Green Toilet Project - Case Study at Rural School in São Domingos - Espera Feliz, Brazil

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Project Partners

Design and Implementation

- Federal University of Viçosa (UFV)
- Fazenda Paraíso State School
- Sanitation Research and Extension Group of the Federal University of Viçosa (GESan)
- Center of Alternative Technology of the Zona da Mata Mineira (CTA-ZM)

Funding

- Swiss Water Partnership Youth (SWP Youth)

1. OBJECTIVE

To design and implement an ecological wastewater treatment system for the State School Fazenda Paraíso - São Domingos using a participatory approach.

2. BACKGROUND

The demand for the construction of an ecological sanitation system was presented to the GESan research group of the University of Viçosa, Brazil by the State School Fazenda Paraíso, coordinated by the teacher and schoolmaster Pacelli Henrique Silva Lopes. The school is located in the municipality of Espera Feliz, in the Zona da Mata of Minas Gerais - Brazil, in the community of São Domingos (Figure 1).

Figure 1: Location of the School unit in São Domingos (Google Maps: -20.5525155,-41.8243598)

The school has approximately 40 people including both employees and students. The community is predominantly composed of medium and low-income family farmers and the coffee monoculture.

Access to WASH in the school

During the first field visit we observed that the school has access to treated water and hygiene infrastructure. They use filters (conventional and ceramic water filter) to clean the water from the kitchen tap before consumption and soap and handwashing facilities are provided for the staff and children (Figure 2).

Figure 2: Water tap, filter, washbasin, and toilet..

The greatest health hazard identified was lack of access to safe sanitation. The school generates wastewater from 3 toilets and a kitchen. Sewage from the toilet was disposed of in a ditch covered by branches and from the kitchen in a blocked grease trap in the neighbor's garden (Figure 3)

Figure 3: Grease trap and trench for disposing of the school's wastewater.

3. DESIGN OF TREATMENT SYSTEMS

An ecological sanitation system was designed to treat the wastewater from the school. The wastewater from the school is divided into blackwater from three bathrooms and greywater from the kitchen. For the treatment of the blackwater we used an Evapotranspiration Tank (TEvap) (treatment system 1) and for the greywater a grease trap (GT) with final disposal in an infiltration trench (IT) (treatment system 2).

The TEvap is a waterproofed tank, which contains filter layers with different materials and sizes, where species of high water demand are planted for their development, and where the absorption of nutrients and water by the plants occurs. The wastewater is deposited in a camera made of tires at the

bottom of the tank, which percolates through the filtering layers and reaches the top soil layer by capillary rise. The water is eliminated by soil and plant evapotranspiration.

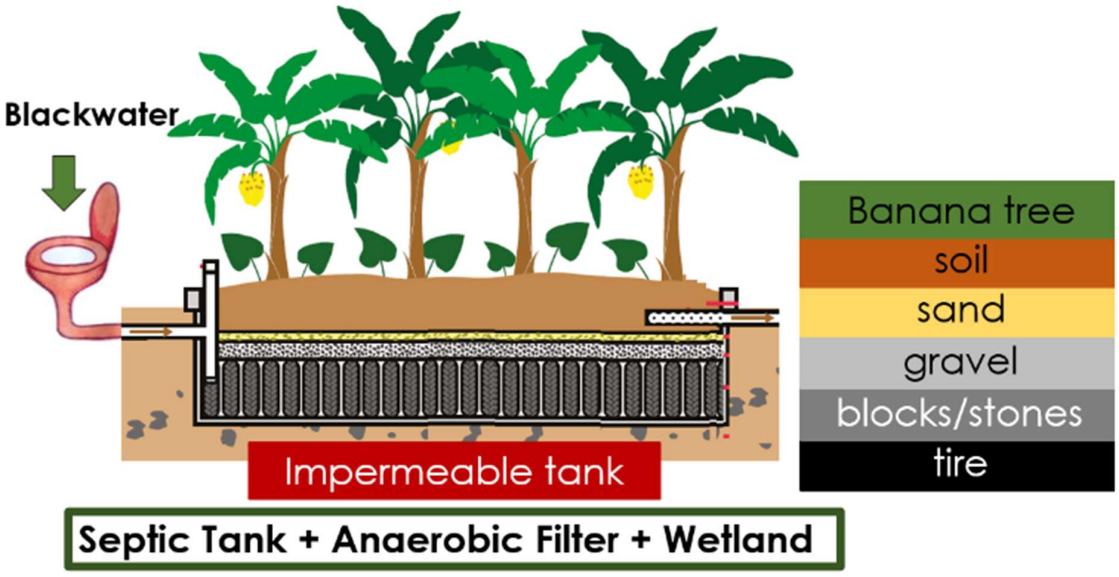


Figure 4: Operation and layers of TEvap.

The TEvap was designed to have 1.5 m depth below ground level and 0.3 m above (to ensure safety). The filter medium used was 60 cm of handmade stone and rubble, 30 cm of gravel, 30 cm of sand and 60 cm of soil for plant support. For the sizing of the surface area the area of 0.4 m^2 per person will be considered. This area was considered due to the fact that it is a half-day school and the most users are children.

The grease trap is the treatment unit for the separation of the fat from water of the kitchen greywater. An important stage of the treatment to avoid the grease accumulation in the infiltration trench, the grease can reduce the lifetime of the system. The grease trap requires periodic maintenance to remove the accumulated grease. The infiltration trench consists of a final disposal system of the greywater from the kitchen. Designed in a rectangular shape and filled with gravel.

The figure 5 shows the ground plan of the school with the location and area used for the construction of the treatment systems. For more information on the design calculations of the systems used and costs please see the appendix.

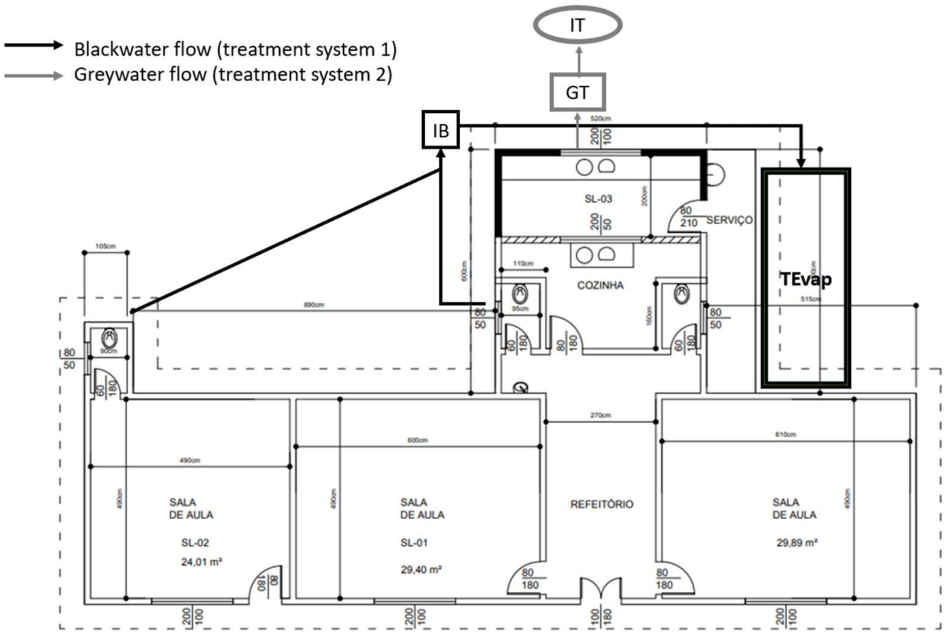


Figure 5: Layout of the school with the areas available for the construction of the treatment systems 1 and 2.

4. IMPLEMENTATION OF TREATMENT SYSTEM

The implementation of the wastewater treatment systems were carried out over several field visits lead by members of the Citizens4water team as well as the GEsan group. A local construction worker as well as two assistant workers, were hired to lead the digging activities of the pits necessary and construct a waterproof tank for the TEvap using local materials and practices.

Field visits

A total of 4 field visits were made with various objectives, from getting to know the site to building and finalizing the wastewater treatment systems, as can be seen in table 1.

Table 1. Dates and purposes of the field visits

Visit	Date	Purpose
01	09/03 - 11/03	First contact with the school and knowledge of the available area, as well as the social and health reality of the project site.
02	16/03 - 19/03	Excavation of the trench for the construction of the TEvap, beginning of the construction of the treatment systems, purchase and delivery of construction materials, and social mobilization of the school and local residents with the sanitation project.
03	30/03 -	TEvap construction completed with a participatory approach to the local

	03/04	community.
04	03/06 - 05/06	Connecting the bathroom pipes with the TEvap and installing the grease trap (GT) and infiltration trench (IT).

Participatory Workshop

The participatory workshop was organized by Juliano Silva and Esther Greenwood on April 2nd, 2022 in the state school of São Domingos. It consisted of a theoretical and practical part. The theoretical part took approximately 2 hours and was attended by 3 representatives from the community (1 female, 2 male). In this
session we brainstormed with participants about the importance of access to safe sanitation and explained how the TEvap and grease box are built and function. The practical part took 4-5 hours and involved filling the water impermeable tank with filter material including building stones, gravel, sand and earth and planting banana trees and heliconia on top.



Figure 6: records of the participative construction of TEvap with the community.

Community engagement and workshop participation

During the first field visits efforts were made to engage with students in the schools and other members of the community living in the neighborhood to better understand their interest for improving their sanitation systems and inform them about our work in the school through informal conversations.Interactions with the students were facilitated through the headmaster of the school who encouraged students to help with preparations for the construction of the tank during and after school hours.

Despite their interest in our work we found it challenging to find people who would commit to taking part in our participatory workshop. Our efforts to collect names of people to participate in the workshop were not successful when using google forms and name lists on sheets which were shared with students via WhatsApp groups as well as left in the school reception.

Communication via the school's Instagram network were also not successful. We found that in general it was challenging for people to commit to a date as their work in the fields was their priority and at weekends most people preferred to go to the bar and relax. We also asked the owner of the bar which was located beside the school to inform and invite customers of the workshop. The owners had a personal interest in our work as it would stop the wastewater from the school accumulating on their land. All of the other participants who joined the workshop lived in the local neighborhood and all but one were reached via the bar owner.

After a few days, some members of Citizens for Water returned together with the GESan Group to finalize the installation of the sanitation systems. On this occasion, the plumbing was connected, the grease trap was installed, and the infiltration trench was built. Thus, the implementation of the wastewater treatment systems was completed and the units available for full use.

Figura 7: records of the step to connecting the bathroom pipes with the TEvap and installing the grease trap (GT) and infiltration trench (IT).

APPENDIX:

DESIGN CALCULATIONS

Grease trap

Volume calculation (Equation 1):

V = 2 N + 20

where:

N = 40 p

V = 100 L

(Note: Dimensions in the descriptive document. There is the idea of using two pre-molded grease tanks in series with a volume of 50 L).

Evapotranspiration Tank

Calculation of the surface area (Equation 2):

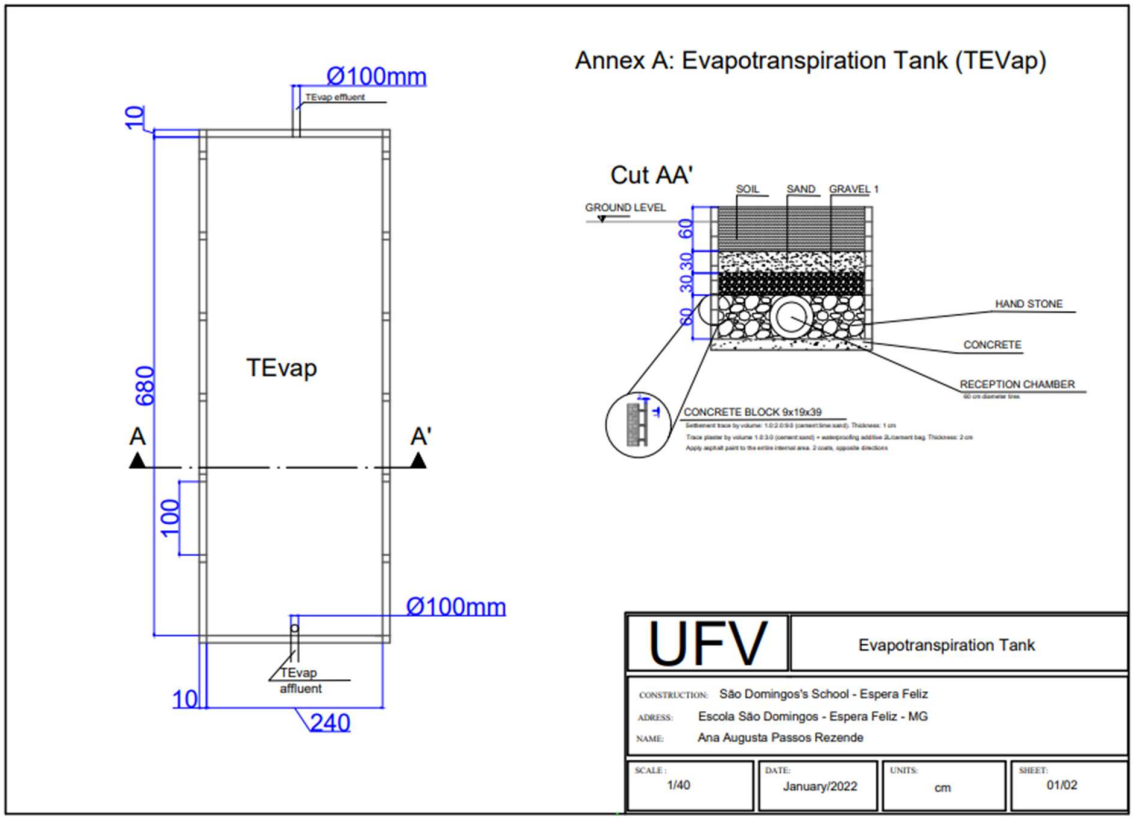
At = N . Ap

where:
n = 40 p
Ap = 0.4 m^2/p

At = 16 m^2

Dimensions:
L = 2,4 m
C = 6,8 m
H = 1,5 m

5. Technical drawings



Annex B: Grease Trap