Guidelines for Implementation of Deep Row Entrenchment in Uttarakhand -

A Temporary Solution for Managing Faecal Sludge and Septage

Submitted by

Sanitation Capacity Building Platform (SCBP)

National Institute of Urban Affairs

to Urban Development Directorate, Government of Uttarakhand

JULY - 2021

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Image 1: DRE trench operation in Odisha
Source: TSU-PMU EY Odisha

1. Introduction: Deep Row Entrenchment in Uttarakhand as a Temporary Solution for Managing Faecal Sludge and Septage

Scope: Most of the Urban Local Bodies (ULBs) in Uttarakhand have no proper treatment facility available for disposal of faecal sludge and septage (FSS). The collected FSS is usually discharged into open ground or drains in an unregulated and ad hoc manner. This has negative implications for both public health and the environment.

The purpose of this document, therefore, is to provide urban the ULBs of Uttarakhand technical guidance on Deep Row Entrenchment (DRE) as an interim measure for safe disposal of FSS in those regions where treatment facilities such as Sewage Treatment Plants (STPs) or Faecal Sludge Treatment Plants (FSTPs) are not presently available within 25 km distance. DRE is one of many methods of land application of FSS. Where DRE is not feasible, other forms of land application of FSS (eg. ridge and furrow method, spray irrigation etc.) can be explored. The present document only deals with the DRE method.

This is a method of land application of FSS where trenches are dug in the ground, filled with sludge and covered with soil. The liquid leaches out and the residual solids, upon decomposition, enriches the soil. However, this technique should only be applied following the correct technical design and also the administrative and safety protocols. Regular quality testing of surrounding water sources and also of the soil at the site is necessary. Failure to do so can cause contamination of land and water sources, which will add to the problem instead of mitigating it.

Limitation: Site selection is one of the most crucial factors of DRE. As such, it requires land availability and that which is relatively flat. Additionally, it should not be carried out in sensitive areas – such as those prone to landslides, flash floods or water recharge zones (surface water or groundwater). The information pertaining to the practice of DRE method for FSS disposal in hilly terrain is limited.

Context of Uttarakhand: Uttarakhand is a predominantly hilly state with 8 of its 13 districts lying entirely in the Himalayan ranges at varying altitudes. This presents its own set of challenges of terrain and weather. Climatic conditions such as high-intensity rainfall and cold weather conditions (including snowfall) along with the fact that large parts of the region are prone to landslides, cloudbursts and flash floods all pose significant barriers to sanitation management. Additionally, the region also comprises the recharge areas of mountain aquifers feeding springs and countless first order streams. Therefore, while formulating any intervention for disposal and treatment of septage, these factors should be kept in mind.

Time period: DRE method should be adopted for a design period of maximum 3 years only. It can be implemented as a temporary and immediate measure by following the technical, administrative and safety procedures laid out in this document. It is advised that a DRE site should not cater to a load of more than 10 KLD of FSS. Simultaneously, ULBs should explore and plan for the long-term disposal of FSS in scientific treatment facilities, either on a stand-alone or cluster model basis.

2. Technical Requirements for DRE Site Selection

The following parameters need to be kept in mind while choosing the site for DRE:

DO's	DON'T's

● Flat surface for easy operations
● Away from human habitation (minimum 500 m)
● Accessible by emptying vehicles
● Soil with good permeability
● Should receive minimum of 4 hours of sunlight daily for 100 consecutive days in a year
● Away from surface water and groundwater sources
  o Minimum 5 m vertical distance from groundwater table
  o Minimum 15 m horizontal distance from water sources
	● Not in a flood-prone area
	● Not in landslide-prone area
	● Not in water resource recharge zones such as watersheds/upstream of surface water bodies or recharge areas of aquifers/mountain springs; and glaciers
	● Not in rocky terrains
	● Not in areas where snow retains for more than one month in a year

Additionally, the priority of choosing a site for DRE can be as follows:

1. If there is already a site demarcated for an upcoming STP or FSTP, DRE may be done at least 30 feet away from the proposed site for the civil structures; i.e. it should be in the green space of the STP/FSTP site
2. An existing solid waste landfill site (where co-composting with wet waste is possible); (distance of 45 ft minimum to be maintained between the solid waste and FSS trenches)
3. Two or three small ULBs (within 20 km of each other) where sludge generation is less, can identify and share a common DRE site in a cluster model
4. Site for individual ULBs where the above are not available

All sites must meet the criteria mentioned in the table above.

A. Administrative Requirements of Site Selection: Any site which has been identified as technically feasible for implementing DRE should receive due administrative clearances as well. This includes those from all concerned departments such as Pollution Control Board and Forest Department/ gram panchayat/ land revenue or District Magistrate (depending on land ownership). The site finalized for DRE must be approved for a period of 1 to maximum 3 years by the Septage Management Cell (SMC) of the ULB before starting the operations.

3. Technical Design of DRE trenches

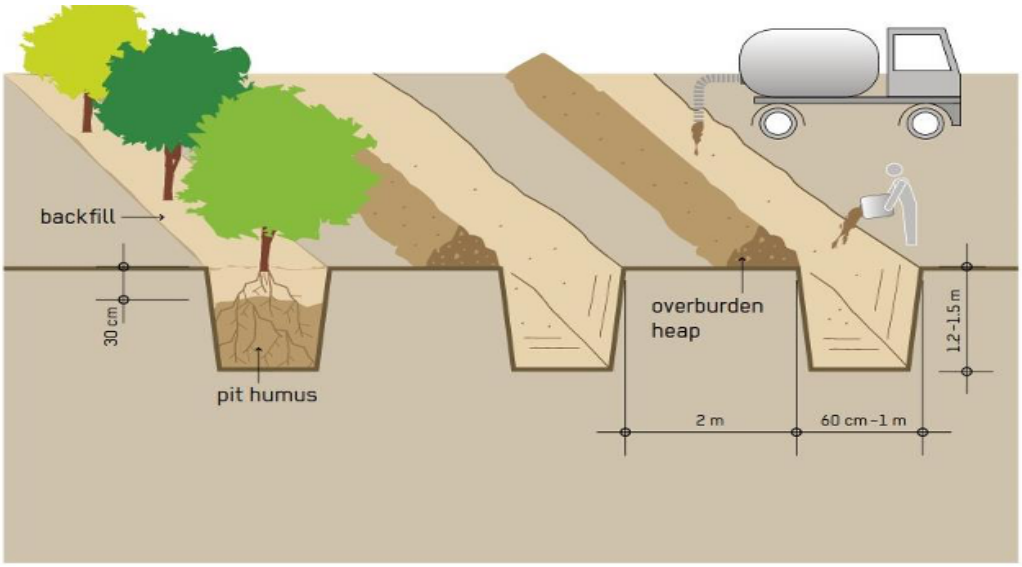


Figure 1: Design of DRE trenches
Source: CPHEEO MoHUA Consultative Document on Land Application of Faecal Septage (2020)

1. Size of and Spacing between the Trenches

The DRE trenches are dug parallel to each other as shown in Figure 1. Their dimensions can be decided as outlined in the following table.

Table 1: Dimensions of DRE trenches

DIMENSION	RANGE	CRITERIA
Depth of trench	1 m to 1.5 m	Bottom of trench should be at least 5-10 metres above highest water table level
Bottom width of trench	0.3 m to 1.5 m	Depending on amount of FSS, width can be decided
Top width of trench	1.25 m to 3 m	
Length of trench	No specified length, depends on site and area available. Generally, 10 m	Length should be parallel to the contour of the land
Side slope of trench	0.5:1	Depends on area available
Space between two consecutive trenches (edge-to-edge)	2 m to 3.5 m	Depending on area available and also taking into consideration space to maneuver desludging vehicles

Sand layer at the bottom of the trench	0.3 m thick	Needs to be provided when groundwater depth is exactly at 5m

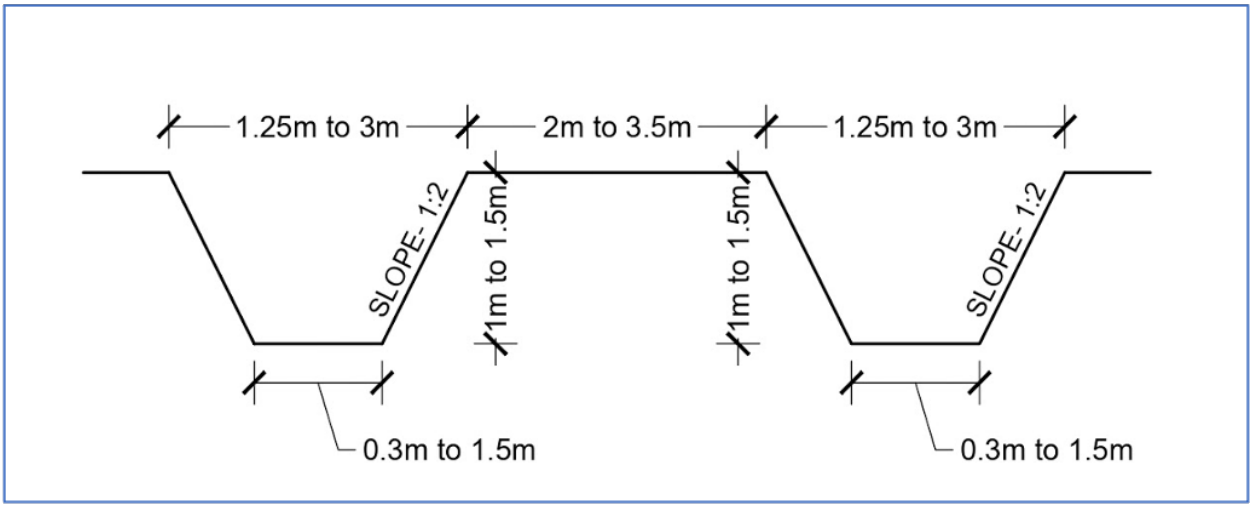


Figure 2: Typical Cross Section of the DRE trench

An estimated area of 250 sq.m would be required for two trenches each with bottom width of 0.3 m, top width of 1 m, depth of 1 m and length of 20 m. These two trenches have a combined volume of 26 cu. m

The calculations are provided in Annexure B. Actual trench size and numbers can be determined based on the land area available and septage generation of the town.

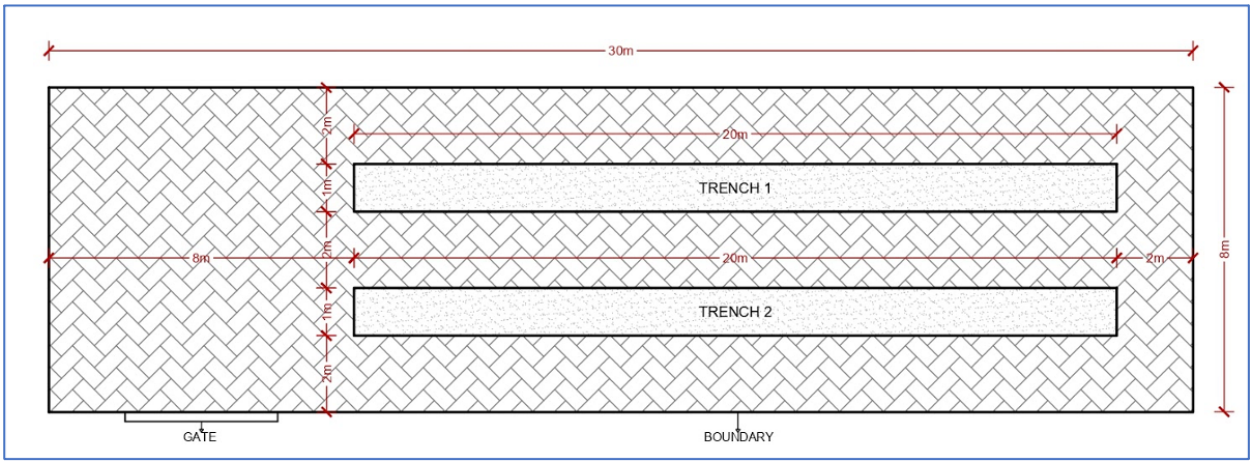


Figure 3: Typical plan of the DRE trench

After digging trenches, bunding should be provided at the edges with the dug up soil. This will help prevent ponding of the trenches during the rainy season. Similarly, a proper drainage system with a soak pit should be provided to prevent run-off from the site to the surroundings. Additionally, vegetative cover should be provided at the periphery of the site for odour control.

4. Operation & Maintenance (O&M) of DRE Site

The operation and maintenance of the DRE must be done systematically. Some of the key aspects are as follows:

1. Process of disposal into the Trenches
    a. The trench facility operator must maintain a logbook noting down the date and time of collection and disposal, source of the sludge and the details of the emptier.
    b. The sludge should be emptied in an even layer into the trench, and then allowed to dry for 2 to 3 days. Thereafter, it should be covered with a layer of 50 mm thickness soil (backfill soil) to prevent exposure to air and vectors.
    c. After the entire trench is filled, it caves in due to leaching and decomposition of the sludge after some time. The time taken for this caving to occur depends on several factors such as weather, soil type, biological activity etc. Therefore, after the caving occurs, it should be filled with soil again to maintain the surface flat.
    d. Three months after the trench gets filled again as outlined in the previous point, the trenches can be planted with trees or used as a green space. For further sludge disposal, a new site might be identified and used keeping in mind the site selection parameters.

2. Precautions of O&M
    a. Avoid sludge disposal before and during rainfall and snowfall seasons. This can be done by not emptying the on-site containments during this time.
    b. The DRE site must be used to dispose of only FSS from residential, and commercial buildings (like schools, colleges, hotels/resorts and offices). No other waste such as food waste from restaurants nor industrial waste of any nature whatsoever shall be disposed of on DRE sites.
    c. All on-site personnel including the emptier should use appropriate personal protective gear and must undergo regular health check-ups preferably arranged by the ULB.
    d. The DRE site must be demarcated, fenced with GI wire mesh of 3 inch by 3 inch and provided with appropriate signages so that there is no trespassing by humans or animals including for grazing.
    e. During disposal, if sludge spills outside the trench by accident, it must be applied/treated with lime to stabilise it.

3. Monitoring Activities
    a. ULB must ensure mandatory monthly testing of water sources in the vicinity (within 100 to 150 feet) of the DRE site to ensure there is no contamination happening. The testing can be done by Jal Santhan as per prescribed BIS standards for water quality. Bacterial contaminants such as faecal coliform and total coliform are the most important parameters to be tested along with DO, BOD, COD and TSS. Additionally, parameters such as pH, Nitrate, Phosphate, Residual Free Chlorine, Chloride, Alkalinity, Turbidity, Total Dissolved Solids (TDS), Fluoride, Sulphate, Total Hardness, Calcium, Magnesium, Arsenic, Copper, Aluminium, Manganese, and Iron can also be tested.
    b. It is desirable that ULB also carry out soil testing at the DRE site after a year to ensure there is no contamination

5. References

1. Central Public Health and Environmental Engineering Organization (CPHEEO) (July 2020) “Advisory on Onsite and Offsite Sewage Management Practices”
2. Central Public Health and Environmental Engineering Organization (CPHEEO) (November 2020) “Consultative document on Land Application of Septage”

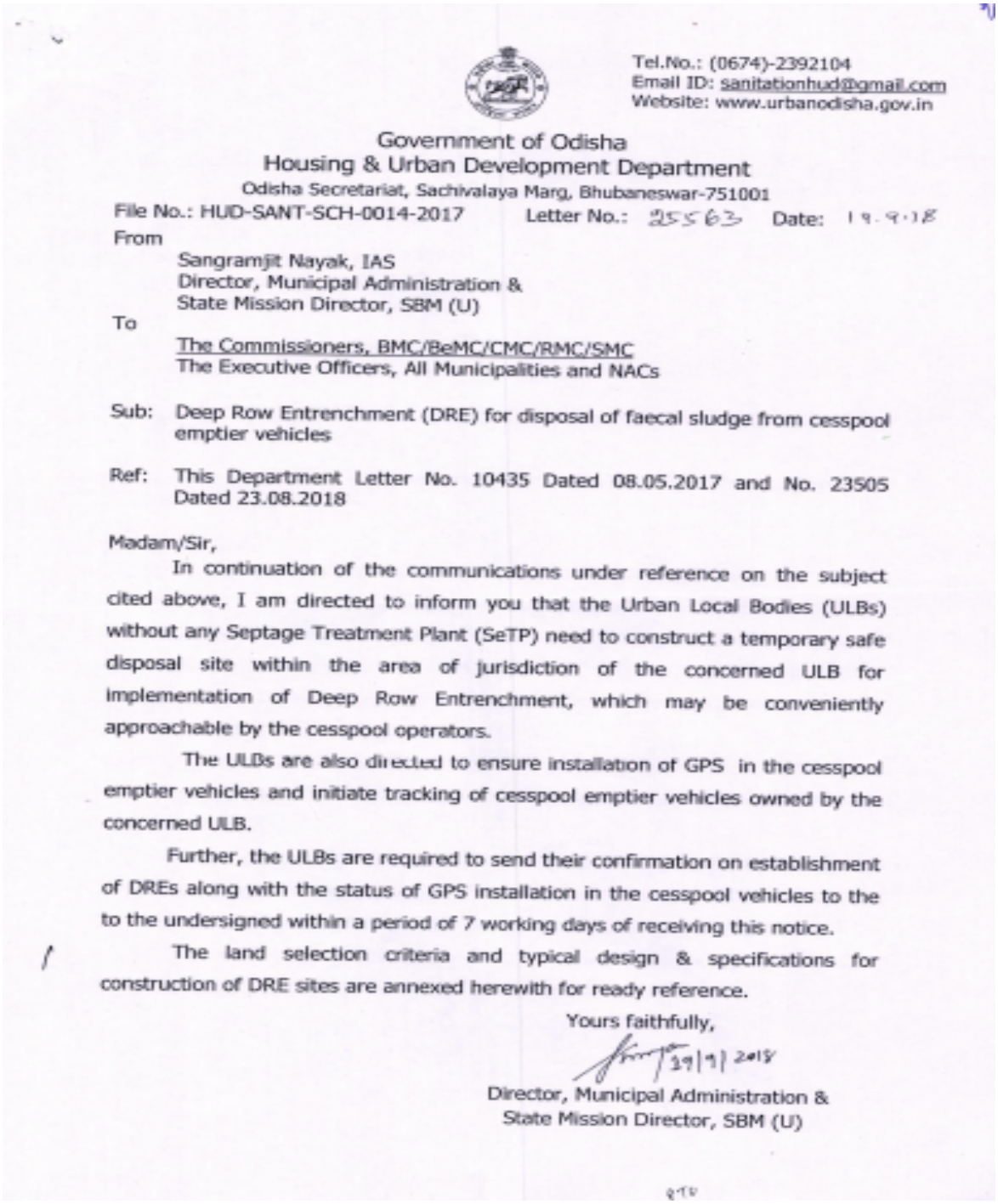
6. ANNEXURE-I: Case Studies From Other States

DRE is accepted practice in countries like Malaysia, South Africa, Thailand and Indonesia. It has also been taken up by some Indian states such as Odisha and Uttar Pradesh as an low-cost, interim solution for FSS disposal.

1. Odisha

The Housing and Urban Development Department, Odisha issued a letter in 2018 directing ULBs without any septage treatment plant to take up DRE as an interim measure. The particulars of the letter, which includes the site selection criteria and design dimensions, are as shown below. Odisha follows the dimensions of DRE trenches as shown in the below document, which have been approved by the National Green Tribunal (NGT).

Image 2: DRE trenches in Odisha
Source: TSU-PMU EY Odisha



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Government of Odisha
Housing & Urban Development Department
Odisha Secretariat, Sachivalaya Marg, Bhubaneswar-751001

File No.: HUD-SANT-SCH-0014-2017 Letter No.: 25563 Date: 19.9.18

From
Sangramjit Nayak, IAS
Director, Municipal Administration &
State Mission Director, SBM (U)

To
The Commissioners, BMC/BeMC/CMC/RMC/SMC
The Executive Officers, All Municipalities and NACs

Sub: Deep Row Entrenchment (DRE) for disposal of faecal sludge from cesspool emptier vehicles

Ref: This Department Letter No. 10435 Dated 08.05.2017 and No. 23505 Dated 23.08.2018

Madam/Sir,

In continuation of the communications under reference on the subject cited above, I am directed to inform you that the Urban Local Bodies (ULBs) without any Septage Treatment Plant (SeTP) need to construct a temporary safe disposal site within the area of jurisdiction of the concerned ULB for implementation of Deep Row Entrenchment, which may be conveniently approachable by the cesspool operators.

The ULBs are also directed to ensure installation of GPS in the cesspool emptier vehicles and initiate tracking of cesspool emptier vehicles owned by the concerned ULB.

Further, the ULBs are required to send their confirmation on establishment of DREs along with the status of GPS installation in the cesspool vehicles to the to the undersigned within a period of 7 working days of receiving this notice.

The land selection criteria and typical design & specifications for construction of DRE sites are annexed herewith for ready reference.

Yours faithfully,

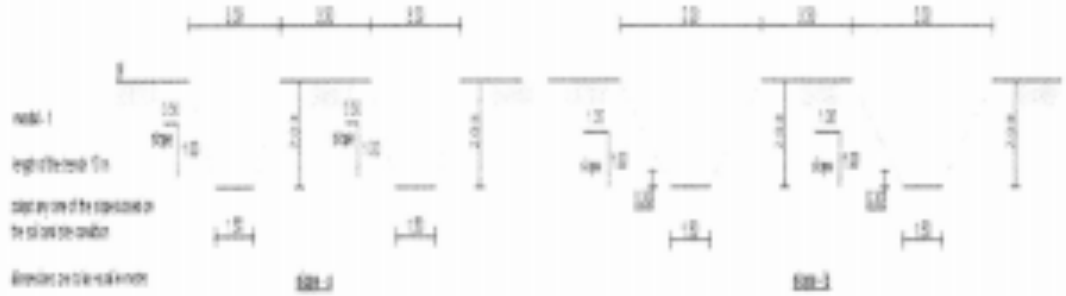
19/9/2018

Director, Municipal Administration &
State Mission Director, SBM (U)

Land Site Selection Criteria

- Legal permissions & approval from relevant authorities
- Not flood prone or should be above recorded flood level
- Not water-logged
- Deep water table
- Soil type – should be porous and allow soakaway
- Reasonably flat
- Sufficient buffer distance to habitable properties (200 m minimum)
- Not close upstream of water intake, well, exposed aquifer (at least 15m), no ground water for potable use or contact or agriculture purposes etc. downstream (of aquifer)
- Accessible by vehicles (road strength, width, bridges, headroom, slope)
- Cesspool emptier vehicle movement should not cause nuisance to neighbourhood
- Compatible to adjacent and neighbouring properties usage
- Close enough to allow logistics of sludge transportation
- Minimum area required based on lifetime projection of need

Typical Design Criteria



Details/item	Measurements (m)
Top width of trench	3.5 m to 5.5 m
Bottom width of trench	1.5 m
Height/depth of trench	1 m to 2 m
Length of trench	10 m
Distance between two trenches	3.5 m
Side slope	0.5:1 to 1:1

2. Uttar Pradesh

Trenching for Safe Management of Faecal Sludge And Septage (FSS) in Nagar Palika Parishad Chunar, UP

The city of Chunar in Uttar Pradesh has an area of 8.31 sq.km and a population of 37,185(as per 2011 census) and is completely dependent on Onsite Sanitation Systems (OSSs). People usually get their OSSs delsudged using the Chunar Nagar Palika Parishad (CNPP) owned 3500 litres capacity vacuum tanker. CNPP charges ₹ 3000 per trip for desludging. The city of Chunar decided to install a dedicated treatment plant for safe management and identified & designated a land for the treatment plant.

Meanwhile, to avoid indiscriminate dumping of FSS in the environment, CNPP in association with CSE established a "Trenching" site for safe disposal of FSS till the time the treatment plant is in place . The site is located about 10 Km from NPP. The capacity of this trenching is about 48 KL. On 4th January 2020 trenching site came into operation and about 24.5 KL of faecal sludge was disposed here safely, till 1st February 2020. The cost of trenching including design and construction of the system was ₹ 28,000 (excluding boundary wall of plot and other incidental costs approx. Rs 50000- 60000), whereas, the monthly expense of operating the trench is estimated to be ₹ 1800[1]

[1] *Source: CPHEEO MoHUA Consultative Document on Land Application of Faecal Septage (2020)*

7. ANNEXURE-II: Area required for Deep Row Entrenchment

A trench size of bottom width of 0.3 m and top width of 1 m,a depth of 1 m and length of 20 m. The volume of this trench would be

V=½(top width+bottom width)*depth*length
=½(1+0.3)*1*20
=13 cu. m

Then, the volume of the trench would be 13 cu. m. For constructing two trenches like this which is spaced 2 m apart, and a setback of 2 m from the fence and a sufficient space of entering of a truck, the length of the site would be (6+20+2) = 28 m and the width of the site would be (2+1+2+1+2) = 8 m. The area taken up would be 28*8= 225 sq.m which is roughly 250 sq.m.

These two trenches would take care of a volume of 26 cu.m that is 26 kl. If a town is making one trip of one tanker of 3 cu. m capacity per month, then this site will satisfy its need for 9 months. Once the trench gets filled, it can be left alone for 6 to 8 months to leach and decompose and then the trench can be emptied with precautions and reused. The trench size and numbers thus can be decided based on the septage quantity emptied in the town.

8. ANNEXURE-III: Proforma for Site selection and design criteria for Deep Row Entrenchment (DRE)

After finalizing the DRE site and dimensions of the trench and the trench site, the Urban Local Bodies are required to fill the following and submit it to Urban Development Directorate, Uttarakhand.

Sl. No.	Activity	
1	**Site Selection Criteria**	**Yes/No**
a)	Identification of possible sites with *Patwari* (No. of sites identified)	
b)	Site above high flood level (HFL)	
c)	Site not prone to water-logging	
d)	Water table deeper than 15ft from bottom level of the trench	
e)	Surface water body minimum distance - 45ft	
f)	Soil type – porous	
g)	Site terrain – flat	
h)	Distance between nearest habitation and site - 200m Minimum	
i)	All weather road accessibility for cesspool emptier vehicle	
j)	Compatible to adjacent and neighbouring properties usage	
k)	Distance of site from town centre < 15km	
l)	GPS tagging of DRE site	
2	**Trench Design**	**Dimensions in m**
a)	Top width of the trench (1.25 m to 3 m)	
b)	Bottom width of the trench (0.3m to 1.50m)	
c)	Height/depth of the trench (1m to 1.5m)	

d)	Length of the trench	
e)	Distance between two trenches - (2m to 3.50m)	

Executive Officer / Municipal Commissioner,

(Name of the ULB) with seal/stamp