

## **Case Study B**

# **COMMUNITY INVOLVEMENT IN GROUNDWATER POLLUTION STUDY**

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## 1.0 INTRODUCTION

Water is one of the vital needs for daily life throughout every Country in the world, so we have a huge responsibility, not only because we need a continuous supply of water, but because we also need that water to be pure and clean.

The aim of this paper is to describe a process of community education and understanding regarding groundwater pollution and water conservation. It is a useful study because it has many aspects and the understanding and developments have progressed over five years. Some outcomes were planned and some were unexpected and there are lessons to be learnt in the process. The program involved the co-operation of a number of government departments: the Tonga Water Board, the Ministry of Health, the Ministry of Lands Survey and Natural Resources, and the Central Planning Department. It also involved schools and community members, Town Officers, and village committees. The program began with the linking of two projects, a Composting Toilet (CT) trial and a research study into groundwater pollution. The second stage of the program was when another community had heard about the CT trial and decided to install this system on their island.

## 2.0 STAGE ONE: TRIALS AND RESEARCH

A trial of CTs was undertaken in Tonga, 1997-1999, as part of an AusAID funded project to institutionally develop the Tonga Water Board (Falkland 1995; Crennan and Benke 1996; Crennan 1999). In the town of Pangai-Hihifo in Ha'apai, reticulated water was sourced from under a farming area outside the town. Over the years, this groundwater had become increasingly salty, and the Tonga Water Board planned to re-locate to a new source and install infiltration galleries into the lens of 'sweet' water under Panagai-Hihifo. Many people had private wells into this valuable catchment, and this is why the village had originally been settled there. However, the water was polluted from septic tanks, pit latrines and domestic animals (Tapealava 1996; IHP/UNESCO 2001). It was considered important to develop a toilet system that did not discharge into the lens and did not use precious water for flushing.

### One to one discussions

In this trial, construction of the toilets were preceded by a large community meeting and small gender segregated group discussions, and then a 'customer survey' of 10% of the town's household's (population approximately 3500 people at that time). Discussions of 2-3 hours were conducted by an external adviser with each household covering issues of water use, and sanitation practice. All households surveyed had a toilet and many households had both a flush toilet and a pit latrine. Most households had access to a rainwater tank and reticulated water, while some also had a private well.

### Volunteer participants make a financial commitment

The idea of a composting toilet was introduced at the end of the discussion, and photographs were shown of CTs in Kiribati, Australia and Europe. Residents were offered the possibility of becoming participants in the trial if it interested them. However, it would cost them 100 pa'anga, (approx \$US50), in advance, to contribute toward materials. There was opportunity for 13 households to participate and this offer was taken up by a cross section of households that varied in economic and educational circumstances. For some families raising the \$T100 was slow and difficult, for others it was just inconvenient. The participants were genuine volunteers and 'ownership' was much increased by the financial commitment.

One CT was installed at a Catholic school and one at a Free Church of Tonga compound, also on a volunteer basis and requiring a financial commitment. The school staff volunteered because they had recently hosted an annual church conference and had been horrified by the consumption of water and blockages in their flush toilets. They also had ongoing water loss from cisterns leaking due to mineral deposits jamming the flushing mechanism. These continuous slow cistern leaks are common in the PICs where groundwater is used for flushing toilets, and they result in much wasted water and extra loading on septic tanks, discharge areas and receiving waters.

## **Saving money is a powerful incentive**

The Deputy Head Master was also the science teacher and he specialised in organic farming. Although Tongan soil is fertile, he could still see a potential use for the compost from the toilets (Pers. comm. Hausia 1997). In Tonga, the community pays for reticulated water and it was reported that nearly half the school's infrastructure budget was consumed in paying for water for the flush toilets. Herein lies the strong motivation to use a dry system ie to save money on water bills. Having found an advocate for the system among the teachers, this school installation proved to be very productive in conveying the message to the community, in a number of ways.

## **Student participation in research**

The composting toilet trial was linked to a UNESCO/IHP/SOPAC-funded groundwater pollution study. The project aims were to establish evidence of the rate and direction of flow of groundwater, the degree of groundwater pollution in the village context, and where pollution was coming from. The overarching question was whether or not there is a safe distance in a village context for the siting of wells and sanitation facilities in relation to each other. This aimed to review the standard criteria that had been imported to the Pacific that 30 m was a safe distance between a water supply source such as a well, and a source of pollution such as a toilet. That standard had been based on European soils and groundwater characteristics, and had not been adapted to local conditions since its introduction to the Pacific in the 1960s (Dillon 1997).

The significance in linking the two projects in terms of community participation was that the second stage of the groundwater pollution study was conducted in the Catholic school grounds, and the children constructed the site and assisted with monitoring of the experiment. The older boys dug the holes down to the groundwater for the monitoring bores (or piezometers), and in return their school fees for one term were paid, ensuring that their parents heard about the project. The whole school witnessed the application of dye tracers into the central piezometer and later observed the pale appearance of the dye in water samples taken from further afield that indicated the direction and rate of flow the groundwater. Prior to this demonstration, the children and most of the teachers did not understand the movement of the groundwater, or that it was capable of carrying pollutants between various sites.

For many months the children regularly collected samples from the piezometers, under the supervision of the science teacher, before final tests were conducted. Samples were also taken from groundwater around the large septic tank that showed that the concentration of pollution in the groundwater closest to the tank was very high and gradually diluted away from the tank. These experiments demonstrated that in a densely populated village area where neighbouring in-ground toilets are located close to each other, pollution may be widespread. Rather than closing private wells to avoid the polluted water, an alternative solution was to use a 'dry' above ground toilet such as the CT instead of the pit latrines and flush toilets. This allows households to keep their independent access to well water and increases motivation to protect the groundwater as a community asset.

## **Appropriate training**

In addition to providing evidence of groundwater pollution from sanitation facilities, the UNESCO/SOPAC groundwater pollution study indicated how to more fully utilise a research process to increase community awareness (IHP 2001). Certain difficulties arose in the first phase of the study, which provided a number of lessons in the planning and management of a cross-cultural, multi-disciplinary project of this nature. In addition, polite feedback from Tongan team members, after the initial fieldwork was completed, revealed common frustrations that needed to be taken into account in counterpart training programs. The second phase of the study was adjusted to ease those frustrations. Although this groundwater pollution study was initially focused on educating government employees, these people are also community members and their training will personally and professionally influence and inform public opinion and understanding. The concerns which needed attention included the following issues.

- **Selection of Location:** the dye tracing experiments were initially conducted in a public oval and the unprotected site was partially vandalised which affected the results of the study and diminished its importance and relevance in the eyes of the community.

**Response:** as previously mentioned, the experiment was re-located to the school grounds and some tasks in the experiment handed over to the teachers and children.

- Method of training and communication:** in the first study period each of the tasks was performed, usually alone, by a team member already skilled in that particular field. As there was insufficient liaison between the team members as a group, there was little understanding of the roles of the other team members, and minimal comprehension of the process and benefits of a multi-disciplinary study.

**Response:** most study activities in the second phase were undertaken as a group with each member leading the others in activities that related to his or her expertise. As the team members came from the Ministry of Health, the Ministry of Lands Survey and Natural Resources and the Tonga Water Board, this collaboration was in itself educational for the team members, and the community who shared in their work.
- Inaccessible monitoring techniques:** the first tracing experiment using Rhodamine-WT was set up by the expatriate project leader but required collection of samples by Tongan counterparts. This particular tracer was not visible to the naked eye and required sensitive equipment to be detected. The project leader conducted testing of most of the samples in Australia. Consequently the Tongan team members did not learn the skills related to the methodology, or directly experience the logic and outcome of the experiments, Reports detailing experimental results are not necessarily thoroughly read, or believed. Visual demonstration of cause and effect is essential if perceptions are to change.

**Response:** in the second phase, a tracer was used that could be tested in the Tonga Water Board laboratory and team members were trained to use equipment provided by the study. The process was filmed and included in the educational video with an explanation by the Science teacher from the Catholic school. The project report was written as joint effort with each member responsible for a certain section, and all members responsible for overall presentation (Crennan et al.1998). Tongan team members have presented results from the studies at international conferences (Fatai 1999).
- Timing of the study:** the week chosen for the initial in-depth study coincided with the final preparations for the annual conference of the Wesleyan church, the largest congregation in Tonga, which was being held in Pangai-Hihifo that year. This resulted in late arrivals of some team members due to inability to secure seats on the flights to Lifuka. In addition community members and government personnel were very preoccupied with conference preparations and were, therefore not interested or available for the study.

**Response:** Although it is often difficult to avoid or predict local events and preoccupations, major annual gatherings of this nature can be noted and avoided with a little prior investigation, especially when the fieldwork is of such a short duration. Some flexibility was introduced to allow for unexpected events such as funerals. In general, the transfer of most of the responsibility for the conduct of the study to local counterparts and community members reduced the regular demand for inflexible project schedules related to input of expatriate advisers.

### **Integrated maintenance**

The trial CT at the school was used and maintained by three classes of boys, and four flush toilets were closed at the suggestion of the Deputy-Principal. At first there was some shyness but the children quickly adapted and consistently used the CT and named it the 'Organic Toilet'. The usual daily practice of sweeping the grounds supplied dry leaves to put in the toilet with each use, to provide the necessary carbon/ nitrogen balance. The basic biology of the decomposition in the toilets was explained to the children and compared to their compost heap and organic garden. After 12 months of the trial, the Head Mistress requested another composting toilet for the girls to use, but it was not part of the trial to provide further toilets. The parents and teachers then raised funds to build a second CT based on the design of the trial toilet but with cheaper materials and some changes to suit their preferences. The school was delighted to report that their water bill dropped from 70 pa'anga a month to 20 pa'anga a month (approx. \$US 35 to \$US10). The domestic trial participants who had flush toilets also reported savings in water bills (Crennan 1999).

### **Cross-sector support and co-operation**

An amateur educational video in Tongan language was shot during the trial and circulated when the trial was completed. The video was scripted and produced with the assistance of CT trial participants, the teachers and children at the Catholic school and various staff of the Tonga Water Board, the Ministry of Health and the Ministry of Lands Survey and Natural Resources. The involvement of this cross section of government departments and the community conveyed the message that this was a community issue that required a

partnership solution. The process of production of the video was as important as the outcome especially for those who contributed to its development.

### **A holistic approach**

The video was introduced by the national Head of the Tonga Water Board and presented the following activities:

- Sampling of private wells and testing the samples for pollution in a laboratory, the installation of infiltration galleries for the new groundwater supply;
- Tonga Water Board staff repairing leaks and installing water meters;
- The ground water pollution study at the Catholic school;
- The uses of rainwater, tank water, and reticulated water;
- Demonstration of CT maintenance by domestic trial participants, including adding the bulking agent and removing compost from the end-product chamber;
- Demonstration of related hygiene issues especially washing hands after using toilet;
- Australian householders emptying compost from their CT and digging it into their garden;
- Biological testing of the compost and the results;
- Interviews with family members from households with a CT on their views about the toilet; and
- Demonstration at coastal households of marine protection provided by a CT in place of a flush toilet or pit latrine.

Family members from the CT trial households volunteered to act in the video, particularly in the scenes demonstrating use of water around the home, and the vulnerability of groundwater to pollution from domestic animals, in-ground rubbish pits, and poorly maintained wells. AusAID personnel ordered one hundred copies of the video and distributed it to government department and schools in Tonga (Pers. comm. Bleakley 1999).

Regular radio programs were broadcast across Tonga describing the progress of the trial. The information provided was very general to avoid transgressing taboos related to public discussion of personal matters such as hygiene and sanitation. However there were reports of people hearing about the program in outer villages and islands of Tonga.

### **3.0 OBSERVATIONS ON PROCESS AND OUTCOMES**

When I first arrived on Ha'api to work at the Central Planning Department, I was new to the idea of the Compost Toilet, and also its nature. So I tried to seek and find more information and answers for myself by talking to the people who planned and organized this project, so that I could understand more about the purpose and the result of this construction project. I found out that the main purpose of having this compost toilet is to minimize causing of any pollution to under ground water.

From my understanding about this work, it was planned to implement the CT in the Island of Ha'apai, because of its low level and the water is so close to the surface that the ground water is really affected both by flush toilets and pit toilets which most of our Pacific Island and different countries in the world use.

When I came to understand the nature of this task I was really encouraged because of its purpose, first of all, for healthy life of the people. So I thought, as a development officer for Rural Areas, I have a special need to find ways to develop the way people live in their respective villages.

As a result of my new understanding I tried to promote and encourage the families to use compost toilet. One of the problems in promoting in this area is making various families understand the nature of compost toilet. How to use it, how to keep it just for the benefit of family as a whole and most of all not to cause any effect on under ground water. There was an education program conducted with the trial but sometimes the people did not quite understand what was being explained to them.

As you may experience while working with your local people, questions and complaints will come from people and this is another part of my work. As we start the project people were still asking question about this new kind of toilet.

Local builders completed composting toilets for 15 families included two toilets for two high schools, and then we informed the families and the schools that they can now start using the house. Staff from the Tonga

Water Board and the external adviser supervised the building. The builders had never built a compost toilet before so they also learnt about the new system. These toilets are not only for helping to minimize the pollution causes to the underground water but it also helps in keeping the environment clean and tidy, because rubbish such as leaves are collected and use in these compost toilets. The rubbish helps make the compost inside the container.

Here are some questions that people often ask hearing about these composting toilets.

1. Are these toilets the same with the pit toilet?
2. Does it attract flies and smell?
3. Are we going to build another one when the container is full?
4. How are we going to empty it out if it's full?
5. Do we need a septic truck to empty it out?
6. When we open up the container, will the waste inside fall out and cause a problem to the environment?
7. The building is too high for us.

All of these above questions we were trying our best to answer so that we make them understand about this project. But the best way for them to learn is to use the new system and experience it for themselves. And as they use this new type of toilet, we also visit them to check how each family is doing and how they relate to the nature of this house.

These are the comments we received from various people after they have been using the CT for some time.

1. We now end all our doubts and fear about this new building.
2. The building is nice and has no problem with the smell or noise.
3. We just only hope that we know this before, so that we can build it closer to our living house.
4. Are there any more donations for building like this? We want our family and relatives to have one like this.

Its very clear that these compost toilet not only do not harm the water resources underground, but they also save water from being wasted on flush toilets.

These are some comment from the people who have a compost toilet as they experience the nature of this work. They say that the CT helps us in the following ways.

1. To minimize the paying of water bills.
2. To limit the spending of money on toilet paper.
3. No worry about the truck to empty it up when it's full.
4. No more digging for new hole, if it is a pit toilet.
5. Reduction of buying and replacing pipes and fittings for the flush toilet because of salty water.

There were also comments from the two Principals from the two Colleges where the project has been constructed. They both agreed the vital part that this project plays in their lives especially to the Students. It helps to reduce the financial side, especially for payment of water bills and also purchase of toilet paper. The children and teachers also learnt about the need to protect the groundwater by participating in the research study.

After one year the Catholic College that had only one compost toilet, completed building another one, to make it two. One for the boys and one for the girls. After we visited them we found out that the first compost toilet build was not yet full. It showed the big reduction in using water for one year and also we can know for certain that no damage has been done to underground water system.

The present situation of this compost toilet is not only useful for low lying areas that are dependent on groundwater, but it also useful for the Outer island because water is always a problem for them and it's helpful for their land.

#### **4.0 STAGE 2 TECHNOLOGY TRANSFER**

As this project had become known throughout the island of Ha'apai and the rest of Tonga through radio programs, and people talking, one of the Town Officers from another island closer to the main land of Tongatapu visited Ha'apai to inquire about this project.

We visited the project together in Ha'apai and he also asked questions, and talks with people about the nature of this work. As a result of this investigation, this village officer, with the help of my office at Central Planning, put together the proposal to request funds for compost toilets for his island, as his village income depends on fishing and handicraft.

This proposal project is for the Island of 'Atata which has no water supply and very small area for people to live and plant local crops.

As our office works together with this village officer to complete all the donors requirements we finally approved to build compost toilets in this village, 20 houses are build by AusAid and 21 by Canada Fund for all this families in 'Atata.

The villagers were so happy and said that they will do the work by themselves. From October 1999 to November 2001 the buildings were constructed. During the building time I often visited them to monitor the work and encourage the people to know how these systems work. We found out that even though there is no underground water supply in Atata, this project limits the pollution caused to their beach because people are living closer to the beach.

These are some interesting comments that people of this island gave about this project.

1. This building is good because we don't have to dig and move the house around all the time as in the pit toilet.
2. This toilet is less affect by the smell or flies due to out stay closer to each other.
3. These new building help for beautification of the Island.

One of the advantages that this village has is a resort right in the island. So they said with these compost toilets that they really give a positive sign about the environment to the tourist who wants to visit their island. For this village, even though they don't have an underground water supply, yet this compost toilet was the greatest development for them.

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