SWAZILAND RURAL WATER SUPPLIES
A BASE - LINE STUDY

BY

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AUGUST 1978

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PREFACE

Each year the Overseas Development Administration (ODA) commissions a number of ex-post evaluation studies with two aims in mind; firstly, to assess the effectiveness of its aid activities and secondly, to learn lessons for improving the effectiveness of future aid activities.

This evaluation is one such study.

Evaluation studies are undertaken by individuals or by teams especially recruited for their particular knowledge with regard to the subject under study. Sometimes these teams will include personnel from ODA (increasingly teams are a mix of ODA and external personnel).

In all cases the reports and conclusions are attributable to the authors, who are finally responsible for their contents, and not to ODA.

Evaluation Unit
Manpower and Evaluation Department

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The Annex containing confidential household details has not been included in the report for general distribution .

INTRODUCTION

WHAT IS A "BASE-LINE" STUDY?

This is the first specifically "baseline" study that the ODM has carried out. The idea of a baseline study is that unless a detailed survey is carried out of the situation before a new development project is implemented it may be impossible later on to evaluate whether the project was a success or failure. Sometimes useful material of a "baseline" type may be available from the project appraisal document or feasibility study, but often this material would not be adequate for a proper evaluation, and a special survey is necessary.

Thus the objective of this study was to send a multidisciplinary team to Swaziland for a short period to obtain just the minimum basic information about the existing water supplies, their quality, location, role in household activities, organisation aspects and so on, to enable an evaluation to be made in say two or three years time when the schemes have been implemented. It should be emphasised that a baseline study is not an appraisal nor a feasibility study, nor is it a research project. It should be aimed directly at the target of collecting data for the eventual evaluation and it usually has to be set up in a great hurry because of the short time available between the approval of the project and when the implementation starts.

COMPOSITION OF THE TEAM

Because of the several disciplines involved it was necessary to send out several people, and because of the urgency it was not possible to get everyone to Swaziland at precisely the same time, nor was this absolutely essential since every person had his or her specific role to perform. The team members and the times they spent in Swaziland were as follows:

Dr Dion Bell, Epidemiologist, Department of Tropical Medicine, University of Liverpool	5-30 March
Mr Aron Cronin, Sociologist, temporarily attached to the MPU	2 March - 14 April
Mr John Lewis, Chemist, Geological Survey, Botswana	13-19 March
Dr Harriet Sibisi, Social Anthropologist	12 March - 12 April
Mr Magnus Todd, ODM Engineering Adviser	2-8 March

TERMS OF REFERENCE

These are given in full in Appendix 1. The project which is the subject of the baseline study comprises 22 small piped water supply schemes to rural communities in Swaziland costing in all £800,000. After discussion with the Swazıland authorities it was decided to confine the study to six selected schemes representing different types of terrain and different water situations. The six

/villages

villages studied were Dwalile, Gege, Luve, Mafutseni, Motshane and Mpolonjene.

The objectives of the study as set out in the terms of reference were:

(i) to obtain the necessary data against which it is possible to measure the changes in health status, water-drawing patterns, the role played by water in village life, and commercial activities and arrangements for maintaining the water supplies;

(ii) to suggest lessons for immediate application to this project as it is implemented in phases, particularly with regard to training needs and policies.

THIS REPORT

Unlike many reports, some of the most valuable results of this survey are contained in the Appendix 2, which sets out the details of the household surveys. These show, household by household, the detailed picture of the present family structure, economic activities of the household, and the present situation regarding the drawing of water, particularly the accessability of water supplies and frequency of collection. In the course of time, when the "ex-post" evaluation is carried out, these detailed notes in the Appendix 2 will be invaluable. Only a brief summary of this material is included in the main part of the report.

The contributions in the main report are by each member of the team and deal with the various disciplines independently as follows:

Chapter 1: Water Quality - Mr W J Lewis

Chapter 2: Medical Data - Dr Dion Bell

Chapter 3: Sociological Data - Dr H Sibisi

Chapter 4: Organisational Aspects - Mr M Todd

Chapter 5: Implementation Aspects - Mr A Cronin

The Annex containing confidential household details has not been included in the report for general distribution .

ACKNOWLEDGEMENTS

This study was planned and implemented in full cooperation with the Swaziland Government, whose ready assistance at all times is gratefully acknowledged. It is hoped that the data collected will be useful to those whose task it is to implement the project as well as to those who may be called upon to evaluate it some time in the future.

SUMMARY OF MAIN FINDINGS

THE BASELINE DATA

1. The first objective of the terms of reference was to gather baseline data on the six selected schemes. Dr Bell found that reasonably good clinic records were available for two of the six villages, and that these will enable an evaluation of the medical benefits of the project to be made. Mr Lewis carried out water quality tests at all six sites, but it will be necessary for him to return again to supplement these with further tests during a different season (as he is in Botswana this should not be too difficult). Dr Sibisi collected extremely detailed information on the time taken to collect water and how it was used in the households, most of which cannot readily be summarised and is therefore contained in the Appendix. Mr Todd and Mr Cronin investigated the organisational and training aspects, which again cannot readily be summarised in what follows but which are of vital importance for the success of the project. The following brief summary, scheme by scheme, gives some of the more interesting results, but of course it is the details themselves that matter. These are now recorded in the report for use when the time comes to carry out the ex-post evaluation.

BRIEF SUMMARIES OF SOME OF THE INFORMATION COLLECTED ON THE SIX SELECTED SITES

DWALILE

Present sources: These are adequate for quantity. The three rivers become muddy in heavy rains, and more distant springs are resorted to. A small ram pump lifts river water to the secondary school and clinic.

Water quality: The water lifted by the ram pump is chemically potable but bacteriologically very poor.

New supply: Will use the same sources as at present, so that the water treatment aspects of the scheme will be of vital importance. The new ram pump has arrived in Swaziland and early installation is anticipated. RWS has enjoyed a good relationship with the community.

Medical: Water-related diseases are common. The Clinic records are of good reliability and will be used for the Study - details were collected for the evaluation in due course.

Community: Twelve sample homesteads with a mean size of 15.7 persons were investigated, of which eight had pit latrines. The headmaster and health assistant have been influential organisers.

GEGE

Present sources: There are adequate springs and rivers near the secondary school but fewer near the clinic.

/Water

Water quality: The two samples taken from a stream which is a common water source showed a low concentration of dissolved minerals, with grossly bad fecal contamination. However, the source for the new supply was of excellent quality except for a low pH.

New supply: The first line has been turned on, and the full scheme is near to completion. RWS has tended to have a bad relationship with the community.

Medical: The Clinic records are good and will be used for the eventual evaluation.

Community: Ten sample homesteads with a mean size of 11.1 persons were investigated of which four had pit latrines (a WC in one case). The headmaster has been an influential organiser.

LUVE

Present sources: There are abundant springs giving generally potable water.

Water quality: The source that is at present pumped to the store was of very satisfactory chemical quality and the bacteriological quality shows only slight degradation.

New supply: Drilling of the borehole was expected imminently. RWS has a good relationship with the community.

Medical: Water-related diseases are common especially in infants. The clinic's records are not suitable for use as baseline data.

Community: Six sample homesteads with a mean size of 16.3 persons were investigated of which two had pit latrines. The store owner has donated his piping to the community.

MAFUTSENI

Present sources: The main source is a stream which often dries up and a water hole has to be dug in the bed. There is also a river.

Water quality: The water from the water hole was potable, but grossly polluted bacteriologically; that from the river was chemically satisfactory but also bacteriologically polluted.

New supply: Borehold drilling should commence shortly. RWS has had a good relationship with the community. CD identified this as a priority scheme.

Medical: No data.

Community: Six sample homesteads with a mean population of 11.7 persons were investigated of which two had pit latrines. The headmaster has been an influential organiser.

/MOTSHANE

MOTSHANE

Present sources: There are abundant springs, streams and rivers.

Water quality: A sample from a stream commonly drawn from had a very low concentration of dissolved salts, but was somewhat polluted bacteriologically. The spring water which is the source of the new supply was of an excellent quality.

New supply: This is close to completion. RWS has got along well with the community, led by a local store-owner.

Medical: No data.

Community: Eight sample homesteads with a mean population of 9.6 persons were investigated of which five had pit latrines.

MPOLONJENE

Present sources: There are various sources but all are very hard and dirty. Few homesteads have tin roofs.

Water quality: A large dam whioh is the present source for the school (the water is chlorinated before distribution) was sampled and found to be chemically satisfactory but grossly polluted bacteriologically.

New supply: A borehole is to be drilled later this year. RWS has not had good communication with the community.

Medical: No data.

Community: Sixteen sample homesteads with a mean population of 16.7 persons were investigated of which four had pit latrines. The headmaster has been an enthusiastic community organiser.

LESSONS FOR IMMEDIATE APPLICATION

2. The second (and less important) objective of the study was to suggest lessons for immediate application, e.g. with regard to training, facilities for maintenance and other aspects on which early action might be necessary.

3. The Team were told that their main task was to collect the basic data so that the comments that follow are not in any way a reappraisal of the project but merely suggestions that arise directly out of their experience on the ground and in respect particularly of the six sites they visited. Although these comments are incidental to the main purpose of the study, they are still valuable since they are the firsthand views of experts in their own fields.

4. Mr Lewis found that the existing water sources are highly polluted (mainly through livestock) and he recommends that all water should be boiled before use and that the Swazi authorities should be advised to start a health education programme to this end (Chapter 1, para. 5.1). Since livestock pollution cannot easily be avoided many of the new schemes will have to use polluted water, so that heavy reliance will have to be placed on adequate treatment before use. He recommends that funds be made

available to enable test equipment to be acquired so that the authorities responsible for maintaining water quality can conduct their own tests (Chapter 1, para. 5.2). He also recommends that emphasis should be placed on the importance of properly operating and maintaining water treatment equipment in any training programme given to the operators who will take charge of the schemes after their completion (Chapter 1, para. 5.4).

5. Dr Dion Bell recommends that despite some of the commonly held sceptical views on this issue a simple ratio such as that of diarrhoeal disease to trauma (which can be obtained from clinical records if they are reasonably representative) can be used to reveal a difference in relative disease prevalence that would escape detection by more formal epidemiological means. If this technique can be tested and proved when the evaluation is carried out it might well be applicable in other parts of the world (Chapter 2, para. 3.1).

6. Dr Harriet Sibisi recommends that those responsible for implementing the water schemes should make a point of involving the school and the headmaster from the outset: this applies not only to the provision of labour but also to the operation and maintenance phases (Chapter 3, para. 4.2).

7. Mr Todd emphasises the importance of training the water-minders to be nominated from each community and the importance of preventive maintenance (Chapter 4, para. 3.5). He states that when the supply to the rural community is not managed and operated by the Water and Sewerage Board the community will be expected to contribute the cost of fuel (if any) required by the scheme, and provide the services of a water-minder (Chapter 4, para. 7.2.3).

8. Mr Cronin notes that there is no central listing of rural water schemes constructed by the various government agencies, and he recommends that they be encouraged to try to compile details of schemes they have constructed and submit them to the Rural Water Supplies branch (chapter 5, para. 8.1). He suggests that the Rural Water Supply Board should arrange for those officials in the various agencies actually engaged in rural water supply activities to hold regular coordination meetings say every three months (Chapter 5, para. 8.4). He recommends that Community Development should give up any continuing rural water supply construction in favour of the Rural Water Supplies(RWS)Board (Chapter 5, para. 8.6) and that health assistants should work alongside the Rural Water Supplies in the community where supplies are being implemented (Chapter 5, para. 8.9).

CHAPTER 1

Water Quality Evaluation

by

W J Lewis

Itinerary

Monday 13 March.	Arrive in Swaziland.
Tuesday 14 March.	Visited Dwalile (6) and Eric Rosenburg/Gege (15/16) collected water samples for chemical analysis and performed field bacteriological measurements.
Wednesday 15 March.	Visited Mpolonjeni (60).
Thursday 16 March.	Visited Mafutseni (124) and Luve (29).
Friday 17 March.	Visited Motshane (27) in morning and had discussions with Mr N S Robins, Geological Survey, Swaziland, and Mr J Shelly, chemist, Swaziland Water and Sewerage Board during afternoon.
Saturday 18 March.	Re-visited Dwalile and Gege accompanied by Mr Shelly in order to test water supplies for fecal coli, culture media had not arrived in time for the first visit.
Sunday 19 March.	Packed water samples for chemical analysis to take back to Botswana. Departed Swaziland.

Water Quality

Bacteriological and chemical quality of water samples from the existing and where possible proposed water supplies was measured at the six schemes chosen for the Baseline study. Because of the limited time available (5 working days) in which to conduct the water quality survey it was not possible to sample all existing water sources in many of the test sites. Sample points were usually chosen on the basis of their being used more frequently by villagers when drawing their water. In any case an existing source such as a stream would certainly exhibit varying water quality from its source to its mouth. Certainly pollution from human and animal wastes would have a profound effect on the potability of the water. Seasonal effects would also play a major role in determining water quality, the dissolved solids being higher during the dry season and coliform organisms at peak concentrations in the wet season due to storm run-off after heavy rains. Thus it must be stressed that the water quality determined in this Baseline study represents an evaluation over an extremely short time period and in no way claims to be a comprehensive appraisal in the six test areas covered.

2. Bacteriological and chemical testing of water samples

2.1 Bacteriological Investigation

Water samples were tested in the field for the presence of total and fecal coliforms. Normal intestinal bacteria are used as indicators of the degree of pollution by enteric wastes and therefore entero-bacterial pathogens. The excreta of man, other mammals and birds contain ESCHERICHIA COLI (E. COLI) in enormous numbers (100 to 1000 million per gram). Hence the occurrence of this organism in water indicates the direct or indirect contamination by matter originating in the intestine of warm-blooded animals. Other coliform organisms are widely distributed in nature and may gain access to water from non fecal sources such as plants and soils.

E.Coli generally do not multiply outside the intestines of warm blooded animals and usually do not live as long as other coliforms organisms. Hence the presence of fecal coliform in natural water is indicative of recent fecal pollution. It cannot however be taken as a measure of the quantitative degree of fecal pollution or of the presence of pathogenic micro-organisms. The general philosophy in using indicator bacteria is that if it can be shown that fecal contamination of the water has occurred, then pathogens MAY also be present. The interpretation to be placed on the presence of coliform organisms in drinking water is generally dependent on whether the water is treated or not. Derived working levels which are generally recognised are laid out in the World Health Organisation publication "International Drinking Water Standards". This is summarized as follows:-

	Drinking Water:		Coliform Organisms (organisms/100 ml)	Fecal Organisms (organisms/100 ml)
1.	Treated supplies	(1)	No coliform in at least 95% of samples for the year.	No fecal coli in any 100 ml sample.
		(2)	Not exceed 4/100 ml in any two consecutive samples or one standard sample when less than 20 per month examined.	
2.	Untreated supplies		< 10	< 1

The method of detection used in the Baseline study was the membrane filtration technique, employing portable field equipment manufactured by the Millipore Corporation of the United States. The membrane filtration technique test makes use of a key trait of fecal coliform, their tolerance for higher temperatures. Thus, when a mixed coliform culture is incubated on a selective nutrient medium at 44.5°C (± 0.2°C) fecal coliform will grow into visible colonies, whereas owing to heat shock others will not.

Results of the bacteriological investigation can be found in table 2.

2.2 Chemical Analysis

The only laboratory analysing water samples in Swaziland is that of the Water and Sewerage Board at their headquarters in Mbabane. Unfortunately this laboratory is not equipped to do complete analysis of the major anions and

cations present in natural waters. Water samples were taken back to the Botswana Geological Survey laboratory for analysis. Sampling procedure was as follows: two 500 ml portions were collected in polythene bottles previously acid washed and then rinsed well in the field with the water to be sampled.

One portion was acidified by addition of 1 ml of concentrated analar quality Hydrochloric Acid. On arrival at the Geological Survey Dept Laboratory Botswana the water samples were filtered through a 0.45 micron membrane filter. The following determinations were carried out on the respective samples.

Filtered + acidified	Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, $So4^{2-}$, No_3^{-}, F^{-}
Filtered + not acidified	$C1^{-}$, HCO_3^{-}, T.D.S.

The results of the chemical analysis of the water samples collected can be found in tables 3 - 8. The ionic balance has been calculated to determine the validity of the analysis.

3. Test Sites

3.1 Dwalile: Scheme No 6

The existing supply is untreated stream water pumped from a ram pump to two storage tanks situated on the premises of the nearby primary school. A small dam has been constructed approximately 200 metres upstream of the intake of the pump. Samples were taken from a standpoint beside the reticulation tank and from the stream adjacent to the ram pump. The chemical analysis of these samples reveal that the water is relatively pure containing only trace amounts of dissolved minerals (see table 3). However the bacteriological investigation indicates fecal contamination of the supply rendering it unfit for human consumption unless treated or boiled. The pollution is most probably animal in origin as cattle drink from the stream. It was reported that during the dry season cattle are brought to the dam for watering.

The proposed scheme is essentially the same as exists except that the pump and storage capacity will be increased and the water chlorinated. It has not yet been decided whether or not to protect the water from dam to pump by piping it. The only advantage of this will be protection of the dug channel from erosion, since it will have little effect on sanitation as it is not intended to protect the stream above the dam or fence off the dam.

3.2 Eric Rosenburg and Gege: Scheme 15/16

The inhabitants in this area draw their water from streams. Two samples were taken (see table 1 and photomap) from a stream supplying a major portion of the community. The chemical analysis (see table 4) shows that the stream water contains low concentrations of dissolved minerals. There is an increase in the dissolved solids content from 44 mg/L in the upstream sample to 64 mg/L in the sample collected further downstream, however this is expected. Bacteriological results (see table 2) indicate gross contamination of the stream by warm blooded animals. Sample 16/2 had a count of 3950 fecal coliform per 100 ml which is an alarming count for a water supply used by people for human consumption. Water is pumped from this point to the clinic and police station. It was evident by the numerous hoof prints in the mud that this point was also popular for watering cattle.

The proposed supply which is very near to completion uses a protected spring with no nearby habitation (see photomap). The water is piped from source to a 90 M^3 reservoir and then distributed to standpoints located in the village, a water sample was collected from the inlet pipe to the reservoir. Its chemical analysis (see table 4) shows it to be purer than rainwater samples collected in a marine environment. The pH of this water is low and the water will be aggressive attacking and corroding metal fittings which it comes into contact with. Total coliform organisms were detected in this water source (see table 2) but these are most probably harmless soil organisms since no fecal organisms were detected. It is proposed to chlorinate this source as a safety measure.

3.3 Mpolonjeni: Scheme No 60

The existing supply is a small dam. Water is also pumped from this dam to a primary school approximately 3 kilometres away.

The water is stored in a 9 M^3 tank which is replenished once a week, usually taking only 4 hours of pumping to accomplish. A chlorinator is installed in the pump house to chlorinate water before storage in the reservoir. Sanitary conditions at this site are totally unfavourable. Approximately 80 metres upslope from this dam is a cattle kraal and dip. There is evidence of drainage into the dam from the kraal and it has been estimated that 200 - 300 head of cattle are watered from this dam every day. This estimate is supported by the abundance of manure droppings at the edge of the water. A water sample was collected nearby to the intake pipe to the water pump. The water was dirty in appearance, its chemical analysis however was very satisfactory. The bacteriological investigation showed gross fecal contamination.

The proposed supply to the school is a borehole sited below the dam tapping infiltrating dam water. This water will be chlorinated twice, at the pump and after storage in the reservoir at the school. A standpipe will put in the line from the pump to the reservoir to serve the community presently drawing water from the dam. It is recommended that the supply borehole should be fenced off so that cattle cannot approach within a distance of thirty metres and that proper attention be paid to its construction to minimise the dangers of contamination at the well head. Depending on the availability and occurrence of groundwater, it may be preferential to site the borehole away from the dam. The advantage of this would be that there is less likelihood of bacterial contamination of the groundwater.

3.4 Mafutseni: Scheme No 124

The school and surrounding inhabitants draw water from a stream which in the dry season dries up. At the time this study was made the stream was approximately 30 cms below the surface of the stream bed. People were drawing their water from a shallow hole dug into the stream bed. Cattle and livestock were also allowed to drink from this source. This water was potable from the chemical viewpoint (see table 6), but the fecal coli count yielded a figure of 2980 organisms/100 ml and greater than 30, 000 organisms/100 ml for the total coli count.

This is very strong evidence of fecal pollution. Another existing supply tested in this area was the river. This is a permanent source which proved to have satisfactory chemical quality, but unsatisfactory bacteriological quality.

The proposed supply to the school is a borehole which will be sited a short distance away from the school. A second borehole will be constructed to serve the rest of the community.

3.5 Luve: Scheme 29

An unprotected spring serves the community in Luve. At present there is a private system installed which is used to pump water to the owners store. Livestock are also watered from this source. The chemical quality of the water is very satisfactory (see table 7) and the bacteriological quality shows slight degradation (see table 2). In the new scheme a borehole will be drilled and the water supply reticulated from a 60 M^3 reservoir.

3.6 Motshane: Scheme 27

The community in this area uses the springs and streams which are plentiful in this mountainous area. A water sample was taken from one of the streams (see

table 8). Concentrations of dissolved salts were very low, but the bacteriological quality once again proved to be above accepted limits (see table 2). The proposed new supply which was in an advanced stage of completion uses a protected mountain spring feeding a 60 M^3 reservoir and thence reticulated to the community. The spring water was sampled at its source and its water chemistry (see table 8) shows it to be a very pure water, very similar to that of sample 16/1 from Eric Rosenburg.

No fecal coliform or total coliform organisms were detected in this water source.

4. Conclusions

All the water samples tested had an acceptable chemical quality. The majority of the samples had a total dissolved solid content (T.D.S.) of 80 mg/L or less. The maximum acceptable limit for T.D.S. laid out by the World Health Organisation is 1600 mg/L (WHO, 1973). The individual constituents in the water also fall well below the maximum acceptable limits for those constituents. The only complaint that can be made is that some of the spring waters may give problems with corrosion.

Only one water sample (27/2) had an acceptable bacteriological water quality. Two samples showed no evidence of fecal pollution (27/2 and 16/1) the remainder showed that fecal contamination had taken place, fecal counts ranging from 100 to 4000/100 ml were determined. These are alarming values for drinking water supplies and indicate a serious risk to public health is likely to people consuming water from these sources, since it is unlikely that the water is boiled before use.

Since the samples that did not show fecal pollution were both new proposed sources this means that all of the existing sources examined in the six areas studied are polluted. The six study areas were carefully chosen out of a possible 128 (approx) as representing a typical cross section. Since all six sites show fecal pollution of existing water supplies, then it is more than probable that a lot of the others are also polluted, possibly some even to a greater degree. It was evident from the site inspections made that the cause of fecal pollution can be directly attributed to contamination of the water sources by cattle and livestock, and it is unlikely tha there is any simple and cheap method of preventing future contamination.

It is often the case that the proposed new schemes make use of poor quality water sources. Hence heavy reliance is made upon water treatment to achieve the desired and necessary improvement in water quality. This reliance on water treatment raises several problems, the more noteworthy being:-

a. reliability

b. effectiveness

c. maintenance.

This is particularly so in a rural African environment where a breakdown is likely to allow untreated water supplies to be pumped to a storage reservoir unchecked until the fault is discovered by maintenance crew, possibly a week later. With the high ambient temperatures common by day in Swaziland it is possible that pathogenic organisms in the water entering a storage reservoir could survive and even multiply, thus presenting an even greater health hazard.

5. Recommendations

The results of the study prove conclusively that fecal pollution of water supplies is a major problem in rural areas where cattle and livestock are allowed to come into contact with the water sources. Thus it must be assumed that there is a very probable and serious health hazard to people using these sources untreated. It is also evident from the study that when the new proposed schemes are completed that this health hazard will be removed. However it will be some time before all of the schemes are completed and in the light of the serious nature of these findings it is recommended that the health authorities in the Swaziland Government be informed. Possibly a health education programme could be started in the rural areas advising people to boil all water for consumption particularly the water used for infants being bottle fed. If conducted in a proper manner this can be achieved without undue alarm to the public.

As previously stated major reliance is being placed on chemical treatment of the water supplies to produce water of acceptable quality. It is recommended that funds be made available to purchase suitable test equipment to enable the authorities responsible for maintaining water quality to conduct their own tests. There are facilities in the Public Health Laboratory at Manzini for testing bacteriological quality of water, but this service is confined to only one day a week because of the high work load coming into the laboratory eg pathological specimens etc. A list and prices of suitable test equipment identical to that used in the Baseline Study can be found in Appendix 1. The advantages of purchasing this equipment would be:

1. Rapid (24 hours) and accurate information of whether the water tested meets bacteriological quality criteria.

2. Portable and easy to use.

3. Very little training necessary to teach people how to use equipment.

4. Provision made of dip type samples which non-qualified personnel can use to test large numbers of samples rapidly (only 3 minutes at each site).

5. More information on water quality criteria in the various villages could help in identifying a priority list for completion of the proposed schemes.

6. The equipment would be available for the Post-construction study.

The equipment is of American manufacture distributed throughout the world. It can be purchased either in Britain or in South Africa. One advantage of purchasing the equipment from South Africa would be that technical assistance would be provided to instruct users in the correct test procedures.

Finally, it is recommended that emphasis should be placed on the importance of properly operating and maintaining water treatment equipment in any training programme given to the operators who will take charge of the schemes after their completion.

Table 1: Description of Sample Locations

Sample No	Location
6/1	Stand point fed from storage tank at Dwalile School.
6/2	Stream below dam, adjacent to ram pump. This stream supplies Dwalile School.
16/1	Spring water feeding 90 M^3 concrete reservoir at Eric Rosenburg.
16/2	Stream sample where road crosses over and immediately below ram pump (supply to clinic and police station at Gege).
16/3	Upstream of 16/2 where road crosses it.
60/1	Mpolonjeni, small dam, sampled at water's edge beside intake to pump.
124/1	Mafutseni, hand dug hole in stream bed behind school.
124/2	River a few metres upstream of cattle dip (Mafutseni).
29/1	Luve unprotected spring used by a private owner to pump to his store.
27/1	Motshane, where stream flows over dirt road.
27/2	Motshane, source of spring feeding 60 M^3 concrete reservoir.

Table 2: Coliform Measurements of Water Supplies

Location	Scheme/ Sample No	Fecal Coli (Organisms/ 100ml)	Total Coli (Organisims/ 100ml)
Dwalile	6/1	N. D.	4000
Dwalile	6/2	120	3000 +
Eric Rosenburg/Gege	16/1	0	800
Eric Rosenburg/Gege	16/2	3950	8000 +
Eric Rosenburg/Gege	16/3	N. D.	8000 +
Mpolonjeni	60/1	400	2400
Mafutseni	124/1	2980	30000 +
Mafutseni	124/2	640	4600
Luve	29/1	100	15000 +
Motshane	27/1	112	1660
Motshane	27/2	0	0

(Membrane Filtration Method Used)

Table 3: Chemical Analysis of Water Samples from Dwalile

Sample Number	6/1		6/2	
Sampled	14.3.78		14.3.78	
Analysed	28.3.78		28.3.78	
Conductivity	53 MICROMHOS		48 MICROMHOS	
pH	5.9		5.7	
	mg/L	Meq/L	mg/L	Meq/L
CO_3	0.0	0.000	0.0	0.000
HCO_3	24.8	0.407	25.4	0.417
CL	3.0	0.085	2.7	0.076
SO_4	0.3	0.006	0.3	0.006
F	0.1	0.005	0.2	0.011
NO_3	0.1	0.002	0.0	0.000
SUM OF ANIONS	28.3	0.504	28.6	0.510
K	1.2	0.031	2.4	0.061
NA	3.8	0.165	4.6	0.200
CA	3.1	0.155	3.1	0.155
MG	1.7	0.140	1.6	0.132
SUM OF CATIONS	9.8	0.491	11.7	0.548
TDS	44		36	
BALANCE	1.4%		-3.6%	

Table 4: Chemical Analysis of Water Samples from Eric Rosenburg and Gege

Sample Number	16/1		16/2	
Sampled	14.3.78		14.3.78	
Analysed	28.3.78		28.3.78	
Conductivity	20 MICROMHOS		76 MICROMHOS	
pH	5		5.9	
	mg/L	Meq/L	mg/L	Meq/L
CO_3	0.0	0.000	0.0	0.000
HCO_3	1.7	0.028	41.5	0.681
CL	4.5	0.127	4.0	0.113
SO_4	0.0	0.000	0.3	0.006
F	0.1	0.005	0.0	0.000
NO_3	0.0	0.000	1.0	0.016
SUM OF ANIONS	6.3	0.160	46.8	0.816
K	0.5	0.013	1.8	0.046
NA	2.4	0.104	4.4	0.191
CA	0.2	0.010	6.4	0.319
MG	0.3	0.025	3.1	0.255
SUM OF CATIONS	3.4	0.152	15.7	0.812
TDS	24		64	
BALANCE	2.6%		0.2%	

Table 4: continued

Sample Number	16/3	
Sampled	14.3.78	
Analysed	28.3.78	
Conductivity	30 MICHROMHOS	
pH	5.5	
	mg/L	Meq/L
CO_3	0.0	0.000
HCO_3	11.6	0.190
CL	4.3	0.121
SO_4	0.3	0.006
F	0.0	0.000
NO_3	0.5	0.008
SUM OF ANIONS	16.7	0.326
K	1.4	0.036
NA	3.4	0.148
CA	1.6	0.080
MG	1.0	0.082
SUM OF CATIONS	7.4	0.346
TDS	44	
BALANCE	-3.0%	

Table 5: Chemical Analysis of Water Sample from Mpolonjeni

Sample Number	60/1	
Sampled	15. 3. 78	
Analysed	28. 3. 78	
Conductivity	387 MCIROMHOS	
pH	5. 9	
	mg/L	Meq/L
CO_3	0. 0	0. 000
HCO_3	148. 1	2. 429
CL	45. 7	1. 289
SO_4	2. 5	0. 052
F	0. 2	0. 011
NO_3	0. 1	0. 002
SUM OF ANIONS	196. 6	3. 782
K	5. 2	0. 133
NA	34. 9	1. 518
CA	22. 2	1. 108
MG	16. 4	1. 349
SUM OF CATIONS	78. 7	4. 108
TDS	232	
BALANCE	-4. 1%	

Table 6: Chemical Analysis of Samples from Mafutseni

Sample Number	124/1		124/2	
Sampled	16.3.78		16.3.78	
Analysed	28.3.78		28.3.78	
Conductivity	290 MICROMHOS		390 MICROMHOS	
pH	5.9		7	
	mg/L	Meq/L	mg/L	Meq/L
CO_3	0.0	0.000	0.0	0.000
HCO_3	164.7	2.701	203.7	3.341
CL	11.1	0.313	26.6	0.750
SO_4	1.3	0.027	5.3	0.110
F	0.4	0.021	0.3	0.016
NO_3	0.6	0.010	0.4	0.007
SUM OF ANIONS	178.1	3.072	236.3	4.224
K	6.6	0.169	6.5	0.166
NA	19.2	0.835	34.8	1.514
CA	21.1	1.053	20.6	1.028
MG	11.3	0.930	17.2	1.415
SUM OF CATIONS	58.2	2.986	79.1	4.123
TDS	174		274	
BALANCE	1.4%		1.2%	

Table 7: Chemical Analysis of Sample from Luve

Sample Number	29/1	
Sampled	16.3.78	
Analysed	28.3.78	
Conductivity	150 MICROMHOS	
pH	5.5	
	mg/L	Meq/L
CO_3	0.0	0.000
HCO_3	59.2	0.971
CL	13.0	0.367
SO_4	1.3	0.027
F	0.1	0.005
NO_3	2.1	0.034
SUM OF ANIONS	75.7	1.404
K	3.3	0.084
NA	16.6	0.722
CA	7.7	0.384
MG	2.4	0.197
SUM OF CATIONS	30.0	1.388
TDS	140	
BALANCE	0.6%	

Table 8: Chemical Analysis of Samples from Motshane

Sample Number	27/1		27/2	
Sampled	17.3.78		17.3.78	
Analysed	28.3.78		28.3.78	
Conductivity	72 MICROMHOS		23 MICROMHOS	
pH	5.5		5.3	
	mg/L	Meq/L	mg/L	Meq/L
CO_3	0.0	0.000	0.0	0.000
HCO_3	40.3	0.661	6.1	0.100
CL	3.0	0.085	4.1	0.116
SO_4	0.8	0.017	0.0	0.000
F	0.0	0.000	0.1	0.005
NO_3	0.2	0.003	0.0	0.000
SUM OF ANIONS	44.3	0.765	10.3	0.221
K	1.3	0.033	1.0	0.026
NA	3.9	0.170	2.4	0.104
CA	2.8	0.140	0.7	0.035
MG	5.1	0.420	0.5	0.041
SUM OF CATIONS	13.1	0.762	4.6	0.206
TDS	56		26	
BALANCE	0.2%		3.5%	

APPENDIX 1

Millipore Test Equipment Necessary to Test for Total and Fecal Coliform Organisms by Membrane Filtration Technique

Item	Cat No	Qty	£ Price
Fecal Coliform Field Kit	XKFC 001 00	1	£537.00
MF - Incubator, Petri Dish	XX63 004 05	1	£917.00
Cast Aluminium chamber block to convert incubator to XX63 004 25		1	£92.00
Counter, 2 Gang Normal	XX75 000 02	1	£77.00
Application Manual		1	£10.00
Consumables			
Coli Count (100/PK)	MCOO 000 00	2	£290.00
Total Coli (M.F - ENDO BROTH)	MOOO 000 2E	2	£16.00
Fecal Coli (M - FC BROTH)	MOOO 000 2F	2	£16.00
Fecal Streptococcus (KF AGAR)	MBOO 000 0S	1	£17.00
T.T.C. Indicator	MBOO 00T TC	1	£6.00
Plastic petri dishes (100/PK)	PD10 047 00	2	£22.00
S - Pak Filters, Type HC (200/PK)	HCWG 047 S3	1	£30.00
Absorbent pads (200/PK)	AP10 047 S1	1	£8.00
Pad dispenser (3/PK)	XX62 000 14	1	£15.00
Sealing Tape (2/PK)	XX63 003 19	1	£9.00
Syringe Replacement Parts Kit	XX62 000 36	1	£12.00
Plastic Pipettes Sterile (25/PK)	XX63 001 35	1	£29.00
	Total Cost		£2103.00

Prices based on those supplied by Millipore Agents in South Africa and converted to pounds sterling using £1 = R1.63.

APPENDIX 2

1. Rainfall during and prior to Baseline Study

	Monthly totals 1978 (mm)		
	JAN	FEB	MARCH
Highveld Mbabane	420.0	225.1	232.1
Middleveld Matsapa	261.5	82.8	230.0
Lowveld Homestead	234.9	72.5	(not available)

2. Longterm Rainfall

mm

Region	Altitude in Metres	Longterm Rainfall		
		Annual	Summer	Winter
Highveld	910 - 1830	1016 - 2286	813 - 1778	203 - 508
Middleveld	330 - 1070	762 - 1143	610 - 914	153 - 229
Lowveld	60 - 730	508 - 890	406 - 711	102 - 178
Lubombo	270 - 820	635 - 1016	508 - 813	127 - 203

SOURCE: Ministry of Works, Power and Communications.

CHAPTER 2

Medical Data and the Evaluation of the Effects of Water on Health

by

Dion Bell

Availability of Baseline Medical Data

In a short visit, reliance must be placed on the medical records available. The relevant medical information concerns water-borne and water-related disease, and this information must be available for the population to be affected by the new water supply. Two important questions have to be considered when assessing the reliability of the available data:

1. Do the data include all illnesses in the area affected?

2. Do the data include illnesses in residents from areas not receiving a new water supply, so possibly submerging the relevant information and rendering later evaluation impossible?

This situation arises when a recorded "residence" is a broad geographical area which includes both homes which will have access to the new water supplies, and those that will not.

Precise diagnosis in the records is of minor importance, as diarrhoea is an unequivocal symptom, and almost always signifies faecal-oral infection of some sort. Scabies and skin infections are also similarly easy to categorise, and refined diagnostic criteria are not needed. Completeness of records is more important than precision, but it is important to be able to distinguish first attendances from reattendances, and so avoid spurious over-recording of illness.

The Six Villages and their Records

The villages of Motshane and Mpolonjeni were not visited, as it was obvious from the facts available that no worthwhile data could be obtained from them. Motshane has no clinic of its own, patients either going to Mbabane or to the asbestos company health centre for medical aid. At Mpolonjeni there is only one clinic session a week, patients otherwise going direct to the Mission Hospital (The Good Shepherd Hospital, Sitege). In neither village therefore was there systematic recording of illness.

Luve (visited 22. 3. 78)

This village has two clinics: the Lusitweni Maloyi Clinic run by the Catholic Mission, and the Luve Anglican Clinic.

The Catholic clinic in Luve is only held on alternate days. Inspection of the register revealed that the patients' residence was usually recorded not under the name 'Luve' - the relatively small area to be served by the new water supply - but under the name 'Ekutsimuleini'. This comprises Luve and a much greater area containing many homesteads not to be supplied with water. Baseline data derived from entries under this broad heading would not reflect the situation in Luve proper.

The Luve Anglican Clinic is staffed by one resident nurse, and is held daily. Furthermore, the patients' residence is identifiable under the name 'Luve'. Although all the medical data that related to Luve (309) was collected from amongst more than 2500 record cards, it is considered that the information cannot be used as a reliable baseline for these reasons:

i. the quality of the records was weak for Baseline purposes;

ii. it is not known - and cannot possibly be discovered - what proportion of 'Luve' patients attend this clinic, the Catholic clinic, or prefer to travel to Manzini for medical attention;

iii. the charges to patients attending the clinic are so high (E1.50 for adults and E1.00 for children) that only the most serious cases would be expected to attend. This impression was borne out by the large range of patent medicines available in the Luve general store.

But it was possible to make some qualitative statements as a result of inspecting the Luve Anglican clinic records and from conversation with the nurse in charge, Sister Isabel Nahlalela:

i. gastroenteritis in children is common;

ii. deaths from gastroenteritis do occur;

iii. deaths from gastroenteritis occasionally occur in children referred to the Raleigh-Fitkin Memorial Hospital in Manzini;

iv. bottle-feeding of infants from the first week of life is common. Many mothers make up the feeds with unboiled water from grossly polluted sources;

v. of all the record cards scrutinised, 309 recorded illness in patients from 'Luve' in the period May 1977 - March 1978 (10 months). Of these 309 new attendances, 47 were with diarrhoeal disease variously labelled as 'diarrhoea', 'gastroenteritis' or 'dysentery'; 20 attendances were due to injuries, including burns. The diarrhoea/trauma index was therefore 2.35. This simple expression of the comparative frequency of diarrhoeal disease may prove very useful in subsequent studies.

In conclusion, whilst there is good evidence from the limited data available that diarrhoeal disease is important in Luve, the incompleteness and other imperfections of the available health records render Luve inappropriate for a serious study of the effects on health of a pure water supply.

Mafutheni (syn: Mafutseni) (visited 29.3.78)

This is another area served by 2 clinics: the Nazarene Mission Clinic (Sister Clara Thurala) adjacent to the School and only 100m from the main Manzini road, and the Catholic clinic about 6km distant. Both clinics charge the usual high mission attendance fees already mentioned. Patients attend the Nazarene clinic from as far as 15km away. But the situation is complicated by the fact that, being near the main road, patients have ready access to Manzini by regular (hourly) bus service. In Manzini there are several types of medical service available: the Raleigh-Fitkin Memorial Hospital, the Catholic clinic, and private medical practitioners. The Sister stated that she sees many babies with diarrhoeal disease and added that all the 'sick ones' were referred to the Raleigh-Fitkin Memorial Hospital in Manzini. It seems probable - especially in view of the high cost of clinic attendance - that most patients with severe diarrhoeal illness would seek medical aid elsewhere than the Nazarene Mission Clinic.

For these reasons, it appeared that no useful baseline medical data could be derived from Mafutheni.

Dwalile (visited on 23.3.78)

This area is served by a single government clinic. Dwalile would serve as an ideal area for evaluating the health benefits of a rural water supply system for these reasons:

i. Dwalile is relatively isolated, and there are no medical facilities available, apart from those offered by the government clinic;

ii. the clinic has excellent staff: a competent and well-trained sister in charge (SN Christine Makanya, with 5 years SRN training), an assistant nurse and a sanitary assistant;

iii. the attendance charge is low: 20c per patient;

iv. the clinic is well provided with medicines of all kinds (in contrast to the meagre provision in the mission clinics visited) and the standard of treatment given is very high. In particular, Sister Christine treats gastroenteritis in children with an efficient oral electrolyte solution regime and can, in emergencies, put up scalp-vein drips;

v. virtually all sick patients attend the government clinic. As the local transport situation is very poor, no patients are referred to hospital (Makayan) except in dire emergencies. In the 7 months preceeding our visit, an average of only one patient per month had been referred to hospital. (The clinic is not visited by a doctor.)

vi. the clinic and its staff have an excellent reputation with the surrounding population, encouraging a high level of utilisation of the clinic services;

vii. the population of Dwalile appears to be very stable, with no notable outward or inward migration. Precise demographic data were not readily available, but data - and a map - should be available from the 1976 census in due course;

viii. a high degree of confidence can be placed in the records kept by Sister Christine.

During the Baseline period all the entries for the 12-month period ending 28. 2. 78 and related to patients from Dwalile were copied from the clinic register.

There seems little point at this stage in engaging in full formal analysis of the available data, but the salient facts are these:

Dwalile - 12 months ending 28 February 1978

Month	Total attendances	All diarrhoea	Diarrhoea age 5 and less	Diarrhoea age 1 and less
3.77	153	17	8	3
4.77	123	15	8	7
5.77	111	10	8	5
6.77	187	22	14	10
7.77	124	9	2	1
8.77	143	5	5	3
9.77	116	17	8	7
10.77	176	30	18	12
11.77	132	20	12	7
12.77	113	16	9	5
1.78	153	24	17	10
2.78	165	10	8	5
Yr ending 2.78	1786	195	117	75

Diarrhoeal disease therefore accounts for 11% of all clinic attendances. Total attendances for trauma (including burns) were 80. The diarrhoea/trauma index is $\frac{195}{80} = 2.4$. The similarity between this index and that from Luve (2.35) is remarkable.

From the clinic register it is not easy to distinguish between new attendances and reattendance. Where a visit is labelled "check", "redressing" or "antenatal", it is easy to perceive that this is a reattendance. But an apparent discrepancy is here revealed, for the total number of reattendances, excluding antenatal visits, is only 54, whereas official government statistics (obtained from Dr Huppert, lately Chief Swazi Government Medical Statistician) suggest that reattendances should considerably outnumber new attendances.

The way in which records at Dwalile have been kept makes it impossible to unravel this problem retrospectively. For this reason, the index diarrhoea/trauma, which is not likely to be unduly influenced by confusion of this sort, may well prove to be a fairly stable index of the incidence of diarrhoeal disease in the population.

Sister Christine has been requested in her future records:

a. to clearly indicate which clinic visits are for a new complaint, and which are reattendances for a previous complaint;

b. to indicate whether or not the patient uses the new water supply.

This will involve asking every patient "do you use the new water supply?". If the answer is "yes", then a circled letter 'S' would be entered at the extreme

right-hand side of the relevant ledger entry. Dr F Friedman, Director of Medical Services, has readily agreed for this to be done.

Dwalile should be revisited by the epidemiologist in 2 years time, and the situation reassessed on the ground. In addition, the entries in the clinic register for the previous 2 years should be copied and analysed appropriately. A field visit would be essential to identify circumstances other than water supply which might have influenced the pattern of recorded illness in the population. During this visit, it might be appropriate to examine the Dwalile children whose homes have benefited from the new water supply, and compare their health status with that of children not so advantaged. At this visit, in the absence of an efficient registration scheme, it might also be revealing to carry out a retrospective inquiry into childhood deaths.

Gege (visited 28.3.78)

Gege is served by a single government clinic, as is Dwalile. The clinic is staffed by one qualified nurse (SN Lydia Masuku) and one nursing orderly. There is no sanitary assistant. Records are kept, as at Dwalile, in a register. SN Masuku has only been at the clinic since 16.1.78. From that time until the present, the standard of record-keeping has been good. Before then the records were not so good, and in particular some bad handwriting caused difficulties.

From conversation with SN Masuku the following major points emerged: about 40 patients attend the clinic daily; the clinic serves the whole community; the nearest hospital - Hlatikulu - is "a long way away"; she had only referred one patient to hospital in the 6 weeks she had been in Gege. There is no other clinic to which patients from Gege have access.

Because of poor handwriting and record-keeping, a complete analysis has not been possible, but the salient facts available for Gege are as follows:

Gege - 12 months ending 31 March 1978. Clinical entries for patients recorded as resident in Gege

Month	Total attendances	All diarrhoea	Diarrhoea age 5 or less	Diarrhoea age 1 or less
4.77	105	16	11	7
5.77	154	23	18	14
6.77	134	15	11	6
7.77	116	10	4	2
8.77	146	8	5	1
9.77	123	7	3	0
10.77	83	up to and including 17.10.77. Records then grossly inadequate until 28.11.77		
11.77	Records only available for 3 days (14 attendances, 1 adult diarrhoea)			
12.77	144	29	23	17
1.78	139	11	10	9
2.78	144	13	12	5
3.78	149	20	12	10
Yr ending 3.78 (10/12)	1274	154	109	71

Diarrhoeal disease accounts for 12% of all clinic attendances. Total attendances for trauma, including burns, were 50. The diarrhoea/trauma index is $\frac{152}{50} = 3.0$, rather higher than in Dwalile.

The quality of records in Gege was much lower than that of the Dwalile records, so less reliance can be placed on the Gege figures. The absence of data for a 2-month period is regrettable, but should not seriously interfere with a subsequent evaluation study in 2 years time.

As for Dwalile, the recording of all future attendances will be required.

Conclusion

Despite sceptical views to the contrary, simple medical records can be used to monitor the prevalence of water-borne diseases. This applies particularly to areas where those with a 'protected' water supply can be readily identified, and where all incidents of illness are recorded in a single register. The use of a simple ratio, such as that of diarrhoeal disease to trauma, might well reveal a difference in relative disease prevalence that would escape detection by more formal epidemiological means.

This approach to an otherwise difficult problem has several advantages, most especially in the elimination of the need for resident supernumerary staff to register disease. This in turn will greatly reduce the cost of evaluation, and so perhaps make possible the use of the method in other parts of the world where evaluation costs would otherwise have been prohibitive.

CHAPTER 3

Report on the Relation between Swazi Local Society and Existing and Potential Water Use

by
Harriet Sibisi

Persons met in Course of Assignment

Dr F Friedman	Director of Medical Services, Kingdom of Swaziland
Dr Huppert	lately Swazi Government Medical Statistician, now Lecturer in Medical Statistics at the University College of Swaziland
Mr Levy	Surveyor General (Lands and Surveys)
Andrew Green	(Economist), Health Planner in the Ministry of Health
Behani Abraham	Co-ordinator, UNEP/UNICEF/WHO Schistosomiasis Control Programme
Leslie Mtetwa	Senior Health Inspector, Ministry of Health
Dr Andrin	(UNDP)
Mr Cliff Williams	Rural Water Engineer

Introduction

The information in this Report is of a general nature, providing an overall view of water sources and use in each locality studied, with brief summary tables of homestead size, cattle owned, and some features relevant to water use. Certain local institutions of special significance for water management are then discussed.

2. Water Sources and Use in the Localities Studied

2.1 The sources of water in the places visited comprise rivers, streams, springs, dams and rain. The last of these is seasonal, and its availability depends on having means of collecting it. The usual means here are corrugated iron roofs and oil-drums or similar containers. Thus homesteads equipped with such iron roofs are advantaged. Otherwise water obviously must be fetched. The containers used are of a standard 20 litre size which can be carried without strain on the heads of women and girls. This made it easy to determine the quantity of water used in each homestead per day. Where water sources are very distant, ox-sledges are occasionally used, bearing much larger containers such as oil-drums. In the two homesteads owning donkeys (see 2.4.3 and 2.4.4 below), they were used as a matter of course to bring water, drawing small home-made carts. In both cases this was commercialized. Where animals are used to fetch water, men as well as women commonly participate in the task.

2.2 Distances from water sources in terms of metres are not meaningful. What counts is the nature of the terrain, and the time it takes to traverse it.

2.3 As can be seen from the following tables more information was gathered in some localities than in others. It appeared that Gege and Mpolonjeni had more organisational problems related to the new water supply than did the other places. Some effort was made to include both large and small homesteads in the sample. Certain information was obtained by personal observation, especially that on houses, pit latrines and sources of water. In some instances the fetching of water was timed as well. Other information was obtained by questioning. The figures most open to doubt are those for cattle: apparently people are reluctant to reveal the size of their herds, for fear that official Government culling policies may be applied to them.

2.4 The situation at each of the six localities is outlined below and summary figures given for the homesteads investigated, of their size, cattle owned, roofing seen on their houses and presence of pit latrines. Possession of water closets and of donkeys where found is also noted. Livestock both use and pollute water and are relevant to its transport and commercialisation (see para 2.1). Where pit latrines are used, pollution of river water is thought to be less. Their prevalence (at Dwalile especially) also can reflect the influence of the Health Assistant at the Government Clinic, an important local institution about which more will be said.

2.4.1 At Dwalile most water used is drawn from the three rivers which pass through the locality. There are a few springs, but they are too far away for most of the inhabitants. Nevertheless, in the rainy season when the river water is very muddy most people prefer to resort to the springs if they can. Residents were well aware that, since the rivers are used for all purposes, the water in them is far from clean; but for most of them there is no alternative. Twelve homesteads were investigated:

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	22	-	4	1	No
2.	18	-	3	1	No
3.	8	-	-	1	Yes
4.	6	-	2	1	Yes
5.	14	6	3	1	Yes
6.	9	13	4	-	Yes
7.	9	13	-	1	Yes
8.	10	20	2	1	No
9.	32	10	10	4	Yes
10.	8	-	1	1	Yes
11.	41	13	6	4	Yes
12.	11	-	4	1	No

Mean Size of Homestead: 15.7 Median 10.5

2.4.2 At Gege there is a very noticeable difference between the densely populated area near Eric Rosenburg Secondary School and the sparser area four kilometres distant, near the clinic, police station, shops, etc. The former area is amply supplied with springs and river water, the latter depends mainly on the river, which the terrain makes more difficult of access. Of the ten homesteads investigated and here listed, the second has a WC.

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	13	3	3	1	No
2.	2	-	-	1	No
3.	6	2	4	-	No
4.	8	6	1	1	Yes
5.	12	7	3	-	Yes
6.	11	-	6	-	Yes
7.	16	-	-	1	No
8.	11	-	1	1	No
9.	7	-	-	1	No
10.	25	11	8	-	No

Mean Size of Homestead: 11.1 Median: 11

2.4.3 At Mafutheni there are no springs and water is available only from a distant river bed where one has to dig a hole and wait for it to fill. The return journey, up a steep incline, is so arduous that a woman usually breaks it for a rest, removing the full container from her head and standing it down. Four homesteads possess boreholes, dug at great expense and provided with storage tanks installed for domestic use. Water is also brought from Manzini (less than 20 km to the west, along a tarred main road) by those who can afford to do so. Of the six homesteads investigated and here listed, the first has a WC and its own

water-pump, and the sixth has eight donkeys. The low prevailing size of these homesteads no doubt reflects the proximity of the town: the sixth is the only one with more than twelve people, and four of the other five have less than nine each.

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	7	-	-	1	Yes
2.	6	-	3	-	No
3.	8	54	-	1	Yes
4.	6	-	3	-	No
5.	12	21	-	2	No
6.	31	26	2	2	No

Mean Size of Homestead: 11.7 Median: 7.5

2.4.4 At Mpolonjeni springs are abundant but the water is cloudy, scarcely drinkable and very hard. The alternative is water at a few distant dams which is commonly contaminated by livestock. Of the sixteen homesteads investigated and here listed, the second half 20 donkeys. As the figures show, less than half of these homesteads have houses with iron roofs and thus are not in much of a position to make use of rainwater to supplement the other unsatisfactory sources.

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	/	10	3	-	No
2.	)	21	7	-	No
3.	31	50	10	-	No
4.	19	6	9	1	Yes
5.	7	20	1	2	No
6.	12	-	5	-	No
7.	35	?	9	2	No
8.	8	30	8	-	No
9.	10	10	3	-	No
10.	11	27	7	-	No
11.	16	-	5	-	No
12.	14	10	5	-	No
13.	21	180	4	1	Yes
14.	17	-	2	1	Yes
15.	40	120	10	3	No
16.	9	-	2	3	Yes

Mean Size of Homestead: 16.7 Median: 13

2.4.5 At Luve there are many springs and streams, with very potable water easily accessible for most inhabitants. Some of them however dry up in winter. Just six homesteads were investigated:

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	20	29	5	2	No
2.	46	32	14	-	No
3.	9	-	2	2	No
4.	3	-	1	-	No
5.	14	-	-	1	Yes
6.	5	-	-	1	Yes

Mean Size of Homestead: 16.3 Median: 11.5

2.4.6 At Motshane there is river water available and an abundance of streams and springs, most of them perennial. This place lies only 12km west of Mbabane, on the main road to Johannesburg and very near the line of rail. Thus it is not surprising that here again homesteads are not very large. As the following figures show, of the eight homesteads investigated and here listed only one has more than twelve people, and four of the remaining have less than ten people each:

	No of People	Cattle	Type of Roofs Thatch	Type of Roofs Iron	Whether Pit Latrine
1.	15	25	5	1	Yes
2.	11	40	3	2	Yes
3.	8	5	3	1	No
4.	9	-	1	1	No
5.	12	-	-	2	Yes
6.	5	-	-	2	Yes
7.	6	-	-	2	No
8.	11	6	-	1	Yes

Mean Size of Homestead: 9.6 Median: 10

NB In none of these six localities are any springs protected.

3. The Significance of Modern Local Institutions

3.1 The School

3.1.1 It soon became evident that a major part in the life of the community was frequently played by the headmaster of the local school. In most of the localities visited the headmaster was especially helpful in making arrangements for the Baseline Study locally. He was equally often a good source of valuable insight into local problems. This is not to say that the chief is without significance, but he exercises traditional functions in a domain territorially defined. By contrast the headmaster controls a key modern institution, the school, which is the gateway to the future for children from all parts of its vicinity. His domain is local but not territorial, and it thus can and often does cut across the boundaries of chiefdoms. This was observable especially at Gege and Mpolonjeni.

3.1.2 In terms of local influence, the headmaster has a number of clear advantages over the chief:

a. He is usually seen as the best informed person in the community, so people come to him for advice on a variety of matters.

b. In a community without telephones he is uniquely able to get in touch quickly with many other inhabitants - for he can send and receive messages through the children. Although it may well be the case that not all the children of the locality attend the school, the fact that they usually live in extended families means that virtually every homestead has some of its children at the school and is thus in contact with it.

c. By this means he can easily summon a meeting whenever there is an issue of local importance to be discussed.

d. He is also able to make use of the school committee for the discussion of matters affecting the community, cutting across the boundaries of chiefdoms.

e. His control over the children's prospects extends to career advice and the possibility of recommending them for grants to enable them to continue their education.

3.1.3 It is important to notice that the headmaster not merely is able to communicate more quickly than the chief with people in the locality, and to communicate with them irrespective of which chiefdom they inhabit, but is in touch with parents in general rather than just with heads of homesteads. Since the men are frequently away working in town or outside Swaziland, this means in practice that the adults who are more in communication with the headmaster are very often the women. The school therefore facilitates participation by women in local affairs.

3.2 The Government Clinic

This is another modern local institution of great importance to the community, especially where it works closely with the school - as is the case notably at Dwalile. The clinic provides for child care and gives health education, of course primarily to mothers. Thus it is able to inform them about water-borne diseases and, again, to involve women in local affairs, especially those pertaining to the health of the community.

3.3 Other Modern Local Institutions

So far as could be seen, institutions such as the market, the store, the Post Office and the police station are at present on the whole less relevant to water supply problems than the school and the Government Clinic. However, this may well be different in other localities.

3.4 An Example of Failure to Use Such Institutions

3.4.1 According to the Rural Water Engineer considerable frustrations were encountered by those endeavouring to provide a water supply at Gege and Mpolonjeni. The understanding had been that the community would be responsible for digging the trenches for the pipes and filling them in afterwards. However, people did not turn up at meetings arranged, and even when they had been met did not carry out the digging as agreed.

3.4.2 The trenches had in fact been dug and the pipes laid in both places by the time of the Baseline study, although the work had not been completed. According to the two headmasters delays and confusions had indeed been experienced. However,

as they saw it the reason was that Rural Water Supply section had not appreciated the significance of the fact that, in each case, the people of the locality come under more than one chiefdom; and RWS had failed to make contact with the one local person who could be of most assistance, namely the headmaster himself. In fact in both cases it was the headmaster who eventually resolved matters by organizing the digging, getting the schoolchildren and the local women to provide the necessary labour.

3.4.3 This example shows how crucial failures of communication can easily occur where the significance of these modern local institutions has not been grasped, in relation to water supply schemes especially. The two cases also bring out the central position of the headmaster in relation to the problem of organizing the required work in the very first phase of a new water supply scheme. He is likely to be of equal importance in subsequent phases. Most notably, the school committee is a ready-made structure for supervising matters of operation and maintenance, all that it needs to do is to include an item on water in the agenda when it meets.

4. Recommendations

4.1 In four weeks it is very difficult to study in depth the kinds of questions posed in the Terms of Reference. The recommendations offered are necessarily therefore tentative.

4.2 Clearly, those responsible for implementing future phases of the water supply schemes ought to make a point of involving the school and the headmaster at the outset, as the above findings indicate. This applies not only to provision of labour but also to operation and maintenance phases. Children can be taught the elements of supply maintenance in the course of their general school education, helping to ensure that at least some of the necessary skills for maintenance and repair will be readily obtainable in the future. More serious breakdowns can well be reported through the school, since the headmaster will be among the first to be informed of them (through the children living near the fault) and is usually able to get in touch easily with the appropriate quarters.

CHAPTER 4

The Organisation of the Water and Sewerage Board and its Rural Water Supply Branch

by

Magnus Todd

SECTION I

Organisation and Responsibilities of Agency for Supplying Water within Swaziland

1.1 In 1974 the Government of Swaziland set up a single agency to be responsible for the supply of water and disposal of sewerage in the urban areas of Swaziland. This agency is autonomous and self accounting and is entitled the Water and Sewerage Board (WSB).

1.2 An organisation chart of the Board is attached at Appendix 'A'. It is managed by a Board of Management which is responsible to the Swazi Government through the Minister of Works and Power. A list of schemes managed and operated by WSB is attached at Appendix 'AI'.

1.3 The Director, who is responsible for day to day management, operation, construction and collection of revenue to the Board, is a fully qualified Water Engineer, supported by technical, managerial and accounting staff.

1.4 The Board also manages, operates, constructs and maintains various minor water supplies to schools, border posts, clinics and police stations on an agency basis for the various ministries concerned but these supplies do not provide water to the rural population.

1.5 In 1975, in order that the needs of the rural communities be met in providing clean and potable water, and in order to co-ordinate the efforts of various ministries such as Health and Community Development in achieving this end it was decided by the Swazi Government to create a Low Income Water Supply Unit.

1.6 This Low Income Water Supply Unit was placed under the administrative control of the Water and Sewerage Board and was renamed the Rural Water Supply Branch of the WSB. This had the effect of making available the Engineering and Management skills of the WSB to a small self-contained unit on an agency basis, a charge of 8% being levied to cover these services.

1.7 A paper giving fuller details is appended at Appendix 'B'.

1.8 An explanatory paper giving details of the organisation and responsibilities of the Rural Water Supplies Branch (WSB) is attached at Appendix 'C' showing its relationship to the WSB and the various government ministries, district teams and traditional authorities.

SECTION 2

Staffing and Training of Staff

2.1 Staffing of the Water and Sewerage Board

The Water and Sewerage Board (excluding the Rural Water Supply Branch) has the following technical staff:-

(a) Engineers - 7 No.

(b) Senior Technicians - 16 No.

(c) Junior Technicians - 26 No.

(d) Chemist - 1 No.

(e) Labour and Tradesmen - 300 approx

2.1.1 All key staff have understudies, either in post or undergoing training abroad or in Swaziland at S.C.O.T. (Swaziland College of Technology).

2.2 Staffing of Rural Water Supplies Branch

In addition to the staff shown in 2.1 above the Branch is staffed as follows:-

(a) Engineer - 1 No.(CIDA)

(b) Senior Technicians - 4 No.(CIDA) + 1 No.(Peace Corps).

2.3 Training of Staff for RWS Branch

2.3.1 Engineer At present one person with a BSc degree in Mathematics and Physics has been identified and is assisting the CIDA engineer. Negotiations are presently in hand for a Canadian Scholarship to give this person engineering training to degree level.

2.3.2 Senior Technicians Three assistants to the Clerks of Works (CIDA) have been identified one of whom has had three years training at S.C.O.T. and has also had three years practical experience. The other two are currently gaining experience and undertaking further relevant training at S.C.O.T. in Water Technology.

2.4 General Staff

Mechanics No problem is expected in obtaining suitable mechanics and trainees are presently taking suitable courses at S.C.O.T.

2.5 Localisation of Expatriate Staff

A localisation programme has been prepared and details are at Appendix 'D'; some slippage may be expected.

2.6 Assessment of Staffing Level (RWS)

It is considered that the current level of staffing for the RWS unit is adequate particularly as this unit would be able to call on the staff and physical resources of the Water and Sewerage Board in any emergency.

SECTION 3

Operation of Water Supply Schemes (Rural)

3.1 Attached at Appendix 'E' is an explanatory paper on the operation of Rural Water Supplies.

3.2 This paper is under discussion with various ministries concerned but has not been finally resolved.

3.3 The District Teams have however agreed to the modus operandi in general terms in that they expect the communities involved to operate and finance the operation of their own schemes. This can be a difficult problem in Swaziland in that villages as such do not exist in a compact mass but are scattered homesteads the focal point of which is usually a school and/or a clinic.

3.4 It is expected however that the community will supply a "water minder" and an "assistant water minder" for each rural scheme.

3.5 Training of Water Minders

As each community will be involved in the construction of its own scheme, it is hoped during that period to be able to identify with the help of the Chief, a suitable person to take on this task. These people will receive training during the construction period and particularly during the commissioning period. Further training and guidance will be given by frequent visits in the early stages by individual RWS staff and by visits of the mobile workshop on routine preventive maintenance visits.

SECTION 4

Maintenance and Repair of Completed Supplies

4.1 Preventive Maintenance

4.1.1 The accent is quite correctly on Preventive Maintenance Procedures, so that, in as far as this is possible, malfunction of the component parts of any scheme can be identified early and remedial action in equipment and operation taken. This remedial action will also include further close training of the water minder and his assistant.

4.1.2 It should be noted that the majority of schemes are of "Low Technology" ie gravity, windmill or hydraulic ram types.

4.1.3 Other schemes are of "Medium Technology" where jet pumps are used.

4.1.4 Other schemes again have pumps of the centrifugal type with filters of the "Rapid" or "Slow Sand" types.

4.1.5 All schemes except borehole schemes (High Technology) will be chlorinated and all schemes have a storage capacity of over one days supply. With the combination of storage time and chlorination the fear of Bilharzia infection from the water supply can be largely discounted.

4.2 Repairs

4.2.1 If the preventive maintenance scheme works adequately the need for emergency repairs due to breakdowns can be minimised by the routine visit of the mobile workshop to each scheme at two-monthly intervals.

4.2.2 Should breakdown occur, communication can be made through the village Chief and the Community Development officer to the RWS branch which will take immediate action to effect repairs and eliminate, where possible, the cause of the breakdown (which could be sheerly mechanical or caused by malfunction on the part of the water minder).

4.2.3 The fact that all schemes are designed to incorporate "one plus" days storage will mean that no community should be completely without water if prompt communication by the Chief and prompt action by RWS is taken.

4.3 Spares

The mobile workshop carries a stock of suitable spares to enable repairs to be carried out.

SECTION 5

Provision of Funding for Maintenance

5.1 Funding

5.1.1 In the year 1977/78 the sum of E80,000 was provided for all RWS schemes (including Agency ie Health, Education etc). This was adequate.

5.1.2 The estimate of funds required for 1978/79 to cover all RWS schemes was E160,000.

5.1.3 The Swazi Government has allocated only E94,000 and the WSB and RWS have informed them that this is inadequate and will mean that all "Agency" schemes which need repair will have to supply funds for repair and maintenance from their own ministries' budgets.

5.1.4 WSB and RWS have informed the Swazi Government that an obligation exists to maintain and repair ODM funded schemes and that the E94,000 allocated will be used to this end, broken down as follows:-

(a) Preventive maintenance, repair and training including staff of RWS and vehicles	E70,000
(b) Operation of schemes directly by WSB including staff and vehicles	E20,000
(c) Repairs to ODM new schemes (teething)	E4,000

5.1.5 The capital funding of tools and equipment for the mobile workshop and the depots at Siteki, Manzini, Mbabane and Nhlangano have been met from the ODM funding and the maintenance and operation of these depots will be met as in para 5.1.4 above.

SECTION 6

Selection Criteria for Rural Water Schemes

6.1 General Comment

Due to the large number of public bodies and ministries involved the selection procedure tends to be rather cumbersome and time consuming particularly the difficulty in convening a priority fixing meeting at which all representatives can attend.

6.2 Procedures of Selection

(a) The Chiefs of each area make a proposal to the District Team.

(b) The District Team (which includes the District Commissioner and a representative from the Department of Community Development and a representative of the RWS Branch) collate the proposals made and allot priorities within the District.

(c) The list from each District Team is considered by the Rural Water Supplies Policy Board and allotted a priority rating for action by the RWS Engineer for Design and Construction purposes.

6.3 Composition of the Rural Water Supplies Policy Board

The Board consists of the following members:-

Permanent Secretary (Works)	- Chairman
P.S. (Health)	- Vice Chairman
P.S. (Finance)	- Member
P.S. (Local Admin)	- Member
P.S. (Agriculture)	- Member
P.S. (Education)	- Member
Prince Gabheni	- Member
Town Clerk, Mbabane	- Member

6.4 Criteria used in Selection of Schemes

The following criteria are among those considered in selection and priority rating of schemes.

(a) Does the present source(s) dry up or become inadequate during the winter (dry) months?

(b) Are the present sources traditionally used by the community polluted or turbid?

(c) Is a school or a clinic (or both) within the area covered by the proposed supply?

(d) Is the community densely populated and relatively compact?

(e) Is the supply from possible sources adequate to meet the needs of the community to be served by the new supply and to allow for possible expansion?

(f) Is the community ready and willing to contribute labour for construction assistance, willing and able to subscribe to the running costs of the completed scheme, and provide a suitable person(s) to be trained as a "water minder"?

SECTION 7

Water Charging Policies

7.1 Urban Areas

7.1.1 In urban areas the WSB supplies potable water to individuals (see Appendix A1). All supplies are metered and charges are raised on the individual supplied.

7.1.2 Where communal stand pipes are provided in these areas no charge is raised to the individual, the charge for water being met by the Ministry of Local Government.

7.2 Rural Areas

7.2.1 The philosophy set out in para 7.1.2 above also applies.

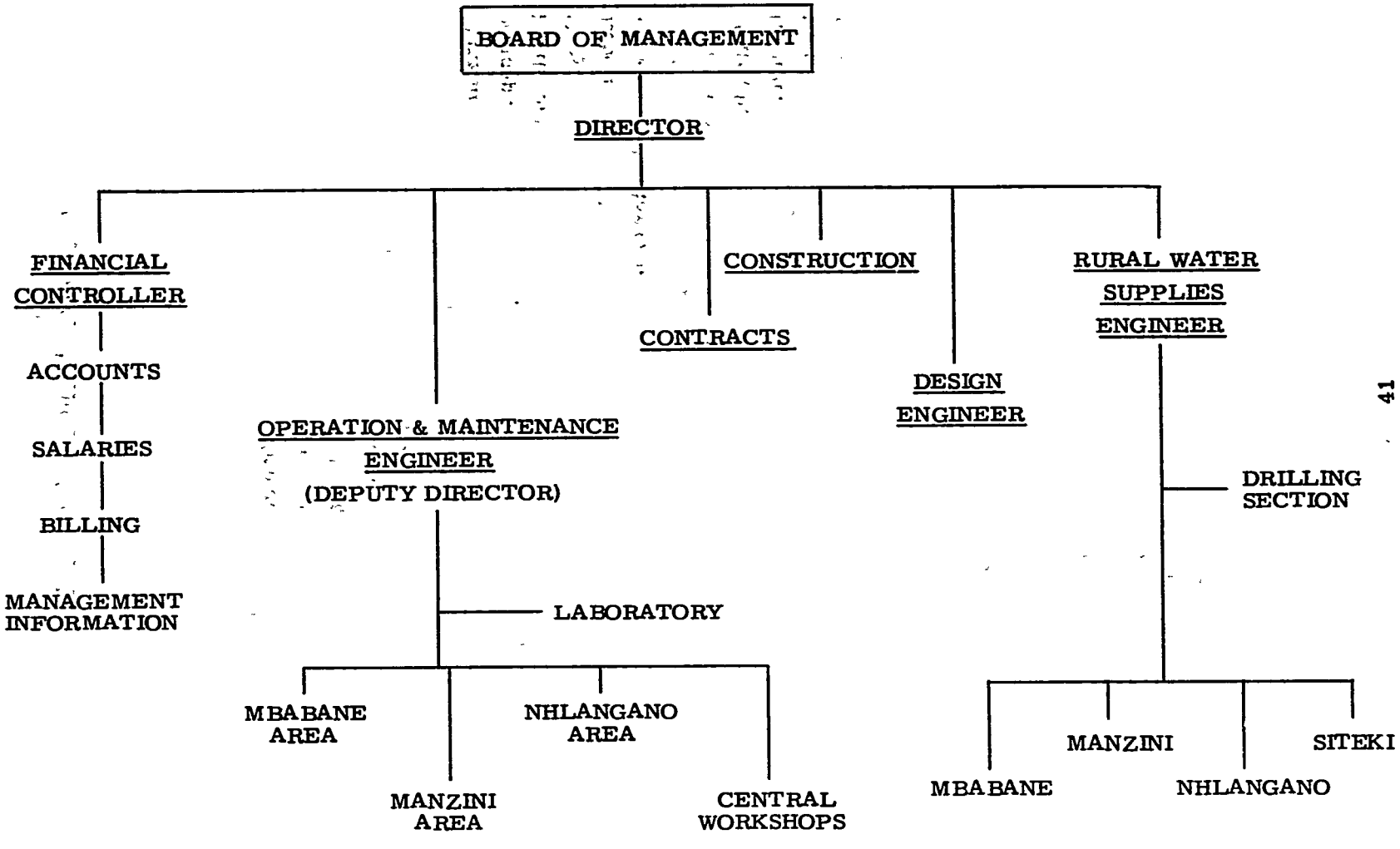
7.2.2 In the case where the supply to the rural community is taken from a supply operated and managed by WSB, the method set out in para 7.1.2 applies.

7.2.3 In the case where the supply to the rural community is not managed and operated by WSB, the community will be expected to contribute the cost of fuel (if any) required by the scheme and provide the services of a "water minder" to look after the day to day operation of the scheme.

7.2.4 In the event of a supply from a scheme in the category of para 7.2.3 above being given to an individual for his sole use and piped to his house this supply will be metered and charges raised on the individual.

APPENDIX A

ORGANISATION CHART OF THE WATER AND SEWERAGE BOARD, SWAZILAND



List of Urban Water Supply and Sewerage Schemes Managed and Operated by WSB

Water	Sewerage
Mbabane	Mbabane
Lobamba	Manzini
Mankayane	Matsapa
Piggs Peak	Kwaluseni
Jacks	Zakhele
Malkerns	
Manzini	
Matsapa	
Kwaluseni	
Croydon	
Lubuli	
Lomahasha Border Gate	
Siteki	
Nhlangano	
Hlatikulu	
Kubutha	
Hluti	
Lavumisa	

THE RESPONSIBILITIES OF THE RURAL WATER SUPPLY BRANCH, OF THE WATER AND SEWERAGE BOARD

A Rural Water Supply Branch has been established under the administrative control of the Water and Sewerage Board. The following is a summary of the Branch's history and a detailing of its responsibilities within the framework of Rural Water Supply Development in Swaziland. This report is meant to introduce the Branch to all Government agencies.

HISTORY

On 1 April 1974 the Water and Sewerage Board was established. This is the main agency responsible for the provision of water supplies in Swaziland, and is a self-accounting commercial organisation. Under its regulations it must seek an adequate financial return from any operation it undertakes. Thus, its obligation to earn a return reinforces its natural tendency to be primarily orientated towards the provision of conventional water supplies to relatively well-off groups in major urban centres.

However, there are many other groups who require water supplies, even if they are not able to pay the full economic costs of services provided. These groups include squatter developments in the semi-urban areas, rural communities, schools, clinics etc.

Some water supplies are already provided for these groups, but efforts so far have been on a fairly small scale, largely due to the lack of any organisation whose specific responsibility is to supply water to income areas, and which also has sufficient equipment and technical expertise to carry out a significant construction programme.

The following organisations are presently involved in one way or another in Rural Water Supplies:

(a) Environment Health Unit

(b) Community Development Unit

(c) Groundwater Development Unit

(d) Water and Sewerage Board, on an agency basis.

In order to concentrate and co-ordinate efforts in Rural Water Supply Development, the Rural Development Committee, on 13 March 1975, agreed to the establishment of a Low Income Water Supplies Unit (now called the Rural Water Supply Branch) under the administrative control of the Water and Sewerage Board.

BRANCH RESPONSIBILITIES

It is the responsibility of the Rural Water Supply Branch to construct water supplies to Low Income Groups in the following areas:

(a) Low Income in the major urban areas, particularly the squatter developments.

(b) Rural Communities

(c) Government institutions in Rural Areas, eg schools and clinics.

The Branch has also been given the responsibility for maintenance of Rural Water Supply Schemes.

ORGANISATION

The Rural Water Supply Branch is responsible to the Director of the Water and Sewerage Board. The Water and Sewerage Board has seen fit to establish a policy-making body for the Branch and has called it the Rural Water Supply Board. This Board is made up of existing Water and Sewerage Board members, plus Permanent Secretaries from the Ministries of Agriculture and Education (refer to the attached Organisation Chart):

The responsibilities of this Board include the establishment of guidelines and criteria for the management and workings of the organisation, and the approval of new water supply projects for submission to ODM.

The Rural Water Supply Branch, as a member of the Water and Sewerage Board can make use of facilities and expertise that are within the Water Board. Besides the Construction and Maintenance responsibilities, a major part of its duties will be to liaise with other Agencies, to ensure that its activities are within the framework of national objectives.

It is intended that the initiation of projects to be undertaken by the Branch will come from the level of the district teams, who will consider proposals from communities and agencies.

Branch offices are established in the four Districts, and located in the communities of Mbabane, Manzini, Nhlangano and Siteki.

FINANCING

The first phase, a three year period, is to be financed by a loan through the Overseas Development Ministry of the United Kingdom. The total estimated cost of the proposed 120 projects in this period is 1.3 Million Emalangeni.

The funds for maintenance work are being provided by the Ministry of Finance and Economic Planning.

TECHNICAL ASSISTANCE

Technical Assistance for establishing the Rural Water Supply Branch is being provided by the World University Services of Canada through the Canadian International Development Agency. The Rural Water Supply Engineer as Branch head, and a Clerk of Works for each district are being provided.

1977/78 PROGRAMME

It is planned that the Branch will undertake twenty major construction projects through 1977/78. The attached list of water supply schemes has been approved by the Rural Water Supply Board. The commencement of work is waiting arrival of necessary equipment and materials purchased in the UK.

INVOLVEMENT OF THE LOCAL POPULATION

It is accepted that any community project must have local involvement in order to succeed. It is, therefore, expected that the local communities will provide unskilled labour on these water supply projects as their own contribution. Then, after the completion of a project, it is expected that the communities will be responsible for its operation. This may include the provision and payment of an operator and the supply of fuel. As mentioned above, the responsibility for maintenance will be with the Rural Water Supply Branch.

FUTURE DEVELOPMENT

It is expected that future water development projects will continue to be initiated at the community level and processed through the District Teams.

V. van Beuzekom
(Secretary)
Rural Water Supply Board

APPENDIX 'C'

B. M. PAPER NO 53

ORGANISATION OF THE RURAL WATER SUPPLY BRANCH

An organisation chart for the Rural Water Supply Branch has been proposed as shown in the attached diagram.

The following are explanatory notes which detail the responsibilities envisaged:

1. The Board of Management of the Water and Sewerage Board has been shown as the policy making body. Since this Board is already in existence, it is considered that it could best handle this responsibility. The authorities of this body over the Rural Water Supply Branch could include the following:

   (i) Establishing realistic target figures for the nation.

   (ii) Adopting water quality standards (similar to the existing Water and Sewerage Board standard).

   (iii) Giving rulings on alternatives.

   (iv) Setting criteria for priorities of development.

   (v) Recommending whether payment for services and water supply should be levied and how.

This Board can seek advice from Ministries or others as required.

2. The Water Resources Branch is shown as advisers to the Board of Management (WSB). They have the overall responsibility for the use of water in Swaziland and as such should be advisers directly to the policy body.

3. The Water and Sewerage Board is shown on the chart as the second level of management. This is meant to illustrate that the Rural Water Supply Branch can make use of facilities and expertise existing within the Board.

4. The third level of Management is the RWS Branch. It has the overall responsibility to co-ordinate rural water supply in Swaziland. It will:

   (i) Liaise with other agencies to ascertain their needs and their programmes.

   (ii) Co-ordinate the work of the four construction teams within the framework of a national plan.

   (iii) Establish, monitor and maintain certain standards regarding water supply.

   (iv) Investigate and co-ordinate efforts into establishing appropriate technology.

   (v) Advise on issues of Policy.

The way the Branch has been shown on the chart is meant to indicate the RWS Engineer's ability to contact the appropriate officers in other Ministries directly when planning and programming his work.

5. The District Construction Units will have the following responsibilities:

(i) Technical design and construction.

(ii) Planning by providing or checking on the priority of schemes.

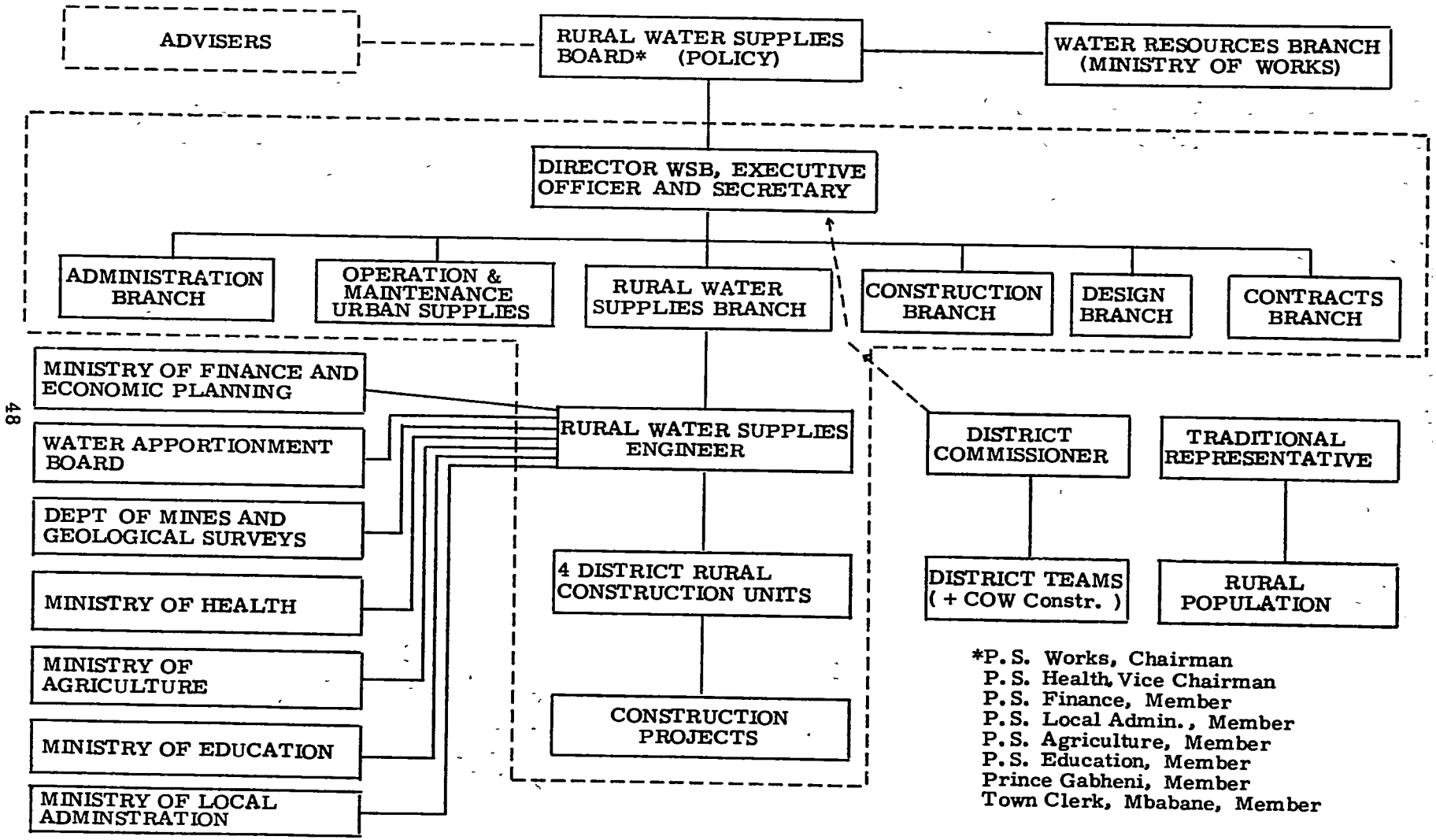
(iii) Developing a proper maintenance programme for all existing and new schemes.

6. The District Commissioner and District Teams will be responsible for collecting the needs of the people and suggesting an order of priority. They will be advisers on the local level, help recruit labour and generally form the link between the Rural Water Supply Branch and the rural people.

7. The Traditional Representatives will be responsible for determining the needs of the rural people and advising the District Commissioner.

The Board's comments or approval on this proposed organisation of the Rural Water Supply Branch is sought. Also the Board's directives are requested on the World Bank's recommendation, a result of their sector study of the Rural Water Supplies from 1 to 12 August 1975. Now that the Rural Water Supply Branch has been established, do these recommendations have to be implemented and how? (See Annex)

RURAL WATER SUPPLIES ORGANISATION CHART



LOCALISATION PROGRAMME

	Post	1976	1977	78	79	80	81	82	83	84	85	86	87
1.	Director	eeeee	eeeeee	eee ss	eee sss	eee sss	eee sss	eee sss	eee sss	eee suu	e uuu	 uul	 llll
2.	Financial Controller	eeeee sssss	eeeeee ssssss	eee sss	eee ssu	eee uuu	e uu	 llll	 llll	 llll	 llll	 llll	 llll
3.	Data Processing Officer	eeeee uuuuu	eeeeee uu*uu	eee uuu	eee uuu	e llll	 llll	 llll	 llll	 llll	 llll	 llll	 llll
4.	Commercial Admin. Impl.	eeeee	eeeeee uuuuuu	eee uu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
5.	Senior Engineer O and M	eeeee	eeeeee	eee s	eee sss	eee sss	eee sss	eee sss	eee suu	eee ul	 llll	 llll	 lll
6.	Contracts Engineer	eeeee	eeeeee	eee s	eee sss	eee sss	eee sss	eee sss	eee suu	eee ul	 llll	 llll	 lll
7.	Construction Engineer	eeeee	eeeeee	eee s	eee sss	eee sss	eee sss	eee sss	eee suu	eee ul	 llll	 llll	 lll
8.	Design Engineer	eeeee	eeeeee sss	eee sss	eee sss	eee sss	eee sss	ee su	 uul	 llll	 llll	 llll	 llll
9.	RWS Engineer	eee	eeeeee sss	eee sss	evv sss	vvv sss	vvv suu	v ul	 llll	 llll	 llll	 llll	 lll
10.	Planning Engineer	eeeee	eeeeee	eee	e	 to Design Engineer							
11.	Electrical Engineer	vvvvv u	vveeee uuuuu	eee uuu	e ll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 llll
12.	Senior Clerk of Works	eeeee	eeeeee sss	eee sss	eee suu	eee us	eee suu	e ul	 llll	 llll	 llll	 llll	 lll
13.	Clerk of Works Mbabane	eeeee	eeeeee uuuuu	eee uuu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
14.	Clerk of Works Manzini	eeeee	eeeeee uuuuu	eee uuu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
15.	Clerk of Works Nhlangano	eeeee uuuuu	ee uullll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
16.	Clerk of Works Constr.	eeeee	eeeeee sss	eee sss	eee su	ee uuu	 lll	 llll	 llll	 llll	 llll	 llll	 lll
17.	Workshop Manager (Mech. Eng.)	vvvvv	eeeeee	eee uuu	eee uuu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll
18.	Static Plant Mechanic	eeeee	eeeeee	eee uuu	eee uu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll
19.	Chemist	eeeee uuuuu	eeeeee uusss	eee sss	e ssu	 ul	 llll	 llll	 llll	 llll	 llll	 llll	 llll
20.	RWS Construction Foreman	 ss	eee ssuuuu	eee us	eee ssu	e ul	 llll	 llll	 llll	 llll	 llll	 llll	 llll
21.	RWS Construction Foreman	 ss	eee ssuuuu	eee uss	eee suu	e ul	 llll	 llll	 llll	 llll	 llll	 llll	 lll
22.	RWS Construction Foreman	 ss	eee ssuuuu	eee uss	eee suu	e ul	 llll	 llll	 llll	 llll	 llll	 llll	 lll
23.	RWS Construction Foreman	 ss	eee ssuuuu	eee uss	eee suu	e ul	 llll	 llll	 llll	 llll	 llll	 llll	 lll
24.	Senior Draughtsman	vvvvv ss	vvvvvv ssuuuu	vvv us	vvvv ssu	 ul	 llll	 llll	 llll	 llll	 llll	 llll	 llll
25.	Surveyor	eeeee	eeeeee ssssss	vv ss	vvv uuu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
26.	Transport Officer	eeeee	eeeeee uuu	ee uuu	 lll	 llll	 llll	 llll	 llll	 llll	 llll	 llll	 lll
27.													

eeeeeeeeee - Expatriate present
vvvvvvvvvv - Expatriate needed
ssssssssss - Attending university or school
uuuuuuuuuu - Understudy
lllllllllllll - Localised
********** - Change of understudy

June 1977

APPENDIX 'E'

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RESPONSIBILITIES FOR THE OPERATION OF SCHEMES

This matter is of major concern to the Rural Water Supply Branch. Various government agency officers have advised that the community must be involved in the schemes, otherwise it would be considered by the people of the community as being a government service and total responsibility.

It is planned that all communities will participate in the construction of the projects by providing unskilled labour with the major task being trenching. This then should give them a feeling of ownership in the system.

In addition to this, it is proposed that the community be responsible for the provision and paying of an Operator and the supply of diesel fuel etc. In other words, they take on the job of the day-to-day operation of the plant.

The benefits of this method of operation are the following:

(i) The community can consider it as their supply

(ii) Proper supervision of the operator can be made

(iii) The supply of fuel could be better controlled

(iv) There would be more care taken of all the equipment

(v) There may be better control on water wastage

The obvious detriment to this method is that the community may not be able to afford the cost.

In the cases where Government Agencies are operating existing supplies to their institutions, it is suggested that they retain the responsibility for operation. However, they may arrange with the local community for assistance both financially and labour.

A community involvement in responsibility is seen as a necessity by the Branch. If the Branch were to be given this responsibility for over 150 supplies, it can only foresee problems in supervision of staff, supplies of fuel and overall operation of the schemes.

The Branch does, however, believe that it can undertake the maintenance work. With a properly designed preventative maintenance programme, break-downs can be kept to a minimum.

CHAPTER 5

The Implementation of the Rural Water Supply Programme in Swaziland

by

Aron Cronin

Summary

This Report sets down the recent and present activities of the main agencies involved with rural water supply in Swaziland, notably RWS. It shows a key process in the chain of bringing piped water to rural areas - how the proposals approved by ODM (and other donors) are translated into actual schemes in the communities.

INTRODUCTION

The Terms of Reference for this Baseline study '... envisaged ... the Engineering Adviser ... covering ... [a] review of the procedures and practices of the relevant Government Departments, notably with regard to their planning, liaison, village-level training, technical and social implementation, and routine and emergency maintenance functions ....'

Unfortunately other demands on his time meant that Magnus Todd could stay in Swaziland for only a very short period, and we agreed to share the investigation of the institutional aspects. Annexe A by Magnus Todd sets out the organisational structure of the Rural Water Supplies (RWS) branch; this present Report considers the actual implementation activities of the Rural Water Supplies branch (hereinafter "RWS"), and other Government agencies and ministries involved in rural domestic water supply provision.

THE GOVERNMENT AGENCIES

Prior to the formation of RWS there were several Government Ministries and departments which had some involvement with providing piped water for domestic use to rural homesteads. Since the coming of RWS, some have given up these activities, others have carried on much as before. The Ministry of Health did some spring protection work and provision of water to some rural dispensaries. The Ministry of Agriculture on occasions ran a pipe or tap off one of its irrigation dams or channels. The Community Development Section (Ministry of Local Administration) apparently built many small gravity schemes with reticulation and protected springs. The Department of Geological Survey and Mines drilled a few boreholes which were topped with a handpump. Additionally the Ministry of Education brought water supplies to some schools (mostly secondary) although it seems to have paid the Public Works Department (PWD) to do the construction on its behalf.

There seems to have been little collaboration between these agencies, and limited record-keeping within them. One result is that to-day there is no central data source showing where schemes have been constructed (by whoever) across the country, nor are there readily accessible lists in the individual agencies. It proved impossible to get a full list of the names (and numbers) of the places where these agencies had built supplies.

Staff of these agencies regretted that to-day there is still insufficient co-operation amongst them; this is considered later in this Report.

MINISTRY OF HEALTH

The Ministry of Health's rural water supply activities are carried out by its Health Assistants. There are approximately 40 of these, attached to rural clinics; they are supervised by 5 Health Inspectors. Besides educating the population around them on health and hygiene matters the Health Assistants also assist with spring protection and pit latrine construction.

Within his area of operation (essentially, as far as he can walk from his residence) the Health Assistant looks out for groups of at least 10 to 12 homesteads (say 50-60 persons) situated near a spring that can easily be protected. He encourages them to come together to raise part of the cost but the community must organise the collection of the money entirely for itself.

The protection system normally employed is a box built of cinder blocks, covered with a tin roof, feeding to a collection tank (the cost of these materials, approx E50, is met by the Ministry). The collection tank feeds a storage tank or reservoir off which one standpipe, located as centrally as possible, is supplied. The pipes, tank and tap after the collection tank must be paid for by the community; the cost is usually approx E200. The trench digging and cement mixing is done by self-help labour. Generally the Ministry finds the communities respond readily, and often collect their share of the cost in just a couple of months.

The actual construction of the box and tanks has until just recently been done by an artisan builder and the local Health Assistant. However during the Baseline Study the builder's employment was terminated by the Ministry as a result of a budgetary cut and it is not clear whether the Health Assistants will continue this work on their own.

Whilst this Ministry has engaged in some spring protection work for many years, it has been particularly active since 1974 since when it has served perhaps 3,000 people from about 35 protected springs. Because of the simple design of the system, and the absence of complex components (eg a purifier), maintenance problems have apparently been minimal and so handled easily by the Health Assistants (rather than the communities).

Another important activity of the Health Assistants is to encourage individual households to construct pit latrines. As with the water supplies there is a more or less standard design for pit latrines. A hole 90 cms x 90 cms x 15 metres deep is reinforced across the top with 8 iron rods on which is placed a concrete slab (1 sq metre) with a hole and ventilation hole. The Health Assistant provides technical help, and for E5 all the materials (excluding the hut). Since 1974, latrines have been constructed at a rate of about 100 a year. The Ministry would like to increase this rate greatly. The WHO Sanitarian who has been encouraging this programme is due to leave the country later this year, and it is not sure whether he will have a successor.

MINISTRY OF AGRICULTURE

The Ministry of Agriculture has had a very minor involvement with rural water supply, almost always as an incidental benefit of an irrigation or livestock scheme (it seems that the original piped supply to the secondary school at Mpolonjeni was built under such an arrangement). For at least the last five years it has only built schemes in Rural Development Areas (RDAs); these are areas of higher population density and good agricultural potential which receive intensive agricultural extension. It has built six schemes in each of the Northern, Central and Southern RDAs, four in the Mahlayatsha Area and two elsewhere. Normally these are simple gravity schemes but there are a few ram pumps and occasionally the seepage from a dam is tapped and piped. None of these schemes serve more than 50 households at most. The cost of such supplies is met by the Ministry, although the potential users are expected to contribute self-help labour. Any maintenance tasks are undertaken by the local works team, which looks after the plant etc in the RDA.

MINISTRY OF MINES, INDUSTRY AND TOURISM; DEPARTMENT OF GEOLOGICAL SURVEYS

Geological Surveys concentrates mainly on investigating mineral resources. In addition it does limited borehold drillings, perhaps 3 or 4 successful ones each year which are topped with a handpump. Unfortunately, because of field visits, no interview was conducted at this Department during the Baseline.

COMMUNITY DEVELOPMENT (AND OTHERS)

The Ministry of Education, the Community Development (CD) section of the Ministry of Local Administration, and the Public Works Department (PWD) have now given up any rural water supply construction activities in favour of RWS.

Community Development has been encouraging small self-help water supply schemes as part of its programme since 1967. CD officers encouraged communities to elect committees to raise funds and organise voluntary construction labour, whilst the section reciprocated with topping-up funds and technical supervision; the approach to the communities seems to have been very much along conventional community development lines, ie helping them to realise a felt need.

On paper it would seem that CD has to date been the largest provider of rural water supplies. Unfortunately, however, one is led to the conclusion that very few rural households presently enjoy regular clean water as a consequence of CD's activities.

At CD Head Office, recent records listed the construction activity for 1970-75:

34 water supplies (3 of these not completed)
140 springs protected
34 water catchment tanks.

Thus allowing for the 3 incomplete water supply systems, 205 water facilities of some sort should have been constructed, these of course in addition to those built in previous years. It is almost certain that for various reasons schemes that had simply been initiated (eg some money collected, a trench dug) appear listed as completed. Further, most completed are now out of order.

There is supporting evidence for the above judgements:

- the CD Progress Report for Hhohho District dated 22/3/78 shows that no project begun since 1971 has been completed. Officials agreed that rural communities must have become discouraged at CD's failures to complete what it had initiated.

- CD officials volunteered that most schemes are now out of order. In many cases this was due to poor design (eg insufficient head) and/or construction standards, and the absence of any proper central maintenance or village-level training programme. Also, communities had to meet the costs of the maintenance and repairs and it seems that the local committees did not have sufficient resources and authorities to raise these. This was especially true of schemes with a diesel pump. Three CD protected springs seen by chance were all in a unsatisfactory state.

One informant said that since 1 April this year CD has had no artisans engaged on water supply construction or repair, while another mentioned that there are a few CD bricklayers and two semi-skilled plumbers who are clearing the backlog of small schemes CD is committed to, but will take on no new ones.

CD's present links with RWS are considered later.

The present staffing of CD is:

Headquarters, Mbabane -

1 Principal CD officer
1 Senior CD officer
1 CD officer
2 typists, 1 clerk, 1 messenger, various construction artisans.

In each of the four District offices:

1 Assistant Community Development officer
4 Community Development assistants.

The Hhohho District office has one ageing Landrover, otherwise CD has no transport of its own. In principle the District Commissioner should help the local CD officers with transport, but they complained that in practice it is not regularly available to them. CD officials felt that on the whole they had not been sufficiently involved with RWS activities, but with a small staff having to cover large areas oft without transport, their difficulties were considerable.

The final department (other than RWS) that should be mentioned is the Ministry of Works, Power and Communication, Water Resources Branch, which is charged with collecting all data related to the country's water resources. It has no record of small water supply schemes, only of large boreholes, dams, irrigation channels etc.

WATER AND SEWERAGE BOARD, RURAL WATER SUPPLY BRANCH (RWS)

Rural Water Supply branch is now the key agency in rural water supply and the recipient of the ODM funding, and therefore called for the closest Baseline study.

Recent History. RWS was created within Water and Sewerage Board (WSB) in November 1975. During its first year a Planning Officer (Wolfgang Walters) toured the country and inspected 130 locations (55 schools, 57 clinics, 11 border-posts, 7 villages) most of which already had some kind of supply. He found 36 existing supplies needed no improvements but only regular maintenance, 51 schemes needed extensions, upgradings and other improvements and construction of 29 schemes was required. Out of this tour came a two-volume detailed Appraisal including each of the schemes (description, sketches, recommendations new designs where necessary, cost estimates, photographs, materials required). It is most unusual for the rural water sector in a developing country to have such a well-prepared document from which to plan future activities, and it is still the basic document for planning in RWS.

The Canadian agency CIDA is funding the technical co-operation. The Rural Wate Supply Engineer arrived in Swaziland in October 1976 and has been working with great drive and enthusiasm in the face of considerable difficulties. On his arriva little was known about the programme and he spent his early months introducing th programme to various Ministries and District offices, inspecting existing supplies and other sites, drawing up plans and compiling an order for UK materials which was sent off in January 1977. Since then until (coincidentally) about the time of the visit of the Baseline team, RWS has been unable to do much work on the twenty schemes of Phase I but with the arrival of the four Clerks of Works (one per District) has kept itself very busy with other activities. These activities have included:

- approaching District Teams to involve them more with planning;
- finishing off schemes begun by other agencies (some begun as far back as 1972) for which there were materials but previously insufficient technical expertise;
- drawing up designs for and preliminary work on schemes ready for when the materials would arrive;
- assisting other initiatives, eg a Peace Corps volunteer at Phonjwane received American funds for a borehole there, and RWS assisted technically;

- maintaining and repairing existing supplies of diverse origins (Health, Education, Agriculture, Community Development, USAID, Peace Corps volunteers, village self-help, Irrigation, Customs, WSB Construction Branch Missions) from E80.000 maintenance funds received in April 197

- construction of systems just to schools (to be extended into the community when the materials became available) with E34,00 given by Swaziland Project for Educational Development (SPED), To some extent it was jiggling of this plus the maintenance money that kept RWS "in business".

In May 1977 ODM gave waivers for the local purchase of building materials, and the construction of offices and stores commenced. In June and July some tools, equipment and vehicles were waivered, as were the remaining vehicles in December. A waiver to hire private drilling contractors was granted in September 1977. In November and December some of the UK equipment ordered in January began to arrive (eg cement mixers, filters). However it was only in March 1978 (ie during the Baseline) that the waiver for the local purchase of PVC piping was agreed and RWS then obtained pipes from South Africa to lay in the trenches that communities had dug or were digging. Thus the main programme has been held back from schedule.

As of mid-April 1978, of the main schemes of Phase I, 3 were in progress in Hhohho District, 3 in Shiselweni, one in Lubombo, 2 in Manzini and 2 completed in Manzini District. 8 boreholes were being drilled by contractors. There will probably be an overlap between the end of Phase I and start of Phase II in September 1978.

Design Parameters; RWS designs a scheme so as to try to serve the greatest number of people possible with the sum of money allocated for it. Air photos are used to check population clusterings and engineering factors such as the location of the source and a site for the storage tank. The first design is field checked, especially to see if the taps have been so located as to serve the greatest possible number of persons. A figure of 10 persons per homestead is assumed; originally the consumption assumed was 15 litres per capita per day (lpcpd), is now 25 lpcpd and 40 lpcpd has been recommended. Sometimes it is an engineering constraint (eg insufficient head) that prevents all of a community being served, but usually it is the prohibitively high cost of serving the farther homesteads. There are three ways in which a community can extend the supply to more households: it can collect the cost of the extra materials (as a rule-of-thumb about 70 cents per metre for piping) which RWS will obtain, and fit free, the community can buy its own materials and extend the scheme itself at any time, although RWS likes to be consulted to make sure the system will not be overloaded; the community can put itself forward for an extension to be constructed under Phase II. For all schemes RWS tries to employ the simplest technology such as gravity feed from a spring, or a ram pump. In the past RWS has tended not to confine the extent of a supply to the area controlled by one Chief, but in the light of some isolated problems of rural rivalries will consider boundary questions more carefully in future.

The installation of washing facilities funded by the Dutch charity ICCO will commence shortly at selected sites for which an artisan will be specially hired.

Approaching Communities. On their first visit to a community, the RWS engineers always try to go accompanied by a CD officer. Through him they explain the nature of RWS, that UK aid is meeting all materials costs, and that that community has been chosen as a priority one, on their part, the beneficiaries must give self-help labour, and in the case of powered supplies buy the future diesel fuel and find a pump operator. Normally a committee to organise the construction labour is selected during that initial meeting; the method of choosing

the committee, its form and size, are left entirely to the people themselves. Then or soon afterwards the line of the scheme is marked out with pegs and WSC explains to the committee about the required trench lengths, depths, and preferred completion dates. On these subsequent visits RWS would much prefer to be accompanied by a CD officer, but this does not often occur. Backfilling is done either by RWS labourers or the beneficiaries closely supervised by RWS.

The RWS Engineer and the Clerks of Works feel most unhappy about the sometimes poor nature of their relationships with the communities they are serving. They realise that early misunderstandings are bound to lead to later difficulties with the schemes and possibly prejudice subsequent co-operation between RWS and the communities, and are most anxious to remedy this situation. They feel it has arisen because in the repeated absence of CD officials they have had to conduct meetings, approach Chiefs and committees, and organize labour (often through poor interpreters), tasks in which they have no training, nor actual responsibility. On some occasions, when trench-digging has come to a halt and men, materials and vehicles have been sitting idly on site, RWS has had to threaten to withdraw completely to get digging recommenced. The RWS Engineer emphasises that resorting to such "high-handed tactics" is wholly wrong and against the spirit of the programme.

Whilst convention and courtesy demand that RWS approaches the Chiefs and their spokesmen, for everyday liaison they tend to contact such people as school head-masters or mission heads.

It was anticipated that from 1 April (1978) a CD official who has been active in the CD rural water programme for some years would be assigned full-time to RWS and organise meetings, act as the main communicator and liaison between engineers and communities, etc. Unfortunately, as at mid-April, this transfer had not yet been effected.

Links with other Government Agencies; This is a difficult issue, and there would be no gain in setting down claims and counter claims made by officials in various departments. In sum, they all felt that inter-departmental co-operation and co-ordination on the matter of the country's rural water supply programme was inadequate and were eager to improve this situation.

The present planning and liaison processes can be considered as occurring at three levels. There was a widespread feeling that the highest body, the Rural Water Supply Board, should give closer scrutiny to the proposals put before it, suggest new programmes, and organise and direct the sought-after inter-departmental co-operation. Officials of most departments represented on the Board, including those in RWS, wanted to see the Board become a proper forum for considering the rural water supply strategies in Swaziland and co-ordinating the efforts of the individual departments.

At the level of planning, many instances were cited of a failure of individual depart ments to indicate their intentions to other departments which have an obvious need to know them. Some examples:

- at Bethel RWS has been helping a Peace Corps volunteer at the school there to construct a water supply using USAID finance. Meanwhile at the same location the Groundwater Development Unit at Geological Surveys has apparently begun to drill a borehole which it will top with a handpump;

- the UNEP Bilharzia Control Programme has seemingly irreversible plans to build a supply in a community where RWS has already commenced construction;

there would appear to have been little discussion between Health and Agriculture on how irrigation ditches might be built so as not to increase the risk of spreading bilharzia infection.

At the third level, implementation, RWS was anxious for more co-ordination so that, for example, CD officials could be available at all the critical moments of a supply's introduction and construction, and Health Assistants could run hygiene courses in the community so that the potential benefits from the piped supply could be maximised.

Maintenance; At present there is no formal system of community "water minders" (see section 3 of Annexe A). The RWS Mobile Workshop, a 5-ton Leyland truck, is run by an IVS volunteer (since April 1977); one counterpart trainee left RWS, but a new trainee was expected shortly (April 1978). From a tour of the country the Mobile Workshop Engineer identified 60 supplies (of which 16 are at missions) built by different agencies for which RWS should take on maintenance responsibilities. In principle he should visit each site every two months for preventative maintenance but in practice finds much of his time going on urgent repairs. Particularly without a counterpart to assist him, he has found the work-load too heavy to allow for any reasonable training of local water minders. Also, moving around the country he discovers out of order supplies not listed in the Appraisal report.

Arrangements at these existing schemes vary widely. At many of those without any mechanical equipment no one at all seems to look after them. At those schemes where a diesel pump has to be started regularly, there is an unskilled minder who can usually do little more than just start the pump. This minder is usually an old man, sometimes unpaid. At school supplies, the minder is often one of the pupils and paid by the Ministry of Education.

To see the Mobile Workshop in action a visit was made to Ekukhanyeni, apparently a typical example (near one of the case study villages, Luve). From the collection basin of a protected spring a diesel pump lifts water through a (blocked?) filter to a storage tank which supplies the Government Primary and Secondary schools, and the teachers' houses. The Ministry of Education built the supply in 1971; originally the teachers used to start the pump. Since 1974 an elderly man has started it daily, originally earning E16 per month, now E58 per month, paid by the Ministry. He has had no formal training; for example he can top up the engine oil but does not know how to change it. The Headmasters have to buy the diesel fuel in Manzini and bring it back on a bus. There is no fund for the fuel, it is purchased from the school fees.

The Six Case Study Schemes, The RWS Engineer and the Clerks of Works were invited to add some background information to that available in the Appraisal and engineering documentation. Here, they are called collectively "RWS".

Dwalile; Cost = E15,800. Because of the small sum of money available for this scheme (1600 metres of piping) and awkward topography, reticulation is being concentrated for the present in the more densely populated area around the school and clinic. Hopefully it will be extended if more money is made available. At least two successful meetings have been held with the community. A Number 7 ram pump has been specially made; it arrived in the workshop in April, and was due to be assembled soon after. The Headmaster has been very helpful.

Gege; Cost = E94,000. RWS finds this case history an excellent example of the need for good support from CD. At the first meeting with the community in 1977 there was no CD representative present and WSC gave their introduction with a plumber translating (probably inadequately). At the second meeting again no CD official attended,

and again RWS felt there were communication difficulties, especially over the question of how soon the supply would be installed. In July RWS wrote to the Chief explaining the reasons for the continued delay (beyond the control of RWS). In September RWS began work by protecting the spring and marking out the lines for the trenches to be dug. Money had been received from SPED (see "Recent History" above) for the cost of the main line from the reservoir to the school, ie the essential first stage. Throughout October and November there was almost no trenching dug. In December the Headmaster of Eric Rosenberg Secondary school intervened and set his pupils to dig the trench from the reservoir to the school.

In January (1978) the Chief asked that those who dug the trenches should be paid. RWS explained that it could not do so, since the self-help labour was the community's contribution in lieu of cash. The Chief then proposed a collection from the community out of which those who dug could be paid. The Chief called a meeting, as a result of which he collected over E200 from the community, so far as RWS knew this money had still not been distributed (April 1978). Unfortunately this still produced insufficient labour, and with a large team of men and equipment standing idly on site (February) the Clerk of Works threatened to leave at once - the next day some 40 people came to dig, and continued coming but then attendance began to trail off once again, but improved after RWS called yet another meeting. It was helpful to have the Headmaster increasingly putting his support and authority behind RWS. Late on RWS realised that the area on the other side of the main road from the Police Station was under the authority of another Chief but fortunately he proved to be co-operative.

During the Baseline study the digging seemed to be going much better. In the first week of April the line from Eric Rosenberg School to the Clinic was turned on, and with that visible encouragement to the community RWS was expecting the remainder of the scheme to be finished quickly.

Mpolonjeni, Cost = E18,100 (E4,400 from the 1977 maintenance vote; E9,700 from ODM; E4,000 from Education). This has been another scheme where RWS has not had all the co-operation from CD it would have liked, and has had a difficult relationship with the community. Because of poor design or construction, the water from the Agriculture scheme was not reaching the secondary school. After 3 difficult meetings with RWS the community finally dug out the old main line and replaced it with a new one. The school pupils dug the trench for a 2-inch pipeline to the school reservoir (paid for by SPED). The water came on to the school on 15 January (1978). During December several misunderstandings seemed to have occurred between RWS and the community. An impression had got around among the people that the water supply was intended for the school only. When RWS at a meeting explained that the supply was most certainly going to be extended to the community but that the community would have to find the cost of the diesel fuel, this seems to have led to considerable speculation about how much each household would have to pay each month. There was also an impression gained that drawers would be limited in the amount of water they could take, whereas RWS are confident that the water will be abundantly available. RWS have arranged 3 subsequent meetings, all of which have had no attendance; the Baseline team was present at one of these failed meetings. In the absence of any real community leadership RWS has worked through the Headmaster and now feels more confident about the supply being extended to the community.

Luve; Cost = E15,100. There have been two very successful meetings here. The borehole is due to be drilled very shortly, and RWS is optimistic of a good response from the community.

Mafutseni; Cost = E36,500. RWS has held several meetings here led by an Assistant Community Development officer, and a good response from the community, led by the headmaster, is anticipated. This is a project which CD proposed as a priority to RWS.

Motshane, Cost = E38,000. Here again RWS has had good co-operation with the Assistant Community Development Officer. At the first community meeting RWS was shown a different source to their proposed one by the community. They re-designed the scheme using that new source and presented it to the community at a later meeting. There was an extraordinarily long delay before the community organised itself to dig the trenches, but then worked with great energy and RWS was expecting to turn the water on at any moment (April 1978). An unusual thing about this scheme is that the primary and secondary schools already have a water supply; this supply to the community is a new and separate one.

SUMMARY AND RECOMMENDATIONS

- There is no central listing of the rural water schemes constructed by the various Government agencies.

They should be encouraged to try to compile details of schemes they have constructed and submit them either to RWS or the Water Resources Branch. This would greatly assist the identification of priority areas for water supply construction, and would probably show RWS old supplies previously unknown to it that could be brought up to standard relatively easily and cheaply as an interim measure. Proposed schemes should also be notified.

- In general the liaison between the various agencies involved in rural water supply is at best irregular and inadequate and in many cases non-existent.

Proper co-ordination is necessary to avoid the waste and duplication of scarce resources available for the provision of rural water supplies. Perhaps the Rural Water Supply Board could arrange for those officials in the various agencies actually engaged in rural water supply activities to hold regular co-ordination meetings say every 3 months.

- The actual rural water supply construction activities of CD do not seem to have been very successful. The co-operation between RWS and CD has not been as close as it should have been.

CD should give up any continuing rural water supply construction activity in favour of RWS which is much better placed technically to carry this out. Some recent experiences of RWS have brought home yet again the common lesson in developing countries that the introduction of a rural water supply is as much a social as an engineering process, and underlined the need for a closer working partnership with CD. The proposed transfer of a CD official to work with RWS full-time is warmly supported.

- For the past year and a half RWS has been very active both establishing itself as an institution and engaging in rural water supply activities although not (until recently) much on the Phase I schemes because of circumstances beyond its control. The establishment of a water minder training programme is expected soon.

- Health Assistants have been doing an excellent job around the country increasing the health and hygiene awareness of communities.

Hopefully one of the outcomes of improved inter-agency co-operation will be that Health Assistants will work alongside RWS in the community when supplies are being implemented.

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