RN – RWH05

Domestic Water Supply using Runoff from the Roofs of Institutional Buildings

by

Terry Thomas

August 2002

This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of the DFID.

CONTENTS

PREFACE

This Research Note is based in part upon a 'mini-conference' on the topic held in June-July 2002 on the discussion forum RWH@JISCMAIL.AC.UK. RWH is used throughout this Note as an abbreviation for 'roofwater harvesting'. The Note incorporates the (DTU) paper used to initiate the discussion and the observations from some 16 contributions covering international experience and specific experiences in Brazil, Ethiopia, India, Sri Lanka and Uganda. These contributions are included in an appendix. Note that the topic is *not* institutional RWH in general, but only the supply of *domestic* water employing *institutional* roofs, for which the abbreviation 'IRWHDS' has been applied.

1. BACKGROUND

In their classic forms, 'institutional RWH' uses run-off from institutional roofs to meet the water needs of that institution and 'domestic RWH' uses runoff from the roof of a house to meet the needs of its inhabitants. However there is a hybrid form of RWH that bridges these two forms by using the 'spare' or 'unused' capacity of some institutional roofs to collect water for domestic use by households outside that institution.

Not all households possess of roofs of sufficient size or quality to practice their own roofwater harvesting. However community buildings such as schools and places of worship, or commercial buildings, may be present that possess large and potentially clean collection surfaces suitable for rainwater harvesting. Such roofs are already sometimes used for institutional water supply – for example school roofs supply water to school pupils. The abbreviation IRWHDS stands for 'Institutional Roof Water-Harvesting System for Domestic Supply'. An IRWHDS system bears some operational similarities to public water supplies using rock catchments (e.g. as in Gibraltar), to the sale of roofwater to neighbours by householders with large roofs and to the sale of ground-runoff water stored in private ponds and tanks.

Roof run-off is almost always of higher quality than ground run-off, the latter usually requiring treatment if it is to achieve potable quality. This note addresses specifically rainwater harvesting from roofs rather than other catchment surfaces.

2. THEORY OF IRWHDS AND DISCUSSION OF ITS VARIOUS FORMS

2.1. Arguments or circumstances favouring IRWHDS

1. Roofs of communal buildings are often hard (e.g. made of tile, iron or asbestos) even in districts where many private households still only possess soft (e.g. grass) roofs. Access to a hard roof is normally a pre-requisite for successful RWH.

2. There are economies of scale to be had from harvesting from large roofs. The sensitivity of tank costs to tank volume is about 0.6. So that a 5-fold increase in tank

size will halve its unit cost (cost per litre capacity), and a 15-fold increase will bring unit costs down below one third. There are likely to be similar economies in guttering and water treatment.

3. Institutional roofs are generally cleaner than domestic ones, being higher and thus less accessible to humans or vermin. Moreover all roofwater is chemically cleaner than water from most other sources and is often biologically cleaner as well.
4. Certain funding agencies would prefer supporting a 'communal' water supply scheme than subsidising supplies to individual households.
5. The presence of a large 'communal' tank greatly facilitates the supply of water by bowser to that community if and when all of its other water sources have failed during a drought.

2.2. Arguments or circumstances discouraging IRWHDS

1. Unless the institutional building is close to those households drawing water from it, significant extra collection time is incurred above that needed to collect from house roofs.
2. The management (e.g. rationing) of the water in a large tank shared by many households is difficult – it may require the staffing of a 'water kiosk'.
3. The total area of institutional roof is rarely sufficient to capture adequate water for more than a small fraction of households in the institution's catchment area.
4. There are few incentives for an institution to invest, in or to energetically maintain, a communal water supply. In almost all cases the operation of an IRWHDS system will not be the main purpose or interest of the institution, its neglect is therefore quite likely. For success a formal operational arrangement is likely to be required, probably commercial.

2.3. Styles of operation

Any style of operation of a IRWHDS has to address the issues of water management, cost recovery and selection of beneficiaries. It is likely that the (institutional) owner of the roof will require some reward. The maintenance of high water quality is likely to be more demanded of a IRWHDS than of a domestic RWH system.

Some likely modes of operation are

OP1. roof is primarily for institutional water supply with any surplus being gifted to associates of the institution, to 'deserving' or to influential households;

OP2. all water from the institutional roof is charitably supplied to deserving households;

OP3. the institutional roof is operated like a business asset, benefiting the institution by the sale of water by the litre, (a variant of this mode is to combine IRWHDS with mobile water-vending, so that the water is delivered by the business to the user households);

OP4. water from the institutional roof is harvested by the community with recovery of capital, maintenance and perhaps end-of-life replacement costs covered via access charges (per litre or per day);

OP5. individual households are allowed to each attach their own tank to part of a communal roof (like a 'sow with piglets') - a rent may be payable to the institution for 'use' of a portion of its roof. Note this mode loses the economy of scale of employing a very large tank.

The amount of water 'surplus to internal needs' will depend upon the sort of institution. Assume a location in the humid tropics with 1200 mm annual rainfall (60% of which reaches a user) and the provision from roofwater of 700 litres per 'institutional member' per year. This gives a rough requirement of $1m^2$ of roofing per such member just to meet their water needs. Only if this threshold is exceeded will there be excess water available for consumption by outside households via any of the operational modes above. If the 'institutional members' are resident on site (i.e. overnight as well as by day) their water requirements will be higher – perhaps 4000 litres per year each – and the threshold of availability of any surplus may rise to $6\ m^2$ per member.

Thus in a single-storey boarding school, hospital or prison there is unlikely to be an exportable surplus, since overall roof area per resident is generally under such a $6m^2$ threshold. (In a multi-storied institution of such a type, an exportable surplus is even less likely.) A day school providing only say 1000 litres per pupil per year (including teachers' families' consumption), may be able to export some of its roofwater. IRWHDS is most likely to be viable if the institution is an office or a place of worship, where almost all the roof run-off is available for export.

2.4. Water management options

As with all other forms of RWH, supply from an IRWHDS is more generous or 'easier' in the wet season than in the dry. Indeed it is so expensive or difficult to guarantee a plentiful supply towards the end of a long dry spell that it is rarely economical to rely solely on RWH at such times. Thus users of an IRWHDS are likely to have to both reduce their consumption and seek water from other sources at certain times of year. As the *unit* value of water to a household declines with increase in daily consumption, and as the effective cost of water from other sources rises in the dry season, there is an economic case for rationing water from any tank. Not only should some wet season run-off be retained for dry season use, but also the 'ration' (i.e. consumption) in the dry season should be lower than in the wet. Whatever precise strategy is decided in the long or short term, it needs to be implemented by controls on the quantities drawn by each user.

WM1 One style of water management is to allocate a declared amount to each household – an amount that varies with household size, with recent rainfall or with current tank contents.

WM2 Another is to permit purchase of any quantity of water, setting a per-unit price that varies by season in order to either achieve a social optimum or to maximise annual income.

In either of these control modes a regulator or bailiff is likely to be needed, directed by the 'owner' of the IRWHDS. By contrast, operation mode OP5 above (sow and piglets) leaves the management of water abstraction entirely to the individual households.

2.5. Cost recovery options

Any RWH system is characterised by the dominance of capital over running costs. Therefore construction has to be authorised by the owner of the necessary capital, whether accumulated before construction by potential beneficiaries, loaned by a financial institution or donated by a charity or government. (Physically the owner of the roof also has powers of embargo and there is a complex interaction between the justification of the roof as a building component and its justification as a water source.) The longevity of the hardware is likely to be at least 10 years, but the asset is hard to 'recover' (move or dismantle into saleable parts) by any owner in the case of users' failure to pay. Uncertainties in payback would be introduced by changes in the quality or accessibility of other water sources in the neighbourhood – including any increase in hard roofing in households.

Running costs increase substantially where staffing is required to issue or to deliver water and the latter will almost certainly have to be reflected in some sort of additional 'delivery charge'.

Thus we arrive at four main modes of cost-recovery

CR1 saving by beneficiaries prior to construction

CR2 loan followed by user subscription

CR3 loan followed by sale by the litre

CR4 gift with no expectation of recovery

2.6. Selection of beneficiaries

The discussion above of operating modes includes some mention of selecting beneficiaries. We can now formalise selection by grouping as follows, with selection of beneficiaries according to respectively:

SE1 their personal closeness to, or social leverage over, the institution

SE2 their geographical closeness to the institutional roof

SE3 their welfare status (e.g. water only to widows)

SE4 their participation in a savings and building group

SE5 their ability to pay for the water service

2.7. Health issues

The quality of water from a shared source needs to be higher, and more thoroughly monitored, than that of any single-household source. We may expect the chemical and physical quality of institutional roofwater to be better than that of other sources, although perhaps rather lacking in taste. The bacterial quality may be somewhat inferior to good groundwater sources. Several design options for obtaining cleaner or clearer water are more viable (in terms of cost and ease of operation) for large roof schemes such as IRWHDS than for small domestic schemes. These options include first-flush diversion, sedimentation buffering of inflows, chlorination and filtering at the outlet. Periodic testing should be applied in accordance with local practice for comparable sources such as protected shallow wells.

3. PRACTICAL EXPERIENCE WITH IRWHDS

IRWHDS is poorly documented in the RWH literature. Gould & Nissen Petersen[1], who devote a chapter of their book to describing numerous examples of domestic RWH around the world, make no specific reference to IRWHDS. The practice has not been described in papers at any of the last three IRCSA conferences (Iran 1997, Brazil 1999 and Germany 2001). Communal and commercial RWH systems are quite numerous, but the water harvested seems to be used only by members of the organisation owning the roof, or for aquifer replenishment, and almost never by neighbouring households.

Participants in the mini-conference did identify a few applications. This in no way could be described as a controlled survey, so the number of systems described has no significance. However the reports give some insight into choices between the many options listed in sections 2.3 to 2.6 above.

In section 2.3 it was argued that 'institutional roofs' capable of yielding surplus water (over institutional needs) were likely to be on places of worship or day schools, rather than on residential establishments. In the examples reported, all were indeed either temples/churches or day schools. Participants also observed that establishing any management/maintenance organisation for buildings such as markets, sports centres and government offices is more difficult than doing so for a church or school. Moreover of the five modes of possible operation (OP1 to OP5), no examples of OP3 (roof managed as an income generating asset) or OP5 ('sow and piglets' attachment of individual tanks) were mentioned. Most reported IRWHDS systems were operated on a basis of partial cost-recovery and with priority given to the (small) water needs of the roof-owning institution.

Cost recovery and tank management is clearly no casual matter and generally requires some sort of water bailiff, whether paid or working voluntarily, with powers to control water issue. (Padlocks are mentioned). Indeed the development of a strong water management structure is asserted to be the key to success in IRWHDS.

Even so, the schemes described were generally sized too small to meet all the water needs of the assigned beneficiaries (or put another way, the choice of beneficiaries was inappropriate, their number well exceeding the system's capacity). One underlying constraint is the relatively small ratio between institutional and domestic roof areas. Often an institutional roof has only say 10 times the area of a typical house's roof, and the latter represents a just-adequate RWH collection area. It hardly justifies the complexity of establishing an IRWHDS management to supply under 20 households.

No survey of overall institutional roof area per inhabitant has been undertaken. A crude calculation (for single storey schools in a country where schoolchildren comprise 25% of the

[1] Gould J & Nissen-Petersen E, 1999, *Rainwater Catchment Systems*, Intermediate Technology Pubs, Chap 9

population and where there is 0.4 m^2 of school roof per schoolchild) shows only some 0.1 m^2 of school roof per inhabitant. On this basis, such roofs could meet the water needs of only a tiny fraction – e.g. under 2% - of the population. This raises big problems of water allocation that the institution would normally wish to avoid.

No examples of wholly ‘commercial’ operation were reported and the capital for construction seems always to have come from government or NGOs, sometimes supplemented by ‘revolving fund’ savings. This may reflect the legal or social difficulties of any ‘public’ institution exploiting its assets via a commercial intermediary. However the ideology of aid and development is currently shifting towards the creation of ‘livelihoods’ within a market economy, so the practice of an institution franchising its roof to a local small business may become more attractive. It seems clear that without an unusual local ‘champion’ any activity as marginal to an institutions main purpose as utilising its roof for water supply will receive poor institutional support. So devolving any RWH activity to a separate body from the institution itself seems necessary for IRWHDS success. In the reported examples, that devolved body was some sort of committee. Committees function well if their remit is of high priority or community-wide. IRWHDS justifies the description of high priority only under conditions of serious water scarcity; it can rarely be community-wide.

Institutional RWH is sometimes seen as a good demonstrator for domestic RWH and some of the reports hinted at that being the main justification for engaging with IRWHDS.

4. SCOPE FOR IRWHDS

4.1. Scenarios

The scope for employing IRWHDS is strongly limited by the lack of adequate institutional roof area to serve the bulk of the population. It is further limited by the absence of well-established models of management and dependence on rather unsustainable stop-gap modes of operation. IRWHDS is likely to be viable when RWH itself is viable (suitable rainfall, problems with other sources) yet most households cannot for some reason practise it. In a ‘charity’ mode it may be a useful way of alleviating water scarcity of very poor people living in grass-roofed houses. In a more commercial mode it may offer poor institutions a means of earning some extra money. However both field observations and logical analysis suggest IRWHDS will never have a large role.

4.2. Technology for IRWHDS

IRWHDS requires the same technology as other forms of institutional RWH. The tanks and gutters are larger (and cheaper per capita supplied) than in domestic RWH systems. Water treatment by sedimentation or chlorination is both more necessary and easier to organise than in domestic RWH systems. Instrumentation or equipment to support tight water management seems essential.

4.3. Economics of IRWHDS

As with all other forms of RWH, the economic return from an IRWHDS system is improved by using comparatively small tanks and designing for only modest levels of demand satisfaction. A well-managed IRWHDS system should be able to provide water at 40 to 60% the cost from a single-house RWH system. Each IRWHDS system offers some 14 hours per week of paid employment , and if well-managed can offer water at 50% to 60% the cost of water from domestic RWH of similar reliability and condition of say 5-year amortisation of construction cost.. This tariff includes the employee cost.

4.4. Socio-gender impact

IRWHDS is likely to have the same socio-gender impact as other forms of RWH. It will save time spent in water-fetching (frequently a predominantly female activity). It can be operated under subsidy with a poverty focus or fully-commercially with a richer-household bias. The decision to install a IRWHDS system is likely to be taken outside the user household. In most cases this will also mean less control by female beneficiaries, but in a few cases women may have proportionally more power in the institution (e.g. a church) than in their own homes. Dependency of poor households upon an institution for an essential resource like water may give unhealthy scope for their greater subordination to that institution.

5. CONCLUSIONS AND RECOMMENDATIONS

For lack of much field evidence, these conclusions are over-dominated by theoretical analysis.

1. There is apparently little interest in IRWHDS except as an informal adjunct to conventional institution RWH (via sale of water surplus to institutional requirements). The fraction of a population it could serve is low and economies of scale in construction are offset by complexity of operation.

2. The per-beneficiary capital cost of IRWHDS will generally be less than 1/2 that of domestic RWH giving the same service. However a ‘sow and piglets’ configuration of IRWHDS (each user has her own cistern) which removes inter-user conflicts, does so with the loss of this strong economy of scale.

3. The management of a seasonally varying water store requires a formal structure, such as a water steward working to rules accepted by the beneficiaries or the issue of water against payment.

4. Achieving high water quality is more important with IRWHDS than with domestic RWH; however it is also easier due to the cleaner roofs used, the lower unit cost of quality assurance measures, the more professional operation and the larger size of cisterns.

5. Only institutions with more than about 6 m^2 of roofing per *institutional resident* will have enough ‘surplus’ water to justify organising its distribution to outside households. In non-residential institutions the threshold above which exportable water becomes available may fall to 1 m^2 of roofing per institutional member.

6. The sort of operational/commercial body best suited to managing an IRWHDS is often incompatible with the institution whose roofing is to be used. Therefore IRWHDS design must specifically address the institution’s interests if it is to succeed.

7. IRWHDS awaits convincing experimentation and demonstration, not so much with respect to technology but with respect to water and financial management.

APPENDIX

Transcript of email mini-conference

(compressed and excluding material not directly concerning IRWHDS)

[First contribution after circulation of introductory paper, dated 28.6.2002]

From: Bisrat Woldemariam, Water Action, Ethiopia <wact@TELECOM.NET.ET>

Concerning the points you have raised on how the systems are run. Please find the following information.

The beneficiaries of the schemes are the students, teachers, priests and the surrounding communities. The school structures serve 1,100 people and the church structures serves 500 more. The project has built up a water committee which charges 0.15 birr for 2 jerry cans of water ($1=8 Ethiopian Birr and 1jerrycan=20 litre). The money is collected by two committees and deposited with the main committee. The committee consists of seven members and sub-committees are located in the school and monastery.

The water in the school compound is rationed as follows

One 40m3 reservoir for teachers,

One 40m3 reservoir for students and

Two-40m3 reservoirs and one 75m3 reservoir for the surrounding communities. The maximum amount of water a household could get is only 4 jerry cans per day.

From the church schemes they give priority for the church service and then to the priests monks, nuns and the surrounding communities.

Please note that the total effective run-off from the school and the churches roof catchments was found 992m3/annum. Though the criteria were set deliberately considering only the water usage i.e. (only for drinking and cooking purpose), there is still a deficit of 2900m3 of water per annum to satisfy the whole requirement of the beneficiaries. However, it is important to bear in mind that the schemes were not intended to supply the whole requirement but they were intended to supplement the usual water shortage occurring during the dry season from ponds, and hence, improve the health condition of the beneficiaries to a certain level

The impact of the programme is that it has released people, particularly women, from walking long distances to collect water and saved working time. It has also improved people's health. Since base line health data is not available, clear indication of changes are not possible. Before 1995 the area faced severe water shortages. The main source of water was the Zeba River and hand dug wells, which dried out in early summer. To fetch water from the river was a 6 hours round trip. To reach it was a difficult task with the path on a cliff edge.

Moreover, it's believed that the scheme have a great impact and role on community awareness towards the use of other alternative water sources other than the traditional ponds and may encourage the beneficiaries to similar replication of roof water harvesting individually or on group basis. In fact till now there is no a replication of institutions RWH schemes constructed by the community itself.

From Brett Martinson, DTU Warwick University dbm@eng.warwick.ac.uk

Bisrat raises some interesting points about the use of institutional roofs for domestic supply.

1. The problems of serving a large number of people (in this case 1,100) from a community roof. Even if the roof is over 500m2, the area per person is less than 1m2, at such a small roof area per capita, demand will soon outstrip supply - particularly if it is envisaged the RWH system will be used for bridging dry seasons. Strict rationing will be required. What conflicts can be expected and how would they be resolved?

2. Replication. Institutional rainwater harvesting is often put in to demystify the technology to surrounding households and encourage replication. What experiences do people have of the effectiveness of this. Does the technology take off or does it simply stay in the schoolyard?

From: Rajindra de S Ariyabandu, Sri Lanka wrsrds@sltnet.lk

Let me also contribute my two cents worth to the institutional roofs debate. I think we have to take these in the context of the location. It appears from Bisrat's account of institutional roofs in Ethiopia is a success. The main reason is the other water sources are 6 hours away. Even the limited quantity of water per household appears to be properly managed. We in Sri Lanka do not have large scale institutional roof water harvesting at present. However, we did try in schools and at an Agrarian Service Centre in a rural area. The first one had limited success and the second one failed miserably. Both for the same reason, management! The question with institutional roofs is who owns the institution, or for that matter the roof. When there were champions to manage the RW systems in schools it became a success. Champions are those who take special interest in managing the RWH systems. In one school it was the Agricultural teacher who apparently resided in the school quarters. This incidentally, was the same reason why such institutional systems failed in Thailand schools. Who owns and who manages? The system at the Agrarian Service Centre functioned to a limited extent during the time of a very powerful secretary to the Ministry of Agriculture. After he retired the system was neglected, though there was definite benefits from the system. So the point is there is something more that just technical criteria for the success of external interventions in rural areas.

By the way Bisrat, who manages the school reservoirs you have in Ethiopia? How effective is the management?

From: Bisrat, Water Action, Ethiopia

Glad to hear from you again. The school reservoirs are managed by a committee. The committee consists of seven members and sub-committees are located in the school and monastery. Though some training was given for committee members on technical and financial management, the committee expressed a clear need for additional training to water committee members.

From: Kobusingye Annette, ACORD, Uganda

This is my small contribution on the above matter

Institutional Rain Water Harvesting in Uganda is practiced and mainly supported by NGO's, like UNICEF in primary schools and ACORD in some Secondary schools and hospitals. UNICEF's goal is to improve sanitation and hygiene in schools so the water is not accessible to the rest of the community members. The tanks are fairly large but the water is only for the pupils and the teachers.

ACORD has built ferro-cement tanks in schools too but the water is also for the targeted people not the whole community.

Institutional Rainwater harvested from hospitals is used by the patients and the nurses and to a small extent by the neighbouring community which buys this water. Institutional rainwater is sold in order to generate some income to maintain the structure.

From: **Paito Obote, WaterAid, Uganda** **<paitoobote@wateraid.or.ug>**

To add a word to the debate, WaterAid in Uganda supported a small NGO in Kisoro district, southwestern Uganda to provide 'communal' roof catchment systems in an area where rainwater is the only readily available source of potable water supply. Initially every household harvests rainwater on a small scale during the rainy season and in the dry season they all converge to a pond with the animals. Most of the tanks were constructed in private homes and a few were constructed on the few institutional houses like schools, churches, mosques, and administrative buildings. The unique feature here is that all houses are roofed with iron sheet simply because there is no thatching material around, so every home has a source of water. The NGO supported by WaterAid was already running a housing scheme (incorporating rainwater water collection system) for its members; the water from the tanks was sold to members at some fixed price. This arrangement would continue until all the members are covered. The new project focused on rainwater harvesting (i.e. not housing) for the whole community but the management arrangements of rationing and selling water remained as before and it has been very successful. Part of the revenue raised is being re-invested in new rainwater tanks to expand the coverage. The project has been very successful and a number of individuals and even district supported projects are copying the system design and operation.

Three main conditions however led to the success of this project:

1.. The existing demand created by the need and the developed tradition of rainwater harvesting.

2.. The existence of a local NGO that provided the framework for local capacity building.

3.. Maximum utilisation of local resources (materials and human) that ensures sustainability and replication.

I believe that with proper management system based on the user community, communal rainwater systems can be successful and highly beneficial.

From: **Ddamulira Dunstan, ACORD Uganda** **dpdunstan@yahoo.com**

I have been following the on going discussion on institutional rain water harvesting with keen interest. ACORD Mbarara supports supports both domestic and institutional rainwater harvesting initiatives in its Mbarara rural programme area. The experience i have gained in this project prompts me to categorise institutions in three kinds:

1) Educational institutions (like primary schools)

2)Religious or faith based institutions(eg Mosques and churches)

3) General public institutions (like Markets and recreation centres)

Apart from General public institutions, promoting rain water harvesting on other categories and ensuring sustainability is quite easy since quite often these institutions have got well established management structures (eg school management board/committees) that can spearhead rainwater harvesting implementation and later sustainability of the facilities put in place. For general institutions sustainability requires setting up and training a committee to take care of the facility(there was a case in Uganda- Mbizzi Nya market where replacing just a broken tap on a roof tank took a lot of time)

However for religious related institutions a balance has to be taken by any R.W.H promoting agency to support all religious institutions within the vicinity so that one religion doesn't feel left out or marginalised.

Institutions present the advantage of constructing large volume tanks because they have large catchment roofs in one place to fill the tanks(ACORD has supported construction of underground tanks of capacity more than 100,000 litres on primary schools and teacher training colleges in Mbarara district Uganda) But often even these overwhelmed by the demand from the beneficiary communities. This prompts the institution's management to either ration or limit the water to a few close people. (Raising a question whether institutional tanks can be classified as communal or not).

Does any one have anything to comment on roof rainwater harvesting from shared individual roofs? Should one take them to be institutional or not? What are the challenges? [I am just sparking off a discussion!]

From: "R. de S. Ariyabandu" <wrsrds@sltnet.lk>

I think we have a definitional issue here. What we have been considering as institutional RWH systems are those which can harvest a large volume of water due the high availability of roof area. They can be community systems in case if they supply to a nearby village community of it can also be individual if the water is used solely by the occupants of the building. Often RWH using government buildings are not community systems though it serves a large number of persons. On the other hand individual household systems in a village community can be termed as community systems project or programme. In this case it is number of individual units serving a larger population. So you see the difference is only how you defined it. On another issue what is the progress of the water policy document? have you posted it already?

From: "Kyung H. Yoo" <khyoo@eng.auburn.edu>

It is not a rainwater catchment but a communal water use system from a spring. Each user pays a small token of water uses and the collected funds are used for paying the operator and maintain the system. This is a system Haiti. Management and management is the most important after a system is established. It is important for the community to manage the limited water for critical period of a year and maintain the facility for long term uses. My experience in Brasil deals with individual house RCR (roof catchment of rainwater) systems and communal water supply from an embankment. This project has not been completed but when completed the community will need to develop and enforce water management guidelines.

From: Terry Thomas, Warwick University, UK dtu@eng.warwick.ac.uk

Thanks for raising the problem of definition. Straightforward domestic RWH and 'straightforward' institutional RWH (where an institution collects water just for its own members' use) are both widely used. The current e-conference was intended to examine the rather rare circumstance whereby the primary objective is supply to households but the means of doing so is to use an institutional roof. The reasons for this practice might be that the roofs on the houses are unsuitable for RWH or that economies can be made by having 1 large system rather than many small ones. Unfortunately the border between this situation of water being exported from the institution and the situation where the institution itself includes 'houses' - for example teachers' houses - is very arbitrary. Moreover some systems are mixed, with some water going to institution members (such as prisoners or priests and worshippers) and the remainder to neighbouring households.

For the purposes of this discussion I suggest we exclude systems where water only goes to institution 'members' but include ones where water also goes to members' families living nearby.

From: Chitra Vishwanath, Rainwater Club, Bamgalore, India
chitravishwanath@vsnl.com

Happened to visit a place called MANAPAD on the east coast of South India near Kanyakumari (the southern most point of mainland India). Salinity ingress to up to 5 km has rendered most shallow wells and borewells unfit to drink from for many villages on the coast. An organisation called ANAWIM has set up 5 ferrocement tanks of capacity 10000 litres each in 5 villages. The one village that I visited had a temple roof as its catchment (about 2500 square feet), actually half a temple roof. The tap to the ferrocement rainwater tank had a lock and one of the ladies of the community kept the key and rationed out water (1 pot per family per day roughly 10 litres). This apparently was good enough for drinking water for the family. The overall system seemed to furnish enough drinking water for about 40 households for 6 months. The ferrocement tank was constructed using a steel mould and was exceedingly well done. The households were very happy with the quality of the water. Unfortunately the other half of the temple roof remains unutilised and funds have not been raised to increase coverage.

From: Ddamulira dunstan, ACORD Uganda

Thanks for raising those interesting observations. However the most interesting one is that in most cases people using water from institutions communally tend to use up all the water without restrictions making the systems run out of water in a very short time. My conscience is telling me that perhaps they do use up the water in the systems unknowingly (unconsciously). You see most system designs never incorporate any kind of component permitting/allowing easy monitoring of water remaining in the tanks. Perhaps if there was any easy way people could easily tell how much water is remaining in the systems then they would try to use it sparingly so as to pass them throughout the dry period until the next rains.

Isn't it high time water professional started seriously thinking about some form of WATER LEVEL MONITORING METER? It can be in form of a simple wooden stick calibrated in a simple area specific measurement (e.g. in Uganda Jerricans), floating on the water and extending out through the cover or breather in the tank roof so that can easily be observed by the users as it goes up and down following the level of the water. Perhaps this combined with other innovations can help people monitor their water usage/consumption and hence ration it depending on the availability of rains to re-fill. The problem of gutter span has also been faced our end. Fortunately for our case the tank was underground and we had to divide the span into two so that the first section near the tank is on top of the roof and the second is connected by a vertical down pipe to a ground level horizontal pipe which directs the water into the tank. Otherwise I will come back to you about the deflector plates.

From: Brian Skinner, WEDC, Loughborough University <B.H.Skinner@lboro.ac.uk>

I agree that a way of monitoring the water level can be useful, particularly for a household system. However for a communal system I don't think that your ideas will usually work. I feel that unfortunately people tend to be rather selfish and do not have a good level of self-control. Where there is an appreciable walk to the alternative source of water people will tend to take as much as they can from the nearer rainwater tank if they can do so with without other members of the community knowing! If other community members think that someone else is 'cheating' they may well join in, thinking why should only they have the easy life!

I feel that people will only restrict the amount that they collect in well-disciplined communities, that use appropriate enforcement of punishments for drawing more than allowed. Has anyone on the list experience of communities successfully using a communal tank?

[Last contribution dated 10th June 2002]

From: "Kyung H. Yoo" <khyoo@eng.auburn.edu>

I agree. One possibility would be charging the water at low but high enough rate and use the collected funds to hire a person to police and operate the system. I don't know how it would work but it could be an alternative to getting whole community thirsty during the critical dry season.

delling water sources for rural communities (SimTanka). Ajit Foundation.