WATER RESEARCH COMMISSION

Financial Planning and Modelling for Regional Water Supply Service Providers

PALMER DEVELOPMENT GROUP

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NOTE

PLEASE NOTE THAT THIS REPORT TT 118/00 IS SUPPORTED BY A SOFTWARE CALLED 'REGIONAL WATER SUPPLY SERVICES MODEL (RWSSM)' AND IS AVAILABLE FOR DOWNLOAD FROM THE WRC WEBSITE http:\\www.wrc.org.za\software

Obtainable from:

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EXECUTIVE SUMMARY

Background

In South Africa the role of regional water supply services providers, typically water boards, is changing. Historically they have been established with the primary function of supplying large urban centres with bulk water. Their emphasis has thus been on developing and running large, technically complex systems. Most importantly they have generally been selling bulk water to financially strong municipalities who paid their accounts.

With the new imperative to rapidly increase the provision of water services to all South Africans, these regional services providers are facing new challenges. Their bulk supply systems are being extended to serve smaller settlements with weaker local economies; they are being required to provide retail services in some cases; and they have to allocate resources to the support of the retail water services providers they supply.

With this changing role such service providers are being exposed to increasing financial risk and it is essential that these risks are understood so that the viability of the organisations are not unduly threatened. In order to assist in assessing such risks, the Water Research Commission has funded this project which is centred on the development of a financial model which allows the financial position of regional water supply services providers to be investigated over a relatively long term.

The model

The model is referred to as the ‘Regional Water Supply Services Model’ (RWSSM). Its structure and format are similar to other investment planning models which have been developed by Palmer Development Group for the Water Research Commission and Development Bank of Southern Africa. The key focus of the model is on financial viability and sustainability of the regional water supply service provider. It is designed as a financial planning tool with a central objective of providing financial inputs into business planning.

The model links decisions made with regard to the service level provided to consumers to water demand and hence to the cost of providing the service. This, in turn, is used to calculate tariff trends which can be used to assess whether the type of service offered is affordable. The implications of expanding systems to accommodate new consumers can be assessed.

Manual

A manual is provided with the model to provide an understanding of, and facilitate the use of, the model. It outlines the aims of the model and describes the structure and philosophy behind the model among other things. The manual is intended to provide detailed guidance to users of the model and help them achieve sufficient competency in using it.

Case studies

In order to test the working of the model two case studies were undertaken as part of the project: Lepelle Northern Water and Bloem Water. These two water boards provide bulk water to areas with substantially different retail customers and thus they provide useful contrasts of the conditions under which regional water services providers function.

In each case sufficient data was collected to set up the form of the model and undertake preliminary runs of the model. A full set of results, including demand projections, service level coverage and financial statements for a 10-year period is produced. However, it needs to be recognised that the resources available for the case studies have been limited and there has not been the time to engage water board staff in the running of the model. Thus the results of the case studies cannot be used for actual planning decisions.

Key factors

The modelling process applied to the two case study areas has allowed key factors influencing the viability of regional water services providers to be identified and their relative impact assessed. These factors include those that cannot be changed, such as physical aspects and retail customer profile, and those that can be influenced, such as planning, institutional arrangements and access to capital.

Conclusions

The case studies have demonstrated that the RWSSM can be applied successfully to water boards as a tool to assist them with planning and to assess the viability of their operations. The comparative results for the two water boards chosen as case studies demonstrate the considerable difficulties which those RWSPs with a large proportion of rural customers confront. Lepelle Northern Water will face a major challenge to maintain the viability of their operations with a rapidly expanding rural client base. Bloem Water, on the other hand, has a largely urban client base which gives them a stronger base.

Way forward

Through this project the RWSSM model has been developed and tested by the researchers. However, the model has not been used interactively with the staff of regional water services providers and it has not been applied in a real planning situation. It is important for the model to be used in a real situation and that further edits are undertaken where necessary.

PREFACE

Palmer Development Group was commissioned by the Water Research Commission to undertake a study aimed at assisting regional water services providers (such as water boards) to take on the necessary investment planning and tariff analysis inherent in their business planning (Project K5/896). The primary objective of this project is to develop a model with a key focus on financial viability and sustainability of the regional water supply service.

The reporting from this project comprises the following:

- Main report, including an overview of the two case studies undertaken as part of the project:
  - Lepelle Northern Water, and
  - Bloem Water
- A manual for using the model.

Acknowledgements

The Steering Committee for this project includes the following people:

Mr J Bhagwan	Water Research Commission
Dr GR Backeberg	Water Research Commission
Mr B. Hollingworth	Development Bank of Southern Africa
Mr H Muller	Department of Water Affairs and Forestry
Mr PD Dyke	Department of Water Affairs and Forestry
Mr FC van Zyl	Department of Water Affairs and Forestry
Mr DN Miller	Miller and Associates cc
Mr PJ Pybus	Consultant
Mr. HG Ott	Rand Water
Mr OJ Stadler	Bloem Water
Mr RJ Strydom	Magalies Water
Mr WJ Vermeulen	Lepelle Northern Water
Mr P Archary	Umgeni Water
Mrs ND Basson	Goudveld Water
Mr LO Marais	Goudveld Water

The project team is indebted to the steering committee for their valuable input in assisting to meet the objectives of the project, and sincerely acknowledge their contribution. The support and finance provided for the project by the Water Research Commission is acknowledged and appreciated.

This project would not have been possible without the cooperation of the staff of the two water boards used as case studies: Lepelle Northern Water and Bloem Water. They have made information available, made time for meetings and have generally been supportive of the project team. This is sincerely appreciated.

Project team

The project team responsible for developing the model, undertaking the case studies and drafting the reports, comprised Ian Palmer, Clive van Horen, and Lindelwa Mabuntana, all from Palmer Development Group.

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1 INTRODUCTION

Provision of water supply services is one of the most important objectives of the government's infrastructure development programme. In terms of the constitution, the responsibility for providing this service rests with local government. However, the actual provision of this service is often transferred to water services providers, who may undertake to provide the retail service direct to consumers and/or the bulk service. Where such service providers serve relatively large areas covering several local authorities, they are referred to as regional water services providers (RWSPs). Such organisations typically focus on bulk water supply but they may also offer a retail water supply service. Water boards are the most typical regional water services providers in the country.

Sound financial planning by RWSPs is vital if the financial sustainability of these organisations is to be assured. Such planning is an integral part of the business planning process which is now a requirement for water boards in terms of the Water Services Act. Financial planning tools to assist these organisations to carry out sound financial planning have been lacking to date although work has been ongoing to develop a suite of financial planning models for use by urban local authorities. (These include the Water Supply Services Model (WSSM) the Sanitation Services Model (SSM) and the Combined Services Model (CSM)).

The primary objective of the project covered by this report is to develop a model which will assist RWSPs with financial planning. It is referred to as the Regional Water Supply Services Model (RWSSM). This model complements the existing urban models.

2 DEVELOPMENT OF THE FINANCIAL MODEL

As mentioned above, the RWSSM is intended primarily for regional water services providers such as water boards. Its structure and format are similar to that of the Water Supply Services Model and the Sanitation Services Model. The key focus of the model is on financial viability and sustainability of the regional water supply service provider. It is designed as a financial planning tool with a central objective of providing financial inputs into business planning.

The model links decisions made with regard to the service level provided to consumers to water demand and hence to the cost of providing the service. This, in turn, is used to calculate tariff trends which can be used to assess whether the type of service offered is affordable. The implications of expanding systems to accommodate new consumers can be assessed.

The model was developed in Excel for Windows programme and as such may be run using Excel 5.0 (or a later version). It is recommended that the model be run on at least a 66MHz machine with 16Mb of RAM. Users require some knowledge of the Excel program.

A manual provided with the model is intended to provide an understanding of, and facilitate the use of, the model. It outlines the aims of the model and describes the structure and philosophy behind the model among other things. The manual is intended to provide detailed guidance to users of the model and help them achieve sufficient competency in using it.

3 CASE STUDIES

3.1 Case study descriptions

To test the applicability of the model, two water boards offered to participate in the project as case studies: Bloem Water and Lepelle Northern Water.

Bloem Water (BW) operates in the Free State province with major supply areas including Bloemfontein, Botshabelo, Thaba'Nchu and small towns.

Lepelle Northern Water (LNW) operates in the Northern Province and is an amalgamation of three previously separate water boards (Phalaborwa Water, Northern Transvaal Water, and Bosveld Water). It serves the towns of Phalaborwa, Pietersburg, and Potgietersrust as well as a large rural area.

The following table gives key statistics for the two water boards.

Table 1: Comparative overview of LNW and Bloem Water

Water board	No of schemes	No of domestic customers served (either direct or by retail WSPs)			Total water sold Ml/yr	Expenditure (98/99) Rm
		Urban	Rural	Total		
Bloem Water	6	147 000	6 900	154 000	46 200	34
Lepelle N Water	9	115 000	313 000	428 000	57 000	93.5

It is evident that LNW has a much larger rural consumer base. While many of their rural consumers have access to a bulk water supply provided by LNW, there are many which are not connected as there is insufficient distribution infrastructure to do this.

Both water boards focus primarily on bulk water supply with a small amount of retail activity. They do not currently offer a sanitation service.

3.2 Case study methodology

The approach to undertaking the case studies was constrained by the relatively small budget allocated to this activity. Provision was made for two visits to the area by the researchers to gather data and engage with the staff of the water boards and other authorities. Only data which was easily accessible could be used and no primary data gathering was possible. This represented a major shortcoming, particularly for the rural areas served by LNW, where there was inadequate information.

The staff of the water boards were co-operative in making information they had access to available to the research team. However it was not possible to engage them in the process of running the models. Neither has it been possible for the model results to be discussed with them and adjusted based on their views.

Due to these limitations, the model results cannot be used for actual planning decisions. The case studies serve primarily to demonstrate that the model is usable. They also serve to identify key factors which influence the viability of RWSSPs.

4 IDENTIFICATION OF KEY FACTORS

The functions of regional bulk water supply services providers are complex and there are numerous factors which affect the viability of these organisations. It is only realistic to address the most important of these factors. In doing this primary reliance has been made on the modelling undertaken for this project which is related to the two case studies. In addition the experience of the researchers with other regional services providers has been used, together with the reported experience of others.

The factors influencing the viability of regional providers have been divided into 4 groups:

- Those which cannot be influenced: physical factors and the consumer profile.
- Institutional arrangements.
- Factors relating to the way schemes are planned and implemented (including capital finance arrangements).
- Factors relating to the way the system is managed (including operating finance arrangements).

4.1 Factors which are fixed

4.1.1 Spatial distribution of population

In a situation where the provision of the same level of service to all consumers is considered, the spatial distribution of population becomes a factor of primary importance, although the impact of this factor on viability is strongly influenced by water resource development opportunities. Considering transmission costs, for example, if regional schemes are to be used, the length of bulk pipelines between settlements is a major driver of costs. On the other hand, if local schemes are used, the distance between settlements becomes less of a factor and transmission costs decline. The high impact of transmission costs in the case of regional schemes is offset to some extent by economies of scale relating to abstraction and treatment costs: with a large number of small local schemes these latter costs per unit of water produced will be greater when compared to larger schemes.

A proper analysis of options is needed to consider the effect of the spatial distribution of population. This is not provided for through the RWSSM but should be undertaken during scheme planning. It is probable that the supply to widely distributed settlements through regional schemes will only be viable if there is sufficient demand at the end of the bulk pipelines. The RWSSM would reflect the effect of this situation in that relatively high tariffs will be required due to the impact of high capex financing costs related to low consumption. However, if capex is being provided at no cost this obviously does not apply. This is discussed later under 4.4.5.

4.1.2 Access to water resources

Clearly if there are good sources of water local to settlements, the capital costs of supply will be relatively low. If these are groundwater sources, costs are reduced further due to the fact that, in general, water does not need to be treated.

As in the case with settlement distribution the BWSSM model does not allow this factor to be analysed as it is not intended to deal with project feasibility analysis. However, the higher capital cost of schemes will be reflected in the model inputs which will, in the outputs, be reflected in the higher tariffs required to sustain the system financially.

4.1.3 Consumer profile

The consumer profile relates to the mix of consumer types (residential, industrial and other) and, in the case of residential consumers, the mix of household incomes.

Consumer profile has a major impact on the viability of water supply schemes. In general, the greater the proportion of low income residential consumers, the less viable the scheme is likely to be as this consumer group uses relatively low volumes of water and is able to afford relatively low payments for the service. The potential negative impact on viability can be ameliorated through careful selection of service levels and appropriate technical solutions. But it generally remains true that the greater the number of wealthier, high water using consumers that are supplied, the easier the business of water supply becomes.

4.2 Factors relating to institutional arrangements

4.2.1 Water services provider responsibilities

While regional water services providers have bulk supply as their primary role, there are situations where they may take on retail functions, thereby acting as retail water services providers. While there are situations where they can improve the viability of their operations in doing this, the reality in South Africa is often the opposite as the regional organisation is generally required to do this for relatively poor areas with low levels of existing infrastructure and little existing management capacity. This reality implies that regional water services providers expose themselves to greater risk as they take on more retail functions.

4.2.2 Capacity of retail water services providers

Regional water services providers rely primarily on bulk water sales to retail water services providers. Therefore they are reliant on the ability of these organisations to run their operations properly, and bring in sufficient revenue from the water they sell to cover the bulk water purchase cost. Further, in expanding systems, the retail water services provider may also be responsible for raising the capital and managing the projects required to expand the distribution infrastructure. This can also be a key factor as the viability of the bulk supply system is dependent on supplying a certain quantity of water. This, in turn, is dependent on the level of sales which can be made by the retailer.

The management capacity of retail water services providers, including their ability to raise capital finance, is therefore a key factor.

4.2.3 The support services function

In addition to bulk and retail services provider activities, there is a third type of activity which can be undertaken by a regional water services provider: that of providing support services. Such support services are aimed at assisting the retail services providers to function properly. While the provision of such a service increases costs, it is intended that this should increase revenue, through promoting an increase in sales, and reduce risk through ensuring that retailers are able to pay their accounts. The provision of support services also has a developmental impact through improving the capacity of local people to manage their own services.

4.3 Factors influenced by planning and implementation decisions

4.3.1 Infrastructure capital costs

Typically high capital costs translate into high recurrent expenditure which requires high tariffs which, in turn, affects the affordability of water to consumers. Obviously much depends on the terms upon which capital is acquired. If it comes as a grant from government, the water supplied becomes relatively cheap. However, if relatively large amounts have to be borrowed, the impact on tariffs can be substantial and this can impact on the viability of the RWSP.

As mentioned above, capital costs may be related to certain factors which cannot be influenced. However, there are other factors which are influenced by planning decisions: technology choice and design horizons, for example.

4.3.2 Understanding consumer profile and demand for services

Providing water supply services which are not tailored to suit the demand exerted by consumers negatively affects the viability of the RWSP and may harm it substantially. It is important to start off by understanding consumers and what services they demand (what they want and can afford to pay for). If a scheme is designed to provide more water than consumers require at the price charged, unnecessary expenditure is incurred. Further, it needs to be recognised that consumers will respond to high prices by using less water.

4.3.3 Understanding scheme operating costs

All too often schemes are planned on the basis of capital costs only based on the view that: ‘if you can get the capital, build it’. However, high operating costs lead to high tariffs which may mean a scheme is providing water which is not affordable to consumers which, in turn, may render the scheme non-viable.

4.3.4 Capital finance

Clearly the cost of capital influences the overall recurrent cost that has to be financed through income from tariffs. Structuring a good finance package is therefore an important planning activity.

4.3.5 Targeting capital grants

There has been a tendency to over-finance bulk infrastructure and under-finance distribution infrastructure in rural areas. This leads to a situation where planned retail sales cannot be realised as there is insufficient distribution infrastructure in place. This, in turn, leads to wasted investment in bulk infrastructure. In order to achieve maximum efficiency of the system as a whole, an appropriate balance needs to be achieved in allocating capital to the various components of the water supply system.

4.3.6 Taking over water services schemes from DWAF

The scale and extent of schemes which a regional WSP takes over from DWAF can have a substantial impact on the viability of a water board. Obviously this depends entirely on whether the scheme itself is viable or not. However, most of the schemes serve rural areas, and are not functioning well. Of greatest concern is the fact that most generate no income. DWAF may hand over the scheme with an operating grant to cover its running expenses, but they will have to reduce this operating grant and this could leave the RWSP with a scheme running at a deficit.

4.4 Factors influenced by management decisions

4.4.1 Generating sales

A RWSP obviously has to sell water effectively if it is to survive financially. Typically the sales are made to retail services providers and selling to these organisations may be a relatively simple matter. However, the success of bulk sales depends upon the success of retail sales. Yet it is often the case, particularly in rural areas, that the retail WSP is not sufficiently organised to sell water in sufficient quantities and raise the income which accrues. In this situation it may be good business practice for the RWSP to engage with the retailer to assist them. The arrangements for doing this have been discussed under Section 4.2.

The extent to which retailers are supported to function effectively may make a substantial difference to the viability of a RWSP.

4.4.2 Operating finance

The term ‘operating finance’ is used here to cover the methods used to raise income to cover the recurrent expenditure incurred by a RWSP. This recurrent expenditure includes the debt servicing cost. Obviously a good income policy backed up with good practice is central to the success of a RWSP as it is for any business.

Income is raised primarily from tariffs charged for the service and from operating grants received from government. Both these elements need to be dealt with properly for the success of a RWSP to be optimised.

4.4.3 Accessing operating grants

While larger urban based RWSPs have managed to run successfully without access to operating grants from government, there are several existing RWSPs which rely on grant finance.

Considering water boards, as the major category of RWSPs, there are three main avenues through which grant finance flows to them from government:

- Historically grant finance has been allocated to certain water boards by DWAF with the amount based on rather *ad hoc* criteria. This is paid as a direct transfer and is typically used to balance the books of the water board concerned. This situation is changing and will be phased out over the next 5 years.

- Certain water boards have taken transfer of schemes previously operated by DWAF which had no cost recovery from consumers. DWAF financed the running cost of such schemes from its own account and, in handing over the scheme, they also assigned the income to operate the scheme as a recurrent grant to the water board. This operating grant is also intended to be an interim measure and the water board is expected to introduce cost recovery from consumers.

- The new ‘equitable share of national revenue’ policy of government makes provision for a constitutionally protected annual grant to local governments in order to assist them to provide services to the poor. If they employ a service provider to provide such services there is a good argument for this service provider to be allocated a portion of the equitable share available to the local government concerned. This would need to be dealt with in negotiations between a RWSP and the local authority and should be written into the contract between them.

The extent to which RWSPs are able to access grant finance is clearly a factor in assessing their viability. There are two contrasting situations here. In the first instance RWSPs that are reliant on grants from DWAF may be vulnerable as national policy is for these to be reduced over time. In the second situation those which can negotiate long-term contracts with local authorities (WSAs) to access a portion of the equitable share will be able to use this funding to improve their viability.

4.4.4 Cross subsidy

The consumer profile in the RWSP supply area has been discussed in Section 4.1.3. If the consumers include a relatively large number of industrial, commercial and high-income residential consumers, it gives the RWSP the opportunity to cross subsidise between these groups and poorer consumers.

Considering bulk supply this can only be effected through the tariffs charged to retailers. Although there are other methods of achieving cross subsidy between individual consumers, it will often be the case that it can only be applied between retail WSPs, typically through charging urban WSPs at higher than cost and rural WSPs at lower than cost. The effect of charging a common bulk water tariff to all retail WSPs is generally sufficient to achieve this as the unit cost of supplying urban areas is generally lower than that applicable to rural areas.

The mechanism for achieving cross subsidy therefore relates to tariff setting policy and particularly whether a common tariff is applied to all WSPs in the supply area or if differentiation is applied either to schemes or to WSPs.

There are arguments for and against cross subsidy and it is not possible to deal with these adequately here. Dealing with these properly for the circumstances in the particular RWSP supply area will however improve the viability of the RWSP.

4.4.5 Tariff setting

Having considered income policy as a factor, including matters relating to cross subsidy, and access to grant finance, the issue of tariff setting becomes important. The use of a sound approach to setting tariffs, and a practical methodology for doing this, with a long-term view, are factors which affect the viability of a RWSP.

4.4.6 Credit control

There has been a history of poor payment ethic with regard to municipal services in South Africa. While much has been done to improve this situation, there are still quite serious problems in many areas. A RWSP may be exposed to this directly if they are providing retail services, or indirectly if they provide water in bulk.

If the viability of the organisation is to be maintained, it is essential that good systems are put in place to ensure that payment for services are actually made. For those RWSPs who supply to relatively wealthy urban WSPs this may not be a major issue, but for those serving rural areas and small towns the problem may be serious.

There may be structural problems if service levels provided to poor households are too high, as was discussed earlier in this section. If the problem is not structural, the solution, to a large extent, lies in good customer relations and the use of pre-payment technology where possible. With regard to prepayment, there are innovative solutions being applied to both bulk supply to small WSPs and retail supply.

5 ASSESSING VIABILITY: LESSONS FROM THE CASE STUDIES

As mentioned in Section 3, limited resources were available for the case studies which were undertaken for this project and the findings can only be used to draw fairly broad conclusions. However, Bloem Water and Lepelle Northern Water offer two contrasting examples of RWSPs which serve to illustrate the general extent to which various factors affect the viability of the organisations. Bloem Water serves largely urban consumers concentrated in one area while Lepelle Northern Water serves an increasing proportion of rural consumers which are widely dispersed. Further the urban WSPs supplied by Lepelle Northern Water are themselves widely dispersed and many of them are located far from good water resources.

The table below is used to briefly assess the various factors identified in Section 4. It is not intended to imply any competition between the two water boards, nor to suggest that either is better. The intention is solely to illustrate the importance of the various factors through examples. This analysis indicates that Lepelle Northern Water faces much greater difficulties than Bloem Water, and probably most other water boards in South Africa. However, this is mainly due to circumstances outside their control.

Table 2 Summary of impacts of key factors on two water boards

Factor	Bloem Water	Lepelle Northern Water
4.1.1 Spatial distribution of population	Although BW is taking on the bulk supply to relatively small towns, set relatively far apart in the Southern Free State, it is fortunate to have most of its large clients located close together (Bloem, Botshabelo and Thaba'Nchu)	LNW has a widely scattered population to serve with only Pietersburg and Phalaborwa representing fairly strong urban centres.
4.1.2 Access to water resources	BW accesses water mainly from the Caledon and Orange Rivers, both strong sources. The Caledon supply is linked to other sources in one integrated system which brings benefits.	LNW runs 9 schemes which are all fairly far apart from each other. It is taking over further schemes from DWAF. While there are adequate water resources in the region to serve its clients, bulk supply lines have to be run over relatively large distances.
4.1.3 Consumer profile	Bloem Water has more urban customers with higher service levels and increased water consumption. However, this difference is not as profound as in LNW. The ratio of high to low consumers is 1:1.5.	LNW customers are largely rural with low service levels and water consumption levels. The ratio of high to low consumers is 1:3.
4.2.1 WSP responsibilities	BW is largely a bulk WSP. It offers a limited retail service in Thaba'Nchu but is working towards handing this over.	LNW is also largely a bulk WSP. Its retail activities are confined to non-residential consumers.
4.2.2 Capacity of retail WSPs	The majority of BWs client WSPs are relatively well managed. However, there are difficulties with Botshabelo and Thaba'Nchu (not assessed as part of this study).	The urban WSPs served by LNW are relatively well managed. However, the board is faced with serious problems due to the weak capacity of rural WSPs in its area of supply.
4.2.3 Support services function	BW runs a relatively small support services operation.	LNW has a relatively well developed support services unit. However, this is presently focused primarily on new projects. There appears to be a need to expand this service substantially.

Table 2 (continued)

Factor	Bloem Water	Lepelle Northern Water
4.3.1 Capital expenditure	BW is faced with relatively low capital expenditure to serve its current WSP clients. If it is to face substantial increase in the future this will be due to an expansion of its supply area. However, the Free State is relatively well provided with water supply services.	LNW is faced with large capital expenditure requirements, even though most of the schemes it is taking over from DWAF have already been constructed with grant finance. The fact that LNW is expanding its supply area so rapidly promotes rapid increase in the need for capital.
4.3.2 Understanding consumer profile and demand for services	BW has been insulated from the need to understand the (retail) consumers in its supply areas as it has fairly strong WSPs who plan for this. There may be exceptions here in the case of Botshabelo and Thaba'Nchu where poor service level planning could lead to future problems.	There appear to be many situations in the LNW supply area where service level planning has not been done properly as there is insufficient understanding of demand for water supply services. LNW are often in a difficult position in that they have only limited participation in the planning process.
4.3.3 Understanding operating costs	In general, it appears that the expansion of the BW system and that of its retail WSPs has been done with a reasonably good understanding of operating costs.	A large proportion of new demand in the LNW area will be from rural areas and there is concern that planning of projects in these areas is not being done with sufficient understanding of operating costs. With expensive regional schemes serving relatively small and dispersed centres of demand the schemes may not be viable.
4.3.4 Capital finance	While this has not been specifically assessed as part of this study it is evident that BW has the capacity to raise the capital it needs.	LNW has historically been able to raise capital but there are concerns for the future if its ratio of capital required per unit of new sales increases, as seems likely. What is of greater concern is the ability of the retail WSPs in rural areas to raise capital. This is important to LNW as such capital is needed to improve service level coverage and promote sales. (This aspect has not been covered sufficiently in this study).

Table 2 (continued)

Factor	Bloem Water	Lepelle Northern Water
4.3.5 Targeting capital grants	The viability of the BW system is not highly dependent on capital grant finance and hence targeting is not a big issue.	In the case of LNW there is a major concern that capital grants have been targeted at bulk infrastructure with too little going to distribution infrastructure. The most obvious example of this is the Arabie scheme where a large regional bulk supply scheme has been built with virtually no distribution infrastructure. The possibilities of making this scheme viable seem remote.
4.3.6 Taking over schemes from DWAF	This has not been specifically investigated for this study but it is understood that BW is not taking over schemes from DWAF.	DWAF has inherited many schemes from the former homelands and now requires handing these over to local government which, in turn, needs to find a WSP to run them. LNW has been identified as the services provider for many of these schemes. The schemes are typically being run with no cost recovery and are reliant on grant finance flows which are insecure. Therefore LNW is taking substantial risks in taking over certain of these schemes.
4.4.1 Generating sales	BW is reasonably well placed to generate large bulk water sales, as the retail WSPs they serve are, by and large, themselves viable operations. There are exceptions but these are proportionally less of a problem than in the case of LNW.	LNW’s urban WSP clients serve relatively strong economic areas and are able to generate substantial retail sales. However, the situation in rural areas is problematic with the level of retail sales being far too low in relation to the capacity of bulk infrastructure provided. This problem arises partly from lack of (retail) WSP capacity and partly due to lack of capital for distribution systems.
4.4.2 Operating finance	BW generates sufficient income to cover its operating expenditure. It seems likely that it will be able to do this in the future.	LNW has also been able to raise sufficient income to cover its annual operating expenditure. However, it is faced with rapidly increasing direct operating costs (doubling every 5 years in real terms). The problems in raising the necessary income to cover these costs will increase dramatically as the supply to rural areas is expanded.

Table 2 (continued)

Factor	Bloem Water	Lepelle Northern Water
4.4.3 Accessing operating grants	BW does not get significant operating grants and is not reliant on such grant finance for its viability.	In the rural areas served by LNW a significant proportion of the income received comes from DWAF, much of this paid on behalf of communities served by LNW. This source of funding is insecure. For LNW to remain viable, access to some of the 'equitable share' paid to local government may be essential.
4.4.4 Cross subsidy	As part of this study it has not been possible to quantify the extent of cross-subsidy which is taking place within the BW supply area. Some will be taking place from Bloemfontein to other WSPs served by the Caledon scheme. However, this is not likely to be large.	In the case of LNW substantial cross-subsidy is taking place within certain schemes. For example, the tariff for bulk water to Pietersburg from the Ebenezer scheme has been rising steadily above the cost of providing this supply, in order to finance the expanding rural bulk distribution system. This represents a cross-subsidy from Pietersburg to the rural areas (mainly Mankweng TLC area).
4.4.5 Tariff setting	BW is faced with a relatively stable operating cost environment and tariff setting on a scheme-by-scheme basis is relatively straightforward and is done using short-term estimates.	LNW is faced with a rapidly changing and uncertain operating cost environment as they take over schemes from DWAF and expand their rural activities. Short term tariff setting arrangements thus have their limitations and long term methods, using investment planning models such as the one developed for this project, for example, offer advantages.
4.4.6 Credit control	Bulk supply to larger urban areas with relatively strong economies typically is not associated with a large debtors problem.	Supply to rural areas brings potentially large debtors problems. LNW has been innovative in supporting the development of bulk prepayment methods to help in overcoming this problem. However, considerable attention will need to be paid to credit control systems in the future if LNW is to remain viable.

6 CONCLUSION FROM CASE STUDIES

The case studies have demonstrated that the RWSSM can be applied successfully to water boards as a tool to assist them with planning and to assess the viability of their operations. The comparative results for the two water boards chosen as case studies demonstrate the considerable difficulties which those RWSPs with a large proportion of rural customers confront. Lepelle Northern Water will face a major challenge to maintain the viability of their operations with a rapidly expanding rural client base. Bloem Water, on the other hand, has a largely urban client base which gives them a stronger base.

7 WAY FORWARD

This research project has had the primary objective of developing a model for regional water services providers and the secondary objective of testing this model using two case studies. This has been achieved but with limited interaction with the two water boards concerned. Further, the budget allocated for the case studies was small and the results are only sufficient to demonstrate the workability of the model.

Before the models can be widely applied as a planning tool, with confidence, they will need to be tested further by two to three regional water services providers, with the opportunity to have adjustments made to the models where necessary. This could be done as part of a process to improve long-term financial planning using financial models as a tool.

To conclude, it is evident that further work is needed with the objectives of:

- Applying the models in a situation where real planning is taking place, with good data and direct involvement of regional water services providers.
- Making final improvements and adjustments to the model.
- Popularising the use of financial modelling as a business planning technique.

WATER RESEARCH COMMISSION

ANNEXURE A

A Case Study of Lepelle Northern Water

August 1999

PALMER DEVELOPMENT GROUP

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LIST OF TABLES AND FIGURES

1 INTRODUCTION TO LEPELLE NORTHERN WATER

Lepelle Northern Water (LNW) is the only water board established in the Northern Province. It has a large area of supply, having been recently formed through the amalgamation of three smaller boards: Phalaborwa Water, Northern Transvaal Water, and Bosveld. The board operates primarily in the Northern District Council area, primarily in the Central, Lowveld and Southern sub-districts, with very limited activity in the Western and Northern sub-districts at present. The area of supply can be characterised as largely rural, including the ex-homeland areas of Lebowa, and Gazankulu. However, it also serves several large towns, including Pietersburg, Phalaborwa and Potgietersrus.

LNW has its head offices in Phalaborwa, with some functions transferred to the regional offices in Tzaneen and Pietersburg. The Community Development department of LNW is housed at Ebenezer.

2 CASE STUDY LIMITATIONS

As mentioned in the main report, the approach to undertaking this case study was constrained by the relatively small budget allocated to this part of the model development project. Provision was made for two visits to the area by the researchers to gather data and engage with the staff of the water boards and other authorities. Only data which was easily accessible could be used and no primary data gathering was possible. This represented a major shortcoming, particularly for the rural areas served by LNW, where there was inadequate information.

The staff of the water boards were cooperative in making information they had access to available to the research team. However it was not possible to engage them in the process of running the models. Neither has it been possible for the model results to be discussed with them and adjusted, based on their views.

Due to these limitations, the model results cannot be used for actual planning decisions. The case studies serve primarily to demonstrate that the model is usable. They also serve to identify key factors which influence the viability of regional water supply services providers (RWSSPs).

3 SUPPLY ARRANGEMENTS

3.1 Types of service offered

LNW's supply arrangements can be divided into 3:

Bulk Supply:

LNW supplies bulk water to urban and rural TLCs (e.g. Pietersburg and Makweng). In urban areas the bulk water is sold to TLCs which are then responsible for distributing it to local consumers. In rural areas voluntary village water committees (acting as water services providers) buy bulk water from LNW, and are then responsible for retail supply to local customers.

Retail Supply:
LNW also retails water services to some of its customers. This is limited largely to urban industrial and commercial customers. In addition, in Phalaborwa, LNW supplies unpurified water to mines and large industries.

Support Services:
LNW has a Community Development department whose core function is to provide support to rural customers. The main aim of the support service is to educate rural communities about water services and related health issues, with a view to building their capacity to efficiently manage and take ownership of their water supply schemes.

3.2 Expanding the system through scheme transfers

The Department of Water Affairs and Forestry is currently engaged in the process of transferring water schemes (including infrastructure and personnel) to various water services authorities and service providers throughout the country. As such, LNW has recently taken over some of the DWAF schemes in the Northern Province (e.g. Nkowankowa scheme, Arabie scheme). This has led to a rapidly increasing number of - mostly poor - consumers in the area of supply, and associated operation and maintenance costs for LNW. Under a situation such as this, long-term financial modelling is important for assessing the financial viability of LNW in a situation of rapid expansion.

4 DEMAND FOR WATER

4.1 Provincial overview

The province is divided into 6 sub-districts (Northern, Western, Central, Bosveld, Lowveld, and Southern), having a combined population estimated at 7 060 000 (DWAF) with an annual growth of 3.5%. Most of the area is rural, with the former homelands of Venda, Gazankulu and Lebowa incorporated into the province. Urban population is primarily concentrated in and around the towns of Pietersburg, Tzaneen, Phalaborwa and Potgietersrus. (Louis Trichard and Messina are not served by LNW currently).

The Northern Province has limited ground water resources, and thus rely primarily on relatively expensive surface water resources to provide for present and projected water demand.

4.2 LNW demand zones

Demand zones served by LNW can be divided into four categories as shown in Table 1:

Table 1: Demand zones within area of supply

Urban bulk – TLCs of:	Rural bulk – TLCs of:	Retail – some non-residential consumers in:	No technical supply: part of the following rural TLCs
Phalaborwa	Mankweng	Phalaborwa	Mankweng
Pietersburg	Haenertsburg	Rural areas	Haenertsburg
Potgietersrus	Hlogotlou		Hlogotlou
Duiwelskloof	Nebo North		Nebo North
Lebowakgomo	Mid Lepelle		Mid Lepelle
Gr Letaba	Ngwaritsi		Ngwaritsi
	Letsitele/Grav		Letsitele/Gravelotte
	Bolobedu		Bolobedu
	Lebowakgomo		Lebowakgomo
	Moletje/Matlala		Moletje/Matlala

The current boundary of the supply areas can be reasonably accurately defined by the boundary limits of the rural TLCs listed in the table. However, it needs to be recognised that LNW only provides a portion of consumers in each of these TLCs with bulk water. Those areas which it does not supply with water are covered under the category: ‘no technical supply’. Further, certain of the urban TLCs supply part of their own bulk water requirements.

4.3 Urban demand zones

These zones are characterised by a core of high–income residential areas with peripheral low-to middle-income areas. With the exception of Phalaborwa, where LNW supplies some large retail consumers directly, the service to urban areas is limited to bulk supply of potable water. The TLCs themselves undertake the retail service. Six demand zones have been identified in this category (Phalaborwa, Pietersburg, Potgietersrus, Duiwelskloof, Haenertsburg, and Greater Letaba). These include the main cities of the Northern Province, save for the urban areas in the Northern Sub-District.

The total population for these zones is estimated at 580 000 which are grouped into 115 000 customer units. The number of customers in this category and the level of service they receive are presented in the table below.

Table 2: Number of urban customer units in each service level category

Service Level	# Customers	Percentage
None/inadequate	33 700	29%
Communal standpipes	19 700	17%
Yard taps	2 900	3%
In-house	58 800	51%
Total	115 100	100%

It is evident that there are still a relatively large number (30%) of customers who are unserved. This represents a future additional demand for bulk water.

4.4 Rural demand zones

Water supply in the rural areas has primarily been the responsibility of DWAF since 1994. However, LNW has recently taken over some of this responsibility as a bulk water services provider. Under this arrangement, LNW sells bulk water to rural communities and the respective water committees are responsible for distributing water to village customers. The total population in the demand zones identified is estimated at 2 040 000 spread across ten rural TLCs. The population is aggregated into 314 000 customer units which are essentially the same as households (see Table 3 below).

Table 3: Number of rural customers in each service level category

Service Level	# Customers	Percentage
None/inadequate	202 000	65%
Communal standpipes	64 000	20%
Yard taps		0%
In-house	47 000	15%
Total	313 000	100%

These figures are based on very rough estimates. However they are sufficient to indicate the great challenge facing the water services sector in the area, where 65% of people do not have adequate services. It is notable that the figures in the table relate to retail services. In many places the bulk water supply service is in place but there is little or no distribution infrastructure in place to deliver the water to individual customers.

4.5 Retail services

LNW's activity in the retailing of water is very limited, but some non-residential customers (institutions, commercial and industrial customers) do get their water supply directly from LNW. The largest retail customers are the mines and other major industries in Phalaborwa. A large proportion of this water is supplied untreated by LNW.

4.6 Support services

Support services to rural customers can be divided into categories:

- *Support to areas with technical supply*: in this case it is assumed that the community is either in the process of being provided with water through a project, or they already have water supply infrastructure. Typically the level of support is at its fullest during project planning and implementation.
- *Support to areas with no technical supply:* where communities do not have an adequate supply or have one which is based on a local source, they are typically 'left to their own devices'. However, it is becoming increasingly important for support to be provided to these communities, to help them plan improvements to their services and manage what services there are properly.

In the case of LNW most of the support is in the first category. Support services provided to the rural communities include setting up of village water committees and steering committees, and educating these committees on financing, managing, and operating water services. In most cases, LNW personnel assume a supervisory role as social consultants have been appointed.

4.7 Level of services

The following table describes the level of services used in the model.

Table 4: Different levels of services used in the model

Category/service level	**Description**
None/inadequate	No service; unreliable supply; >200m from homestead; <25 *l*/c-d
Communal standpipes	A reliable supply of clean drinking water within 200 m of the homestead
Yard tanks	Piped water supply to tank on site, filled periodically (e.g. once per day)
Yard taps (on-site sanitation)	Piped water supply to tap on site, coupled with on-site sanitation
Yard taps (w/borne sanitation)	Piped water supply to tap on site, coupled with waterborne sanitation
In-house	Piped water supply to house with multiple taps, waterborne sanitation
In-house, low income	Consumption typically in the region of 18 – 24 *kl* per month
In-house, middle income	Consumption typically in the region of 20 – 30 *kl* per month
In-house, high income	Consumption typically exceeds 30 *kl* per month

Because of lack of information from the various TLCs on the level of services, the figures used are based on national estimates and general knowledge of the area.

Currently, it is estimated that more than 50% of the combined urban and rural population have an inadequate supply of water. Communal standpipes serve about 20% of the total rural population and 17% of the urban population. Urban areas have a small number of customers with yard taps. Some of these may be illegal connections but many have been provided under the site and service schemes. Also, in urban areas a substantial number of customers have in-house services with monthly consumption typically in the range between 18 *kl* (low income) to over 30 *kl* (high income).

4.8 Current demand for water

The following figures represent the amount of bulk water supplied to both rural and urban areas served by LNW presented over a ten-year period. The net consumption is derived by subtracting the volume supplied by its own sources from the total domestic and non-domestic consumption.

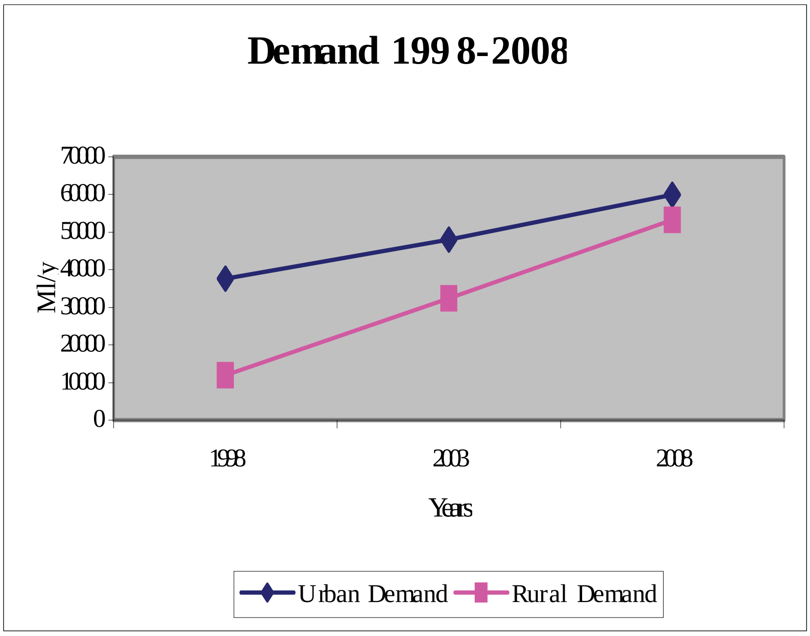

Figure 1: Urban and rural water demand: 1998 - 2008

The graph shows the high projected growth in demand, particularly in rural areas where the potential for demand to increase by a factor of 5 (i.e. 500%) over 10 years is indicated. The urban demand increase is estimated at 25% for a five-year period.

5 WATER SUPPLY SCHEMES

5.1 Schemes and their capacity

Nine schemes operated by LNW have been identified. These include some of the schemes that have been recently transferred by DWAF to LNW.

Table 5: LNW schemes and their capacity

Name of the Scheme	Current Production (m3/d)	Area Served by the Scheme
Phalaborwa	42.5	Phalaborwa
Ebenezer	35.0	Pietersburg, Mankweng, Haenertsburg
Olifantspoort	35.0	Pietersburg, Lebowakgomo, Moletje/Matlala
Doorndraai	12.6	Potgietersrust
Politsi	4.5	Duiwelskloof, Greater Letaba
Nkowankowa	24.0	Greater Letaba, Letsitele
Arabie	20.0	Hlogotlou, Nebo North, Mid. Lepelle
Vergelegen	10.0	Ngwaritsi
Modjadji	10.0	Bolobedu

Note: Figures are rough estimates in some cases.

LNW purifies a total of 57 000 M*l*/y, 50 000 of which is sold to domestic customers and 7 000 sold to non-domestic customers (institutional, commercial, and industrial sectors). In addition, 37 800 M*l*/y of untreated water is sold directly to mines from the Phalaborwa scheme.

5.2 Matching supply with demand

There is a shortage of water in the areas served by LNW. This is indicated graphically in Figure 2. The graph shows a demand that is barely met by the supply in the first 5-year period and substantial increases in the capacity of schemes serving the area are needed. It should be noted that the increase in demand is based on the assumption that sufficient funding is available to provide the distribution infrastructure to connect consumers and that there is sufficient capacity to manage the retail services.

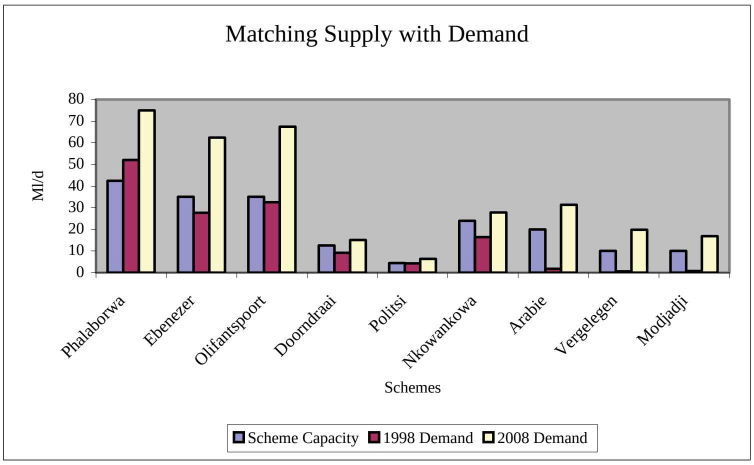

Figure 2: Matching Supply with Demand

5.3 Proposed expansion of service

Demand for bulk water from LNW will increase with increased retail sales, largely to new customers, and increased transfer of schemes from DWAF. This increase is influenced by the levels of service to be offered and certain assumptions have been made in this regard in the model. In rural areas a mix of communal standpipes with yard connections is assumed. In urban areas, respective TLCs have resolved (in line with their water services development plans) that all new residential customers will have at least yard taps with waterborne sanitation as a minimum service level.

To ensure that existing customers' water supply is improved, LNW intends upgrading service levels in its existing supply areas. However, due to the extent to which settlements are scattered, it will not be feasible to provide water for all at the current RDP levels. A small proportion of the population will remain with inadequate water supply. It is assumed that in 10 years' time less than 25% of the total population served by LNW will have inadequate water supply. The rest will be upgraded to at least have access to a communal standpipe of 'RDP standard' (within 250 meters of the dwelling).

5.4 Expansion of area of supply

LNW is gradually expanding its services to other areas. This is evident by the number of schemes transferred by DWAF to LNW. The expansion of services includes both technical water supply and support services. LNW's increased activity can be noticed in the Northern Sub-District where a number of schemes are being taken over and more support given to the customers. To cater for the increase in support services, LNW intended increasing its Community Development personnel by at least two people by mid-year.

6 COSTS

6.1 Capital costs of bulk infrastructure

To ascertain capital costs, the model uses defaults which are based on national estimates. These should be replaced by local figures, where possible, as the use of national averages can give seriously misleading results. However, with regard to this case study it was not possible to get accurate information on capital costs. So generally it has been necessary to rely on defaults in the model.

The following table presents the capital infrastructure investment needed between 1998 and 2003 in order to meet the projected demand for water (cost = R'000 real). From the table below it is evident that for LNW to meet its current demand (1998) there has to be major investment in urban bulk infrastructure.

Table 6: Estimated capital expenditure for 1998 – 2008 (Rm –1998 prices)

	1999-2003	2004-2008	Total
Urban bulk	85	129	214
Rural bulk	157	570	727
Asset replacement and other	27	49	76
Total	**269**	**748**	**1017**

A total capex requirement of the order of *one billion Rand* over the next 10 years is indicated. This high figure results from a combination of a large number of new customers to be provided for and the high unit cost of bulk infrastructure in the region.

It should be noted that these figures are based on the assumption that LNW does not expand its supply areas to new TLC areas.

6.2 Operating costs

Operating costs are calculated per scheme for both existing capacity and new capacity (after scheme expansion). The current operating costs for each scheme are presented in the following table. Costs range from a low of 38c/k*l* in Phalaborwa to a high of 278c/k*l* in Arabie.

Table 7: Direct operating costs per scheme

Scheme	Costs (c/kl)	
	Existing Capacity	New Capacity
Phalaborwa	38	42
Politsi	71	78
Ebenezer	82	90
Doorndraai	142	156
Olifantspoort	45	50
Arabie	253	278
Nkowankowa	83	91
Modjadji	73	80
Vergelegen	73	80

As part of this case study it has not been possible to give an assessment of operating costs. Therefore the current figures have been used in the analysis. With regard to the schemes which LNW have been operating for a long time, the figures are likely to be relatively good. However, for those which they have recently taken over, the figures must be considered to be very rough estimates and, in many cases, appear to be too low.

7 FINANCIAL RESULTS

7.1 Income and expenditure

Table 8 below summarises the modelled results for income and expenditure for LNW over the 10-year period used in the modelling.

Table 8: Income and expenditure trends 1998 – 2008 (R'000s)

Description	1998	2003	2008
INCOME			
- Bulk sales to urban TLCs	57 300	78 000	101 600
- Bulk sales to rural areas	20 300	67 100	115 500
- Retail sales	200	200	200
- Total sales	77 800	145 300	217 300
- Income from transfers from DWAF and LG	17 100	17 100	17 100
Total	**94 900**	**162 400**	**234 400**
EXPENDITURE			
- Direct costs of bulk and retail supply	32 300	62 600	94 000
- Direct costs of support function	5 100	5 400	4 700
- Administration and head office costs	7 500	9 600	12 200
- Provision for non-payment	4 500	9 300	14 300
- Interest and redemption on existing debt	44 000	29 000	14 000
- Interest and redemption on new loans	0	18 200	84 800
Total	**93 400**	**134 100**	**224 000**
NET INCOME	**1 500**	**28 400**	**10 700**

The indication is that both income and expenditure will need to increase by 240% over the next 10 years if LNW is to meet the requirements of providing bulk water to the currently identified demand zones. This is an enormous challenge.

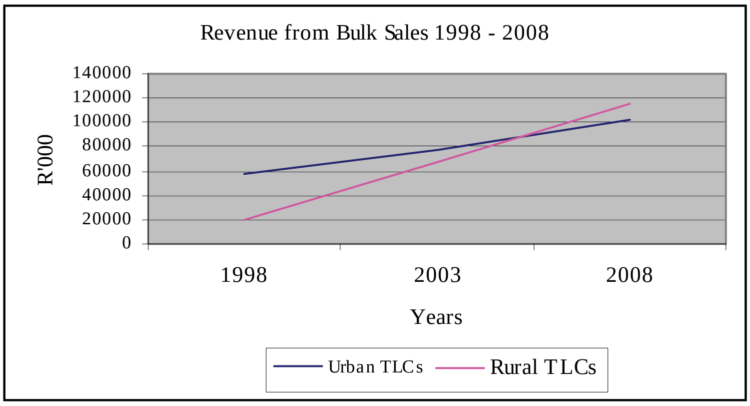

Figure 3: Net revenue from urban and rural bulk services

7.2 Tariffs

Tariff levels have been estimated using the model in order to generate sufficient income to cover expenses over the modelling period. The results are shown in the table below.

Table 9: Tariffs for bulk water per scheme (real terms – 1998 prices)

Scheme	Tariff					
	Current Capacity			Expanded Capacity		
	1998	2003	2008	1998	2003	2008
Phalaborwa	97	101	101	101	105	105
Politsi	126	131	131	133	138	138
Ebenezer	174	181	181	182	190	190
Doondraai	162	169	169	176	183	183
Olifantspoort	284	295	295	289	300	300
Arabie	286	298	298	311	324	324
Nkowankowa	102	106	106	110	115	115
Modjadji	102	106	106	109	114	114
Vergelegen	150	156	156	157	164	164

It is indicated that the current tariff levels are reasonable and that increases, in real terms, do not need to be large. However, it should be noted that this is based on some very broad assumptions regarding both operating and capital expenditure required.

7.3 Capital finance

Based on the rough estimates made for this case study, LNW will have to raise in the order of R1 000 million in capital over the next 10 years in order to meet the requirements of providing bulk water to those in the presently identified demand zones. Of this it has been estimated that R139 million will come from capital grants from government. Approximately R160 million can be financed from retained income but the balance (approximately R700 million) needs to be borrowed. The feasibility of the bulk water supply arrangements in the LNW supply area thus depends on the credit-worthiness of LNW as a large borrower. There are concerns in this regard.

8 CONCLUSIONS

The case study carried out for LNW has been undertaken primarily to show the workability of the RWSSM model. However, it has also provided an indication of the factors which influence the viability of the water board. In this regard it is notable that this viability is dependent on three major factors:

- The ability of LNW to effectively manage a 240% expansion of its operations over the next 10 years.
- The ability of the board to raise loans totalling of the order of R 700 million over this period.
- The ability of the retail water services providers to which it sells bulk water to expand their distribution systems.
- The ability of these retail water services providers to pay for this service.

Each of these factors is dealt with in the main report from this project.

WATER RESEARCH COMMISSION

ANNEXURE B

A Case Study of Bloem Water

August 1999

PALMER DEVELOPMENT GROUP

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1 INTRODUCTION TO BLOEM WATER

Bloem Water was established in 1990 and operates in the southern part of the Free State province with its activities concentrated in the Bloemfontein – Botshabelo – Thaba'Nchu area. The area of supply can be characterised as mainly urban with a few small towns and some rural villages in the former Thaba'Nchu district which was part of the ex-homeland of Bophuthatswana. A total of 154 000 residential customer units are supplied by the water board - 4% of which are in rural areas. Most of the bulk water is supplied from the Welbedacht scheme which draws water from the Caledon River.

2 CASE STUDY LIMITATIONS

As mentioned in the main report, the approach to undertaking this case study was constrained by the relatively small budget allocated to this part of the model development project. Provision was made for two visits to the area by the researchers to gather data and engage with the staff of the water boards and other authorities. Only data which was easily accessible could be used and no primary data gathering was possible. This represented a major shortcoming, particularly for the rural areas where there was inadequate information.

The staff of the water boards were co-operative in making information they had access to available to the research team. However it was not possible to engage them in the process of running the models. Neither has it been possible for the model results to be discussed with them and adjusted based on their views.

Due to these limitations, the model results cannot be used for actual planning decisions. The case studies serve primarily to demonstrate that the model is usable. They also serve to identify key factors which influence the viability of regional water supply services providers (RWSSPs).

3 SUPPLY ARRANGEMENTS

3.1 Service types

Bloem Water's service arrangements can be separated into three service types: bulk supply, retail supply and support services provision, as described below:

Bulk Supply
Bloem Water supplies bulk water to urban and rural TLCs. In urban areas bulk water is sold to the municipalities who are then responsible for retailing it to local consumers. In rural areas there is little water services provider capacity and local community structures need to be relied upon.

Retail Supply
Bloem Water retails water to residential consumers mainly in the Greater Thaba'Nchu area. It also serves certain large industries directly. A total of 14 600 residential customers are supplied through this arrangement.

Support Services
Bloem Water does not have an extensive support service. However, 9 steering committees have been established in the supply areas. Their main objective is empowering communities with regards to water related issues. These committees are also responsible for ensuring community involvement during planning and execution of various stages of water supply projects.

3.2 Scheme transfers

The Thaba'Nchu area was transferred by DWAF to Bloem Water and has now been successfully integrated. Boreholes in the rural areas are being maintained by Bloem Water, and a program had been worked out to handing them over to the TRC.

4 DEMAND FOR WATER

4.1 Provincial overview

The Free State has a population estimated at 2.8 million (6.9% of South Africa's 1995 total population). Population growth since 1980 has been generally lower than the average for South Africa, estimated at 1.6 %. In 1991, the Free State was the fourth most urbanised province with 54% of the total population living in urban areas.

The province is divided into four district council areas: Northern Free State, Eastern Free State, Goldfields, and Bloem Area. Bloem area contains the Bloemfontein-Botshabelo-Thaba'Nchu complex (with 31% of the province's total population) and is the most urbanised region. Bloemfontein is the largest single municipal area in the province.

4.2 Bloem Water's demand profile

Demand for water in the Bloem Water's area of supply has been divided into four categories as shown in the table below.

Table 1: Bloem Water's area of supply

Urban TLC	**Rural bulk**	**Retail**	**Support**
Bloemfontein	Villages	Greater Thaba'Nchu	Villages
Botshabelo			
Wepener			
Bethulie/Springfontein/Trompsburg			
Dewetsdorp/Reddersburg/Edenburg			
Philippolis			
Gariep			

4.3 Urban demand zones

In the urban areas, Bloem Water supplies bulk potable water to urban TLCs who retail consumers. This category comprises seven areas: Bloemfontein, Botshabelo, Wepener, Philippolis, Gariep, Bethulie/Springfontein/Trompsburg, and Dewetsdorp/Reddersburg/Edenburg. The following table shows the total urban bulk customers for the area served by Bloem Water, according to service levels provided.

Table 2: Number of urban customers in each service level category

Service Level	No of retail Customers
None/inadequate	6 500
Communal standpipes	33 200
Yard taps	20 800
In-house	71 800
Total	**132 300**

4.4 Rural demand zones

DWAF and the ex-Bophuthatswana Government have been responsible for provision of water in the rural areas. Bloem Water has recently taken over the responsibility of supplying water to rural areas in the southern Free State. There are an estimated 6 900 customers in this category (see table below) served mainly by Bloem Water.

Table 3: Number of rural customers by service level category

Service Level	No of Customers
None/inadequate	700
Communal standpipes	4 100
Yard taps	1 400
In-house	600
Total	**6 800**

4.5 Retail services

Bloem Water is retailing water to Greater Thaba'Nchu which comprises the CBD and surrounding residential areas. A programme aiming at providing metered on-site water services was initiated in 1997. Negotiations are also under way with a view to the Greater Thaba'Nchu municipality taking over reticulation responsibilities. The total number of customer in this category is estimated at 14 600 residential and non-residential customers. Residential customers in each service category are shown in the following table.

Table 4: Number of retail customers by service level category

Service Level	No of Customers
None/inadequate	700
Communal standpipes	2 200
Yard taps	0
In-house	11 700
Total	**14 600**

4.6 Level of services

About 5% of Bloem Water's customers have inadequate water supply. This shows a high level of supply compared to LNW where more than 50% of total customers have an inadequate service. This high level of service is associated with the largely urban character of the area but, to some extent, can also be attributed to the high level of illegal connections in the area – especially in Bloemfontein (PDG, 1996).

In total 25% of customers have communal standpipe service, while 14% have yard taps with waterborne sanitation, and 54% with in-house water supply. In an analysis of infrastructure programs involving different levels of service, Bloem Water concluded that the minimum acceptable level of service in the area is the yard tap (PDG, 1996).

4.7 Current demand for water

Demand for purified water in this area is estimated at 50 000m^3/yr with approximately 54% sold to residential households. Almost 80% of the total water sold by Bloem water is used in Bloemfontein. Botshabelo has some water-intensive industries (brewery and textile), with the result that there is a relatively high non-residential consumption. However, water users in the remaining areas supplied by Bloem Water are largely residential.

Current consumption and projected growth are shown in the graph below. The graph reflects the urban consumption pattern mentioned above. The graph also reflects a relatively flat growth pattern which is consistent with the finding that retail customers in the supply area of Bloem Water already have a relatively high level of service.

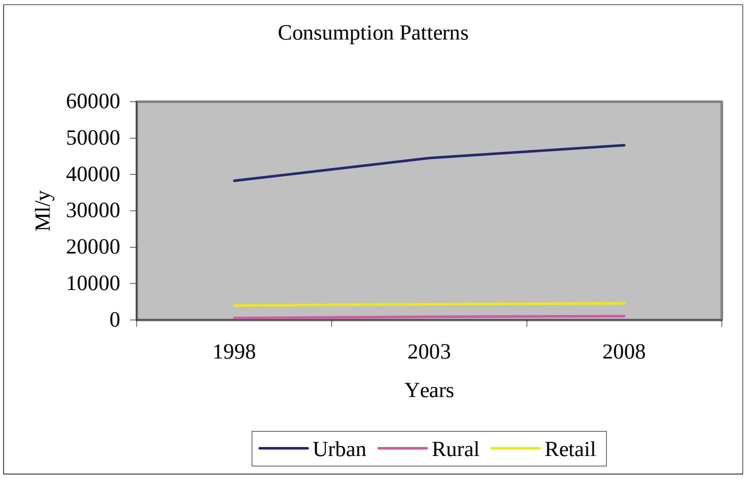

Figure 1: Consumption Patterns over 10 years

5 WATER SUPPLY SCHEMES

There are six schemes operated by Bloem Water with a total capacity of 60 412 M*l*/a.

Table 5: Schemes operated by Bloem Water

Name of the Scheme	**Current Production (m^3/d)**	**Area Served by the Scheme**
Welgedacht	140	Bloemfontein, Botshabelo, Wepener, Dewetsdorp/Reddersburg/Edenburg,
Rusfontein	10	Botshabelo, Rural Villages
Groothoek	16	Greater Thaba'Nchu, Villages
Bethulie	4	Bethulie/Springfontein/Trompsburg
Gariep	2.5	Gariep
Philippolis	2.0	Philippolis

Bloem Water purifies a total of approximately 60 000 M*l*/a, 71% of which is sold to urban TLCs and only 0.3% to rural areas. Five percent is sold directly to customers in Greater Thaba'Nchu. The balance (22%) is unaccounted for (UAW).

5.1 Matching supply with demand

As shown in the graph below, Bloem Water has a relatively good supply of water, enough to meet the daily demand of its customers. The Rusfontein scheme has limited capacity; however, water is augmented from the Knellpoort Dam via the Novo Pump Station. Welgedacht is by far the biggest scheme operated by Bloem Water, and it supplies 78% of the total demand. The graph shows a steady increase in water demand over time; however, the figures from the rough analysis done for this study show there is sufficient supply to meet the projected 10-year demand.

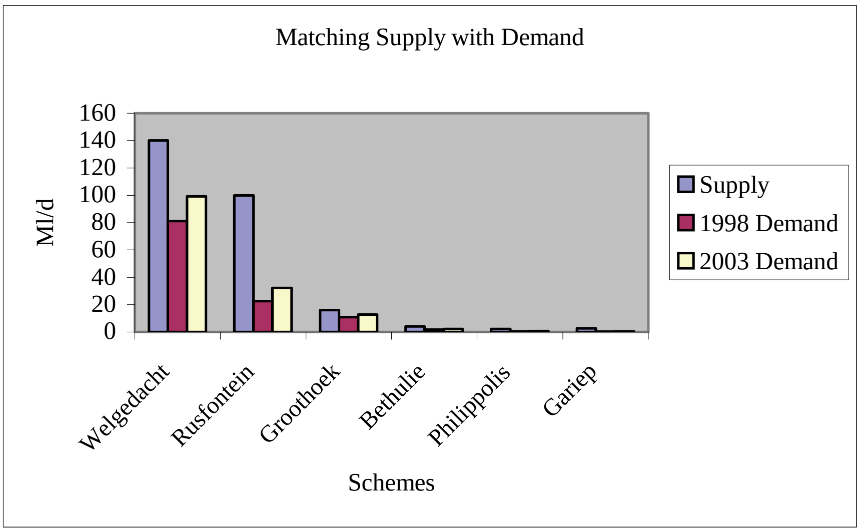

Figure 2: Matching Supply with Demand

5.2 Proposed expansion of service

Bloem Water currently provides water services to three regions: Caledon River, Modder River, and Orange River regions. The area of supply is likely to increase to include all the small towns and rural villages within these regions. Bloem Water's new customers are ensured of adequate water supply as the schemes have sufficient capacity to meet current and projected demand. The minimum service level provided will be communal stand-pipes in rural areas and yard taps in the urban areas.

6 COSTS

6.1 Capital costs

As part of this case study it has not been possible to obtain accurate estimates of the capital cost of required expansions. Therefore default values in the model, which are based on national averages, have been used to ascertain costs.

6.1.1 Bulk infrastructure

Because demand in Bloem Water's supply area is adequately met by the available supply, it is not necessary to upgrade any of the schemes in the short term. However, if the supply area increases and consumption increases, infrastructure investment may be necessary.

6.1.2 Retail infrastructure

To provide adequate service for new and existing customers in the Greater Thaba'Nchu area where Bloem Water provides retail services, investment in infrastructure is necessary. The following table shows how much capital investment is needed to adequately address the demand for retail services:

Table 6: Capital costs for retail infrastructure (Rands at 1998 prices)

	1998	**2003**	**2008**
New Customers	0	533 000	446 000
Upgrades	0	249 000	0
Total	**0**	**782 000**	**446 000**

6.2 Operating costs

Operating costs calculated per scheme for the existing capacity are shown in the table below. It is estimated that these costs would increase by 2% per annum. The bigger schemes (Welgedacht, Groothoek, and Rusfontein) have much lower operating costs than the smaller schemes (Gariep, Bethulie, and Philippolis).

Table 7: Direct operating costs per scheme

Scheme	**Costs (c/k*l*)**
Welgedacht	55
Rusfontein	68
Groothoek	54
Bethulie	277
Philippolis	277
Gariep	277

7 FINANCIAL RESULTS

7.1 Income and expenditure

Table 8 below summarises the modelled results for income and expenditure for Bloem Water over the 10 year period used in the modelling.

Table 8: Income and expenditure trends 1998 – 2008 (R'000s)

Description	1998	2003	2008
INCOME			
- Bulk sales to urban TLCs	44000	63000	75000
- Bulk sales to rural areas	700	800	900
- Retail sales	7000	9600	11000
- Total sales	51700	73400	86900
- Investment income	12000	12000	12000
- Income from transfers from DWAF and LG	7700	0	0
Total	**71400**	**85400**	**98900**
EXPENDITURE			
- Direct costs of bulk and retail supply	29000	31000	33000
- Direct costs of support function	1600	1400	1400
- Administration and head office costs	5400	6500	6500
- Catchment management charges	1300	1600	1700
- Provision for non-payment	2300	3300	3800
- Interest and redemption	28000	28000	28000
Total	**67600**	**71800**	**74400**
NET INCOME	**3800**	**13600**	**24500**

These results indicate that only a modest increase in expenditure is projected (10% over the next 10 years) and that revenue can easily match this. However, it needs to be recognised that these figures are based on rough estimates only in as far as there has been the time available for this case study.

Revenue trends are shown in the following figure.

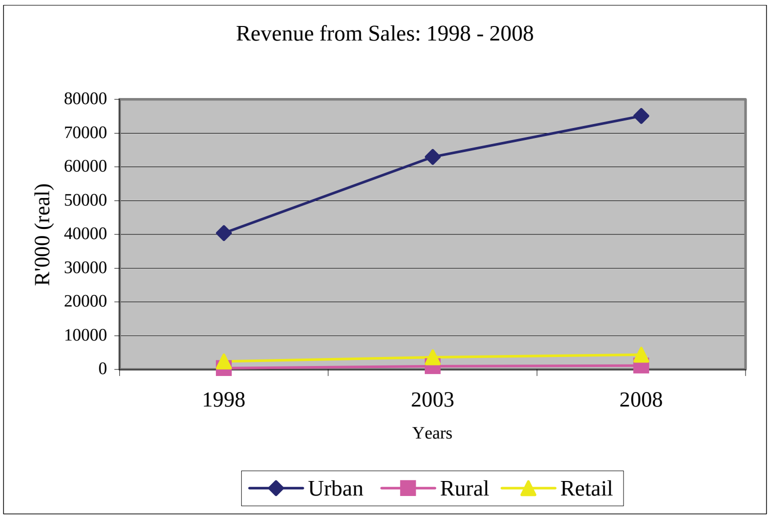

Figure 3: Revenue from Sales

7.2 Tariffs

The following table shows trends in tariff increase over the ten-year period. It is notable that the larger schemes, Welgedacht, Rusfontein, and Bethulie have higher tariffs compared to the smaller schemes. Increases in tariffs with time, in real terms, have been provided for and do not appear to be unrealistic.

Table 9: Tariff increase over the ten-year period

Scheme	1998	2003	2008
Welgedacht	1.06	1.42	1.57
Rusfontein	1.06	1.42	1.57
Bethulie	1.06	1.42	1.57
Philippolis	0.67	0.90	0.99
Gariep	0.67	0.90	0.99

8 CONCLUSIONS

The case study carried out for Bloem Water has been undertaken primarily to show the workability of the RWSSM model. However, it has also provided an indication of the factors which influence the viability of the water board. In this regard it is evident that Bloem Water is not faced with serious threats to its viability. This relates to the fact that it has a relatively strong urban base, relatively good current service level coverage and has not had to face rapid expansion of its supply area.

The factors which are considered to influence the viability of the board are dealt with in more detail in the main body of the report.

9 REFERENCE

Palmer Development Group (1996). Bloemfontein – Botshabelo – Thaba'Nchu, Economic Infrastructure Plan. Free State Strategic Unit.

MANUAL FOR THE REGIONAL WATER SUPPLY SERVICES MODEL

NOTE

Please note that this report is supported by a software called 'Regional Water Supply Services Model' (RWSSM) and is available for download from the WRC website http:\\www.wrc.org.za\software.

PREFACE

Model origin

Since 1994, an expanding suite of financial planning models has been developed for use in the water services sector. These models include a Water Supply Services Model (WSSM) and a Sanitation Services Model (SSM) which are aimed at water services, and the Combined Services Model (CSM) which integrates water, sanitation, electricity, roads and solid waste services. All three models are targeted at local authorities.

This model, the Regional Water Supply Services Model (RWSSM) complements the existing models, insofar as it is intended primarily for regional-scale water services providers, such as water boards and district/regional councils. It thus fills a large gap in the previous suite of models, particularly since many regional water agencies have limited capacity to carry out sound financial planning. The model has been developed with the support of the Water Research Commission (WRC).

The format and structure of the RWSSM is similar to the WSSM and SSM models referred to above.

This manual

This manual is intended to provide an understanding of and facilitate the use of the Regional Water Supply Services Model. It describes the philosophy behind the model, outlines its aims, lists key assumptions, describes the structure and data inputs required, and explains the model results. The manual is intended to provide detailed guidance to users of the model and to help them achieve a sufficient level of competence to utilise the model.

Separate manuals describing the Water Supply Services Model and the Sanitation Services Model, are available from the Water Research Commission.

ACKNOWLEDGMENTS

The *Water Research Commission* (WRC) provided funding for the development of the Regional Water Supply Services Model (RWSSM), and for the earlier Water Supply Services Model and the Sanitation Services Model, all of which were developed by Palmer Development Group. The RWSSM has built on these earlier models and draws directly from the intellectual capital accumulated in their design and use. Some components of the WSSM have been used directly, with modifications, in the RWSSM and so the work of Bee Thompson in developing the earlier models must be acknowledged and thanks are due to her for the foundation work she undertook. Likewise, Ian Palmer contributed materially to the development of the RWSSM, while Clive van Horen had primary responsibility for developing the model.

Bloem Water and *Lepelle Northern Water* agreed to participate in the project and offered themselves as case studies, through the provision of data, comments and input through the Project Steering Committee. Thanks are due, in particular, to Okkie Stadler and Johan de Klerk of Bloem Water and to Wessel Vermeulen and Wynand van Tonder of Lepelle Northern Water.

Thanks are due also to the members of the WRC Steering Committee who contributed their time and insights to the project.

CONTENTS

INTRODUCTION

Background

The provision of water supply services to urban and rural communities is one of the most important objectives of the Government's infrastructure development programme. Responsibility for providing these services rests not only with local authorities, but also with water boards and district councils.[1] To-date, relatively little research and policy attention has been given to water agencies, which operate at a regional scale and perform a range of diverse functions in diverse settlements. In recent years water boards have, for instance, taken on additional functions over and above their traditional focus on bulk water supply, including direct retail supply in rural and peri-urban areas, construction of new rural water supply schemes, and provision of mentoring and support to rural water services providers. Moreover, water boards and district councils generally cover a wide geographical area containing a number of towns and rural settlement areas.

Medium-term financial planning is a key element of sound business practice for water boards and district councils. Financial planning in this context is complex, yet vital for the financial sustainability of these agencies. Whereas financial planning tools have been developed for use by urban local authorities supplying water and sanitation services, this has not been the case, until now, for regional water supply service providers. This document describes a financial planning tool which has been developed for exactly this purpose, the Regional Water Supply Services Model (RWSSM).

The Water Services Act

The Water Services Act No. 108 of 1997 (RSA 1997a) contains a number of specific requirements for water boards. In particular, they are now required to prepare business plans on an annual basis. This provision is similar to the Act's requirement for water services authorities to prepare water services development plans (WSDP).

Section 40 of the Act stipulates that all water boards and District Councils must prepare a business plan which must be adopted not more than one month after the end of each financial year, relating to the following five financial years. The Act specifically requires that the business plan contains information regarding at least the following items (sec 40 (2)):

a) "each specific primary and other activity to be undertaken and the performance targets for each;

b) the tariff applicable to each service, the method by which it was determined, the motivation for the tariff and the estimated tariff income;

c) forecasts of capital expenditure for the primary and other activities for the next five years;

d) *any other information the Minister may prescribe from time to time."*

The business plan is required to be submitted to the Minister. Section 40 (3) of the Act allows water boards to exclude commercially sensitive information from their business plans, provided they obtain the Minister's approval.

[1] The term 'district council' is not used in all provinces, for example, KwaZulu Natal has 'regional councils' - the difference is semantic only.

Purpose of the RSWSSM

In addition to acting as a financial planning tool for ongoing use by water boards and regional water agencies, a central objective of the RWSSM is to provide the financial inputs into the business planning exercise. The key variables in the model include the tariffs to be charged over the next 10 years (that is, 5 years beyond the period stipulated in the Water Services Act). Outputs include detailed financial statements containing all the aggregate financial information which could be required for business planning purposes. In addition, the model projects capital expenditure over the 10-year planning period.

Objectives of the Regional Water Supply Services Model

The broad aim of the model described in this report is to assist regional water agencies such as water boards and district councils to undertake the necessary investment planning and tariff analysis inherent in their business planning exercises, as described above. More specifically, its purposes are:

- To provide a practical strategic planning tool for parties involved in (or with a stake in) investment planning and tariff determination for water supply services at a regional scale.
- To undertake financial viability analyses of existing and new operations for regions containing a mixture of settlement types and water service provision arrangements. In particular, the model aims to assess the financial impacts on a regional water agency of expanding its role beyond traditional core activities (bulk water supply) to include retail water supply (normally in rural areas) or the provision of support and mentoring services to rural water services providers.
- To allow for testing the sensitivities of the financial position of regional water agencies to changes in input parameters.
- To guide decision-makers in the development of policy and service delivery and management strategies which will facilitate accelerated and sustainable provision of water services to all residents.

The model is intended to allow for inclusion of a number of urban and rural settlements in the organisation's supply area, and for the range of bulk, distribution and support activities to various demand zones.

Scope

The model has been developed for application at a regional scale, typically incorporating more than one urban area within a larger rural area. Target users include water boards - either as a whole, or operating divisions defined on geographical or functional bases - and district (regional) councils which carry the responsibility for water service provision. The model includes provision for up to 30 separate 'Demand Zones', falling into four broad categories:

- Urban local authorities which purchase water in bulk from the regional water agency.
- Rural local authorities or water services providers, also purchasing bulk water.
- Areas - normally rural - in which the agency undertakes retail water supply itself.
- Areas - also usually rural - in which the agency does not supply water, but provides support and mentorship services to other water services providers.

As noted earlier, other models are available for more detailed analysis of water services to urban areas, namely WSSM and SSM , available from the WRC.

BASIC METHODOLOGY

The user of the model would generally undertake the following steps:

1. Estimate current and future consumption

The model user must begin by developing a thorough understanding of current and possible future water consumption. This requires information regarding the zones in which water demand is the responsibility of the utility, the number of consumers in each area, their current and target levels of service, the demographic profile of those areas, existing service coverage, consumption growth and the macro water balance.

2. Enter information on supply capacity

Having built up a picture of the demand side, the user must provide information about the supply side, namely, the number and names of schemes, their capacities and cost build-ups. Once this has been collected, the supply and demand sides are matched, and the model generates a default capital expansion programme, based on calculated supply shortfalls and default capital costs.

Once these data have been collected and input into the model, it can be used very quickly and efficiently for planning and analysis. It is also possible (and desirable) to refine and improve the inputs as they become available.

3. Enter financial and other data

The model user then enters information about operating expenditure, capital and operating subsidies, the starting balance sheet, tariffs and non-payment levels.

In addition to the above inputs, all of which are compulsory, the user has the option of over-riding default assumptions and using more accurate estimates suited to his/her circumstances.

4. Assess outputs

The key outputs provided by the model are as follows (in each case for 10 years):

- annual financial statements;
- consumption levels by consumer group;
- bulk and retail water costs and tariffs;
- capital expenditure levels and related items.

These outputs need to be assessed in terms of the financial viability of the agency over the 10-year period, the physical feasibility of the investment programme proposed, the affordability of the tariff levels proposed, and the political acceptability of the service goals and required tariffs/tariff increases to maintain or achieve financial viability.

5. Undertake a sensitivity analysis

The model user may then make adjustments to inputs to determine sensitivities of key model outcomes to those parameters.

6. Update and refine the analysis

As new or more accurate data becomes available, the analysis can be further refined. Updating the model at regular intervals (such as every year or two) is also recommended for ongoing monitoring and planning.

MODEL FEATURES

The key focus of the model is on the financial viability and sustainability of the regional water supply service provider. It allows the user to investigate the implications of alternative input variables on key financial indicators, in an iterative manner. In addition, the model has the following main features.

Policy neutrality

The model is policy neutral, insofar as it does not impose any policy choices on the user, but provides the flexibility to test the implications of alternative policy choices on the financial viability and sustainability of water services.

Many service options and flexible timing

The investment programme allows for the provision of eight different types of water supply service for residential consumers, and three kinds of non-residential consumers. Service upgrading programmes can take place over a period of one to ten years, and there is flexibility in terms of both service options and timing of upgrades.

Multiple supply schemes and demand zones

An important feature of the model is that it allows for a number of different demand zones to be matched with a range of supply sources, including matches which are not on a simple one-to-one basis. This makes the model applicable to the typical water board or district council operation where there are a number of towns and rural areas with multiple supply schemes.

Diverse business activities

The model has provision for four main kinds of activities to be undertaken by the regional water agency. In the default case, these comprise provision of bulk water to urban local authorities, provision of bulk water to rural authorities, provision of retail water to (mainly rural) areas, and the provision of support and mentorship to other (again, mostly rural) water services providers. In most cases, results for these activities can be shown separately.

Flexible tariff structure

The model contains a number of tariff options for the various service levels, with provision for a number of tariff components, including fixed charges and up to four tariff blocks. There is also provision for different tariffs for each service level, and for non-residential consumers. In addition, there is provision to increase or decrease the tariff levels during the 10-year planning horizon.

Bulk and connector infrastructure expansion

The model can be used to predict when expansion will be required in the various components of bulk and/or connector infrastructure. This can be done either by inputting capital expenditure directly, or by using the default calculations produced by the model based on the matched supply and demand.

Prediction of consumption

Consumption is projected for the ten-year period, broken down into various categories of users (urban bulk, rural bulk, retail). These projections have the advantage of incorporating, in a consistent manner, predictions of population and economic growth levels of service provision, as well as changes in consumption for other reasons (such as changes in technology or taste).

Fund accounting methods

The model is based on the most commonly used accounting policy in water boards and district councils, namely the use of fund accounting. Provision is made in the model for transfers to and from funds, which means that water system fixed assets are not depreciated. Instead, charges against income are based on interest and redemption charges. In time, this may change as more RWAs switch to depreciation accounting, at which point model revisions may be warranted. If a particular RWA uses depreciation accounting, these charges can be reflected in the Income Statement under Other Expenditure.

Ease of use and transparency

The model itself is easy to use once a certain degree of familiarity has been reached with its structure, input requirements and output format. It comprises a set of spreadsheet pages organised into four sections (see below), with data input blocks clearly marked.

The model is transparent in that there are no hidden or 'black box' calculations. For ease of use, most calculations occur in the 'engine' (section 4 of the model), which users can safely ignore without any loss of effectiveness. Should s/he wish to trace calculations, however, this is possible (although calculations do, at times, become rather complicated).

Default values

The model is designed in such a way that an initial run is possible with a minimum of information. Default values are used when information is not entered by the user.

Essential inputs are entered in the yellow input blocks, and the model cannot run without these. Inputs that replace default values are entered in the white input blocks, and the relevant defaults are shown in blue below or next to the blocks.

Some of the defaults are simply numbers entered into the model during its development, and these are displayed in bold blue type. Others are calculated from model data, and are shown in normal blue type. Where relevant, notes are attached to the defaults explaining their calculation (using the Excel Comment function).

Protection against incompatible entries

The model provides a limited degree of protection against nonsensical results arising from the entry of incompatible data. Major incompatibilities will produce error messages and/or the model will not calculate outputs. For example, if the user makes an error in matching water supply schemes with demand zones, an error message will alert the user to this problem.

This protection is, however, limited as the model cannot detect all input errors or nonsensical values. As such, the outputs reflect the quality of inputs **-** the adage 'garbage in, garbage out' applies!

All sheets are protected against entries in cells other than those intended for user inputs. Should the user have to modify a sheet, however, this can be done by using the Tools function in Excel (select 'Protection', and click on 'Unprotect Sheet'). After making any changes, the user should Protect the sheet again, and save the new version of the file with a new name in case the original version must be retrieved.

Nominal and real values

As a rule, inputs and results are shown in real (today's) Rands. Wherever necessary, however, such as in the case of projected borrowings, the calculations in the engine are based on nominal Rands which are then converted back to real values to be consistent.

TECHNICAL SPECIFICATIONS

The model was developed using Excel for Windows, and may be run using Excel 5.0 or a later version. It is recommended that the model be run on at least a 66 MHz machine with 16 Mb of RAM. The user requires only a basic knowledge of the Excel spreadsheet package. On average, it will require a few days of effort to collect the base input data, after which iterations can be run on the model using alternative variables in a matter of minutes.

THE MODEL STRUCTURE

The model consists of four sections:

Section 1: This section of the model contains compulsory inputs. Essential information is entered regarding water consumption, consumer units, service levels, water supply schemes, costs, tariffs, the subsidy environment and the organisation's financial position. The setting of tariff levels is a key input and impacts directly on financial viability.

Section 2: This section contains a number of default inputs, and the user has the option of over-riding them with more accurate local information. It is not essential for the user to change any of these variables.

Section 3: This section of the model contains the main outputs, including financial statements and cash flow graphs.

Section 4: This is the 'engine' where most of the calculations are conducted. A user would access this section only to trace the model's calculations, if desired.

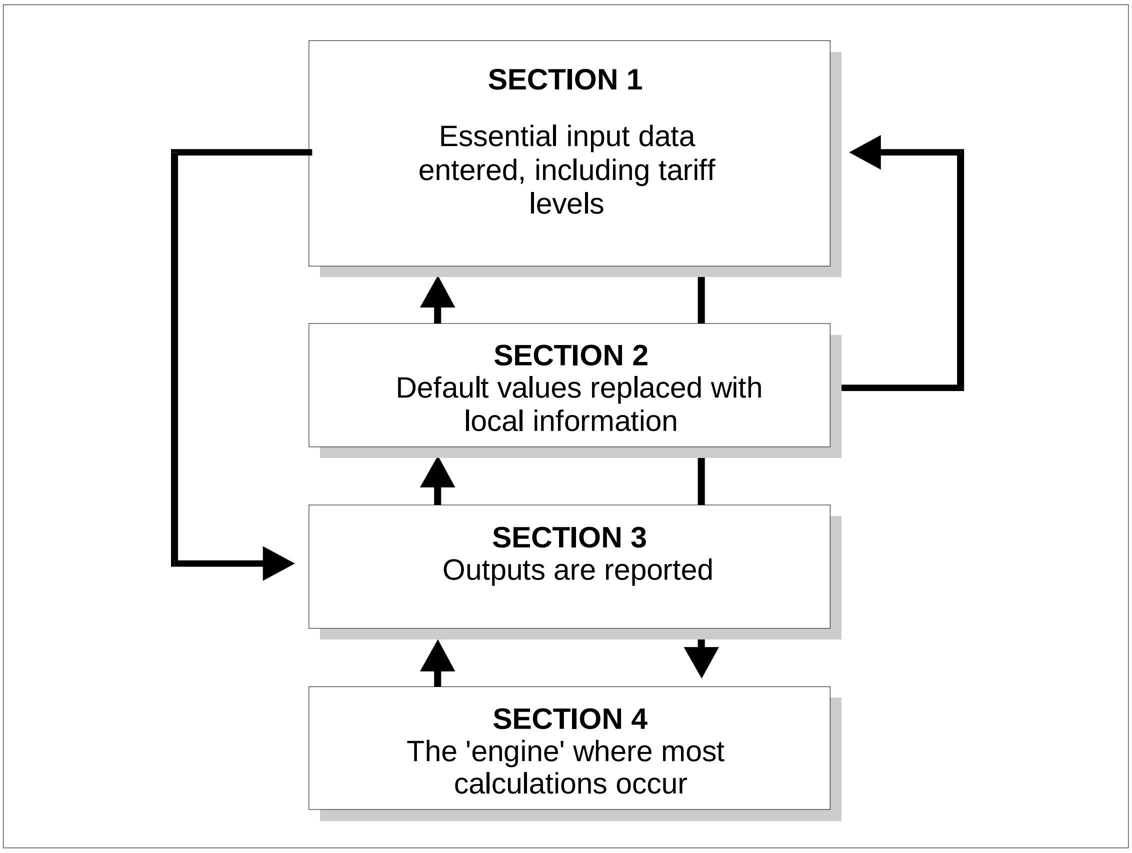

Figure 1: The broad structure of the RWSSM model

MODEL ASSUMPTIONS

The model makes the following implicit assumptions:

Timespan: The model covers an 11-year period with 'Year 0' being the current planning year and 'Year 1' being the first year of planned investment. The backlog of services must be made up by the end of the period.

Decision unit: One organisation, a regional water agency, exercises control over investment and tariff decisions in a discrete supply area, which can include both urban and rural settlements.[2]

Availability of financial data: This agency already provides a service and has proper budgets and financial statements.[3]

Financing: The finance required for investment in infrastructure may be obtained from consumer contributions, current revenue and/or subsidies. The balance is borrowed under conditions set by the user of the model. Only one set of conditions applies, however, so that no provision is made for borrowing from internal and external sources at different rates.

MODEL DESCRIPTION

Introduction

The inputs and outputs of the Regional Water Supply Service Model are discussed in this section. The discussion will make most sense if the reader has access to the relevant screens of the model, either electronically or in hard copy format.

Note that sheets in section 1 of the model are numbered 1.1, 1.2, 1.3 etc.; those in section 2 are numbered 2.1, 2.2, 2.3 etc. and those in section 3 are numbered 3.1, 3.2....

The following formatting conventions are used in the model and in this manual:

◊ Default values are marked with a diamond.

All data input areas are yellow (essential inputs) or white (inputs with default values) on the screen and light grey or white respectively when printed.

All numerical inputs are entered as numbers. Where percentages are required, the user enters a number and the model converts this to a percentage.

Sources of information and assumptions made regarding data inputs should be recorded for future reference. This may be done either on paper or on the model itself:

- Data sheets are available for recording this information on paper.
- Data can be entered on the screen by means of 'comments' in the relevant blocks. To insert a comment, unprotect the screen if using Excel 7. Place the cursor on the input block and highlight the 'Insert' option on the tool bar, then select 'Comment'. A text box will appear. Type in the note and when complete, click elsewhere on the screen. The note will be recorded and appear on the screen in the form of a red triangle. In order to read the note in Excel 97, simply place the cursor on the block and the note will appear on the screen.

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[2] Provision is made in the model for cases where customers of the regional water agency (such as municipalities) also have their own supply sources.

[3] Should this not be the case, a base year can be 'manufactured' by the user. For example, it can be assumed that the agency provides two (high-income) residential users and a single non-residential user with the service. 'Manufacturing' data, however, requires a certain level of familiarity with the model so that the consumer unit, consumption and expenditure inputs are compatible.

RWSSM Section 1:
ESSENTIAL INFORMATION

Sheet 1.1: Description

The purpose of the 'Description' input page is to identify the Regional Water Agency and model user, set the base year and record details unique to the particular run of the model. Most of these variables appear at the top of subsequent screens. The user should input:

Regional Water Agency
The name of the organisation being modelled.

Type
The type of organisation being modelled – for example, Water Board, District Council or Regional Council.

Run
A unique run number for each run within a particular batch (usually starting at 1). This number is shown on every subsequent screen.

Scenario
A brief description of the scenario. Details, for example of the service levels to be provided and cash flow targets, can be recorded. It is also useful to make notes of key estimates and assumptions. For example, if the number of households and service levels in certain areas are uncertain, this should be recorded.

Base year
The current planning year (Year 0). If Year 0 is 1997, the first year of investment will be 1998 and the last year of analysis will be 2007. It is important to identify this base year correctly and to be consistent when inputting data later on.

Financial years and calendar years generally do not coincide, and the user is therefore asked to enter the financial year to which the planning year refers. Note that it is important to enter a single year (as a number) for the base year, since this input is used to calculate all the 'year' displays on subsequent screens.

Sheet 1.2: Existing demand zones

On this sheet, the user defines all the 'demand zones' in the RWA's supply area. For these purposes, a demand zone is an area containing a group of consumers, both present and future, with geographical or institutional similarities which can be treated as a logical unit. Demand zones fall into one of four categories:

- Urban local authorities or water services providers, which are supplied in bulk by the RWA.
- Rural local authorities or water services providers, also supplied in bulk by the RWA.
- Areas - usually, but not necessarily, rural - in which the RWA provides retail water services.
- Rural areas where no technical supply schemes are in operation. Often only a support function is provided by the RWA.

The names of each demand zone falling into the above categories, must be entered by the user. If their names are long, they should be abbreviated to about 10 characters, since these names are used elsewhere in the model.

As noted in the model, provision is made for up to 20 urban TLCs and up to 15 each for 'rural bulk', 'retail' and 'support' demand zones. The total number of demand zones, however, cannot exceed 30 - this constraint is necessary to limit the size and complexity of the model. If there are more than 30 separate demand zones in the supply area of a regional water agency, they should be split into more than one group and the RWSSM should be run separately for each group.

Error messages will appear if the number of demand zones entered does not tally with the number of names entered.

Sheets 1.3 to 1.6: Present number of consumers in demand zones

These four sheets are identical to each other in structure, with each sheet corresponding to the category of demand zones as defined in Sheet 1.2. For each demand zone, the names of which are displayed automatically by the model, the user must enter the number of consumer units (normally households) with each kind of service level.

The following 8 service levels can apply to residential consumers (these definitions also appear on the sheets):

- *No/inadequate services:* as defined by RDP standards, that is, with no formal service, with an unreliable supply, with a supply more than 200 metres from the homestead, or a supply delivering less than 25 *l*/cap.d.
- *Communal standpipes:* a reliable supply of clean drinking water within 200 metres of the homestead.
- *Yard tanks:* piped water supply to a tank on-site, which is filled periodically (such as once a day).
- *Yard taps (on-site sanitation):* piped water supply to a yard tap on the site, together with on-site sanitation such as a VIP.
- *Yard taps (waterborne sanitation):* piped water supply to a yard tap on the site, together with waterborne sanitation.
- *In-house, low income:* piped water supply to a house, including multiple taps and waterborne sanitation; consumption is generally in the region of 18 to 24 k*l*/month.
- *In house, middle income:* as above, except higher consumption of 20 to 30 k*l*/month.
- *In house, high income:* as above, except with consumption normally in excess of 30 k*l*/month.

This information must be entered for each of the four categories of demand zones.

Note that bulk water suppliers seldom have this information at hand, since they usually supply water in bulk to other service providers which, in turn, supply their retail customers. Consequently, it is often necessary to obtain this information from the retail service providers themselves.[4]

Although this is a relatively demanding requirement, the reason for requiring this information is sound: an understanding of the consumer base in an area, and its demand for water, will greatly improve the quality of the financial and technical planning by the regional water agency. Indeed, several water boards have recently begun to build their knowledge about the retail consumers in their area even though this is supplied by municipalities, because of the implications this has for the water board's business.

[4] In the case of local authority water services providers, a useful source of information is their Water Services Development Plans. In terms of the Water Services Act, these should contain precisely the information required regarding the customer base, service levels and growth.

In the case of the fourth category of demand zone - that in which there are no formal supply schemes, all consumer units will, by definition, fall into the ‘no/inadequate supply’ category. Generally, it is adequate to group all these consumer units into one zone even if they are geographically dispersed, because the model is based on average support costs.

In addition to the service levels, these sheets also have provision for the user to specify what kind of support services will be provided by the RWA to consumers in each demand zone. Provision is made for 5 levels of support services:

- No support.
- Full support to unserved CUs.
- Partial support to served CUs.
- Full support to served CUs.
- Other (as defined by the user).

Each of these will have its costs, as specified later in the model. The input sheet allows the user to specify the percentage distribution of consumer units (as entered on the same sheet) between these five categories.

The model allows the user to specify the level of support applicable in the base year, and 10 years later. The model automatically calculates the number of CUs to whom the relevant support services are provided during intervening years, based on a straight line adjustment.

Sheet 1.7: Consumption growth

Growth in consumer units

The user is asked to enter a rate of growth in the number of residential and non-residential consumer units for the base year, year 5 and year 10. The model extrapolates rates for the intervening years.

◊ The default rates are 3.5%, 3.2% and 2.8% for the three years respectively for residential and 3.5% for non-residential CUs.

These growth rates refer to increases in the number of consumer units; consequently, consumption will grow compared with existing levels, and there will also be additional investment in infrastructure to serve these consumers. These capital expenditure amounts and corresponding subsidies are integrated into the model's projections.

On this sheet, the user is also asked to enter the estimated total number of consumer units in the entire supply area. The model then compares this macro total with the total of the micro estimates (for each demand zone) and reports the error margin in % terms. If the difference between the top-down and bottom-up estimates is unacceptably high, this points to the need to check the data.

Sheet 1.8: Service levels for new residential consumer units

The purpose of this sheet is to define the service levels of new residential consumer units (which have grown at the rate entered in the previous sheet).

For each of the four demand zone categories (bulk to urban TLCs, bulk to rural TRC, etc), the user enters the percentage of new low-income CUs which will have each type of service. Note that the percentages must be entered as numbers, not in percentage format, as the model interprets the entered numbers as percentages.

◊ The percentage provided with in-house connections is calculated by the model, and will be 100% in the absence of other inputs. This means that the default investment programme provides all low-income CUs with in-house connections.

If the other entries add up to more than 100 an error message will appear in the 'In-house, low income' box and the model will not calculate.

Sheet 1.9: Service levels for upgrading of residential consumers

The aim of this sheet is similar to the previous one, except that it refers to services provided to existing consumers with no/inadequate services - the 'backlog' - as well as upgrading of consumers to higher service levels.

Services to be provided

Backlog (A): for CUs with no or inadequate services, the user specifies the percentage distribution of service types that it will have received by the end of the investment period. This is done in the first row of the input table. If the numbers entered exceed 100, an error message will appear and the model will not calculate. For information purposes, the number of CUs involved is shown to the right of the input blocks.

Upgrading (B): the next seven rows allow the user to enter an upgrading programme for existing CUs. The programme is specified by entering the final percentage distribution of services of CUs with the services specified in the column. Note that 'downgrading' is not permitted for model-determined services, for example from an in-house connection to a yard tap. Likewise, households cannot move from one income level to another. The number of CUs in each of the service categories in the base year is displayed to the right of the input table.

Once again, error messages will appear if any of the row entries add up to more than 100, and the model will not calculate.

Note that the upgrading programme is for existing consumers only, and the investment programme does not make provision for the subsequent upgrading of new connections.

Time frames

Time frames for making up the backlog (A) and for the upgrading programme (B) are then selected. The model assumes that an equal annual number of connections are made in order to achieve the final distribution of service levels over the specified time frame.

Sheet 1.10: Water supplied by other authorities ('own sources')

In this sheet, the user is required to enter the amounts of water supplied to end consumers by parties other than the Regional Water Agency itself. This usually refers to a situation in which a water board supplies bulk water to a municipality which also has its own sources of supply. It is important to take account of these sources, since the model is demand-driven and demand for the RWA's water will be reduced by the amount of water supplied from other sources.

The user is required to enter the daily supply capacity, in M*l*, of other sources, for each demand zone in three of the four categories (this is not necessary for the Support category since the RWA does not supply water to those consumers).

Sheet 1.11: Water consumption

The purpose of this sheet is to provide the macro water balance for the Regional Water Agency as a whole and to calculate water losses.

The agency’s current water purchases, production and sales are recorded here. The items required include those relating to purchases/production of water and sale of water (in separate blocks). Regarding the production of water, the following information is needed:

- **Total purified water purchased:** this refers to purified water which the agency purchases (if any) from another service provider such as a water board or large industrial consumer. The amount is expressed in M*l* per annum.
- **Total raw water purchased/used:** this is self-explanatory.
- **Total water purified:** this is normally the same as Total Raw Water Purchased/Used, although could be less if some raw water is not purified, for example, if it is sold to farmers. *The model does not make provision for revenue from the sale of unpurified water - if material, this could be treated as Other Revenue.*

Regarding water sales, the total quantity of water sold by the RWA, both bulk and retail, must be entered, in M*l* per year. If this information is available, sales should be entered separately for **residential** and **non-residential consumers**. The model calculates total water sales. For information purposes and to check the accuracy of the various sources of data, the model shows the calculated amount of total sales, based on the micro-level calculations using the number of consumers and their consumption profiles. The difference in % terms is shown, and if this is too large, the user should check the various sources of data for consistency.

The user is also required to enter the quantity of **water used but not sold** in M*l* per year. This usually refers to water used by the service provider itself and for which no revenue is received, but also includes water provided free of charge to external consumers (e.g. public standpipe consumers) and water used in fire-fighting and the watering of parks. This is part of losses, but can be accounted for.

The model then calculates **Physical water losses**, which is the difference between the total amount of purified water used and the amounts sold and used by the service provider. The percentage loss is shown on the right of the input block, and if this percentage conflicts with other estimates the previous inputs on this sheet must be checked.

The capacity, in M*l* per day average annual flow, may be entered for information purposes.

Sheet 1.12: Water balances for demand zones

The purpose of this sheet is to test the accuracy of data inputs by comparing water sales as calculated by the model, with water sales derived from the financial records of the utility. This is done for each demand zone, using ‘net’ water sales by the organisation. The latter refers to sales made by the utility to consumers in the demand zone, that is, excluding any water supplied to consumer units from their own sources.

The model calculates the percentage difference between the two sales figures. The user must exercise judgement as to what constitutes an acceptable margin of error – if the difference is unacceptably large, the data inputs should be checked for accuracy and consistency. In the event of a large difference, the error could be due to incorrect estimates of total sales (from the financial records of the organisation) or, more likely, inaccurate consumption data (especially if these are default numbers), or incorrect numbers of consumer units in the demand zone.

Sheet 1.13: Existing supply schemes

The purpose of this sheet is for the user to enter the costs and capacities of the supply schemes operated by the RWA. This information is used by the model, firstly, to compare with expected consumption in order to calculate a default capital expenditure programme and, secondly, to calculate the costs of supplying water for purposes of the financial statements and other outputs.

Number of existing supply schemes

The user enters the number of separate supply schemes. As noted in the model, a 'supply scheme' is defined as a separate supply system which produces treated bulk water. It could, for example, share a raw water source with another 'scheme', but would then have its own treatment works, pipelines and reservoirs supplying a particular bulk (or retail) demand zone.

The model therefore caters for the situation in which schemes supply more than one town and have feeder lines supplying rural water projects.

The model caters for a maximum of 15 supply schemes. If there are more than this, the model reports an error message, and the user has to split the RWA's operations into two or more divisions.

Supply scheme information

For each supply scheme, the user is required to enter information about the entire supply chain, effectively providing a cost build-up for the direct cost of treated bulk water. At each stage, the user also has to enter the capacity of the supply infrastructure:

- **Name:** A unique name should be entered for each supply scheme, preferably not more than 8 or 9 characters long. This name is then used again by the model in other sheets.
- **Raw water source:** The user enters the supply capacity in M*l*/day of the raw water source. This would usually correspond with the permitted off-take in terms of DWAF licences, or with the capacity of dams, etc. At this stage, the user also enters the cost in c/k*l* of the raw water.[5] This cost is not calculated by the model, but is usually readily available from RWA records. As with other items, provision is made for different costs and capacities in the various supply schemes.
- **Raw water transfer:** As with the raw water source, the capacity constraint and the cost in c/k*l* are entered, for both pumping capacity and the raw water pipeline capacity. In this and all cases below, the capacity should refer to the peak capacity; in other words, it should take account of the additional capacity needed to meet peak demand.
- **Treatment works:** Again, the supply capacity in M*l*/day and the treatment cost in c/k*l* are entered by the user.
- **Intermediate cost of treated water:** The values for this item are derived in one of two ways: either they are entered directly by the user, and this is done only where the RWA purchases treated water from another source; or they are calculated by the model based on the costs entered above where the RWA treats its own water. It is also possible, if the RWA does not have adequate cost breakdowns for the raw water components above, to simply enter values at this stage.

◊ The default calculation for the supply capacity is based on the minimum of the capacities previously entered: in other words, the model takes a conservative approach based on the smallest link in the supply chain.

- **Treated water transfer:** This is similar to the Raw Water Transfer item.
- **Bulk storage (reservoirs):** Here, costs are entered in the normal way.

Based on all of the above elements in the supply chain, the model then calculates the total **Direct cost of bulk water** in c/k*l*. This excludes indirect costs such as overheads and finance charges, but includes both fixed and variable costs **-** it should therefore not be confused with the marginal cost of supplying water (which would exclude fixed costs such as salaries, rent, etc). In addition, the model calculates the **Capacity constraint** in M*l*/day, being the minimum capacity of all previous supply components.

The model therefore has provision for separate cost structures in each supply scheme, which could be important if differential tariffs are to be applied.

Provision is also made on this sheet for **increasing the cost of supply** if there will be **expansions** to these schemes. The user can enter this cost in c/k*l*, which represents the *average* cost of supplying water from the new, expanded scheme, including water currently supplied (that is, not the marginal cost).

◊ The default calculation for the 'Cost from expanded works' equals the current average cost.

Finally, provision is made in this sheet for the user to estimate the **% change in costs**, in real terms, for the 10-year period. These % changes are assumed to apply to *all* supply schemes (changes cannot be specified for each individual scheme in order to minimise complexity of the model).

[5] VAT is always excluded from these amounts, as are other taxes or levies.

Sheet 1.14: Matching consumption and supply: capacity expansions for category 1

This is the most complex part of the model in terms of its internal calculations and workings, although it is less complex from an end-user's perspective. The aim of this sheet is to match particular supply schemes and demand zones, in order to determine what capacity expansions are required to meet future water demand. The main output of the sheet is the capital expenditure required to meet future demand over the next ten years.

In outline, the user is required to specify what the supply sources are for each demand zone. Each zone can have a maximum of 3 supply sources - if there are more than this in reality, the demand zone should be further sub-divided. This category of demand zones (urban bulk water supply) can have a maximum of 25 demand-supply matches; if more are required, the model should be run more than once.

The inputs required and defaults provided are as follows, for each demand-supply match:

◊ **Number:** The model keeps a running total of how many demand-supply matches have been dealt with (maximum 25, as noted above).

◊ **Name of demand zone:** The model inserts the name of the demand zone being dealt with. If a particular demand zone has more than one supply source, and these have not yet been addressed, the next match will also refer to the same demand zone; otherwise, the next demand zone is used.

- **Total supply schemes for this demand zone:** The user must enter a number from 1 to 3 in the yellow box. This refers to the number of schemes which supply a particular local authority or demand zone. Normally this value will be 1, but in larger towns there may be multiple supply sources for a given demand zone.
- **Name of this supply source:** The user enters the name of the supply source, which should exactly correspond with one of the names entered on the previous sheet.
- **For this demand zone, this source is number:** The user specifies whether this is the first, second or third supply source from which the demand zone is supplied with bulk water. The model requires a ranking order to calculate shortfalls in demand and the order in which supply expansions occur. The model will return an error message if the number entered in this cell exceeds the 'Total number of supply schemes' previously specified.
- **% allocated to this demand zone:** The user should specify in this cell what portion of the supply scheme's output is allocated to the current demand zone. In the simplest environment, this will be 100%, but where there are large supply schemes serving multiple towns and rural projects, it is necessary to apportion capacity according to some kind of priority. This information is necessary in order to allocate supply capacity to the demand zone, which, in turn, is necessary for the aim of this sheet, namely to compare available supply capacity with expected consumption in particular demand zones.

The model then calculates a running total of the portions of a scheme's capacity which have already been allocated to individual demand zones. This cumulative total is calculated for this entire sheet, as well as those relating to the other two categories (rural bulk and retail supply).

Based on the allocation of supply to future consumption, the model then calculates a mini water balance for each match. The projected consumption in M*l*/day is calculated based on the number of consumer units in each zone and their consumption profile, while the supply capacity is based on the portion of the scheme's (minimum) capacity allocated to this scheme. In the case of projected consumption, this refers to the *net* (unsatisfied) consumption, after taking account of consumption supplied by supply schemes previously dealt with.

The resulting **surplus/(shortfall) in capacity** is calculated by the model and displayed numerically. In addition, a small graph shows the expected future consumption (the blue line) compared with the available supply capacity (the purple line). This provides a quick overview of the expected surplus or shortfall in supply capacity.

- **Capacity expansion for this demand zone to come from this source? Enter Y/N:** This question **will** appear if there is a calculated shortfall in supply capacity. If the user enters 'Y', the model will calculate default capital expenditure required for each of the four main supply components: raw water source, treatment, pumping and transfer. This default capex is based on the unit costs of additional supply capacity and the amount of additional capacity (in M*l*/day) which is required. If the user enters 'N' in response to this question, the model will assume zero capex for this supply source.

This process is repeated for up to 25 consumption-supply matches in the case of Category 1 demand zones.

Because this sheet is unavoidably large - repeating the above structure for 25 potential matches - it cannot be printed out onto a single page and makes for difficult reading in printed form. The user can easily adjust the portion of the sheet to be printed, however, should only a portion of the sheet be required.

Sheet 1.15: Matching consumption and supply: capacity expansions for category 2

This sheet is the same as the previous one, except that it deals with the second category of demand zones, namely those rural areas to which the RWA supplies water in bulk. The format of the sheet is the same, except that it accommodates a smaller number of matches: 20 as opposed to 25 for category 1.

Sheet 1.16: Matching consumption and supply: capacity expansions for category 3

This sheet, dealing with demand zones in which the RWA provides retail water services, is the same as the previous two sheets, except that it also allows for 20 consumption-supply matches.

Sheet 1.17: Head office expenses

In this sheet, the user enters the indirect expenditure levels of the RWA including head office costs and finance charges. These indirect costs are those which cannot be (and have not been) allocated directly to individual supply schemes, but which nevertheless must be allocated to the main functions in order to generate a realistic cost of service provision.

The inputs required are as follows:

- **Annual expenditure amounts:** the costs incurred in the base year, in R'000, should be entered for each of the main categories (staff costs, buildings, etc). These amounts should correspond with the RWA's annual financial statements and should be readily available.
- **(Optional) Percentage allocations to bulk, support and retail:** It is important for purposes of calculating current and future costs that total costs are allocated to the 3 main functional activities (bulk, support and retail). The model provides opportunities to over-ride the default percentages.

◊ The default split in cost allocations between bulk, support and retail is 85:10:5, except in the case of Administration and Billing, in which case the allocation to retail services is higher and to bulk lower (75% and 15% respectively) because of the higher administration burden for retail supply.

Average Head Office costs in c/k*l* for bulk and retail water and in R/CU for support services, are calculated and displayed by the model.

In addition, provision is made for the user to **change Head Office costs** over the 10-year period (in real terms. These percentages are assumed to apply equally to all cost categories.

Sheet 1.18: Operating costs for retail supply

In this sheet, the user estimates any *additional* direct expenses incurred by the RWA in respect of retail water supply, over and above those already included in the previous sheet under Head Office costs.

These costs are entered for the base year, and for years 5 and 10; the model assumes straight line adjustments in intervening years.

The model shows the expenditure amounts in each of the ten years, as well as an equivalent cost in c/k*l* applicable to retail water supply only.

Sheet 1.19: Direct support costs

This sheet requires the user to enter the direct costs of providing support and mentorship in respect of areas within the RWA's jurisdiction but in which other service providers (such as rural community-based service providers) supply consumers directly with water. This excludes the portion of indirect Head Office costs allocated to support services.

The user is required to enter a figure for average monthly support costs for both residential and non-residential consumers for the base year and years 5 and 10. The model assumes that the costs change in equal annual increments between the values entered.

Sheet 1.20: Starting financial position

The aim of this sheet is to capture important items of information regarding the starting financial position of the RWA.

Starting balance sheet

The most important items on the Balance Sheet of the organisation at the end of the base year are summarised in this section. This is necessary as a starting point for the projected financial impacts produced by the model. The items listed on the balance sheet include the following:

- **Capital employed:** Capital development funds, loan redemption funds, other funds, accumulated income, accumulated grants and connection fees, long term liabilities, long term provisions and other liabilities.
- **Employment of capital:** Fixed assets (bulk, reticulation, other), depreciable assets, investments, other long-term assets, current assets (inventories, debtors, bank & cash), current liabilities (creditors & provisions, bank overdraft, other current liabilities).

In reality, the RWA's balance sheet disclosure could differ slightly from the model's generic format, in which case items should be aggregated and adjusted, as necessary. There is a check in the model to ensure that the Balance Sheet balances.

Inflation rate

The user is required to enter the general inflation rate (normally based on the CPI) in the base year and in years 5 and 10. Should these differ, the model calculates inflation in the intervening years on a straight line basis.

◊ The default inflation rate is 8% throughout the period.

Existing debt

For purposes of projecting the future finance charges on existing liabilities, the user must enter the average term remaining for existing liabilities (in years), and the average cost of that debt. Where the RWA has a debt profile with widely diverging interest rates and terms, the user should calculate weighted average values (weighted according to the size of the liabilities).

Sheet 1.21: Operating subsidies and transfer payments

In this sheet, the user specifies the amounts (in R'000) which the RWA receives in respect of *operating* activities for the ten-year period. These transfers could include inter-governmental grants, equitable share subsidies or other subsidies paid by the various tiers of government for operating costs.

Sheet 1.22: Fund transfers

The aim of this sheet is to specify the methods used by the RWA to make transfers to its funds. Three kinds of funds are included in the model, as noted below. In each case, the amounts calculated are shown on the sheet.

Capital development fund

The model requires the user to specify the basis on which transfers to the Capital Development Fund (CDF) are made, with the two options being:

- Transfers calculated as a % of sales revenue: this includes cases where a levy on tariffs or a fixed amount in c/k*l* is charged against revenues.
- Transfers calculated as a % of net income (before transfers): in this case, the transfer is 'below the line'.

The user must select only one of these options, and the model will produce an error message if both options are used.

Loan redemption fund

In this case, the model calculates the transfers automatically, being the capital portion of interest and redemption charges.

Other funds

Provision is made in the model for transfers to be made to other funds. Many RWAs operate more than one fund and these should be aggregated into this category. The transfers can be calculated in either of the two approaches as for the CDF, or as lump sum transfers entered directly by the user. Only one of these three methods can be selected and the model will produce an error message if this is not done.

Sheet 1.23: Bulk tariffs

The aim of this sheet is to assist the user in setting bulk tariffs. Provision is made for different tariffs for each supply scheme, should the RWA not apply a policy of uniform tariffs across its jurisdiction.

The sheet summarises the cost build up for each supply scheme (all in c/k*l*), including the direct cost of water, allocated Head Office overheads and allocated interest and redemption charges. This yields a total cost of supply for each scheme.

Using the cost build-up as a guide, the user then specifies the current **bulk tariff** in c/k*l* for each supply source. The model compares this with the cost, and calculates the % margin on cost price. For information purposes, the model calculates the bulk tariff after any supply expansions (being adjusted by the same differential included on 'Sheet 1.12: Water balances for demand zones'.)

Finally, the user enters the real % increase or decrease applicable to all these tariffs over the 10-year period. It is assumed that the % change affects all supply schemes equally.

Sheet 1.24: Retail tariffs

This sheet contains information about the retail tariff structure and levels applicable to all direct retail customers of the RWA. This applies only to retail customers, that is, Category 3 demand zones.

The consumer enters the following items for each of the service levels (standpipes, yard taps, non-residential consumers, etc):

- **Fixed charges:** the amount of any fixed monthly charge is entered here in Rands per month, for each of the service levels shown.
- **Consumption charges?:** the user specifies whether there are no consumption charges at all ('0'), a single rate consumption charge ('1'), or block rates ('2').
- **Block sizes:** provision is made for 4 consumption blocks, each with its own consumption charge. The user can specify the consumption bands or use the existing model values. Note that these cells are formatted to have 'k*l*' appear as a suffix to the numbers entered by the user.
- **Consumption charges in c/k*l*:** the user then specifies what the consumption charges are in c/k*l* for each of the four consumption blocks. Should there be fewer than 4 blocks, the consumption charge for the adjacent blocks should simply be made equal.

As with other sheets, the user can enter the values of real % increases or decreases over the 10-year period. Again, these percentages are assumed to affect all tariff components and demand zones equally.

Sheet 1.25: Non-payment

In this sheet, the user estimates the average % of billed revenue which is not recovered from consumers. This sheet allows for the % of non-payment to vary from one demand zone to another, within each of the three categories (urban bulk supply, rural bulk supply, retail supply).

The values are entered as numbers and the model reads them as percentages. The names of the demand zones appear automatically, based on the names previously entered.

RWSSM Section 2: REPLACING DEFAULT VALUES

As noted earlier in this manual, Section 2 of the model contains default values for variables which are not highly specific to the Regional Water Authority. Depending on the availability of information and time, users can over-ride these data with their own, more accurate values. This will obviously increase the accuracy of the projections and their usefulness.

Sheet 2.1: Capital costs for bulk infrastructure

This screen allows the user to modify the default unit costs for bulk infrastructure. These costs are specified for 4 categories, being:

- Source of supply
- Treatment
- Pumping
- Transfer.

In each case, amounts relate to R million per M*l*/day of additional capacity required.

In the second block the user can specify the additional capacity requirement for each component over and above the average annual flow, expressed as a percentage. For example, if the average annual flow in a system is 100 M*l*/day then an additional capacity requirement of 20% for treatment works means that the works must be able to deliver 120 M*l*/day.

Sheet 2.2: Capital costs for retail services

In this sheet, unit capital costs for internal (i.e. reticulated) services are entered as a cost per site, both for new services being provided to new consumer units, and for upgrading of existing services to higher service levels. The amounts are in Rands per consumer unit and should include the cost of meters, terminals, valves and other components, but exclude the costs of on-site plumbing, which are for the consumer's account.

Since these costs are for the full ten-year period, the estimates should refer, as far as possible, to the likely average cost of developments over the period.

◊ The default costs for new services are in 1998 prices.

◊ The default costs for upgrading are calculated as a percentage of the costs of a new service, and will adjust to the costs for new services entered by the user. For information, the percentages used in the calculations are shown in blue to the right of the input table.

The same applies to infrastructure for non-residential consumers.

Sheet 2.3: Asset replacement and other capital expenditure

Asset replacement

The model links capital expenditure on asset replacement to the replacement cost of infrastructure in the base year. Note that this is assumed to be actual expenditure, and not merely a provision for future replacement (as in a transfer to funds). It is assumed that expenditure on asset replacement will be for existing infrastructure only, and not for new infrastructure provided during the course of the investment programme.

The model shows the **starting book value of existing infrastructure** in the first column, based on the values entered in the starting Balance Sheet. Default values are included in the model for the annual cost of replacing assets - these are estimates only and range from 1% to 2.5% of book value - the user may over-ride these with other percentages. It should be noted that asset values could be stated at historical cost (most commonly) or replacement cost. The % used will obviously be lower if it is applied to a replacement cost valuation than an historic cost valuation.

The resulting expenditure per annum (R'000) in base year Rands, is shown in the last column.

Capital expenditure: other infrastructure **and** ***Head Office capital expenditure***
The user may enter other capital expenditure in this table in R'000 per annum. Entries may be made in nominal or real terms, as specified by the user. Types of expenditure that this table is designed to accommodate include expenditure on the rehabilitation of deteriorated infrastructure, and unusual expenditure such as the construction of a new head office building. The table can also be used to enter expenditure on bulk and connector infrastructure if these are excluded from the normal calculations for any reason. If such entries are to be made, the user must ensure that the costs of any expansion calculated by the model are cancelled out. This is best achieved by entering zeros in the cost input blocks on the relevant screens.

Sheet 2.4: Capital subsidies - bulk infrastructure

Capital subsidies may be available to the RWA for bulk and connector infrastructure, and this screen makes provision for grants to be provided in three ways:

- **Grants per qualifying CU:** for residential CUs that would qualify for the Consolidated Municipal Infrastructure Programme (CMIP) grant in terms of government policy. Current policy (1998) involves a R3000 grant per qualifying household, and this would have to be passed on by the local authority to the RWA. The model allows for the user to enter a percentage in respect of the portion of households which will qualify for the subsidy, as well as the period over which subsidies will be paid.

  ◊ The default grant is an estimate of the amount required to provide a consumer unit in the area with 6 k*l* per month, or the amount entered by the user in the appropriate block. This amount is calculated on the basis of local costs, and on whether bulk infrastructure is the responsibility of the service provider.

  For this option the user can also specify the expected rate of increase in the *nominal* value of the grant (default = the rate of inflation).

- **Grants as a percentage of the cost of bulk services:** in this case, this refers to capital cost of bulk infrastructure.

  ◊ The default is zero.

- **Flat grants:** in this option, grants can be entered as fixed amounts in R'000 per annum. Here the user needs to specify whether the amounts have been entered in nominal or real terms (default = nominal).

Sheet 2.5: Capital subsidies - retail infrastructure

There are four sources of finance for internal services: consumer payments, capital subsidies, income earned by the service provider, and borrowing by the service provider. On this screen the user may enter information about the first two.

New residential CUs and elimination of the backlog

Capital subsidies can be entered as an amount per consumer unit by service type, in base year rands. In the current policy environment this subsidy is most likely to be the housing subsidy, which is available to households with incomes below R3 500 per month and which have not previously received state assistance for housing and services. All households to be provided with formal sites would qualify for this subsidy, thus including new households and consumer units currently with inadequate services.[6] No provision is made for subsidies to CUs in the middle- and high-income brackets, because the housing subsidy is not available to them and it is unlikely that another source will be forthcoming.

CU payments are payments made to the developer, whether the service provider itself or a private agency fulfils this role, together with additional connection fees paid to the service provider.

If the sum of the subsidy amount and the CU payment is less than the total cost, the balance must be financed by the service provider either in the form of borrowing or by using surpluses generated internally.

◊ The default CU payments for residential CUs in the first three income categories are estimations. For higher-income and non-residential CUs they are the full costs of service provision.

◊ The default subsidies for residential CUs equal the difference between the costs of service provision and CU payments entered on this screen. The result is that, in the base year, the service provider would make neither a profit nor a loss on these services.

Upgrading from standpipes in informal areas

Housing subsidies are likely to be available to households in informal areas which are currently provided with communal standpipes. Should this be the case, the user can enter the **subsidy** amount provided per CU for upgrading, along with the **CU payment**.

◊ The default CU payments are those used for new services, and the default subsidy amounts are calculated in the same manner as for new services.

Rate of increase in the nominal value of housing subsidies

The nominal value of the capital (housing) subsidies used for water supply may not increase sufficiently to keep pace with inflation, and if so, the real value will decline. The user can specify the nominal rate at which these subsidies are to increase, in percentages per annum.

◊ The default rate of increase is 50% of the inflation rate, which is displayed directly below the input boxes.

It is important to note here that, since CU payments only keep pace with inflation, decreases in the real value of the subsidies will result in the service provider being responsible for raising the additional finance.

Household payments for other upgrading

CU payments for other service upgrading can be entered here.

◊ The defaults are the full (internal service) costs of the upgrading, which increase with inflation.

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[6] There may be exceptions to this, however, for example if the infrastructure in an area is so badly deteriorated that it effectively provides an inadequate service. But this situation is better dealt with by recording the services as they are meant to be and providing for their rehabilitation on screen 2.3.

Sheet 2.6: Loans and constraints

The cost of loans for capital expenditure

The user can enter the borrowing rate on loans for long-term borrowing for the base year, year 5 and year 10. The model extrapolates the rates for the intervening years. These rates must be entered in nominal terms, and the model then calculates the real rates which are also displayed. The loan repayment period must then be entered at each of the 3 points.

◊ The default interest rates are the nominal rates calculated for a real rate of 6% per annum. The default repayment period is 15 years.

Note that only one set of loan conditions is provided for per year. No provision is therefore made for loans from various sources which carry different conditions and so the user is required to estimate an average rate for loans from the various sources.

The cost of short-term loans (returns on cash surpluses)

These rates refer to the cost of short-term borrowings to cover operating deficits, and returns on cash surpluses generated on this account. Again, rates must be entered in nominal terms for the base year, year 5 and year 10 of the programme.

◊ The default rates are calculated for an 8% real rate for short-term loans, and a 5% real return on cash surpluses.

Portion of net income available for capex

The user has the option of specifying what portion of net income - after finance charges, loan redemptions and fund transfers - is available to finance capital expenditure. The balance will generally contribute to cash reserves which will build up and, in practice, could be used to retire debt more quickly, or finance other acquisitions.

◊ The default portion is set at 80% of net income.

Sheet 2.7: Present consumption by category in demand zones

This sheet deals with the consumption profile of each type of consumer, in each of the three categories of demand zone. The values used here will determine the overall consumption levels and trajectories for the RWA as a whole. The amounts to be entered are in k*l* per month.

◊ The defaults for residential CUs are estimates based on case studies and previous experience (see RSA 1997b). The defaults for non-residential CUs are rough estimates only, and may be totally inappropriate for the area concerned given the wide range of sizes possible in each of these categories.

There is no provision in the model for increases in consumption by particular consumer units at a micro level, because of the additional complexity this introduces. At a macro level, however, consumption growth is accounted for through the estimated percentage increases in numbers of CUs, and through upgrading of consumers to higher service levels.

The micro water balance calculation in 'Sheet 1.10: Water supplied by other authorities ('own sources')

In this sheet, the user is required to enter the amounts of water supplied to end consumers by parties other than the Regional Water Agency itself. This usually refers to a situation in which a water board supplies bulk water to a municipality which also has its own sources of supply. It is important to take account of these sources, since the model is demand-driven and demand for the RWA's water will be reduced by the amount of water supplied from other sources.

The user is required to enter the daily supply capacity, in Ml, of other sources, for each demand zone in three of the four categories (this is not necessary for the Support category since the RWA does not supply water to those consumers).

Sheet 1.11: Water consumption' is built up from these individual consumption levels, and is compared on that sheet with the macro water balance. If the discrepancy between the two estimates as reported on that sheet is too large, the assumed consumption levels on this sheet should be adjusted to achieve a more reasonable set of estimates.

Sheet 2.8: Other income and expenditure

Other income

The income information entered on this sheet makes provision for other income to be included, that is, over and above revenue from the sale of water and operating subsidies already included. The user has the option of entering absolute amounts for Investment Income and Other Income for the 10-year period. The amounts should be entered in real terms.

Other expenditure

This screen makes provision for including expenditure items other than those accounted for in previous screens. One such item could be contributions RWAs are expected to make to local authorities, such as if they take over retail water supply thereby denying the municipality a source of net income from water trading. Provision exists to model any payments the RWA might make to local authorities by way of compensation.

WRC levy

The model provides the option of adjusting the Water Research Commission levy, either by increasing the amount of the levy in the base year, or adjusting its level in real terms over the 10-year period.

◊ The default levy equals its level in 1998, which was 2.65 c/k*l*.

This levy has no net effect on the finances of the RWA since the agency merely acts as the agent of the Department of Water Affairs and Forestry. The RWA collects the levy based on its water sales, and pays that amount straight over to the Department, which, in turn, funds the Water Research Commission.

Sheet 2.9: Catchment management agency charges and functions

CMA charges

Provision is made for changing the default assumption regarding CMA charges which the RWA will have to pay. In addition, there is provision for changing the amount of the charge in real terms.

◊ The default CMA charge, which is a very rough estimate since it has not yet been introduced or even calculated accurately, is 2.5 c/k*l*.

This represents a net cost to the RWA which is therefore included in the Income Statement.

CMA charges

Although current policy is that neither water boards nor district councils will act as Catchment Management Agencies themselves, it is possible that RWAs might be contracted by the new CMAs to carry out certain functions on their behalf, for example, monitoring water quality. In that case, those functions will be carried out under contract, at arms length, on a cost recovery basis. Consequently, the net financial implications should be negligible and so no provision is made for income or expenditure associated with carrying out these functions.

RWSSM Section 3:
MODEL OUTPUTS

Section 3 consists of 4 output sheets in formats appropriate for printing.

Sheet 3.1: Summary tables (1)

Three tables are provided, showing:

- Water consumption by Demand Zone category and in total (in M*l*a)
- Water Research Commission levies payable (in R'000 real/a)
- Catchment Management Charges paid (in R'000 real/a).

Sheet 3.2: Summary tables (2)

Table 1 on this screen provides a summary of capital expenditure (in R'000 real/a), broken down into:

- Bulk capex
- Retail capex
- Asset replacement
- Head Office capex
- Other capex

In addition, subsidies and connection fees are shown, giving a net capital expenditure amount which is equivalent to the financing requirement.

Table 2 on this sheet shows the monthly revenue received for the average consumer unit to which the RWA provides retail services (that is, demand zone category 3). The table shows total billings broken down into the fixed monthly charge and consumption charges, the portion of this which is not paid (on average) and the net revenue received per CU.

Sheet 3.3: Annual financial statements

This sheet contains a complete set of annual financial statements for the organisation over a 10-year period. All amounts shown are in real Rands (R'000). The components are:

- An income statement, showing all operating revenues and expenditures for each financial year.
- A balance sheet, showing all assets, liabilities, funds and reserves as at the end of each financial year.
- A cash flow statement, showing all cash movements of an operating and capital nature.
- Selected financial ratios (debt equity, interest cover, and returns on equity and income).

This represents one of the major outputs of the model.

Sheet 3.4: Unit costs in various categories

This sheet summarises the unit costs (in c/k*l*) for each of the four Demand Zone categories, with sub-headings for direct and indirect (allocated) costs. In the case of support activities, unit costs are expressed in Rands per CU per year.

REFERENCES

RSA (1997a) *Water Services Act, 1997*, Act No. 108, 1997. Office of the President Pretoria.

RSA (1997b) *Municipal Infrastructure Investment Framework.* Department of Constitutional Development Pretoria.