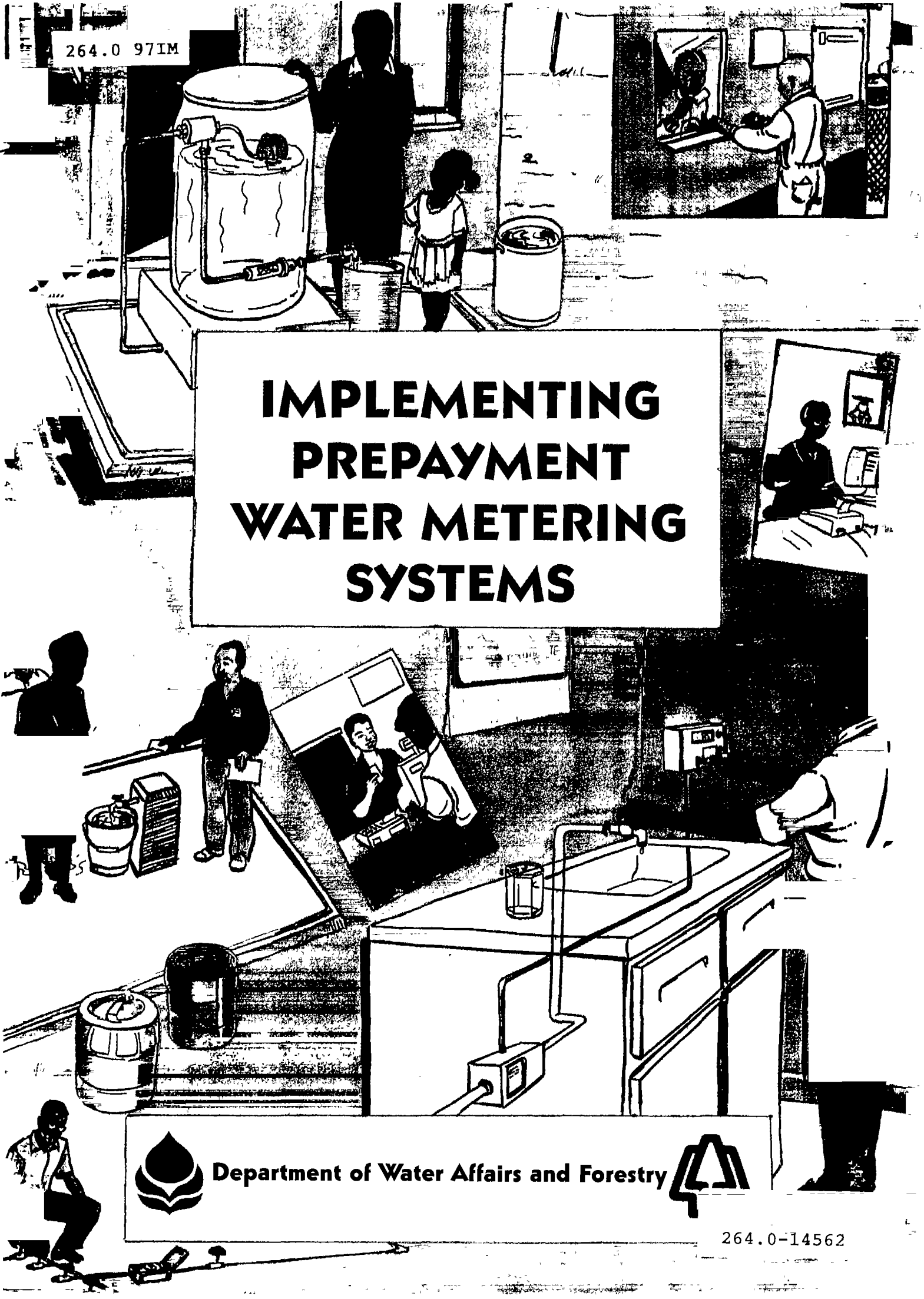

IMPLEMENTING PREPAYMENT WATER METERING SYSTEMS

Department of Water Affairs and Forestry

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IMPLEMENTING PREPAYMENT WATER METERING SYSTEMS OCTOBER 1997

Study and report sponsored by **DFID**
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Report prepared by

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FOREWORD

Cost recovery is a key element for sustainable water supply. Currently most water service providers are experiencing problems with cost recovery from community water supply schemes. Many are considering introducing prepayment systems or other innovative ways of cost recovery.

Prepayment water metering systems are already available in South Africa although historic and practical performance reports in a 'real' environment are in many cases still lacking. Although this report is by no means the final word on this subject, it predicts that both water service providers and their customers are likely to welcome these systems as cost effective and user friendly. The report also explains how water payment and administrative support systems can be selected and introduced in a manner which promotes effective cost recovery.

Metering, prepayment, and the accompanying systems should never be viewed as technical solutions to the problem but instead a holistic approach should always be adopted. For this very reason this report discusses a whole range of options and not a single system. Secondly the 'cost' of 'cost recovery', and especially the administration costs, are also included as this must be taken into account for affordability and sustainablity.

Please use this report as a guideline to help you and your customers decide what systems to choose and how to implement your choice in a way which builds sound relationships of accountability. Remember an important reason customers pay their water scheme accounts is to help you to provide them with a better and more reliable service - Masakhane.

Organisations are invited to request presentations to help them and their customers become familiar with this report. Suggestions for amendments and follow-up studies are also invited. If you would like to make proposals or need such a presentation in your area please contact:

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Invaluable time was given by the project steering committee, listed below, in directing the study and in discussing various aspects.

Project Steering Committee:

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Douglas Smith	Rand Water: Community Based Projects Department
Derek Hazelton	CSIR. Division of Water, Environment and Forestry Technology

The contributions of the suppliers who took part in this survey are also acknowledged.

Sincere thanks are extended to all the above and the many other contributors without whom the completion of this report would not have been possible.

Note
The inclusion of suppliers' names, products or concepts in this report does not imply recommendation. Likewise, the omission of names, products or concepts does not imply rejection.

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EXECUTIVE SUMMARY

A major effort is currently being made in South Africa to increase water supply coverage by new capital works. There is an urgent need to balance this by promoting sustainability, of both new and existing schemes. The main objective of this study is to contribute towards sustainability through the development of effective cost recovery and water supply management policies for use in communities where conventional billing is not viable.

Prepayment water metering systems survey

A desk survey was conducted of unconventional metering or vending devices available in South Africa, or likely to become available. Details of the suppliers who took part in the survey and their products are given in Annexure A of the main report.

The following systems were investigated:

- **hand-held meter reading route planner, recorder, data processor with field-billing option** suitable for use with dedicated household connections and bulk service connections, as manufactured by Radix and marketed in Southern Africa by Consolidated African Technologies;
- **manually filled household distributed storage tanks** suitable for dedicated household connections with a consumption of up to 6 kℓ/mth, as installed by Durban Water and Waste;
- **automatic filling regulated household distributed storage tanks** suitable for dedicated household connections with a consumption of up to 15 or 22,5 kℓ/mth, as designed by the CSIR and supplied by Plasti Drum;
- **mechanically operated coupon activated vending units** with different units being offered to cater for shared household or public standpipe connections and bulk service connections, as supplied by Teqnovo;
- **electronically operated prepayment systems** suitable for dedicated household connections, shared household or public standpipe connections and bulk service connections, as supplied by ABB Kent/Telbit, Bambamanzi, Control Instruments/Plessey, Cumcon and Schlumberger/AEG;
- **PC based water utility management systems** designed for use with all metered service connections, as installed by HCS and others.

Based on these submissions and the findings of the literature survey a decision support diagram was compiled for selecting possible retail cost recovery options and administration support systems. This diagram is presented as Figure 2.5 of the main report, and descriptions of the different options listed can be found in Table 2.1 of the main report. A wide variety of options is given to indicate how the new options surveyed compare with existing traditional options.

Table 1 overleaf illustrates typical average charges required per household to maintain a sustainable break-even situation for the different cost recovery options and administration support systems. The assumptions on which this Table is based are given on page 16 of the main report. Actual costs vary considerably from community to community depending on the availability of exploitable resources, the nature of the scheme constructed, and the cost effectiveness of the operation and management system in place. Therefore, the table should not be used for tariff setting and some care should even be exercised in using it to compare different cost recovery options without checking actual costs applicable to the scheme being examined.

Table 1 Typical average charges required per household per month to maintain a sustainable break-even situation for the different cost recovery options and administration support systems

Type of scheme and cost recovery method	Typical average charges per household: R-c/mth				Tariff R-c/kℓ
	Cost of bulk water used by households	Reticulation system O & M costs	Reticulation system capital repayments	Total charges	
Average water consumption: 4 kℓ/mth per household with 15 households sharing each standpipe					
Electronic vending	6-00	5-40	2-94	14-34	3-59
Flat rate	6-00	9-50	0-00	15-50	3-88
Graded rate	6-00	10-00	0-00	16-00	4-00
Attended standpipes	6-00	11-20	0-43	17-63	4-41
Mechanical vending	6-00	8-40	8-50	22-90	5-76
Average water consumption: 6 kℓ/mth per household with 4 households sharing each yard tap					
Electronic vending	9-00	8-00	21-25	38-25	6-38
Average water consumption: 6 kℓ/mth per household from individual household yard taps or house connections					
Regulated storage tanks	9-00	16-65	17-30	42-95	7-16
Manual storage tanks	9-00	19-50	19-57	48-07	8-01
*Electronic vending	9-00	12-50	41-22	62-72	10-45
Average water consumption: 14 kℓ/mth per household from individual household yard taps or house connections					
Regulated storage tanks	21-00	23-67	18-67	63-33	4-52
*Field billing	21-00	27-39	29-45	77-84	5-56
*Self billing	21-00	33-13	29-09	84-22	6-02
*Electronic vending	21-00	18-50	45-58	85-08	6-08
*Conventional billing	21-00	39-45	29-09	89-54	6-40
Average water consumption: 34 kℓ/mth per household from individual house connections					
*Electronic vending	51-00	33-50	51-49	135-99	4-00
*Conventional billing	51-00	60-11	35-00	146-11	4-30

*At the project design stage, the capital repayment charges for these options could be reduced by approximately R6-00/mth through installing unregulated break pressure storage tanks

The charges in the table are divided into four columns as follows:

column 1 = production and delivery cost of bulk water used by householders - the customer has control over this item;

column 2 = recurrent reticulation system operation, caretaking, maintenance, administration and management costs, including the cost of unaccounted-for water, and an allowance for non-payment write-offs where applicable - all items the water service provider has some control over;

column 3 = reticulation system capital repayments - the water service provider has no day-to-day control over this item as it is fixed during the design and construction phases of the project **but** good care of the infrastructure means it will be possible to use the infrastructure after the loan repayments are complete and this charge becomes zero; and

column 4 = total charges - the addition of the first three columns.

A fifth column indicates the water tariff, in R-c per kℓ, which results from the charges.

Recommendations regarding the use of the water metering systems survey

Summary descriptions of the different cost recovery options are given in Table 2.1 of the main report.

Flat rate, graded rates, attended access points and mechanically operated access points can all be considered for, but are generally limited to, shared connections in small villages of up to 100 households. In theory, flat rate cost recovery is simple to administer but may not be acceptable to consumers in communities where people living near the access point consume more water, yet pay the same rate as those living further away. Graded rates, which are still relatively simple to administer, are introduced to overcome this problem. However, getting community members to agree on the graded rates is often problematic. Thus, some communities prefer attended cash or coupon operated access points even though these are more expensive and more difficult to administer. Limited opening hours is another disadvantage of this method of cost recovery, hence the demand for unattended access points. For small communities, mechanically operated units, being stand alone units, require less capital expenditure to install than card operated systems. Finding reliable and tamper proof units may, however, be a problem.

There is a need to promote **intermediate levels of service**, such as individual household distributed storage tanks and privately operated shared yard taps, to cater for customers who demand a higher level of service than public standpipes but who cannot afford conventional full pressure, or unregulated roof tank pressure, individual household connections. Distributed storage tanks are easier to administer because the customer pays a fixed monthly charge. There are two types of distributed storage tanks: manually filled tanks and unattended regulated or trickle feed tanks. Unattended units can meet a wider range of demands and are usually cheaper to operate. A disadvantage of distributed storage tanks is that they cannot supply a sudden unusually high demand without prior special arrangements being made. Such a demand can occur during funerals, for example. With privately operated shared yard taps the registered owner is responsible for paying the full account. How the account is shared is agreed between the households sharing the tap and the registered owner or account holder, without the water provider influencing the decision. The higher consumption per access point achieved through shared yard taps helps to reduce costs per litre, but if the account is not paid the water provider may have difficulty in cutting off the supplies since the other customers are likely to claim they have paid their share. Linking privately operated shared yard taps to an electronic prepayment cost recovery system will overcome this possible disadvantage.

Electronic prepayment systems seem to be appropriate for settlements with more than 100 households for both shared and individual household connections. Their acceptability to both the service provider and service user is expected to be high. They are particularly attractive for shared connections where the capital cost can be shared by a number of users. When used for individual household connections, electronic prepayment systems do not overcome the problem of high unit costs associated with low consumption levels, but they are still competitive with conventional metered billing systems. Electronic prepayment systems have proved themselves in the electricity supply industry. Their worth to the water supply industry still has to be verified.

For individual household connections, **semi-automatic field billing and self-billing systems** appear to be marginally less expensive to implement than electronic prepayment systems but they are not as versatile as the electronic systems since they are not suitable for shared connections. Conventional metered billing systems, and other manual variations thereof, are also only suitable for individual household connections. Except when used in villages with less than 100 households and/or when combined with field billing, conventional metered billing appears to be marginally more expensive than electronic prepayment.

Where cost recovery is based on **fixed monthly payments,** manually implemented administration systems may be a practical possibility for settlements with up to about 400 households, depending on the skills potential within the settlement. Once there are more than about 60 accounts which vary each month, higher levels of skills are needed to administer the system and a computer-based bookkeeping and water auditing package is likely to be needed. However, as the management of the simplest water scheme requires a range of skills to ensure its sustainability and the proper control of finances, the choice of cost recovery system will be determined by its acceptability to both the authority and the customers rather than by the initial training costs.

A national programme, with equal status and comparable resources to the existing initiatives to increase coverage, needs to be put in place to focus on sustainability issues related to all community water and sanitation schemes but especially existing ones. Such a programme will include the refurbishment of some of these existing schemes. It should also consider how the water utility management systems installed with the cost recovery systems are to be integrated with the proposed National Water Supply and Sanitation Information Management System and the proposed Regulations applicable to local authorities so that uniform minimum reporting standards can be developed.

The literature survey

In order to inform the recommendations for decision making and to increase understanding of the socio-economic environment in which community water supply schemes are managed a literature survey was also carried out.

An analysis of surveys reported by WHO in 1990 rated poor cost recovery as the most severe constraint on the attainment of sustainable water supplies in Africa. However, cost recovery can only be implemented successfully when customers are satisfied they are getting value for money. To ensure this, other major constraints militating against a quality service must also be overcome. These constraints are predominantly organisational rather than technical.

When cost recovery is not implemented, the rich and influential receive more by way of subsidy than the poor, communities are misled into believing that water provision is cheap, and the Government's budget is spent operating existing schemes rather than implementing new ones. Conversely paying for water encourages a relationship of accountability between the water service provider and their customers. As a result, water schemes where communities pay the operating and maintenance costs are the ones which provide the most reliable service.

Willingness to pay depends on proper consultation and community empowerment. One important way of empowering communities is by giving individual households a choice between a number of options. Higher levels of service, including individual household yard taps, are substantially more costly to build, operate and maintain than basic levels of service. In normal circumstances these additional costs are recovered by a substantial increase in demand. However when low income households obtain individual yard taps **and pay for the water**, the demand does not increase significantly. As a result the tariffs required to achieve full cost recovery become unacceptably high for the majority of customers. Intermediate levels of service, such as distributed storage tanks and privately operated shared yard taps, should be promoted.

Furthermore, whilst just over 50% of rural households live below the rural Household Subsistence Level, there is a minority of households with incomes up to three times this level. Offering a variety of levels of service within the same scheme is an equitable solution that facilitates full cost recovery.

Even when customers are paying for water, costs must be controlled. Since such a high percentage of the costs are fixed during design and construction and do not vary with consumption, engineers should take care to design appropriate schemes. Costs which can be partially controlled after the construction of a scheme are administration, operation and routine maintenance costs, and unaccounted-for water. Control of all these costs is especially important for community water supply schemes because of the tight financial constraints within which they function.

The literature continually stresses the importance of community structures being empowered to manage schemes. Building institutional capacity and developing support services is a long process, but financial commitment from project managers and funders for these activities will result in lower ongoing running costs.

Ongoing requirements for governmental extension services and private sector interventions are likely to include: health and hygiene education; management support and performance auditing to assist with planning, budgeting, hardware and human resource monitoring, evaluation techniques and corrective action; an accessible information and decision support system; and interventions to help with major maintenance work, as well as droughts and other disasters.

CHAPTER 1 INTRODUCTION

1.1 Objectives

The main objective of this study is to contribute towards the development of an effective cost recovery and water supply management policy for use by the Department of Water Affairs and Forestry (DWAF) and other authorities in communities where conventional billing is not viable.

Other objectives are:

- to establish a broad understanding of the environment in which community water supply schemes are managed, operated and maintained in so far as this environment impacts on the implementation of effective cost recovery systems;
- to ascertain what unconventional metering or vending devices (such as prepaid meters) are, or are likely to become, available in South Africa;
- to evaluate the suitability of these products for use in existing and future community water supply schemes and how they compare with more traditional options; and
- to evaluate the broad implications of these products on administrative support requirements and costs.

Thus the scope is not confined to the evaluation of the devices themselves but includes the evaluation of the administrative support structures necessary to implement cost recovery using the devices.

1.2 Implementation methodology

The survey is being implemented in three parts:

- a literature survey of the socio-economic environment in which community water supply schemes are managed, including southern African case studies;
- a desk survey of available water metering/vending devices and the administrative support structures necessary to use them; and
- on-site inspections of devices already installed in South Africa.

Site inspections are underway (mid-1997) and will be the subject of a further report. The desk survey and the literature survey are complete and are reported on herein.

CHAPTER 2 SURVEY OF PREPAYMENT WATER METERING SYSTEMS

2.1 The invitations and advertising of the survey

The survey was launched by drawing up:

- a letter of invitation to potential suppliers of water cost recovery devices to take part in the survey;
- a press release to advertise the survey to potential device suppliers; and
- a list of potential device suppliers.

Once these three tasks were complete the press release was faxed to about 70 publications and the invitation faxed to 10 potential suppliers of water cost recovery systems. A further five invitations were faxed later when additional potential suppliers were brought to our attention through the press release and other miscellaneous sources.

2.2 The response from potential suppliers

2.2.1 Ten companies responded to the invitation to take part in the survey. This number was in excess of expectations but, excluding Teqnovo's response for their bulk supply mechanical prepaid meter, suppliers indicated that the application of the technology being promoted was new to the water cost recovery market and therefore no list of sites where the relevant devices had been installed in South Africa was available. ABB Kent/Telbit, Bambamanzi and Teqnovo, potential suppliers of electronic prepaid meters suitable for both individual household connections and shared standpipes, did however indicate that they were optimistic about pilot projects being commissioned towards the middle of 1997.

2.2.2 The electronic prepayment water management systems offered are all computer-based and comprise the following components:

a) a computer for collecting and processing data;
b) support units for registering and deregistering customers;
c) vending terminals where customers buy their credits;
d) customer credit control units installed close to where each customer accesses his/her water supply; and
e) water metering valve control units which interact with the customer credit control units.

Items a) and b), b) and c), or a) to c) can be combined in single units but for large installations keeping them separate can be important for flexibility and perhaps total costs. When they are kept separate they are often semi-permanently linked for the automatic transfer and updating of information but such linking is not essential.

Items d) and e) can be combined in a single unit and this is probably advantageous in helping to achieve a rugged tamper proof installation. A failure in or the disconnection of any component in either of these units will result in the water being turned off.

All the systems offered seem to be capable of linking customers to a single customer credit control unit, thereby making it easier to manage unaccounted-for water (UAW) and to monitor individual customer and water access points. In the simple systems, information flow between items c) and d) is only one way whilst with 'smart' technology feedback is also possible. The advantages of this two-way communication will depend on the information captured and on the analysis and reporting capability of the management software.

Flexibility with respect to tariff structures, fixed charges, variable charges and debt repayment varies from system to system. Therefore the requirements of the water supply authority must be clearly stated when issuing enquiry documents. Moreover, flexibility should be achieved via adjustments made at the computer or the support units, rather than at each customer's credit control unit as this would compromise security and make the adjustments themselves more difficult to implement.

Assuming that a particular supplier's technology is generally reliable and that it is acceptable to both the water provider and customer **possible weaknesses** which require meticulous evaluation for remote rural schemes are:

- the power supplies to the customer credit and valve control units; and
- the total capital cost per community when the costs of the computer, support unit and vending terminal are included.

2.2.3 Generally submissions were less comprehensive than had been expected.

2.3 Overview of the individual submissions

An overview of each submission is provided below. Annexure A contains an evaluation of each system offered in a standard format.

2.3.1 **Consolidated African Technologies (CAT):** supply meter reading systems for **individual household connections** which require no data entry personnel in the billing section and optional add-on portable printers which allow on-the-spot field billing. CAT have 50 clients in southern Africa and were recently awarded a substantial order from Botswana covering both the water and electricity industries. The units are normally battery powered and the battery packs need recharging.

2.3.2 **Durban Metropolitan Water and Waste:** provide manually filled 200ℓ tanks next to homes for **individual household connections.** People within the community are appointed as water bailiffs whose duty is to fill each tank daily from a manifold feeding the tanks. Since much of the work is done by community members and the water is paid for in advance, Durban Metropolitan Water and Waste report that very competitive water tariffs are possible with this system. Further analysis of this claim is given in Table 2.3.

2.3.3 **Plasti Drum/CSIR:** produce a system similar to the Durban Water and Waste system, again for **individual household connections** which are left permanently attached to the water main. As a result the 200ℓ tank can be used to supply household demands of up to 500ℓ/day (rather than the 200ℓ/day provided by the Durban system). Ten test units were installed in peri-urban areas of KwaZulu-Natal for a Water Research Commission study on cost recovery carried out in conjunction with Umgeni Water. All the households involved in the study responded positively to the units.

2.3.4 **Teqnovo:** produce coupon operated mechanical prepaid water meters/dispensers for **bulk water supplies and shared standpipes** as well as electronically controlled units for **shared standpipes.** To date over 100 of the bulk water supply units have been sold and the first prototype shared standpipe units will be installed shortly. Teqnovo can also supply telemetric bulk water control systems. It is anticipated that, compared to electronic units, mechanical units will require additional administration to collect the coupons and to monitor unaccounted-for water since the mechanical units cannot link individual users to individual dispensers. On the other hand, communities are likely to find that the non-electric mechanical units are easier to repair and maintain.

2.3.5 **ABB Kent/Telbit:** produce electronic prepaid water meters designed for both **individual household connections** and **shared standpipes.** A mains or battery driven energy source is supplied to control the unit. No details of the unit's flexibility with respect to tariff structuring were given. Special feature: the unit shuts down if there is no water pressure. Although ABB Kent/Telbit have no current client list for prepaid water meters they have recently submitted three proposals and were optimistic about receiving orders early in 1997.

2.3.6 **Bambamanzi Trading SA:** produce electronic prepaid water meters designed for both **individual household connections** and **shared standpipes.** The primary energy source for the household unit is a solar panel set in the lid of the unit's casing whilst the shared standpipe units are battery powered. The units allow for a four-part tariff structure whilst Bambamanzi recommends using a maximum of three parts during normal use so that the four-part structure can be utilised for abnormal temporary tariffs during periods of rationing. Special features: Bambamanzi offers a mobile point of sale unit. They are planning to introduce an on-line computer bureau service for clients in the last quarter of 1997. The customer's 'smart tokens'™ allow full two-way information flow. Their 'turnkey' prepayment water metering and management system has been designed in South Africa for South African conditions. They claim it is easy to use, reliable, and tamper proof. The computer management system processes sales, water usage, meter readings, unaccounted-for water, management reports, etc. Three pilot projects were commissioned in May 1997: an Umgeni Water project with individual yard connections, and Rand Water and Magalies Water projects at Moddersprui t and elsewhere with shared standpipes.

2.3.7 **Plessey/Control Instruments (CI):** have designed and are ready to produce prepaid water dispensers for both **individual household connections** and **shared standpipes.** The Plessey customer credit control unit has been in use for eight years and over 400 000 units have already been installed for prepaid electricity meters. The water measuring/valve control unit is new but it is assembled from well proven components. A mains or battery driven energy source is supplied to control the unit. Tariffs are structured at the customer vending terminals and arrangements for block tariffs are available. Special features: Plessey/CI are planning an exchange system to minimise downtime due to maintenance. The display on the customer credit control unit is programmed to display available credit, water usage, and high usage. This unit can be configured for both water and electricity with the data for each commodity being stored separately. It uses keypad technology for entering credits. A card slot is therefore not necessary. The water meter valve control unit can be manufactured to restrict water usage rather than cutting it off. When credit is bought a coded receipt is received. Lost receipts can be re-issued without any danger of the selling authority or the customer being financially penalised. Shared standpipes are operated by purchasing a number of tickets for fixed amounts of credit.

2.3.8 **Cumcon:** have made an informal submission by telephone. They have designed and produced prepaid utility management systems. The water management portion has focused on **bulk supplies** and **individual household connections.** The system can be adapted easily to cater for **shared standpipes**. Special features: this company has a policy of leasing units with a full maintenance service until they are sure the utility selling authority has the capacity to maintain the units. They currently market a Utility Management System for managing both water and electricity sales. A facility to add telephones and/or gas has already been designed and could be implemented at a low additional cost. Full two-way communication is maintained between the central data processing unit and all outstations (both the individual customer's control units and the bulk water supply control points) by means of a solar/battery powered VHF radio link with a 45 km radius operating distance. The individual outstations can be programmed to indicate and/or transmit information on any anomalous water utility indicators such as: high night flow rates, high day flow rates, high and low daily consumption, negative and excessive positive long-term trends, low and high reservoir levels, high and low pipeline pressures, etc. By processing the incoming data from the individual outstations unaccounted-for water can be calculated on a semi-continuous basis and anomalies such as high figures and positive trends flagged. Design variations also include unattended vending terminals. The credit bought at such a terminal is transmitted automatically to the customer's control unit.

2.3.9 **Schlumberger Measurements and Systems:** produce a prepaid water metering system for **Individual household connections** in the UK where 3500 units are currently in use. Opinion poll results suggest that this system is very popular with users. The water prepayment system uses the same smart key token system as their UK prepayment electricity meter, of which over 1,5 million units have been installed in the UK. Special features of the unit allow emergency negative credits. Negative credits and fixed charges, where applicable, are deducted first when the customer's control unit is credited with funds. The system can also be programmed to recover payment arrears by deducting an agreed amount from each new credit. Schlumberger recently completed its take-over of AEG Energy Controls, a manufacturer of keypad-code and disposable card prepayment electricity meters. To date they have not entered the water prepayment market in South Africa but would welcome the opportunity to discuss adapting their existing range of products to the local environment.

2.3.10 The individual submissions end with a brief indication of some of the current South African thinking on general Water Data Management Systems and how they may be affected by both the proposed National Water Supply and Sanitation Information Management System and the proposed regulations applicable to local authorities. Whilst a full analysis of these subjects is beyond the brief of this survey it is important to keep in mind that the administrative support systems installed with cost recovery systems should as far as practical support these other initiatives. Only the submission by **Hydraulic Computer Services** was a direct response to invitations sent out in terms of this survey. Their administrative support systems cover all operation and maintenance management needs including water billing and control of unaccounted-for water. Their systems also cover planning and design for upgrades and rehabilitation. This last feature is unique in that it uses real current data already collected during the day-to-day management of the system. This in turn adds significantly to the range of financial savings and technical benefits derived from Hydraulic Computer Services management systems without increasing the workload of the water service provider's staff. The rehabilitation module includes meter and pipe replacement schedulers. Other Water Data Management Systems on the market currently cover fewer information needs but some are set out in a manner which starts considering nationwide replication and data exchange.

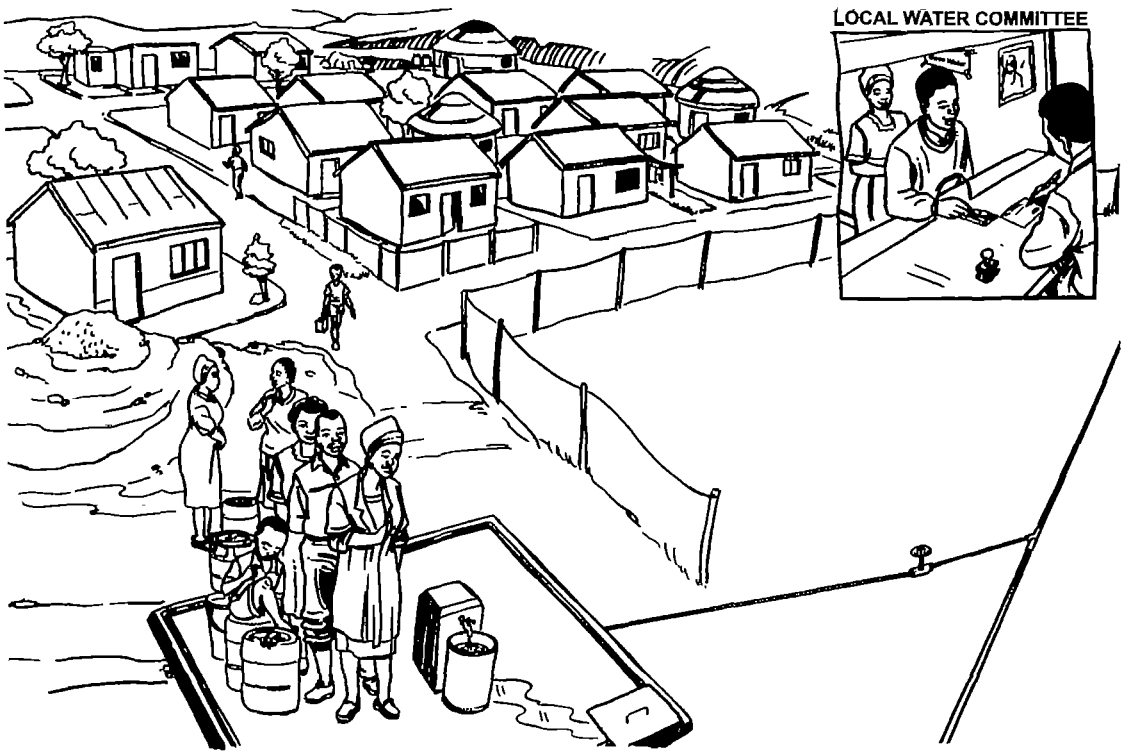


Figure 2.1 RDP basic level of service: Cost recovery option no. 1: Public standpipe: Prepaid flat rate/graded rate

Figure 2.2 RDP basic level of service: Cost recovery option no. 2: Public standpipe: Prepaid with attendant

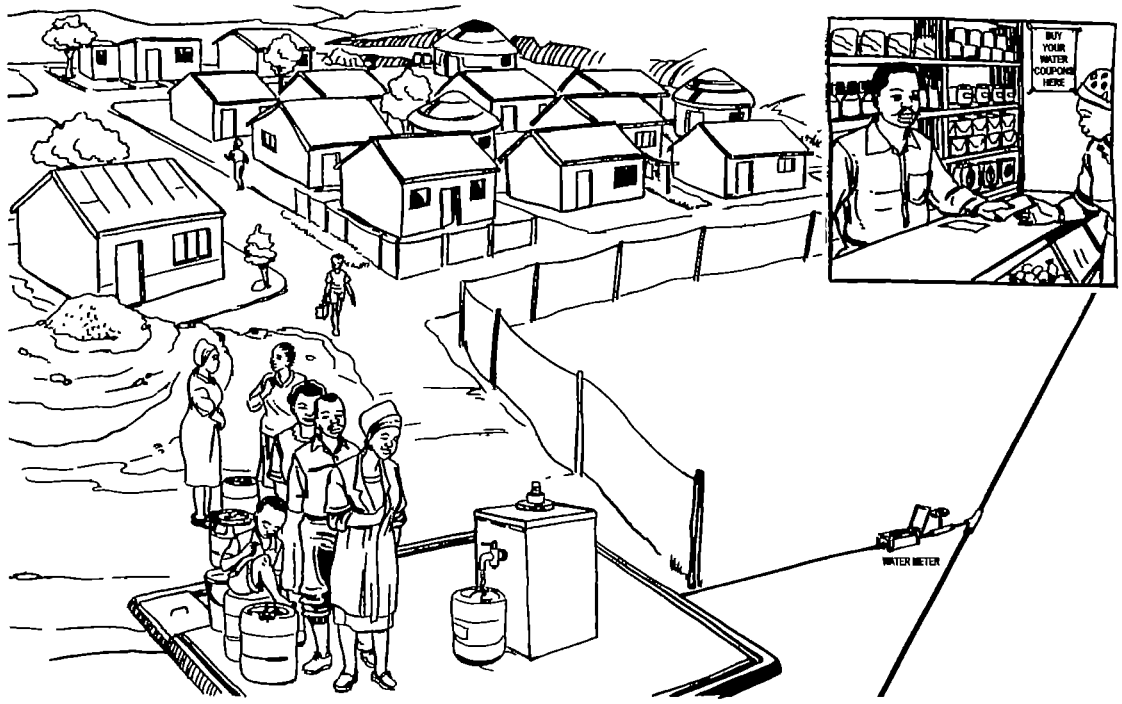


Figure 2.3 RDP basic level of service: Cost recovery option no. 3: Public standpipe: Prepaid mechanical vending

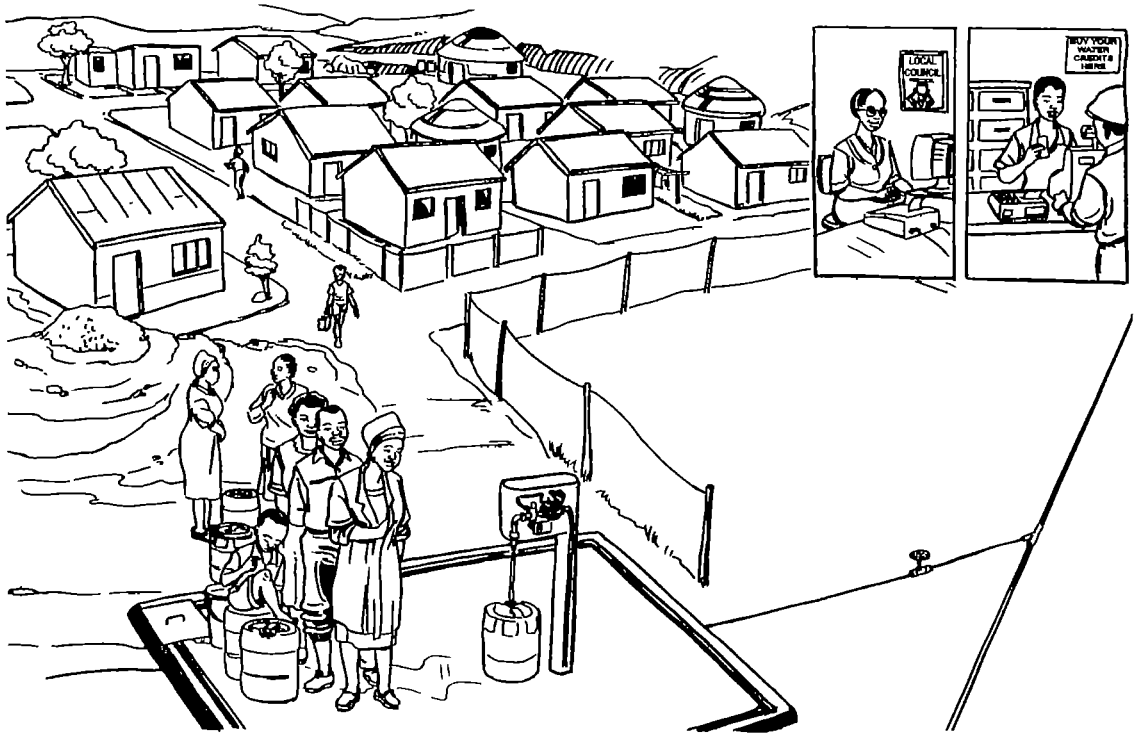


Figure 2.4 RDP basic level of service: Cost recovery option no. 4: Public standpipe: Prepaid electronic vending

2.4 A comparison of cost recovery options

Summary details of a wide range of cost recovery options are given in Table 2.1. The table is an adaptation and extension of tables included in van Wijk-Sijbesma 1989 and cited and adapted in Evans 1992. Figures 2.1 to 2.4 and 2.6 to 2.12 illustrate these options. The illustrations are grouped in three sets corresponding to basic RDP levels, intermediate levels and the highest levels of service. The concept of levels of service relates to affordability, which is discussed in the literature survey.

In Table 2.1 the cost recovery options are grouped under four headings. The first group of options are based on the service water provider charging the customer a fixed charge per month. The second group are all metered prepayment options. The third group are all metered billing systems. In this report the fourth group, for other miscellaneous options, contains only one option.

The purpose of giving details of such a wide variety of options is to indicate how the new options surveyed compare with the existing, more traditional options. The typical charges required to cover total operating and maintenance costs for all the different options listed will then be examined.

2.4.1 **Options with fixed payments per month** are less costly to implement and need a less well developed administrative system than other cost recovery options. A perceived lack of 'fairness' and problems with unaccounted-for water and water wastage were traditionally regarded as weaknesses with this group of options. However, the graded flat rate option and the distributed storage tank options have helped to extend its range of usefulness. It is also interesting to note that it is natural to implement all these options as prepayment systems although it is not an essential component of the way they operate.

2.4.2 **Metered prepayment options** achieve the benefits of more conventional metered charging without the need for such a high capacity administration. They also help water service providers to attain better cash flows and a lower incidence of bad debts and help customers with budgeting. In general, provided they are implemented within an environment where all the pre-conditions for effective cost recovery are met, it is anticipated that water service providers will not be disappointed in the results obtained from implementing a prepayment cost recovery option. The introduction of electronically controlled prepayment systems is likely to revolutionise cost recovery from shared connections in many medium and large villages throughout South Africa. Whilst such systems are even more suitable technically for individual household connections and are competitive with conventional billing systems, they do not overcome the problem of the high unit costs associated with low water consumption levels from individual connections installed in community water supply schemes. It is, therefore, still important to promote intermediate levels of service such as household distributed storage tanks and privately operated shared yard taps to cater for customers who demand a higher level of service than RDP standard standpipes but cannot afford traditional individual household connections.

2.4.3 **Metered billing systems** are associated with individual household connections and for this reason alone are expensive to implement. However, they should not be ignored as there are ways of making them more appropriate for community water supply schemes. Suggestions include self-billing and field billing, computer-based administration systems and hand-held computer route planners with meter reading processor and optional field-printed billing facilities. The hand-held computer route planners with printers are extensively used in Botswana and it is claimed that the resultant well-motivated meter readers are the frontline operators of very successful cost recovery systems.

2.4.4 Important factors associated with the typical applications for the different cost recovery options are settlement size, whether connections are shared or dedicated to individual households and, for individual household connections, the water usage levels. Based on these observations, the submissions received from the devices survey and the general findings of the literature survey, a decision support diagram (Figure 2.5) has been compiled for selecting possible retail cost recovery options and administration support systems for community water supply schemes. In proposing a choice of options to communities possible options can first be selected using this decision support diagram and then further details can be abstracted from Annexure A.

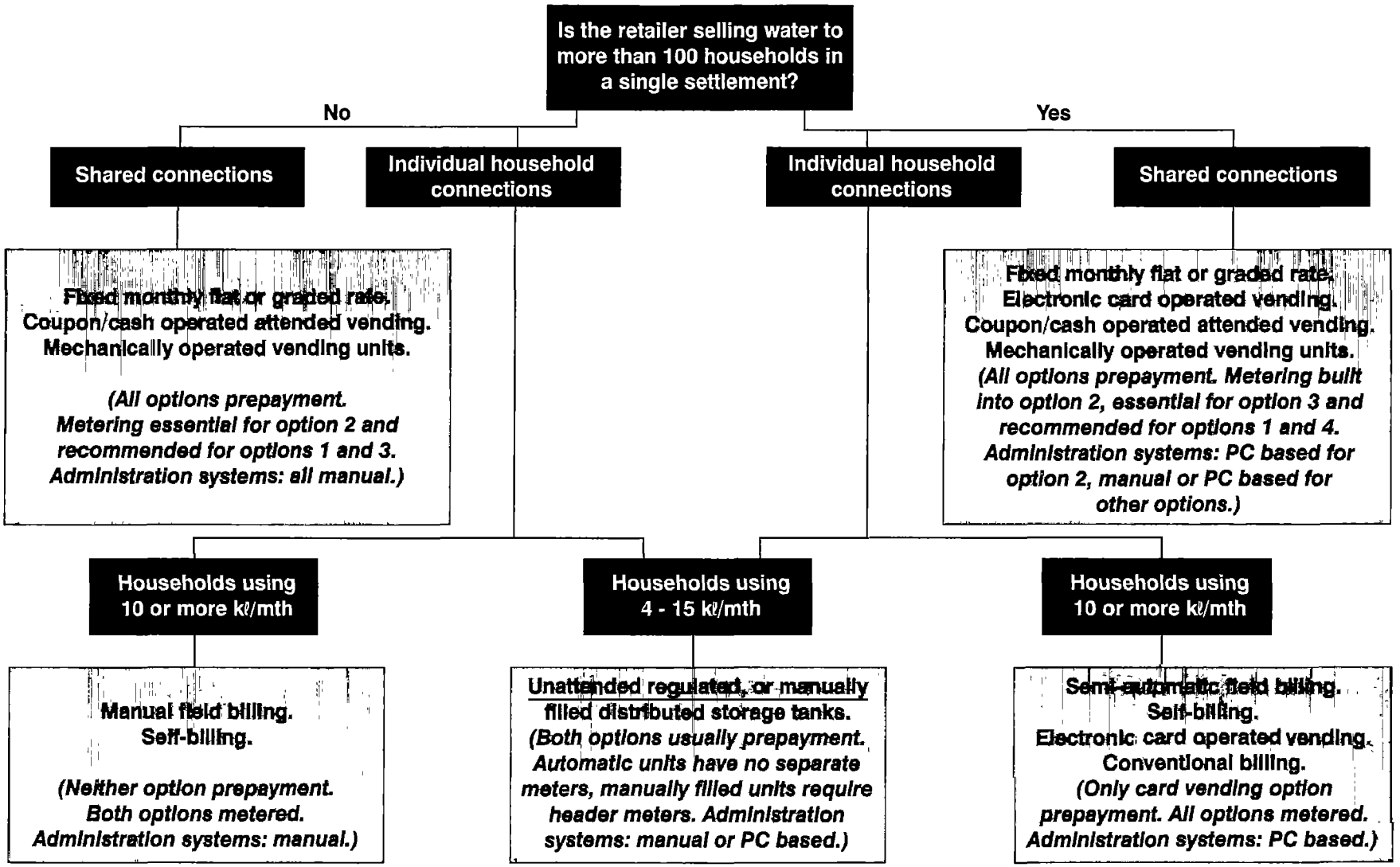


Figure 2.5 Decision support diagram for choosing suitable retail cost recovery and administration support options
Site inspections are essential to verify the suitability of the electronic card and mechanical operated vending systems. Cost recovery options are listed in order of likely total present value implementation costs and therefore likely acceptability to the selling authority. Acceptability to the customer has not been taken into consideration and this aspect must be checked before implementing any particular option.

Table 2.1 Summary of distribution system cost recovery options

Option	Applicable to	Some general comments
Fixed monthly payments:	Fixed monthly payment systems are less costly to implement and require a less well developed administrative system to maintain than other cost recovery options. Although not an essential component of these options, it is natural and common practice to implement these options as prepayment systems.	
Flat rate.	Shared connections with user group members benefitting more or less equally. Not recommended (long-term) for individual household connections.	Inexpensive to implement. Unacceptable to many user groups because benefits rarely perceived as equal. Wastage difficult to control. UAW control becomes separated from cost recovery.
Graded rates, rate dependent on user benefits and sometimes capacity to pay.	Shared connections. Not recommended (long-term) for individual household connections.	If run efficiently and transparently more acceptable to users. Tariffs adjusted according to ability to pay should be avoided except where absolutely necessary. Requires well trusted and organised community committee to control. UAW control becomes separated from cost recovery.
Manually filled distributed storage tanks. Tanks filled regularly every day.	Single household connections with low to medium water usage levels.	These units are useful as an intermediate level of water supply. There are capital, maintenance and relatively high operating costs associated with these units.
Unattended regulated distributed storage tanks.	Single household connections with low to medium water usage levels.	There are capital and maintenance costs associated with these units. However the units can also be used to increase the capacity of the distribution system by smoothing the demand curve thereby reducing total costs per kℓ of water delivered. Because it sets maximum daily consumption and not actual consumption, tariff setting and UAW monitoring is more difficult than with fully metered systems.
General services taxation based on graded rates.	Shared connections. Not recommended (long-term) for individual household connections.	Refer notes on graded rates above. Some additional cost savings can be achieved due to shared billing costs. Itemising the water charge is still recommended when this option is implemented.

Table 2.1 *continued*

Option	Applicable to	Some general comments
Prepayment:	Achieves the benefits of more conventional metered charging without the need for such a high capacity administration. Helps supply authorities attain better cash flow and a lower incidence of bad debts and helps water users with their budgeting.	
Attended money or coupon operated access point.	Shared connections only.	Because of the attendant, the operating costs are high. When money is used theft may be a problem. When coupons are used organising their distribution requires additional administration. Opening hours are limited.
Unattended coin or coupon mechanically operated vending.	Shared connections in small villages.	The availability of a reliable tamper proof unit may be a problem. The potential of a satisfactory unit providing an effective cost recovery system for small villages where electronically controlled vending is too expensive is high.
Unattended electronically controlled vending.	Shared or single household connections in medium and large sized villages.	Not fully proven for water as of April 1997. However the potential for wide applicability and acceptability is exceptionally high. Does not solve all the problems associated with the high cost of water per kℓ associated with individual household connections when water usage is low. For such applications there is still a need to promote intermediate levels of service.
Metered charging:	Requires high capacity efficient administration.	
Centralised billing and collection.	Single household connections with medium to high water usage and shared connections after agreement has been reached on who will pay and how the bill will be shared.	Generally higher user acceptance because it is the traditional method of cost recovery in South Africa. Running costs are high especially in low income areas where low water usage tends to make it inappropriate.
Decentralised billing with centralised collection.	As above.	Invoice delivered by meter reader to reduce running cost. Generally as above.
Decentralised billing and collection.	As above.	Invoice delivered and money collected by meter reader to further reduce running costs. Not appropriate in areas where violent crime associated with robbery is common. Some external spot auditing required.
Self billing and centralised collection.	As above.	Cheapest method of metered charging. Spot auditing and a penalty system for low meter reading required. Self billing has been implemented by the UK supermarket chain "Safeway".
Other:		
Cooperative funding.	Small groups using water in connection with a money generating cooperative enterprise, especially where revenue is uneven and/or water usage is uneven during the year.	Funds can be kept and put aside from earnings generated by the cooperative without additional administrative costs when it is available for use until more earnings are generated.

Figure 2.6 Intermediate level of service: Cost recovery option no. 1: Shared standpipe: Electronic vending

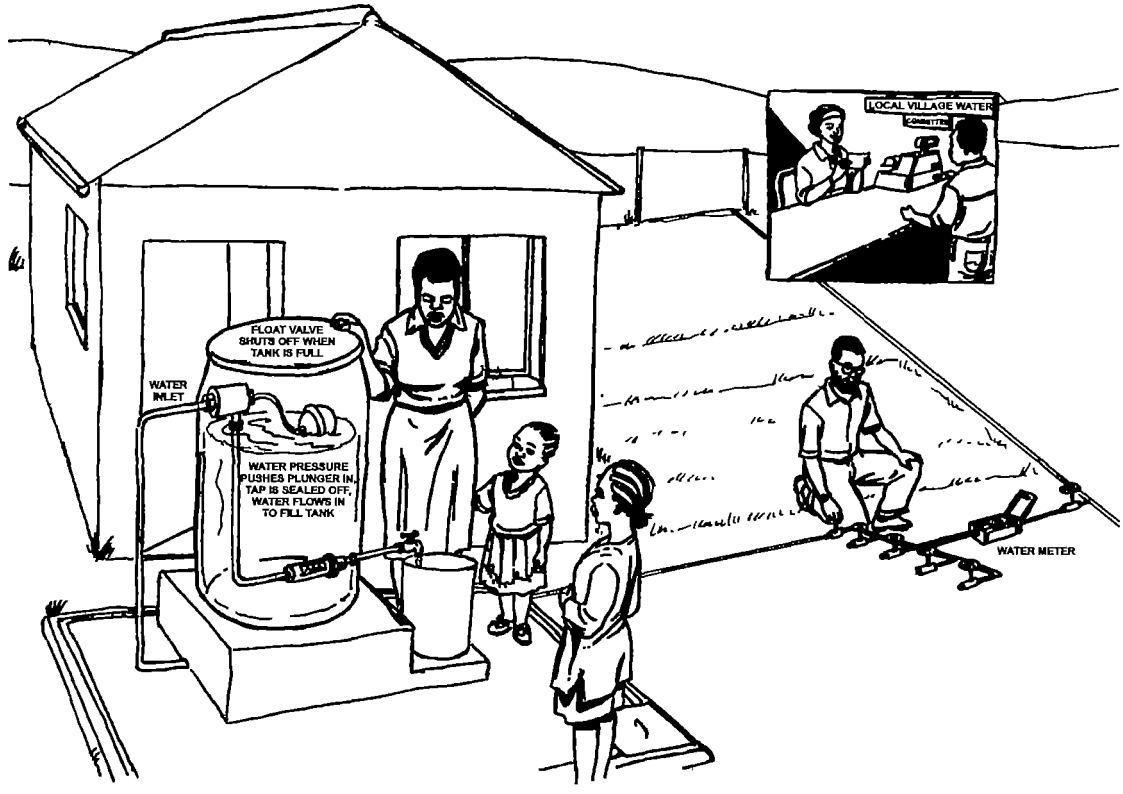


Figure 2.7 Intermediate level of service: Cost recovery option no. 2: Individual household manually filled storage tanks

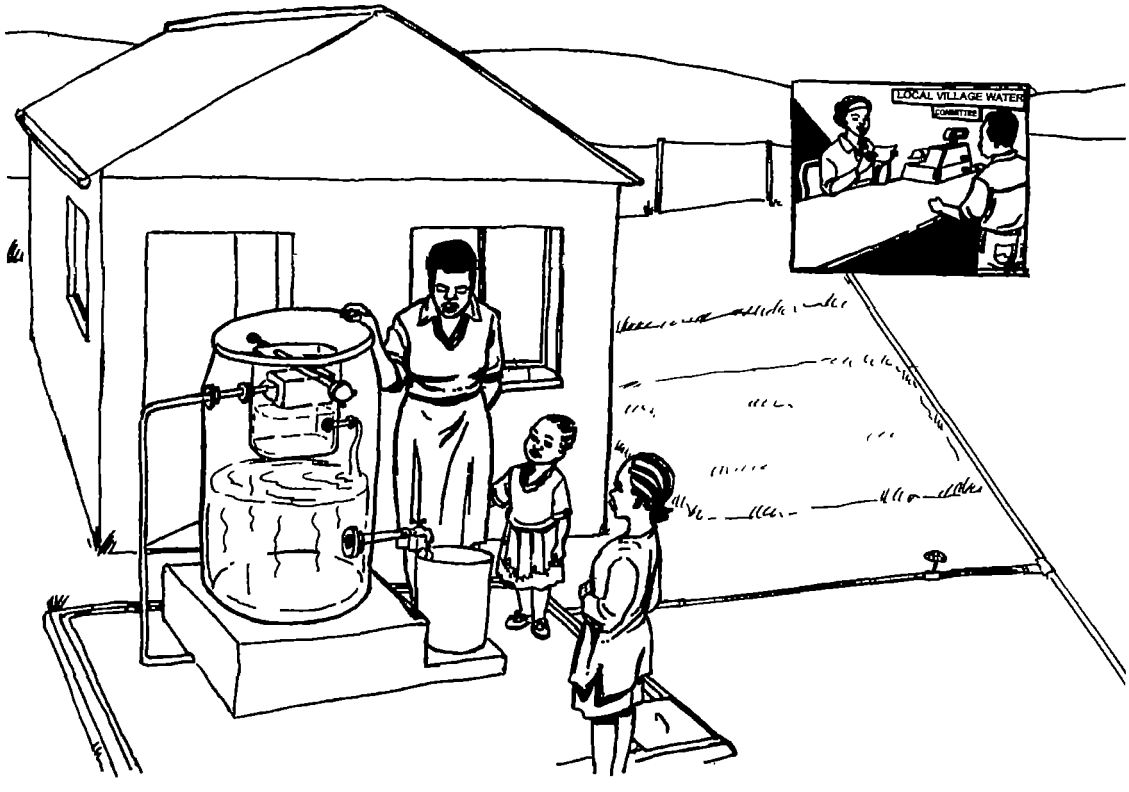


Figure 2.8 Intermediate level of service: Cost recovery option no. 3: Individual household unattended regulated storage tanks

2.5 Typical charges required to cover total costs

2.5.1 Apart from needing general details on different cost recovery options, water service providers and their customers need to have estimates of the charges needed to cover total costs before they choose a particular option or set of options. Typical total costs for various options and different water consumptions are given in Table 2.2. These total costs provide a rough guide to the comparative costs between different options, to help water service providers establish more accurate estimates. They can follow the approach used in calculating the examples given to check the costs applicable to their own schemes.

Actual costs vary considerably from community to community depending on the availability of exploitable resources, the nature of the scheme constructed and the cost effectiveness of the operation and management system in place. Therefore, **water service providers should never use the figures quoted in Table 2.2 for tariff setting and some care should even be exercised in using them to compare different cost recovery options without examining the assumptions on which the figures are based and calculating the actual costs applicable to the scheme being examined.** These assumptions are listed in Section 2.5.2 below.

The charges in Table 2.2 are divided into four columns as follows:

column 1 = production and delivery cost of bulk water used by households - the customer has control over this item;

column 2 = recurrent reticulation system operation, caretaking, maintenance, administration and management costs, including the cost of unaccounted-for water and an allowance for non-payment write-offs where applicable - all items the water service provider has some control over;

column 3 = reticulation system capital repayments - the water service provider has no day-to-day control over this item as it became fixed during the design and construction phases of the project **but** good care of the infrastructure means it will be possible to use the infrastructure after the loan repayments are complete and the loan charge is zero; and

column 4 = total charges - the addition of the first three columns.

Recent developments within the Department of Water Affairs and Forestry allow for the capital cost of an appropriate cost recovery system to be included in applications for grant finance for basic RDP level of service provision. This means the greater part of each of the three capital repayment charges listed in the first five lines of Table 2.2 will fall away. Some charge should still be collected to allow for the replacement of cost recovery system components which wear out.

Table 2.2 Typical average charges required per household per month to maintain a sustainable break-even situation for the different cost recovery options and administration support systems

Type of scheme and cost recovery method	Typical average charges per household: R-c/mth			
	Cost of bulk water used by households	Reticulation system O & M costs	Reticulation system capital repayments	Total charges
Average water consumption: 4 kℓ/mth per household with 15 households sharing each standpipe				
Electronic vending	6-00	5-40	2-94	14-34
Flat rate	6-00	9-50	0-00	15-50
Graded rate	6-00	10-00	0-00	16-00
Attended standpipes	6-00	11-20	0-43	17-63
Mechanical vending	6-00	8-40	8-50	22-90
Average water consumption: 6 kℓ/mth per household with 4 households sharing each yard tap				
Electronic vending	9-00	8-00	21-25	38-25
Average water consumption: 6 kℓ/mth per household from individual household yard taps or house connections				
Regulated storage tanks	9-00	16-65	17-30	42-95
Manual storage tanks	9-00	19-50	19-57	48-07
*Electronic vending	9-00	12-50	41-22	62-72
Average water consumption: 14 kℓ/mth per household from individual household yard taps or house connections				
Regulated storage tanks	21-00	23-67	18-67	63-33
*Field billing	21-00	27-39	29-45	77-84
*Self billing	21-00	33-13	29-09	84-22
*Electronic vending	21-00	18-50	45-58	85-08
*Conventional billing	21-00	39-45	29-09	89-54
Average water consumption: 34 kℓ/mth per household from individual house connections				
*Electronic vending	51-00	33-50	51-49	135-99
*Conventional billing	51-00	60-11	35-00	146-11

* At the project design state, the capital repayment charges for these options could be reduced by approximately R6-00/mth through installing unregulated break pressure storage tanks

2.5.2 The assumptions on which Table 2.2 is based are as follows.

- Bulk water costs R1-50/kℓ.
- Each shared standpipe has only one outlet or water collecting point.
- Water losses from the reticulation system are equivalent to 4kℓ/mth per access point = R6-00/mth per access point.
- R0-75/kℓ of water sold has been allowed for general reticulation maintenance, repair and long-term replacement.
- The administration charges allowed are to cover the full cost of managing the reticulation system which includes the cost of administering the cost recovery system, managing unaccounted-for water and arranging for maintenance work to be carried out.
- The capital cost for reticulation is based on the estimated peak demand for the situation being examined. No allowance has been made for any growth in demand. Where the level of service does not exceed the basic RDP service provision policy (as defined in DWAF 1994 pp. 15 and 16) it is assumed that grant finance has been obtained to pay the capital cost of the reticulation and no allowance has been made to pay for the reticulation capital cost or to build up a sinking fund to replace it when required. In all other cases a 25 year payback period and 10% per year compound interest rate has been allowed - this corresponds to collecting R9-09/mth for each R1000 borrowed.
- To maintain cost recovery hardware and software and to replace them in the long term, money is to be collected on the basis of paying back loan capital over a period of 10 years at 15% per year compound interest - this corresponds to collecting R16-00/mth for each R1000 spent on cost recovery hardware and software. Amounts of money required for central system management items, credit vending terminals and access point hardware are listed and accounted for separately.
- Only one vending terminal has been allowed per 900 households for customers to buy their credits for electronic prepayment systems.

To enable readers to obtain a better overview of the typical monthly household water charges reported in Table 2.2 further details of the assumptions used in calculating them are given in Table 2.3.

Note should be taken of the sensitivity of the various payment methods described to these assumptions. For example, electronic prepayment systems are sensitive to the number of households in a village and the assumption that 900 households can be adequately served by a single terminal for selling 'credits'. Shared standpipe methods are sensitive to the number of households sharing each standpipe, etc.

Table 2.3 **Further details of the assumptions used to calculate the typical monthly household water charges for the different cost recovery options and the administrative support systems given in Table 2.2 and the resultant tariffs for each option**

Type of scheme and cost recovery method	Administration charge per household R-c	Capital amount allowed: Rand				Under recovery allowance %	Tariff R-c/kℓ assuming community of 900 households
		Reticulation/ household	Central computer	Per credit terminal	Per access point		
Average water consumption: 4 kℓ/mth per household with 15 households sharing each standpipe							
Electronic vending	2-00	* 1 000	20 000	5 000	2 200	0	3-59
Flat rate	3-00	* 1 000	N/A	N/A	N/A	20	3-88
Graded rate	3-40	* 1 000	N/A	N/A	N/A	20	4-00
Attended standpipes	7-00	* 1 000	N/A	N/A	400	0	4-41
Mechanical vending	5-00	* 1 000	N/A	N/A	7 900	0	5-76
Average water consumption: 6 kℓ/mth per household with 4 households sharing each yard tap							
Electronic vending	2-00	1 300	20 000	5 000	2 200	0	6-38
Average water consumption: 6 kℓ/mth per household from individual household yard taps or house connections							
Regulated storage tanks	4-00	750	N/A	N/A	650	5	7-16
Manual storage tanks	9-00	1 000	N/A	N/A	650	0	8-01
Electronic vending	2-00	1 370	20 000	5 000	1 750	0	10-45
Average water consumption: 14 kℓ/mth per household from individual household yard taps or house connections							
Regulated storage tanks	4-00	900	N/A	N/A	650	5	4-52
Field billing	7-00	1 850	30 000	N/A	750	5	5-56
Self billing	5-00	1 850	10 000	N/A	750	15	6-02
Electronic vending	2-00	1 850	20 000	5 000	1 750	0	6-08
Conventional billing	14-00	1 850	10 000	N/A	750	10	6-40
Average water consumption: 34 kℓ/mth per household from individual house connections							
Electronic vending	2-00	2 500	20 000	5 000	1 750	0	4-00
Conventional billing	14-00	2 500	N/A	N/A	750	10	4-30

* Grant finance for which no repayment charge has been levied.

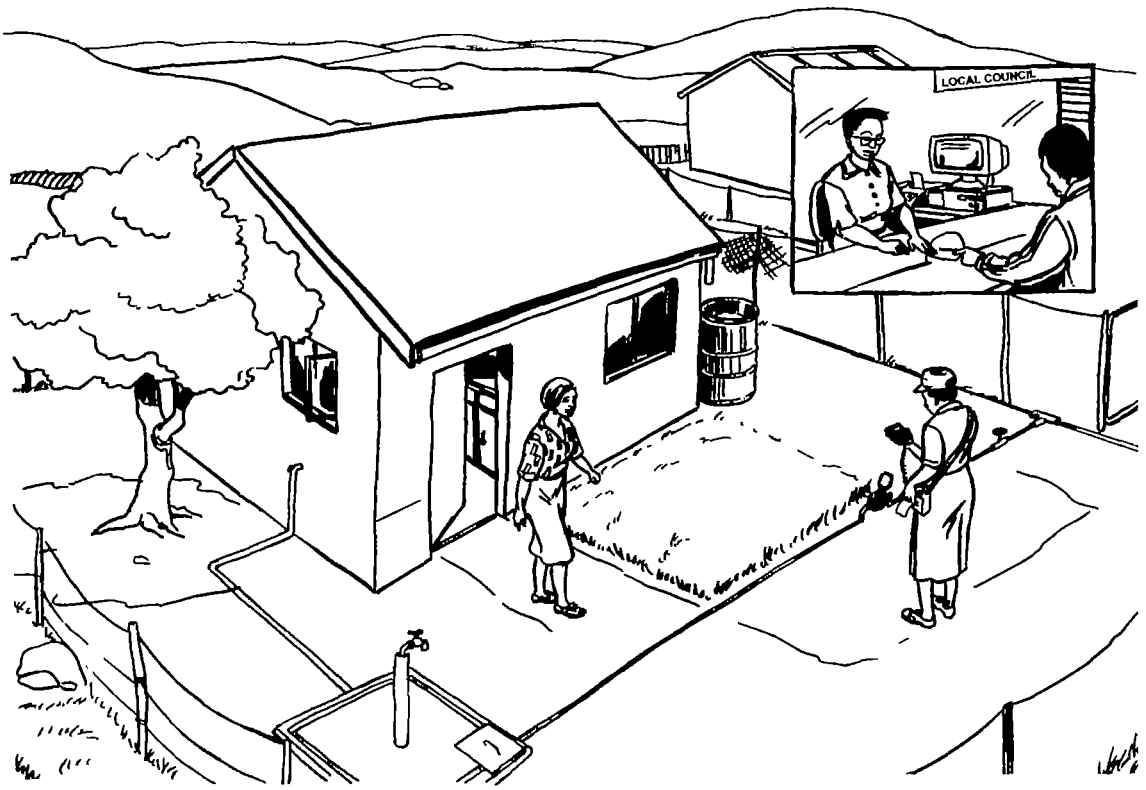


Figure 2.9 Highest level of service: Cost recovery option no. 1: Household connection: Programmed field billing

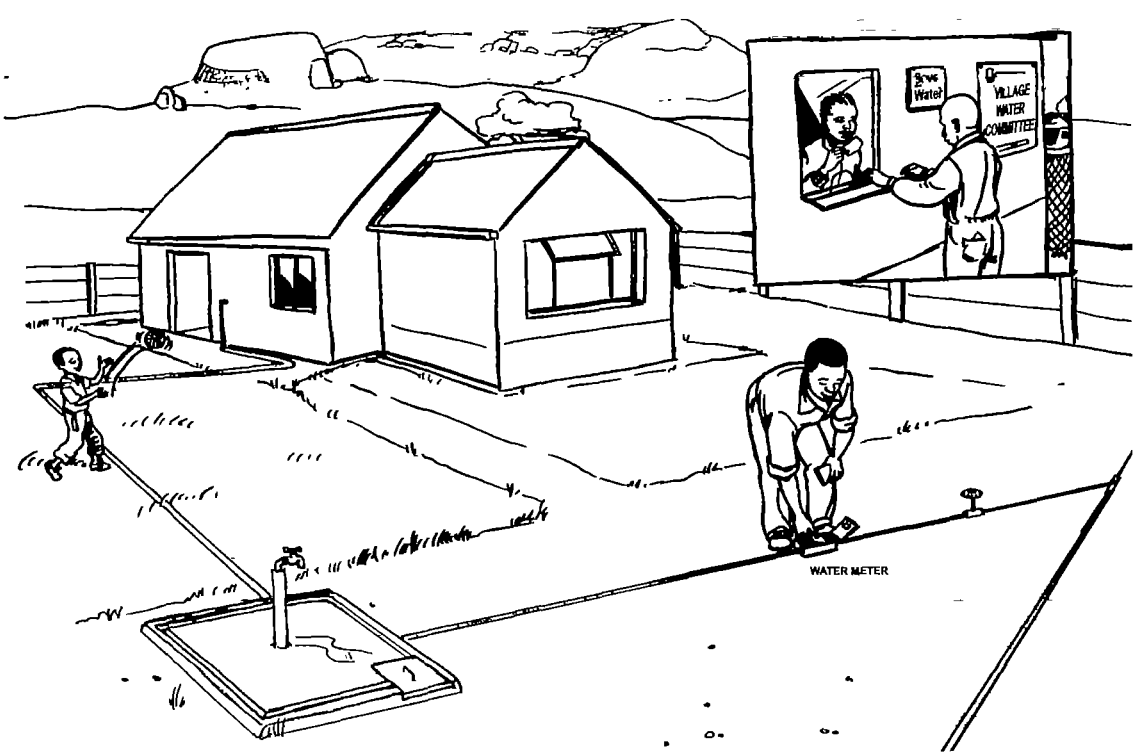


Figure 2.10 Highest level of service: Cost recovery option no. 2: Household connection: Self-billing

Figure 2.11 Highest level of service: Cost recovery option no. 3: Household connection: Prepaid electronic vending

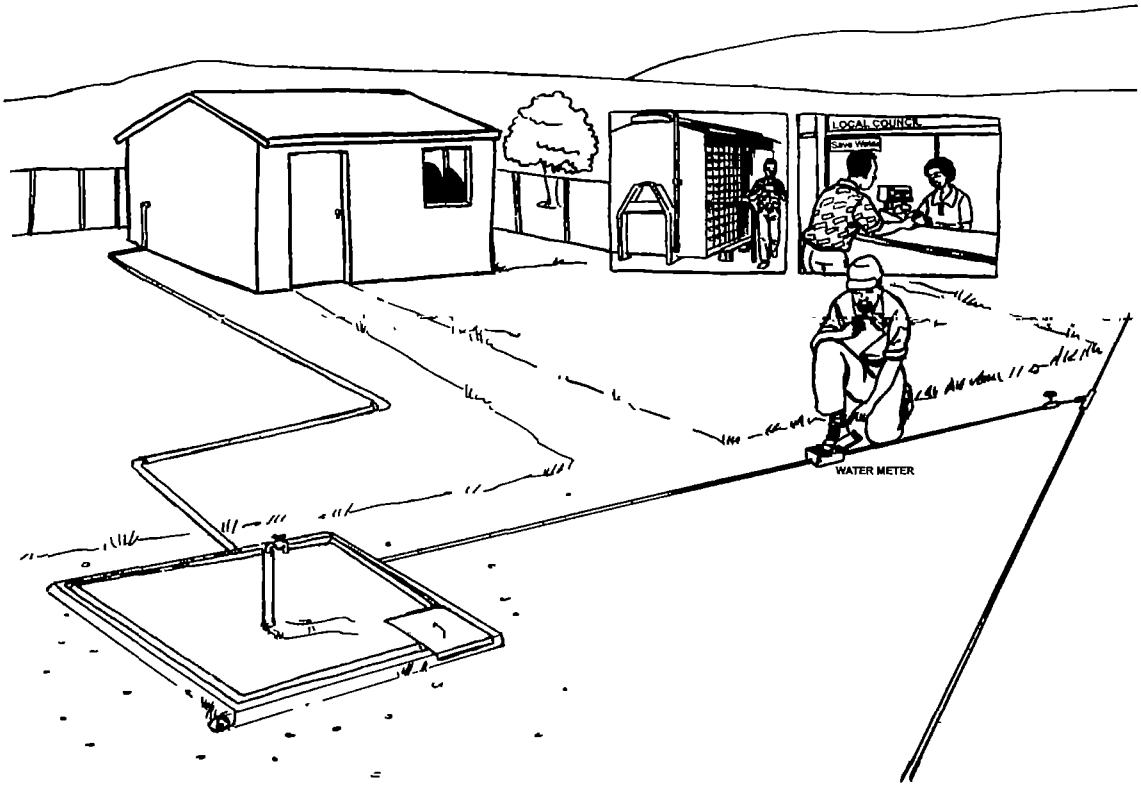


Figure 2.12 Highest level of service: Cost recovery option no. 4: Household connection: Conventional billing

2.5.3 Whilst the water charges and tariffs reported in Tables 2.2 and 2.3 are appreciably higher than households are accustomed to being charged by public utilities in South Africa, Figure 2.13 illustrates just how low these tariffs are compared with the prices charged for other widely used commodities.

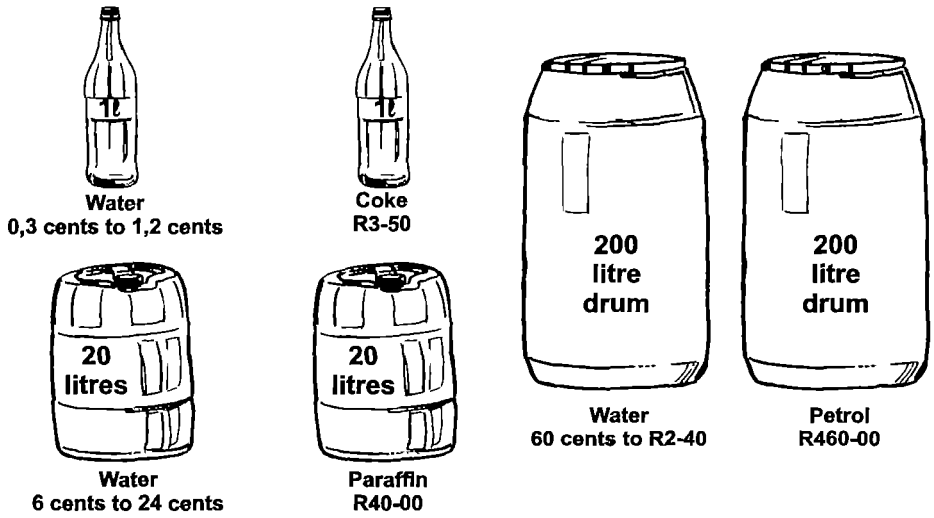


Figure 2.13 Typical comparative costs for water sold from R3-00 to R12-00 per 1 000 litres
(Adapted from: Serfontein, N (1996))

2.6 Conclusions and recommendations of the systems survey

2.6.1 **Flat rate, graded rates, attended access points and mechanically operated access points** can all be considered for, but are generally limited to, shared connections in small villages comprising up to 100 households. In theory, flat rate cost recovery is simple to administer but may not be acceptable to consumers in communities where people living near the access point consume more water yet pay the same rate as those living further away. Graded rates which are still relatively simple to administer can be introduced to overcome this problem, however, getting community members to agree on the rates can be difficult. Thus despite being more expensive and more difficult to administer some communities prefer attended cash or coupon operated access points. Limited opening hours are an added disadvantage of this method of cost recovery, hence the demand for unattended access points. For small communities, mechanically operated units, being stand alone units, require less capital expenditure to install than card operated systems. Finding reliable and tamper proof units may, however, be a problem.

2.6.2 There is a need to promote **intermediate levels of service** such as household distributed storage tanks and privately operated shared yard taps to cater for customers who demand a higher level of service than public standpipes but cannot afford individual household connections.

Distributed storage tanks are easier to administer because customers pay a fixed monthly charge. There are two types:

- manually filled units; and
- unattended regulated units (which can deal with a wider range of demands and are usually cheaper to operate).

A disadvantage of distributed storage tanks is that they cannot supply a sudden unusually high demand without prior special arrangements being made. Such a demand can occur during funerals, for example.

With privately operated shared yard taps the registered owner is responsible for paying the full account. How the account is shared is agreed between the households sharing the tap and the registered owner or account holder, without the water provider influencing the decision. The higher consumption per access point helps to reduce costs per litre, but if the account is not paid the water provider may have difficulty in cutting off the supplies since the other customers are likely to claim they have paid their share. Linking privately operated shared yard taps to an electronic prepayment cost recovery system will overcome this possible disadvantage.

2.6.3 **Electronic prepayment systems** appear to have wide applicability in settlements with more than 100 households for both shared and individual household connections. Acceptability to both the service provider and service user is expected to be high. They are particularly attractive for shared connections where the capital cost can be shared by a number of users. When used for individual household connections electronic prepayment systems do not overcome the problem of high unit costs associated with low consumption levels but they are still competitive with conventional metered billing systems. Electronic prepayment systems have proved themselves in the electricity supply industry. Their worth to the water supply industry still has to be verified.

2.6.4 For individual household connections, **semi-automatic field billing and self-billing systems** appear to be marginally less expensive to implement than electronic prepayment systems but they are not as versatile as the electronic systems since they are not suitable for shared connections. Conventional metered billing systems and other manual variations thereof are also only suitable for individual household connections. Except when used in villages with less than 100 households and/or when combined with field billing, conventional metered billing appears to be marginally more expensive than electronic prepayment.

2.6.5 Where cost recovery is based on **fixed monthly payments**, manually implemented administration systems may be a practical possibility for settlements with up to about 400 households, depending on the skills potential within the settlement. Once there are more than about 60 accounts which vary each month, higher levels of skills are needed to administer the system and a computer-based bookkeeping and water auditing package are likely to be needed. As the management of the simplest water scheme requires a range of skills to ensure its sustainability and the proper control of finances, general acceptability of the chosen cost recovery system to both the authority and the customers will determine viable choices rather than the initial training costs.

2.6.6 A national programme, with equal status and comparable resources to the existing initiatives to increase coverage, needs to be put in place to focus on sustainability issues related to all community water and sanitation schemes but especially existing ones. Such a programme will include the refurbishment of some of these existing schemes as well as considering all the conclusions of the literature survey.

2.6.7 Such a programme should also consider how the water utility management systems installed with the cost recovery systems are to be integrated with the proposed National Water Supply and Sanitation Management System and the proposed regulations applicable to local authorities so that uniform minimum reporting standards can be developed.

CHAPTER 3 LITERATURE SURVEY

3.1 Constraints to sustainable community water supplies

Katko (1991a pp. 19-21 and 1986 pp. 231-244, reproduced in 1991a pp. 83-96) reports extensively on seven studies carried out between 1978 and 1985 into the major constraints frustrating the development of sustainable water supplies and sanitation in developing countries. The studies were based on a questionnaire developed by the World Health Organization (WHO) in which respondents were asked to rank a fixed list of 17 'major' constraints to effective water supply and sanitation delivery. The respondents were professional staff responsible for the implementation of water supply and, sometimes, sanitation projects in developing countries either as local employees of government departments or as expatriate employees of external funding organisations. Figure 3.1 shows the combined results of four of the studies carried out in Africa.

The four studies which were combined are as follows:

- WHO African region: whole water and sanitation sector study involving 28 government official respondents (1980);
- Katko, Kenya: rural water supply study involving 19 expatriate respondents (1979-1985);
- Katko, Malawi: rural water supply study involving 11 expatriate respondents (1978-1985); and
- Katko, Tanzania: rural water supply study involving 19 expatriate respondents (1978-1984).

The overall ranking of the constraints is shown from top to bottom in the figure whilst the horizontal shaded areas show the highest and lowest ranking of each constraint obtained in the individual surveys relative to the overall ranking. In these early surveys operation and maintenance, combined with overall organisational logistics, were considered the most severe constraints. Too few trained professional staff and a poor cost recovery framework were the next most severe constraints.

This hierarchy of constraints is very similar to common problems reported by George Bunker, a water and sanitation engineer working in Central and South America, in a presentation he made to the Colegio de Ingenieros de Panama in **1938**. As cited by Donaldson (1984 p. 6), Bunker reported, amongst other details, that:

- the operation and maintenance of the systems were poor;
- there was usually a lack of trained technical and managerial personnel;
- financing was often a problem; and
- organisational problems were more common than technical ones.

Dabbagh (1991, cited by Katko 1991a p.19) analysed later surveys reported by WHO in 1990. This analysis by Dabbagh rated poor cost recovery as the most severe constraint on the attainment of sustainable water supplies in Africa, followed by maintenance and organisational logistics.

Katko (1991a p.19) also reports that cost recovery related constraints are not limited to developing countries. In 1984, from a survey of 24 constraints in the water supply industry in the USA, the American Waterworks Association reported inadequate tariffs as the most severe one. Financing constraints were one reason, Katko reports, for the privatisation of water and sewerage systems in Britain.

1	Operation and maintenance		3 Government Officials
2	Overall organisational logistics	1 Tanzania	5 Malawi
3	Too few trained professionals	1 Malawi	10 Kenya
4	Poor cost recovery framework	2 Kenya	10 Government officials
5	Funding limitations	1 Gov. officials	12 Kenya
6	Intermittent water services		14 Malawi
7	Poor government policy	2 Malawi	14 Tanzania
8	Too few trained technicians	5 Government officials	11 Malawi
9	Poor knowledge of resources	6 Kenya	12 Malawi
10	Poor institutional framework	6 Malawi	13 Kenya
11	Poor health education	8 Malawi and Tanzania	14 Gov. officials
12	Import restrictions	6 Tanzania	14 Kenya
13	Inappropriate technology	5 Kenya	16 Malawi
14	Poor legal framework	6 Government officials	17 Tanzania
15	Non-involvement of communities	8 Kenya	17 Malawi
16	Poor design criteria	11 Government officials	17 Kenya
17	Inadequate water resources	13 Malawi	

Figure 3.1 Major constraints to effective community water supply as ranked by the respondents of four studies carried out in Africa
(Adapted from Katko (1986 pp. 231-244) reproduced in Katko (1991 pp 83-6))

In the 1960s and 1970s this need for cost recovery was not understood by the governments of the newly independent states or by providers of development aid, and water was regarded as a social service to be provided free of charge (Katko 1992). However, since the 1980s the wheel has turned full circle. Now according to Yacoob (1990) there is a real danger of the implementation of cost recovery becoming an end in itself and of this overwhelming focus on cost recovery taking essential resources away from capacity building and training. When this happens the implementation of cost recovery contributes nothing to sustainability and probably militates against it.

Currently in South Africa much emphasis is being placed on capital works to increase coverage. Without sustainability, increased coverage does not address poor service delivery but represents a significant waste of scarce resources. Sustainability is here defined as: the benefits of the water supply project continuing indefinitely in a reliable manner at a level genuinely acceptable to the community it serves and close to the design parameters, without an unacceptable level of external managerial, technical or financial support (adapted from Hodgkin 1994 p. vii).

There is thus an urgent need to increase the resources for and emphasis on institutional capacity building and training for water scheme management, operation, caretaking and maintenance **as well as** for the much wider implementation of cost recovery as defined in the Water Supply and Sanitation Policy White Paper (DWAF 1994).

3.2 Overcoming the constraints to sustainable water supplies

The literature continually stresses community participation in facilitating sustainable community water supply schemes. For example, refer Churchill 1987, *Rural water supply and sanitation: time for change;* WHO 1989, *Principles and models to achieve sustainable community water supply and to extend household sanitation,* p. 15; Abbott 1989, *Community participation in water supply planning: the Ramogodi experience;* and UNDP - World Bank 1996, *Water and sanitation program: annual report July 1994 - June 1995,* p. 14. Some recent literature, for example Donnelly-Roark 1992 cited in Hodgkin 1994 p. 12, describes different categories of community participation and reports that community participation which empowers communities to control projects is critical in facilitating sustainability. Community control is achieved through community structures, normally assisted by an outside facilitator. Through this structure the community can initiate demands, define their own goals, assess options, and finally assume responsibility for the required actions to implement the chosen option. Some authorities also report that the ownership of the completed project assets is an important aspect of control and hence sustainability.

Such community empowerment builds self-reliance and autonomy at the community level. The ultimate question then becomes how much autonomy is desirable at this level? Hodgkin (1994 p.12) replies that communities should be given or take as much autonomy as they can assimilate, but that no community can be totally self-sufficient. Each community will still have to interact with government authorities and to rely on other outside assistance to meet some of its needs. Apart from capacity building and training, ongoing governmental extension services and private sector interventions are likely to include health and hygiene education, supportive management monitoring and performance auditing, an information and decision-making support system that is accessible to all without restriction, and interventions associated with major maintenance work, as well as droughts and other disasters (WHO 1989 p. 15; DWAF 1994 pp. 29-32 and Hodgkin 1994 pp. 9 and 12).

As well as agreeing on the empowerment process it is important that the key role players meet and agree on the essential elements which must be fulfilled to ensure sustainability. These key elements should include soft elements like capacity building and training as well as hard elements like operational, maintenance and cost recovery requirements. Thereafter it is necessary for the role-players to agree on the allocation of responsibilities in a manner which ensures that all have a clear understanding and acceptance of who is responsible for what, when things are to be carried out and to what standards they are to be carried out (refer WHO 1989 p.15).

Do these recommendations in the literature, with respect to strong community participation, empowerment and control, conflict with the recommendation in Abrams 1996 (p. 34, paragraph 8.2.3) that, as an alternative to the policy of the establishment of Statutory Local Water Committees, DWAF should adopt a policy of support for the establishment, building and maintaining of local government? No, provided the latter is carried out in accordance with further recommendations as to **how** it should be done and provided local government representatives and officials maintain, or preferably increase, the commitment already shown by DWAF officials to demand-driven community empowerment strategies. Such strategies are integral to the Water Supply and Sanitation Policy (DWAF 1994) and the Reconstruction and Development Programme (Government of National Unity 1994) White Papers.

With respect to how DWAF should implement its Local Government Support Programme, Abrams (1996, p. 36, paragraph 8.2.11) states:

> *"related to local government demarcation issues is the question of the need for village or ward level local government substructures in order to ensure local involvement in and ownership of development. This is a point which the Department should not compromise on when dealing with provinces and District Councils. If the Department is to assist local government in the provision of services and if it is to provide capital subsidies for the construction of basic water supply services, then a precondition should be the establishment of formal local sub-structures, possibly chaired by the locally elected Councillor responsible for water.* ***It is strongly advised that this issue be actively promoted through the Department's engagement in the various activities presently underway in the development of local government policy and legislation."***

He further recommends (p. 37, paragraph 8.2.12): "that the Statutory Local Water Committee Regulations be rewritten in the form of draft local government sub-structures".

Hyden, in *No Shortcuts to Progress: African Development in Perspective* (1983: pp. 94-95), challenges us to understand the limits of what can be achieved by government agencies both centralised and decentralised. Therefore, (pp. 95 and 113), apart from encouraging the promotion of genuine community involvement, he also advises that the primary tier of local government should be at village level, that all levels should be administratively simple and that such institutions should be built from the bottom up. He goes on (p. 122) to advise governments to give more attention to developing structures outside government into which public sector institutions can meaningfully plug their own inputs. He claims (p. 132) that a growing number of responsible politicians and officials in Africa realise the long-term benefits for their countries of a strategy that strengthens the private and voluntary sectors. He is not talking of weakening government structures. However, he does see a need for substantially reforming them, loosening control, and strengthening the feedback mechanism that increases the potential for self-regulation and direct participation at local levels in forms consistent with the development of society at large. Such a reorientation, he claims, is not likely to come about as a result of training aimed at strengthening policy-making capacities in individual government departments. The only way it can be realised, he says, is by allowing groups in society, through intermediary non-governmental organisations, to exercise pressures in such a direction.

Overall, therefore, it is not a question of agreeing which structures such as village committees, local government, or private and voluntary sectors should be supported, but of agreeing **how** these structures should be supported and **by whom**. For example, will DWAF continue to play a meaningful long-term role in supporting village committees or will it gradually hand over this responsibility to local government by ensuring that local government has been empowered to take over responsibility for this task?

It is sobering to note that Hodgkin (1994 p. 28) reports from his own experiences and from those of other WASH colleagues working in Africa and Asia that sustainable development has two distinct phases. The first requires the establishment of institutional capacity and a base of experience without which an understanding of the needs of the sector is difficult. The second phase includes planning, implementation, evaluation, feedback, and revision. The whole process can take nearly 10 years and one of the most damaging mistakes which can be made by project facilitators and funders is to refuse to make long-term commitments in support of their water and sanitation activities.

3.3 The concept of 'free water' and its consequences

After independence African countries considered domestic water supplies as a social service which the government should provide free of charge to rich and poor alike. Aid agencies also largely accepted this policy (Katko 1991a). Despite high enthusiasm, ambitious development plans and commendable progress from the early 1960s, in 1990, at the end of the International Drinking Water Supply and Sanitation Decade, more than half the rural population of these countries was still without adequate supplies. Using the rates of implementation reported at that time further net gains in percentage coverage by the year 2000 will be modest and the total numbers unserved will continue to rise (see Table 3.1 below).

Table 3.1 Water supply coverage for rural Africa: 1980, 1990 and predicted for 2000 based on 1980 to 1990 rates of progress

Year	Total population (millions)	% Coverage	Population served (millions)	Population unserved (millions)
1980	333	33	110	223
1990	410	42	172	238
2000	497	47	234	262

(Source. UN General Assembly (1990) cited by Evans (1992 p. 5))

In rural South Africa over the same period the governments of the TBVC states and other homelands, to curry favour with their subjects, also indulged in a policy of little or no cost recovery from existing water supply schemes. In addition, cost recovery was generally impossible to implement due to their illegitimacy, little or no consultation with beneficiaries, a lack of structures to implement cost recovery and/or the low quality of service caused by maintenance being neglected (personal observations and DWAF 1994 p. 5).

The results of the policy of free water are:

- the rich and influential receive more by way of subsidy than the poor (as Cairncross and Kinnear (1988) noted when they found that the poorest people in Khartoum had to pay 120 times more for water they purchased through vendors than the rich paid for their piped connections (cited in Franceys 1990));
- it leads to people being treated as the objects of aid rather than partners in development which results in there being no relationship of accountability between the provider of the service and the beneficiaries (as the DWAF White Paper (1994 p. 7) states, "the worst possible approach is to regard poor people as having no resources" of their own);
- as more schemes are commissioned there is a rapid reduction in the finances available for the development of new basic services for those who have nothing because the government's entire budget becomes consumed in operating and maintaining existing low levels of service and/or maintenance gets neglected (DWAF 1994 p. 23); and
- communities have been misled into believing that water provision is cheap and as a result they have little or no understanding of the true costs of implementing water projects or operating and maintaining them (Murdoch Jr. 1956 cited in Katko 1992).

In contrast to the low demand for water from schemes where cost recovery has been implemented, schemes with 'free water' are without any form of demand management. As a result they often operate at demands far in excess of their design capacities causing many customers to receive no water during periods of peak demand. Subsequent customer dissatisfaction, vandalism, water hammer and 'overloading' of pumping plant become a major cause of failure of such schemes. The presence of unauthorised connections on free water schemes leads to even higher water demand and earlier scheme failure.

3.4 The need for cost recovery and current South African policy

As organisations involved in the provision of domestic water supplies acknowledged the consequences of free water delivery and read reports demonstrating that water supply schemes where communities pay all operating and maintenance costs are the ones which provide the most reliable service, the need for cost recovery became fully accepted (Katko 1991a p. 22 and Evans 1992 p. 4). Now, in the mid-1990s, some institutions are even seeking to recover the full capital costs as well as the operation and maintenance costs from facilities supplying poor rural and peri-urban communities with water (Yacoob 1990).

In South Africa the DWAF White Paper (1994) states that:

> ***"The basic policy of Government is that services should be self-financing at a local and regional level. The only exception to this is that, where poor communities are not able to afford basic services, Government may subsidise the cost of construction of basic minimum services but not the operating, maintenance or replacement costs"*** (p. 19).

The basic minimum service is defined as: 25 litres per person per day within 200 m of the person's dwelling with the minimum water quality, availability and assurance of supply also being specified (refer pp.15 and 16).

> "Where communities [or individual households within a community - added by the author] choose a higher level of service than the basic service, such as making provision for household connections, the extra costs will have to be borne by the community [or individual households concerned - added by the author]. The Department of Water Affairs and Forestry, or its agent (for example a Water Board), will however endeavour to assist the community to raise such extra finance" (p. 21).

Further details of DWAF's tariff policy and when it is to be implemented are set out in pp. 23-26 of the White Paper. These details reject the adoption of a uniform tariff throughout the country and guide authorities in the direction of settings tariffs at the lowest appropriate level in consultation with affected communities. Other provisions include: "if Government is providing subsidies, it too may wish to establish certain tariff structures", and: "where support services are provided by regional agencies, the cost of these will also have to be determined by both local communities and the service providers." Although not specifically ruled out, the concept of cross-subsidisation seems to be discouraged in favour of administrative simplicity. On the other hand "water consumption exceeding 250 litres per capita per day is to be charged for at marginal cost defined as the present day cost of the latest or next augmentation scheme."

3.5 Affordability

Sub-Saharan Africa is currently facing an acute crisis, and the number of poor people in the sub-continent is expected to rise before the end of the century (World Bank 1990, cited in Evans 1992 p. 19). In South Africa per capita incomes are currently below 1960s levels (World Bank 1995, cited in UNDP 1996 p. 3). It is therefore not surprising to find that according to the most recently published rural poverty survey 50,3% of all rural households live below the rural Household Subsistence Level where the minimum income for a family of two adults and four children is taken to be R723,05 per month (May *et al.* 1995 main report p.10).

From May *et al.* (1995) the approximate distribution of rural African household monthly incomes can be estimated (refer Table 3.2).

The analysis of poverty using access to basic needs or under-nutrition as criteria reveals a similarly depressing picture. In terms of under-nutrition, approximately 57% of rural households in South Africa fall below a 2100 calories per day nutritional poverty line and the average under-nourished household is estimated to fall 32,3% short of their caloric needs (May *et al.* 1995 p. 55).

Table 3.2 Approximate distribution of rural African household monthly incomes In South Africa based on data collected between August and December 1993

% of rural African households	Median adult equivalent monthly income	Estimated average family size	Number of equivalent adults	Median rural African household monthly income
Poorest decile	R 79	7,0	3,87	R 306
2nd decile	R 113	6,6	3,72	R 421
3rd decile	R 143	6,2	3,56	R 512
4th decile	R 176	5,8	3,40	R 600
5th decile	R 211	5,4	3,24	R 682
6th decile	R 252	4,9	3,05	R 770
7th decile	R 294	4,5	2,89	R 849
8th decile	R 389	4,1	2,73	R 1 062
9th decile	R 508	3,7	2,57	R 1 304
Richest decile	R 895	3,3	2,40	R 2 148

(Source. May *et al.* 1995 based on main report p. 9, table 1, table 9 and figure 1)

Affordability is a very imperfect measure of what people will pay for water. Income and poverty indicators are reported here primarily to demonstrate the importance of:

- keeping the price (and the costs, both capital and operation and maintenance) of providing basic water needs as defined in the DWAF White Paper (1994 p. 15) as low as practical so that this need can be satisfied with the lowest cost-benefit ratio to all South Africans (for example refer to MacRae and Whittington 1988);
- engineers, sociologists and development practitioners not fuelling communities' demands and expectations for water supplies in excess of basic needs provision, nor deciding for communities that only basic needs will be provided for; and
- acknowledging the spread of incomes even within rural communities, so that those households with higher incomes which are willing to pay the full cost of a higher level of service will have their demands satisfied, thereby allowing the local water management organisation to have a higher income base with which to operate and maintain the scheme. A number of possible scenarios are depicted in Figures 3.2 to 3.6 .

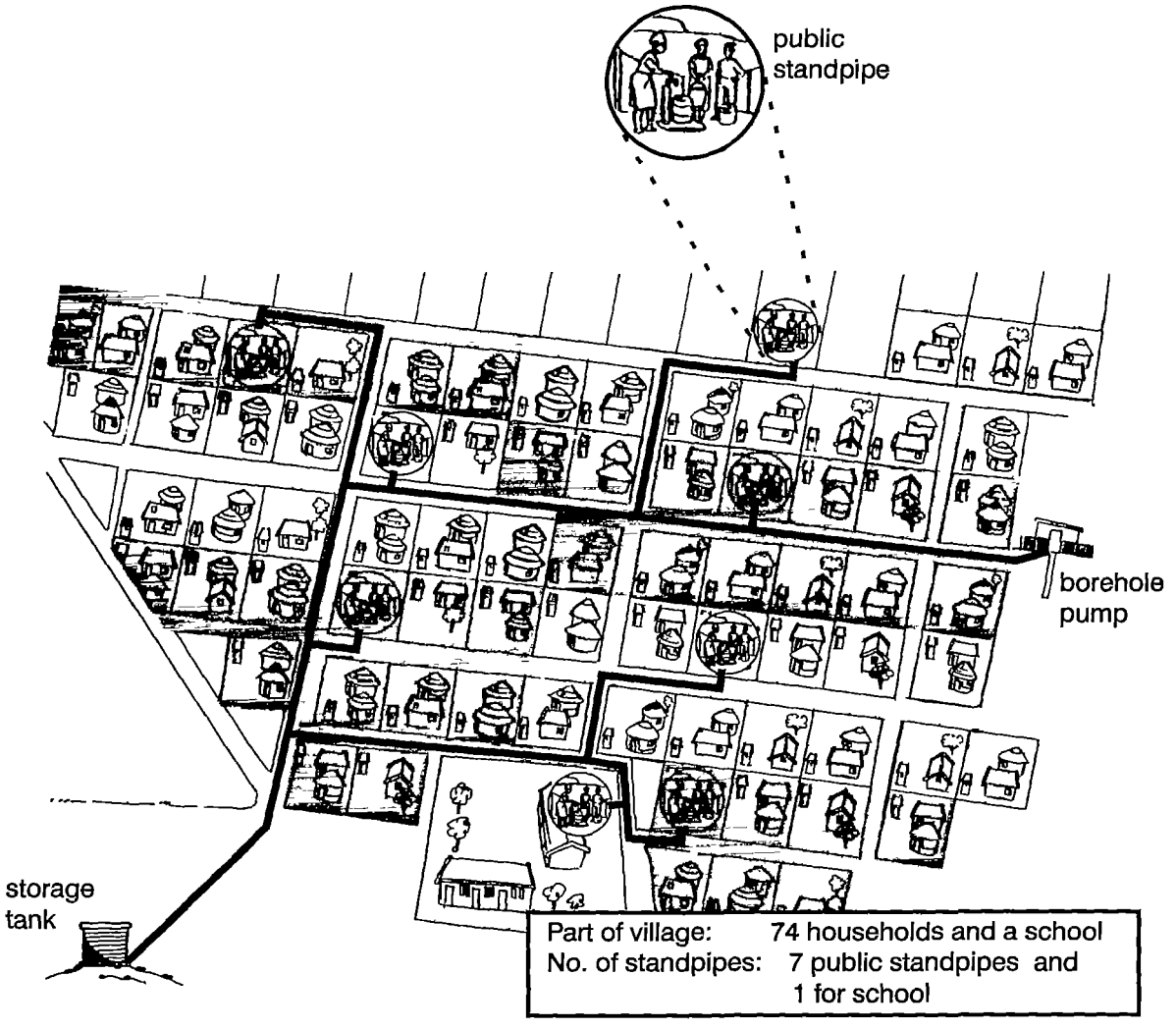


Figure 3.2 Basic RDP level of service: Maximum cartage distance 200 m

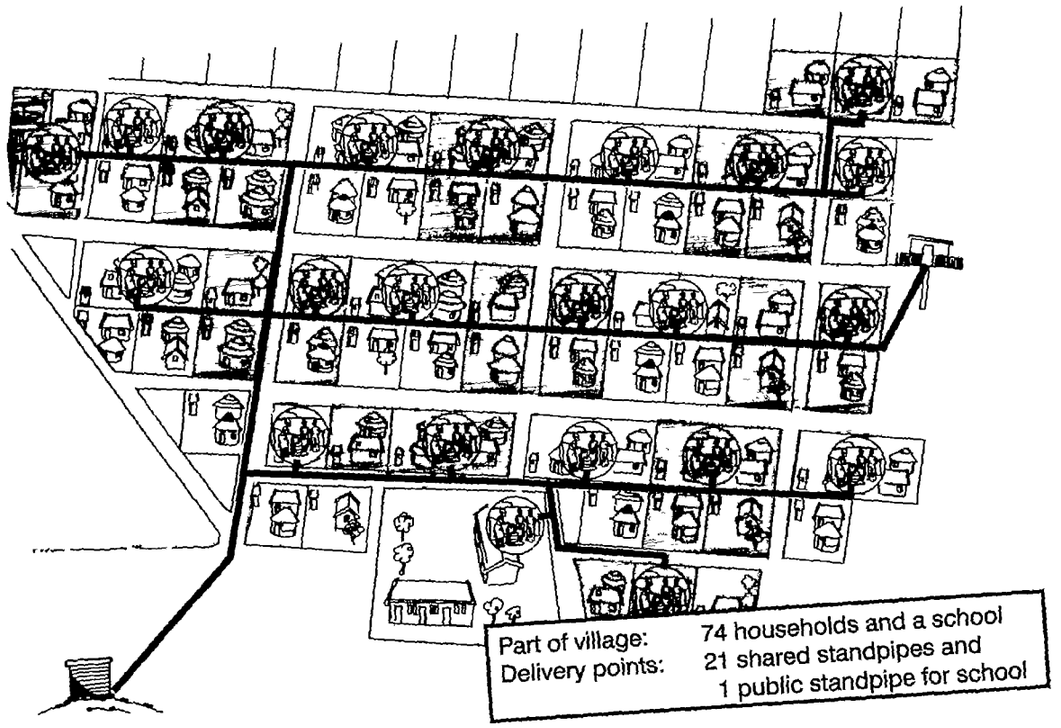


Figure 3.3 Intermediate level of service: A maximum of 4 households share each standpipe

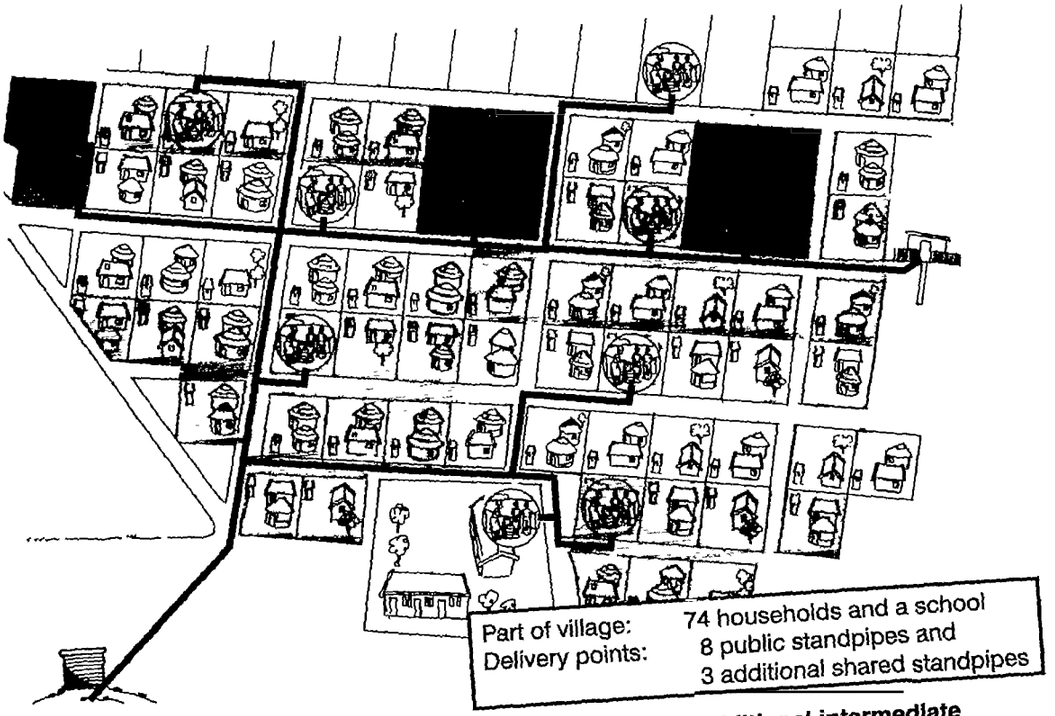


Figure 3.4 Mixed levels of service: Basic RDP level plus 3 additional intermediate level standpipes each of which is shared by 3 or 4 households.

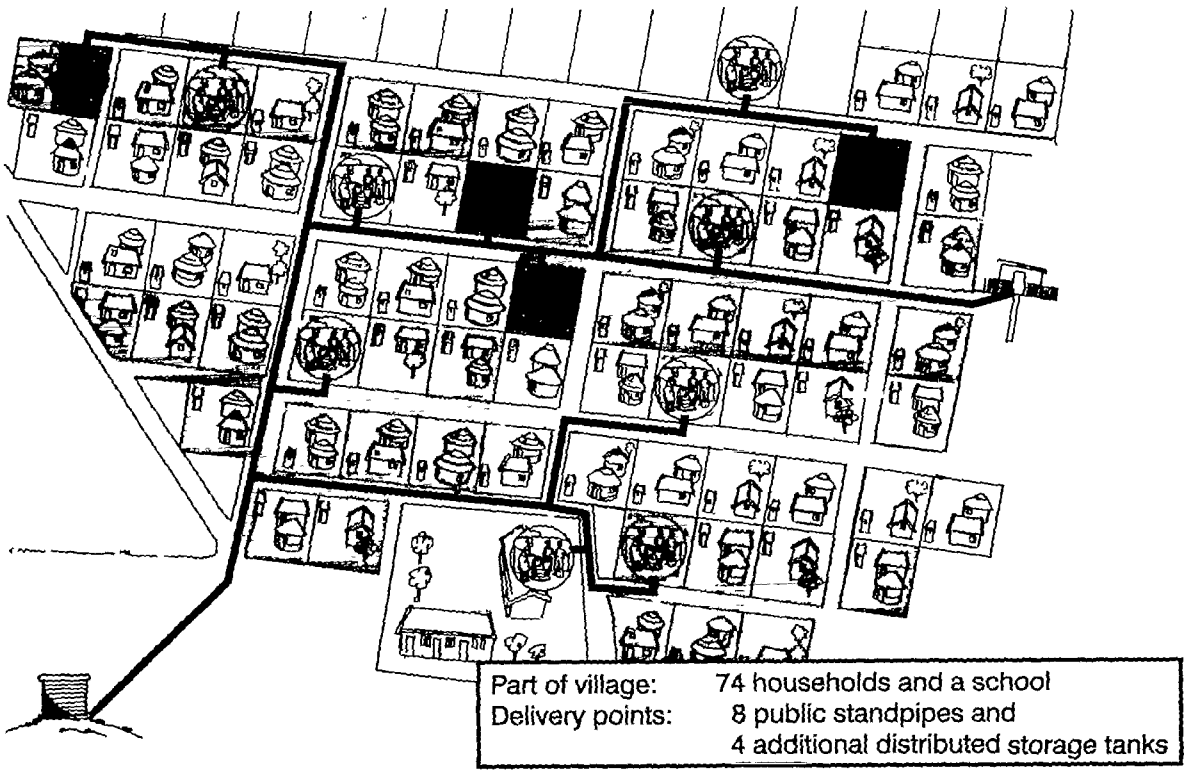


Figure 3.5 Mixed levels of service: Basic RDP level plus 4 additional intermediate level manual or automatically filled regulated storage tanks each dedicated to an individual household

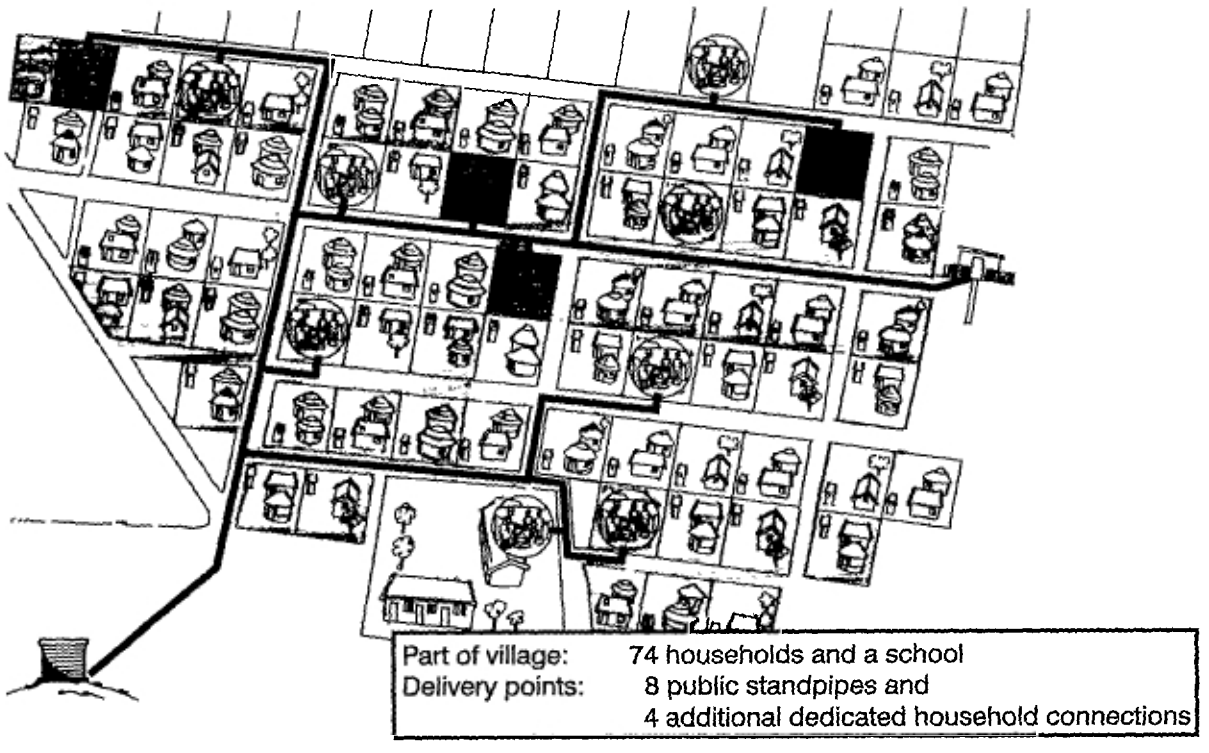


Figure 3.6 Mixed levels of service: Basic RDP level plus 4 additional high level yard taps or house connections each dedicated to an individual household

3.6 Willingness to pay

A common way of measuring willingness to pay (and even ability to pay) quoted in the literature refers to what poor households, without an alternative water source, pay private vendors for water (for example, Katko 1991b, p. 63, reproduced in Katko 1991a p. 130) Katko even suggests that these payments can be used as design criteria for water services in peri-urban areas. Such surveys are useful in countering false arguments stating that poor communities cannot pay anything for water, and for encouraging households to pay an equitable price. However, in the author's view, using such examples as a measure of a community's willingness to pay for water from a community scheme is likely to yield unrealistic figures. Such figures are likely to result in an under-estimate of the difficulties facing water service providers in rural areas and the salaries which can be paid to operators from community contributions.

Using surveys of what households pay water resellers and vendors for water, yield unrealistically high figures because a representative sample of households is rarely interviewed and, even if such a sample were interviewed, communities expect to pay lower prices for water from community or government agency schemes. Katko (1991b pp. 66-69, reproduced in 1991a pp. 142-145) also discusses problems associated with private reselling and vending. He suggests that regulation may be necessary in some instances, for example those relating to inadequate water quality, but he also states that such entrepreneurship should be recoginised positively in its own right and as a challenge to utilities to provide communities with a more reliable service at a lower price.

There is usually a big difference between the attitudes of men and women in villages with respect to demands for an improved water supply. Women are generally responsible for water collection. Young children, mostly girls, help the women in this task. Grown men are, however, almost never involved in the day to day collection of water. As a result in most villages the women are more willing to pay for improved water supplies than the men. However, the men control most of the meagre money resources available. Thus, without adequate community mobilisation and empowerment, sustainable water supplies are almost impossible to implement (personal experience and Evans 1992 p. 25).

Adequate community mobilisation and empowerment means ensuring that village meetings called to plan the upgrading of water supplies, or to ensure the sustainability of existing schemes, are organised in a way that attracts men, women and older youth to come and participate in the meetings. Committee office bearers must also be representative of these three groups. The statutory local water committee regulations promulgated on 12 July 1995 (Government Gazette 1995 and included as appendix 8 in Abrams 1996) stipulated that at least one-third of water committee office bearers are to be women. Whilst grown men almost never become involved in the day-to-day collection of water a few invariably come forth at village meetings and take on leadership roles. These leaders may be headmen, schoolteachers, other professionals, government extension officers, church ministers, shop owners and successful small businessmen and farmers. They play an essential role in project sustainability. In most villages they do so naturally in a non-dominating manner through:

- facilitating women's participation and assumption of leadership roles;
- bringing the rest of the menfolk around to considering the women's points of view so that where supposed conflicting interests exist these can be sorted out through negotiation between equals;
- ensuring that youth are also a part of all decision-making processes.

Including youth, and not just women, in community decision making has become more important in recent years since such youth have generally become more marginalised as fewer school leavers obtain jobs in the formal sector. When included in decision making youth can contribute to project implementation and sustainability. When they are not included they can completely sabotage the implementation of innovative technologies that are enthusiastically accepted by the rest of the community by resorting to vandalism and threatening behaviour towards their elders (personal communications with James Croswell of Croswell and Associates, a Director of Stocks and Stocks, and Sello Semenya of Painting, Semenya and Associates).

Outside agencies, such as funders and technical facilitators, can play important roles in either facilitating or hindering village leaders' ability to implement democratic, non-dominating forms of leadership which are so necessary for sustainable development. For example, democratic forms of leadership are weakened, and sometimes even destroyed, by outside experts becoming impatient with the pace of progress and demanding immediate visible results from the community's leaders who then adopt authoritarian methods to get things done more quickly. Equally common is for outside experts to take over decision making, either because of their own impatience or lack of confidence in the community or its leadership, or because of pressure from their superiors to produce visible results and/or to be less of a cost burden on project implementation. Hodgkin (1994 p. 22) describes this hindering action as squandering opportunities for institutional development, ignoring national development priorities and directives, and creating enduring resentments that impede the realisation of sustainable project benefits.

The positive aspects of facilitation of democratic leadership and the core values of the Reconstruction and Development Programme White Paper 1994 can easily be forgotten. It is therefore important that senior management encourage field staff to facilitate the growth of such leadership and values through general attitudes of support and through making sufficient human and cash resources available. Are there any publications that can help us to understand such leadership, select community leaders and train them using the principles of adult education? One such local book is Lobinger's (undated) *Towards non-dominating leadership*, primarily written for giving guidance on the training of emergent community church leaders but equally useful for learning the basics of sound secular community leadership.

Therefore, willingness to pay, and sometimes even acceptance of a project, clearly depends on proper consultation and community empowerment. "No consultation, no cash flow" proclaims Ngwema (1996) in a recent issue of *Democracy in Action*. One important way project implementing agents can empower communities is by giving them a choice of several projects to choose from. This is done by visiting the community, listening to their demands and suggestions, and writing a short clear feasibility study report which describes a number of ways in which their water supply can be upgraded, and gives an overview of advantages and disadvantages of each, as well as rough capital and running costs per month per household (refer, for example, Hazelton 1993). The community then discusses the feasibility report and makes their own choice whilst having the report writer available to answer questions. Generally, communities take a wide number of parameters into consideration before coming to a decision but if this does not happen the report writer may gently suggest further parameters to be considered or ask communities how they will feel after project implementation rather than focusing on their current feelings (MacRae and Whittington 1988 p. 258).

No articles quoting actual amounts which communities had paid for water over extended periods were found, so the author can only quote personal experience. In the deep poorer rural areas of Northern Province, communities which were visited actively sought to have shared standpipes to DWAF basic water standards in place of handpumps. However, when the feasibility reports stated that operation and maintenance costs would be R12-00 or more per month per household, as was the case for some of the smaller villages, communities queried the figure and wanted to know what would happen **if they regularly collected R7-00 per month from each household as this was the maximum most households could afford.**

A number of other remote communities in Northern Province were visited by the author which have existing stand alone reticulated schemes operated by the communities themselves. With respect to access/cartage all these schemes are below the DWAF White Paper basic water supply standards. In addition, water is not available at all times but only on a fairly regular basis in the morning and then again later in the afternoon and evening for a total of up to 12 hours per day. The reason water is made available for a limited number of hours varies from scheme to scheme but is for one or a combination of the three following reasons:

- Operating the scheme in this manner reduces running costs by curtailing demand and water losses.
- The water source or pumping equipment cannot deliver the total demand. Water is therefore only made available when there is water in the distribution reservoir. This manner of operation helps to ensure that all customers have equal access to the limited water delivered by the system.

- Organising pump operators to operate the pumping equipment on a semi-continuous basis, including overnight, to ensure the full demand can be met has proved more difficult than organising the limited regular set hours for water availability.

Customers from these schemes pay between R3 and R5 per month per household for water. The pump operators work on a voluntary basis without any payment. Record keeping appears to be weak. In some of the schemes the consumers are expected to pay their levy on a regular monthly basis, whilst in others money is only collected on a rotational basis as and when it is required for essential needs, such as fuel or minor maintenance work. Major breakdowns cause crises which normally result in these schemes being out of order for at least one month.

From the little information available, the water demand from yard connections once meaningful cost recovery has been instituted is low. A study was carried out in 1994/5 in slightly richer peri-urban developing communities who obtain their water from Umgeni Water reticulated and managed schemes in the area between Pietermaritzburg and Durban (Hazelton and Kondlo 1996). Households in these communities with individual yard taps or house connections were then paying R1-425/kℓ, including VAT, for their water. **The average value of bills issued to households was R20-00/mth** corresponding to an average water consumption of 14kℓ/mth per household. There was a minimum monthly bill which corresponded to a consumption of 4kℓ/mth. Over 30% of households regularly consumed less than this figure. Thus **over 30% of the bills issued were for R5-70/mth.**

Water usage in such communities is however, on average, still very much less than that used by typical established urban communities in South Africa (refer Figure 3.7).

None of the households in the peri-urban communities studied had water-borne sewage. It is estimated that water-borne sewage would increase water consumption in poor areas by approximately 4kℓ/mth and increase the average value of bills issued to households to approximately R25-65/mth.

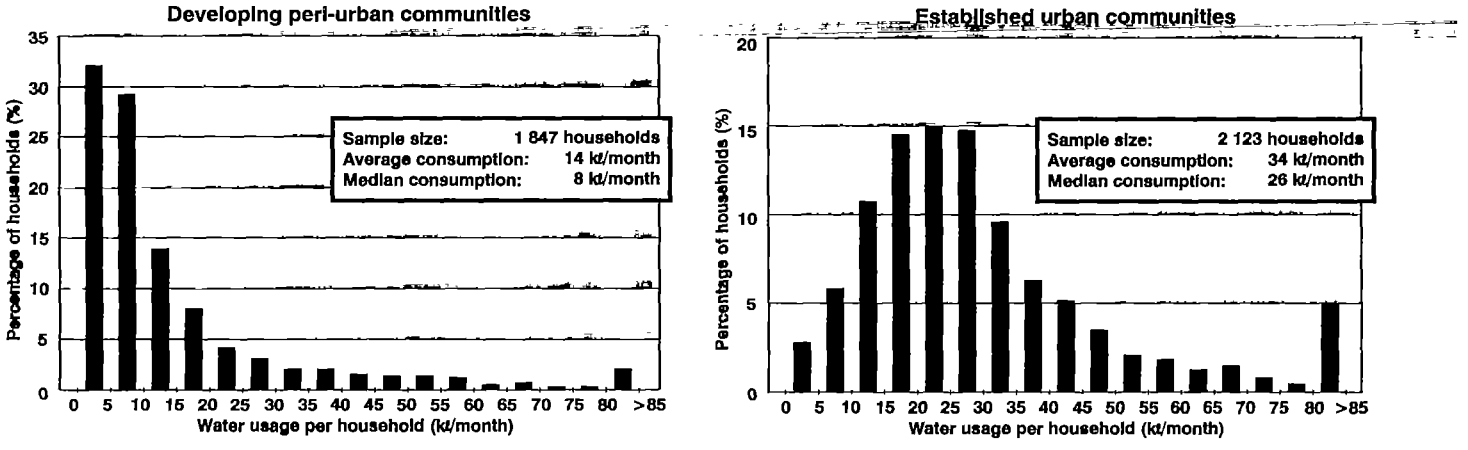


Figure 3.7 Typical water consumption for individual household connections: developing peri-urban communities versus established urban communities
(Source: Hazelton and Kondlo (1996 p.4))

In rural areas households with individual connections can be expected to use on average less than 14 kℓ/mth even when only a small percentage of households have access to this level of service. Planners have been anticipating that households with access to water at a basic RDP level of service will use an average of between 3 and 5 kℓ/mth, corresponding to approximately 15 to 25 ℓ/day per person. The latest indications are that once meaningful cost recovery is introduced this figure is likely to drop to 2 kℓ/mth.

3.7 General pre-conditions for effective cost recovery

Regardless of customers' general willingness to pay, cost recovery can only be implemented successfully when customers are satisfied that they are getting value for their money. This means that cost recovery cannot be implemented in isolation without ensuring that the other major constraints militating against a quality service are also overcome.

With these general thoughts in mind, the pre-conditions for effective cost recovery set out in Box 3.1 have been drawn up.

Box 3.1 Pre-conditions for effective cost recovery

- **The service must be reliable.**
- **The water quality must be acceptable.**
- **The level of service must be appropriate.**
- **An appropriate revenue collecting and accounting system must be in place.**
- **Unaccounted-for water must be controlled.**
- **There must be customer acceptance of the cost recovery options used and of the revenue collecting authority.**
- **Assuming the other pre-conditions are in place, customers must know that water will be disconnected if bills are not paid.**

Implementation of these pre-conditions requires an administration with adequately trained and motivated staff.

(Adapted from: Hazelton and Kondlo (1996 p.12) and Katko (1990 p. 89) reproduced in Katko (1991a p. 30))

A history of, or the continued presence of, water schemes which supply 'free water' can quickly build up a culture of non-payment. Therefore, new schemes should charge for water from day one and water charges should be introduced to older schemes in a systematic planned manner without further delay. The charges should also reflect broad long-term policy.

Once effective cost recovery has been successfully introduced water service providers can generally expect the overall willingness to pay to increase with time.

Effective cost recovery from many existing schemes will not be achieved for some time because of the poor quality of service delivery. The quality of service, in turn, will not improve until the capacity of the community and local government structures is improved and the rundown schemes are refurbished. In the interim, it is therefore essential to budget realistically for these costs and some of the current shortfall in revenue collection **as well as setting targets for improved revenue collection**

3.8 Costs

The literature does not quote reliable costs of supplying water to rural customers. Figures obtained from Umgeni Water's Financial Department indicate that **the average 1995 all inclusive net cost excluding VAT of accounted-for water supplied to its peri-urban customers was approximately R5-00/kℓ.** (Note these are the same schemes discussed towards the end of Section 3.6 where the selling price is R1-25 (excluding VAT) - a shortfall of R3-75/kℓ between the selling price and quoted cost!). The schemes are predominantly a mixture of shared standpipes and yard connections. The reticulated pipework within the communities was predominantly constructed with grant finance and therefore capital repayment charges for the reticulated pipework are negligible. Full charges for all bulk water **delivered to the community boundaries** are included. The cost is inflated because it includes the full cost of Community Liaison Officers who spend part of their time arranging new yard/house connections and because it includes part of the cost of these connections through maintenance staff not distinguishing between time spent on maintenance work and time spent installing new connections.

Typical figures for the combined operating, maintenance and replacement cost of schemes supplying water to DWAF's basic water standards are not available in the literature. In addition costs vary considerably from community to community depending on the availability of exploitable resources as acknowledged in the DWAF White Paper, the nature of the scheme constructed, and the cost effectiveness of the operation and management system in place. However, a number of useful generalisations can be made:

- **assuming the full construction cost has been subsidised with grant capital, in excess of 40% of the total running costs of a basic water supply scheme are still fixed** (estimated from van Ryneveld 1995 p. 3);
- **when capital redemption is included, the fixed portion of running costs rises to 80%** (Katko 1992 p. 2623);
- **life-line tariffs set to cover operating and maintenance costs only** of services provided to basic water supply standards (as defined in DWAF 1994 pp. 15 and 16) with a house consumption of 4kℓ/mth (equals 25ℓ per person per day assuming an average family size of 5,26 people) **are likely to be around R4-00/kℓ. This tariff equals the full present day marginal tariff obtained by applying full cost recovery to schemes in typical middle class areas** with individual house connections at full reticulation system pressure and an average water consumption figure of 34kℓ/mth (refer Figure 3.7);
- **the cost of supplying water to customers through individual house connections at full reticulation system pressure with water consumption figures of 6 and 14kℓ/mth is likely to require tariffs of R10-50 and R5-60 respectively** to achieve full cost recovery (refer Table 2.3);
- **the same quantities, 6 and 14kℓ/mth, can be supplied using regulated distributed storage tanks for full cost recovery tariffs of R8-00 and R4-50 respectively** (refer Table 2.3).

3.9 Tariffs

3.9.1 An examination of the sections on affordability, willingness to pay and costs makes it clear that customers paying equitable tariffs does not guarantee the financial viability of community water supply schemes. Implementing and organising the management of such schemes in a manner which limits total costs to the revenue collected is still a daunting challenge.

3.9.2 Since a high percentage of costs with respect to water supply schemes are fixed during the design and construction phases of a project and do not vary with consumption, it is recommended that:

- engineers take sufficient care to ensure that they design appropriate schemes (Hazelton 1993 p. 15);

and that, after implementation:

- the water service provider introduces a fixed charge per month per connection to cover up to 40% of the provider's total income and to encourage the use of **privately operated shared connections** as an intermediate level of service (Katko 1991a p. 37). (Refer Case Study 3.1.)

A corollary to the above is that the **life-line or social tariff** (DWAF 1994 p. 24) **must not apply to the first 25ℓ per capita per day supplied to customers with a level of service above the basic service provision level.**

3.9.3 Costs which can be partially controlled after a scheme has been constructed are:

- administration, operation and routine maintenance costs through adequate capacity building, staff training and motivation and the appropriate selection of administration and management techniques;
- unaccounted-for water through ongoing monitoring and corrective action (refer Table 3.3 for typical water losses), and
- staff salaries, mainly through payments being task related.

Control of all these costs is especially important for community water supply schemes because of the tight financial constraints within which they and the majority of their customers function.

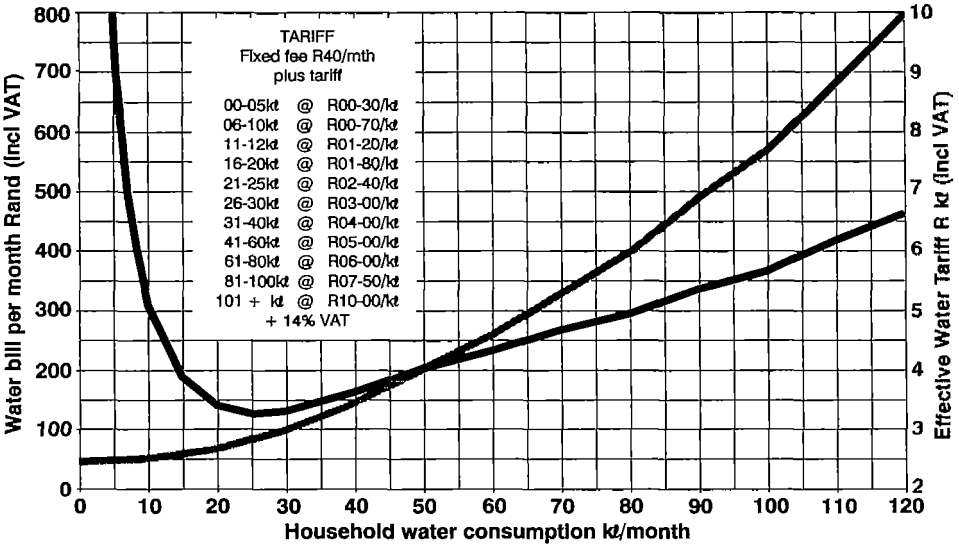
Table 3.3 Typical losses from a well-maintained water supply scheme

Average water usage per connection (kℓ/month)	Required inflow per connection (kℓ/month)	Loss of inflow (%)
5	8,6 - 10,0	42 - 50
10	13,6 - 15,0	26 - 33
15	18,6 - 20,0	19 - 25
20	23,6 - 25,0	15 - 20
25	28,6 - 30,0	13 - 17
30	33,6 - 35,0	11 - 14
40	43,6 - 45,0	8 - 11

(Source. Hazelton (1996) p 8)

3.9.4 In the long term, as schemes become old, overall unaccounted-for water is likely to exceed the figures shown in Table 3.3 due to leakage from the main reticulation pipework.

Case Study 3.1 Greater Hermanus economic water tariff



Greater Hermanus sets its high service tariffs to ensure financial sustainability and to conserve water

The village and environs of Greater Hermanus are situated on the Atlantic Ocean in the Western Cape about 125 km east of Cape Town. Some of the richer people owning houses in Hermanus don't live there for much of the year as they are away managing their businesses in Gauteng or one of the other industrial or commercial centres of South Africa. Low water consumption from these houses whilst vacant would be a drain on the Greater Hermanus Municipality's finances so it charges a fixed assurance of supply fee to cover the provision of the infrastructure and the minimum institutional capacity required to ensure the infrastructure is cared for. In the case of individual house connections the fixed fee before any water is used is R40/mth excluding VAT. **(Section 3.9 of this study recommends that all water service providers should introduce a fixed charge per month per connection to cover up to 40% of the provider's total income.)**

Once the fixed service charge has been paid the water usage tariffs excluding VAT start at the very low level of 30c/kℓ for the first 5kℓ/mth and gradually increase in 10 steps to R10/kℓ for usages in excess of 100kℓ/mth. Greater Hermanus introduced these high tariffs for excessive water usage because it faced a serious dilemma; unless it introduced water conservation measures it would have to stop all development in the village since it was soon going to exceed its water quota fixed by the South African Water Court. Other South African villages may not face such a severe curtailment of their growth in domestic water usage but may face the possibility of the existing water source or infrastructure being inadequate to supply any increased demand. In other cases it may be beneficial to use water from the existing supply for livestock, industry or vegetable gardens where exploiting a new source or upgrading the existing infrastructure for these purposes would be too expensive. **In all these cases it is nearly always much better to increase tariffs for large demands once the full capacity of the existing source or infrastructure is being approached.**

The graphs above show the full picture of the Greater Hermanus economic tariff for high levels of service. Households with individual connections who use only 5kℓ/mth pay R47-31 inc. VAT reflecting an effective tariff of R9-46/kℓ. Users of 10kℓ/mth pay R51-30 and the effective tariff reduces to R5-13kℓ/mth. **The effective tariff continues to reduce until a figure of R3-28kℓ/mth is reached at a usage of 25kℓ/mth which the Hermanus Municipality regards as a cost effective sustainable water usage for house connections.** Interestingly, even for a usage of 100kℓ/mth the effective tariff is only R5-77/kℓ, quite a lot cheaper than the effective tariff of R9-46/kℓ for a usage of 5kℓ/mth. However, the municipality is likely to be making a significant profit from customers using 100kℓ/mth and may be making a small loss from those households who use no water or only 5kℓ/mth.

Hermanus is also implementing a pilot project to install 400 combined security and prepayment metering systems for water and other municipal services.

(Source: Preston (1997) and van der Linde (1997a or 1997b))

3.9.5 In addition, it must be acknowledged that some form of subsidisation may well be required in the early years to ensure the sustainability of some schemes which are controlled by utilities with little ability to practise internal cross-subsidisation and/or whose schemes operate at a low utilisation factor.

If no subsidisation takes place, the life-line tariffs charged to some rural communities may well be higher than the full cost recovery tariffs charged to many urban customers. This is contrary to the implied intentions of the 1994 DWAF White Paper.

On the other hand, if the water service provider does not obtain sufficient funds to remain a financially viable institution and to enable it to operate and maintain the water services it is managing in an effective manner the quality of its service will deteriorate and all efforts at maintaining cost recovery are also likely to fail.

Katko (1990 p. 93, reproduced in Katko 1991a p.13), believes that it is possible for the water supply industry to be self-sufficient whilst supplying a basic service to the rural and urban poor at affordable prices through cross-subsidisation from fees collected from middle-level and large customers.

The DWAF *Water Supply and Sanitation Policy* White Paper 1994, p.24 states that normal tariffs for demands not exceeding 250ℓ per capita per day will include a charge to cover losses incurred through life-line tariffs, whilst p. 25 states that marginal tariffs will be charged for water consumption exceeding 250ℓ per capita per day. Furthermore p. 25 also states that consideration will be given to calculating all tariffs on the basis of the current value of the infrastructure rather than the historic value, as part of DWAF's self-sufficient approach to sector financing.

There is an urgent need to establish the viability of such an approach to providing water for all at equitable tariffs. However, rather than DWAF specifying the tariffs that water service providers should charge or investigating the differences between service providers' historic and current values of infrastructure, it is recommended in the first instance, that investigations focus on the concept of establishing a simple formula:

- to levy water service providers with above average water consumptions per connection; and
- to subsidise water service providers with below average water consumptions, with an adjustment dependent on what percentage of the connections are at or below the basic service provision standard.

However, subsidies must not be paid on the basis of a formula. They must rather only be paid in the form of timeous special incentive bonuses awarded to vulnerable utilities which show exceptional initiative in meeting the challenges of achieving full cost recovery.

3.10 Conclusions and recommendations of the literature survey

3.10.1 An analysis by Dabbagh (1991) of surveys reported by WHO in 1990 rated poor cost recovery as the most severe constraint on the attainment of sustainable water supplies in Africa, followed by maintenance and organisational logistics.

3.10.2 Cost recovery can only be implemented successfully when customers are satisfied that they are getting value for their money. This means that cost recovery cannot be implemented in isolation without ensuring that the other major constraints militating against a quality service are also overcome.

3.10.3 Organisational problems rather than technical problems predominate the constraints which have to be overcome to achieve quality community water supplies.

These organisational problems predominate because infrastructural development to date has been organised around the assumption that communities have a basic need for water which can be gratified by top-down external interventions. In addition the need for ongoing operation and maintenance has often been neglected. The problems can be overcome if the infrastructural development is organised around actual demands and a community's willingness to pay. In this way communities become empowered from the start of feasibility study planning. **Empowerment centres around being able to choose between a number of alternatives and being trained to control the process.** Empowerment continues throughout project implementation and culminates with villages taking control of their local infrastructure by managing its operation, maintenance and financial sustainability.

3.10.4 Currently in South Africa a major effort is being made to increase coverage by new capital works. There is an urgent need to balance this by promoting sustainability through increasing the resources and emphasis dedicated to institutional capacity building and training for water scheme management, operation, caretaking and maintenance **as well as** through the wider implementation of cost recovery.

3.10.5 The literature continually stresses the importance of water service authorities empowering community structures to act as the water service provider and operating agent for small schemes and for the distribution portions of large schemes. Such empowerment of community structures builds up autonomy and self-reliance but not total self-sufficiency.

3.10.6 Ongoing requirements for governmental extension services and private sector interventions are likely to include:

- health and hygiene education;
- management support and performance auditing to assist with planning, budgeting, hardware and human resource monitoring, evaluation techniques and corrective action;
- an accessible information and decision support system; and
- interventions to help with major maintenance work as well as droughts and other disasters.

3.10.7 Building institutional capacity, training and developing support services is a long process. After initial planning and implementation there is a need for evaluation, feedback and revision. This process can take nearly 10 years and one of the most damaging mistakes which can be made is for project managers or funders to refuse to make long-term commitments in support of their water and sanitation activities. What will this support cost? A typical figure quoted in the literature is 25% of the capital cost of the infrastructure being constructed. More centralised capacity building will result in similar initial costs but substantially higher ongoing running costs.

3.10.8 Also important is the concept of stakeholders negotiating a clear joint understanding, acceptance and agreement as to who is responsible for what.

3.10.9 The general conclusions drawn from the literature survey, the Government of National Unity's 1994 White Paper on Reconstruction and Development and DWAF's own 1994 Water Supply and Sanitation Policy White Paper form excellent guidelines within which to implement cost recovery.

3.10.10 Willingness to pay depends on proper consultation and community empowerment. **One important way of empowering communities is by giving individual households a choice between a number of options.** One way of doing this is by visiting the community, listening to individual households' demands and suggestions, and writing a short clear feasibility report which describes a number of ways in which to introduce cost recovery and/or upgrade the water supply, as the case may be. The report should give an overview of the advantages and disadvantages of each choice as well as rough capital and running costs per month per household. The community then discusses the report and individual households make their own choice whilst having the report writer available to answer questions.

Generally, communities take a wide number of parameters into consideration before coming to a decision but if this does not happen the feasibility report writer can suggest further parameters, or ask community members how they would feel after project implementation, rather than focusing on their current feelings.

Box 3.2 What happens when cost recovery is not implemented

- **The rich and influential receive more by way of subsidy than the poor.**
- **It leads to people being treated as the objects of aid rather than partners in development.**
- **As more schemes are commissioned the Government's budget becomes consumed in operating existing schemes. Thus little or no money is left for the development of new schemes for those who have nothing.**
- **Communities are misled into believing that water provision is cheap.**

On the other hand, paying for water encourages a relationship of accountability between the water service provider and its customers. As a result water schemes where communities pay the operating and maintenance costs are the ones which provide the most reliable service.

3.10.11 Customers paying equitable tariffs does not guarantee the financial viability of community water supply schemes. Implementing and organising the management of such schemes in a manner which limits total costs to the revenue collected is still a daunting challenge.

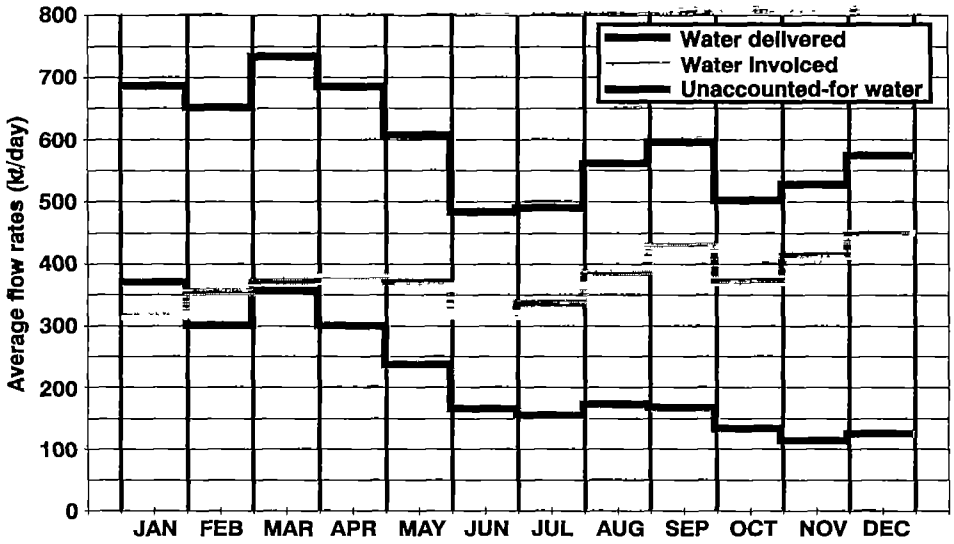
3.10.12 Since a high percentage of costs with respect to water supply schemes are fixed during the design and construction phases of a project and do not vary with consumption, it is recommended that:

- engineers take sufficient care to ensure that they design appropriate schemes;

and that, after implementation:

- the operating utility introduces a fixed charge per month per connection to cover up to 40% of a utility's total income and to encourage the use of **privately operated shared connections** as an intermediate level of service.

Case Study 3.2 Thabelopa water supply Botswana 1 Jan 1996 to 31 Dec 1996



Revitalising cost recovery in a Botswana village

In 1983 the water supply in the village of Thabelopa*, South West of Gaborone in Botswana, was upgraded with each household obtaining its own yard tap or house connection. The upgrading was well designed and constructed. In addition a manual administration and water management system was implemented after which unaccounted-for water stabilised at between 20 and 25%, a satisfactory percentage for the village's modest average household consumption of approximately 15 kl/mth.

Towards the middle of 1995 the Department of Water Affairs in Botswana and their consultants, started planning to change the manual administration and water management system in the village to a computerised system. Between 1983 and 1995 a generally reliable quality of service had been maintained but unaccounted-for water had risen to more than 50%. An examination of the minimum night flows in the village proved that leaking pipes was not the cause of this high level of unaccounted-for water. A broader study however, revealed that some new households had never been registered as customers whilst some old customers had somehow been lost from the register. In addition, other households had faulty meters since no system had been put in place to check when meters needed to be repaired or replaced.

By the end of 1995 the new computerised administration and water management system had been installed and commissioned. Villagers were simultaneously made aware that faulty meters would be replaced and unregistered customers would in future be receiving bills. In January 1996 a systematic programme of registering unregistered households and of repairing faulty meters was launched. The programme took ten months to complete.

The above graph reflects the dramatic decrease in unaccounted-for water from over 50% to its previous level of between 20% and 25%, as implementation of the programme proceeded. Water service providers should also note that, by the end of the twelve month period, a 40% increase in water billed had been achieved but with a 20% reduction in water delivered as customers adjusted their consumption in the face of accurate billing. When cost recovery is introduced for the first time a much larger percentage drop in water delivered can be expected.

* Note Thabelopa is not the real name of the village.
(Adapted from Ressman, A (1997))

3.10.13 Costs which can be partially controlled after a scheme has been constructed are:

- administration, operation and routine maintenance costs through adequate capacity building, staff training and motivation, and the selection of appropriate administration and management techniques;
- unaccounted-for water through ongoing monitoring and corrective action; and
- staff salaries mainly through payments being task related.

Control of **all** these costs is especially important for community water supply schemes because of the tight financial constraints within which they function.

3.10.14 Financial viability will not be achieved for some time to come until the existing poor quality of service delivery has been improved. In turn the quality of service will not improve until the capacity of community and local government structures is improved, and until existing rundown schemes are refurbished. It is therefore essential, in the interim, to budget realistically for these costs and some of the current shortfall in revenue collection **as well as setting targets for improved revenue collection.**

3.10.15 In addition it must be acknowledged that some form of cross-subsidisation may be required in the early years to ensure the sustainability of some schemes which are controlled by utilities with little ability to practise internal cross-subsidisation and/or whose schemes operate at a low utilisation factor. Otherwise the life-line tariffs charged to some rural communities may well be higher than the full cost recovery tariffs charged to many urban customers.

3.10.16 However cross-subsidies must not be paid on the basis of a formula. They must rather only be paid in the form of timeous special incentive bonuses awarded to vulnerable utilities showing exceptional initiative in meeting the challenges of achieving full cost recovery.

3.10.17 Cost recovery efforts, and indeed broader initiatives to improve community water supplies, will fail if water service authorities, both central and local, do not appreciate the limits of what they can achieve and therefore facilitate the development of local private and voluntary initiatives.

3.10.18 Higher levels of service, including individual household yard taps, are substantially more costly to build, operate and maintain than basic levels of service. In normal circumstances these additional costs are recovered by a substantial increase in demand. However, when low income households obtain individual yard taps, **and pay for the water**, the demand does not increase significantly. As a result the tariffs required to achieve full cost recovery become unacceptably high. There is thus a need to promote intermediate levels of service such as distributed storage tanks and privately operated shared yard taps to cater for customers who demand a higher level of service than public standpipes but cannot afford individual household connections. Case Study 3.1 shows the reduction in demand that can be expected due to the introduction of more effective cost recovery on existing schemes but when cost recovery is being introduced for the first time the percentage drop in water consumption is likely to be appreciably higher.

3.10.19 Just over 50% of rural households live below the rural Household Subsistence Level. In most villages however there are a minority of households with incomes up to about three times the Household Subsistence Level. This means that, to satisfy all sustainable customer demands and to facilitate full cost recovery, most community water supply schemes should incorporate a variety of levels of service including individual household connections whilst the majority are still supplied at the basic level. In accordance with government policy, all but the basic level of service would be financed by loan capital and charges calculated accordingly.

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ANNEXURE A

SUMMARY OF INFORMATION SUBMITTED BY SUPPLIERS

Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Consolidated African Technologies (CAT)** **Formally EREX Electronics**
Contact Person/Tel No:	Mr Ronnie Mortimer: Tel: (011) 789-1014
Products Offered:	Radix hand-held meter reading route planner, recorder, data processor and field billing systems.
Targeted Markets:	Individual household connections. Can be used for bulk sales.
Special Features:	Simple, robust. Power source - rechargeable battery. Mains and car battery powered chargers available.
Additional Comments:	Tariff flexibility and unaccounted-for water not covered in submission. Radix have 144 distributors in 70 countries. The software, which has been written in South Africa in MS Access and Powerbuilder, conforms to all Windows and DBC (Open Database Connectivity) standards. **10 electricity field billing systems in operation in South Africa.** **CAT serves every utility organisation in Botswana.**
Budget Costs Excl VAT:	Equipment required per meter reader R19 502-00. Price based on exchange rate of R7-50 = 1 UK pound.

The above particulars are given for general guidance only. Readers who require up to date information or more details are advised to consult the supplier.

Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Durban Metropolitan Water and Waste**
Contact Person/Tel No:	Mr Frank Stevens: Tel: (031) 302-4606
Products Offered:	Manually filled distributed storage tank systems.
Targeted Markets:	Individual household connections with a consumption up to 200ℓ/day = 6 kℓ/mth
Special Features:	Simple, robust. Low capital investment when compared with other individual household connection options.
Additional Comments:	Durban Water and Waste have such systems in operation. The water bailiffs who fill the tanks are paid by Durban Water and Waste on a task rate/water accounted-for basis. The consumers make a fixed monthly prepayment to Durban Water and Waste. In exchange they receive a plastic card as a receipt to show the water bailiff.
Budget Costs Excl VAT:	Per unit ex works R175-00.

The above particulars are given for general guidance only. Readers who require up to date information or more details are advised to consult the supplier.

Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Plastl Drum to CSIR design**
Contact Person/Tel No:	Mr Bibi Avivi: Tel: (011) 433-2046 Mr Derek Hazelton: Tel: (012) 841-4574
Products Offered:	Automatic filling regulated distributed storage tank systems.
Targeted Markets:	Individual household connections with a consumption up to 500 or 750ℓ/day = 15 or 22,5 kℓ/mth.
Special Features:	Simple, robust. Low capital investment when compared with other individual household connection options. No meters to be read. Consumer (pre-)payment is a fixed amount per month.
Additional Comments:	**10 units were installed** in community water schemes reticulated by Umgeni Water. They were installed for evaluation as part of a Water Research Commission cost recovery study. The study which was jointly implemented by Umgeni Water and CSIR staff members who reported that all households responded positively to the units installed. UAW more difficult to monitor accurately.
Budget Costs Excl VAT:	Per unit ex works R200-00

The above particulars are given for general guidance only. Readers who require up to date information or more details are advised to consult the supplier.

Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Teqnovo**
Contact Person/Tel No:	Dr E. Fourie: Tel: (012) 342-1513
Products Offered:	Coupon operated mechanical prepaid bulk and standpipe water meters. Electronically operated prepaid standpipe and individual household water metering systems. Can also supply telemetric bulk water control systems.
Targeted Markets:	Bulk water supplies. Shared standpipes and household connections.
Special Features:	No external power sources required. Exceptionally rugged and tamper proof construction. Flexibility in serving clients special needs.
Additional Comments:	**Over 100 mechanical bulk supply units sold in Northern Province.** It is anticipated that the administrative requirements for electronically operated systems will be less than for mechanically operated systems.
Budget Costs Excl VAT:	Bulk water supply unit ex works price R24 000-00. Shared standpipe unit ex works price R2 800-00.

The above particulars are given for general guidance only. Readers who require up to date information or more details are advised to consult the supplier.

Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**ABB Kent/Telbit**
Contact Person/Tel No:	Mr Anthony Matthews: Tel: (011) 474-8697
Products Offered:	Electronically operated prepayment systems.
Targeted Markets:	Shared standpipes, and individual household connections.
Special Features:	Shared standpipe system: customers credits stored on a touch memory button and unit dispenses fixed amount or can have quantity selection dial. Individual household connections: credits bought as 15 digit code on a receipt, and credits transferred to household unit via a keypad. Base station: links each customer to a particular access point, and unit processes sales, VAT and printing of receipts.
Additional Comments:	Both units warn customers when they are running out of credit. Power source - rechargeable batteries, recharging frequency not stated. Tariff flexibility and unaccounted-for water not covered in submission.
Budget Costs Excl VAT:	10 year life touch memory unit R18-00 each. Shared standpipe control units ex works R1415-00 each. Individual household connection unit ex works R1015-00 each. Base station with software ex works R24624-00 each. Customer training free at Telbit premises.

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Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Bambamanzi Trading SA (Pty) Ltd.**
Contact Person/Tel No:	Neil Rodseth/Wayne Richards: Tel: (031) 709-1547
Products Offered:	"Smart token" ™ electronically operated prepayment systems.
Targeted Markets:	Shared standpipes, and individual household connections. Unaccounted-for water management.
Special Features:	Systems operate on smart technology; read and write information transfer. Shared standpipe system: primary energy source - rechargeable battery power (12V), and can dispense water in any volumes 24 hours per day. Individual household connections: primary energy - solar power with battery backup. Shared and individual connections: credits transferred to customers via a "smart token" ™ slot Base station computer management system and customer vending unit: links each customer to a particular access point, and unit processes sales, water usage, meter readings, unaccounted-for water, management reports, etc.
Additional Comments:	Easy to use LCD panel on customer control units displays remaining credit. System allows for 4 tariff structures. The system includes a mobile point-of-sale unit. Bambamanzi plan to introduce on-line computer bureau Oct/Dec 1997. Three pilot projects commissioned May 1997: Umgeni Water individual yard connections, and Rand Water and Magalies Water shared standpipes.
Budget Costs Excl VAT:	Individual household unites R750-00 to R850-00. Shared standpipe units R1150-00 to R1300-00. "Smart token" ™ R25-00 each (25 year life span).

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Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Plessey/Control Instruments joint submission**
Contact Person/Tel No:	Mr Alasdair Morrison of Control Instruments: Tel: (021) 52-4930 Mr Mark Chewins of Plessey Metering: Tel: (021) 797-6171
Products Offered:	Electronically operated prepayment systems for household connections and shared standpipes.
Targeted Markets:	Municipalities and local authorities.
Special Features:	Primary energy source - mains or battery. Tariffs are structured at the customer credit vending terminals (not at the individual customer credit control units). Arrangements for block tariffs are available. Credits entered via a key pad. A card slot is therefore not necessary. Credit bought as a coded receipt, lost receipts can be re-issued. Shared standpipes are operated by buying a number of tickets for fixed amounts of credit. A single unit can be configured for both water and electricity with the data for each commodity being stored separately.
Additional Comments:	Plessey electronic energy dispensers have been in use for 8 years and over 400 000 customer credit control units for prepaid electricity meters have been installed. The Control Instruments water metering valve control unit is assembled from well proven components.
Budget Costs Excl VAT:	Ex works price based on an order of 2000 units: R500-00 to R750-00 per unit depending on the final configuration and software needed.

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Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Cumcon**
Contact Person/Tel No:	Mr Larry Barnett: Tel: (011) 648-9993
Products Offered:	Electronically operated utility management system.
Targeted Markets:	Individual household two channel water and electricity prepayment utility management systems. Semi-continuous analysis of unaccounted-for water and water usage are fundamental components of the system.
Special Features:	Full two-way communication is maintained between the central data processing unit and all outstations both the individual customer's control units and the bulk water supply points, by means of a solar/battery powered VHF radio link with a 45 km radius operating distance. Design variations include unattended vending terminals. The credit bought at such a terminal can be transmitted automatically to the customer's control unit. Cumcon's currently marketed system manages water and electricity sales. A facility to add telephones and/or gas has already been designed and could be implemented as a low additional cost.
Additional Comments:	The system as described above was designed and tested in the field between 1979 and 1987. The system can be adapted easily to cater for shared standpipes.
Budget Costs Excl VAT:	Complete systems are leased at a cost of R67-00 per month per customer credit control unit including maintenance.

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Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Schlumberger Measurement & Systems Pty Ltd.**
Contact Person/Tel No:	Mr S F Ditchem: Tel: (021) 948-6830
Products Offered:	Smart key electronically operated prepayment water management system.
Targeted Markets:	Individual household connections.
Special Features:	A vending terminal designed to be sited in a local shop. The customer interface credit control unit (CIU) which can be installed, in a convenient location, separately from the valve control unit (VCU). Both are battery powered. The customer credit control unit can handle both fixed and volume based charges plus emergency negative credits. Clear audible and visible indicators warn when credit is low. Charges are debited one per day allowing the customer time to purchase credit. Payment arrears can be collected by allocating a fixed percentage of each new credit to arrears recovery.
Additional Comments:	Submission based on UK smart key technology with over 1,5 million prepaid electricity and 3 500 prepaid water meters installed. Schlumberger have indicated their interest in discussing specific South African requirements and combining UK expertise with their own considerable local expertise gained from the prepaid electricity meter market where they use both key pad and disposable credit transfer technology.
Budget Costs Excl VAT:	R3 000-00 per domestic installation (VCU + CIU).

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Unconventional water metering and vending devices for use in community water supply schemes: Details of potential suppliers and their products

Supplier's Name:	**Hydraulic Computer Services**
Contact Person/Tel No:	Mr Allan Ressman: Tel: (011) 803-8333
Products Offered:	A customised suite of computerised software applications for the integrated management of all facets of a water service provider's business. Areas optimised include: billing systems, unaccounted-for water control, water demand management, system network analysis and evaluation, meter replacements, pipe replacements, reservoir storage, pumping costs, planning and design of extensions, and creating and updating master plans.
Targeted Markets:	Small, medium and large water supply and sewer reticulation authorities.
Special Features:	The software provided integrates strategic planning, system upgrading design, management control and operational control in a single information system within a GIS environment using real current data. The system has been developed so that it can be integrated easily with any RDBMS (relational data base e.g. Access, Paradox, Oracle, Infomix). GIS (Geographic Information Systems) are also well supported and Hydraulic Computer Services has experience of integrating their software with ReGIS, Arcinfo and Autoworld. In most areas the database 'controls' the GIS so that the system can be operated by personnel with little knowledge of GIS. The cost recovery/UAW module includes a meter replacement scheduler.
Additional Comments:	HCS offers classroom and hands-on training of staff from all sizes of water authority during and after project implementation.
Budget Costs Excl VAT:	No costs presented.

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