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Soak Pit Design Guidelines in Humanitarian Contexts

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1. Introduction: Why these guidelines?

Overflowing soak pits are a common sight in humanitarian operations. The reasons why can be multiple: clogging, under dimensioning and, more generally, the use of blueprints that do not account for the local context (soil characteristics, flow to be absorbed, characteristics of the greywater, etc.). A soak pit that overflows after six months (and sometimes even before commissioning) can be considered a wasted investment. These guidelines aim to address these issues by:

1. Providing methods and tools to assess local soil characteristics and develop tailor-made designs for soak pits.
2. Providing a refresher about the different soak pit design options.
3. Providing a holistic view beyond the soak pit itself, including the use of plants to increase water absorption and the option of pretreatment.

Water and greywater generated by tap stands, bathing units and washing areas can quickly create a nuisance in settlements, such as: transforming the area around tap stands into mud pools, eroding roads, and creating vector breeding areas. However, this “excess”, “wasted” water is also a resource, especially in water scarce areas. It is common to see residents diverting this water for gardens, brick making or to give to animals to drink. Before planning a soak pit, it is, thus, important to consult the community about if and how this water could be used. Any volume that is used does not need to be infiltrated, leading to lesser soak pit volumes and, therefore, cost savings. Similarly, because budgets often do not allow for the construction of soak pits big enough to be used all year round, “planning for future overflow” should be done from the start, with one goal: to avoid ponding.

These guidelines propose a context-specific approach to design and implement soak pits for the control and disposal of greywater, as well as excess water from tap stands, in refugee settings. Greywater is defined as wastewater from sinks, shower blocks, laundries and kitchens. The document does not include blackwater treatment and disposal. The information provided compiles and complements a review of different practical emergency infrastructure guides (especially Gensch et al., 2018; UNHCR, 2015; Davis et al., 2002).

Key take-aways

- *Understanding local soil characteristics is crucial for an effective design of a soak pit as they determine soil stability and the infiltration capacity. These guidelines provide tools to quickly assess soil characteristics.*
- *The infiltration will almost only take place via the vertical walls of the pit and keep in mind that the bottom can become quickly clogged.*
- *Consider pre-treatment in order to extend the lifetime of the soak pit, especially when the water comes from a washing area, kitchen or showers.*
- *Consider adding productive plants around the soak pit in order to increase water absorption.*
- *Consider water reuse opportunities – these can help reduce the volume of the soak pit and prevent uncontrolled overflows.*

2. Soak pit basics

A soak pit, also known as a “soak-away”, is a porous-walled chamber excavated in the ground used for the safe infiltration of excess water and greywater into the soil (**Figure 1**). Compared to other types of wastewater, greywater has less polluting characteristics, but still has the potential to contaminate soil and groundwater as it may also contain faecal bacteria.

Treatment in a soak pit consists of percolating water into the soil. The purification occurs, first, through a physical filtration in which particles are retained by the soil matrix and, second, through biochemical processes during which the microorganisms that are present in the soil decompose the organic matter.

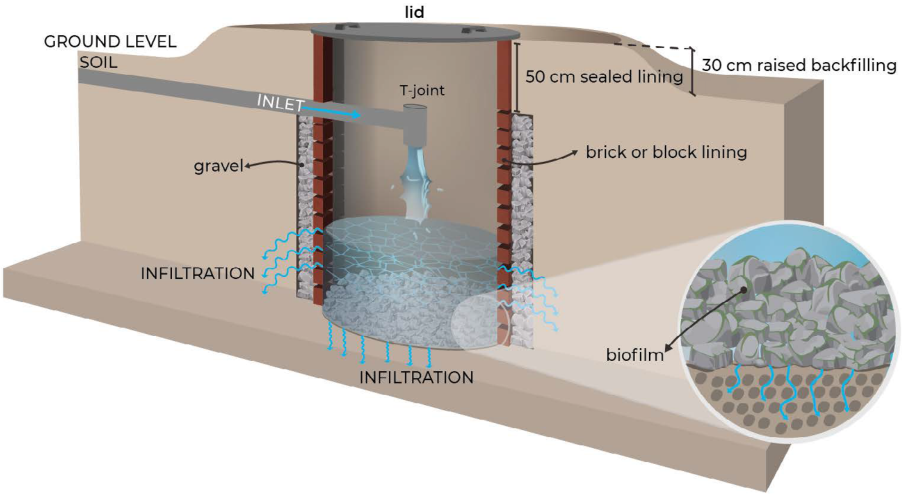


Figure 1 : *General characteristics of a soak pit.*

3. Soak pit design

3. 1. Design parameters

Dimensioning a soak pit requires two main design parameters: the incoming flowrate and the hydraulic loading rate. They can be described as follows:

- **Flowrate** (Q): the amount of water or greywater that can enter the soak pit over a specified time interval ($L\ d^{-1}$). It can be estimated, for example, via bucket measurement or the estimation of the water consumed by shower or laundry areas.
- **Hydraulic loading rate** (HLR) or **infiltration rate**: the amount of water or greywater that can be infiltrated into a given surface area over a specified time interval ($L\ m^{-2}\ d^{-1}$). **Table 1** provides estimations of the hydraulic loading rate according to the soil texture and percolation rate (US EPA, 1992; ABNT, 1997).

The soil characteristics will determine the hydraulic loading rate, as well as the stability of the pit walls. It is, thus, important to understand the characteristics of the local soil. There are two ways to assess this:

- **Conduct a soil texture assessment:** two different field tests can be chosen from to characterise the soil based on the respective proportions of clay, silt and sand: the Feel Method (explained in **Annex 1**) and the Sedimentation Method (explained in **Annex 2**).
- **Conduct a percolation test:** a percolation test (explained in **Annex 3**) allows for measuring the percolation rate into the soil. The latter can be also be estimated directly based on the soil texture by using **Table 1**.

Table 1 : *Recommended hydraulic loading rate for a soak pit with different soil types and soil percolation rates*

(adapted from Crites and Tchobanoglous, 1998; Morel et al., 2006; Reed and Dean, 1994).

Soil texture	Percolation rate (min cm^{-1})	Hydraulic loading rate ($L\ m^{-2}\ d^{-1}$)	
		Water	Pre-treated wastewater
Gravel, coarse sand	< 0.4	1,500 - 2,400	not appropriate
Coarse to medium sand	0.4 – 2		50
Fine sand, loamy sand	2 – 6	720 - 1,500	30
Sandy loam, loam	6 – 12	480 - 720	25
Loam, porous silt loam	12 – 25	240 - 480	20
Silty clay loam, clay loam	25 – 50	120 - 240	8
Clays, colloidal clays	> 50	24 - 120	not appropriate

3. 2. Pit sizing calculations

The estimated flowrate Q ($L\ d^{-1}$) and the hydraulic loading rate HLR ($L\ m^{-2}\ d^{-1}$), as given in **Table 1**, allows for calculating the required infiltration area A_i as per **Equation 1**. **The Infiltration Area** (A_i) is the surface area (m^2) required to infiltrate the amount of water or greywater entering the soak pit. **Note that the Infiltration Area includes only the vertical walls of the soak pit and excludes the bottom area** as it commonly clogs quickly.

$$A_i = Q / HLR \qquad \text{(Eq. 1)}$$

Where A_i is the infiltration area (m^2), HLR is the hydraulic loading rate ($L\ m^{-2}\ d^{-1}$), as given in **Table 1**, and Q is the effluent flowrate ($L\ d^{-1}$).

Common diameters and depths for the design of a soak pit are presented in **Table 2**.

Table 2 : *Common diameters and depths of soak pits.*

Type	Dimensions
Lined soak pit	Diameter: 1 - 2.5 m; Depth: 1.5 to 5 m
Unlined soak pit	Diameter: 1 - 2.5 m; Depth: 1.5 to 3 m
Banana-tree circle	Diameter: 1 - 2 m; Depth: 0.6 to 1 m

The definition of the right size and depth of a soak pit is based on local factors. The bottom of the soak pit should be at least 1.5 m above the water table. This defines a maximum depth for the soak pit. If the water table is not a limiting factor, the desired diameter can be freely chosen and the depth calculated using **Equation 2**, which divides the infiltration area by the perimeter of the pit.

$$\mathbf{H = (A_i / (\pi * D)) + 0.5} \qquad \text{(Eq. 2)}$$

Where **H** is the pit depth (m), $\mathbf{A_i}$ is the infiltration area (m^2), and **D** is the diameter (m). (π * D) calculates the perimeter of the pit. The 0.5 m. is an estimation of the distance between the pipe inlet and the lid of the soak pit, which is the section of the pit where water will not infiltrate, as this is not counted as part of the infiltration area.

If the water table is a limiting factor for the soak pit depth, then the maximum depth is set and the diameter should be calculated using **Equation 3**.

$$\mathbf{D = A_i / (\pi * (H - 0.5))} \qquad \text{(Eq. 3)}$$

If necessary, several soak pits can be installed in a series, where the overflow of the first pit enters the second pit, etc. In that latter case, the infiltration area is distributed among the different soak pits. The distance between the soak pits depends on the available space and the terrain slope. A minimum distance of 1.5 m between them is recommended to avoid the saturation of the soil. **Annex 5** gives an example of how soak pit dimensions can be calculated.

Figure 2 synthesises the calculation process and the link between the different parameters.

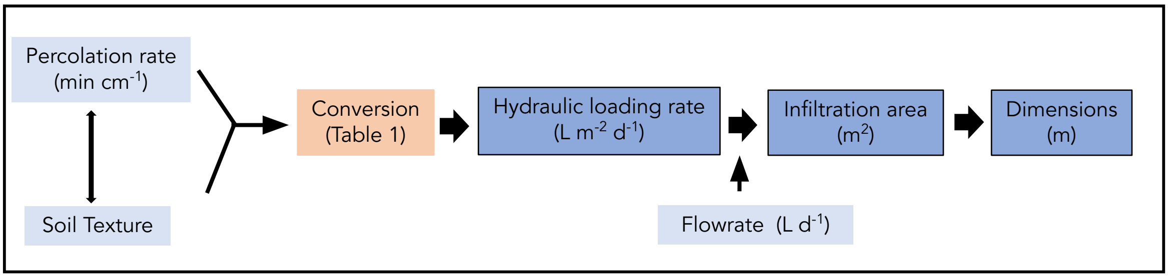


Figure 2 : *Calculation process for sizing a soak pit*

3. 3. Further design considerations

The location of soak pits for the infiltration of greywater should be at least 30 meters away from a groundwater water source (Davis & Lambert, 2002). To avoid groundwater contamination, the bottom of the soak pit must be at least 1.5 meters above the water table in most soil types.

When designing a soak pit, particular attention should be given to the pit cover and potential need for pre-treatment. The pit cover, together with a raised backfilling of 30 cm (see in **Chapter 4**) and pit lining on at least the top 50 cm of the pit prevents rainwater from entering and overloading the pit. A stable **lid** prevents people from falling in and keep them from having direct contact with contaminated water. For these reasons, the lid should be sturdy, but not too heavy, to allow for unrestricted operation and maintenance and should cover the whole diameter of the soak pit. Usually, concrete lids with a thickness of 5 cm are used. To ease the regular maintenance of the pit, it is recommended to install two handles on the top of the lid to allow two workers to simultaneously remove the cover by hand or to use a wooden pole as additional support to remove the lid.

Fats, oils, grease (FOG) and solids present in the greywater may lead to clogging of the soak pit. In order to prevent them from reaching the soak pit, a **pre-treatment** step can be added either at the source or upstream of the soak pit. For the treatment of greywater with a high concentration of FOG, the use of a solid filter, grease trap, or settlement tank before releasing the greywater into the soak pit is necessary. The grease trap (**Figure 3**) helps to separate the liquid from the grease and solids present in the greywater. Its maintenance has to be done periodically (approximately once a month). The solids and grease should be removed and safely disposed of as solid waste.

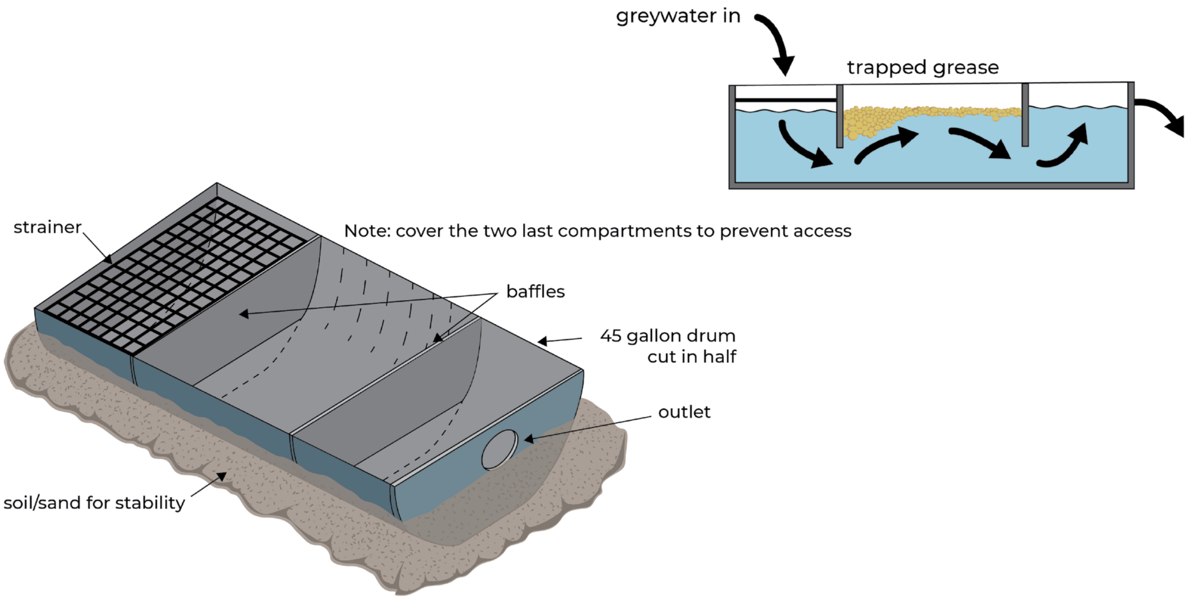


Figure 3 : *Simple grease trap* ***(adapted from Davis & Lambert, 2002).***

The use of productive plants, such as banana trees, can increase the water absorption. A list of productive plants recommended for increased water absorption can be found in **Annex 4**. The benefits from this may include increased water absorption, production of food, flowers or construction material. It is important to highlight that some plants should not be used for lined soak pits as their roots could harm the structure of the walls (e.g. papaya-trees).

4. Implementation

Different designs can be used for the soak pit walls and floor. Depending on soil stability, the pit can be left unlined or lined with materials, such as concrete, bricks, drums or tires, with regular holes in the walls to maximise infiltration.

This chapter covers the construction of **unlined** (**Figure 4**) and **lined** (**Figure 5** and **Figure 6**) soak pits, and the necessary materials required to build them. In both cases, the internal space of the soak pit can be left empty or filled with a porous material such as stones and gravel. Filling the soak pit with a porous material will contribute to the distribution of water in the soil, prevent the walls from collapsing and create a larger surface area for biofilm development. Using local materials for the soak pit construction is suggested as it could lower the costs and alleviate supply chain issues.

4. 1. Unlined soak pit construction

Here are the steps to conduct an unlined soak pit:

1. Dig the pit according to the calculated dimensions. The soil removed can be used for the construction of a raised backfilling that should be 30 cm high.
2. When digging, plan for the space and support needed for the 50 cm sealed lining, which will be made, for example, with bricks. It will prevent infiltration of surface run-off and access to rodents. Increase the diameter of the pit on the top 50 cm, according to the width of planned lining.
3. Fill the pit with stones and gravel (5 - 25 cm in diameter) from the bottom up to the beginning of the lining.
4. Add the inlet pipe, the tee-pipe and the lid.

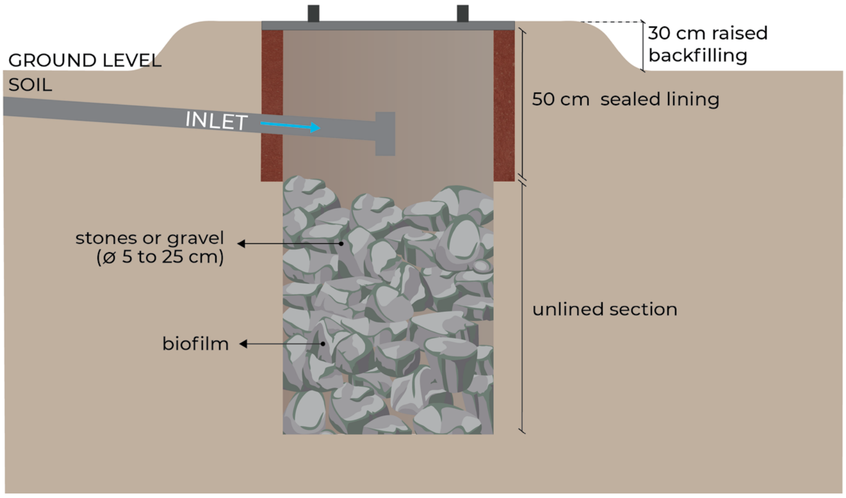


Figure 4 : *Unlined soak pit design*

4. 2. Lined soak pit construction

Here are the steps to construct a lined soak pit:

1. Dig the soak pit according to the calculated dimensions with an added 0.6 m beyond the required pit diameter in order to leave 0.3 m space for the gravel between the pit lining wall and the soil. The soil removed can be used for the construction of a raised backfilling that should be 30 cm high.
2. Construct the lined soak pit walls in the pit. These can be built with bricks, blocks, drums or tires. The top 50 cm of the pit should be fully lined to prevent infiltration of surface run-off and access to rodents. The walls should be perforated or have open joints. The size of the openings depend on the soil characteristics. The holes are at least 1.5 cm in diameter with a maximum distance of 20 cm from each other. Bricks or blocks can be placed with holes between them to allow for percolation.
3. Add gravel at the bottom of the pit and in the space between the lining and the soil to reduce the risk of clogging.
4. Add the inlet pipe, the tee-pipe and the cover lid.

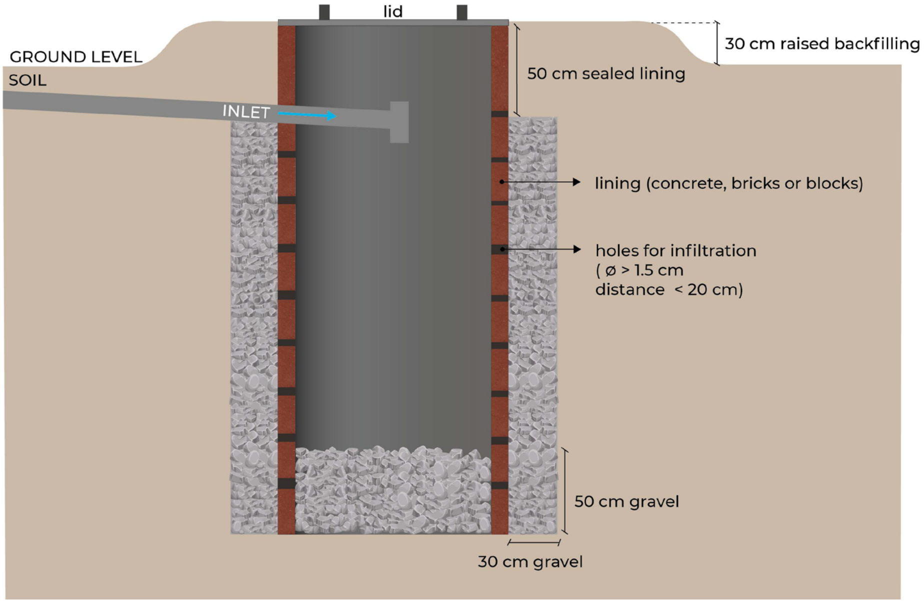


Figure 5 : *Lined soak pit design.*

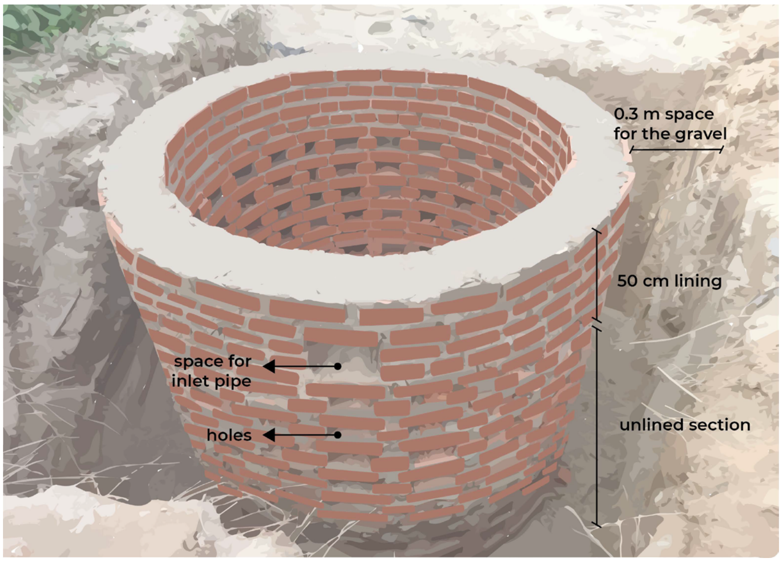


Figure 6 : *Lined soak pit construction.*

4. 3. Example of a nature-based design

A low-cost and simple version of an unlined soak pit is the so-called “banana-tree circle”. This type of soak pit is particularly recommended for households in areas with a high availability of organic matter and plants. Banana trees or other appropriate plants (see **Annex 4**) are planted around the pit in order to absorb water and, thus, increase the infiltration capacity of the soak pit. **Figure 6** shows the example of a “banana-tree circle” from Brazil, which can be useful at household or compound level (Tonetti et al., 2017; FUNASA, 2015). The unlined pit is filled with sticks and larger pieces of wood at the bottom, topped with straw and dry leaves. Banana-trees are planted on the soil mound surrounding the soak pit, on a width up to 2 meters with approximately 60 cm space between them. Knowing the plant characteristics, such as the length of the root systems, is important. As an example: the banana-tree root system can range from 0.6 to 1 m in depth, which indicates more or less the radius where absorption will take place. The consumption of parts of the plants, such as roots or leaves, which have direct contact with the soil and greywater is not recommended due to the possible risk of microbiological contamination.

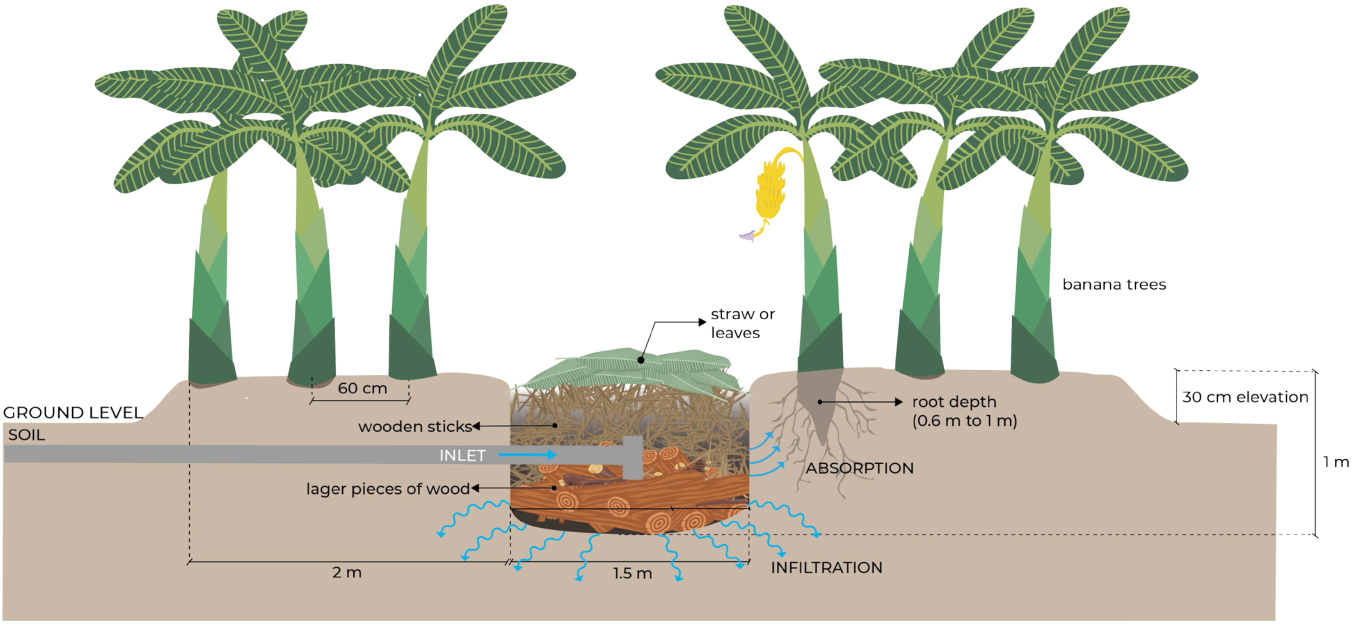


Figure 7 : *Banana -tree circle system, a low-cost nature-based solution*

5. Operation and maintenance

Operation and maintenance is important for the long-term performance of a soak pit. A well designed soak pit requires operation and maintenance every three to five years (Tilley et al., 2014). The main operational threat is clogging and sludge build-up. When this occurs, it is necessary to carry out maintenance by excavating the fill material, cleaning it, or replacing it with new gravel. Overflow of the soak pit may happen due to clogging, but also to a flowrate higher than the design allows. In all cases, it is worth considering how best the overflowing water can be managed or used for other purposes.

With the banana-tree circle option, the organic material should be replaced once decomposed (normally every three months in tropical conditions). The roots of the banana tree naturally contribute to the maintenance of the soil structure, reducing the risk of clogging. If clogging does occur, the maintenance is similar to that of a conventional soak pit.

6. References

ABNT, 1997. Associação Brasileira de Normas Técnicas. NBR 13969: Septic tank - Units for treatment and disposal of liquid effluents - Project, construction and operation. Rio de Janeiro. 1997.

Action Contre la Faim (ACF), 2005. Water, sanitation and hygiene for populations at risk. Hermann Éditeurs des Sciences et des Arts Paris, France.

Burks, B. D., Minnis, M. M., 1994. Onsite wastewater treatment systems. Madison, Wi: Hogarth House.

Castagna, G et al., 2019. Guia prático: Manejo da água. IPESA, 2a edition.

Crites, R. and Tchobanoglous, G., 1998. Small and decentralized wastewater management systems. Water Resources and Environmental Engineering, firth ed. WCB/McGraw-Hill, Boston.

Crouch, D., 2021. Banana Circle. Treeyo Permaculture Edu. https://treeyopermacultureedu.com/chapter-10-the-humid-tropics/banana-circle/ (accessed 01 June 2021).

Davis, J. and Lambert, R. 2002. Engineering in Emergencies – a practical guide for field workers. Published in association with RedR. 2nd Edition.

Dwumfour-Asare, B., Nyarko, K. B., Awuah, E., Essandoh, H. M. K., Gyan, B. A., Ofori-Addo, H., 2018. Indigenous plants for informal greywater treatment and reuse by some households in Ghana. Journal of Water Reuse and Desalination, 084, 553–565.

FUNASA, 2015. Ministry of Health. Nacional Fundation of Health. Sanitation Manual. 4th ed. FUNASA, Brasília. Brazil.

Gensch, R., Jennings, A., Renggli, S., Reymond, P., 2018. Compendium of Sanitation Technologies in Emergencies. German WASH Network (GWN), Swiss Federal Institute of Aquatic Science and Technology (Eawag), Global WASH Cluster (GWC) and Sustainable Sanitation Alliance (SuSanA). Berlin, Germany.

Médecins Sans Frontières (MSF), 2010. Public health engineering in precarious situations.

Morel, A. and Diener, S. 2006. Greywater Management in Low and Middle-Income Countries, Review of different treatment systems for households or neighbourhoods. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.

Oxfam, 2008. Septic Tank Guidelines. Technical Brief. Oxfam: Oxford, UK.

Reed, R and Dean, P.T. 1994. Recommended Methods for the Disposal of Sanitary Wastes from Temporary Field Medical Facilities. Disasters. Vol 18. N 4.

Silva, J. R. M. et al. 2022. Design model of Banana Tree Circle as a nature-based solution for a sustainable greywater management. Submitted.

Thien. S. J., 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education. 8:54-55.

Tilley, E., Ulrich, L., Lüthi, C., Reymond, P. and Zurbrügg, C., 2014. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.

Tonetti, A. et al., 2017. Treatment of domestic wastewater in isolated communities - reference for the choice of solutions. Biblioteca Unicamp. Campinas, Brazil.

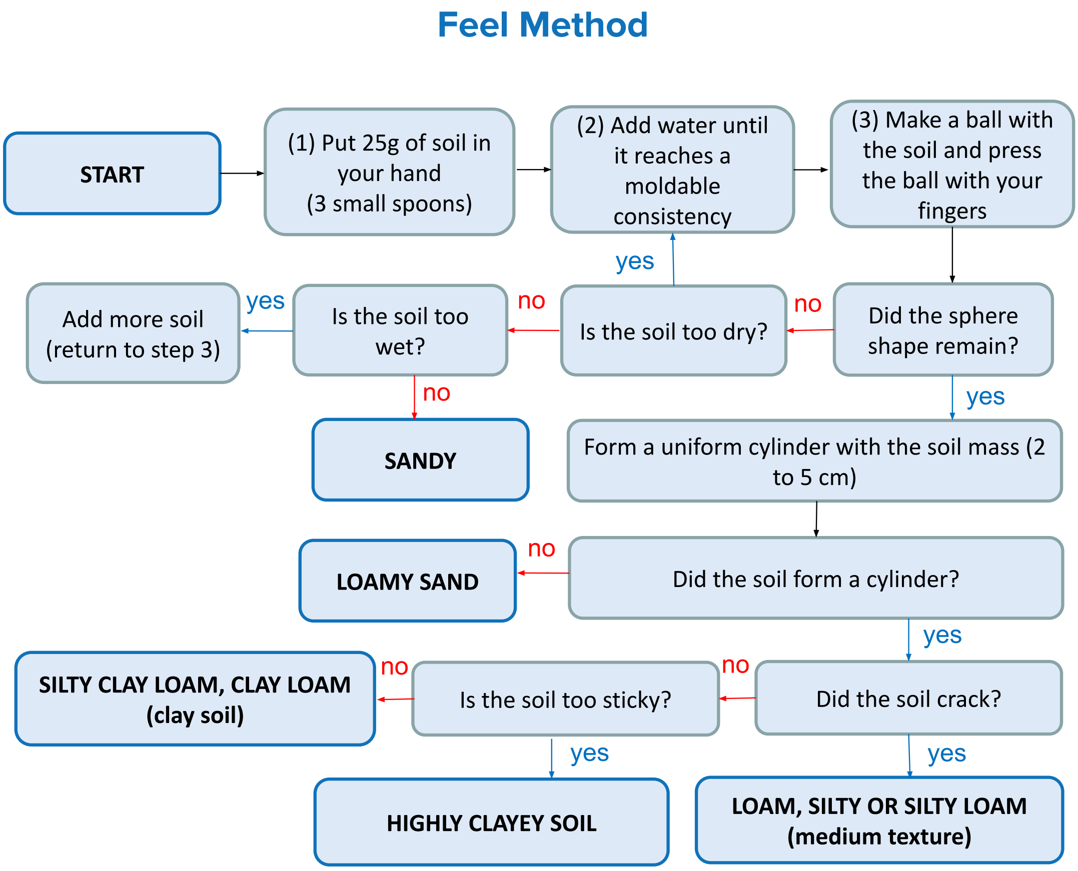
UNHCR, 2015. UNHCR WASH Manual. Geneva, Switzerland.

US EPA, 1992. Wastewater Treatment/Disposal for small Communities, U. S. Environmental Protection Agency, Washington DC.

ANNEX 1 - The Feel Method

The Feel Method, presented below in **Table 3**, helps to determine the soil texture. Once the soil texture is known, **Table 1** provides estimations for the soil percolation rate and hydraulic loading rate.

Table 3 : *The Feel Method* ***(adapted from Tonetti et al. (2017).***



ANNEX 2 - The Sedimentation Method

Using the Sedimentation Method, it is possible to calculate the percentage of sand, silt, and clay in the soil sample and determine the type of soil.

1. For this test, the soil sample must be free of roots and stones.
2. Fill a transparent container with the soil sample (1/3 of the pot), water (2/3 of the pot), and a spoonful of detergent.
3. Close the pot with a lid, shake it until the sample becomes homogenous, and leave it to rest for 24 hours.
4. It will then be possible to see three layers forming (1st sand, 2nd silt, and 3rd clay) as shown in **Figure 8**.
5. With a ruler, measure the total soil content that has deposited on the bottom of the container (three layers together). Then, measure each individual layer.
6. For each layer, perform the following calculation:

   (Height of the specific layer / Height of the total content) * 100
7. Then, apply the percentages of sand, silt and clay to the Soil Texture Triangle (**Figure 9**) to determine the name of the textural class of a soil sample.
8. See **Annex 5** - Case Study – Sizing calculation for a soak pit for an example of how to use the Soil Texture Triangle.

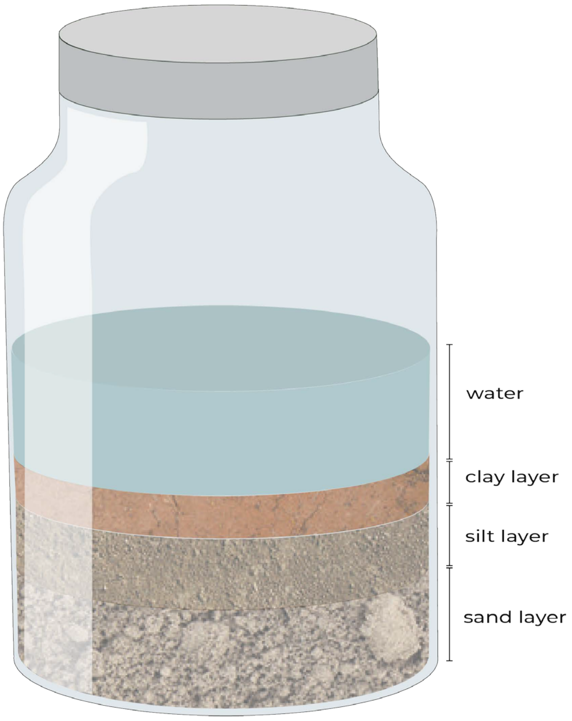


Figure 8 : *Three layers of soil in the pot for the Sedimentation Method.*

Figure 9 : *USDA Soil Textural Triangle*

(courtesy of United States Department of Agriculture, Natural Resources Conservation Service).

ANNEX 3 - Determining the soil percolation rate

The percolation tests are performed to determine the percolation rate (min cm^{-1}) of water into the soil in order to be able to calculate the hydraulic loading rate (L m^{-2} d^{-1}). This is an easy test to perform in the field, and should be done close to where the soak pits will be built.

The test is conducted at the location where the soak pit will be built, with the following steps, illustrated in **Figure 10**:

1. A trench with dimensions 30x30x30 cm is excavated.
2. Add a bottom layer of 5 cm of gravel to avoid clogging during the test.
3. Add water to the trench and wait for it to be absorbed. Repeat this operation several times until the water level decreases as slowly as possible, simulating a saturated soil condition (this step takes from 4 to 12 hours).
4. Use a watch and a ruler to measure how many minutes it takes for the water level to decrease by 1 cm. This time is the soil percolation rate (min cm-1).
5. The conversion from the soil percolation rate to the hydraulic loading rate can be found in **Table 1**.

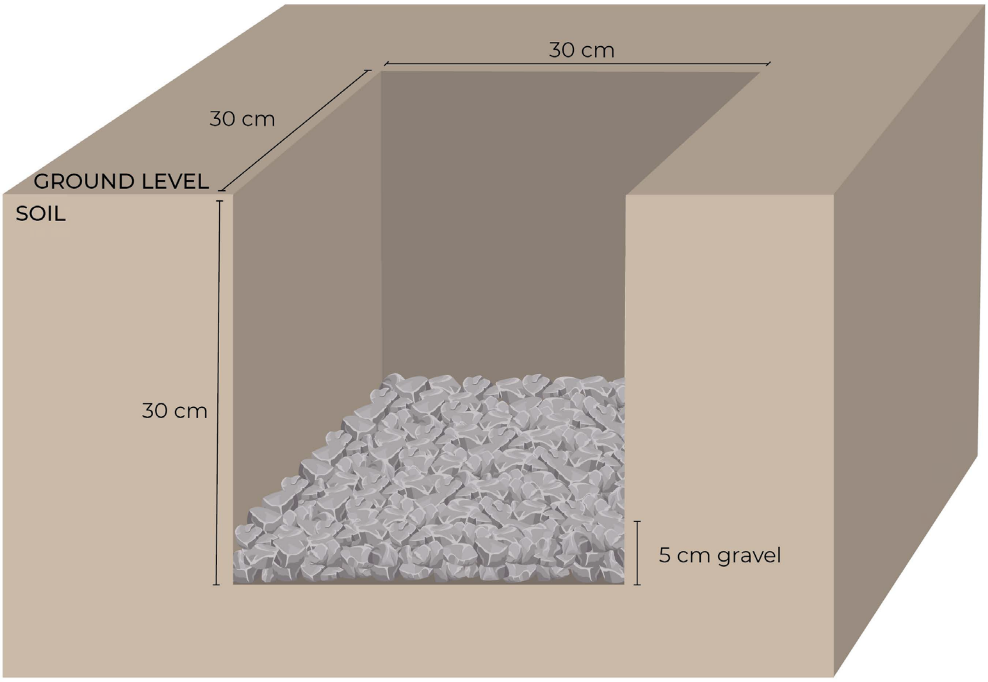


Figure 10 : *Set up for a soil percolation test.* ***(adapted from Castagna et al., 2019)***

ANNEX 4 - Productive plants

Table 4 shows a list of productive plants suitable for water absorption that could be used to enhance the infiltration capacity of soak pits. Some plants, such as the papaya-tree, should not be used with lined soak pits because their deep and strong roots might break the structure of the wall. They can, however, be used for unlined soak pits. All the other productive plants mentioned in the Table below are appropriate for lined soak pits as well. To decide on the most suitable type of plant to use, it is recommended to engage the local community to learn about native plants with good water absorption or transpiration capacity, and to find out which plants they are interested in using.

Table 4 : *List of suitable productive plants for increasing water absorption*

Plant	Characteristics
Banana-tree	**Benefits:** high water absorption rate. Simple to maintain and easily found in tropical countries. Produces banana fruit. **Root depth:** 0.6 to 1 m.
Papaya-tree	**Benefits:** produces papaya fruit and wood. **Root depth:** approximately 3.4 m.
Bamboo	**Benefits:** high water absorption rate, it can be used for construction and is easily found in tropical countries. Produces wood. **Root depth:** approximately 0.6 m.
Heliconia	**Benefits:** high water absorption rate and produces flowers. **Root depth:** 0.4 m
Taro (“taioba”)	**Benefits:** high water absorption rate. **Root depth:** 0.1 to 0.4 m
Lilium	**Benefits:** high water absorption rate and produces flowers. **Root depth:** 0.3 to 1.5 m

ANNEX 5 - Case Study – Sizing calculation for a soak pit

This case study features the design calculation for a soak pit that receives greywater from communal showers (with six cabins) and laundry points serving refugees with eight families (32 people). The total per capita water consumption is estimated at 20 litres per person per day. Assuming that 70 % of the daily per capita water consumption ends up as greywater flow, it can be estimated that:

Effluent flowrate (Q) = 32 cap * 20 L / cap / d * 70 % = 450 L / d

A Sedimentation Test (see **Annex 2**) was performed to identify the soil type at the location. The result is illustrated in **Figure 11** and leads to the following composition of the soil:

- Clay (0.8 cm / 4 cm) x 100 = 20%
- Silt (1.2 cm / 4 cm) x 100 = 30%
- Sand (2.0 cm / 4 cm) x 100 = 50%

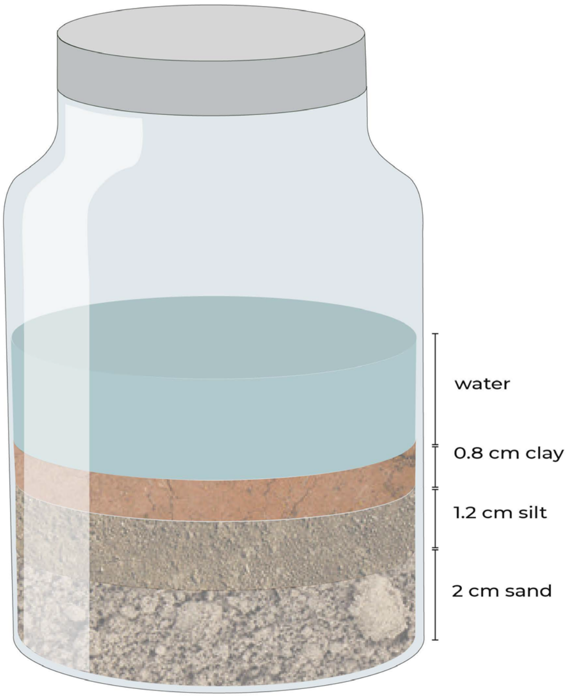


Figure 11 : *Sedimentation Test.*

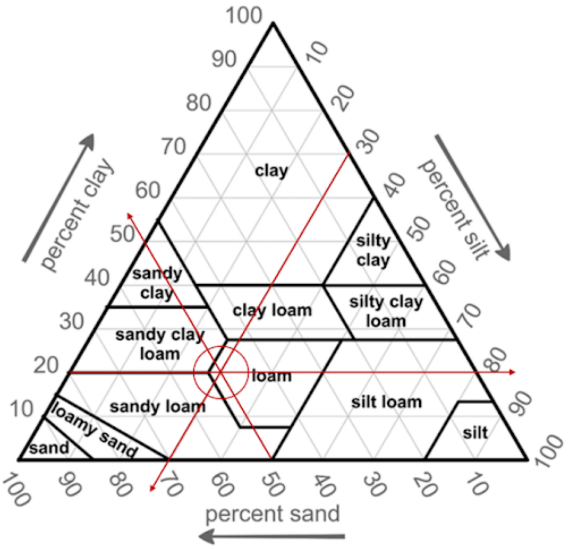


Figure 12 : *USDA Soil Textural Triangle*

(Courtesy of United States Department of Agriculture, Natural Resources Conservation Service).

Using the Soil Textural Triangle (**Figure 12**), it is possible to identify that this is a loam soil. Based on this information, **Table 1** provides an estimated hydraulic loading rate of around 20 L / m^2 * d.

A_i = Q / HLR

where: A_i = infiltration area (m^2), HLR = the hydraulic loading rate (L m^{-2} d^{-1}), and Q = the effluent flowrate (L d^{-1}).

$$A_i = \frac{450\ L/d}{20\ L\ /\ m^{2*}\ d}$$

A_i = 23 m^2

Assuming that one unlined soak pit will have a diameter of 1 m (**Table 2**), the depth will be:

$H = (Ai / (\pi * D)) + 0.5)$

where: H is the pit depth (m) and D is the diameter of the pit (m)

$H = (23 / (\pi * 1)) + 0.5$

$H = (7.5\text{m}) + 0.5\text{ m}$ (7.5 m (infiltration depth) + 0.5m (sealed lining))

$H = 8\text{ m}$

Note: The depth is much higher than recommended. This justifies the construction of several soak pits in a series. In this case, we will construct three soak pits in a series with 4 m distance between each of them.

Following are the dimensions of each:

D = 1 m

H = 3 m (2.5 m (infiltration depth) + 0.5m (sealed lining))

Productive plants (see **Annex 4**) can be added around the pits. In this example, banana trees were planted. **Figure 13** illustrates the final design.

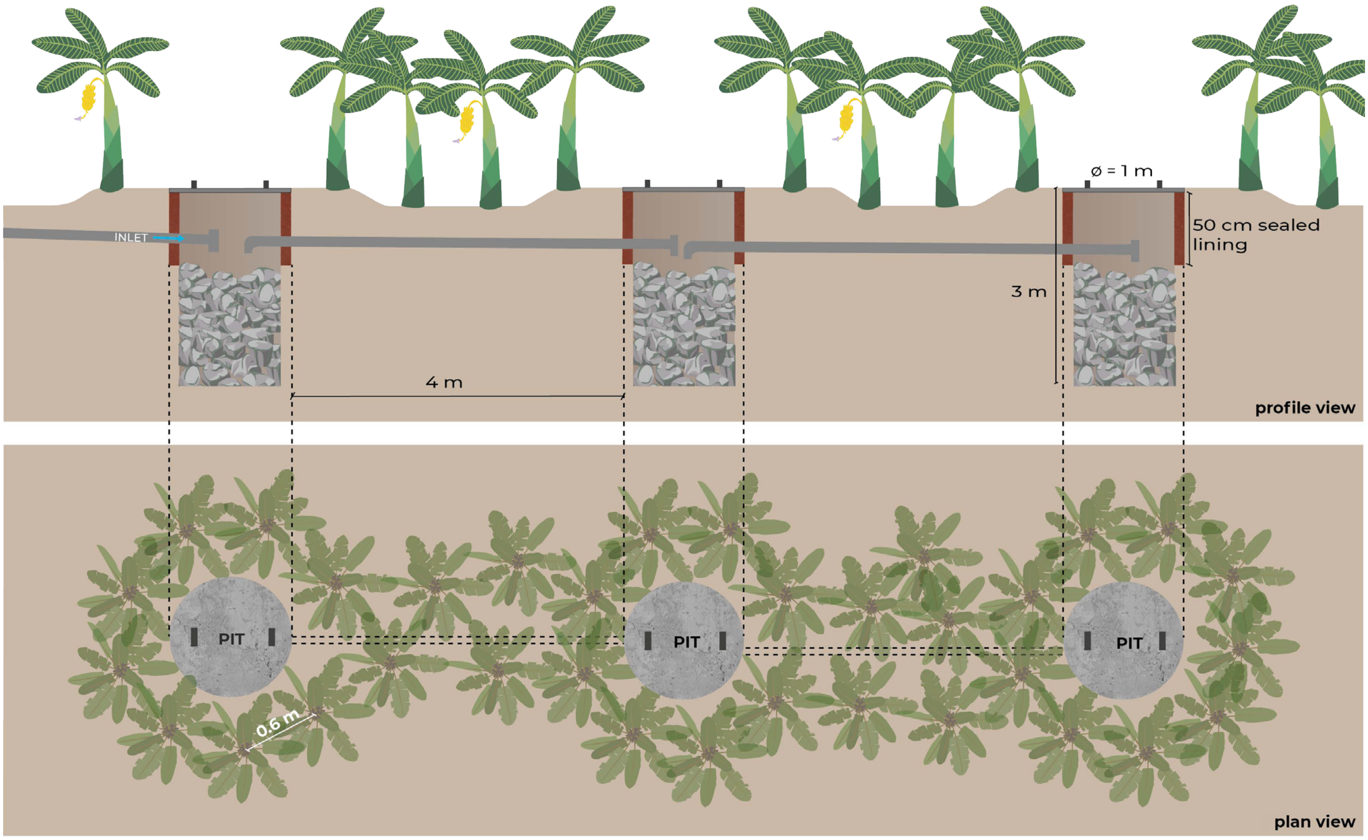


Figure 13 : *Design layout of the case study, featuring three soak pits in series and the addition of productive plants to increase water absorption.*

ACKNOWLEDGEMENTS

Authorship

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LINKS

- UNHCR WASH
- Geneva Technical Hub

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