Global Gant 1524632
Addendum : Final Text-Report

> … Nun tut es mir doch leid, dass wir nicht noch länger bleiben können. Wir haben hier viele Freunde gefunden - und natürlich auch viel geschafft. Am Dienstagmorgen werden wir an einer letzten Dienstberatung mit Zoara teilnehmen …
>
> … at the end we are sorry that we cannot stay longer. We made many friends and, naturally, achieved a lot. On Tuesday morning we will participate at the last meeting with Zoara staff …
>
> **Maik Herrmann,** March 27th, 2016

Background – purpose of the Global Grant

This Project was planned following a "request" by Dr. Elson Randrianantenaina from Madagascar, who visited the RC Leipzig during the spring of 2013 in search of support for a newly planned rural hospital in Southern Madagascar. Following his presentation details of his intentions were discussed and it became clear that a concept for hygienized, (non-chlorinated) drinking-water supplies as well as a concept for the treatment and environmentally friendly disposal of waste fluids from toilets, showers and other water uses were missing. We, "Water-without-Borders e.V," (WoG) and the RC Leipzig were asked for help.

Partners and Roles

Dr. Elson R. had established a small, surgical-oriented hospital in the vicinity of Fotadrevo in Southern Madagascar and in an area without any medical support. This hospital operated in rental space and was financially independent with an enormous demand for medical services. Against this background, he had decided to build a new small hospital with approximately 50 beds for stationary patients and additional ambulant services. Partner in this endeavour was the NGO "Doctors for Madagaskar e.V." (DfM) who provided the funding for the new buildings. The task of WoG was to establish a water supply system and waste water disposal facilities.

"Water without Borders" (WoG) was founded in 2013 in order to provide German Rotary Clubs with assistance for water projects in developing countries. It is WoG's special aim to support not only hygienized drinking water supplies but also environmentally friendly waste water treatments. The classical Rotarian approach to provide a well and distribution system for water is considered inadequate and in urgent need of replacement. In addition, WoG permits the application use of German tax laws for humanitarian projects and thus complements the activities of WASRAG (Water and Sanitation Rotarian Action Group). WoG sees itself as a partner of WASRAG and follows the activities of ESFI (Eau Sans Frontiers International) in France. Both WoG and ESFI are public service organisations (NGO's) with tax-exempt status and function as organisations from Rotarians for Rotarians.

The decision to apply for a Global Grant for partial funding of this project was taken after consultation with RDG (Rotary Deutschland Gemeindienst) in Düsseldorf, the arm of TRF in Germany. RDG accepted WoG as lead agency for the project and all financial aspects were handled directly with and through RDG. Money transfer to Madagascar occurred only following specific requests with appropriate documentation. This assistance of RDG was co-responsible for the ultimate success of the project.

As partner for the Global Grant application (Fig.1) acted the RI District 1880 and several Rotary Clubs in Germany under the leadership of RC Leipzig and RC Leipzig-Centrum. Two private sponsors added their support. Our host partner was the RC Ivato in Madagascar who became essential for the execution of the project. The value of the help of his members in the transfer of funds from Germany, the help with personal accounts of

the young

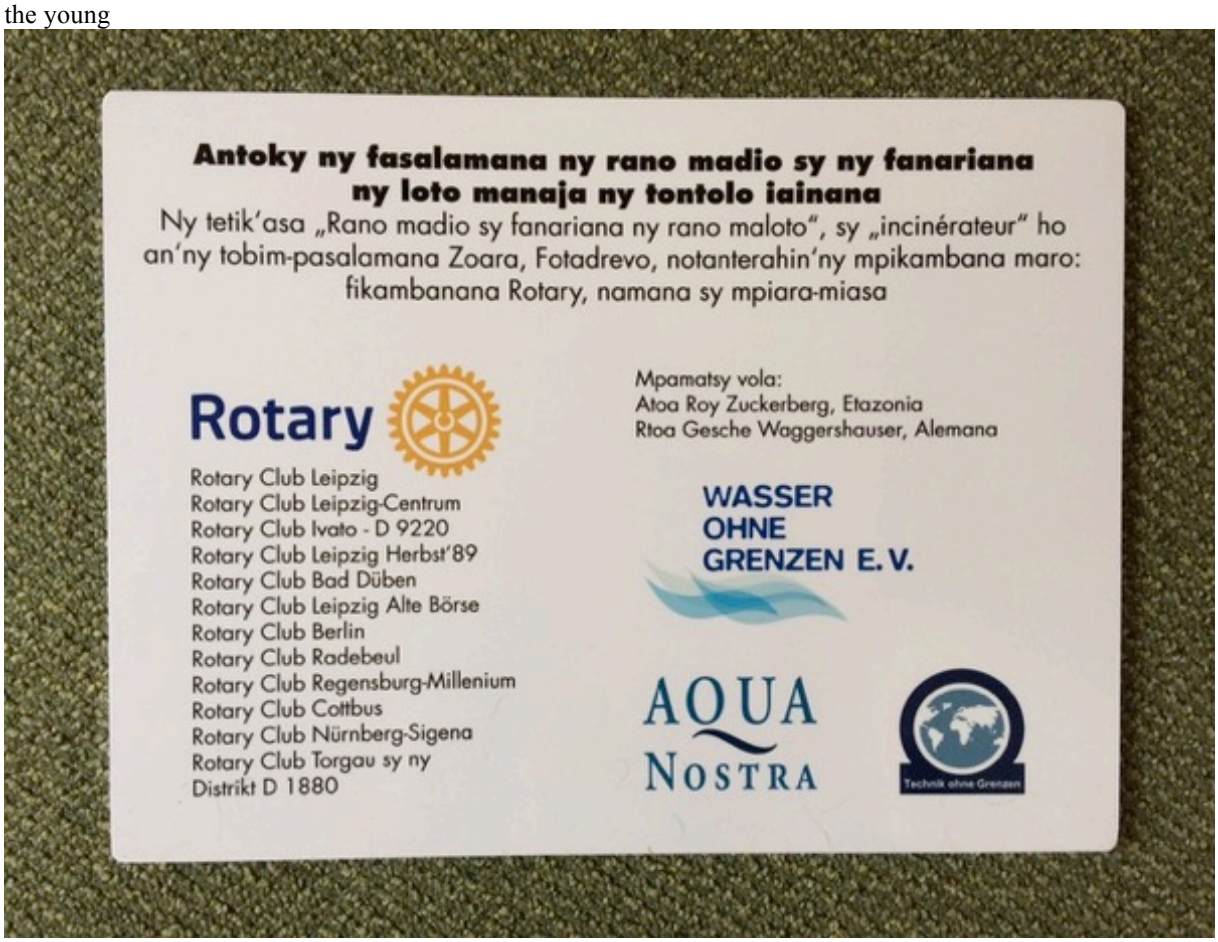

Fig. 1. Plaque at the hospital showing donors and sponsors

For the young Germans from "TeoG" which participated on the construction process, the help with accommodation during transit, assistance with the purchase and transfer to Fotadrevo of building materials as well as some site visits cannot be overstated. This collaboration developed very well – thanks also to the financial management by RDG.

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The actual construction of the facilities succeeded with the help of students working for "Technic-without-borders e.V." (TeoG) again a NGO from Rotarians for Rotarians. The financing of this group had to occur largely outside the Global Grant, because travel restriction did not permit their direct engagement. In our view, this is a too restrictive measure and caused serious problems – see below.

The supervising technical partner was the SME "Aqua Nostra" at Striegistal in Saxony. The CEO Maik Herrmann guided not only the initial site inspection and planning but was also very actively and decisively involved in the supervision and construction of the facilities.

The Project-Concept/ Project Goals:

Hygienic Drinking Water Supplies and Waste Water Treatment Facilities for Small Rural Hospitals or Schools in Africa.

Basics

Sub-Saharan Africa still lags behind most other developing regions in terms of drinking water supply and sanitation, causing illness and death from water-borne diseases (see Millennium goals and their non-achievement). Therefore, international efforts focus increasingly on Water, Sanitation and Health programs (WASH) for small communities and population centers.

A great number of international organizations across the developing world are engaged in providing safe drinking water to rural population. If the hydrogeology and meteorological regime of the areas are known this is a rather simple and straight forward task, especially if options for purification methods exist and can be selected according to local conditions.
However, personal experience from Mauritius and Zimbabwe as well as comprehensive discussions with representatives/members of the Network of African Academies of Sciences (NASAC) shows that few, if any, transferable concepts exist for dealing with waste and waste water especially in rural hospitals and schools. Most disposal methods are very unsatisfactory and pose a danger to the health of rural communities because transfer of waste water to surface water systems or groundwater is not excluded.

In order to address this need and to help development organizations the not-for-profit NGO "Water-without-Borders e,V." (WoG) was founded and works very closely with "Aqua Nostra", a commercial SME company which provided the technological know-how for low cost waste water treatment systems and supported WoG during the installation of such facilities in Madagascar.

The first task was to define a technological concept applicable to an environment without electrical power and limited water supply and then install this as a pilot facility at a new clinic in Southern Madagascar. This positive decision was taken because the medical Director of the clinic recognized the need for a chlorine-free drinking water supply as well as waste water treatment facilities. His support offered a good perspective for sustainability. In other words: this project was seen as a pilot and learning facility and applies exclusively low cost technologies which do not require a continuous power supply and can be operated and maintained by local personnel.

The functions for such facilities are:

a) low-cost, functional and transferable.
b) they fulfill the basic needs of small hospitals, namely the provision of hygienically safe drinking water and the safe treatment and disposal of waste-fluids and
c) permit the reuse of sufficiently treated water for the (non-food) production of organic matter
d) can be operated by local personnel which will be trained on-site and, finally,
e) can demonstrate the feasibility of WASH concepts for applications in schools and in the local communities.

The South of Madagascar is extremely under-developed and has very few medical facilities. One of these is in Fotadrevo. There, Dr. Randrianantenaina established a small clinic and began to operate in very limited rented space and with military tents for the patients. This clinic now serves a region with at least 150000 inhabitants. The present new locality is also close to the village of Fotadrevo and is privately owned: The overall responsibility for the project and development of the new clinic lies again with Dr. Randrianantenaina. He is the clinical Director of the hospital and director of the Elson Hanitra Madagascar Mission (EHMM), a Madagascan not-for-profit organization which was incorporated in 2006 as NGO by a group of Madagascan doctors, lawyers and administrators with the aim to improve the wellbeing of people especially in the poor South of the country. The association EHMM is also committed to improving basic education in rural areas and runs projects to improve social justice and nutrition in local communities.

Fig 2. The new Clinic in Fotadrevo, Madagascar. A second phase is planned on this land after the functionality of the present clinic is appropriately documented and financing can be assured. Water supplies and waste water treatment will also be expanded.

This new hospital has been built between August 2016 and March 2016 and operates with about 30 beds. Construction and equipment supplies were largely financed through "Doctors for Madagascar e.V." (DfM) and basic construction of the first phases was finished during April 2015. (see Fig 2). WoG is collaborating with DfM who coordinated the construction of new buildings, the installation of our WASH facilities are closely coordinated with DfM.

Drinking Water

Parallel to the construction of waste water treatment (this GG) the association WoG provided the hospital with a new well for drinking water (Figs 3/4) and a membrane based purification system (Fig.5) which does supply the hospital with clean drinking water. This system works very well (if properly maintained) and supplies all buildings with hygienically clean drinking water.

Although this component of the Water Supply and Treatment System was not financed through the present Global Grant is reported here because it is an integral component of this water supply and treatment system. The financial support came from Rotary District 1880, private donors and several Rotary Clubs in Germany.

Figure 3. New water well with tower with solar panel for the submersible pump.

Figure 4. View of the new well.

Figure 5. Public access – membrane-filter-PAUL used for the hygienisation of drinking water

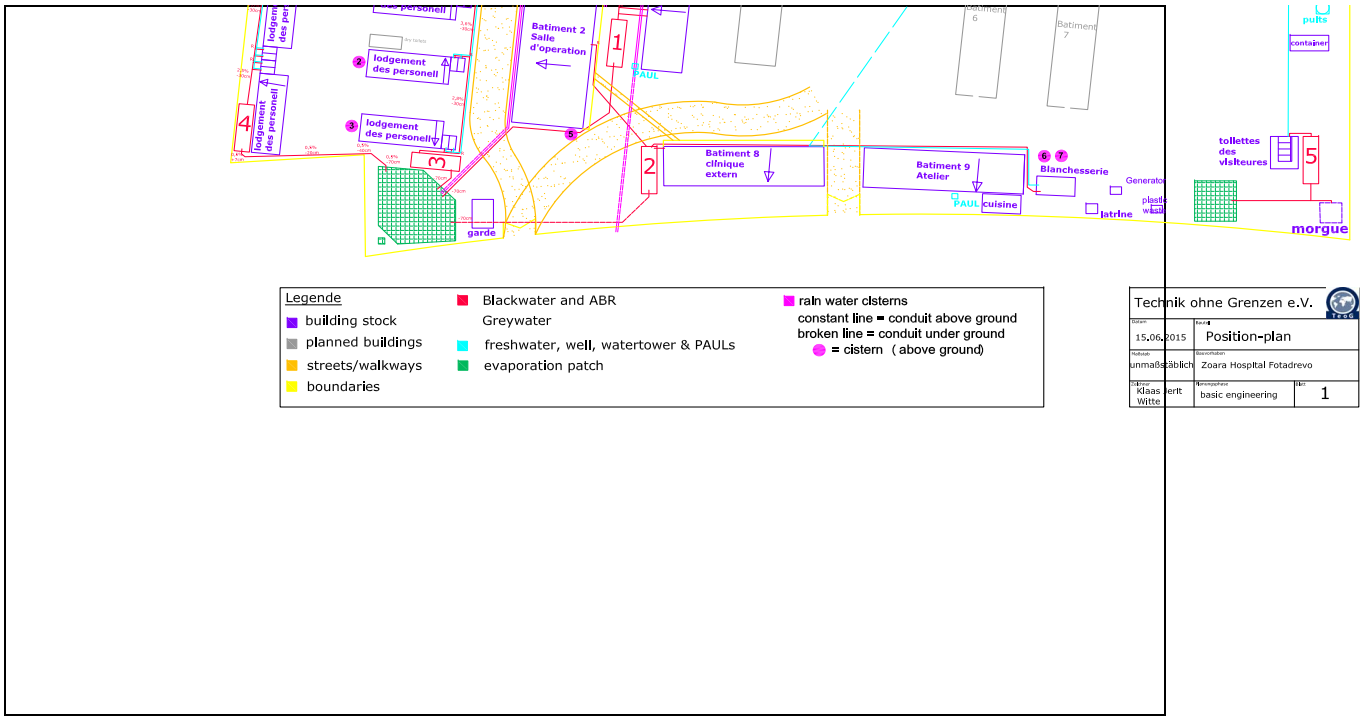


Figure 6. General location map with the lay out of drinking water supply pipes and waste water treatment facilities and future buildings.

Black Water System

To construct and operate successfully a black water treatment system for a rural hospital in an environment without electrical power, no technically trained personnel which, in addition, is largely non-literal as well as a partner Club located a three days trip away from the place of action is a special challenge. Not surprising we faced a number of technical and administrative problems because we should have had permanent supervision from the outside during the entire construction phase. However, Global Grant travel rules do permit only two persons travel to the side and assume that local initiative can carry the project. This, however, is only possible in standardized projects such as well-boring for water supplies but is not possible for more complex projects. Nevertheless, the first components were built by a local contractor. However, non-adherence to the construction plans necessitated subsequent substantial additional expenses to modify or repair these components which were build without supervision. **Thus, the restrictiveness of Global Grants with regards to travel of foreign specialists threatened the success of the entire project:**

Officially permitted travel were undertaken by Aqua Nostra during 2015 and Rot. A. Schoepa during February/April 2016 and a second time during March 2017. These trips served the planning and initial supervision of activities, whereas the last trip was necessary in order to carry out last adjustments and minor repairs with the assistance of the trainee. All other travel for members of TeoG and Aqua Nostra had to be organized and financed through additional funding which was significant as an additional 9 trips had to be undertaken because of outside non-adherence to an agreement regarding the support staff. Furthermore, the formal handover of the installation to the hospital was not yet possible and will have to be undertaken with personal funds.

The first phase of the construction of black water treatment facilities through WoG has been finished during spring 2016 and systems are being tested and operated since. However, in response to local traditions and demands we had to build a two component system, one for the medical staff and patients and another system for guests (not part of this Global Grant). Technological challenges were largely overcome and we can demonstrate to have a functional black water treatment system, which satisfies the needs we had specified at the beginning: no appearance of waste fluids at the surface or other surface contamination and no infiltration into the subsurface.

The medical staff has water toilets and collection of the waste in Anaerobic Biological Reactors (ABR). (Figs 7/8/9/10). Within these systems a fermentation process is initiated with the aid of "effective microorganisms" thus reducing the amount of organic substance. From the ABR the pre-purified waste water is directed toward bottom-sealed evapo-transpiration bed with banana plants used as evapo-transpirators. No residual fluid is left and residual organic compounds are providing nutrients for the plants as well as soil forming components. Initially we assumed that non-nutritional plants such as cotton or bamboo would provide the evapo-transpiration power but locally it was decided to plant bananas, which grow very well and have a higher evapo-transpiration potential (see Fig. 11/12). After ripening of the first bananas appropriate testing for food safety was done in a registered laboratory in Germany. The bananas were declared safe to eat.

The toilet system for the guest (Fig. 13/14) had to respect local traditions which include the use of stones and sticks for cleaning. As open defecation is not permitted on the hospital grounds, we had to construct a latrine type collection system with discharge into an ABR.

Again, this entire system has not been tested before but observations over several months show that no waste water leaves the compound and none appears at the surface thus avoiding breeding grounds for Malaria flies and other harmful insects etc..

Figure 7/8. Five Chamber Abiotic Batch Reactor Unit (ABR) used for the collection and partial treatment of the waste water.

Figures 9/10/. The toilets and showers for patients outside

Figures 11/12. The evapotranspiration bed with banana plants at end of construction and 6 months later

Figure 13/14. The toilets and showers for guest and family members of patients under construction

Grey Water System with Rainwater Collection

The grey water system was planned in order to use the purified water combined with rainwater for toilet flushing and other simple uses. However, functional waste water treatment systems demand sufficient water supply in order to operate continuously and with minimal service. It turned out, that the present hospital is too small to provide the necessary volumes. Therefore, it was decided to delay the final construction of the grey water treatment facilities until the following phase of expansion of the hospital – as indicated on the map of Fig. 6. Gray-water is now being collected and treated with the black-water in the ABRs.

In addition, a functioning rainwater collection system has been installed. Rain water is collected in large surface tanks (fig.15/16). These 5 m^3 tanks were constructed for the project in Antanarivo. As long as the water is fresh it can be used for washing and showering and represents an emergency supply. However, the tanks have to remain closed in order to prevent breeding and growth of differing fly larvae. The rainwater will in general not be hygienized and, therefore, a portion is used to flush the patients toilette.

A number of tanks may be retained for emergency situations in which case the water may have to be sterilized with chlorine compounds and thereafter must be passed through the membrane system before use.
Furthermore, should the future expansion of the clinic, which is already in the planning stages, require a functioning grey-water collection and treatment for toilet flushing then the present installations can be used in toto.

Any excess rain water collected is being passed into gravel filled infiltration pits (no ponds !!!) in order to foster ground water renewal though infiltration.


Figures /15/16. Rain-water collection tanks manufactured for installation at the Hospital in Fotadrevo

Training

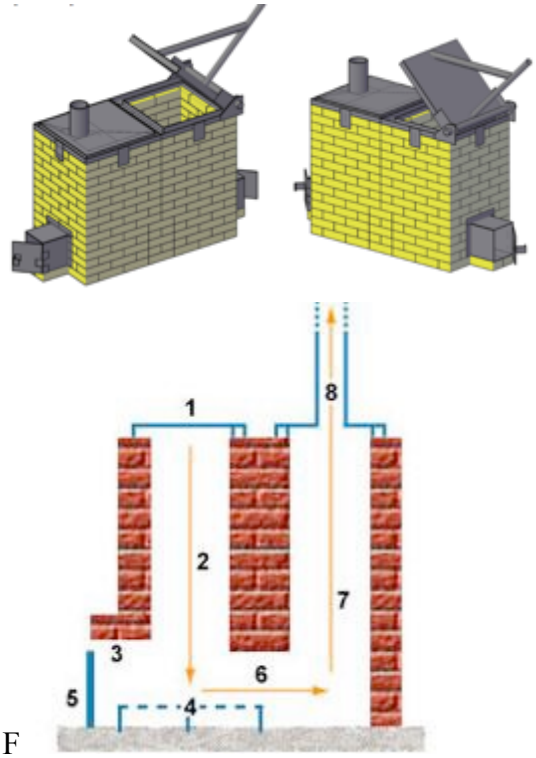
Before starting construction we had an agreement with the hospital and DfM that two persons employed by the hospital would participate in the construction of the facilities and be trained to instruct the users about the use of the facilities, supervise their use and maintain their functionality. Because of local staff-problems, this agreement was only partially and intermittently fulfilled which necessitated extra efforts on our part in the cinstruction efforts as well as their use und function.

However, in May 2016 on person was hired and is now dedicated to the system. Although without technical training, he was introduced during a 3 months period to the technical aspects of the system (learning by doing) during the last phase of revision in the fall of 2016.
During a site visit in the spring of 2017, he then received three weeks of theoretical training on hygiene and the function and maintenance of individual components.

All funds left in the Global Grant should be used to assist in the continued financing of this person.

Incinerator

The hospital required an incinerator for the hospital waste and as there is enough burning material to ensure a clean solution for the disposal of the infectious waste it was decided to build a DeMontfort Mark 8a. unit which can be constructed with local building-materials. This model can burn around 50 kg of waste per hour and has an average lifespan of 3-5 years. Its dimension are ca. 1380 x 690 x 1140 mm (length x width x height) without the outer layer and the chimney.
The figure 17 below shows the appearance and schematic layout of the incinerator as well as the “path” followed by waste during the burning process. In the beginning the incinerator will be preheated until it reaches its operating temperature after about an hour. Then the waste is inserted through the loading door (1) into the first combustion chamber (2) and the door is closed with an airtight sand seal. In the chamber the waste is heated by radiation from the hot bricks and falls down as the previous load is burned away. The waste is burned until the ash finally falls through the grate (4). From the ash door in the front (5) air flows into the tunnel (3) and forces the combustible gases (such as carbon monoxide) into the second combustion chamber (7). There they meet a further supply of air from a second ash door in the back (not shown in the figure). The gases undergo a second combustion, raising temperatures even higher, and reducing them to stable compounds (such as carbon dioxide). The hot gases then escape through the chimney (8). They are denser than the surrounding air and this difference provides the driving force to induce more air into the combustion chambers.



(1) Loading door
(2) First combustion chamber
(3) Tunnel
(4) Grate
(5) Ash door
(6) Tunnel
(7) Second combustion chamber
(8) Chimney

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Figure 16. Major components and areas of the De Montfort incinerator

Figure 17. Incineration unit after completion

Benefits

In a hospital environment it is difficult to estimate correctly the number of people served by this facility. However, on average there are daily about 200 – 300 people on the grounds:
All benefits of this project go to the staff, patients and family members of patients or guests. There are about 20 medical/hospital staff employed by the clinic and most live with their families on the hospital ground. There is no kitchen for the approximately 30 stationary patients and therefore, 2 -3 family members come with each patient. No accounting exists for the much larger number of ambulant patients.

The "WASH-education" reaches thus a very large number of local people and has lead to requests to expand these services.

Unfortunately, the number of wells in the area has increased during recent years and the hospital uses about 4-5 times more water than anticipated by the director and DfM before construction. Combined, this has the consequence that water levels are falling and deeper wells will have to be installed. The rainwater management component of this project has thus been proven to be a necessary benefit as it provided an additional water supply.

Promotion of Pilot Facility and potential Other Localities

The WASH project in Fotadrevo is presently been "copied" and installed at a second hospital in southern Madagascar. A local Builder has studied our documents and the installation and has offered to build a waster treatment unit at the Ejida hospital accordingly. (see Fig. 18)

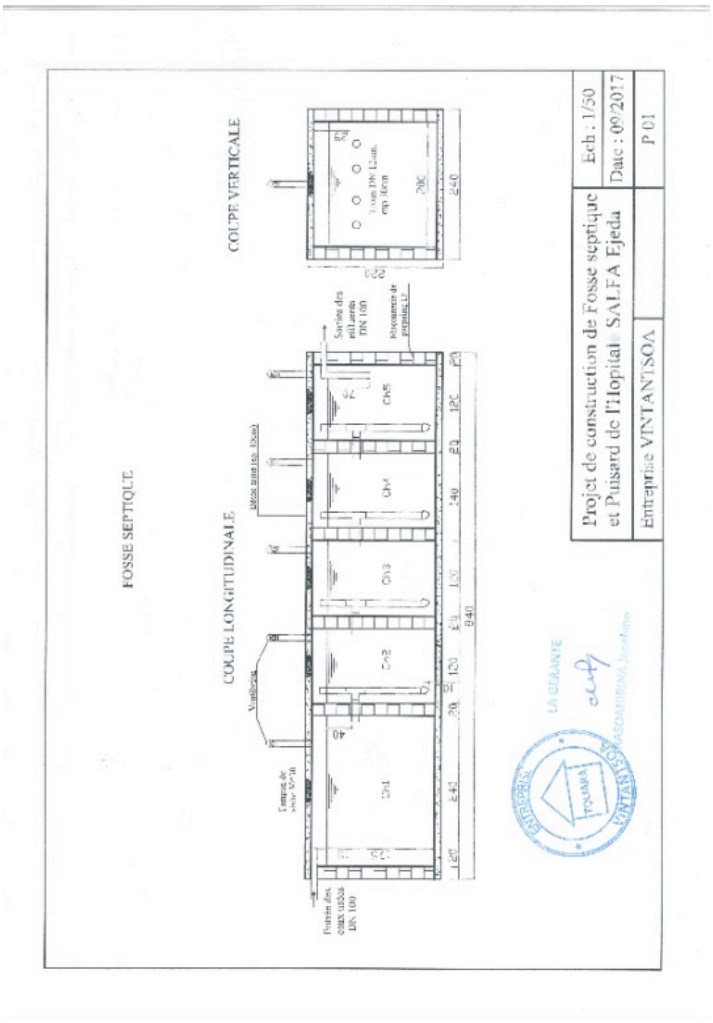

Fig. 18. Copy of Fotadreveo design for the treatment of waste water.
The Fotadreveo installation also was guiding the installation of hygienized drinking water and waste water treatment facilities in an orphanage an school in Caye , Haiti. The project was carried out by our TeoG partners and the SME Aqua Nostra with financing through a German non-Rotarian-NGO. However, the concluding work in Haiti will deal with rainwater management and will be an independent Global Grant, that tackles issues not addressed within the previous activities.

Additional WASH projects with the assistance of WoG are in preparation:

RC Radebeul with the support of District 1880, other RC's in the District as well as WoG plan a WASH project in Ethiopia at a locality where a new and stable settlement has been established.

RC Leipzig with the support of other Clubs in Leipzig, the District 1880 and WoG are preparing a WASH - project in Sierra Leone where the NGO Forticolo e.V. has been active for over a decade in the regional development and has built more than 10 schools and several community projects. WoG will provide concepts for integrated WASH projects first on a pilot base and then wherever in the overall project need arises.

In addition, WoG has started an annual water-forum series, where the fourth forum will be held this year (2017) in October in Oberhausen , Germany. Participants are Rotarians which a have been nominated to function as District speakers for water projects as well as interested Rotarians. This series is an increasing success because it also presents a platform for open discussion of projects planned or in progress by Rotary Districts and Clubs in Germany. The Madagascar project was presented on several occasions within and outside the Fora. In this context WoG presents itself as partner for the Clubs and Districts and assistance with advice, partnership or project-management. The overall theme for the Oberhausen meeting is the controlled irrigation of school gardens and small-scale agriculture in water scarce areas of Africa. The topic is presented by a professional scientist and then discussed within the group.

Education

The entire system of Water supply and treatment was build in partnership and ,(following appropriate instruction, with the assistance and guidance of students from TeoG. They used their knowledge gained to prepare their thesis at their respective University:

1) One Bachelor Thesis was written at the University of Karlsruhe

   Author : Lea Kohlhage
   Title: Erarbeitung eines methodischen Vorgehens zur Konzeption eines Trink- und Abwassersystems am konkreten Beispiel der Entwicklungszusammenarbeit in Fotadrevo. April 2014

2) One MSc and one BEng Thesis were written and defended at the Applied Technical University of Leipzig

MSc Thesis
Author: Nico Reuschl,
T itle: Besonderheiten bei der Ausführung von Baustellen in Entwicklungsländern am Beispiel des Zoara Hospitals in Fotadrevo, Madagaskar, May 2017

BEng.Thesis
Authot: Klaas Jerit Witte
Title: Wasserver-und Abwasserentsorgung in ariden Gebieten von Entwicklungsländern am Beispiel des Südens von Madagaskar. August 2017