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A WATER PRICING STUDY
FOR
THE REPUBLIC OF ZAMBIA

SUMMARY REPORT

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1. INTRODUCTION

In 1981 the consultants prepared a report, "A Water Pricing Study for Western Province, Zambia" for the Zambian Government. Not unnaturally DWA felt unable to implement increased water rates in one province alone. At the same time it was hesitant to request government approval for major pricing changes nationwide when the study was based on only one province. Consequently this study represents an extension of that work to the national level.

The major objective remains unchanged, to examine the present pricing policy being followed by DWA and to recommend an appropriate tariff structure for the 1980's. The major emphasis is on township water supply schemes because they are more important than rural supplies in terms of costs and potential revenue, and because the issues involved are more complex.

This volume is a summary of the 346 page main report. Hence when the reader feels that certain statements in this report are insufficiently backed up by data, he is referred to the appropriate section in the main report.

2. PRESENT FINANCIAL SITUATION

2.1 Present Water Pricing Policy

Government's present pricing policy for the smaller township supplies operated by DWA is that revenue should cover the costs of operation and maintenance. Unfortunately current revenues are dismally failing to meet this limited financial objective.

2.2 Present Water Rates and Revenues

At present metered consumers are supposed to pay K4 for their first 35m³ per month and 18n/m³ for additional consumption. However, meter readings are usually ignored when consumers are billed so that in some townships domestic consumers who happen to have a meter are charged less than unmetered domestic consumers, who are charged K5 per month. Most institutions are charged fixed monthly rates which are often considerably higher than those paid by domestic consumers, but there is no consistency between townships. Consumers using communal taps are supposed to pay K1 per month.

All DWA water rates are very low compared to the costs of operating the supplies. This is largely because DWA's water rates have fallen well behind inflation due to the political difficulties associated with increasing water rates. Consequently while over the last decade the costs of constructing and operating water supplies have increased at an annual average rate of 15%, there has been just one minor increase in water rates in 1979. That increase failed to make up the ground lost to inflation in the 1970's. Since 1979 rates have not been increased whilst costs have almost doubled. The result is that present rates are, in real terms, approximately half 1979 rates. Furthermore individual connection rates are only one third, and communal rates are only one half, of those of ten years ago.

The present rate structure of K4 per month and 18n/m³ for consumption above 35m³ per month implies an overall rate of approximately 15n/m³ of water consumed. This is far higher than the consultants' revenue estimates which are as follows;-

| | | |
|---------------------------------------------------------------------------------------|---|---------------------|
| Average expected revenue with present charging method, (i.e. ignoring meter readings) | = | 8n/m ³ |
| Average revenue actually collected by councils | = | 4.2n/m ³ |
| Average revenue remitted by councils to DWA | = | 1.8n/m ³ |

Hence it can be concluded that;-

Under 30% of the revenue intended by the present tariff structure is actually being collected. Over 45% of the intended revenue is lost due to a failure to charge on a quantity used basis. The remainder is lost to a failure of revenue collection.

The councils fail to collect approximately half of the revenue that they should collect under today's flat rate charges. They also fail to remit approximately half of the money collected to DWA. Hence DWA is only receiving one quarter of the revenue expected from the present flat rate method of charging, or about 12% of the revenue implied by the present theoretical tariff structure.

2.3 Comparison of Township Water Supply Income and Expenditure

Despite the fact that the approved estimate for "Maintenance of Township Water Supplies" in 1982 was only K673,200, the consultants estimate that the actual cost of township water supply operation was approximately K2,000,000, large parts of the direct and indirect costs allocable to township water supplies having been accounted for under other expenditure headings. DWA's income covers less than 10% of this total expenditure.

Even if all revenue collected by the councils was remitted, it would only cover 15% of all direct and indirect township recurrent expenditure. If all the revenue that should be collected was actually collected, 30% of recurrent expenditures would be covered. Hence in order to cover present recurrent expenditures, water rates would need to be increased by a factor in excess of three, even if 100% revenue collection and remittance was achieved.

2.4 DWA's Financial Situation

As a result of insufficient Treasury funding DWA is facing a financial crisis. This has serious implications for the short and longer term futures of the township water supplies. The most common problems are;-

- (i) the capacity of a supply falls far below consumer demand
- (ii) the pressure is too low to supply certain parts of the township reliably
- (iii) the equipment and distribution system is old so that break-downs and breakages are common
- (iv) the inability to pay for the necessary recurrent inputs.

The first three points mean that capital expenditures are urgently required at most supplies in order to maintain the present level of service. The current township development programme is providing approximately two to three new supplies/major augmentations per year at a time when DWA is operating over 50 supplies, virtually all of which require major augmentations in the next few years. Based on available feasibility studies it is estimated that the development expenditure requirement for all DWA schemes in the near future is approaching K100 million. Hence it is vital that more capital funds are made available very soon. However, this study's limited augmentation strategy could mean that relatively limited injections of capital funds may lead to a major improvement in the supply situation. Nevertheless in the current financial environment, hopes for any real increases in development funds may have to rest on donors.

Recurrent financial allocations are also inadequate for operating and maintaining township supplies properly. PWEs even have insufficient funds for vital inputs such as spares and fuel. This means that existing assets are not always being fully utilised, for example pumping hours may be restricted. The lack of recurrent finance is also resulting in a deterioration of some supplies due to a lack of proper maintenance and repair. Furthermore the resulting technical problems mean that operation becomes more difficult than it need be. This trend may accelerate in the future if recurrent allocations are not increased. Hence in order to make the most of the limited resources available to the sector it is more important that recurrent allocations meet requirements, than that capital funding allows all demands to be met.

Nevertheless the Ministry of Finance always seems to reduce DWA's recurrent requests even though they are based on what DWA actually requires. Furthermore the approved recurrent expenditures have, in real terms, been falling in recent years, and the recurrent situation facing DWA is now considerably worse than in 1980.

It is therefore desirable that

- (a) Government increases the recurrent financial allocations to match requirements. If this does not occur it is likely that existing assets and future capital investments will be partially wasted.
- (b) NORAD and other donors continue their assistance after scheme completion with resources for operation and maintenance.
- (c) The amount of revenue from water rates is increased very significantly. Although under the existing financial system this would only reduce the recurrent requirement indirectly, it may influence Government to provide increased recurrent finance.

3 COSTS

3.1 Capital Costs

It is estimated that the 1983 capital costs of new township schemes or major augmentations are typically K1500/m³ at the larger townships and K3000/m³ at the smaller townships. At an average township with a design requirement of 1000m³ per day, the unit cost is estimated at around K2000/m³, giving a total capital cost of K2 million.

3.2 A Limited Augmentation Strategy

While the present capital cost of a new typical township supply/major augmentation is generally very expensive, the consultants found that at some supplies minor investments could significantly increase the quantity, and/or improve the quality, of the water available. It is estimated that, on average, it should be possible to increase the current production capability of a scheme by 50% by this strategy. This will sometimes mean that a scheme will only be brought up to the original design capacity. In some cases the increase in capacity may still fail to supply today's requirements. In others the period for which the investment would allow all demands to be met may be quite short.

However, the crucial factor is that it would represent an improvement and allow a higher proportion of present and future demands to be satisfied. Furthermore, the period required for planning and implementation would usually be very short. The overall average cost is estimated at just over K100,000 per supply, i.e. approximately 5% - 6% of the cost of a typical full augmentation suggested by various consultants.

It is therefore contended that when capital funds for water supply development are short the limited augmentation strategy is appropriate. The application of limited development finance for small augmentations could lead to significant improvements at many supplies even though the solution proposed would be sub-optimal in a situation where more resources were available, i.e. in the present situation this approach represents a "better buy" than major augmentations.

It is recommended that the idea is further pursued by a donor funded study, which should be part of an aid package, which also includes finance of between K1 million and K2 million for carrying out the augmentations suggested by the study.

3.3 Operation and Maintenance Costs

The present overall average recurrent cost of a township supply including provincial overhead costs is close to K50,000 per annum, over 60% of which represents staff and labour costs. If a supply is not augmented, or if a limited augmentation is undertaken, this cost will not increase significantly during the 1980's in real terms. However, where major augmentations are undertaken this cost may increase by over 70% to almost K90,000 per annum. If all DWA supplies were fully augmented the total annual operation and maintenance cost would be around K4.5 million but if the only augmentations undertaken were part of a limited augmentation strategy, the annual operation and maintenance cost would be around K2.5 million.

3.4 Total Annual Costs

The annual capital costs of a limited augmentation may typically be K10,000, thus increasing the total annual cost to K60,000. However, the annual capital costs of a typical major augmentation will be over K170,000 and will therefore increase the total annual cost to well over K250,000.

Hence if all DWA supplies were fully augmented as proposed in various consultants' reports, the total annual capital cost of all DWA supplies would be well over K8 million. Thus together with the annual operation and maintenance cost of around K4.5 million, the total annual cost would be approximately K13 million. However, if the augmentations that are undertaken are in line with the recommended limited augmentation strategy, the total annual cost would be between K2.5 and K3.0 million.

3.5 Unit Costs

Due to economies of scale the unit cost of water will generally be lower at the larger capacity supplies. Table 1 presents the unit operation and maintenance, and unit total costs, of water at large, medium and small DWA supplies together with the overall average unit costs, for the no, limited and full augmentation situations. In the full augmentation situation, unlike in the no and limited augmentation situations when similar amounts of water are pumped throughout the 1983-8 period, increasing amounts of water are pumped over time. Hence unit costs will fall during 1983-8, and the figures in Table 1 represent 1983-8 averages.

Table 1
Unit Costs of Water Produced

| | Unit operation and maintenance cost of water produced (n/m ³) | | | Unit total cost of water produced (n/m ³) | | |
|-----------------|---------------------------------------------------------------------------|---------------------------|------------------------|-------------------------------------------------------|---------------------------|------------------------|
| | No augmen- tation | Limited augmen- tation | Full augmen- tation | No augmen- tation | Limited augmen- tation | Full augmen- tation |
| Large supply | 27.9 | 18.2 | 23.8 | 27.9 | 21.0 | 68.3 |
| Medium supply | 32.0 | 21.2 | 31.0 | 32.0 | 25.3 | 90.5 |
| Small supply | 40.1 | 28.0 | 43.9 | 40.1 | 35.2 | 142.0 |
| Overall average | 31.5 | 20.9 | 29.9 | 31.5 | 24.9 | 88.3 |

Hence the overall average operation and maintenance cost is around 30n/m³ in the no and full augmentation situations, but only around 20 n/m³ in the limited augmentation situation. The lower limited augmentation cost is due to the fact that more water is being produced than in the no augmentation situation, but at a similar total cost. The overall average total unit cost is around 30n/m³ in the no augmentation situation, 25n/m³ in the limited augmentation situation and 90n/m³ in the full augmentation situation. The high latter figure is due to the large capital cost element. All the above figures are based on the use of electricity, when diesel is used the unit costs are between 9-18n/m³ higher.

Hence, it could be said that the overall production cost of water is around 30n/m³ provided that; (a) only a limited number of the smaller supplies use diesel, and (b) the capital costs of major augmentations are excluded.

Since all the above figures are expressed in terms of water produced, the cubic metre costs of water consumed would be 20% higher to allow for leakage and other losses.

3.6 Short Term Variable Costs

The short term variable costs of production, i.e. chemicals, and energy when electricity is used, are between 4 and 5 n/m³, of water produced. Hence when there is spare capacity short term marginal costs are quite low. However when diesel is used, the cost quadruples to an overall average figure close to 20 n/m³ of water produced.

3.7 Foreign Exchange Elements of Costs

The consultants estimate that on average the development costs of township supplies contain a 40% foreign exchange element. The corresponding figure for operation and maintenance costs is 16%.

4 ABILITY AND WILLINGNESS TO PAY

The proportion of income that consumers can afford to pay for water has no objective answer, although a figure of 5% is often quoted as the acceptable ceiling. The consultants adopted this figure as the maximum that consumers should be asked to pay for water from their own connection. However, since the poorer consumers cannot only afford less in absolute terms, but also in percentage terms, and receive a lower level of service, figures of 3% for low cost housing residents using communal standpipes, and 2½% for squatters are used in this study.

While median income is more representative of a particular group than mean income it is still not a very satisfactory base for calculating ability to pay, since 50% of the population would be paying more than the intended percentage. On the other hand to take the lowest income in any group would be unrealistic and so a compromise is required. The consultants suggest that the lower interquartile figure would be suitable. Table 2 presents the consultants' estimates of the median and lower interquartile income figures for the different consumer categories, together with maximum ability to pay estimates based on the percentages suggested above.

Table 2
Income and Ability to Pay for Water

| | Median income (K/month) | Lower inter- quartile income (K/month) | Maximum ability to pay (%) | Maximum ability to pay (K/month) |
|-------------------------------|-------------------------------|----------------------------------------------------|-------------------------------------|-------------------------------------------|
| High cost housing residents | 650 | 400 | 5% | 20.00 |
| Medium cost housing residents | 300 | 250 | 5% | 12.50 |
| Low cost I housing residents | 125 | 100 | 5% | 5.00 |
| Low cost II housing residents | 125 | 100 | 3% | 3.00 |
| Informal housing residents | 100 | 70 | 2½% | 1.75 |
| Rural inhabitants | 15-30* | 10 | 2½% | 0.25 |

* depending on area.

In the course of the socio-economic survey the consultant estimated consumers' maximum willingness to pay for water. The average figures for the different groups are as follows;-

| | |
|---------------------------------------------------------------|-------------|
| High cost housing residents for their own house connection | K25/month |
| Medium cost housing residents for their own house connection | K15/month |
| Low service township consumers for their own house connection | K4-5/month |
| Rural inhabitants for their own house connection | K2/month |
| Low service township consumers for communal standpipe access | K2/month |
| Rural inhabitants for communal standpipe access | K0.50/month |

It can be seen that willingness to pay is consistent with the ability to pay figures presented above. The majority of low cost and informal housing residents would be willing to pay the current monthly water rate for their own connection. However, their willingness to pay to be connected is far below current connection fees.

Most low cost housing consumers currently using communal standpipes and most shanty dwellers using natural sources are both willing to pay K2 for communal point access. In fact most of them claimed that they would prefer to pay K2 per month for communal standpipe access to using a free well equipped with a handpump. Hence the low level of collection from communal standpipes is probably due to consumers being able to "get away" without paying rather than to a basic inability and unwillingness to pay the existing rates.

The willingness of rural consumers to pay for any water supply service is very low. This confirmed; (i) the unlikelihood of an effective demand existing in rural areas to justify piped supplies catering for individual connections and, (ii) attempts to charge rural consumers for communal standpipe access, particularly for wells equipped with handpumps, will fail.

This very low willingness to pay for water suggests that the recommendation contained in the Northern Sector Study by Lottie and Associates, that piped supplies should be extended to nearby villages, is inappropriate unless government is prepared to subsidise all the development and recurrent costs.

5 METERING

5.1 Introduction

If consumers are not metered they have no financial incentive to use water economically and to prevent wastage. Hence metering results in reduced consumption/wastage provided that the water is charged for on a quantity used basis and revenue collection is reasonably efficient. Metering also distributes the costs of supplying water equitably i.e. in proportion to the amount consumed.

5.2 Present Situation

At present approximately 65% of connections at DWA supplies are metered but the vast majority of the meters are not functioning. This is hardly surprising since DWA has no meaningful maintenance system for meters, and there is no mechanism for remedial action to be taken when meters stop functioning. Virtually all supplies have no facilities or competence for testing and cleaning meters let alone the spare parts and skill for repairing them. In fact the whole metering situation at DWA supplies is rather futile;- (i) the majority of meters are not working, (ii) even though they are not working properly some meters recording obviously incorrect consumption data are still being read, (iii) even when a working meter is read the consumer is not usually billed on a quantity used basis, i.e. the readings are often disregarded for billing purposes, and (iv) even though meters are currently not fulfilling any function either for billing or for planning, new connections are still being fitted with meters.

5.3 Cost of Metering

The consultants estimate that the total capital cost of installing a meter is K120. Based on an average meter life of eight years, and a discount rate of 6.5%, this results in an annual capital cost of just under K20. Maintenance and billing costs increase the total annual cost to K27.

5.4 The Metering Decision

It is important that the metering decision is based on a quantitative analysis rather than on intuition. On one side of the equation are the costs of metering;- (i) the purchase and installation of the meters, (ii) the subsequent costs of maintenance and (iii) the reading and billing costs. These must be compared with the benefits of metering;- (i) capital cost savings on new schemes/major augmentations due to a reduced design capacity. The consultants estimate that at a typical DWA supply this cost saving could exceed K200,000. This would far exceed the costs of metering all connections. Based on the annual cost of metering figure of K27 per connection per annum, universal metering would be justified on capital cost savings alone wherever the marginal cost of a new supply/major augmentation exceeded K370/m³. Since the 1983 average cost is K2000/m³, this figure will nearly always be exceeded. (ii) capital cost savings resulting from delayed augmentations.

At supplies where demand exceeds capacity widespread metering may represent a short term alternative to a major augmentation. At a typical DWA supply the cost saving may exceed K100,000 for every year's delay. Even a one year delay would more than cover the cost of metering all connections.

(iii) operational cost savings resulting from less water being pumped. Unless marginal cost exceeds 4n/m³ it is unlikely that metering could be justified on operational cost savings alone. However, since the variable costs will typically be around 5n/m³ metering is almost certainly appropriate for some townships. Where diesel is used, resulting in very high short term variable costs of around 15-20n/m³, metering should receive high priority.

It will not be possible to make precise metering decisions until there is better data available, particularly on the effect that metering has on consumption. Nevertheless it can be concluded that:

- (1) All major consumers must be metered.
- (2) As far as the average consumer is concerned capital savings alone justify metering where:

- (i) a new supply/major augmentation is now, or will shortly, be required in order to meet metered demands, provided that the effect of metering is taken into account during the design stage so that the potential cost savings are actually achieved,
- (ii) a new supply/major augmentations is now, or will shortly be, required in order to meet unmetered demand, but where metering will permit a significant delay in incurring the necessary development expenditure.

Since water supply development in Zambia is now at the stage where most supplies fall into one or other of these categories, metering is often justified by capital savings.

At supplies where there is considerable spare capacity, for example at supplies where major augmentations have recently been completed, metering can only be justified at the moment by variable cost savings. In this case metering should be restricted to major consumers unless variable costs exceed $4n/m^3$. Low cost consumers should only be metered if variable costs exceed $10n/m^3$.

Hence it can be concluded that universal metering is recommended at most supplies in Zambia. The only exceptions being those with spare capacity and marginal costs below $4n/m^3$. At supplies with spare capacity and with marginal costs between $4n/m^3$ and $10n/m^3$, consumers other than low cost housing residents should be metered.

The lack of foreign exchange has been a major constraint on meter purchasing by DWA. However, it is estimated that in most DWA townships where metering is financially justified, it will be even more favourable from a foreign exchange point of view i.e. metering will save more foreign exchange than it costs.

Although a cost benefit trade off suggests that metering is worthwhile, the final decision must also take other factors into account.

The most important is the willingness of DWA/councils to charge for water on a quantity used basis and their ability to enforce this pricing method. If this cannot be achieved there is no point in incurring the costs of metering. Secondly the authorities must have the capacity to handle the technical and administrative burden that will result from universal metering. This will require an effective meter maintenance service, improved meter reading and more efficient billing and revenue collection. It is, therefore, suggested that while universal metering is recommended for most supplies, DWA should only install the number of meters that it can adequately service, both technically and administratively. Since it would be worthwhile to devote resources to building up this capability, it is hoped that donor assistance will be made available in order to achieve this objective.

At the moment DWA/councils should meter selectively i.e. concentrate on metering major consumers, particularly institutional and commercial consumers, whose accurate metering and subsequent billing is especially important in order to minimise the amount of water wasted and increase revenue. This would represent an optimum use of DWA'S limited metering resources.

6 REDUCTION OF WATER REQUIREMENTS

6.1 Wastage

At present there is a large amount of water wasted at most DWA schemes resulting in unnecessarily high recurrent expenditure and/or an inability to fulfill part of the existing demand. The main causes are defective plumbing, consumer mis-use i.e. leaving taps running, and unnecessary distribution losses. Hence serious efforts must be made to reduce this wastage even if widespread metering cannot be adopted. The strategies that DWA should consider should include; systematic checking of the distribution system for losses and the immediate identification of leakages, the policing of communal standpipes, limited metering, improved publicity, restricting supply, installing restricted flow devices, and experimenting with waste-not taps.

6.2 Garden Watering

The consultants estimate that 35% of dry season consumption at DWA supplies may be used for gardening. While there are very significant benefits from gardening; improved nutrition, financial savings on food for individual families and increased national food production, a balance must be achieved between the needs of vegetable production and the proper use of a water supply

Since garden watering adds to peak demand, it not only increases recurrent costs, but also increases the capacity required and leads to augmentations being required several years before they would otherwise have been. It therefore increases capital costs, and must often be restricted or discouraged. This can be done either by formal restriction of use, or by universal metering accompanied by a pricing structure in which domestic use above a certain level is charged at a much higher price. Although the latter may be the long term solution, DWA's financial, administrative and technical constraints may mean that universal metering will not be possible for several years.

Where dry season demand exceeds the capacity of the supply no one, not even metered consumers, should be allowed to water their garden, if watering deprives other consumers of their more basic domestic requirements. DWA's strategy should include the issuing of water restriction notices and the formation of anti-water wastage squads. Guilty consumers must be issued with warnings that further transgressions will lead to disconnection. DWA should urge government to pass legislation to enable them to disconnect consumers who ignore the warning letter to stop gardening, in the same way as they can disconnect those who fail to pay their water bills. Consumers would be reconnected as soon as they paid the reconnection fee, but if, as is proposed, the reconnection fee is dramatically increased, the system should deter consumers from depriving other residents of water. If local politicians oppose the enforcement of disconnection, DWA should make it clear that they cannot provide an effective water service without political backing.

Gardening should also be discouraged where unmetered consumers, who are paying fixed monthly water rates, use large amounts of water for gardening. Thus increasing recurrent costs and advancing the time when the next augmentation will be required. Unfortunately this situation is common in every township in Zambia but no one has yet found the answer to the problem. It is suggested that unmetered consumers be forbidden to water their gardens but that they should have the right to request a meter. This would entail their paying for the meter and subsequently paying for water on a quantity used basis. They would then have the right to water their garden, subject to any local seasonal restrictions, as soon as they had paid their meter fee even if the authority was unable to install a meter immediately. Unmetered consumers found watering their gardens illegally would be subject to disconnection as discussed above.

7 COMMUNAL STANDPIPE PAYMENT

7.1 The Problem

At present the level of collection from communal standpipes is extremely low. The real problem is that it is difficult to differentiate between those who pay and those who do not pay. The result is that some who fail to pay continue to draw water freely. Other consumers who see them getting away without paying soon follow suit. It is, therefore, not surprising that experience from water supplies all over Zambia shows that although consumers utilise the supplies, they often resist paying their water rates. The socio-economic survey shows that this resistance is not due to an unwillingness to pay but is due to a well founded belief that they can "get away with it". However it is difficult to devise any strategy that will solve the problem.

7.2 Possible Strategies

The consultants examined a number of ideas for enforcing payment from communal standpipe users. These are listed below.

| Idea | Conclusion |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| (1) Lock communal points | Would cause too many problems. |
| (2) Refuse repairs of a standpipe until arrears are paid | Has merit if the problem of only some consumers paying can be overcome. |
| (3) Report offenders to heads of department | Insufficient by itself. |
| (4) Involve the Party | Not a solution. |
| (5) Mount an education campaign | Necessary, but by itself insufficient. |
| (6) Deduct government employees' rates at source from salaries | Unlikely to work smoothly. |
| (7) Supervision of standpipes | Full-time supervision would be too expensive but partial supervision has considerable merit and is the consultants' recommended strategy. |
| (8) Water kiosks | A practical solution that would yield revenue but which requires a political judgement. |

No approach is very satisfactory but the recommended strategy would be partial standpipe supervision with a standpipe guardian working for three to four days per month, refusing access to those unable to produce a current receipt.

There are two main alternatives to trying to make all communal standpipe consumers pay for their water. The first is to adopt a policy of free water from communal taps. This has considerable social merit and is also administratively simple, popular with consumers and politically attractive. The only real argument against it is that it entails a loss of revenue to the authority. However, this loss will be very limited. It is estimated that only 8% of gross revenue will be derived from communal standpipe consumers.

The second alternative would be to provide free communal water in the townships to all consumers other than (i) government/council employees and (ii) council house tenants. This would be practical in that it would result in that proportion of the revenue that could realistically be collected being collected, and would minimise resources being wasted on attempts to collect rates which are difficult if not impossible to collect. Furthermore, the apparent inequity is partly illusory since most of those who will have to pay their water rates are living in subsidised accommodation.

7.3 Recommended Policy

The consultants believe that the strategy of only charging government/council employees and council house tenants for communal standpipe access should be followed, but discussions in Zambia showed that it would meet with considerable opposition and it should be presented in a different way.

Therefore, the recommendation is that all households using communal standpipes should pay a monthly fee for access. Councils should deduct the money from the monthly salaries of all its employees. Other occupants of council or government housing should have the water rate added to their rent bill. The appropriate financial transfers would then be made to DWA. All other consumers should pay their water rates to the council/DWA. Payment should be encouraged by partial supervision of standpipes supported by an information/education programme.

However, the actual decision as to how much effort should be put into rate payment encouragement should be left to the initiative of the officers in charge, who know the local situation. If an officer feels that manpower resources would be wasted in attempting to enforce standpipe payment, his view should be respected. On the other hand officers who pursue payment enforcement must be supported by headquarters whenever they need assistance in combatting local political opposition. The consultants believe that in practice this will mean that their recommended policy of only charging government/council employees and tenants will be followed.

8 CONNECTION FEE POLICY

8.1 Present Situation

The current fee charged by DWA for a new $\frac{1}{2}$ " connection is K100 plus the cost of pipes in excess of 100 feet. The consultants estimate that the average cost to DWA of providing a $\frac{1}{2}$ " connection in 1983 is K224. Hence the current fee only covers half of the actual cost. This is not surprising since it only reflects the level of inflation since the last fee increase.

8.2 Recommended Policy for High and Medium Cost Housing Residents and Non-Domestic Consumers

For all consumers other than those living in low cost housing, it is recommended that the connection fee should reflect the full costs of making the connection. Therefore, DWA should introduce a new fee of K250 for all connections. This figure will cover DWA's costs until mid 1984.

It is also recommended that the present practice, whereby consumers who need a connecting line in excess of 30 metres must pay for the additional pipes, be continued. While there is no social reason why people who accidentally live nearer a branch line should be rewarded with a lower connection fee, government must limit subsidisation of the wealthier section of the community. Since the additional fee should reflect the cost of the pipes and a small allowance for the cost of labour, it is recommended that for $\frac{1}{2}$ " connections a charge of K30 should be made per additional pipe length in excess of five.

For larger than minimum size connections it is strongly recommended that all consumers are charged the full cost of connection. The proposed minimum rates are K450 and K1350 for 1" and 2" connections respectively. Where actual cost exceeds these figures, the consumer should be charged actual cost. All the above proposed connection fees should be increased every two years in line with inflation.

8.3 Recommended Policy for Low Cost Housing Residents

There is a strong case for encouraging individual connections in low cost housing areas;- (i) the realised benefits are much greater than those from communal standpipes, (ii) the socio-economic survey showed that many low cost families currently using communal standpipes display a significant willingness to pay monthly rates for individual connections, and (iii) the greater the number of individual connections, the higher the revenue collection. Individual connections in the low cost housing areas can be encouraged by lower connection fees.

The consultants tend to disagree with the view that connection fees must cover all costs of connection for every category of consumer because the fee decision should not be based solely on financial criteria. The spreading of the benefits of large government investments must be encouraged, if necessary by subsidisation. On the other hand the consultants are unable to disregard costs and financial criteria to the extent that they could recommend fees of K30, which the socio-economic survey suggested the majority of low cost housing residents would be willing to pay. It is recommended that the fee for low cost housing residents should remain at K100, until the standard fee for other consumers is increased beyond the currently proposed figure of K250. This will reduce the initial resistance of those willing to pay monthly rates to investing in a connection since it represents well under one month's income for the majority of low cost housing families. On the other hand it is high enough to deter frivolous requests. It is also recommended that all low service consumers should be charged the cost of pipes in excess of 30 metres because a fee of K100 already contains a high subsidy element, and even though social criteria are important, financial criteria cannot be completely ignored.

In order to complement the above recommendation it is suggested that wherever there are three or more low cost housing residents who are living near each other and are willing to pay K100 for their own connections, but where the distance to the existing branch line exceeds 30 metres, DWA should extend a minor branch line into the area free of charge. The connection fees should then be based on the distance from the new extension. An important factor in determining the priority which DWA should accord to such extensions would be whether or not there are likely to be other potential consumers who could be connected to the same extension.

In practice the majority of low cost housing is owned by councils/ government who would probably be responsible for the cost of connections. Hence, if most low cost consumers are to be connected, the cost may well be borne directly or indirectly by the government. The important question is whether or not it is worth K200 of public funds to provide a family with its own house connection. The consultants believe that this investment would be worthwhile at all supplies where there is spare capacity because it would result in significant social and health benefits. Nevertheless there would still be merit in councils charging the tenants K100 to deter frivolous claims regarding willingness to pay subsequent monthly rates. This would be returnable if the tenant had to move and was up to date with his monthly rate payment.

8.4 Identical Fees for Metered and Unmetered Connections

It is recommended that, contrary to the majority view within DWA, the connection fee for metered and unmetered connections should be the same. This will enable DWA to generate a limited amount of additional income, and will be equitable since the decision of whether or not to meter a certain consumer, area or township will not usually be made by the consumer. The corollary to this recommendation is that whenever it becomes appropriate to meter a particular town, meters should be installed free of charge. If on the other hand, lower connection fees were charged for non metered consumers it might be necessary to charge for a meter when it was later installed. Consumers' opposition to this would be understandable since they might feel that they were being charged for nothing, or even worse, to allow the authority to subsequently increase their monthly bills.

9 RECOMMENDED TARIFFS AND THEIR FINANCIAL IMPLICATIONS

9.1 Introduction

It should be noted that all rates and costs in this chapter are expressed in 1983 values.

9.2 Basis for the Proposed Tariff

The cost of producing water, ignoring the capital costs of major augmentations which DWA could not hope to recover, i.e. the costs of administration, operation and maintenance and of minor augmentations is around 30n/m³. This means that the cost of water supplied is around 36n/m³ due to leakage and other losses. However, leakage is only part of the water produced for which DWA will be unable to collect revenue. The consultants estimate that revenue will only be collected for 51% of all water produced. Hence, in order to cover all operation and maintenance and limited augmentation costs, DWA would need to charge 60 n/m³.

For a typical 7 person family living in high/medium cost housing and consuming 250 l.c.d. a rate of 60 n/m³ would represent a monthly rate of about K32. The socio-economic survey showed that only a minority would be willing to pay this figure. For a typical 7 person household living in low cost housing and consuming 100 l.c.d. from their own connection, a rate of 60 n/m³ would represent a monthly rate of about K13 per month, again well above the average willingness to pay.

Hence it is recommended that the major criteria in determining DWA's rates should be consumers' maximum ability and willingness to pay for water. These are summarised below.

Table 3

Summary of Average Ability and Willingness to Pay for Water

| | Ability to pay (K/month) | Willingness to pay (K/month) |
|------------------------------|--------------------------------|------------------------------------|
| For individual connections:- | | |
| High cost housing | 20 | 25 |
| Medium cost housing | 12.5 | 15 |
| Low cost housing | 5 | - |
| For communal point access:- | | |
| Low cost housing | 3 | 2 |
| Informal housing | 1.75 | 2.10 |

9.3 Proposed Tariffs

Since it is considered impractical to charge different rates to medium and high cost housing residents, the following rates are proposed as the maximum flat rates that should be levied in providing consumers with the "design criteria" consumption.

| | | |
|---------------------------------------|---|---------------|
| High and medium cost housing families | - | K15 per month |
| Low cost families with own connection | - | K6 per month |
| Communal standpipe consumers | - | K2 per month |

These represent rates of approximately 28 n/m³ for house connection consumption and 23.5 n/m³ for communal standpipe consumption.

However, as it is recommended that all major consumers are metered immediately and that universal metering is adopted as soon as DWA develops the necessary technical and administrative capability to handle the problems of metering, the above rates for domestic consumers with their own connections are only applicable prior to widespread metering.

In order to partially reconcile the conflicting rate functions, it is recommended that metered consumption charges should be composed of a fixed basic sum together with unit rates for additional consumption. The effective rate for the basic consumption should be lower than the rate for additional consumption.

DWA has, in theory, been following a similar policy for some years. Consequently the consultants endorse the present theoretical policy in principle. However it is considered that the quantity of water, (35m³), which DWA allows low cost consumers for the minimum monthly rate is too high, and a figure of 20m³ is proposed. It is also proposed that the minimum rate for low cost housing consumers should be lower than that charged to other consumers.

The following rates are recommended for metered consumers:-

| | |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High and medium cost domestic, institutional, industrial and commercial consumers | K10.50 for the first 35 m ³ / month and K0.50/m ³ for additional consumption |
| Low cost domestic consumers | K4.00 for the first 20m ³ /month, K0.30/m ³ for the next 15m ³ / month, and K0.50/m ³ for additional consumption |

The proposed tariff structure fails to fully meet any criterion since it represents a compromise between the conflicting rate functions. It meets social criteria to the extent that consumers should not be excluded from the supply because they cannot afford the rates. Even the poorer township consumers are not being asked to pay much more than 2% of their monthly cash incomes. It accords with the economic criterion at all supplies other than those where there is considerable spare capacity, to the extent that the price of additional consumption and marginal costs are both high. But it may fail to ration the water effectively where there are serious supply constraints, and it may unduly restrict use where there is spare capacity. Furthermore it will only partially meet the financial criterion although it will satisfy the latter to the extent that revenue should cover a significant proportion of recurrent expenditure.

9.4 Uniform Pricing Policy

It is proposed that the recommended rates be charged at all supplies, i.e. that there should be a uniform national pricing policy in the short/medium term. This policy is practical, equitable, and politically acceptable. Furthermore the most urgent pricing change required in DWA's rates is a large increase. A differential pricing policy, which has the merit of increasing economic efficiency, would complicate the issue, increase the opposition and delay the necessary price increase. The only proposed exception to the uniform policy is that where supplies are especially unreliable, unmetered consumers' monthly rates should be reduced to the minimum rate applicable to metered consumers.

9.5 Future Rate Increases

It is important that the proposed rates are increased in line with costs. If they are allowed to fall behind inflation, due to the political difficulties associated with increasing water rates, financial viability will be undermined. While there is nothing wrong with subsidisation in principle, subsidies must be planned and sanctioned with the knowledge of their extent and implications, and not arise by default. It is therefore recommended that the proposed rates be increased every second year by the percentage needed to maintain their real value.

9.6 Estimated Unit Revenue

It is estimated that the recommended policy will result in an average unit revenue of around 15n/m³ of all water produced. The average unit revenue from water produced for individual connection consumers, i.e. their consumption and the associated leakage, will be around 24n/m³.

9.7 The Financial Implications of the Proposed Policy

Even these dramatically increased rates will not enable DWA to cover all its recurrent costs including all allocable overheads, let alone contribute towards capital costs.

It is estimated, based on the assumption that costs will be increased in line with inflation, that revenue will cover the following proportions of costs during the period 1983-8:-

- (i) at supplies where no augmentation is implemented, between 40% and 50% of recurrent costs.
- (ii) at supplies where a limited augmentation is implemented, between 60% and 70% of recurrent costs, and between 50% and 60% of all costs including annual capital costs.
- (iii) at supplies where a major augmentation is implemented, between 40% and 50% of recurrent costs and between 15% and 20% of all costs including annual capital costs.

Hence, whatever augmentation strategy is adopted the proposed rating policy is unlikely to enable DWA to cover much more than 50% of its total recurrent costs of the township water supplies.

However, the new rates will enable DWA to more than cover its short term variable costs, i.e. chemical and energy costs. Although these costs at diesel operated supplies may exceed revenue, at supplies operated with electricity these costs will only represent one quarter of revenue.

9.8 Overall Comparison of Projected Revenues and Costs

If no supplies were to be augmented, the average annual total revenue during 1983-8 would be around K1.4 million compared to an annual average recurrent cost of K3.0 million. Hence the annual subsidy required would be approximately K1.6 million.

If minor augmentations were undertaken, the annual revenue would average K2.1 million compared to an annual average recurrent cost of K3.0 million. Hence the average annual recurrent subsidy requirement would be K0.9 million. The annual capital cost of K0.5 million would increase the total effective annual subsidy required to K1.4 million.

If major augmentations were undertaken at all DWA supplies, annual revenue would average K2.3 million compared to an annual average recurrent cost of K4.8 million. Hence the average annual recurrent subsidy requirement would be K2.5 million. Annual capital costs would increase the total effective annual subsidy required by K8.6 million to K11.1 million.

Even this rather unpromising financial outlook is based on a 90% level of revenue collection from individual connections. If the level of collection was only 60% the different deficits would increase by K0.5 - 0.8 million. The broad overall average percentage of recurrent costs covered for an equal situation mix would fall from around 55% to around 36%.

10 RATE PAYMENT ENCOURAGEMENT

10.1 Disconnection Policy

A major contributory factor to the low level of collection is that the present theoretical policy is not followed, and the disconnection deterrent is not used effectively. DWA only disconnects a very limited number of consumers in arrears with their rates. The disconnection weapon is not used sufficiently frequently and is applied inconsistently. This is in part due to the possible political implications, but is also due to the inefficiency of councils in supplying DWA officers with lists of debtors, and to a limited availability of transport and plumbers.

The worst payers of water rates at DWA supplies are government institutions and departments. The problem is serious for two reasons;- (i) it represents a serious loss of revenue and (ii) it sets a poor example to other consumers. But not unaturally DWA officers are reluctant to disconnect government institutions and this reluctance leads to increasing arrears since payment of their water bills drops down institutions' payment ranking lists. If this problem of non-payment by government departments is to be solved central government must give a lead to DWA and to the councils.

If the Government believes that institutions etc. should have free water a policy statement should be issued to this effect. If, on the other hand, it is decided that all consumers should be treated similarly and that all departments/institutions must pay, DWA requires high level support to enforce rate payment. Treating all consumers similarly does not, of course, mean disconnecting a hospital as casually as disconnecting a domestic consumer, in fact disconnection of hospitals may never be possible. However it does mean that after three months, a local DWA officer in charge should be able to disconnect most other currently "protected" institutions if they fail to meet the payment criteria.

On the other hand, it could be argued that institutions' debts to DWA are just part of the larger network of inter-departmental debt which doesn't really matter provided that it does not distort government spending priorities and/or disguise resource allocations. The consultants consider non payment by institutions is less serious than the fact that they are major wasters of water.

It is probable that the only effective way to reduce this huge wastage by institutions is to meter them and to charge them on the basis of quantity used. But for this to be effective, they must be made to pay their bills. Hence, disconnection of institutions is probably more important as part of the strategy to reduce wastage of water and consequently of government finance, than to ensure that DWA receives payment.

10.2 The Need for a Strict Disconnection Policy

Disconnection is an extremely effective way to persuade consumers to pay their water bills. The vast majority of disconnections result in the consumer rushing to pay his outstanding bill. Therefore in order to assist improved revenue collection, it is vital that a strict disconnection policy for non-payment of water rates be uniformly enforced, possibly supported by an Act of Parliament. Customers must believe that they will not be able to "get away" with not paying their bills. If this were to be achieved warnings would carry much more weight and only a small proportion of those warned would actually have to be disconnected and revenue collection would become relatively easy.

It is recommended that DWA establishes provincial disconnection teams which should also be responsible for all new connections. Small teams, provided with vehicles and properly equipped, could represent an efficient method of operation and use of resources.

10.3 Reconnection Fee

The reconnection fee has two main functions;- (a) to cover the costs of reconnection and (b) to act as a deterrent. At present it is failing to fulfil these goals. DWA's reconnection fee is only K5, but the costs of disconnecting and reconnecting have been estimated at K12. Furthermore, the deterrent effect of the existing reconnection fee is minimal. It is therefore proposed that the fee be dramatically increased as follows;-

| | |
|-------------------------------------------------|----------------------------------|
| Low cost housing domestic consumers | K40 |
| High and medium cost domestic consumers | K80 |
| Industrial, commercial and industrial consumers | K80 + 10% of arrears outstanding |

The main purpose of these fees is to encourage consumers to pay their water rates on time, i.e. to promote water rates to a higher position in their payment ranking list than they currently hold.

10.4 Deposits

It would be possible for DWA to introduce a deposit system to back up a stricter policy of disconnection. It would mean that consumers would have to place a cash deposit in order to cover any subsequent non-payment of rates. The size of the deposit would vary for different consumer categories. However, the consultants recommend that deposits should not be introduced until revenue accounting improves.

11 RESPONSIBILITY FOR TOWNSHIP WATER SUPPLIES

In the longer term it may be appropriate, within the context of the decentralisation programme, for DWA to relinquish control of the township water supplies to the district councils. This would need to be accompanied by the transfer of many DWA staff to the councils. However, schemes should not be handed over until the councils together with the transferred staff, are capable of operating and maintaining the supplies efficiently.

At present, although DWA could be better staffed, it is well staffed with skilled manpower compared with most councils, which do not yet run their own township water supply. It also has a much higher level of the necessary knowhow. In general, schemes which have been handed over to councils have not been well run, and councils continue to ask DWA for assistance. Hence, the councils should not be encouraged to take over township supplies from DWA until they have acquired the necessary technical staff and fully understand the finance implications, i.e. for the time being, DWA should continue to be responsible for the township water supplies that it currently operates.

12 BILLING AND REVENUE COLLECTION

The existing arrangement whereby DWA is responsible for the operation of water supplies but where councils bill and collect revenue on an agency basis is unsatisfactory in most townships. The performance of most councils is poor;- they display a low clerical efficiency, their billing and accounting work is sloppy, collection is very lax, debts are often not pursued, they fail to provide DWA with accurate information on water rate defaulters necessary to enforce a strict disconnection policy, they usually only remit part of the revenue, on average 50%, to DWA, and they often appear unconcerned at the low level of collection.

Hence the consultants propose that as long as DWA is responsible for operating and maintaining the supplies it should also be responsible for revenue collection. The main purpose of this recommendation is to increase collection for government both directly through increased efficiency, and indirectly through permitting more efficient sanctions. Hopefully DWA would bill and collect revenue more efficiently than the councils do since the latter have little incentive to perform well. In addition DWA would, at all times, be able to identify consumers due for warnings and disconnection. Finally the existing problem of getting councils to hand over 90 percent of the revenue collected would automatically disappear.

Merely taking over the responsibility for revenue collection will not automatically lead to improved efficiency since the calibre of the personnel writing the bills, collecting the revenue and keeping the books would be similar to that of council employees. In order that DWA performs the administrative tasks more efficiently than the councils have been doing, a training programme for its clerical staff is needed. It is therefore proposed that a donor be requested to provide a training officer to establish the necessary programme, so that the clerks start their work properly trained for it. It will also be necessary for senior officers to continually supervise the clerical staff since an improved billing and collection performance will ultimately be their responsibility.

13 RURAL WATER SUPPLY STRATEGY

At present, the maintenance of rural supplies is extremely poor and many supplies have been abandoned. In line with the theme of making the most of existing assets it is suggested that development of new rural supplies should be temporarily reduced until a higher proportion of existing supplies are well maintained. The resources and finance saved by a reduced development programme should be devoted to improving maintenance. It is further recommended that supplies that are still working and those where only minor repairs are required should receive priority over supplies where rehabilitation is required.

Furthermore, DWA's present role in rural water supply maintenance should be recognised, i.e. while councils are responsible for maintenance, the limited maintenance that is undertaken is sometimes done by DWA's district officers providing informal assistance. Whether or not the actual responsibility for rural supply maintenance is officially transferred to DWA is less important than that DWA receives additional resources for either, (i) maintaining rural water supplies or, (ii) providing assistance to councils to maintain water supplies.

14 RECOMMENDED PRICING POLICY FOR RURAL WATER SUPPLIES

Rural water supplies must be provided free of charge. Rural consumers have a very limited ability to pay for water. The consultants estimate that, based on current rural incomes and on generally accepted ability to pay criteria, the maximum monthly fee that rural consumers should be charged is 50 ngwee per month. Furthermore, rural inhabitants do not usually perceive a high need for improved supplies while their nearby traditional sources are still available. Hence it is not surprising that the willingness of rural consumers to pay for shallow wells and well points is very low. The people appreciate improved supplies, but generally do not feel that the improvement is worth paying for.

Hence attempts to charge consumers regularly would meet with failure. If the rates were set at a very low level the costs of collection would take a major part, if not all, of the revenue collected. But if higher rates were charged, and in the unlikely event that payment was successfully enforced, most consumers would simply revert to using their traditional sources. Meanwhile the authority would be bearing a large administrative burden. Although a limited willingness to pay for repairs exists it is unlikely that any collection procedure could be successfully adopted on a wide scale. Consequently the only practical policy is free rural water supplies. This policy also has considerable social merit.

Thus if Government has limited funds for rural water it must restrict the number of supplies which it constructs rather than attempt to increase available funds by charging for rural water supplies. The important rural water supply question is whether the probable benefits will justify the investments and the continuing costs of operation and maintenance, bearing in mind that no revenue will be raised.

APPENDIX A BACKGROUND TO WATER PRICING POLICY

A1 Introduction

Water supplies can be financed in a variety of ways: at one extreme by government development and continuing recurrent grants to pay for all the capital and operation and maintenance costs. At the other extreme by water charges which cover all running costs and which repay the full capital costs over time. The appropriate policy for DWA township water supplies will lie somewhere between these extremes and the appropriate level of subsidization will depend partly on the way in which the authorities regard water supplies, for example, whether they regard them as public utilities or as social services. Historically water supplies in Zambia have been regarded as public utilities which should cover their costs, but in the more recent past government has implicitly tended to view the smaller township water supplies and communal facilities in particular, as social services.

The major problem in determining the optimum water pricing policy is that the three major functions of water rates, economic, financial and social usually conflict and reconciliation may be a complex task involving trade offs between the different objectives. The decisions involved are largely political and they should be guided by, and consistent with, government's high level objectives. An understanding of the major functions of, or major criteria for determining, water rates is therefore necessary, so that these inherent conflicts, and the problems and consequences of alternative pricing strategies, can be properly comprehended.

A2 Economic Criteria

The economic function of water rates is to influence consumer behaviour so that sound economic investment resource allocation decisions are made and efficient use of resources is achieved, i.e. so that capacity is expanded at the appropriate rate and that capacity is as fully used as possible. Economic theory shows that this can be done by basing the price of water on the marginal cost of production, i.e. by charging consumers a price for the water which reflects the costs of supplying that additional water. Theoretically consumers will then adjust their consumption so that the incremental cost of producing additional water

is equal to the incremental value of that water to them. If price exceeds marginal cost, demand will be unnecessarily restricted and the level of under-utilisation will be greater than it should have been, i.e. a greater part of the investment than is necessary will be wasted for some time. If price is less than marginal cost the quantity of water demanded will increase and the capacity will soon become a constraint. Augmentations which cannot be justified on economic grounds will be needed.

Township supplies have high fixed capital cost elements with significant economies of scale, so that marginal cost can be below average cost. Furthermore a large element of the operation and maintenance costs will be fixed. Hence over a considerable operational range, unit costs of the supplies will fall with increasing utilization, and the marginal costs will be low until consumption approaches capacity. Therefore the economic criterion is likely to suggest a low price until demand approaches capacity. However when augmentations are required and many or all components of the supplies have to be replaced or augmented, marginal costs will increase dramatically. An economic criterion would suggest a high price based on this high marginal cost prior to such augmentations being required. This would ensure that these augmentations are not demanded until they are economically justified. Theoretically the short run marginal cost, (short term variable cost), should be charged until demand reaches capacity. This would mean a low price at most DWA supplies having spare capacity since this short term variable cost is usually low. When demand reaches capacity the price should be increased until the long run marginal cost, (which takes into account the cost of the augmentation), is being charged and the supply is fully utilised. At this point further investment is justified. But once the investment has been made the efficiency criterion would suggest dropping the price to short run marginal cost. Although this strategy leads to an efficient use of resources when the supply is operating below capacity and provides an accurate signal for justifying new capacity, it is impractical for a real life situation since the "lumpiness" of water supply investments would lead to vast fluctuations in price.

A3 Financial Criteria

A strict financial criterion requires that revenues cover all operating and capital costs, including depreciation and interest charges. Thus whereas the economic approach ignores sunk costs, the financial or accounting approach includes all such costs and is concerned with total and average costs. It means that water rates have to be based on total average costs and large discrepancies can occur between the structure of prices and costs.

If strict financial criteria are not observed government must subsidise the shortfall. In many developing countries including Zambia government subsidies have often failed to make good the cost/revenue deficit. This has; (i) inhibited the development of new supplies, (ii) lead to a deterioration of some existing supplies and (iii) acted as a constraint on operation. When a government is able to finance any subsidisation requirement, limited weight can be given to the financial criterion but the Zambian government is not in this position. The present financial criterion, i.e. that revenues must cover operation and maintenance costs with Government/donors financing all capital costs, is only acceptable provided that the Government fully appreciates all the implications of such a policy and is prepared to finance all capital development, either directly or indirectly through donors.

During the early years of a new augmentation when demand is well below capacity financially determined rates would be higher than the prices indicated by economic considerations. Conversely when demand is approaching capacity and costly investments are required, the financial criterion may indicate a price which is lower than that which is appropriate from the economic point of view.

A4 Social Criteria

The social criterion is subjective and includes objectives such as relieving poverty, meeting basic needs, redistributing income, etc. It would require that DWA provides all inhabitants of the supply areas with a certain minimum quantity of water at a price they can afford to ensure satisfactory health standards, i.e. no consumers should be excluded from using the supply on the basis of price.

Social criteria may often suggest that the service is worth more than the people are willing to pay. Thus a low price is indicated in order to make the supply widely available to low income groups.

In addition to considering economic, financial and social criteria the architects of a pricing policy/tariff structure must ensure that it is administratively simple and can be handled effectively by the probable calibre of staff. It must also be acceptable to consumers, local leaders and politicians.

A5 Reconciliation of Conflicting Criteria

In the short and medium terms the economic and social criteria will both suggest a low price for water at supplies where there is considerable spare capacity. Consequently there is unlikely to be a serious conflict between these criteria, at least during the early years of the schemes. However, the low rate suggested by the economic and social criteria would lead to a large financial deficit. Alternatively if strict financial criteria were adopted, use of the scheme would be limited, the level of under-utilisation would increase, the rating system would be inequitable and some or even a majority of consumers may be excluded from the supply altogether.

When demand approaches or has reached capacity the high marginal costs will mean that the economic criterion will suggest high water rates. Therefore although the financial and economic criteria are unlikely to coincide they will not seriously conflict. However they will contradict the low price suggested by the social criteria.

Possible strategies to reconcile these different water rate functions include; (i) price discrimination between different groups of consumers. In Zambian townships this would mean very low prices for the poorest consumers using communal water points. This would go some way to meeting social criteria. Higher prices for other consumers would contribute towards meeting the financial objective. While this strategy would partly reconcile the financial and social criteria it would clash with the economic function of water rates.

(ii) utilisation of a two part tariff system. When marginal

cost is low it may be possible to partially reconcile the efficiency and financial criteria by charging consumers fixed basic fees in order to raise revenue, combined with a low cubic metre rate for additional consumption based on the marginal cost, to encourage full use of the facility. The potential conflict with social criteria can be reduced by differential fixed rate charges, i.e. by very low fixed rate charges for the poorest group so that these consumers are not deterred from using the supply. For usage above that covered by the fixed fee it would not be unreasonable to charge all consumers the same unit rate.

A two part tariff can also achieve reconciliation when a supply is up against capacity and marginal costs are high. Concessionary rates would be charged for communal consumption and for minimal use from private domestic connections to provide for basic health needs, to encourage use up to the desirable minimum level and to satisfy social criteria. Above this minimum consumption level the rates can be increased to that demanded by the economic criterion, i.e. to be in line with the high marginal cost. Wastage will be discouraged, resources should be used efficiently and the reduced demand will enable expensive augmentations to be delayed. In addition the financial criterion will be satisfied whenever marginal cost exceeds average cost and a financial surplus may even be generated.

However, it will rarely, if ever, be possible to achieve total reconciliation between the conflicting functions of water rates. The weighting that will be given to the different criteria should then in part depend upon how water supplies are viewed by Government. If they are primarily regarded as public utilities greater weight should be given to financial criteria. However, if as in Zambia, water supplies, particularly communal facilities, are regarded as a social service or even as a "merit want", greater weight should be given to social criteria.

A6 Flat Rates

Although the measurement of water consumed, i.e. metering, is necessary to reconcile the conflicting functions of water rates, this may not always be desirable due to the limited administrative/technical capability of the operating agency or because the costs of metering

exceed its benefits. In such cases flat rate charges must be levied.

This pricing method conflicts with the economic criteria to varying extents at all times. Since flat rates encourage wastage they will result in operational resources being wasted even when there is considerable spare capacity, although when the variable costs are low the conflict with the economic criteria will be a limited one. However, when a supply is up against capacity flat rates will represent a total contradiction of the efficiency criterion.

Where consumers can be divided into a number of well defined groups it may be possible to satisfy social criteria to a certain extent by charging different rates to different consumer groups. In Zambia the most appropriate consumer grouping would be housing categories with lower rates for the poorer housing categories.

Flat rates do not necessarily conflict with the financial criterion since they can be selected to meet a pre-determined level of revenue. However, if this resultant rate does not meet the social criteria, there may be no way of reconciling the financial/social criteria conflict.