for Engineers in Trichy Corporation

On-site Sanitation systems: Septic tanks and Twin pits

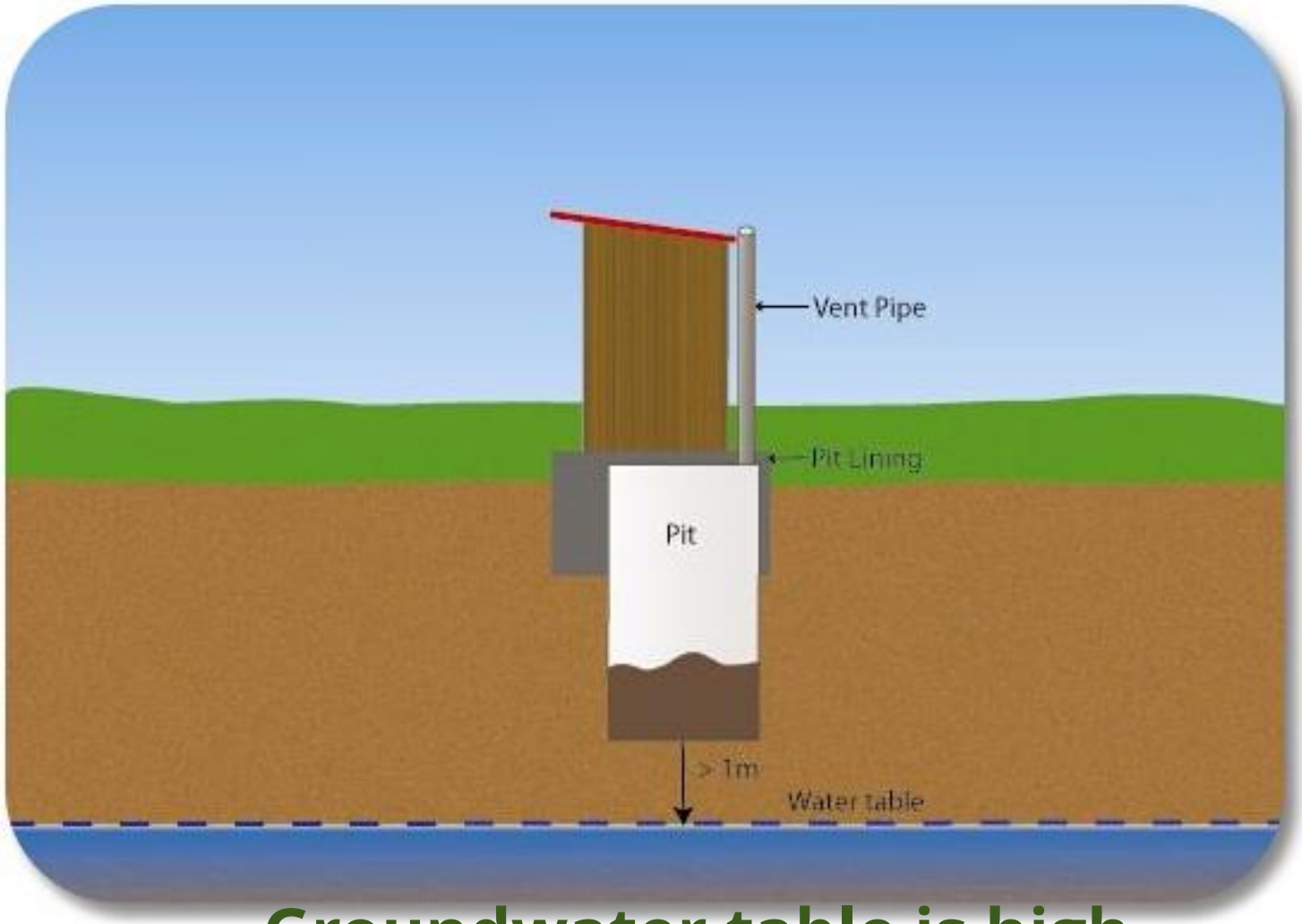
Kitchen



Bathroom

Both Kitchen and Bathroom wastewater needs containment.

What if...



Groundwater table is high

Whic m to

Pit system are not suitable for such conditions

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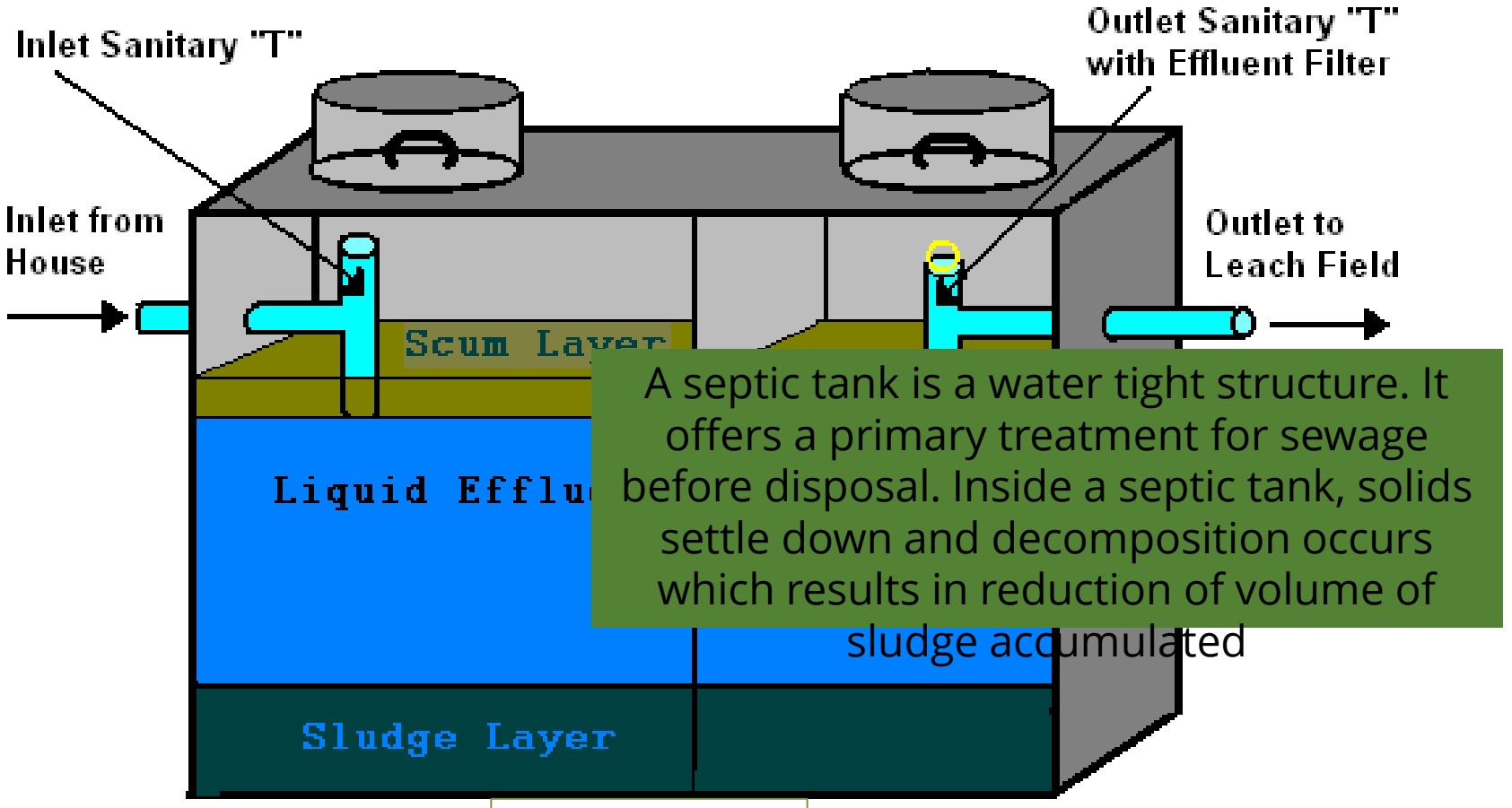
Solution



A septic tank is a water tight structure. It offers a primary treatment for sewage before disposal. Inside a septic tank, solids settle down and decomposition occurs which results in reduction of volume of sludge accumulated

Septic tank

Lets build a septic tank for a household

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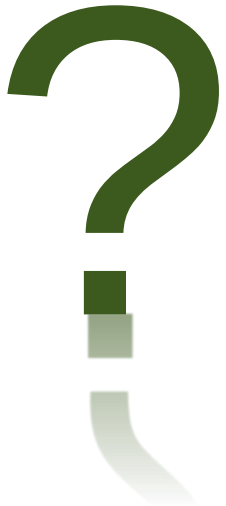
Key Question to be answered before designing a Septic tank

What should be the volume of a septic tank?

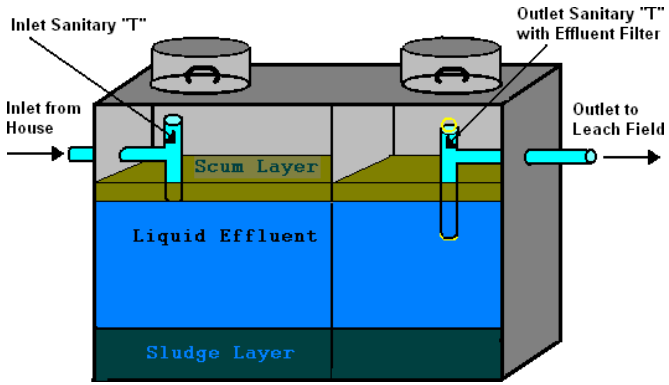


What factors affect volume of a Septic tank

No. of persons using toilet

Desludging Frequency

Factors affecting size of a Septic tank



No. of persons using toilet × Sludge accumulation rate × Desludging Frequency

Volume =No. of persons x sludge accumulation rate x desludging frequency

Sludge accumulation rate value according to CPEEHO – 0.00028 m3 / person / ann

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Guidelines from CPHEEO Manual & IS 2470 (part 1&2)

Septic tank design guidelines

Septic tank	5 users			10 users			15 users		
	Length	Breadth	Liquid Depth	Length	Breadth	Liquid Depth	Length	Breadth	Liquid Depth
	1.5	0.75	1.05	2	0.9	1.4	2	0.9	2

Soak pit design guideline

Soak Pit	Diameter	Depth
	0.9	1.0

Note

- Depth from bottom of pit to invert level of incoming pipe or drain (all dimensions in m).
- Sludge Storage Volume is 3 years.
- 300 mm of free board should be provided between invert level of pipe to pit cover.
- Important to consider the infiltration rate of the soil while designing the soak pit

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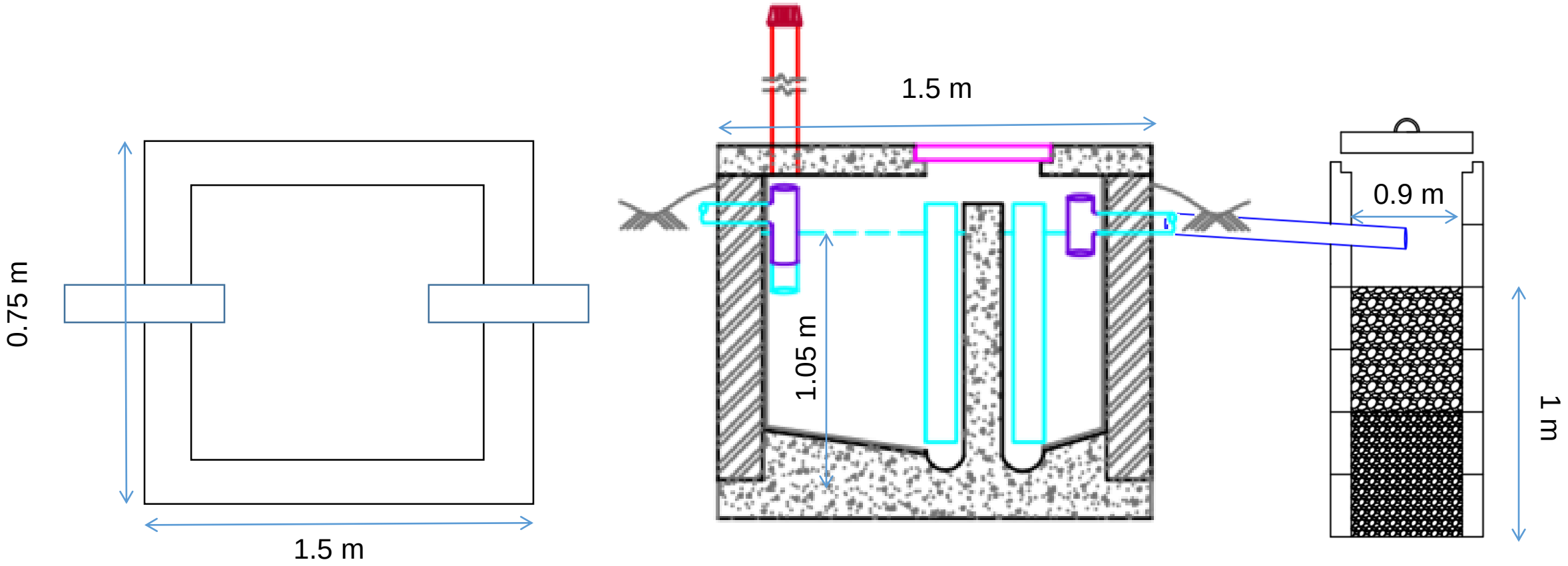
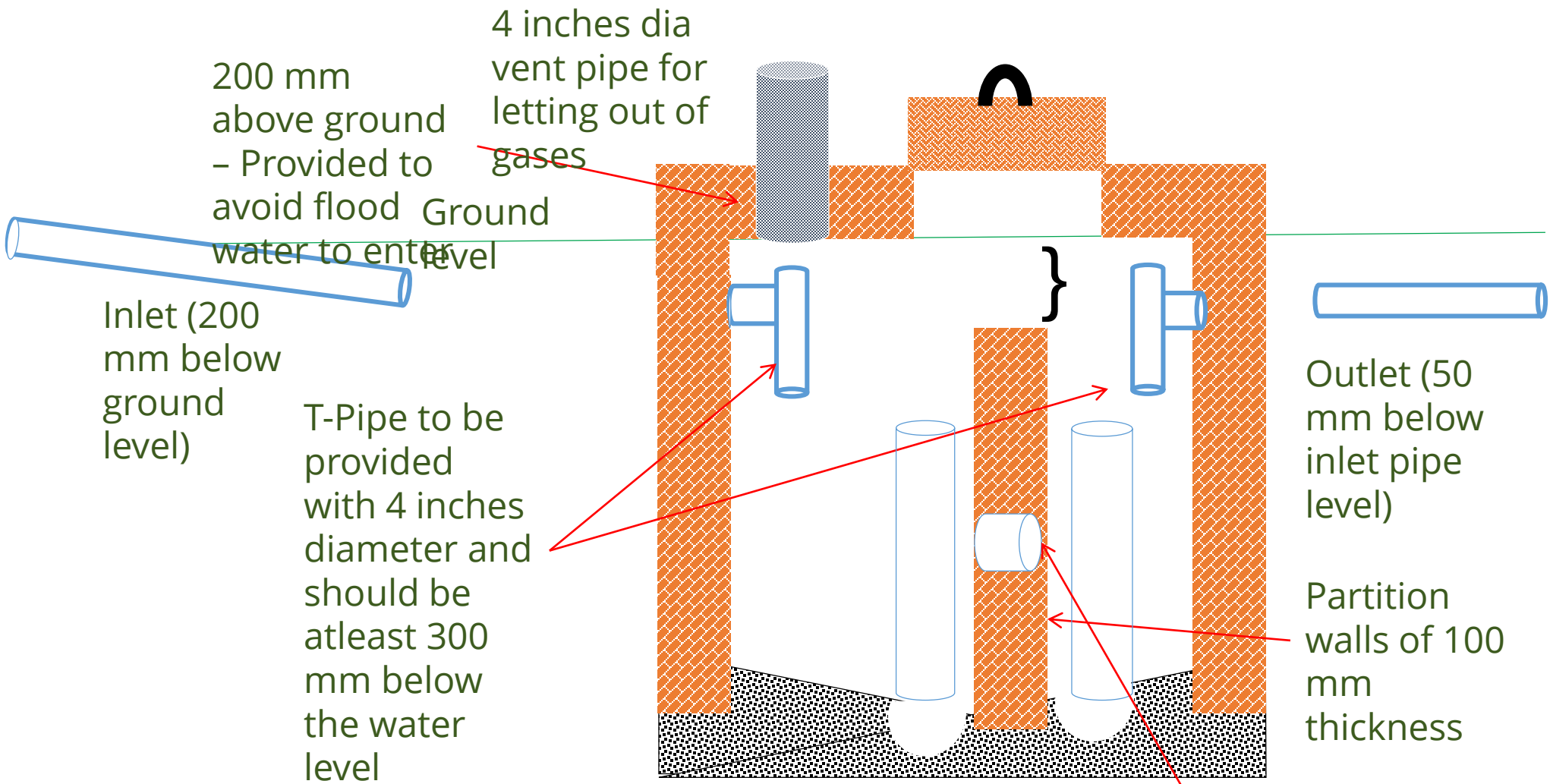
Dimension of Septic tank



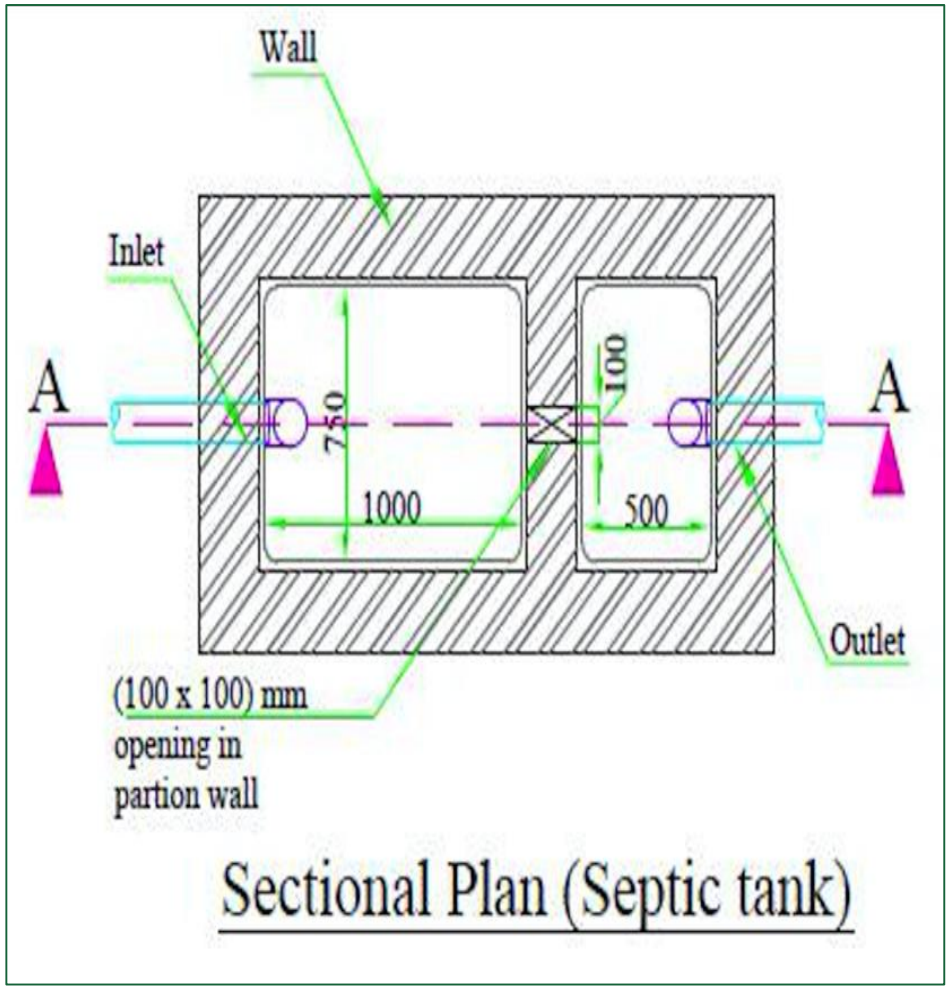
PLAN **SECTION**

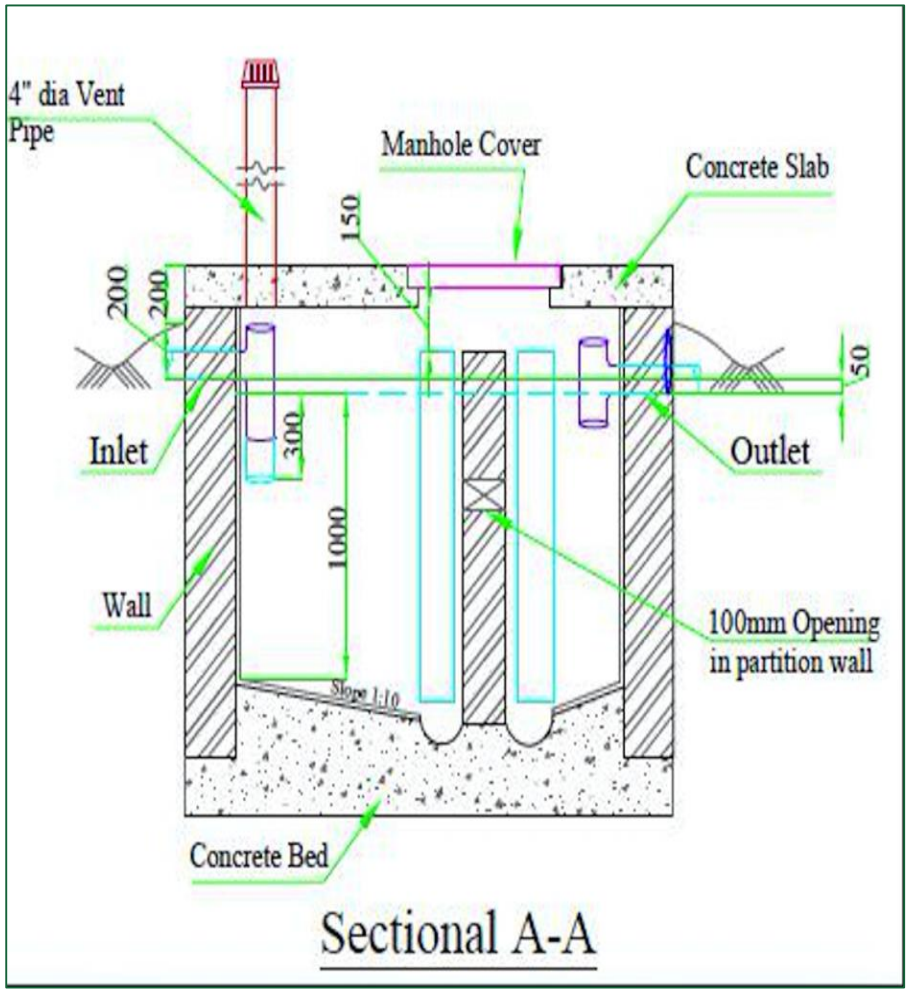
Lets get started…

Septic tank (in detail)

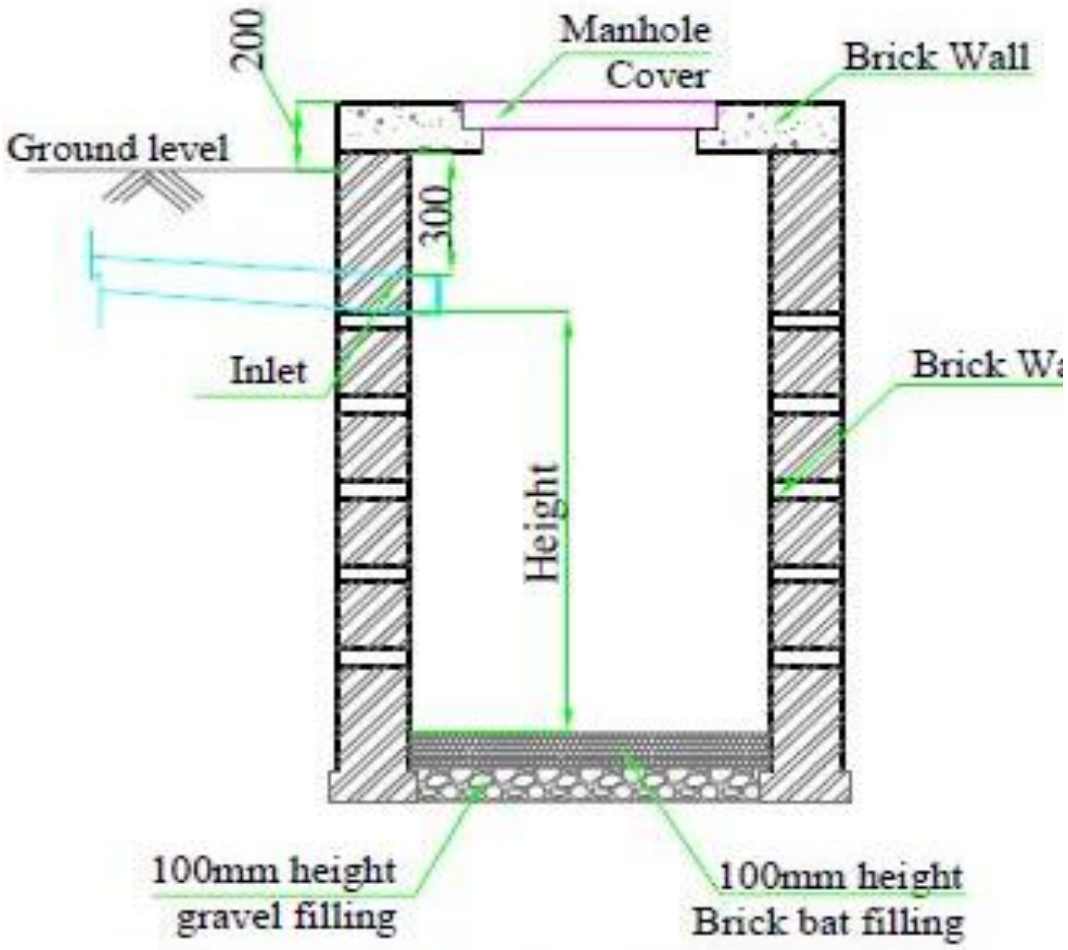


Septic tank (section & plan)

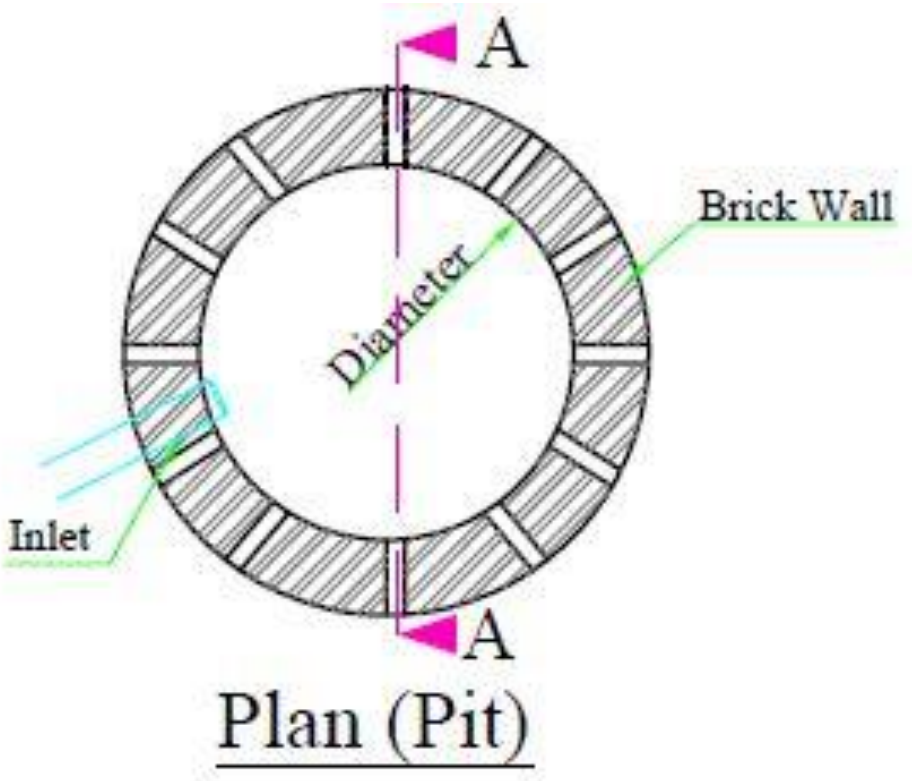




Section and plan of Soak pit



Section A-A



Plan (Pit)

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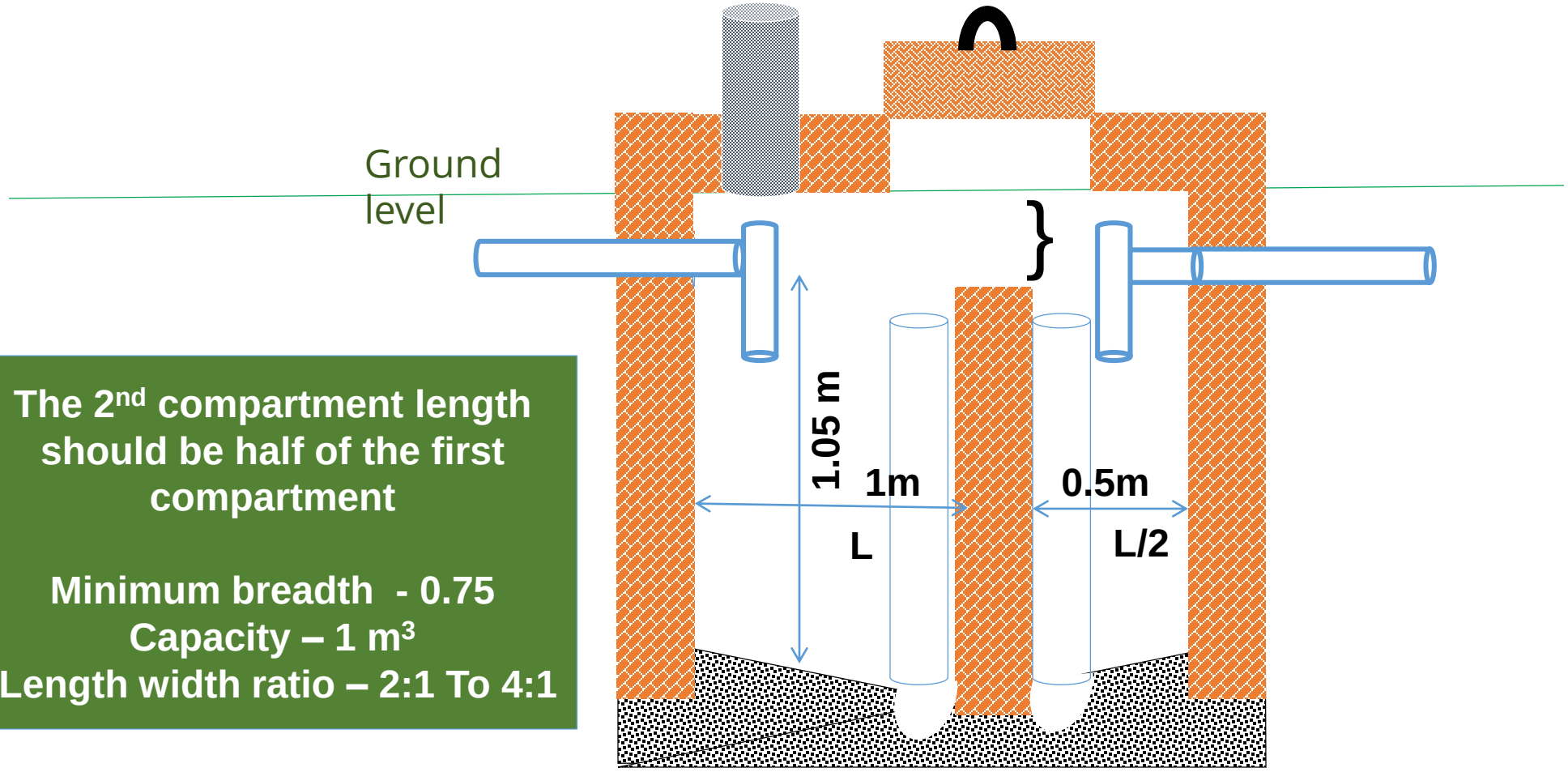
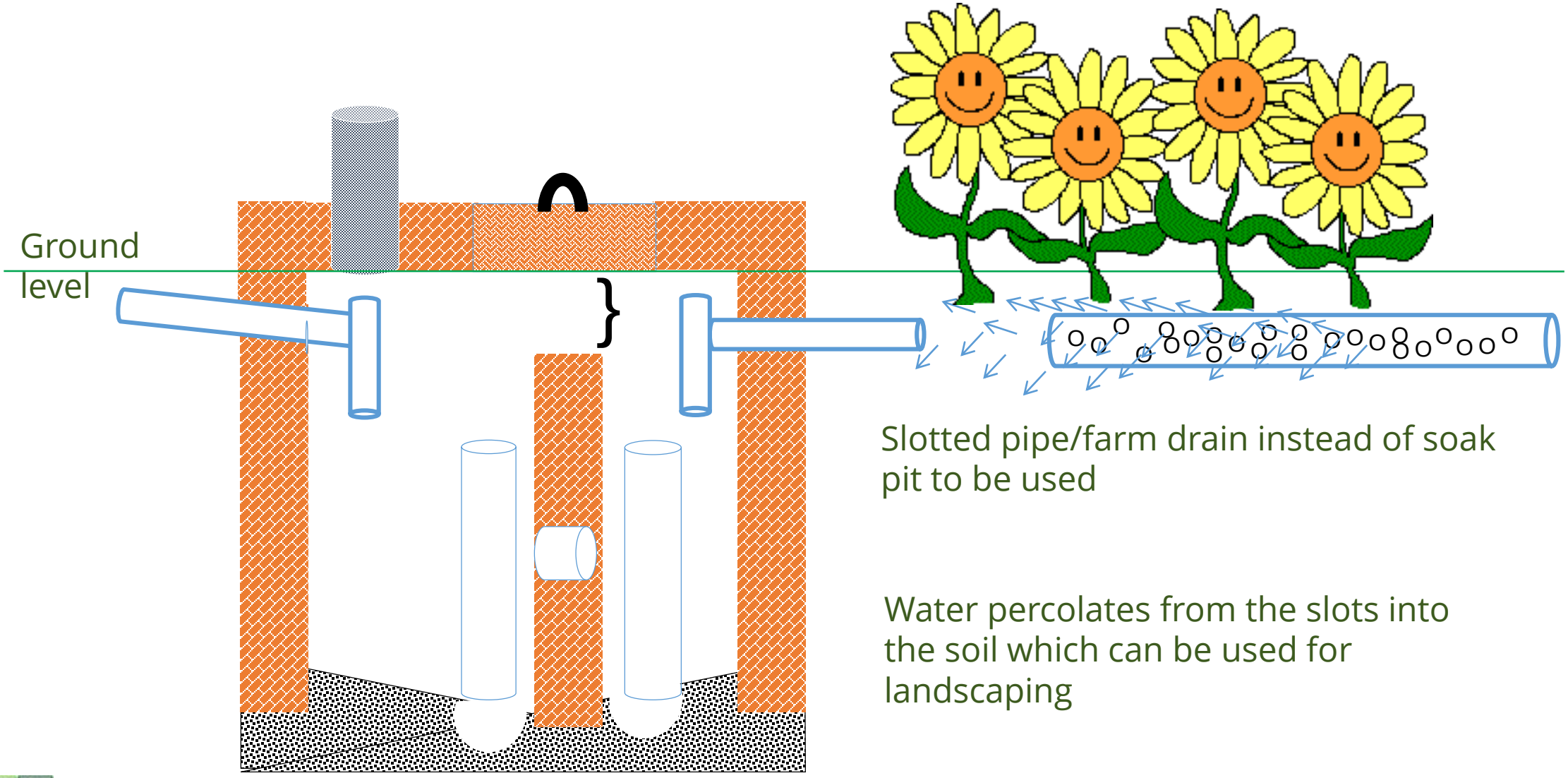
Guideline for compartment



The 2nd compartment length should be half of the first compartment

Minimum breadth - 0.75
Capacity – 1 m^3
Length width ratio – 2:1 To 4:1

Reuse option



Slotted pipe/farm drain instead of soak pit to be used

Water percolates from the slots into the soil which can be used for landscaping

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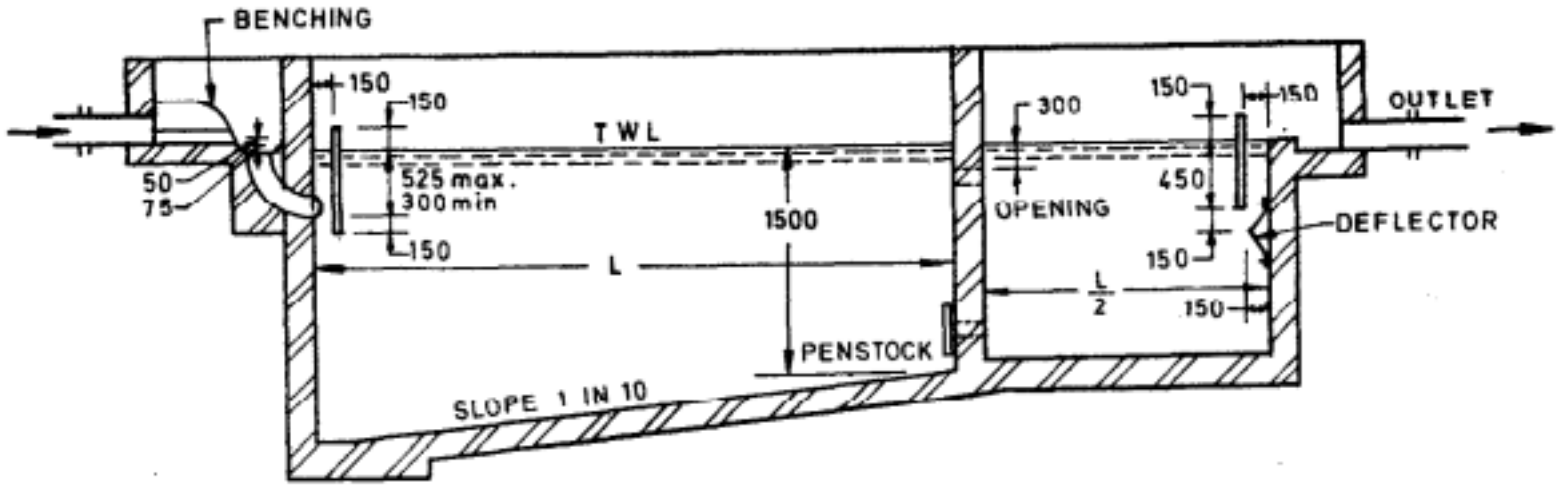
Requisites for septic tank

- Septic tank need to be periodically desludged (local municipality must ensure this service) Desludging reduces the risk of overflow and clogging
- Septic tank outlet cannot be let out into storm water drain
- Septic tank must always be followed by soak pit or dispersion trench, if not can be connected to a farm drain for reuse
- Septic tank should be a water tight structure

Septic tank for large enterprises (pop. over 50)



No. of Users	Length (m)	Breadth (m)	Liquid depth (cleaning interval of)	
			2 years	3 years
50	5.0	2.00	1.0	1.24
100	7.5	2.65	1.0	1.24
150	10.0	3.00	1.0	1.24
200	12.0	3.30	1.0	1.24
300	15.0	4.00	1.0	1.24

Twin pits

Assumption

No. of persons

= 5

Frequency of desludging (in year)

= 3

Guidelines from CPHEEO Manual

Pit	5 users		10 users		15 users	
	Diameter	Depth	Diameter	Depth	Diameter	Depth
	1	1.3	1.4	1.4	1.6	1.5

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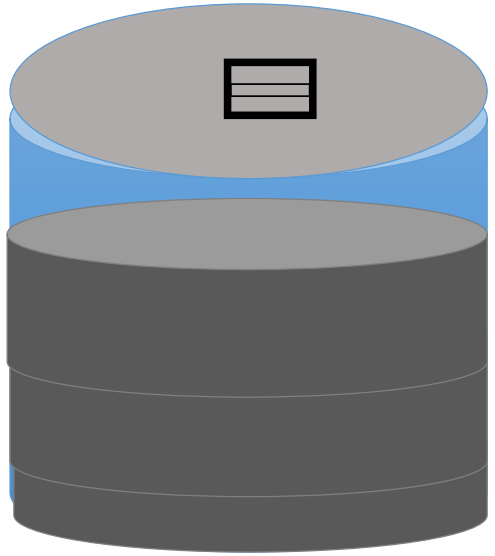
Factors affecting size of a pit

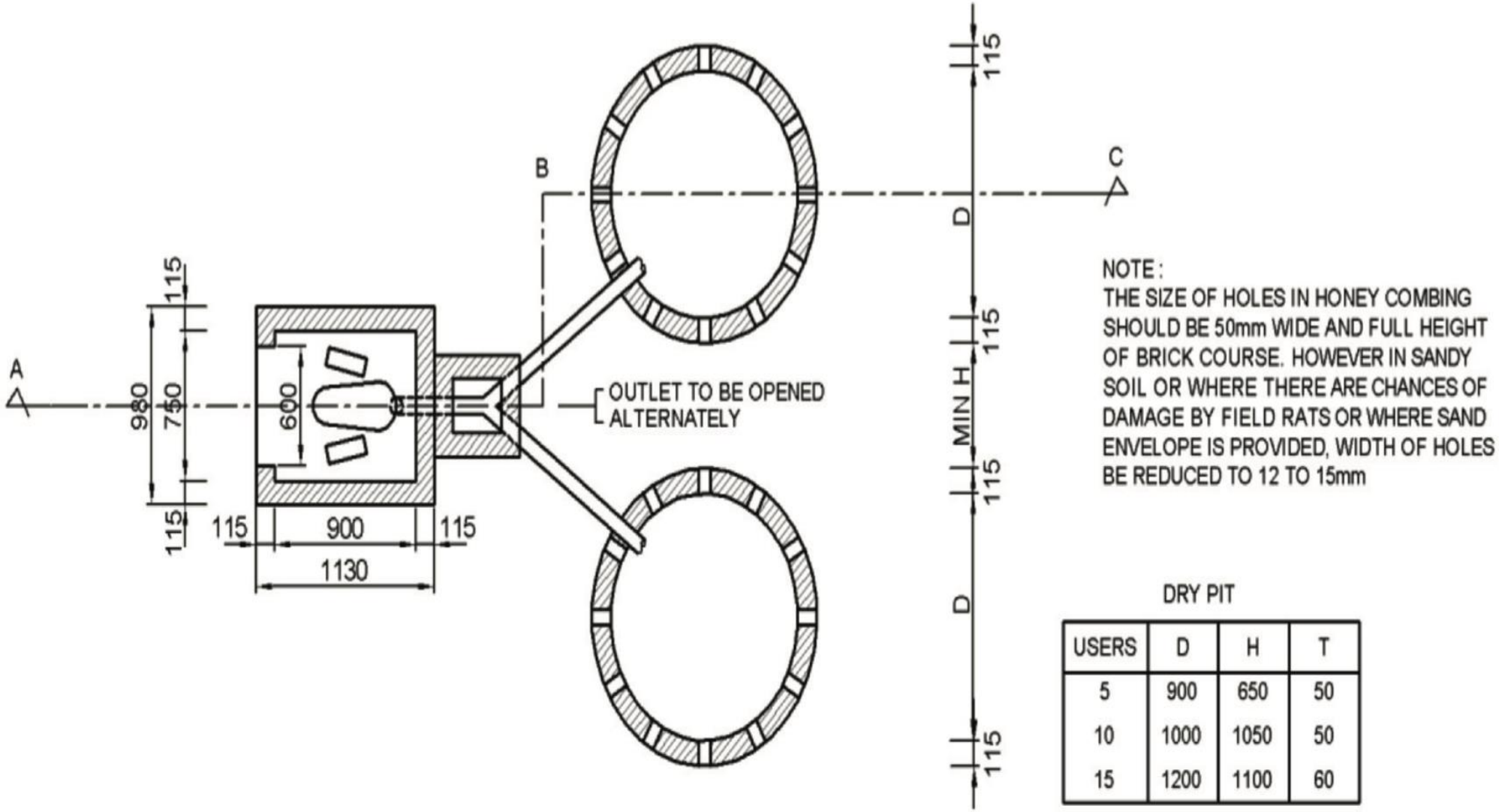


No. of persons using toilet ✖ Sludge accumulation rate ✖ Desludging Frequency

Volume = No. of persons x sludge accumulation rate x desludging frequency

Sludge accumulation rate value according to CPEEHO – 0.00028 m3 / person / annum

Plan of pour flush toilet with twin pit



NOTE :
THE SIZE OF HOLES IN HONEY COMBING SHOULD BE 50mm WIDE AND FULL HEIGHT OF BRICK COURSE. HOWEVER IN SANDY SOIL OR WHERE THERE ARE CHANCES OF DAMAGE BY FIELD RATS OR WHERE SAND ENVELOPE IS PROVIDED, WIDTH OF HOLES BE REDUCED TO 12 TO 15mm

DRY PIT

USERS	D	H	T
5	900	650	50
10	1000	1050	50
15	1200	1100	60

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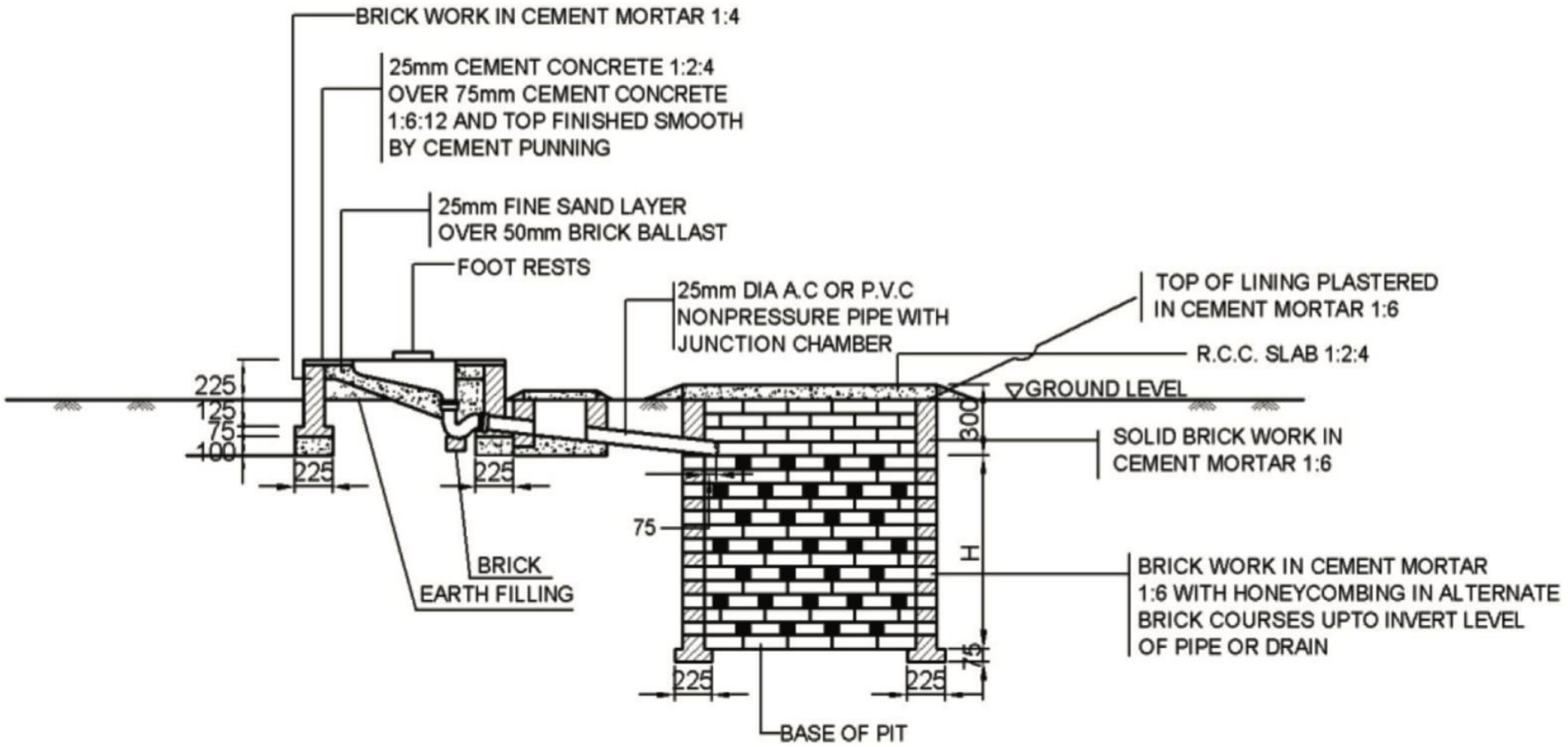
Section of pour flush toilet with twin pit



SECTION A B C

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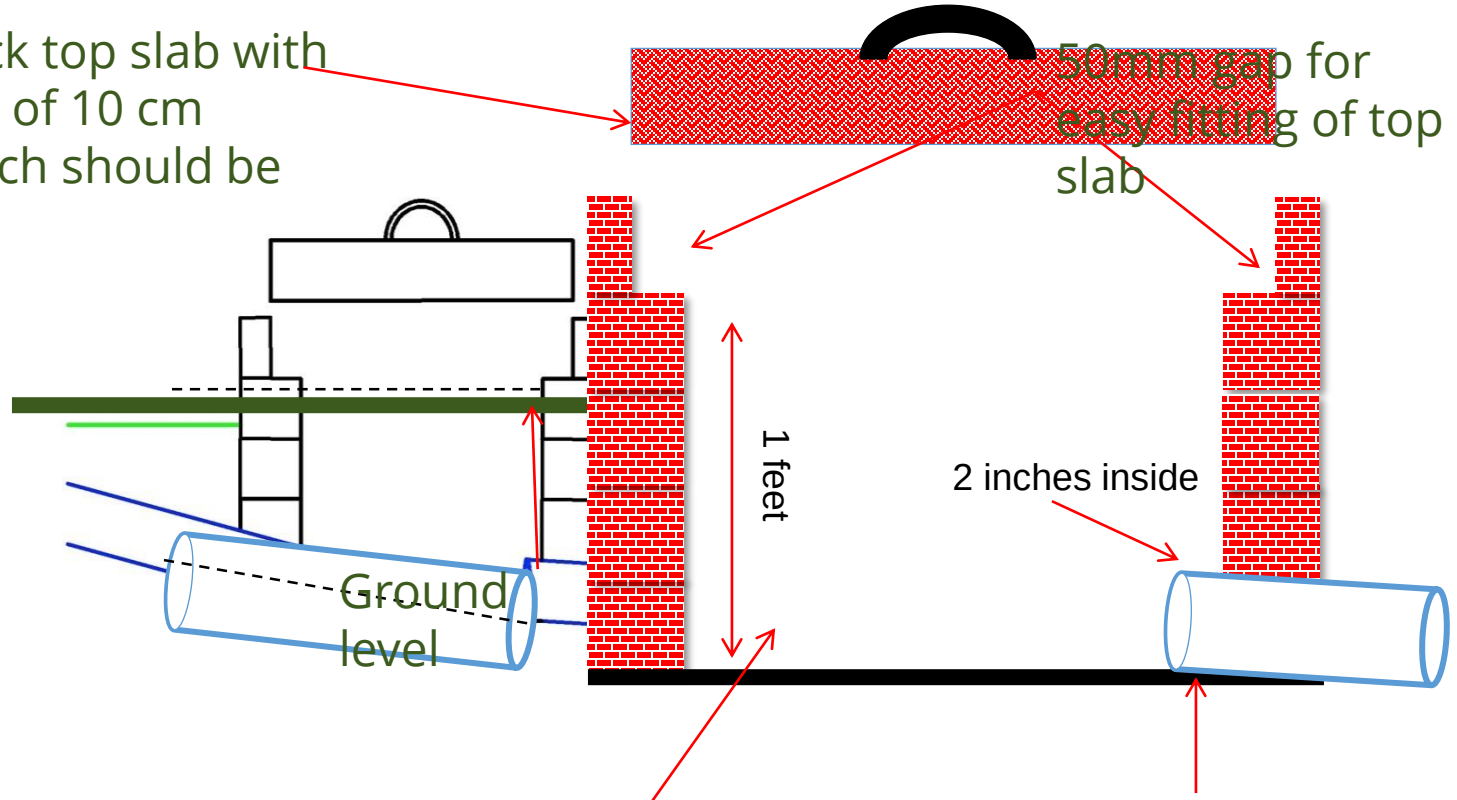
Inspection Chamber (Side view)

100 mm thick top slab with two handles of 10 cm diameter each should be provided



Should be 1 inch inside the chamber

The bottom should be in a slope of 1:10 (The slope is based on water usage)

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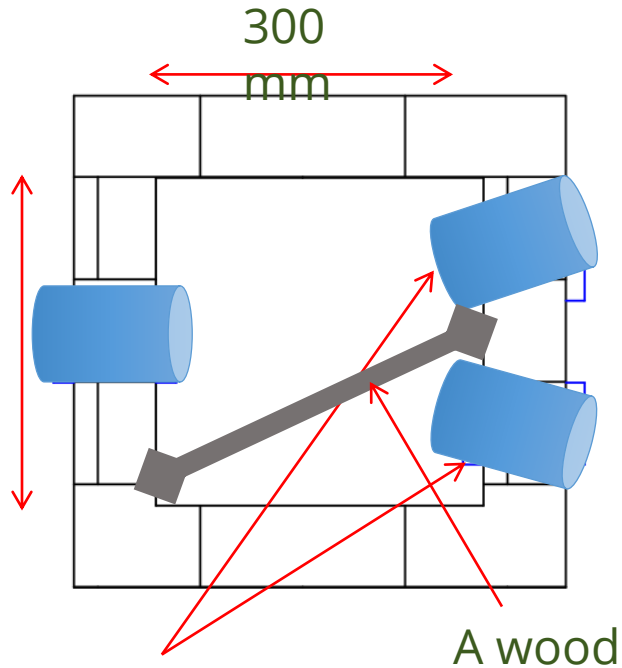
Inspection Chamber (Top and Side view)

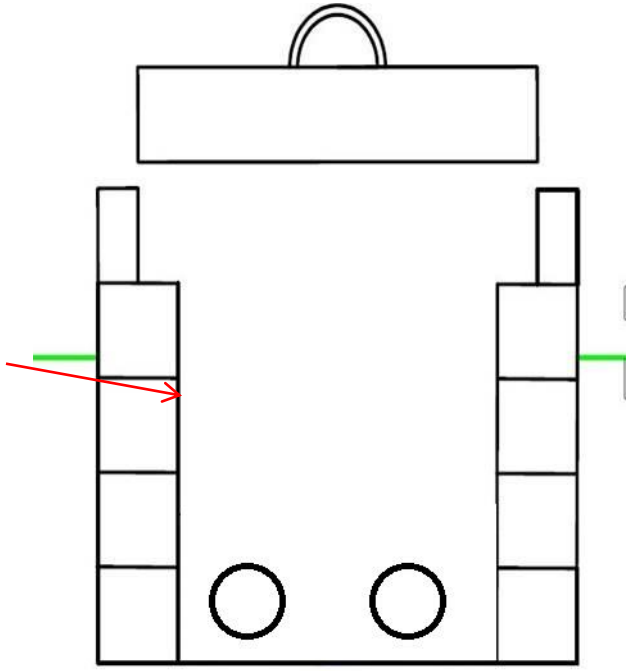


The pipes should be placed at 100 mm from each other and 50 mm from the wall

A wooden stopper to control the flow once the pit is filled

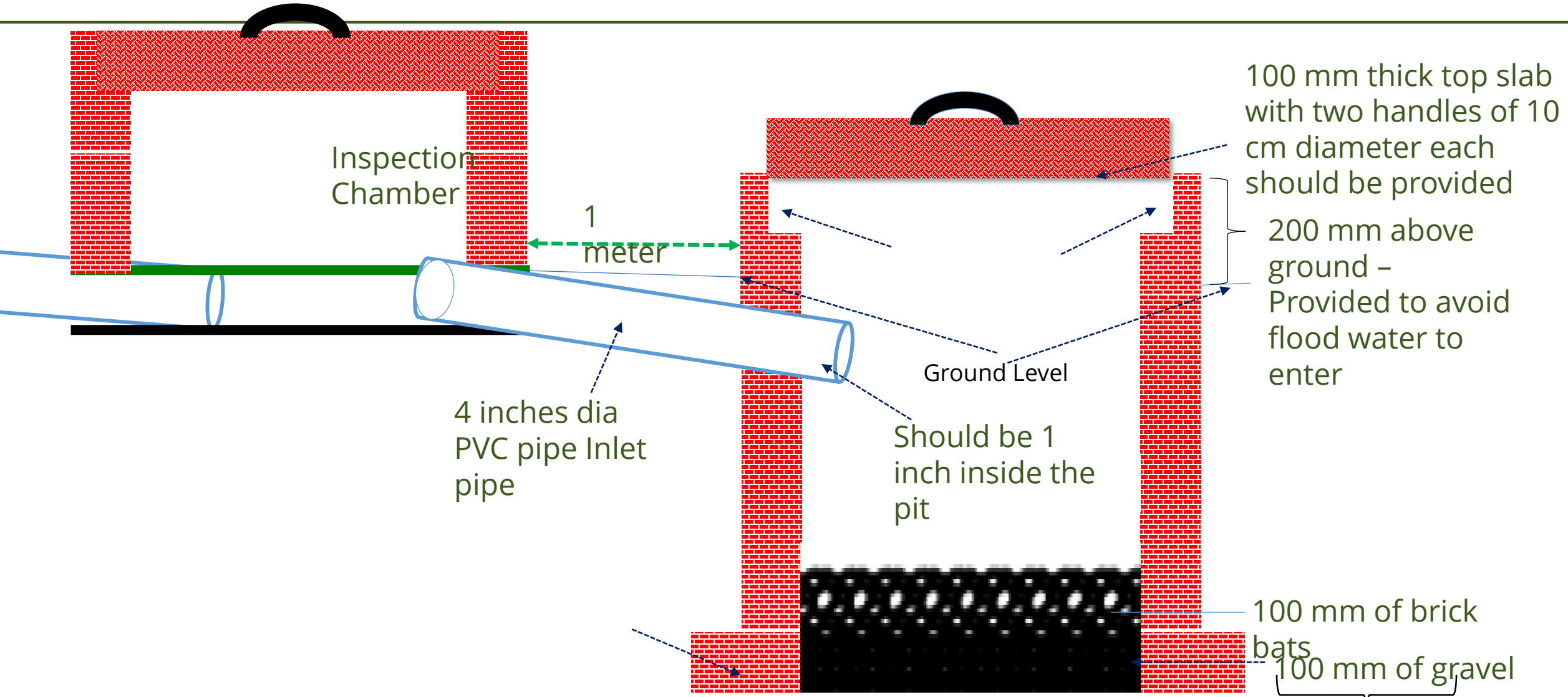
Top View

Smooth plastering



Side View

Design of Twin Pit



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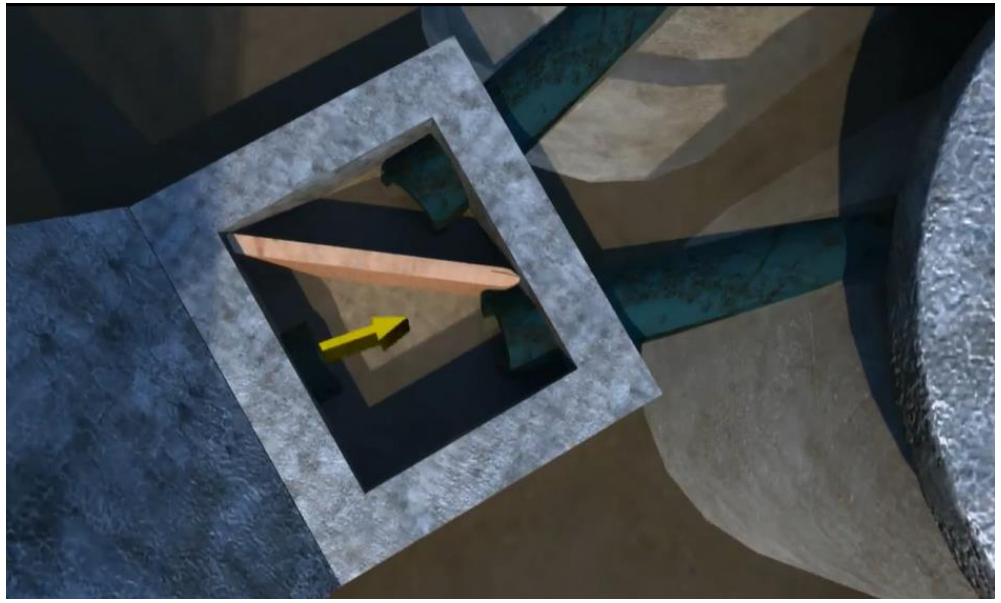
Requisite of design (inspection chamber)

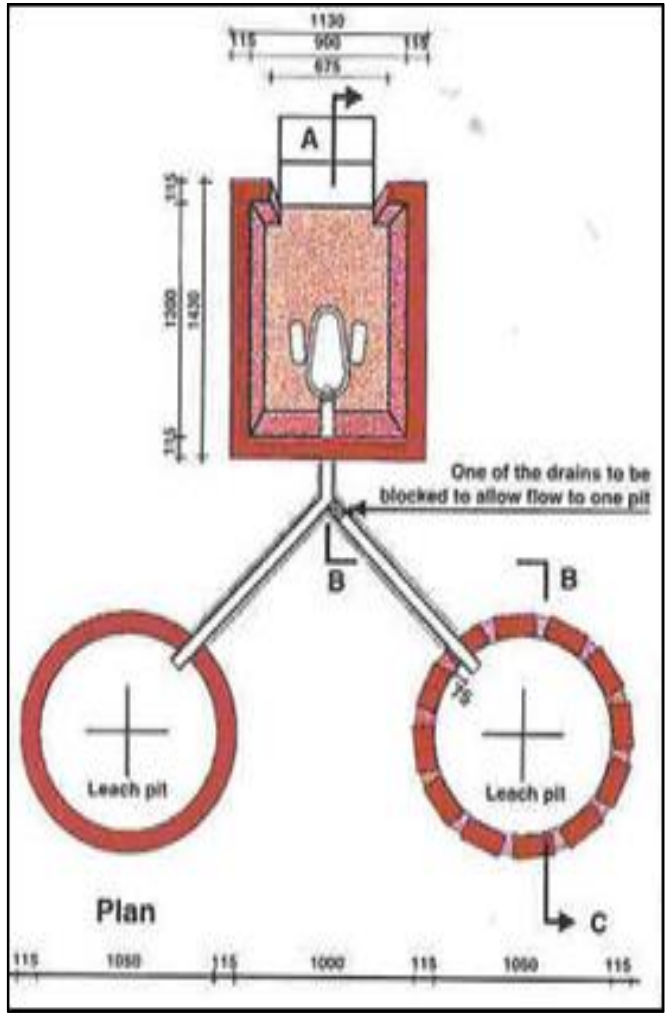
In case pipes are used, a chamber is provided at the bifurcation point to facilitate cleaning and allowing flow to one pit at a time.



3D view of Inspection Chamber

Different methods of constructing septic tank – Tamil Nadu

Requisite for design



The two pits should be at least 1 meter apart.

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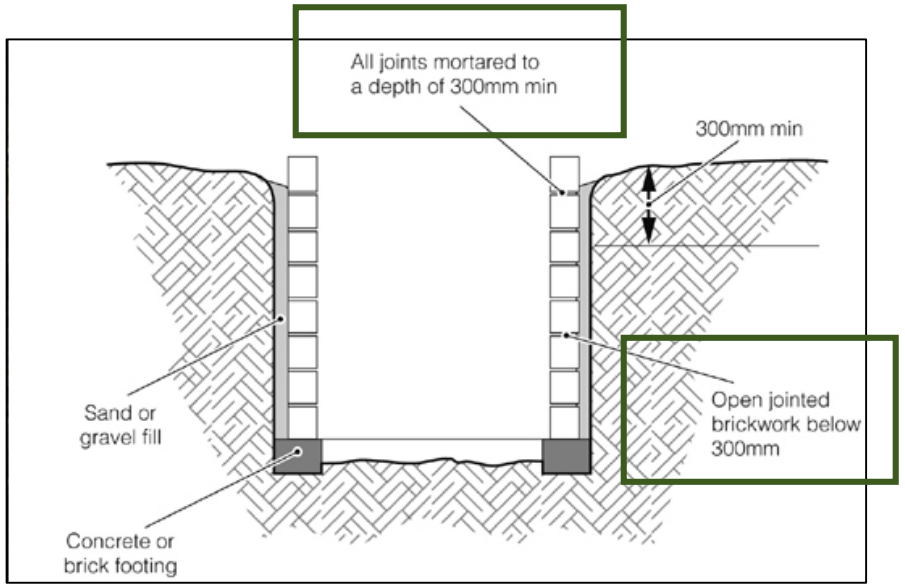
Requisite for design



There should be 3 finger gap between the bricks for water percolation.

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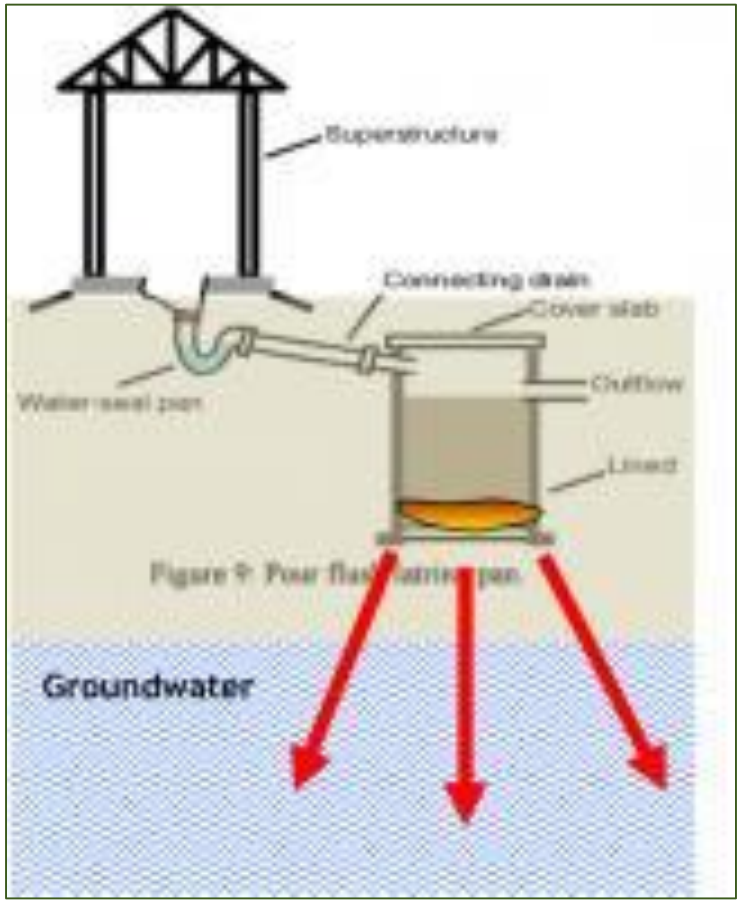
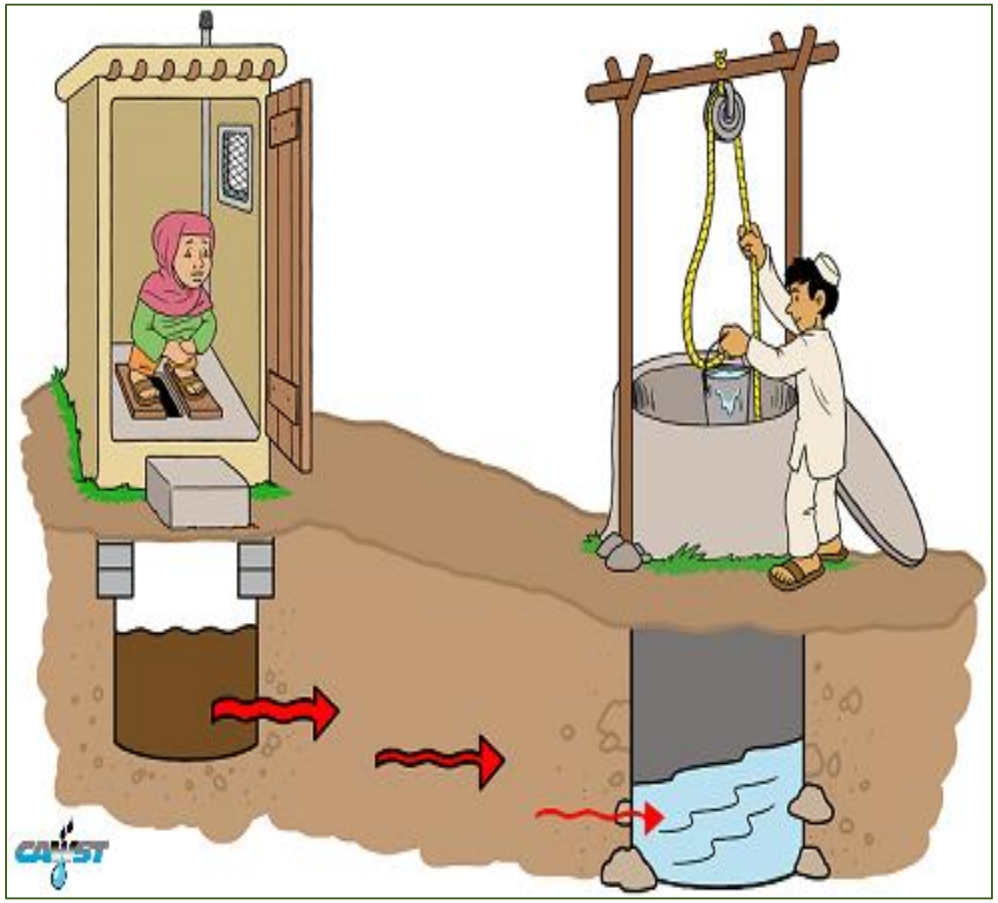
Requisite for design





Based on soil conditions maintain a minimum horizontal distance of 10 feet from nearby water sources

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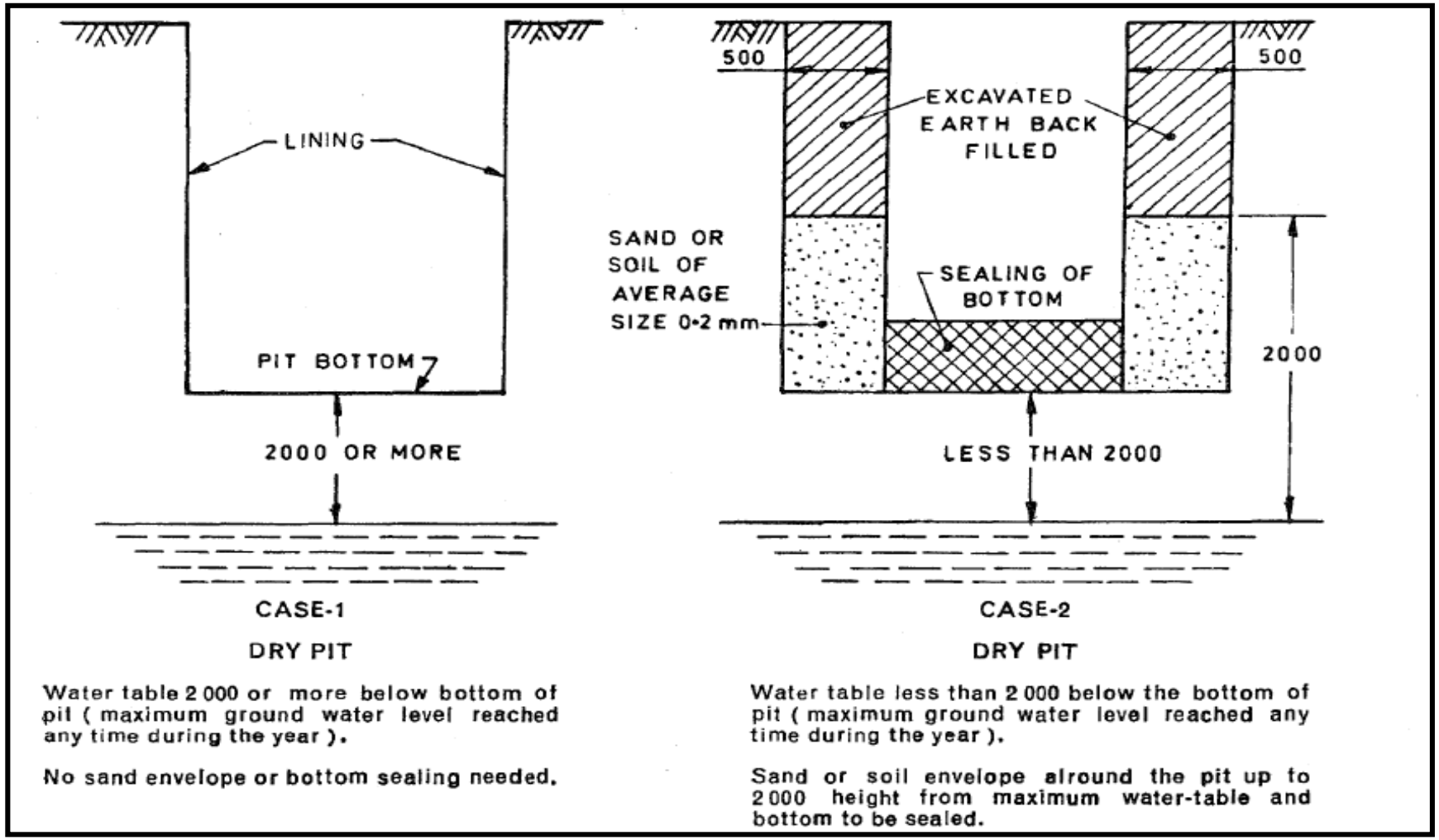
Water table: Alternate Measures



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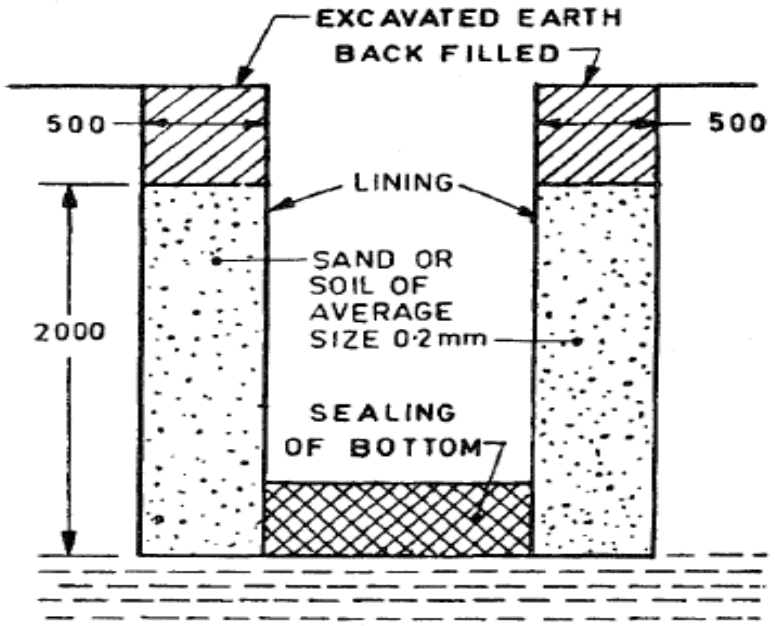
Water table: Alternate Measures

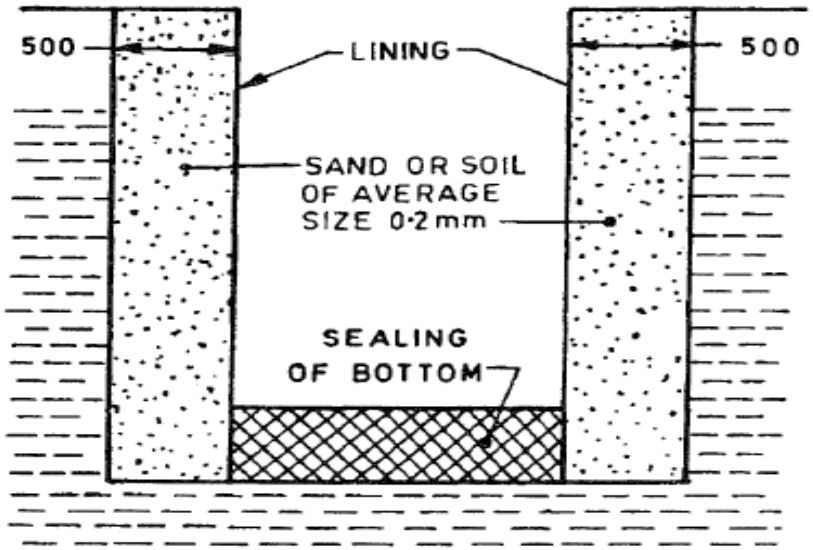


CASE-3

WET PIT

Water table at the bottom of the pit (maximum ground water level reached any time during the year).

Sand or soil envelope around the pit up to 2 000 height from highest water table and sealing of bottom needed.



CASE-4

WET PIT

Water table above the bottom of the pit (maximum ground water level reached any time during the year).

Sand envelope around the pit and sealing of bottom needed.

NOTE — When envelope is provided, lining of pits should not be in honey comb brick work but should be in masonry with vertical joints open (without mortar) 12 to 15 mm wide.

All dimensions in millimetres.

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Critical aspects of Design of Septic tank and Twin pit

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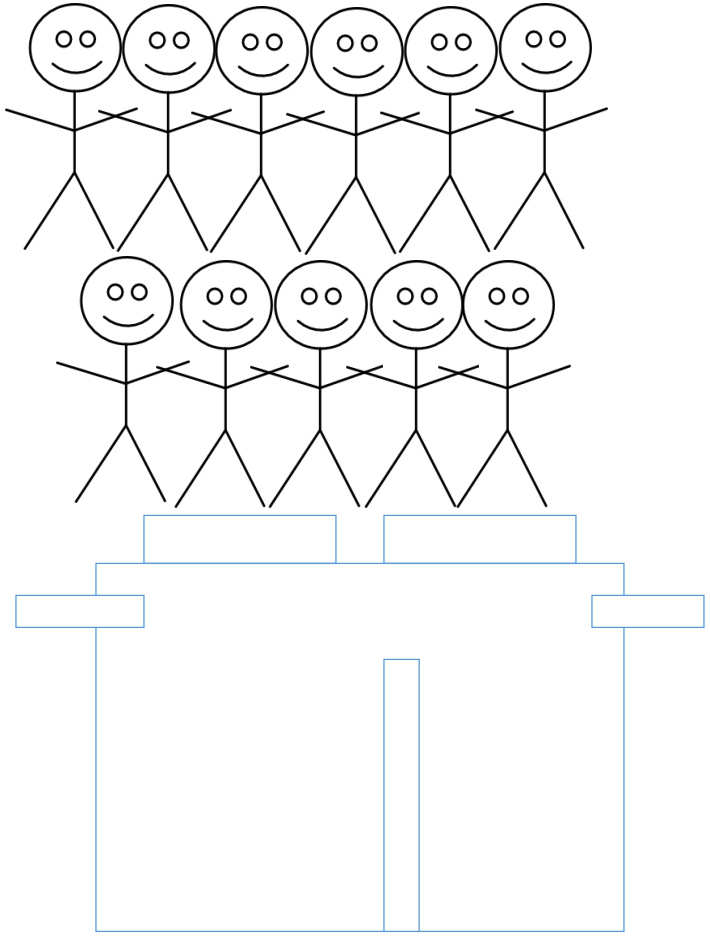
Under designing of Septic tank



Under designing of septic tank or any onsite treatment system can lead to frequent removal of sludge which results in high operational and maintenance cost

It also causes nuisance and inconveniences to user

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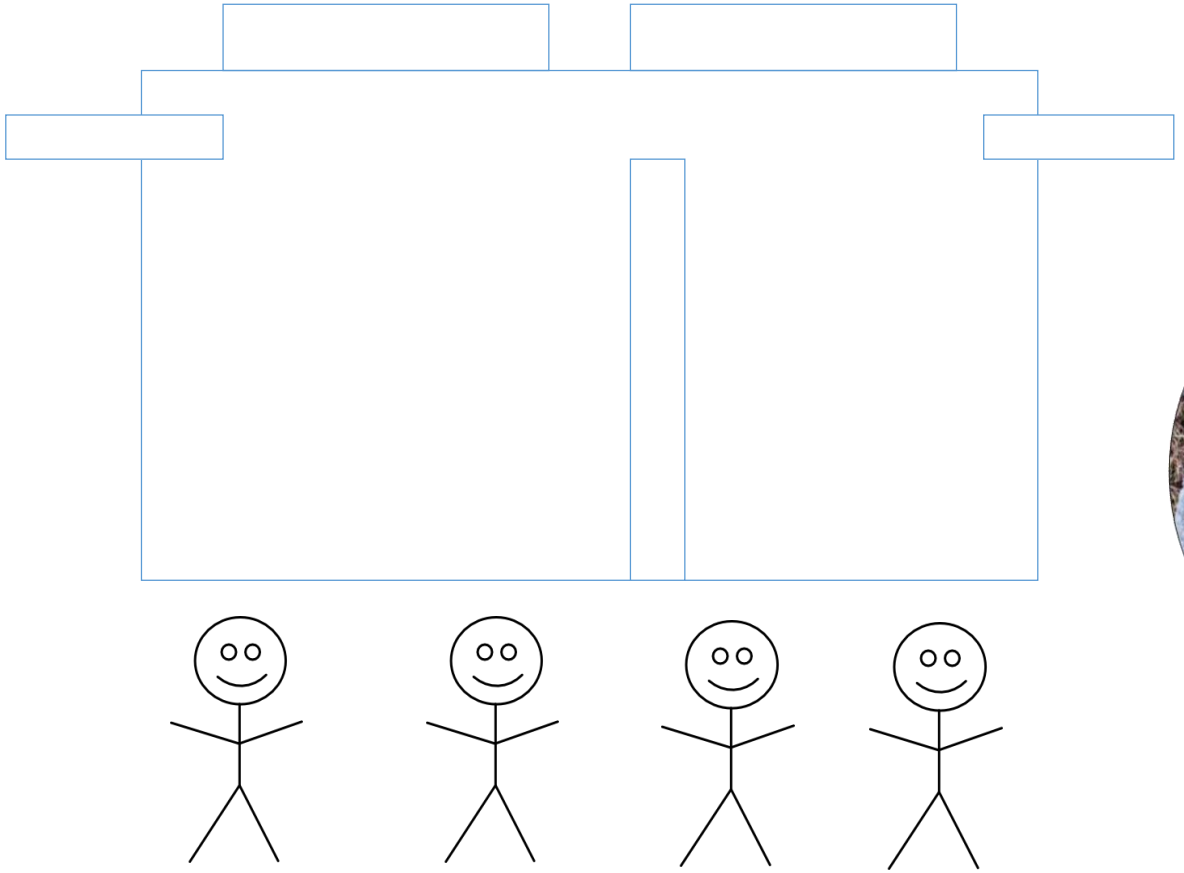
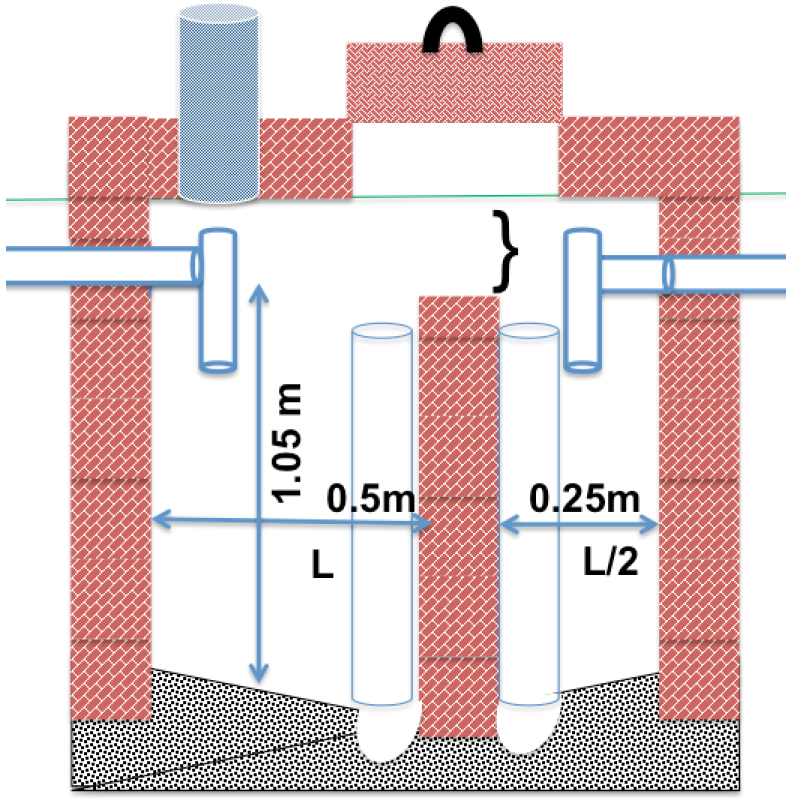
Over designing of Septic tank/pit



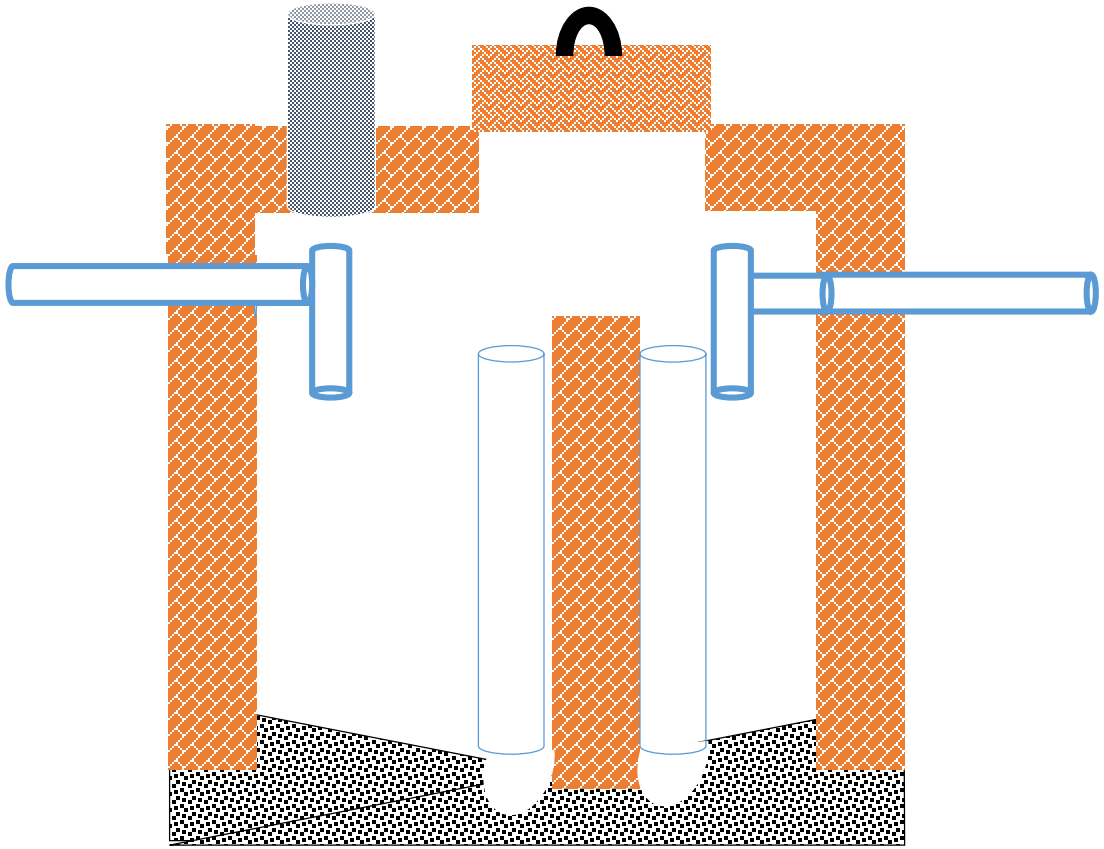
Overdesigning of onsite treatment system causes inconvenience at the time of desludging as the sludge solidifies and is difficult to remove

Ratio of compartment size



If the ratio of compartment size is not maintained, the sludge settlement time is reduced, leading to partial treatment.

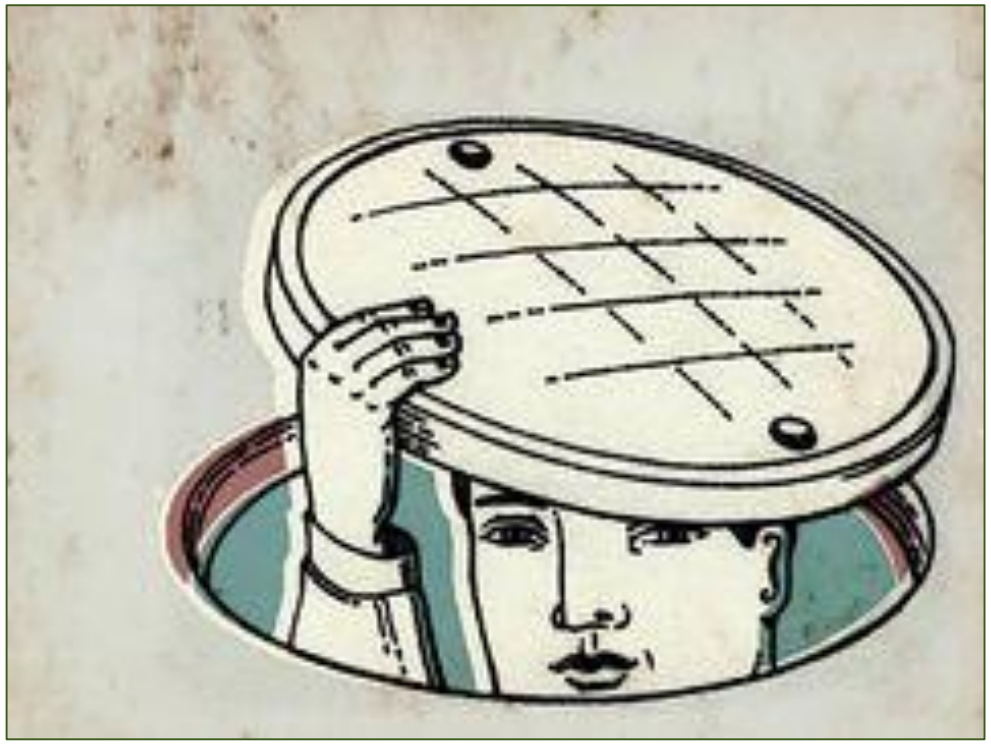
Smooth bidding of base of compartment



If the base is not smooth, the sludge accumulates in the groves and its difficult to remove at the time of desludging

Twin Pit

Manhole cover poor design/construction



Poor design and placement of manhole cover can lead to injuries and nuisance inform of pest in the onsite systems

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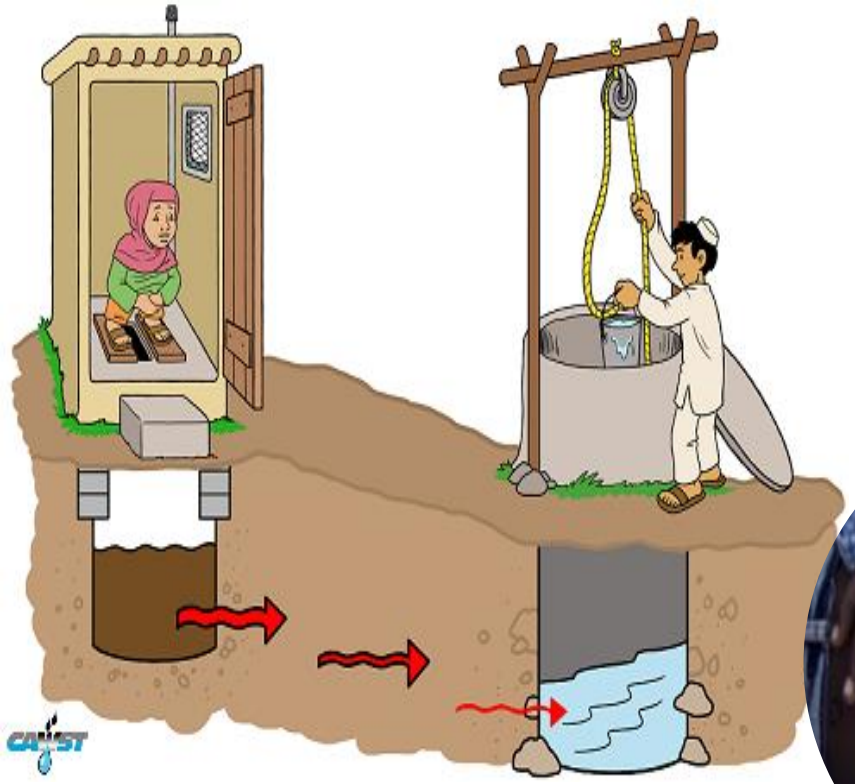
Ignorance of water body in vicinity



If the distance is less than the prescribed distance, the percolation from pit can pollute the water source which can cause health problems

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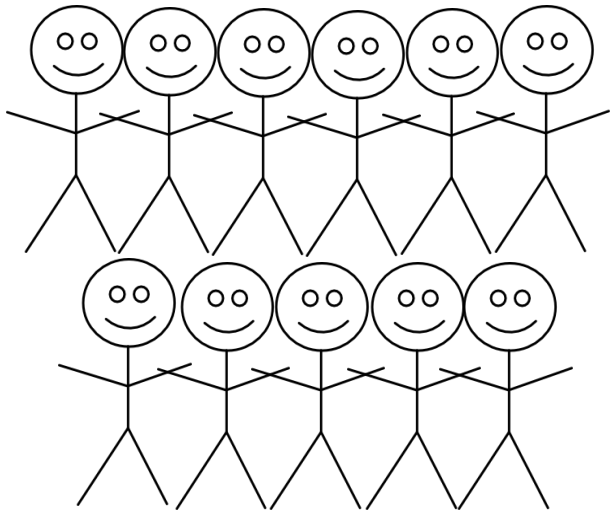
Under designing of Pit



Under designing of septic tank or any onsite treatment system can lead to frequent removal of sludge which results in high operational and maintenance cost It also cause nuisance and inconvenience to user

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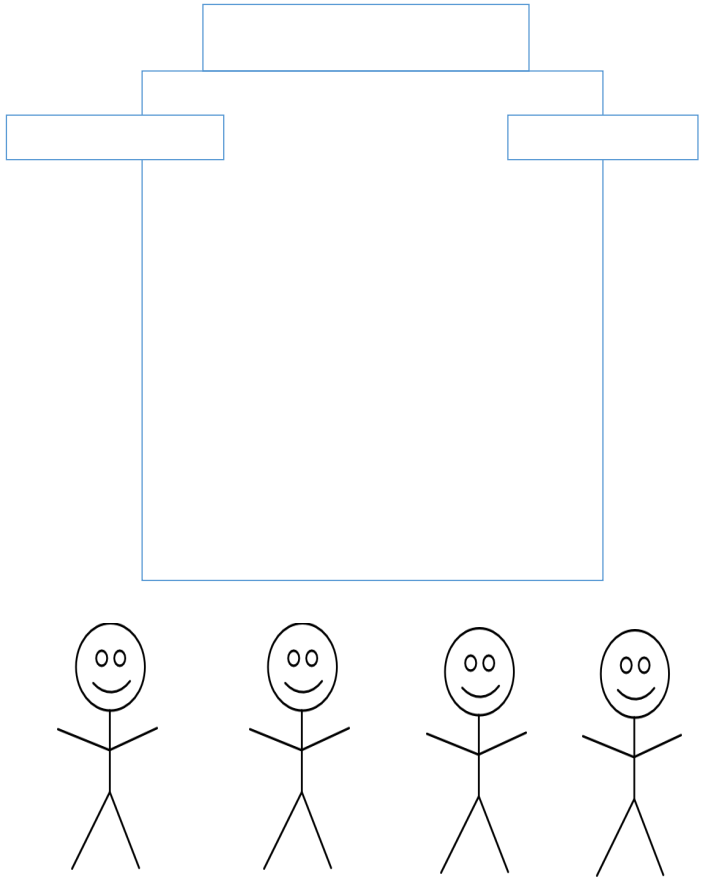
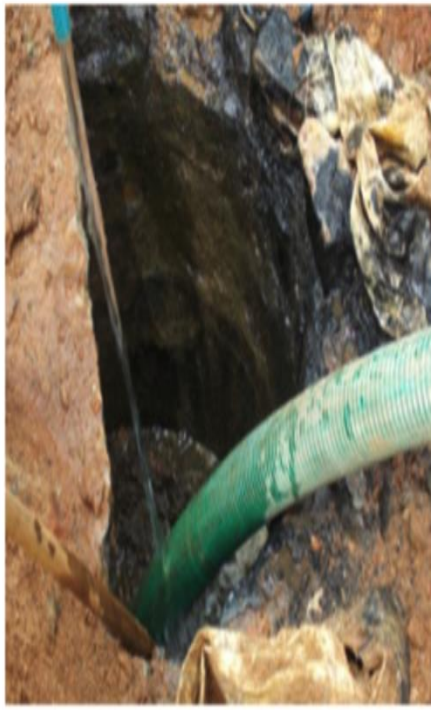
Over designing of Pit



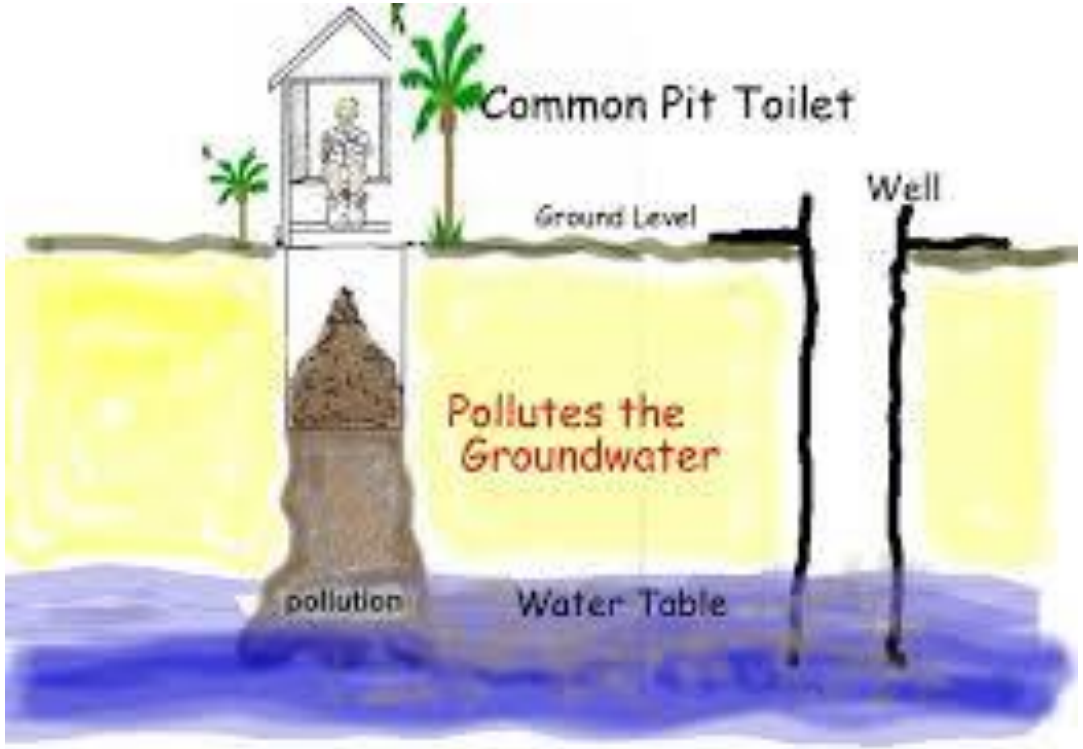
Overdesigning of onsite treatment system causes inconvenience at the time of desludging as the sludge solidifies and is difficult to remove

Lining of pit



If pit lining is without requisite gap water percolation is slow and pit fills more frequently.

Ignorance of plastering aspects



If the onsite systems base plaster is poor it can lead to pollution of the water source which can cause health problems

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Thank You