Sharing it out

Introducing water demand management strategies for small towns

A WELL Study produced under Task 513
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Executive Summary

The purpose of this report is to describe a number of practical measures that may facilitate the development of an effective water demand management strategy in small towns in developing countries. The report has been prepared primarily as a briefing document for the organisations responsible for service provision. First and foremost this includes water supply departments and municipal authorities. The document may also be useful for their project partners in the private, NGO and donor communities.

Water demand management has been defined as a practical strategy that improves the *equitable*, *efficient* and *sustainable* use of water. It achieves this by:

- stressing equitable access to water, reflected in a strategy that is specifically designed to improve service delivery to the poor;
- treating water as both an economic as well as a social good, and managing and pricing it accordingly;
- balancing the management of losses and consumption with new or augmented supplies; and
- managing the change from a supply driven to a demand responsive culture.

The special situation of small towns has been reflected in both the content and presentation of this report. Small towns have several potential advantages compared to larger towns and cities, as well as a number of constraints. Both are reflected in the measures described.

The report focuses on residential and institutional consumers. The use of water by industries and farmers has not been considered. Many of the measures described, however, are both relevant and transferable.

Problem definition is a key part of an effective demand management strategy. The report describes how a combination of quantitative and qualitative techniques can be used to establish water use patterns. Critically, if service providers are expected to improve the equity of water distribution, they must be able to measure water consumption within the town boundary, and not just the consumption of consumers with direct access to piped water.

The report demonstrates the use of a water-use table (see below) to establish and monitor consumption. The percentages in the table refer to the proportion of the town's population using each source as its principal supply.

Water from other sources (wells, tube-wells and springs)			**Water produced by service provider (piped)**				
Community sources (27%)	Private wells (7.5%)	Water supplied by vendors (37.5%)	Stand-pipe users (22%)	House or yard tap (3%)	Illegal connections (3%)	Known institutional use	Physical losses (including production losses)

Equity can be improved by investing directly in improving the service provision for the poor. The resources committed can be used very efficiently if a demand responsive approach is used. Alternatively, by improving the efficiency of existing services, the financial and water resources saved can be used to improve equity. This report illustrates this 'belt and braces' approach, focusing on five practical measures:

- introducing a demand responsive approach to service provision;
- improving the service provided by communal standpipes;
- reducing revenue losses;
- reducing physical losses; and
- building public support for demand management.

Although the first and second of these would not usually be considered as part of a water demand management strategy, they have been included because both can improve the equity and efficiency of service provision. In practice, it is neither feasible nor desirable to separate issues of supply and demand. Both must go together, with demand management providing an appropriate logic to all investments.

The measures are described individually. In practice they cannot be used in isolation but would form part of a cohesive, mutually reinforcing programme. This may also include the efficient development of new water supplies or expanding the capacity of those in use.

Water demand management cannot be implemented on an *ad hoc* basis but requires formal arrangements for project management. In practice, this can be achieved by combining measures into a number of discrete sub-projects, each with its own aim, objectives, indicators, activities, resources, budget and manager.

Reflected throughout this report is the suggestion that water demand management should be introduced *incrementally*. This approach has a number of significant advantages.

- it allows water service providers to learn the 'art' of demand management by monitoring progress, evaluating performance and refining their strategy;
- it allows time to build public and political awareness and confidence;
- it provides funders the opportunity to invest in pilot projects; and
- it allows time for service providers to move from a supply driven to a demand responsive and poverty sensitive culture.

The points discussed are brought together in the conclusion. This section highlights a number of important gaps in knowledge and practice that may prevent or delay the uptake of an effective demand management strategy.

Contents List

Abbreviations

CBO	Community based organisation
DFID	Department for International Development (UK)
EHP	Environmental Health Project (USA)
IRC	International Reference Centre for Water Supply and Sanitation (NE)
KaR	Knowledge and Research Project (DFID)
l pcd	litres per capita day
NGO	Non-governmental organisation
UKWIR	United Kingdom Water Industry Research
UN ESA	United Nations Population Department, Department of Economic and Social Affairs
WEDC	Water, Engineering and Development Centre, Loughborough University (UK)
WELL	Water and Environmental Health at London and Loughborough
WSP	Water and Sanitation Programme

Concepts and definitions

Average incremental cost

The average incremental cost is the cost of implementing an option divided by the volume of water saved or produced by that option. Both costs and benefits are expressed in terms of their net present value, taking into account externalities (their wider social and environmental impacts). This result can be used to rank options in order of decreasing efficiency. In practice, such techniques may be too complicated to employ in small towns introducing water demand management.

Coping Strategy

The means by which an individual, household or other entity improves the service received to the standard desired. This is associated with some sort of economic trade off, for example, people's time, effort or income. Coping strategies can therefore be used as an indicator of unmet demand.

Demand

Used in a technical sense, demand is the quantity of water that users are expected to consume.

Used in a non-technical context, demand can be defined as an expression of desire for a particular service, measured by the contribution people are willing and able to make to receive and sustain it. In other words, it is what people want, constrained by the resources they control.

Demand assessment:

The techniques used to measure demand. A number of methods have been developed. These include:

- contingent valuation methodologies, in which people are asked to state their willingness to pay for a service described to them during the course of an interview;
- participatory techniques in which a group of potential users are facilitated to establish their preferences and demand; and
- revealed preference studies: formal assessments of people's coping strategies, usually associated with a survey or field observations.

Demand management

A long term, practical strategy that improves the equitable, efficient and sustainable use of water.

Demand responsive approach

An implementation strategy based on meeting demand for services by providing users with an appropriate choice of service and service level options.

Physical losses

This can be defined as water entering the distribution network but not supplied to users. As such, physical losses are made up of distribution losses and supply pipe losses resulting from pipe leaks. By definition, physical losses exclude production losses and the losses incurred within a residence, for example, associated with a leaking WC. *In this report, the latter has been included as a physical loss in order that it features in a water demand management strategy.*

Production losses

Water lost during the production of piped water before it enters the distribution network. This includes water used as part of the production process (for example, back-washing) but not recovered, as well as leaks and overflows. Production losses are often significant and must be monitored and managed by the service provider.

Revenue losses

Also described as commercial losses, revenue losses can be defined in terms of the quantity of water supplied to users but not paid for at the rate set by the water service provider. Revenue losses result from unauthorised connections, under-recording meters, and inefficient billing and revenue collection.

Social capital

Social capital consists of the social resources (networks, membership of groups, relations of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods (DFID, 1998).

Small towns

Various definitions for small town have been proposed, although it is almost impossible to capture the variety of contexts in which small towns are found. The following definition emerged from a recent e-mail based conference on small town water supply and sanitation:

> ”Small towns are urban settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped water systems, but are too small and dispersed to be efficiently managed by a conventional large water utility. They require formal management arrangements, a legal basis for ownership and management, and the ability to expand to meet the growing demand for water. Small towns usually have populations between 5,000 and 50,000, but can be larger or smaller” (Jones and Roche, 2000).

Unaccounted for water

The sum of physical losses and revenue losses. This excludes production losses and, depending on how physical losses are defined, losses incurred within a residence.

Willingness to pay

What individuals, families or other economic entities are willing and able to pay in return for a particular service. In this context, ‘pay’ can be a financial contribution, or someone’s time, labour or economic produce.

Willingness to pay is a description of how people value a service or a service level, and is different to ‘affordability’, which is based on external perceptions of value.

1. Introduction

1.1 The water crisis

Fresh water is an increasingly scarce resource. Global consumption rose six-fold between 1990 and 2000, and the rate of increase of consumption is accelerating (DFID, 2001). The impact of this water scarcity is felt most of all in urban areas, where the combined effects of population pressure, economic growth, deteriorating water quality and the competing demands of agriculture, industry and domestic users are most concentrated.

Traditionally, the response has been to expand existing supplies and develop new supplies. The cost of doing so has increased sharply. Research has shown that in some cities the unit cost of water has doubled with every successive project (Bhatia and Falkenmark, 1993). Intermittent water supplies, deteriorating water quality and falling water tables are the result.

Whilst this has an effect on those fortunate enough to be connected to a piped water supply, the impact of water scarcity is felt most of all by the urban poor, both in terms of their health and livelihoods. With the poor making up 40% of the urban population in developing countries (Black, 1996), the economic and social consequences are of global significance.

A fundamental change of thinking is required, reflecting the need to allocate water resources efficiently and equitably. Both factors are implicit in water demand management.

1.2 What is water demand management?

Water demand management can be defined as a practical strategy that improves the equitable, efficient and sustainable use of water[1].

It achieves this by:

- stressing equitable access to water, reflected in a strategy that is specifically designed to improve service delivery to the poor;
- treating water as both an economic as well as a social good, and managing and pricing it accordingly;
- balancing the management of losses and consumption with the development or expansion of supplies; and
- managing a change in organisational culture from being technology focused and supply driven to one which puts people first and is demand responsive.

Water demand management should not just be seen as a collection of measures to conserve water that has been supplied. The principles of demand management outlined above should be applied equally to supply-side investments.

1.3 Why small towns?

This report focuses on water demand management in small towns. Small towns have fallen into a ‘development gap’ between rural settlements (where most development approaches rely on community based initiatives) and larger urban centres (where economies of scale, higher political profile and better access to resources increase the available options). To date, small towns have not been a development priority, despite the fact that an estimated 40-45% of the urban population in developing countries live in towns of less than 100,000 people (UN ESA, 1996).

[1] Adapted from Deverill et al, 2001 (forthcoming)

The special situation of small towns has been reflected in the content and presentation of this report. Complicated techniques have been avoided. Small towns have, however, a number of significant advantages compared to larger towns and cities. These are emphasised in the approaches described.

1.4 Scope

The report describes measures which focus on residential and institutional users, and reflects the fact that a significant proportion of the population is unlikely to have direct access to piped water.

The use of water by industrial users, farmers and market gardeners falls outside the scope of this report. Many of the measures described are, however, relevant and transferable.

Production losses can be significant, especially in small towns characterised by ageing infrastructure. However, in the interests of brevity, this issue is not discussed in detail.

1.5 Who is this document for?

This report has been prepared primarily as a briefing document for the organisations and individuals responsible for the provision of water in small towns. First and foremost this includes town water supply departments and municipal authorities. The document may also be useful for their partners in the private, NGO or donor communities.

1.6 How this report is structured

The report is structured in six sections. In Section 2, small towns are defined in terms of their demography, infrastructure and institutions. The comparative advantages and constraints of implementing water demand management in small towns are highlighted.

Section 3 concerns problem analysis, showing how quantitative and qualitative assessments can be combined to identify clear priorities for demand management. The importance of establishing the problems facing all users, and not those using piped water, is emphasised.

Section 4 describes in detail the five practical measures that may be particularly useful in a small town scenario. These concern:

- the adoption of a demand responsive approach;
- improving service levels associate with communal taps;
- the reduction of revenue losses;
- the reduction of physical losses; and
- promoting public support for water demand management.

Section 5 brings the preceding sections together by considering how priorities can be developed into practical objectives and associated activities. Demand management strategy can therefore be managed as a programme of inter-related projects. The need for stakeholder participation throughout the planning process is emphasised as an important way of maintaining public interest and support.

Conclusions are made in Section 6, bringing together key points from each section and identifying important gaps in knowledge and practice that may prevent or delay the uptake of an effective demand management strategy.

2. The small town context

2.1 What is a small town?

What is considered to be a small town depends on the local context. The recent e-mail conference on small town water supply and sanitation avoided a precise definition in terms of overall size. Instead it focused on institutional and management arrangements and the need to meet growing demand for water. After much debate, the following definition of a small town was developed by conference participants (Jones and Roche, 2000):

"Small towns are urban settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped water systems, but are too small and dispersed to be efficiently managed by a conventional large water utility. They require formal management arrangements, a legal basis for ownership and management, and the ability to expand to meet the growing demand for water. Small towns usually have populations between 5,000 and 50,000, but can be larger or smaller."

Whether all small towns can benefit from economies of scale is open to question. In practice, the design of existing water supply infrastructure may be inappropriate for the number of users, the quantity of water they consume and their willingness to pay for it.

Rather than adopt a rigid definition, small towns can be described in more general terms by their common characteristics. In the context of water supply, these often include:

Demographic

- A rapidly growing population and with it a rapidly increasing demand for water.
- A relatively large peri-urban fringe relative to the total population, relying on a variety of coping strategies to improve access to water.

Infrastructure

- A piped water supply serving a relatively small urban centre. This is often characterised by ageing infrastructure, interrupted or intermittent services and poor water quality. Access to piped water can be significantly improved by water vendors and buying from neighbours.
- A variety of informal water sources. Examples include open wells and bore holes fitted with hand pumps, these being more common in the peri-urban fringe.

Institutional

- A water service provider with limited autonomy, incentives, commercial focus and customer orientation, often highly dependent on external subsidies, and often driven by a short-term political agenda and the need to respond to an imminent or on-going water crisis.
- A variety of small scale providers, including households, who sell water to their neighbours, water vendors, well diggers and drillers, latrine pit diggers and emptiers, all of whom are responding to unmet demand for water and sanitation.

Whatever the local situation, there is a need to look at the distribution and use of water resources as a whole. The demands and capacities of all households should be considered, rather than only focusing on the minority with direct access to a piped water supply. With this in mind, the following subsections identify key opportunities and constraints that must be taken into account when considering demand management.

2.2 Opportunities

The special situation of many small towns offers key opportunities that can be harnessed by a water demand strategy. These are often overlooked by conventional technology driven solutions.

2.2.1 Harnessing unmet demand

Unmet demand for water and sanitation results in people adopting a variety of coping strategies. Examples of the latter include buying water from vendors or waiting hours in a queue at a communal tap.

Responding to unmet demand means providing people with an improved service which they are willing to pay or. The fact that many users have to contribute substantially for a relatively poor service indicates that there is considerable scope to harness unmet demand, improving both equity and efficiency.

2.2.2 Tapping social capital

People who share common interests or problems often join together to agree and implement a solution. This is often evidenced by their coping strategies in rural areas, and to a lesser extent, in peri-urban areas. The co-operation itself has an intrinsic value, sometimes referred to as social capital.

The provision and sustainability of community managed rural water supplies and sanitation relies to a large extent on social capital. This contrasts with the situation in larger towns and cities, where economies of scale favour ‘large scale‘ solutions based more on financial capital and infrastructure. The situation in many small towns favours a combination of approaches.

In practice, however, the majority of water service providers in small towns adopt practices developed for larger towns and cities. Opportunities exist to develop demand responsive services by making better use of social capital.

2.2.3 Using ‘alternative’ service options

Service providers usually focus on conventional systems associated with a piped water supply. This limits what can be achieved and overlooks many opportunities to develop ‘alternative’ service options which can be more effective and more sustainable.

Examples of alternative service options include various technologies, management systems and payment methods. Many of these build on and reinforce the social capital, knowledge and skills which are often evident in small towns, especially in the peri-urban fringe.

2.2.4 Information flow, accountability and transparency

Demand management largely concerns altering the perceptions and practices of users. Its success depends largely on the communication of messages to target audiences and the existence of channels that facilitate transparency and accountability.

The size of a small town greatly facilitates effective vertical communication. It is also more simple for stakeholders to communicate ‘horizontally’ with each other and co-ordinate activities. Both factors can be exploited in the design of a responsive and cohesive demand management strategy.

2.3 Constraints

Just as it is important to exploit the comparative advantages of small towns, it is also important to understand their constraints.

2.3.1 Perpetual crisis

The water supply situation in many small towns may be akin to a perpetual or seasonal crisis. As a result, a significant proportion of the resources available may be reserved for short term and often very expensive supply-side measures (such as the use of water tankers) to relieve the situation. Political support is focused on solving the crisis and managers may be unable to divert resources to establish longer term solutions.

2.3.2 Political pressure

Service providers in small towns have limited authority. As a result, political leaders tend to have a greater influence than would otherwise be the case. In practice, the long-term nature of demand management, and the perception that some users may be disadvantaged by its implementation, can result in obstruction.

2.3.3 Limited autonomy

The autonomy of water service providers in small towns is often limited. As a result, managers may be unable to determine policies, set tariffs and reorganise.

Water service providers are often controlled by a municipality or town council. In some cases, revenue from water sales is reallocated to other sectors, eliminating a key incentive to reduce revenue losses.

2.3.4 Limited human resources

Associated with lack of autonomy is a lack of capacity and expertise. Water service providers tend to be technical organisations, dominated by engineers with little expertise of commercial practice, customer relations, participatory approaches and demand-side solutions.

2.3.5 Limited financial resources

Finally, service providers in small towns do not usually attract substantial financial resources to invest in improved water supplies.

2.4 Summary

An effective small town demand management strategy should exploit the advantages discussed, whilst taking into account the constraints. The following types of approach could be useful:

- Adopt social marketing techniques to promote water demand management to the public and its leaders.
- Establish effective partnerships. The opportunities and constraints described in this section reinforce the need to work in partnership with the public, with organisations capable of identifying and harnessing social capital, and with organisations capable of identifying and developing a wide range of appropriate service options.
- Adopt an incremental approach that allows the capacity and credibility of the water service provider to be built over time, together with public support.
- Implement a demand responsive approach to improve the equity and efficiency of service delivery.

3. Problem analysis

In order to plan an effective water demand management strategy, the problem and its underlying causes have to be understood. The information obtained can be used to advocate the need for demand management, emphasising the importance of improving the equity of water distribution.

3.1 Quantitative analysis

Conventionally a supply-demand imbalance would be determined by estimating the future consumption of piped water, and comparing this with what can be supplied. The problem is therefore defined in terms of a projected imbalance. Demand management measures are then introduced to 'save' this amount of water in the most economically efficient way.

This type of approach has been developed for use in developed countries, where the issue of equitable access to water has largely been resolved. There is a risk that, in a situation characterised by its inequity, the water saved is used to delay future investments rather than improve the existing situation.

The approach therefore has to be adapted to fit local patterns of water use and reflect the fact that a high proportion of 'users' may not have access to a piped water supply.

3.1.1 Estimating the quantity of water entering the distribution network

The quantity of water entering the distribution network over a 12 month period can be relatively simple to estimate, based on flow measurements. Production losses, associated with water storage and treatment, should also be estimated. This may become the focus of a separate water saving programme.

3.1.2 Estimating the quantity of water consumed

It is more difficult to estimate the volume of water consumed and which sources are being used. Bearing in mind the constraints listed in the previous section, the following method is suggested. This has been developed from a comprehensive survey of water use in Dehra Dun, India, undertaken in 1995 (EHP, 1996).

Residential survey

The residential population is categorised into a number of user groups according to the principal source of water used. Establishing these categories requires some form of preliminary investigation. It is important to include the entire residential population within the town's boundaries, ensuring that those living in the peri-urban fringe, in informal settlements and in rented properties in the town centre are included.

The quantity of water consumed by each user group in a typical week is then estimated. This can be established through a survey. If it is women who manage the collection and use of water, they must be consulted. Women should also be selected and trained as enumerators. It may be possible to co-operate with a local NGO or college in this respect.

Different forms of questionnaire are likely to be needed for each user group. For example, someone using a well could be asked to estimate the number of water containers taken the week before, rather than estimate this volume in litres.

Seasonal variations should be reflected in the analysis. If the survey can only be done at one time of year, it is probably most effective to undertake it during the dry season. People can also be asked to recall their normal water consumption to obtain a weighted average.

Wherever there is a water meter it should be checked. In this way it may be possible to incorporate a correction factor into people's estimates. In the Dehra Dun study, for example, it

was concluded that respondents with private connections under-estimated consumption by about 25%.

If water is taken from an intermediary, such as a vendor, further investigations are needed to establish what proportion of water, if any, comes from a piped supply.

The survey should attempt to establish the amount of water being used by households with unauthorised or illegal connections. This will not be easy, especially in densely packed houses. It may be necessary to check existing records and match these with observations, or examine the fittings used to make the connection. Local knowledge may also be useful in identifying households with unauthorised connections.

Institutional survey

The use of water by institutions such as the town administration, hospitals, prisons, the police, the army, schools and colleges should be estimated. Water used by institutions is usually metered, but often they have a poor payment record.

In general, it is difficult to estimate institutional water use other than by metering. However, it may be possible to organise a participatory water audit, particularly in schools where the need to conserve water may be better understood. In its most simple form, this consists of measuring water use and supply over a period of time (participatory water audits are covered in more detail in Section 4.5).

Physical losses

Physical losses are difficult to measure directly. At this stage, they can be estimated by balancing the water used and the water supplied.

3.1.3 Analysis of results

The results of the survey may be presented in the form of a chart. This can then be used to explain the situation to other stakeholders, elicit support for demand management and agree priorities. An example is shown below. In this case, data has been averaged over the year, taking into account seasonal variations.

<table>
<tr><td colspan="3">← Water from other sources (wells, tube-wells and springs) →</td><td></td><td colspan="5">← Water entering distribution network (piped) →</td></tr>
<tr><td>Traditional community sources (27%)</td><td>Private wells (7.5%)</td><td>Water supplied by vendors (37.5%)</td><td></td><td>Stand-pipe users (22%)</td><td>House or yard tap (3%)</td><td>Illegal connections (3%)</td><td>known institutional use</td><td>Physical losses (excluding production losses)</td></tr>
</table>

Table I. Analysis of water supply and use

The percentages used in the chart refer to the proportion of the population using those sources, and provide a measure of equitable access to water. Although the information presented is based on estimation, it provides a good foundation to plan the introduction of a long-term demand management strategy.

In this case, it can be seen that:

- Over 60% of the population does not use piped water as its principal water source.

- Only 36% of the water consumed is supplied by the water service provider. The remainder comes from wells, tube wells and springs.
- Of the water entering the distribution network, about 45% never reaches consumers. Losses include leakage from distribution mains, supply pipes, private and communal connections, under-recording meters and overflows.
- About 40% of the piped water supplied is taken from community taps, either by users or by vendors, and supplies about a quarter of the town's population.
- 20% of the piped water supplied is used by households with private connections,
- 20% of the piped water is taken by households with illegal connections.
- 20% is used by institutions (estimated from working meters and water use audits).

The information presented in Table I can be supplemented by establishing the average amount of water consumed by each group, measured in terms of litres per capita day (l pcd). This is shown in the table below, together with the unit price of water in shillings (sh) if applicable, and the proportion of people who actually pay this.

User group	**vol used (l pcd)**	**unit price (sh/20 l)**	**average bill**	**proportion of payment received**
Traditional communal sources	15	N/A	N/A	
Private wells	50	N/A	N/A	
Water supplied by vendors	15	90 sh	68 sh	100%
Stand pipe users	10	N/A	N/A	
Private connections	45	15 sh	34 sh	60%
Unauthorised connections	45	N/A	N/A	
Institutional users	50	15 sh	37 sh	20%

Table II. Water use and financial data

This table shows:

- Households with private connections (legal and illegal) consume three times as much water per capita than those taking water from community taps.
- People who buy from vendors pay six times the price of water paid by people with private connections. Even though they use less water, they pay twice as much in absolute terms.
- Only 60% of revenue associated with private connections and 20% of the revenue associated with institutional users is received.

3.2 Participatory assessment

The quantitative approach described in the proceeding sub-section provides useful information. However, it does not describe the underlying cause of problems, nor does it investigate people's perceptions and possible solutions.

For a complete picture of the problems facing the water service provider, some sort of participatory assessment is essential.

Most water service providers are unlikely to have the capacity to undertake participatory investigation. However, there may be local NGO's who are experienced in techniques that can be used, again demonstrating the virtue of establishing local partnerships.

Skilled facilitators can investigate many of the issues previously identified in the quantitative assessment. A number of participatory tools can be used, although it is not within the scope of this report to describe them in any detail. The use of representative groups of users (focus groups) in such investigations is one of many options.

Causal relationships and possible solutions should be explored, concerning, for example, perceptions about the health risks of using contaminated water; the prices charged and service provided by vendors, compared to that provided by the municipality. Seasonal variations in coping strategies should also be examined.

Consultation is also a vital step in establishing a working relationship, transparency and trust between users and the water service provider, as well as other stakeholders. Without this, much of the social capital referred to in Section 2 will remain inaccessible.

3.2.1 Problem analysis and setting priorities

The next stage is to bring together the results from the qualitative and quantitative assessments. The aim is to agree rather than fix demand management priorities. These can then be developed into specific objectives.

Priorities can in theory be set by the water service provider or municipality without further consultation. However, there are several reasons why other stakeholders, and most importantly, representatives of the general public, should be involved in decision making:

- To implement a demand management strategy, support will inevitably be needed from all stakeholders, above all, from the public and its leaders.
- Consultation in setting priorities promotes transparency and will enhance the collective ownership of the resulting strategy.
- The particular interests of key stakeholders can be identified and taken into account.
- The risk of developing measures that exclude or otherwise disadvantage marginalised groups is reduced.
- The water service provider is encouraged to look beyond the area served directly by a piped water supply.
- Information channels will have to be established and organisations created to represent the views of different groups of users and provide feedback. These can be used throughout the development and implementation of a water demand management strategy.

Such a process has to be facilitated by a neutral party and potential conflict situations identified and resolved at an early stage. Box 1 is an example of the priorities that could result from this type of stakeholder consultation.

Box 1: Results of priority setting exercise

Priority 1: To improve access to safe water in unserved areas.

Priority 2: To improve the service levels provided by communal taps.

Priority 3: To improve the service provider's financial situation.

Priority 4: To reduce physical losses in the piped water supply.

Of these priorities, the first and second may not have been identified if the public had not been involved. Conventionally, neither of these would be associated with demand management because they relate to supply side investments. However, as both are designed to improve the equity of water distribution, they can be included in a demand management strategy.

This point reinforces the fact that it is difficult to separate demand and supply. In fact, a strategy that includes both may encourage public and political support for the programme as a whole.

Finally, a fifth priority has been added which relates to the process rather than the problem. This reflects the importance of monitoring progress.

Priority 5: To establish an effective monitoring system to access the effectiveness of the measures planned and provide a basis for future improvement;

4. Demand management measures

Having agreed priorities, the next step is to investigate appropriate measures that are likely to be needed to achieve them.

This section describes five measures that address the priorities identified in Box 1.

- the adoption of a demand responsive approach to service provision;
- improving the service provided by communal stand pipes;
- the reduction of revenue losses;
- the reduction of physical losses; and
- raising public awareness of the need to conserve water.

The additional priority, concerning the establishment of a system to monitor improvements, is described in Section 5.

4.1 Introducing a demand responsive approach

There is a strong connection between demand management and adopting a demand responsive approach to service delivery. This enables people to select the service and service levels they want and are willing and able to pay for. They therefore have a stake in sustaining the supply and potential incentives to conserve water.

Studies have shown that people's willingness to pay for a particular service is related to their income and household circumstances. How services are managed and how payments are made are also important (World Bank, 1993). This should be reflected in the options provided. For example, some people may be more willing to buy a private connection if they can pay by instalments rather than in a lump sum.

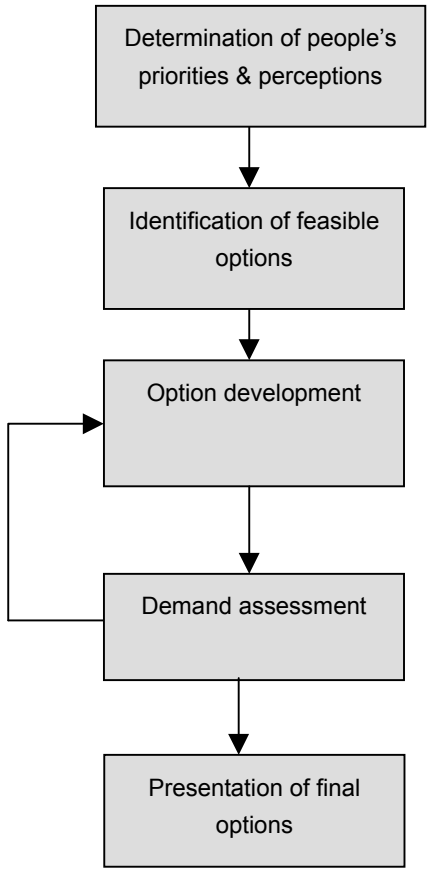

Figure 1 : The design process

4.1.1 The process

The demand responsive process is summarized in the flow chart, adapted from Deverill et al, 2001b.

It is important to emphasise that the identification and development of feasible options must take into account the priorities and perceptions of potential users. The design process must allow for user participation and decision making.

Demand assessment provides the means to test whether the options developed are able to capture demand. A variety of methods can be used.

Demand for an improved service is not always evident and may have to be *stimulated*. For example, people will only want to pay for a protected well fitted with a hand-pump if they perceive that the benefits outweigh the costs. Demand will be weak if people are not aware of what these benefits are.

The options offered must reflect local priorities and perceptions of value. It may be more effective to 'market' the protected well in terms of convenience and child security, rather than its potential health benefit.

Box 2 illustrates how such a process could be applied in practice. The example is based on an objective derived from the first priority listed in Box 1. Objective setting is an important part of the planning process and is described in Section 5.

Box 2: Use of a demand responsive approach to improve access to water in unserved areas

Priority: To improve access to safe water in unserved areas

Objective: To improve access to safe water in three peri-urban wards not served by piped water

Activities:

1. Agree roles and responsibilities with project partners and other stakeholders. These include community leaders and a number of local NGOs or CBOs with experience in social facilitation.
2. Agree ward selection criteria. These should include expressions of demand for improved water supplies. External assessments of need and practical considerations may also be taken into account.
3. Disseminate the project's objectives and selection criteria. Details of what is expected from each ward in terms of the contributions required should also be publicised. On this basis, select the three wards.
4. Investigate people's attitudes, perceptions and priorities in each selected ward, relating to sanitation, the provision and use of water and associated hygiene. The results can be used to inform a hygiene promotion campaign. Social marketing may be needed to stimulate demand. For further details, see WELL, 1998.
5. Identify and investigate feasible options in each ward. Consultation with a cross section of local residents can provide useful information, however, marginalised groups may have to be encouraged to participate in this process.
6. In consultation with representative groups of users, refine and develop a 'menu' of two or three feasible options for each ward. Each major option should be associated with a set of management and payment 'sub-options'. Life-cycle costs associated with each option should be calculated.
7. Assess demand for each option set by presenting potential users with information about the options and establishing their willingness to pay. The assessment is used to identify the option(s) that are most likely to capture demand, and ensure that no group of users is being disadvantaged or excluded.
8. Draw up and agree an action plan with the project's stakeholders. This should detail the resources needed as well as a project cash flow.

In this case, the following technical options may be feasible. These should be complemented by a number of management and payment choices.

- improving and protecting existing ground water sources, for example, dug wells, springs and tube wells fitted with hand pumps;
- developing new ground water sources;

- rain water harvesting;
- extending an existing piped water supply; and
- promoting safe in-home water storage;

Meeting this particular objective will require an investment of financial and other resources. Many household's may be willing to contribute substantially for the particular services they want. Assuming external funding is unavailable, the balance may have to be raised by the water service provider.

4.1.2 Provision for the poor

Special provision has to be made to ensure that the poorest households are not excluded or disadvantaged by the process itself. The following steps are suggested:

- Ensuring that the poor are identified and their practices, perceptions, priorities and demands established. One way of doing this is through the use of focus groups and participatory wealth ranking exercises.
- Ensuring that vulnerable groups participate in consultation and decision making. The use of focus groups can identify key issues and also give credence to the participation of the poor in a wider forum.
- Developing a range of appropriate options designed to meet the needs of the poor. Options must be informed by people's perceptions and not based on assumption.
- Identifying appropriate expressions of demand, taking into account the availability of resources (financial, physical and social) used to measure it. The poorest families and individuals may be unable to make any measurable contribution.
- Ensuring that subsidies are specifically designed to reach the poor and are not diverted to meet the interests of the better off.
- Ensuring that the poor are not disadvantaged by any of the measures taken. For example, a rising block tariff may result in families who share a single yard tap being charged more.

4.1.3 Pricing

Setting an appropriate price for each level of service is an important part of both demand responsive approach and demand management. The pricing policy should reflect a number of factors:

- The cost of providing and sustaining that level of service.
- An effective subsidy policy. In practice, many subsidies are unsustainable and do not in any case reach the poor. That does not mean that subsidies should not be used, but they must be carefully designed and their impact monitored.
- Demand. People are often willing to pay for the type of service they want. This should be reflected in its price, and may provide opportunities for cross subsidising services designed to meet the needs of the poor;
- The need to conserve water. At moderate or high consumption levels, the price of water can significantly influence the quantity used. The price is a key incentive for users to moderate consumption. Care must be taken to ensure that the poor are not disadvantaged.

In practice, the use of tariff changes to manage consumption requires a good understanding of how consumers are likely to react. It is pragmatic to adopt a long term, incremental approach to pricing, and match tariff reforms with service improvements.

4.1.4 Summary: the principles of meeting demand

The principles of meeting demand summarised in Box 3 below should not just be reflected in supply side improvements, but in *every* measure associated with a demand management strategy.

Box 3: Principles of meeting demand

1. Communities, households and individuals are enabled to make an informed choice of:
   - whether they want to participate in a project;
   - how services are to be allocated, managed, and maintained;
   - service level options;
   - how contributions are to be made and managed;
   - (In practice, options will be limited not only by their absolute feasibility, but also by the capacity of project staff and communities to deliver and sustain them).
2. Specific provision is made to ensure that marginalised groups are able to participate.
3. The right of all people to an affordable, basic level of service is not compromised.
4. Systems for effective collective decision-making are established.
5. Facilities are designed and management systems are established which are capable of responding to future changes in demand.

(Deverill et al, 2001b)

Further details of the demand responsive approach and social marketing are found in WELL, 1998. Detailed guidelines on designing to meet demand in peri-urban as well as rural areas are currently being prepared by WEDC and will be available shortly.

4.2 Improving the service provided by communal stand pipes

Communal taps are often poorly maintained and require constant attention from service providers. In overall terms, they are often regarded by the service provider as a financial liability, and are often removed if or when higher levels of service become available.

In practice a significant proportion of the town's population may depend, directly or indirectly, on communal standpipes. They may not be able to afford a higher level of service. The issue is how to improve the service provided by communal taps rather than whether or not to remove them. This can be achieved in three ways, following the principles of meeting demand established in Section 4.1.

- Ensuring that the level of service provided is the one needed.

This relates to the location and physical design of the tap stand, the quality and quantity of water provided, when water is made available, and the reliability of the service. A storage tank can be used to improve the availability, reliability and quality of water.

- Ensuring that the method of payment is the one preferred.

  There are usually a number of options for payment. For example, users can pay per container taken, pay a flat rate each month, or pay an annual user fee. They should be able to choose the system which best suits their circumstances. To avoid complexity, collective decision making may be needed to narrow choices down. Special provision may have to be made for the poorest individuals and families, in terms of a subsidy.

- Ensuring the management system is the one preferred.

  Once again, a variety of options exist. It is important that the cost of a management system is reflected in the price of water it provides.

Table III (adapted from Sansom et al, 2000) identifies some of the options that could be developed, associated with the provision of standpipes. An additional option may be for some users to upgrade to a higher level of service, such as a yard tap.

Technical options	**Payment options**	**Management options**
General Technical options include location, design, metering, number of taps per tap-stand, and the use of wastewater for productive purposes. Connection Standpipe connected to: ▪ Municipal pipe network ▪ local source (e.g. a bore hole) ▪ augmented by rain water harvesting Storage Capacity Standpipe with associated storage capacity, e.g. 500 – 5000 litres. Use ▪ single or multiple tap ▪ standpipe designed for institutional use (for example a market or school) ▪ shared standpipe with single water bill (relatively few users)	General Payment may be on delivery, in advance or in arrears, and flat rate or based on the volume used… Flat rate charge This may be preferred because it is simple to manage and because the amount of water that can be carried inevitably limits water consumption. However, organised reselling may result in excessive consumption. Volumetric charge For example, per bucket. This may be preferred because it is more equitable and provides additional incentives to conserve water. Payment options may be extended with the use of: pre-payment cards, tokens, and manual or automated dispensing. Further options relate to where water is paid for, e.g. ▪ at a water kiosk ▪ at a local shop ▪ at a local water office	General Water is inevitably wasted if how it is dispensed is not adequately managed, whatever the technology and paid for. Water points therefore have to be managed, but here there are many options: Water kiosks These may be managed by an non-commercial organisation (CBO or NGO), an entrepreneur, or a private concern. Privately managed taps These may be associated with an existing concern, typically a shop. Automated kiosks managed by the water service provider or a contracted organisation. Management responsibilities should reflect the ownership of infrastructure and may extend over any number of standpipes, and for a varying period of time.

Table III. Options for community stand pipes

Whether people should have to pay for water from communal facilities is a matter of debate. On one side are issues concerning the right to what is often considered basic level of service. On the other are issues relating to economic efficiency and resource scarcity.

Whatever one's ideology, people are more likely to pay for the type of service they want. If users do not contribute, and the water service provider is unable to maintain communal facilities, these soon become unavailable. This forces people to go elsewhere and end up paying more in terms of their coping strategy, for what they perceive to be a lower level of service.

4.3 Reducing revenue losses

Revenue losses (also described as commercial losses) represent water used but not paid for, expressed as a volume of water rather than its value in monetary terms.

Revenue losses result from the unauthorised use of water (associated with unauthorised connections and meter tampering), under recording or broken meters, and inefficient billing and revenue collection procedures.

In terms of demand management, reducing revenue losses has two important consequences.

- Revenue goes up. This is associated with a relatively short time frame, potentially providing the water service provider with funds to invest in improving water supplies.
- As water is being paid for, less is used. The water saved can be used to improve the overall service provided.

The remainder of this section looks at specific measures that can be taken to reduce revenue losses.

4.3.1 Improving revenue collection

If revenue is not collected, users have little incentive to conserve water. This deprives the water service provider of funds that could be used to improve the service.

Revenue collection may be poor because bills are not issued, money is not collected or no action is taken against defaulters. The first step to improve revenue collection is to measure the problem. Three indicators can be used to do this, guide future improvements and monitor their impact. These are described in Box 4.

Box 4: Financial indicators for improving revenue collection

The following three financial indicators qualify and quantify the efficiency of revenue collection:

1. Billing efficiency: the ratio of current bills and the amount owed;
2. Collection efficiency: the ratio of current receipts and the amount billed;

The product of (1) and (2) gives an overall efficiency for revenue collection. However, a further indicator is needed that reflects the value of arrears owed.

3. Accounts receivables: the ratio of money owed and average monthly income, expressed in terms of months. This indicates the extent of arrears. A value of more than three months suggests that arrears are not being adequately managed.

Only once the problem has been qualified and quantified can appropriate measures be taken to improve the situation. In this context, the following measures could be considered:

- ensuring that water meter readers are able to read and record the quantity of water used accurately;
- checking that meters are working and replace those which are not. The cost of meter inspection and replacement should be reflected in the price charged; [2]
- establishing and maintaining a register of users;
- establishing a convenient payment system (or systems) that takes into account people's perceptions;
- agreeing with stakeholders a transparent system to deal with the non-payment of bills and ensure that there is an effective system for dealing with customer complaints;
- establishing transparent accounting systems;
- setting targets for improving collection efficiency; and
- providing meter readers and revenue collection staff with performance-based incentives.

Meter reading, billing and revenue collection are relatively simple processes that can be managed at local level, providing cost-effective alternatives to more centralised systems.

Users should be consulted to establish which system of billing and collection is most convenient for them, bearing in mind that the costs of doing this should be reflected in the price of water.

Institutional users

May institutions do not pay water bills, or if they do, pay late. With relatively high levels of service and few incentives to conserve water, they can use a significant proportion of the water supplied. The non-payment of bills by government institutions may also provide others with an excuse not to pay themselves.

Encouraging institutions to pay can be difficult. Cutting of the water supply to hospital or prison is neither desirable nor practical. In absolute terms, there is probably nothing better than a local champion who is prepared to take up the cause with the organisation or departments concerned.

Such a process may benefit from the water service provider offering to facilitate institutional water audits and to detect and repair leaks free of charge. Not only will this reduce consumption, but it provides key opportunities to market water conservation.

4.3.2 Managing unauthorised use

The unauthorised use of water mainly concerns illegal connections, although meters may also be broken or tampered with to under-record flows. More positively, the presence of illegal connections can suggest unmet demand for higher levels of service.

The first action to take is to establish and maintain a *user register*. This implies that there must be a formal system of applying for and receiving a private connection in the first place.

The detection of illegal connections can be made much more easy with public support and local knowledge. Various incentives can also be put in place to help the identification process. These may include an amnesty of limited duration, followed later on by penalties. There is little point in describing unauthorised use as 'illegal' if the practice is not prohibited by law, or the law is not enforced. Such measures may have to be supported with bylaws passed by the municipality.

[2] Water meters cannot be neglected and have to be managed. In Dehra Dun, a survey found that only 5 out of 916 residential water meters were actually working (EHP, 1996).

One way of reducing illegal connections is to make higher levels of service more accessible. This can be done by establishing and responding to demand for private connections. People with private connections have to pay for the water they use and are likely to use significantly less water compared to households with illegal connections.

A useful by-product of managing unauthorised use is to reduce the physical losses associated with poorly installed house connections, which often leak and are unlikely to be repaired by the user or reported to the water service provider.

4.4 Reducing physical losses

Physical losses can be defined as the quantity of water that enters the distribution system but not supplied to users (Yepes, 1995). This does not take into account production losses, which can be significant[3].

Excluding this latter factor, physical losses are made up of three major components:

- leakage from the distribution system;
- leakage from supply pipes connecting premises to the distribution system, and
- leakage within premises[4].

In common with other water demand management measures, the management of physical losses should be seen as a continuous process of inspection and action which becomes an established, operational routine.

4.4.1 Dedicated resources

Maintenance of existing infrastructure is often a low priority for many town water service providers. Whilst major leaks are dealt with on a case by case basis, a greater number of smaller leaks may not be repaired even if they are reported. An ad-hoc response is an inefficient use of limited resources.

The reduction of physical losses calls for an effective management system and dedicated resources: manpower, tools and equipment, leak repair kits, and some form of appropriate transport. It also requires accurate and timely information and a co-ordinated response. In short, the issue needs to be *operationalised*.

4.4.2 Mapping the network

A pre-requisite for dealing with physical losses is a network map, showing not only where the pipes are, but their type and size, and where they are in relation to the streets above. The map, if regularly updated, becomes a valuable tool to help plan what will become a continuous process of identifying and repairing leaks or replacing pipes. If necessary, pipe markers should be placed to identify the course of pipes on the ground.

Once the map is complete, the network can be divided into a number of zones. Eventually, water entering and leaving each zone should be metered in order that pipe bursts can be detected as a matter of routine.

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[3] For example, Eyatu (2000) identifies significant production losses in two out of three small towns included in his field research. Any demand management strategy should address this issue, although it has not been included here in the interests of brevity.

[4] In-premise losses have in theory been paid for and are not the direct responsibility of the water service provider. However they cannot be ignored, and the water service provider can do much to facilitate the home-based water demand management.

More immediately, the zones can be used to delineate areas of responsibility for maintenance crews. It is good practice to mark boundaries on the ground.

If possible, the private and public connections within a zone should be made the responsibility of a single individual. He or she becomes the principal point of contact for all users in the area. Such a policy is likely to improve fault reporting, responsiveness, communication with customers and accountability.

4.4.3 Initial survey

As an initial step, the entire network (both distribution and supply pipes) should be surveyed, pipes and zone boundaries marked, and leaks recorded and repaired. This could be timed to coincide with a user survey (associated with the creation of a user register and the identification of illegal connections). Connections and repairs can be marked on the map. At a later stage, it may be more cost effective to replace designated sections of pipe rather than repair frequent leaks.

4.4.4 Bulk metering

Once the initial steps described have been completed, a more systematic approach is needed to managing physical losses. This involves routinely measuring and monitoring bulk flows to identify and locate pipe bursts.

Once installed, bulk meters must be regularly checked. This means routine inspection and replacement, sending meters away for periodic calibration and, if necessary, replacement.

4.4.5 Managing physical losses

Table IV illustrates one way of representing information on physical losses. This is based on the same concept used in Table I.

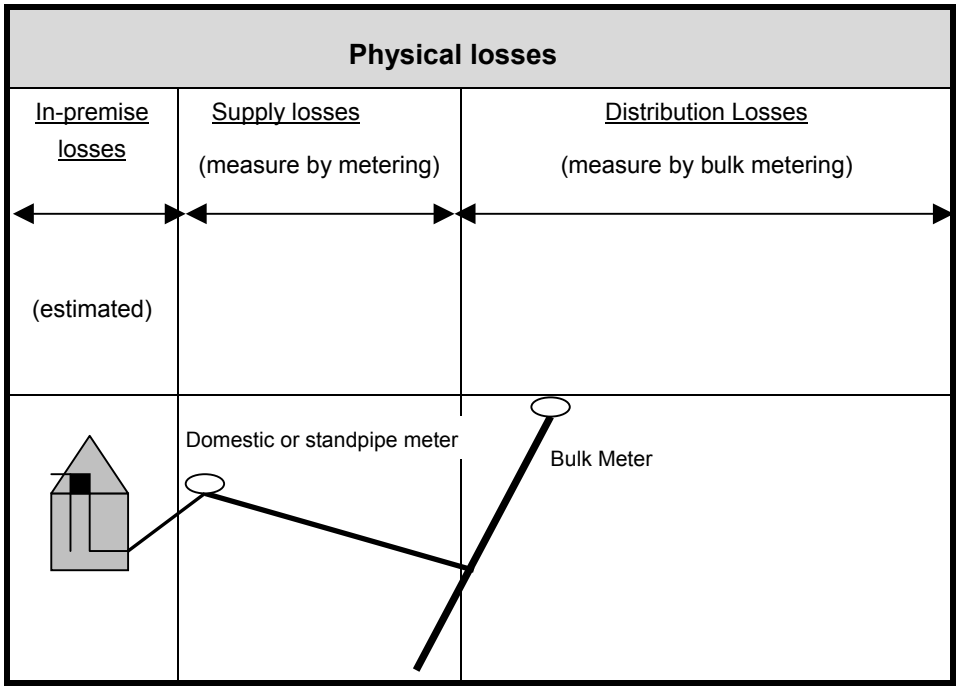


Table IV. Analysis of physical losses

As indicated, supply pipe leaks can account for a significant proportion of physical losses. This can only be measured if each connection is metered. Domestic water meters are, however,

vulnerable to damage, and should be periodically tested *in-situ* and if necessary repaired or replaced. Fortunately, many domestic water meters are simple to strip, repair and test in a local workshop.

Losses incurred within premises are more difficult to assess. If water is paid for according to the volume supplied, there is a strong incentive for the user to identify and rectify leaks. The water service provider can assist with measures that include:

- promoting household awareness of the need to rectify leaks quickly;
- providing households with practical information, for example, on how to change a leaking tap washer or WC cistern seal, or clean a defective ball valve;
- providing households with a list of approved plumbers;
- providing institutional users with information on how to carry out a water audit and monitor water use; and
- providing free advice to institutional users on how to reduce leakage.

All of these points are associated with the promotion of public awareness for the need for water conservation. An example of an institutional water audit is described in the following section.

4.5 Mobilising public support for demand management

4.5.1 Key issues

Public support for demand management is essential if it is to be accepted. Many of its measures are specifically designed to influence user behaviour, using the price of water as one incentive. People and politicians are likely to be suspicious of a strategy that they believe will result in higher water bills.

Promoting public support is therefore a critical part of demand management and should be prioritised accordingly.

The following factors should be considered:

Overall purpose of demand management

The public needs to be made aware of the purpose of a demand management strategy, emphasising the need to improve access to services throughout the town, and their role in consultation and decision making. The aim is to make demand management a public concern throughout the town rather than something led (and owned) by the water service provider.

Public participation

Demand management provides extensive opportunities for public participation. In particular, this is associated with the demand responsive approach in which users are given options and are able to chose the type of service they receive (including how it is managed) and are willing to pay for. Consultation should extend to the identification and development of appropriate messages and how these can be communicated.

Segmented audience

The public is not a single homogeneous entity, but is made up of a variety of different groups, differentiated by many factors (including age, gender, livelihood, social and economic status and location) as well as the service they receive.

Each group (or market segment) is associated with a set of priorities, perceptions and demands. This should be reflected in the promotion strategy adopted. Appropriate messages should be targeted at key market segments.

Public champions

Promoting water demand management can be greatly assisted by active support from popular opinion leaders. Particular efforts should be made to bring and keep such individuals on-side. Examples include traditional leaders, a key member of the administration, a local teacher, and the sister in charge of the local clinic.

Table V illustrates the concept of market segmentation and some of the promotional techniques that could be used to encourage public support associated with the introduction of a demand management strategy.

Market Segment	**Key message(s) to be promoted (based on consultation)**	**Method of communication to be used (based on consultation)**
Peri-urban households, mostly using vended water or taking it from traditional users	Households to benefit from a choice of improved affordable services, subject to user demand Health benefits of safe water	Public meetings Local theatre group Schools (child to child programme)
Households living in urban centre, currently relying on communal taps	Households to benefit from a choice of improved affordable services, subject to user demand (including higher levels of service)	Leaflet from water service provider Meetings at public taps
Households with private connections to a piped water supply	Households to select a consumer panel to help design and introduce 'fair payment for a fair service', a package of reforms designed to improve service levels.	Leaflet from water service provider School play Meetings arranged at local schools Visits arranged to water treatment works

Table V. Possible market segments and promotional messages

4.5.2 Participatory water audits

The promotional messages referred to previously concern households rather than institutions. There are however several ways of promoting institutional support for demand management. One of these is the idea of a water audit carried out by the institution itself, facilitated by the water service provider.

In this case the institution could be a department of the municipality, a hospital or school, or a factory. There may be no better place to start than the water treatment plant and the offices of the service provider.

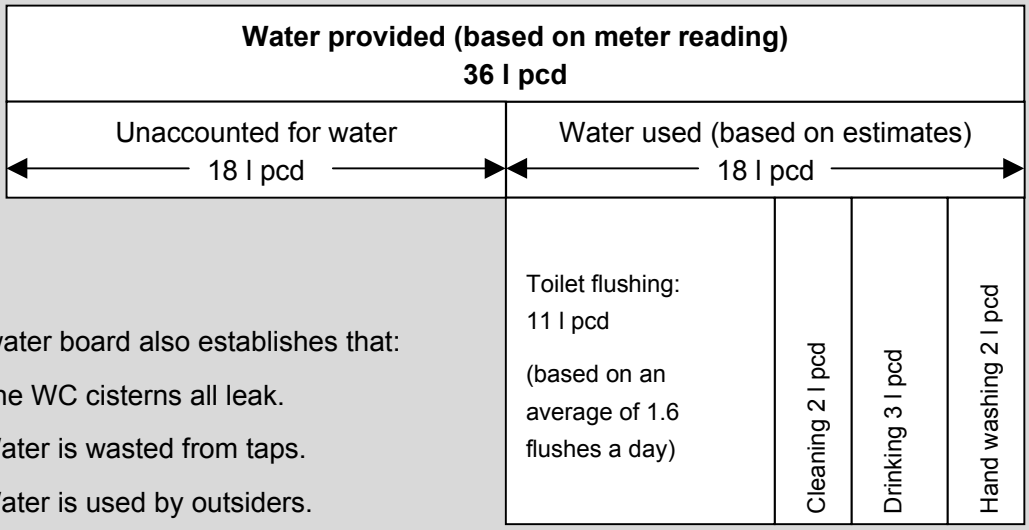
The objective of the audit is to facilitate the introduction of improved water management practices within the institution. It therefore goes beyond identifying and fixing leaks. A hypothetical example of this in shown in Box 5, in this case associated with a school.

Box 5: Participatory water audit in schools

As part of a campaign to promote the need for water conservation in schools, a member of the service provider visits a school to facilitate its first water audit. A month ago, a meter was installed to measure consumption, which has averaged 36 l per capita day (pcd). Members of staff with homes on the school grounds are already billed separately. Under a new by-law, schools are expected to pay for the water they consume, and there is now a strong incentive to conserve water.

Under the guidance of the service provider, the school has appointed its own water board, consisting of a teacher and a cross section of students. These now meet the visitor.

The plan adopted is to estimate where the water supplied is going. Class surveys and discussions are planned, the results of which are drawn up below:



The water board also establishes that:

- The WC cisterns all leak.
- Water is wasted from taps.
- Water is used by outsiders.

As a result, the following measures are agreed:

- Arrange for the WCs to be repaired.
- Install smaller taps and reduce water pressure with valves.
- Investigate building a urinal for boys.
- Reduce the WC flush volume from 7 to 6 litres with a block wrapped in a plastic bag.
- The water service provider should discuss the provision of a standpipe with neighbouring households.
- The school water board should continue to review water use every six months.

5. Planning and implementing water demand management

The adoption of a demand management strategy requires formal arrangements for project management. This should reflect its long-term nature, the cross-linkages that exist between measures, and the need to co-ordinate and phase in their introduction.

Section 3 stressed the need to involve all the major stakeholders in identifying priorities for water demand management. The same participatory approach should be used to develop priorities into objectives and break this down further into a number of activities.

In this context, it is important to consult and involve representatives of the general public, not restricting this to households with access to piped water. Failure to do this will result in a programme that is neither demand responsive nor backed up by public support.

5.1 Objective setting

The priorities identified in Section 3 should be developed into a number of objectives. Whereas the former is expressed in general terms, an objective is qualified. This is embodied by the acronym SMART, which spells out the characteristics of an effective objective:

S: Specific

M: Measurable

A: Achievable

R: Realistic

T: Time bound

This is illustrated in Table VI below, which associates each priority with a specific objective. These may seem relatively modest, but demand management is a long-term strategy and the objectives described are associated with its introduction. Once these have been achieved, new objectives can be set and the process continued.

Priority	Objective
To improve access to safe water in unserved areas	To establish safe and sustainable water supplies in three selected wards, reducing the average time spent fetching water by 50% within three years
To reduced physical losses in the piped water supply	To reduce physical losses from 50% to 35% in two years
To reduce revenue losses associated with private and illegal connections	To reduce revenue losses from 75% to 50% in two years

Table VI. Developing objectives from priorities

Each objective should be associated with a number of measurable indicators. The use of the terms ‘safe’ and ‘sustainable’ in Table VI should be qualified by stating how they are to be measured. For example, water quality could be measured by the number of faecal coliform per 100 ml, or the score achieved in a sanitary inspection[5].

[5] Details of how to conduct a sanitary inspection of this type are found in Howard, 2000.

5.2 Targets and time frames

Objectives need to be associated with targets and time frames, and both should be selected carefully. There may be a strong temptation to set over ambitious targets to gain public or political approval.

Reflecting the general lack of experience of many water service providers in this field, it may be more effective to set relatively modest targets and relatively short time frames to achieve them. The results achieved could then be reviewed and used to guide the development of new targets, possibly with a longer time frame. In this way, a water demand strategy can be piloted through its initial stages.

This is reflected in the objectives listed in Table VI, in which two out of three objectives (relating to reducing revenue and physical losses) are associated with two-year time frame. The percentage improvements may seem ambitious but reflect the law of diminishing returns. Proportionate reductions in revenue and physical losses would be harder to achieve in the future.

5.3 Activities

The various activities required to achieve each objective can now be determined. Depending on the objective, these may embody one or more of the demand management measures listed at the beginning of Section 4.

Each objective is thus developed into a sub-project, consisting of a number of specific activities. The human, physical and financial resources required can now be established. Each sub-project should have a designated budget, resources and project manager.

It is highly likely that a water service provider will need to call on other organisations to provide certain expertise. The development of a public awareness campaign is likely to need additional capacity. It may be possible to obtain this from the private sector, local government departments or a local NGO.

Linkages between sub-project activities should be identified. There may be a way to combine resources and avoid duplication of effort. It is also possible that activities associated with one sub-project can only occur after other activities from another sub-project have been completed. Sub-projects have to be carefully co-ordinated, this should be reflected in the milestones used to monitor progress.

5.4 Cost-benefit ratios

Manuals on water demand management often emphasise the need to establish the cost-benefit ratio associated with each objective. This can be expressed in terms of its average incremental cost: the cost associated with saving each unit of water. Objectives can then be prioritised, starting with the most efficient (see UKWIR, 1996 for more details).

Such an approach may be inappropriate for small towns for several reasons:

- the need to improve equity is not reflected in how benefits are measured;
- benefits which are measured only in terms of water savings do not take into account other issues - such as convenience - that users may regard as being equally or more important;
- it is unlikely that all the water saved by a measure will reach users: a proportion may be lost ‘downstream’; and
- the expertise required to calculate and use average incremental costs is unlikely to be locally available.

Whilst it may be justified in situations where water quality and equity of access are not major problems, the value of such an approach to prioritise investments in this context seems limited.

For small towns, where the need for demand management is often acute, priorities can be determined from a relatively simple analysis of water use (as illustrated in Table I). At a later stage, more sophisticated techniques may be introduced to guide further investments.

5.5 Funding streams

One of the problems associated with introducing a demand management strategy is how to attract funding. Water service providers in small towns often have difficulties in finding funds for any project, let alone one which does not prioritise investments in physical infrastructure.

In practice, the size of funding 'problem' may be reduced by a number of factors:

- Demand management can be introduced incrementally: the initial phases need not require a sizeable investment.
- The introduction of demand responsive approach is associated with relatively modest investments and short pay back periods (this is especially true of measures to reduce revenue losses). This may make it attractive to investors.

With these points in mind, potential sources of funding include the following;

- Revenue savings: money recovered by improving revenue collection may be reinvested to meet other demand management objectives.
- Inclusion in an existing programme: it may be possible to build demand management into an existing or a planned project for which funding is to be made available.
- The private sector: Opening up opportunities for the private sector may generate funds. However, it is important that an appropriate regulatory structure is in place.
- One-off funding for pilot projects: demand management, although much needed, is rarely practised. There may be funding from a variety of donors to fund a pilot project in a small town.

6. Conclusions

Water demand management has been presented as a long term, practical strategy. There is no associated blueprint; instead, the strategy should be designed to meet the particular circumstances of a small town, taking into account local opportunities and constraints. The following key points should be stressed:

Demand management is not about improving the efficiency of piped water supplies. The situation in many urban areas in developing countries is characterised by inequity as well as inefficiency, and this must be addressed by the strategy and measures adopted.

Much of the available information concerning demand management is based on models designed for relatively large and wealthy cities such as Windhoek and Singapore. The overall focus tends to be on the use of piped water, technology and economics. The need to address issues of equity is rarely emphasised, and it is implicitly assumed that capacity and resources exist to design and implement an effective demand management programme.

Alternative strategies for demand management are needed for small towns, where a significant proportion of people may not be using piped water at all, and the service provider's technical capacity and financial resources are often very limited.

A variety of practical measures and tools have been suggested. These are designed to encourage the service provider and other stakeholders to investigate the issue of access to water throughout the town. The aim is to develop an inclusive, poverty sensitive demand management strategy.

Lack of capacity can be overcome by the service provider establishing effective partnerships with other stakeholders, including local NGOs and the private sector. The fact that there are striking similarities between some demand management measures and aspects of rural water supply and sanitation is important, in that social and technical expertise may be locally available.

Involving the public in this partnership, both as participants and as decision makers, is particularly important. Mechanisms must therefore be created to facilitate communication and collective decision making. Transparency and accountability are vital. The goal is to make demand management a public concern and a public responsibility, rather than one that only the service provider considers important.

This research has uncovered a number of significant gaps in knowledge and practice. The first of these concerns the lack of case studies. Although there is a growing need for demand management strategies in many small towns, there is little evidence of it being adopted.

Most small town water projects concern the provision of new infrastructure and the development of new sources. Despite the opportunities to build demand management into this process, it seems that little is being done. It would be useful to investigate why this is the case, and what if anything is obstructing progress in this respect.

Further work is also needed to investigate the issue of how water is actually used. In many situations, people living in urban and peri-urban areas rely on water to sustain a variety of livelihoods. If issues of equity and resource allocation are to be addressed, this must be taken into account. Associated with this is the question of water quality. Demand management does not just concern the quantity of water made available, but its quality as well.

Finally, many of the ideas and tools used in this report have not been field tested. Opportunities are needed to pilot the development and implementation of water demand management in a small town. The results could be used to produce practical guidelines to encourage its uptake elsewhere.

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