Water-well bucket protection in Zambia

by Dermot Carty

Community participation and education have proved essential in finding a solution to the 'bucket problem' facing the villagers of Kasama. Dermot Carty describes the evolution of a simple, but successful, design.

THE KASAMA RURAL WATER Supply Project (KRWSP) has been in operation in Kasama District, Northern Province, Zambia, since 1983. Funded by Ireland's Department of Foreign Affairs bilateral aid division, together with the Zambian government's Department of Water Affairs and Ministry of Lands and Natural Resources, the aim of the project is to provide a safe and convenient source of water in selected villages in the form of dug wells.

The most common source of water, and the one used by the majority of the community, is a *dambo*, a small seasonal swamp area, usually located some distance from and downhill of the village. From 25 random observations, the average distance from a central point in a village, one way, was 835m, (maximum 2,700m, minimum 355m). These sources are normally a shallow hole dug in the *dambo* area where the water table is close to the ground; no protection is provided and they are particularly prone to contamination during the rains.

In most of the villages, there are also a number of unprotected dug-wells. These, however, are prone to 'dry up' in the dry season and are usually privately owned and operated by the family group only. Other water sources such as springs, rivers, and streams are used by the community, but are located mostly some distance from the village.

Kasama project objectives

Project wells are located in villages on sites chosen by the community with assistance from project personnel and representatives of the Ministry of Health, the District Social Development Office (where available), and the Department of Water Affairs. The wells have to be dug, lined, and protected with a concrete surround and soakaway; water can then be extracted using a bucket and windlass system. Simultaneously, health education is conducted by local health assistants during and after construction, and topics discussed range from preventative maintenance to personal and domestic hygiene and sanitation.

Villagers are encouraged to keep the area around the well clean, and the soakpit free from leaves and other debris. This should prevent ponding and the resulting breeding ground for mosquitoes, and stop surface contamination entering the well.

Community participation

A major feature of the project is community participation. The project operates on the basis of outside assistance being given only *after* the communities have provided a specified amount of input, which is provided in the form of labour: the villagers dig the well until they reach the water table. Some villages are lucky and reach the water at reasonably shallow depths, 4 to 6m, while others have to dig considerably deeper, and in one case a depth of 22m was recorded. To organize and supervise this work a village well-committee is elected, encouraged by the project to consist of a minimum of six people, half of whom should be women-though of course this can prove problematical for social and cultural reasons. The committee is also responsible for helping to motivate the community, liaising with the health education officers, and on completion of the well, making sure the well is maintained and there is adequate funding for spares.

Solving the bucket problem

One area requiring constant attention is the well head where the windlass, bucket and windlass supports are located. Experience has shown that the bucket itself requires the greatest attention, as the manufacture and quality of the bucket is outside the control of the project. If the bucket fails or falls into the well, the users quite often use paint cans, plastic

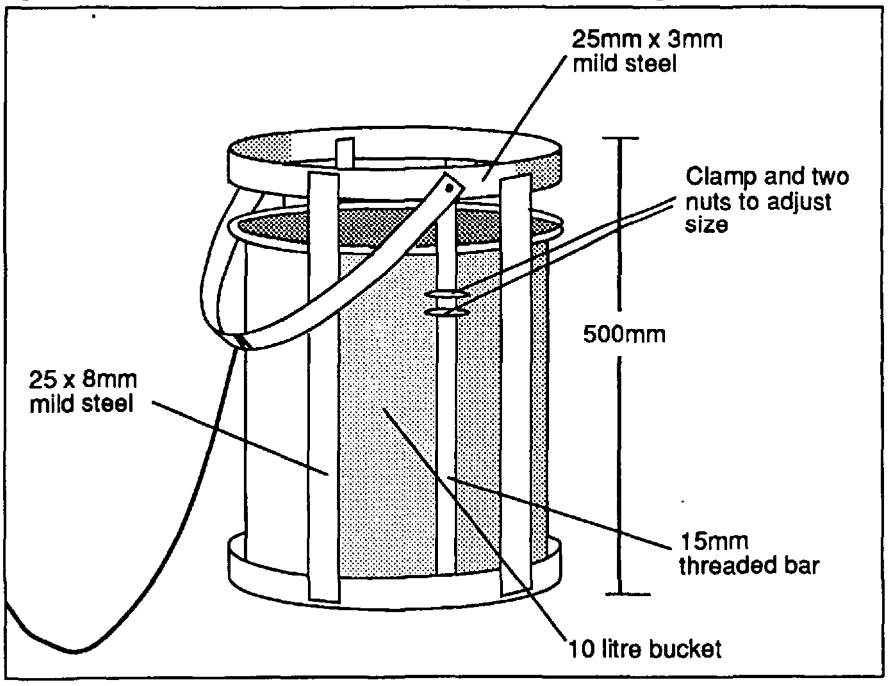

Figure 1. The third and final method was to construct a cage in which the bucket would be fixed.

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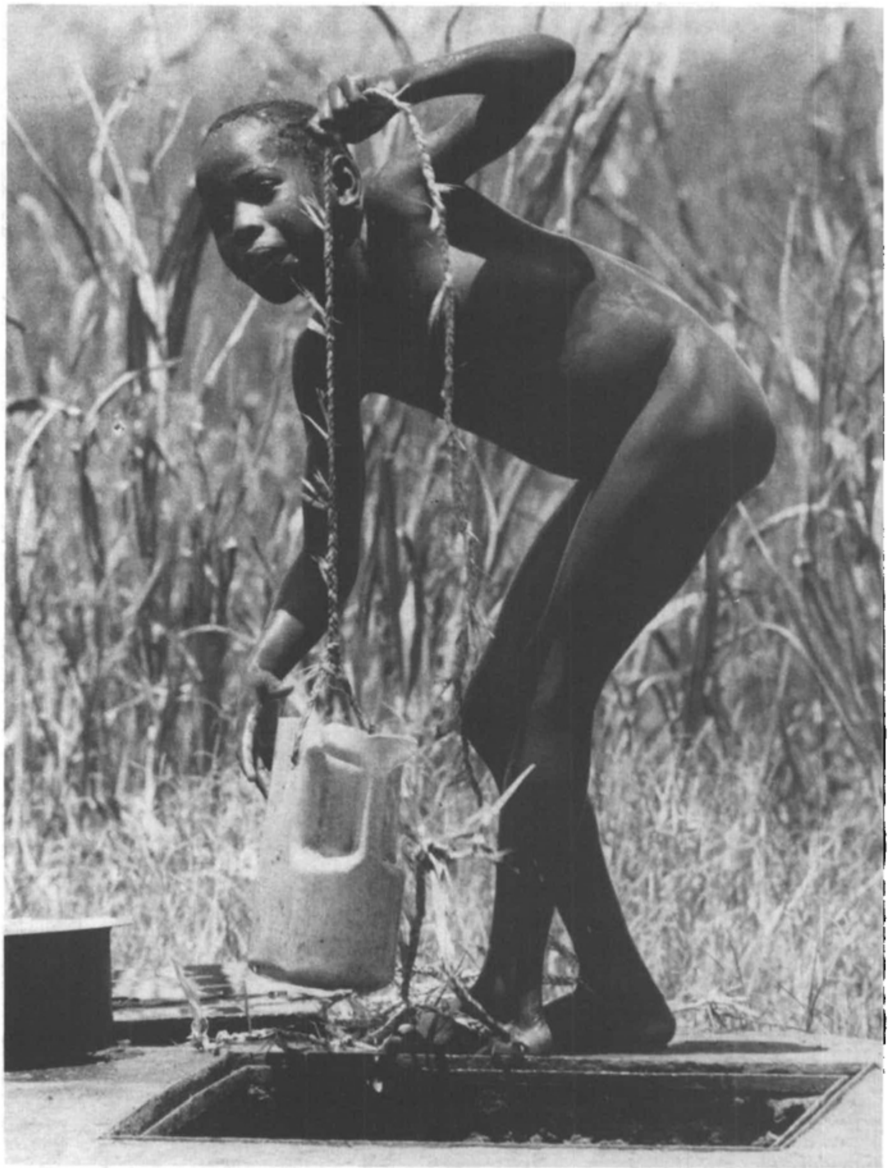
containers or old oil cans to extract the water. These are usually tied to a piece of rope made from bark, rubber strips, wire or string. It is also necessary to stand on top of the well to lift the container out and the rope is thrown to the ground behind the user. All of these activities can easily introduce contamination into the well and soon many cans, containers, bits of rope and debris fall into the well. When this situation develops, the villagers tend to revert to their old source.

The two sizes of bucket commonly available throughout Zambia have a 15- and a 10-litre capacity. These buckets are manufactured from galvanized sheet steel, and have folded side and bottom seams. The handle is manufactured from 6mm-wide galvanized mild-steel bar. Holes are punched in the sides of the bucket and the handle pushed through and bent upwards to prevent it from falling off. Initially, 15-litre buckets were installed on all wells as standard. These were simply fitted by welding the handle to the chain and then closing the handle loops and spot welding. The most common problem with the bucket was seam-splitting, or the handle pulling right through the sides of the bucket.



Plastic containers tied to a piece of rope are often used if the bucket fails.

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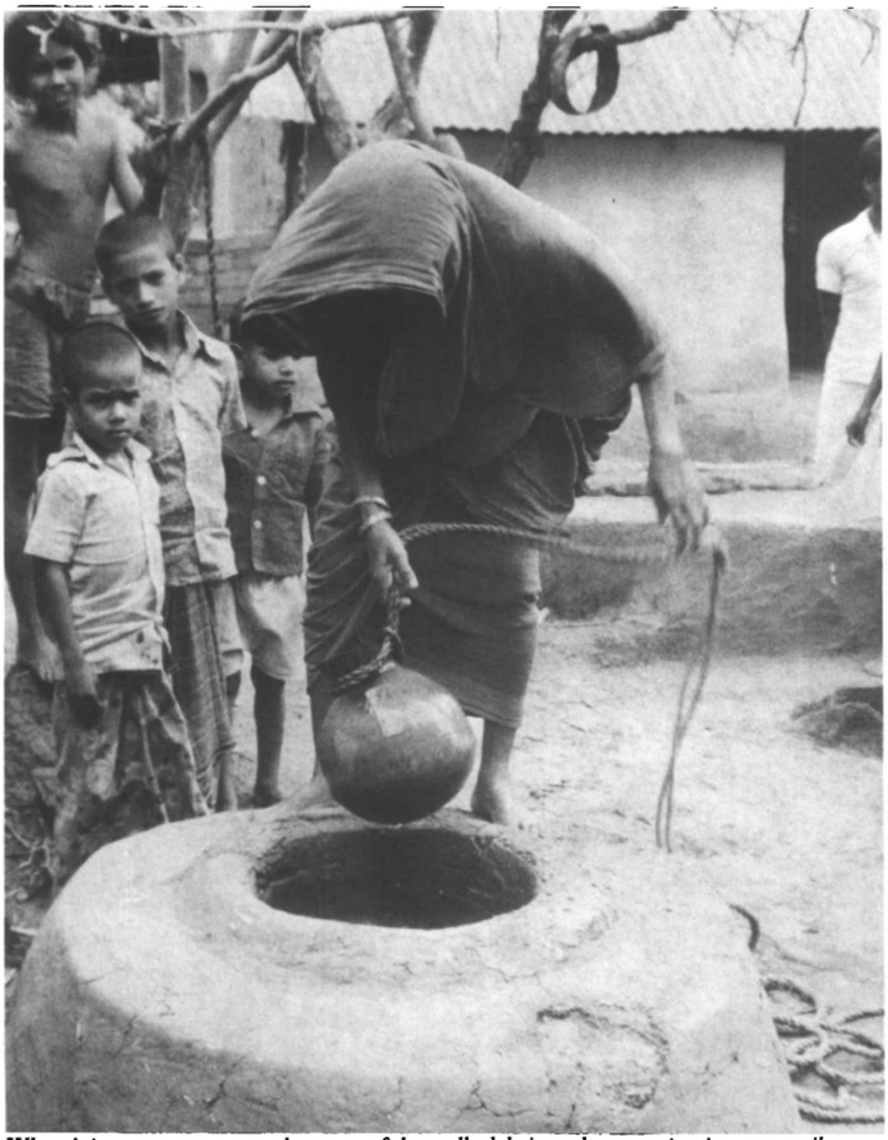
The search for alternatives

Two physical approaches to help the communities with the problem of unreliable buckets were adopted:

- encouragement of communities to purchase and keep in hand a spare bucket at all times;
- investigations into alternative types of bucket; or methods to strengthen and protect the existing types.

The first attempt to strengthen the bucket involved the manufacturer fixing a flat steel bar to the bottom of the bucket to strengthen the bottom rim, but this resulted only in the bottom falling out completely more



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When it is necessary to stand on top of the well, debris and contamination are easily introduced.

quickly. The second attempt was to manufacture a complete bucket from 3mm sheet steel at the project workshop. A number of shapes and sizes were made allowing the project fitters a free hand in what they thought was an appropriate design for a long-lasting well bucket. These buckets were installed by the communities and were found to be too heavy, as well as proving far too expensive. Now replaced at the well, these buckets are still in use at the project workshop.

The simple cage design

The third and final method adopted to cope with unreliable buckets was to construct a cage in which the bucket would be fixed (Figure 1). The design criteria proposed were:

- the bucket must be manufactured from locally available materials;
- it must be adjustable to suit most of the buckets which are being made in the rural areas;
- the cage design must be simple, not requiring spanners or other tools necessary to tighten the bucket in position;
- the final cage must be easy for the rural communities to operate, without outside assistance;
- the project staff must be capable of manufacturing the cage.

Cage components

Basically the cage consists of two metal rings made from 25mm x 3mm flat mild steel which are welded parallel to each other 500mm apart, using four 25mm x 8mm mild steel uprights and two pieces of 15mm threaded bar. The bottom ring has two pieces of flat bar welded across it to prevent the bucket falling through. The threaded bar has a clamp fixed to each side which can be adjusted to suit the size of bucket and which can be tightened and held in place by two nuts. The handle of the cage is made of a short piece of chain fitted to a loop on either side of the cage. A second, larger loop is fitted to the cage at the point where the handle is connected to the cage. This protects the chain from wearing at this point as the assembly is being lifted and pulled through the opening in the concrete cover.

To facilitate the tightening of the clamps on the bucket, a notch is cut in the windlass assembly which is suitable for this purpose. The windlass assembly and the cage are manufactured at the project workshop in Kasama.

A popular innovation

During Phase One of the project, from July 1983 to June 1988, a total of 115 self-help wells were completed, and a further 22 existing Kasama District Council wells were rehabilitated. The bucket cage was introduced in mid-1986 on a trial basis and was subsequently adopted as standard.

Existing wells were issued with a cage to bring them up to the same standard. To date, only one cage has been found in need of repairs and returned to the project, and this was due to an earlier design fault when a solid steel handle was used. This handle was flared where it passed through the upper ring and in this case the flare had worn away and the handle had fallen off. This cage was later rehabilitated and used again.

The cages were readily accepted and used when introduced, and their reliability has further encouraged their widespread use. A conceptual problem, identified in a sociological survey carried out in the communities, was that although the 10-litre bucket is automatically issued with the cage, villagers often believe the bucket and cage full of water is heavier than a 15-litre bucket of water. This has been proved wrong, as shown by the continuing use of the cages.

Room for improvement

The 'bucket and cage' system, while working well at present, would benefit from further improvements. Although the cages are holding up extremely well, they are starting to deteriorate and will eventually wear out as a result of continuous scraping and rubbing against the top of the well opening. A solution to this problem would be a reduction in the width of the windlass access across which the chain can travel as it is being wound up; this calls for a major redesign of the well head. As with the introduction of the original idea into the Zambian communities, these improvements will need time to be worked out and accepted. ■