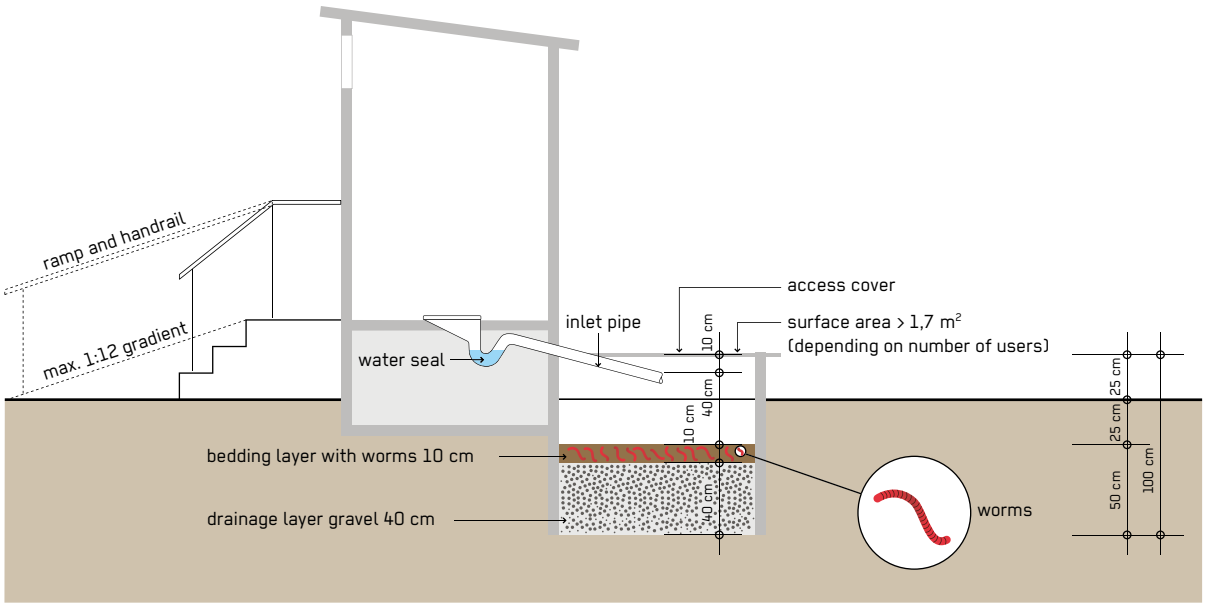
Worm-Based Toilet (Emerging Technology)

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	** Household * Neighbourhood City	** Household ** Shared Public	Excreta containment, Sludge volume reduction, Pathogen reduction
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
* Little	** Medium	Urine, Faeces, (Dry Cleansing Materials), (Anal Cleansing Water), Flushwater	Vermi-Compost, Effluent



The Worm-Based Toilet is an emerging technology that has been used successfully in rural, peri-urban and camp settings. It consists of a pour flush pan connected to a vermifilter (filter containing worms). The effluent infiltrates into the soil and the vermicompost (worm waste) is emptied approximately every 5 years.

By using composting worms the solids are considerably reduced. 1 kg of human faeces is converted into approximately 100–200 g of vermicompost. The system thus needs emptying less frequently than traditional pit systems. The vermicompost is generated at the top of the system and is a dry humus-like material, which, compared with untreated excreta, is relatively easy and safe to empty.

Design Considerations: The surface area of the household tank for the vermifilter varies from 0.7 m^2 to 1 m^2 depending on the number of users. The depth of the tank is approximately 1 m. The bottom of the tank is exposed to the soil. The tank contains 40 cm of drainage material (gravel or stones), 10 cm of organic bedding material (woodchips, coconut husks or compost) and the worms. The lid to this tank needs to fit extremely well, but should not be sealed. This is then connected to the pour flush system.

Materials: Worm-Based Toilets can be constructed from locally available materials. The superstructure should contain a roof and a door for privacy. A pour flush pan is also required. The offset tank can be made from various materials including concrete rings, masonry and brickwork. The most important material is the worms (100 g per person). The type of worms required are composting worms. Four species of worms have been successfully used to date, namely Eisenia fetida, Eudrilus eugeniae,

Perionyx excavatus and Eisenia andrei. They can be found locally, bought from vermicomposting or vermiculture businesses, or imported.

Applicability: Worm-Based Toilets are a viable solution if long-term household sanitation is required and emptying is an issue. They are particularly appropriate in contexts where water is available and used for flushing, and in camp communities that have a strategy of implementing household systems. As the toilets can be built half above and half below the ground they can be used in areas with relatively high water tables (approx. 1 m). As the effluent enters the soil, a certain infiltration capacity is required. Securing a worm supply can be an issue.

Operation and Maintenance: General operation and maintenance (O & M) measures include regular cleaning of toilets, advice on proper use, minor repairs, regular checking of the well-being of the worms and the monitoring of the filling of the tank. These toilets require emptying approximately every 5 years. Ideally the toilets are emptied by the household after they have been un-used for one week, allowing the fresh faeces to be converted into vermicompost. The vermicompost should be removed from the edges of the tank with a small spade, then the vermicompost from the middle should be spread across the surface to create a bedding later. The harvested vermicompost can be buried on-site. When sensitising the users, it should be highlighted that only water, faeces, urine and possibly toilet paper should go into these toilets. The toilets should only be cleaned with water and a brush, and should be flushed after every use including urination. O & M is still a grey area as the systems which have been built have not been emptied yet. If emptying by the households is not an option (due to acceptability issues or other reasons) other options involving local service providers need to be identified.

Health and Safety: If used and managed well, Worm-Based Toilets can be considered a safe excreta containment technology. They need to be equipped with Handwashing Facilities **(U.7)** and proper handwashing with soap after toilet use needs to be addressed as part of the hygiene promotion activities **(X.12)**. Recent research studies suggest that the effluent from worm-based systems can be considered safer than the effluent from septic tanks and that the vermicompost generated can be considered safer than faecal sludge. However, more research is required to confirm this.

Costs: Worm-Based Toilets can be built using locally available materials. The worms can be costly, but in larger-scale projects worm cultivation can be incorporated. The cost is comparable to that of a well-constructed pit latrine. O & M costs should be included over the lifetime of the toilet. Over time this technology becomes increasingly financially viable compared with other pit latrine systems.

Social Considerations: The potential handing over to beneficiaries and the roles and responsibilities for O & M need to be agreed upon from the design phase and closely linked to respective hygiene promotion activities **(X.12)** to ensure appropriate use, operation and maintenance of the facilities. The community needs to be sensitised to the worms and toilets. This can be done by highlighting advantages of the system, i.e. little space required, convenient water-based system, no odour, less emptying, rather than discussing the use of the worms. There has been little adverse reaction to the use of worms.

Strengths and Weaknesses:

⊕ No odour
⊕ Design is adaptable to locally available materials
⊕ Low emptying frequency (> 5 years of use)
⊕ Easier and more pleasant to empty

⊖ Requires water for flushing (min 200 ml) and composting worms (100 g per person)
⊖ Unclear if menstrual hygiene products can be digested by the worms
⊖ Bleach or other chemicals cannot be used to clean the toilet
⊖ Lack of evidence on O & M

→ **References and further reading material for this technology can be found on page 191**