Domestic water consumption in rural Guatemala

Mark Trigg

Water-supply projects make assumptions about how much water people need and, therefore, how much they consume — quantities rarely checked out in the field. One group in Guatemala preferred to rely on hard facts — and managed to find them the easy way.

The people of the Ixil region, in Guatemala's western highlands, suffered terribly during the 36-year civil war. Many of the indigenous Mayan Indians were killed, and their villages — plus what little infrastructure they had — destroyed. The war ended officially in 1996.

Clearly, the assumptions used to design previous water systems were irrelevant in 1997 — COMENSA decided to collect original data.

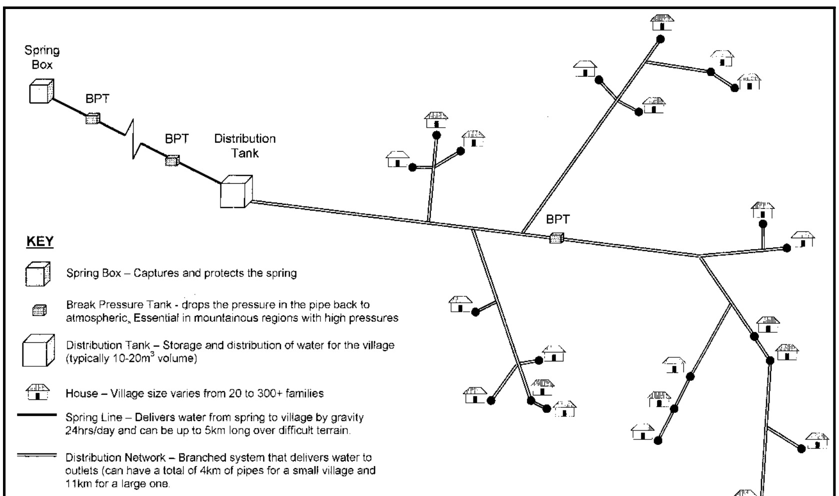
Using local masons, administrators and health promoters, COMENSA (Comida y Ensenanza Para la Salud, or 'Food and Education for Health') is working to rebuild the villagers' damaged water systems, and install new water supplies. In general, the systems consist of a captured spring piped under gravity to a distribution tank, from where the water is distributed to communal tapstands or yard connections (see Figure 1, below). The tanks are constructed from reinforced concrete, and the pipes are PVC, manufactured in-country.

Changes

Over the last few years, COMENSA has become aware of significant changes in the needs and wants of the Ixil people which have accompanied increasing political stability, urbanization and prosperity. Clearly, the assumptions used to design water systems were irrelevant in 1997, and there was no up-to-date information on rural water demands. General guidelines for piped systems give a range of 30 to 254 l/p/d, with COMENSA using 45 l/p/d.

Working in conjunction with SAFAD (Silsoe Aid for Appropriate Development) COMENSA decided to collect original data from the existing systems. Time and workload constraints forced them to use a limited survey approach with data collected from village systems, showing the patterns of water demand throughout the day, giving a peak hour factor (PHF) and the daily per capita consumption in the rural villages. The team chose systems that were relatively new, that had no major leaks, and that allowed them to monitor the unrestricted use of water.

Figure 1. Installed water systems common in Ixil region.



Ways and means

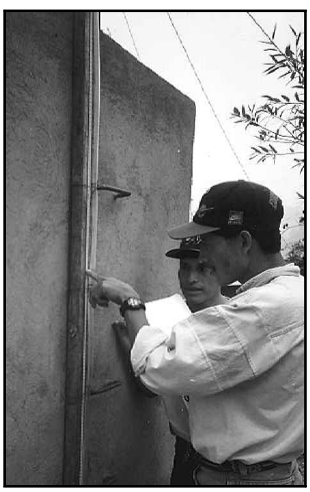
The distribution tank in the village system which stores the water normally fills continuously from the spring. It only starts to empty when the village demand is greater than the spring flow. By measuring the level of water in the tank at intervals, the amount of water used during that interval by the villagers can be calculated from the volume difference. Naturally, an allowance must be made for the spring flow entering the tank and any overflow from the tank. In order to avoid the need to measure all these flows, the inlet to the tank can be closed in the morning when measurements begin, although this is only possible where the tank is big enough to hold an entire day's supply.

The SAFAD/COMENSA team measured the level of water in the tank using a simple, clear-plastic tube, one end of which was placed at the bottom of the tank, with the other end wired to a stake with a tape measure outside the tank. The tube was filled with water and acted like a large U-tube manometer, indicating the level of the water in the tank to the nearest millimetre. Readings were taken every 15 minutes starting at 5am, before the villagers began to use water, and finishing at 7pm when they stopped for the day. Start and finish times depend upon local practices. The level of error for this method of measurement varies according to tank dimensions and the volume of water used and, with a reading accuracy of ± 1mm, is around ± 6 per cent for the lowest flows and ± 0.5 per cent for the peak flows measured from a tank with a 1.5m x 1.5m plan area.

Bald statistics give only a partial picture of daily water use — discreet observations of people's activities were correlated with the measurements.

Five typical systems were chosen: two communal supply systems, and three systems that provided yard/house connections to each house in the village. Each system was measured for two consecutive days. All the measurements were undertaken towards the end of the dry season.

The equipment proved to be very simple to carry around and install. The villagers found the method straightforward and, because they were already used to COMENSA staff being around, were not bothered by the team and did not appear to use the water supply differently. As the photo on the left shows, the time between measurements was used constructively to train one of the staff in basic volume and flow measurements using the tank measurements as a relevant example.



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COMENSA staff measure tank levels — on-the-job training.

In addition to these main measurements, complementary techniques were used throughout the year. Discussions with the village water committee and the community provided a good overall view of the situation, together with basic data on water sources and volumes used. On-going data collection — by observing water-use patterns at collection points and carrying out household surveys — also helps to build a bigger picture.

Results and observations

The daily per capita consumption for the Ixil villages' communal systems was found to average 42 l/p/d, while the people who had access to systems supporting yard connections were using 84 l/p/d. For the communal systems, the highest PHF was 7.3, with a mean of 5.8. For yard-connection systems the highest PHF was 4.2, with a mean of 3.0.

Figures 2 and 3 (right) show the mean consumption patterns recorded in the two different types of system. The approximate breakdown of the components of consumption are displayed in Figure 4 on page 23.

As bald statistics give only a partial picture of daily water use, discreet observations of people's activities were correlated with the measurements. Clothes-washing, usually done every morning between 8 and 9 o'clock, accounted for 49 per cent of the total, and can be seen clearly in the water-demand graphs. First-hand observations indicate that it is normal practice to use between 10 to15 litres of water per item of clothing.

With the systems that provide yard connections, water tends to be used as and when needed, and the demand graphs demonstrate this. Twice the quantity of water is used, since people find more uses for the easily available water. Simple monitoring of a system will often highlight the existence of significant leaks which are not always obvious from above-ground.

In the Ixil villages with no water systems, people collect water collected from local springs or hillside seepages. Here, water use varies from about 20 l/p/d for nearby water sources (up to 200m), dropping to 5 l/p/d for more distant sources (1km or more).

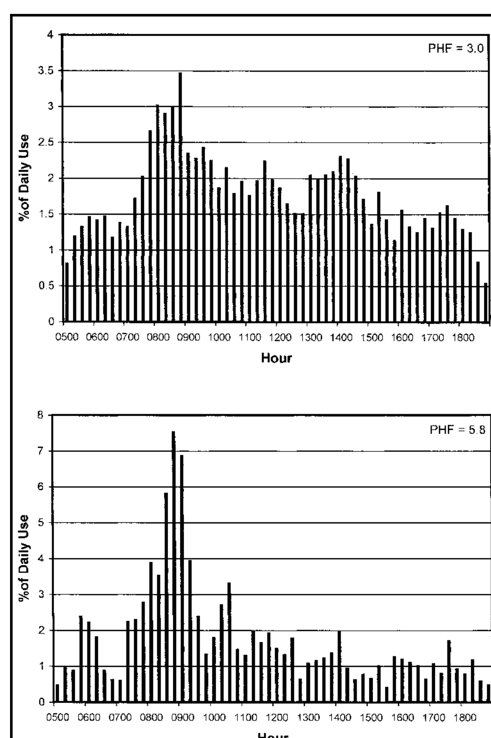

Figure 2 (top) Communal system demand. Figure 3. Yard-connection system demand.

Savings and sizings

COMENSA is now in a better position to understand the use of water within the region, and the information collected will enable staff to design better systems that are more appropriate to the needs of the villagers. Indeed, systems can now be designed which make savings of a third of the pipe costs due to the application of peak hour factors in typical systems. Tanks can also be sized correctly, and the ability of a spring to supply a village, and for how long, can be assessed more accurately.

With the trend towards yard connections comes a doubling in the quantity of water used. Ensuing problems, such as increased wastewater from individual houses where the water-table is high, need to be addressed. Rocketing water demands in some areas with limited water supplies highlight the importance of having accurate, up-to-date information regarding water usage, particularly if decisions need to be made about demand management or future policies.

Simple data collection — some basic guidelines

- **Think carefully about what is needed and the kind of data to collect.**
- **Keep it simple. Try and gauge the accuracy of the methods used.**
- **Try not to do too much. This sort of data collection should be thought of as supplementary to current work.**
- **Keep a field diary, with a record of notes, observations, and the methods used to collect the data.**
- **If you have discovered something important or useful, share it. It may help someone to put together a bigger picture.**

Conclusions

Without the basic, relevant key information necessary to plan and implement projects, planners and engineers aiming to deliver a system or services are effectively operating blind. At best the project will work, but be inappropriate and, at worst, will fail totally. Other implications are excessive project costs and inadequate or unsustainable systems. Basic information must be collected to ensure that a system will be appropriate for its intended use.

The gathering of data does not need to be a complex affair, carried out by highly trained researchers working with a big budget, although these certainly have their place. Relevant work can be carried out in the field, inexpensively, and in conjunction with other work. It can employ appropriate technologies and simple techniques. As little or as much data as is needed can be collected. Project planners and engineers need to accept this and own that simple techniques can yield results which are as, or more, accurate than those indicated by complex technological instruments.

Consider water meters, for example. Even with proper siting, as the flow drops to the low end of the meter's range, the errors increase. These are not insignificant, and even allowable errors according to British Standard (BS)5728 can be around ± 5 per cent. Compare this with the simple method of timing the filling of a standard volume. Provided the volume is appropriate to the size of flow being measured, with three consecutive readings, a reasonable degree of accuracy can be obtained. For example, if the timing is accurate to ± 1 second, and one is measuring a flow of 0.25 l/s with a container of 10 litres, the error is ± 2.5 per cent. The method is simple to understand, the equipment is highly portable, does not require installation, and can be demonstrated easily. Yet project staff remain reluctant to believe that this method is accurate enough for practical purposes.

The experiences of SAFAD/COMENSA in Guatemala show that basic data collection is possible. Hopefully, this will encourage other fieldworkers to collect much-needed data for their projects — and to rely no longer on convenient but ill-founded assumptions. ■

Acknowledgement

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An Ixil mother and daughter wash clothes at an eight-position *lavadero.*

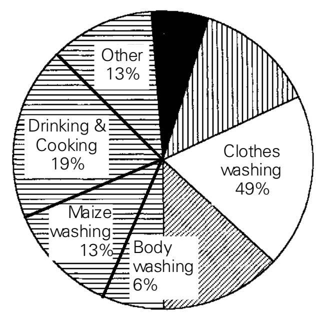

Figure 4. Typical water use in the Ixil villages.

about the author
Mark Trigg is a mechanical engineer. He took his Master's degree in Soil and Water Engineering at Silsoe College — and made a working visit to Zimbabwe. Subsequently he worked in Guatemala with SAFAD and is now employed with ACF (Action Contre le Faim) in Uganda.

SAFAD is a unique, student-run charity based at Silsoe College. It aims to provide skilled professional volunteers to work with partner NGOs in developing countries, whilst providing practical experience of development work for the volunteers.