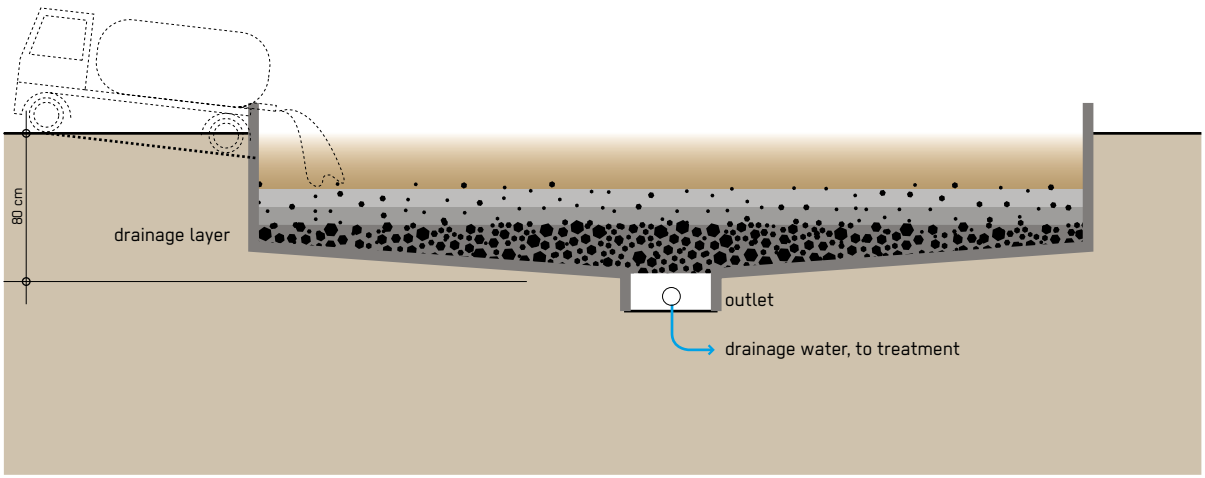
Unplanted Drying Beds

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	Household * Neighbourhood ** City	Household Shared ** Public	Sludge drying, Sludge volume reduction
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
*** High	** Medium	● Sludge	● Sludge, ● Effluent



An Unplanted Drying Bed is a simple, permeable bed that, when loaded with sludge, allows the sludge to dewater by filtration and evaporation and separates and drains the percolated leachate. Approximately 50 % to 80 % of the sludge volume drains off as the liquid evaporates. Once dry, the sludge is removed and the bed can receive liquid sludge again. The dry sludge, however, is not effectively sanitised and needs further treatment.

An Unplanted Drying Bed is made of layers of gravel and sand that support the sludge and allow the liquid to infiltrate. The bottom of the drying bed is lined with perforated pipes to drain the leachate that percolates through the bed. Sludge should not be applied in layers that are too thick (maximum 30 cm), or the sludge will not dry effectively. The final moisture content after 10 to 15 days of drying should be approximately 60 %. When the sludge reaches sufficient dryness, it must be separated from the sand layer and transported for further treatment, end use or final disposal. The leachate that is collected in the drainage pipes must also be treated properly, for example in Waste Stabilisation Ponds **(T.5)**, depending on where it is discharged.

Design Considerations: The drainage pipes are covered by three to five graded layers of gravel and sand. The bottom layer should be coarse gravel and the top layer fine sand (0.1 to 0.5 mm effective grain size). The top sand layer should be 20 to 30 cm thick because some sand will be lost each time the sludge is removed. To improve drying and percolation, sludge application can alternate between two or more beds. The number of beds needed is a function of the frequency of sludge arrivals and the number of days necessary for drying in the local climate, to which a few days must be added for sludge removal. The inlet should be equipped with a splash plate to prevent erosion of the sand layer and to allow for even distribution of the sludge. The bed surface depends essentially

on the characteristics of the local sludge and its capacity to dry, and on the climate. This translates into an admissible loading rate of around 50 kg total solids/m^2/year in a temperate climate, and around 100 to 200 kg total solids/m^2/year in a tropical climate. Usually, the beds are designed to be able to receive a 30 cm sludge layer. The design of the Unplanted Drying Beds must ensure access to people and trucks for discharging the sludge and removing the dried sludge. If installed in wet climates, the facility should be covered with a roof and special caution should be given to prevent the inflow of surface runoff.

Materials: Drying beds require the availability of gravel and sand of the correct grain size. Furthermore, piping for the drainage is needed. To remove dried sludge, shovels and rakes are required as well as personal protective equipment for the workers. The bed itself can be constructed with cement and bricks or concrete and needs to be sealed at the bottom.

Applicability: Unplanted Drying Beds are particularly adapted to warm climates and sludge that is stabilised and rather concentrated. Sludge drying is an effective way to decrease the volume of sludge, which is especially important when it has to be transported elsewhere for further treatment, end-use or disposal. Sludge drying is not effective at stabilising the organic fraction or decreasing the pathogenic content. Further storage or treatment of the dried sludge might be required to eliminate pathogens. Excessive rain or high humidity may prevent the sludge from properly drying. Unplanted Drying Beds are best suited where there is inexpensive, available space situated far from homes and businesses. If designed to service urban areas, they should be at the border of the community, but within economic reach for Motorised Emptying operators **(C.2)**. The necessary surface area required can be reduced by thickening the sludge beforehand, for example in a Sedimentation/Thickening Pond **(T.8)**.

Operation and Maintenance: A trained staff for operation and maintenance is required. Dried sludge can be removed after 10 to 15 days, depending on climatic conditions. It can be removed with shovels and wheelbarrows. Because some sand is lost with every removal of sludge, the top layer must be replaced when it gets thin. The discharge area must be kept clean and the effluent drains should be regularly flushed.

Health and Safety: Both the incoming and dried sludge are pathogenic. Workers should be equipped with proper personal protective equipment (boots, gloves, and clothing). The dried sludge and effluent are not sanitised and may require further treatment or storage, depending on the desired end-use. The leachate also needs further treatment.

Costs: This is an option with medium capital costs and low operating costs. As there is a lot of space required, the land costs might be considerable.

Social Considerations: Unplanted Drying Beds may cause a nuisance for nearby residents due to bad odours and the presence of flies. Thus, it should be located away from residential areas. The staff should be properly trained on sludge management and safety measures.

Strengths and Weaknesses:

- ⊕ Good dewatering efficiency, especially in dry and hot climates
- ⊕ Can be built and repaired with locally available materials
- ⊕ Relatively low capital costs; low operating costs
- ⊕ Simple operation

- ⊖ Requires a large land area
- ⊖ Odours and flies are normally noticeable
- ⊖ Labour intensive product removal
- ⊖ Limited stabilisation and pathogen reduction

→ **References and further reading material for this technology can be found on page 194**