ALTERNATIVE SYSTEMS FOR WATER SUPPLY AND SANITATION IN RURAL COMMUNITIES OF MEXICO

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Abstract

A marginalized rural community in Morelos, Mexico was selected to establish alternative systems for water supply and sanitation. At the community level a system was installed to capture rainwater that included elements to preserve water quality such as catchment area, sedimentation and storage pot. In the houses were installed appropriate technologies for rain water harvesting, water disinfection by solar radiation, mechanical pump, gray water treatment and waste treatment by composting in addition to implementing a home garden for food production under irrigation operant self. This package of appropriate technologies provide alternative management and use of water to the residents of this community.

Key Words: Appropriate technologies, rain water harvesting, rural areas.

Introduction

A diagnosis on the status of water and sanitation in marginalized communities in the municipalities of Los Altos de Morelos (Gómez, 2007) identified specific actions to improve water supply and promote the use and wastewater treatment. Among the study communities is Felipe Neri which belongs to the municipality of Tlalnepantla, State of Morelos, whose lack of water from surface sources and / or ground water has resulted in the search for alternative sources of supply such as the rainwater catchment housing and community level. As is known, the quantity and quality of water used in homes and proper sanitation have a great influence on health therefore decided to establish a community model for capturing and storing rain water to provide 12.5 l / p / day and the volume stored in the tanks home (at least 10 m^3), will allow the population to have a water supply of at least 46.5 liters per person per day, which is within the range recommended by the World Health Organization (WHO, 2006) to meet the needs of hygiene, food preparation, drinking and washing clothes. At home were installed ten packages of appropriate technologies for water supply, water disinfection, wastewater treatment and water reuse.

Methods

With rainfall data for the last 20 years in the study area, the material used in the catchment area and water supply, we determined the area required to capture rain water, the volume of sediment and storage pot to give to 12.5 l / p / d for 1300 inhabitants, for calculations we used the methodology of the runoff coefficient for this type of system (COLPOS, 2007), the same procedure was used to calculate the rain water harvesting at home. Other appropriate technologies as gray water treatment was designed to comply with NOM-001-SEMARNAT-1996 that establishes the maximum permissible limits of pollutants in wastewater discharges in water and soil. For the production of food for family consumption, we implemented a home garden with the minimum dimensions for the needs of a family of five people on average that includes elements for the automatic irrigation and pumping without electricity consumption. For drinking water a solar concentrator is used to disinfect water and meet the drinking water standard.

Results and discussion

Community model of rainwater catchment includes the following elements: a) a catchment area of 1.920 m^2 on compacted natural ground level and covered with geomembrane Polyvinyl Chloride (PVC) of 1.2 mm thickness, b) a 315 m^3 sedimentation tank formed by compacted soil excavation and covered with PVC geomembrane thickness of 1.2 mm equipped with gratings of 3 and 5 cm opening and screens inside to slow the water flow and allowing the sedimentation of smaller particles (Figure 1), c) pot of 2.800 m3 of storage capacity, formed from the excavation of ground floor also slopes covered with PVC geomembrane in which was placed a geomembrane floating cover equipped with 12 strainers 4 in diameter and 7 floats 8 in diameter and 6 m in length, this cover allows the one hand, the income of the water collected on the surface and another, to protect the stored water from solar radiation income and animal waste (Figure 2). This system can provide better quality water in addition to these community models are scalable and adaptable to the geomorphological characteristics of different areas.

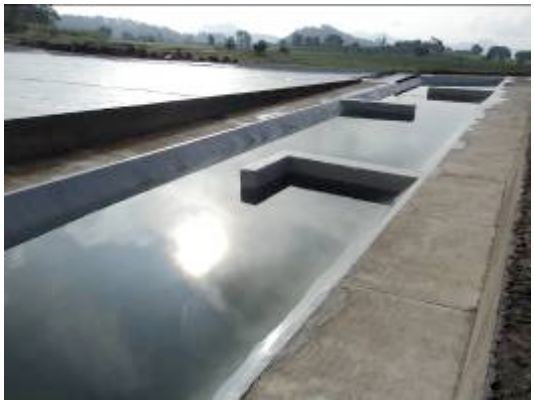

Figura 1. Catchment area and sedimentation tank.

Figura 2. Storage tank.

For water supply and sanitation in homes was considered an average of five persons per family and a water consumption of 45 l / p / day which resulted in a required storage volume of 50 m3, for this was installed a cylindrical tank , made of brick coated steel mesh and concrete. The gray water from washing dishes and clothes are sent to a grease trap and then to an anaerobic–aerobic biological treatment which consists of an upflow anaerobic filter and finally through a horizontal subsurface flow wetland (Figure 3). For the treatment of feces was installed a dry ecological toilet, which has a toilet with urine separation, and two composting cameras with a vent pipe and hoses to send the urine to a soakaway

To disinfect drinking water was installed a solar box developed by researchers at the Mexican Institute of Water Technology (IMTA). The solar box consists of wood paneling and mirrors to concentrate solar radiation in bottles of Polyethylene Terephthalate (PET) filled with water free of solids which after 8 h of exposure is achieved 99.99% inactivation of bacteria (Martin et al, 1999). The family garden has an area of up to 72 m^2 and is designed to produce food for a family. The orchard is irrigated by intermittent self operating system called Flush Tank Fund (FTF), consisting of a 200 liter tank, a device for opening and closing and a perforated pipe for selective irrigation furrows to which is equipped with gates. With the FTF can ensure irrigation efficiencies above 75%. For the distribution of water in the home or to the family garden was implemented a bicycle pump, a device that works through the mechanical action of pedaling a bicycle (Figure 4).

As a result the houses have water in adequate quantity and quality for human use and consumption during dry season, and get products such as gray treated wastewater for irrigation of the garden and compost obtained from the dry toilet, the pump requires no electricity and the family has a surface for food production.

Figura 3. Ecological laundry.

Figura 4.Package of appropriate technologies.

Conclusions

The implementation of solutions aimed at individual or community use of small sources of water or rain water and sanitation using small-scale alternatives that meet the specific needs of each community that are both easy to operate and low cost, enable sustainable water management in rural areas.

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