

# Green Toilet - An innovative & Sustainable Flood Resilient Toilet for Flood Prone and High Groundwater Table Areas



**Dr. Pawan Kumar Jha**

*Dr Jha has over 30 years of practical experience & expertise in the WASH sector in developing sustainable technologies, their implementation, monitoring, evaluation, capacity building and policy research in the fields of sanitation, solid and liquid waste management, septage management and biogas technology in India and other developing countries.*

## Problems with conventional toilets during floods and in high groundwater table areas:

**L**each pit toilets (single or double pits) and septic tank toilets are extensively implemented in unsewered areas in India and other developing countries. However, such toilets can't be used during a flood situation. In case of flooding, pits fill with floodwater immediately, making them unusable, and people are forced to defecate in open at elevated places. Toilet pits are also severely damaged.

Retrofitting of substructures/superstructure is required, resulting in recurring costs for households.

Floods are widespread in Asian countries. There isn't any toilet technology suitable for unsewered areas in any developing country, especially during flood situations. Human waste along with floodwater, flows everywhere. Such problems are a pressing concern for communities in the targeted areas. However, due to a lack of socio-culturally acceptable & affordable toilet technology, the problems remain unsolved.

## Climate Resilient Toilet (Green Toilet):

The innovative design of the Climate Resilient Toilet, named Green Toilet, developed by the Author, is suitable for any flood situation. It can be used uninterrupted during a flooding situation till the households remain in their houses. Further, there is no or at least a minimal chance (depending upon groundwater level) of groundwater pollution when effluent leaches into the soil.

Green Toilets were first implemented in 2019, in an entire village located near the Koshi River in Supaul district, Bihar, India, where annual devastating flooding occurs. Its functioning, operation and maintenance were studied in detail. All toilets worked uninterrupted, even during floods with water levels up to 2 ft in the village.

Based on the experience, other Green Toilets were implemented in flood-affected area in Bangladesh (Gaibandha Municipality) in March 2024, where annual flooding is the norm. It is low-cost, with no O&M costs. Operational results and quality of effluent from the toilets are encouraging.

**About the Green Toilet:**

The Green Toilet is constructed using locally made ring channels. Ring channels are commonly available in many countries. Other materials required are a PVC pipe of 4" dia. Toilet seat/pan & trap, which is the same as in regular toilets.

The plinth level of the superstructure is raised to the normal floodwater level, when families remain in their houses during a flood situation. Usually, it is raised to 2 ft above the ground level. In the event of severe flood, communities are typically displaced to safer areas. There are two chambers connected in series. First chamber is connected to the toilet pan at one end and to the second chamber at the opposite end through the PVC pipe. The bottoms of both chambers are sealed with PCC (Plane Cement Concrete) to prevent wastewater from leaching into the soil.

The first chamber acts as a settling chamber. From this chamber, effluent flows to the second chamber, which acts as a treatment chamber. The diameter of each chamber is 3-3.5 ft, and the depth is 4-5 ft below ground and 2 ft above the ground. The upper ends of the chambers are adequately covered.

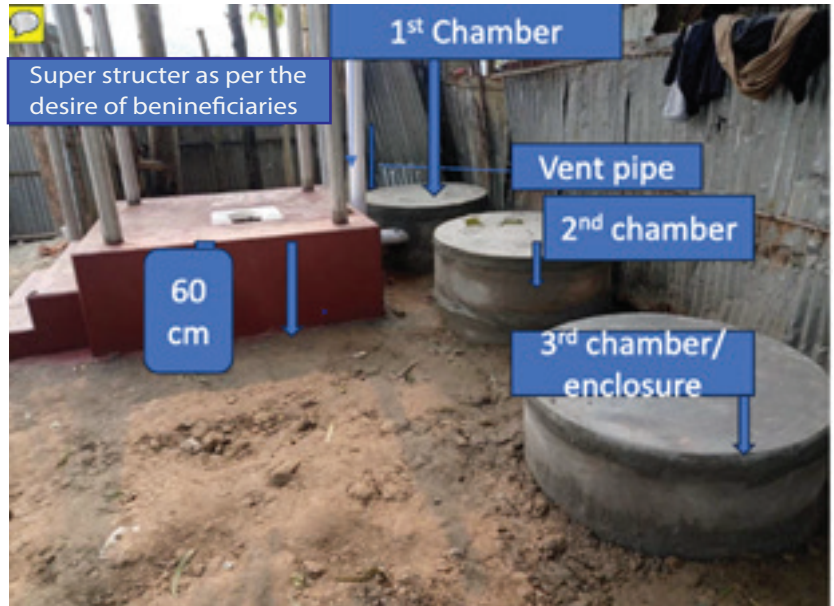


Fig 1. A Green Toilet with chambers without superstructure

Second chamber contains bacterial growth media in the form of used cement bags. Such media is very effective and is compactly placed in the chamber, floating vertically submerged throughout the water column. There are several growth media in the market. But they can't be placed throughout the water column.

The level of flow of effluent is maintained so that it flows from the 2nd chamber, to the 3rd chamber at a level of 4"- 6" above the soil surface.

This chamber acts as an enclosure for the

effluent. The height of the 3rd chamber is only 1-1.5ft. Treated effluent percolates in soil from its top surface in the 3rd chamber (where there is no drainage system).

Therefore, there is little or no chance of groundwater pollution where the groundwater table is even 2 meters.

Where a covered drainage system is available, effluent from the 2nd chamber is directly connected to the drainage system for discharge. In that case, a 3rd chamber is not required.



**Physical appearance of samples from the 1st and 2nd Chambers:**



*Fig3. Left sample from 1st chamber and right from 2nd chamber*

The sample from the 1st chamber is blackish, and that of the 2nd chamber it is whitish. It clearly shows the quality of treatment in the 2nd chamber. From the 2nd chamber, it flows to the 3rd chamber at a level of 4-6" above the ground level. In this chamber, effluent percolates through the soil from its top level. Therefore, there is little to no chance of groundwater pollution, depending on the groundwater table of the area.

**Test reports of the effluents:**

Effluent from the 1st and 2nd chambers were analyzed through a well-recognized laboratory in Dhaka, Bangladesh. Reduction of different parameters (TSS, COD, BOD and Total Coliforms) in the effluent of the 2nd chamber, ranges from 96-99.7% over the 1st chamber. It is mainly due to the growth media and the

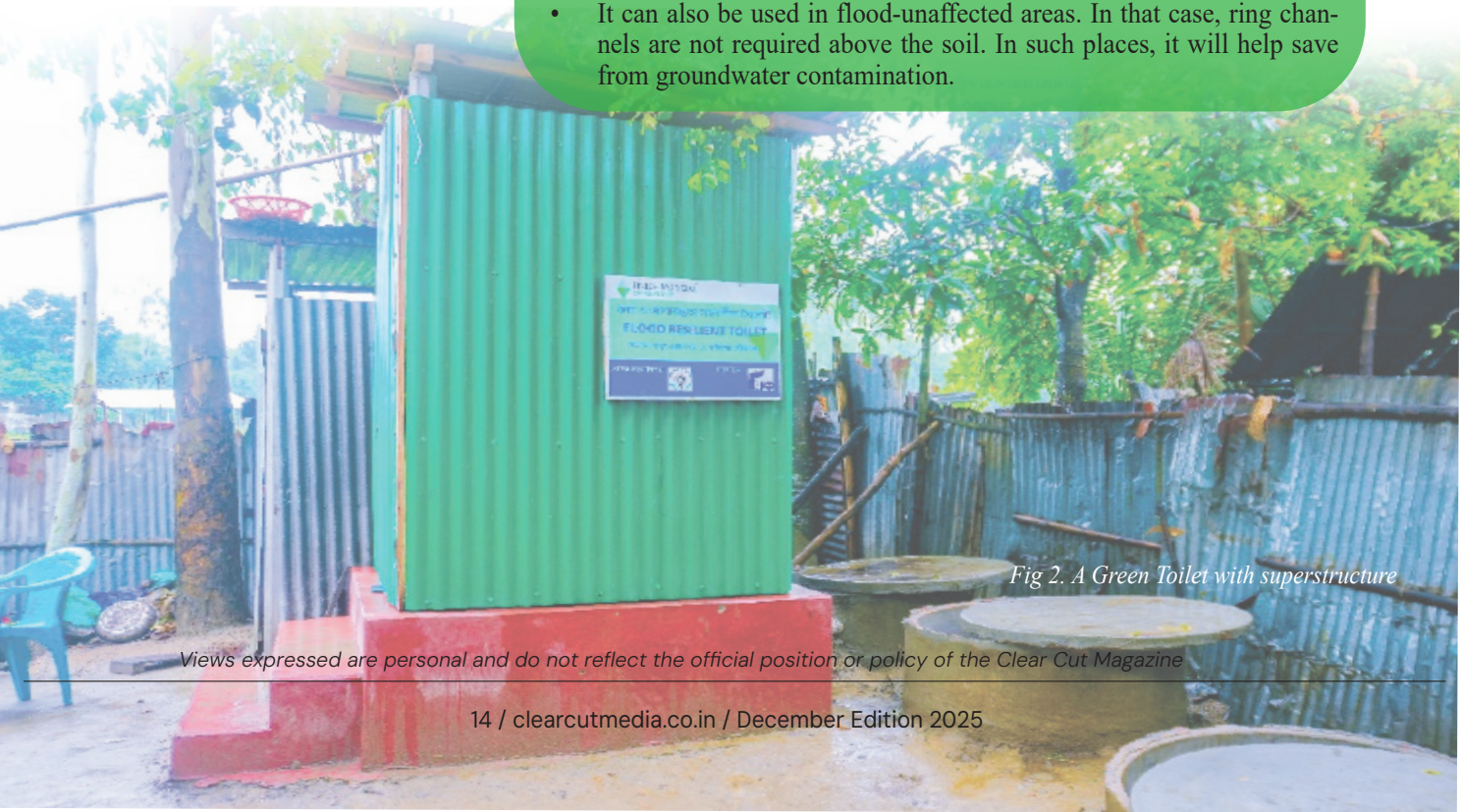
anaerobic filter in the 2nd chamber, which are placed throughout the water column.

Such a high level of effluent treatment is not known with any on-site sanitation technology under anaerobic conditions.

*About the Author:  
Dr. Pawan Kumar Jha, M.Sc., PhD.  
Director, MARC India, New Delhi*

**Advantages of the Green Toilet:**

- It is socio-culturally acceptable, economically affordable, and climate-resilient.
- It can be used uninterrupted during a flood.
- A semi-skilled mason, after training, can construct the entire toilet system within 2-3 days.
- It is low-cost. Its operation and maintenance cost is NIL.
- There is little or no chance of groundwater pollution from Green Toilets, as effluent leaches into the soil from the top surface.
- It can also be used in flood-unaffected areas. In that case, ring channels are not required above the soil. In such places, it will help save from groundwater contamination.



*Fig 2. A Green Toilet with superstructure*

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