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Rural Water Supply in Bangladesh

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RURAL WATER SUPPLY IN BANGLADESH

M.H. KHAN, May 1980

INTRODUCTION:

Bangladesh is a flat alluvial delta of the mighty rivers the Ganges, Brahmaputra & Moghna. An area of 55.600 sq.miles with 85 million people, increasing at the rate of 2.8% per year, giving the worlds highest rural density (1530 per sq. mile).

The annual rainfall only in monsoon is about 100 inches spread over five months from June to October. For nearly half of the year about one fifth of the country remains under 3-4 feet of water during monsoon.

Rural settlements are generally scattered clusters of homesteads surrounded by agricultural fields. In the north the homesteads have ringwells and ponds and in other parts ponds, near-by canals or rivers provide them water for drinking and all other purposes. Unsanitary disposal of human excreta, low literacy rate (20%) lack of health education, poor living condition are responsible for contamination of these sources of water for the inhabitants. These sources of water in turn become sources for spread of gastroenteritis.

In a study WHO & UNICEF in June 1977 (A survey of Rural Bangladesh on diarrhoeal Morbidity, water Usage and Related Factors - John D. Skoda & J.B. Mendis of UNICEF & Michael Chia of WHO, Bangladesh) and several other studies indicate that nearly 60% of rural children suffer from some sort of water borne diseases. 80% suffer from helmenthasis, 28% of all deaths of infants and children are due to diarrhoea & dysentery and 36% due to all enteric diseases. It is further learnt that 80% of all diseases in all age groups of people are water related.

With the beginning of this century there were serious cut breaks of cholera in this country in epidemic from which continued for years. To face this problem Govt. was trying to supply safe water to the rural populace. Due to availability of aquifers within a reasonable depth almost all over the country, scattered settlements and the poor economic condition of the people, hand pump tubewells were found to be the best possible solution for providing safe water.

At the time of independence of this country in 1947 it inharited 50.000 wells and from 1947 to 1971 a total of 1.35.000 more wells were installed. At this stage one public tubewell was meant for an average of 400 people. There were,however, nearly 2.50.000 wells installed besides the Govt. wells by the private individuals who were comparatively well off. Those wells have been installed in the inner compounds of the owners only for the use of the inmates and their neighbours & others are not generally allowed to use

UNICEF Aided First Rural Water Supply Programme (1972-76)

After creation of Bangladesh in Dec'1971 the Govt. felt necessity of improving the precarious rural water supply condition of the country and in May'73 the Govt. WHO and UNICEF signed a plan of Operation for the First Water Supply Construction project in Bangladesh. The major objective of this project was to sink 1.00.000 new wells and resink 60.000 chokedup wells. Besides this 1200 deep (depth from 200 ft to 1200 ft) wells were installed in the coastal areas of Bangladesh where shallow wells (depth less than 200 ft) give saline water or aquifers are not available at shallow depths.

During this period UNICEF supplied the Govt. with pite, strainer, cement, vehicles, pig iron & coke. Pig iron & coke were issued to the local foundries to manufacture hand pumps for UNICEF which is responsible for execution of the works for the Government. UNICEF also provided assistance for the short term training of 100 Asstt. Engineers, 150 Sub-Asstt.Engineers & 1600 tubewell mechanics. In this programme UNICEF contributed 20.8 million US dollars and the Govt. provided 10.1 million US dollars. By the end of December 1976 there was on the average one public well for 250 people. During this period (1972-76) about 40.000 wells were sunk per year. It may be pointed out that the DPHE is capable of handling installation of 70.000 wells per year under the existing setup provided all materials & fund are available.

UNICEF Aided Second Rural Water Supply Programme (1977-1980)

During this programme (signed in Aug'78) 1.80.000 shallow wells, 7500 deep wells and more than 20.000 other wells will be installed besides replacement of 30.000 chokedup wells. Unlike the earlier programme this programme provides beneficiaries contribution of 50% of the installation cost for shallow wells & Tk.1000 (US $ 60) for each deep well. Govt. of Bangladesh will spend about 40 million US Dollars in this programme and there will be one well for every 178 people and 75% of the people will have access to a well within 700 ft. of their residence and 40% within a distance of 400 ft.

90% of the people of Bangladesh live directly on the ground water aquifers which exist at reasonable depths having nearly unlimited reserve of safe & pure water. There are sufficient good foundries manufacturing hand pumps & spare parts. There are over 1.000 very efficient drilling squads headed by one each drilling technician available in the country who can be hired by the contracters when needed. These drillers are experts in indigeneous simple method of installation of well up to 200ft. depth without any machine. Moreover DPHE is an organised and efficient implementing agency. For these favourable situations it is feasible to implement such a large programme.

EFFECT OF THE TUBE-WELL PROGRAMMES:

Depending upon local conditions and easy access to other sources of water 67 to 93% people use tubewell water for drinking and only 7% people use tubewell water for all purposes.

The impact of supplying safe water by providing hand tubewells in reducing water borne diseases has been studied but not very meticulously and extensively. The International Diarrhoeal Diseases Institute in Dacca determined that the attack rate of bacteriologically confirmed cases of cholera for a group of people using multiple sources (tubewells, ponds, canals, rivers, ring wells, ditches) of water was 48% higher than the attack rate for a group of people using tubewell as the single source of water.

FUTURE PROGRAMME:

The UN Water Conference, held in March'1977 in Argentina declared 1981-1990 as the Decade for International Drinking Water Supply. The target is to provide all with safe water by 1990. In line with this the Govt. of Bangladesh has prepared an outline of the programme for the decade whose 2nd Five year plan is to begin in July 1990. The target is to provide one tubewell for every 100 people by 1985 and in the 3rd Five Year Plan one tubewell for every 75 people by 1990.

To implement the above programme 50.000 wells are required to be sunk every year. To cope with the population increase alone 25.000 wells are necessary every year. To get best results out of these tubewell programmes the environmental sanitation, health education, improvement of general living condition of the people are prerequisites.

It has been observed that on the average a tubewell gives good service for 10 years i.e. 10% wells get chokedup every year, these are required to be withdrawn and resunk with partly new materials. By the end of 1990 there will be 1.000.000 public wells in the country and 1.00.000 are required to be resunk yearly besides new sinking of 25.000 wells to maintain statusquo of one well for 75 persons. To foster self reliance the Govt. should setup industries to manufacture all tubewell materials. At present 90% materials including G.I. & PVC pipes are imported. Due to favourable hydrogeological condition, scattered housing locations & socio-economic condition of the country handpump tubewells will stand as the only source of safe water for the majority of the people for years to come.

PROBLEM AREAS:

There are, however, nearly 10% people who can not be served with handpump wells for want of good aquifers in the areas they live. Those areas are located in south-eastern and south-western parts of Bangladesh. During last two years I have installed about 100 infiltration galleries suspended in the unprotected pond water in south eastern zone. The ground water is highly saline but rain water accumulated in those ponds containing suspended solids about

1500 mg/l and salinity less than 100 mg/l. A 45-gallon oil barrel was given 1200 numbers 1/8 inch perforations and sand having fineness modulus (F.M.) 1.6 and 2.8 were placed in layers in the centre of which a piece of strainer fitted and connected with 1½" diameter G.I. pipe to the bank on a concrete platform and a hand pump fitted on it. The water is found clean and in bacteriological tests raw water was found to have pathogenic organisms and coliform count upto 3000 per ml. whereas the fittered water had no pathogens and coliform count less than 10.

These results although indicate that the so filtered water cannot be allowed for the communities but there is no alternative for them. If some improvement is done on the ponds by protection against contanination from outside and the filters maintained properly this can be the most economic source of water for these people. One such unit costs $ 250 without improvement of the pond. If these filter units are installed in those areas where tubewells are not successful along with other devices for special areas the Govt. will have to spend $ 4.0 million. We are conducting surveys & small experimental devices are being tried but for want of funds Guvt. is not in a position to embark on an installation programme.

OBSERVATIONS:

a) In early 1978 I conducted a survey through my junior colleagues in Dumaria area of Khulna District under my control which revealed that 98% of the literate people favour use of tube-well water for all purposes, 60% of illiterate people do so. 33% people complain of mineral contents like iron & salinity in tubewell water and prefer more convenient sources like ring wells, tanks, ponds, canals & rivers. 23% reported that the platform of the tubewells were small & inconvenient for washing, bathing & other purposes. They preferred conventional sources of water for all other purposes.

b) Dissolved iron, chloride and hardness are the major problems in all-purpose use of water in rural Bangladesh. We have found that in relation to international standards of mineral contents iron upto 2 mg/l, chloride upto 600 mg/l and hardness upto 200 mg/l are generally acceptable to the people. People are inclined to use unprotected surface water in the problem areas & expose them to the attack of water borne diseases. In Jessere one of my junior colleagues has constructed a very simple iron removal unit where raw water contain 7 mg/l of iron and the unit effluent contain 1.2 mg/l. It has been observed that water use from the same unit has increased three times. 0% area of Bangladesh will have iron content over 5 mg/l, 50% over 2 mg/l.

Removal of chloride & hardness is not so simple and comparative study could not be made. Rain water cannot be collected economically due to roofing and container problem and for the reason that it rains only in monsoon.

c) Due to economic and cultural background woman in Bangladesh are responsible for satisfying most of the needs for which water is used. Free movements of adult women are not well accepted by the society as such they have to be particular about privacy and protection once they leave their homes. It is, therefore, difficult for women to utilize the public wells for multipurpose uses as the public tubewells are located so that they donot easily give room for privacy and accessible for all people within the area. For these reasons longer the distance the lesser the use of tubewell water for other purposes than drinking.

A tubewell usually yields 4 to 10 gallons of water per minute. This discharge is suitable for a family or household of 10 to 15 members if they want to use the water for all purposes. The water requirement of a rural household is in the order of 10 gallons per head per day. To get best results from the tubewell programme each family may be provided with one tubewell.

BARBADOS WATERWORKS DEPARTMENT

TITLE OF PAPER:

"TOWARDS THE EVOLUTION OF A TRAINING DELIVERY SYSTEM FOR THE EASTERN CARIBBEAN"

by: DENIS K. YEARWOOD

Date: August, 1980

SUMMARY:

This paper describes the origins and development of a Training Delivery System for Waterworks personnel in the Eastern Caribbean. This Training Delivery System (T.D.S.) for the Eastern Caribbean represents the "residual" of years of training effort in the water industry of ten (10) small islands Anguilla, Antigua, Barbados, British Virgin Islands, Dominica, Grenada, Montserrat, St. Kitts/Nevis, St. Lucia, St. Vincent in the English-Speaking Caribbean. The aim of the Training Delivery System is to create an adequate self-sustaining capability through which the training needs of water utility personnel in the region can be met using local personnel and institutional resources. The T.D.S. embraces approximately 2000 water utility personnel in the ten islands whose total population is just over half million.

In previous years efforts had been made to up-grade personnel in the water industry with such persons receiving training usually at institutions outside the region. An assessment of the status of water utility training, conducted by PAHO and CIDA in 1977, highlighted a number of inadequacies in the training efforts undertaken up to then. A number of recommendations resulted from this assessment and these recommendations, on being adopted, were used to determine the new direction water utility/would take.

The Training Delivery System as perceived in 1977 would strengthen water utility training throughout the region building upon an existing nucleus of trainers who were the results of previous years training efforts.

BACKGROUND TO THE T.D.S.

Before I introduce the concept of the T.D.S. itself I feel that I should give you an insight into the sequence of events leading up to its creation. The training of waterworks personnel has occupied the minds of Caribbean Water Engineers ever since the mid-sixties. There was never any doubt in the minds of these Engineers as to who was responsible for this training. It was always conceived as the responsibility of the respective water utilities, drawing upon whatever external assistance was available.

At a regional seminar held at the University of the West Indies in 1965 discussions centred among other things on manpower availability in the water sector and some of the resolutions that came out of the conference were:

1. That there should be regional co-operation in Technical education throughout the Caribbean area.

2. Duplication of expensive facilities should be avoided where possible.

3. Sharing of facilities in terms of placement in regional programmes of staff and students should be encouraged and planned.

Nevertheless, the training remained a neglected component of management activity within the water utilities so much so that none of them had any clearly defined training policy. Training of individuals was done in an 'ad hoc' manner and there was over-reliance on external facilities and funds provided by PAHO and CIDA.

In 1975 at the Sixth Annual Conference of Caribbean Water Engineers held in Grenada and again in 1976 at the Guyana conference there was some discussion of the training programme offered by PAHO/CIDA and it was suggested that the pros and cons of establishing a regional training centre should be examined.

In early 1977 PAHO and CIDA made an assessment of the status of water utility training in the region and recorded a number of significant findings among them being:-

1. That there was a gross inbalance in training effort. A disproportionately high percentage of training funds were spent on engineers and technicians who represent less than four (4%) of the total work force. By contrast very little, if any, training had been provided for skilled, semi-skilled and unskilled employees who constitute over 80% of the total work force.

2. That the type of training was inadequate as these technical people were not trained in the communication skills and instructional techniques needed to pass on their knowledge and experience within the respective utilities. In fact it became apparent that such personnel were never encouraged to see training as part of their job.

3. That the training efforts of previous years had produced a nucleus of technically trained people who, together with local vocational training institutions, afforded a basis on which to build a self-sustaining training capability.

PAHO and CIDA then made a number of recommendations which called for a novel approach to water utility training within the region. These recommendations proposed that active consideration be given to:

1. Developing a self-sustaining Training Delivery System (T.D.S.) for the water utilities of the Eastern Caribbean.

2. Training of Trainers, so that home-country training could be substaintially increased.

3. Developing of appropriate Training/Job manuals.

4. Establishing linkages between water utilities and existing training institutions in the region.

5. Manager/Supervisor training.

These recommendations were unanimously endorsed by the ten (10) participating countries and work began on preparing details of a programme of activities. At the Eighth Annual Conference of Caribbean Water Engineers held in Jamaica in September 1977 three papers were presented dealing with various aspects of water utility training. A draft paper outlining the organisational structure of the proposed Training Delivery System was also circulated at this conference.

CONCEPT OF A TRAINING DELIVERY SYSTEM (TDS)

A system is often defined as "an interconnected complex of functionally related components designed to achieve a predetermined objective". The T.D.S., which I am about to describe, aptly meets this definition. It was conceived of as consisting of the following related elements:-

Training Policy
Personnel Policy
Defined Organisational Structure
Budget
Manpower Inventory
Inventory of Training Resources
Manpower Development Plan
Definition of the Training Methodology
Multi-disciplinary Pool of Instructors
Performance-oriented Instructional Materials
Evaluation of Effectiveness

It is clear from the above that the T.D.S. represented a significant departure from the traditional practice of awarding a few ad hoc fellowships and conducting the occasional seminar. In fact the T.D.S. was a revolutionary idea in waterworks training in the Caribbean and from the outset it required the reorientation of personnel and training materials. When the various interconnected components of the T.D.S. are fully developed the likely result is the successful development of the attitudes, knowledge and skill required by an individual to satisfactorily perform on the job while at the same time realising his personal and the organisational goods.

DEVELOPMENT OF THE TRAINING DELIVERY SYSTEM

In describing the development of the T.D.S. I wish to stress specifically on three items that occurred early in the programme of activities. These items were:-

1. The Development of the T.D.S. Organisation
2. The Training of Trainers
3. The Development of Training/Job Manuals and Job-Aids.

Development of the T.D.S. Organisation

In developing the T.D.S. organisation attention was focussed on the need to develop the human resources the organisational framework and linkages between the various water utilities as well as with existing local training institutions for a self-sustaining waterworks Training Delivery System. With this in mind it was felt that a joint-venture T.D.S. for the Eastern Caribbean waterworks industry was most appropriate and would greatly reduce overall training costs while simultaneously maximising human and institutional resources.

Barbados was chosen as the most suitable location from which to co-ordinate the Eastern Caribbean T.D.S. for several reasons chief among them being:

(a) Geographic location - Barbados is located at the south-eastern end of the island chain and has a good communications network with the other islands.

(b) Size of existing water utility - the Waterworks Department in Barbados, with about 1,000 personnel, has enough employees to sustain its own training programme and is almost as large as the other water utilities combined.

(c) Training Institutions - Barbados has a number of established training institutions e.g. The Barbados Community College, Barbados Institute of Management and Productivity, The Samuel Jackman Prescod Polytechnic, all of which are very receptive to collaboration.

An Office of Training Co-ordination (O.T.C.) has been established in Barbados at the Waterworks Department and is staffed by a Training Co-ordinator, an Assistant Training Co-ordinator and a typist.

This office performs two primary functions - one national and the other regional. These two functions are described in Appendix I. Each participating country has appointed its own Training Co-ordinator who performs a national training role while simultaneously acting as the link between the O.T.C. and the respective local water utility.

A number of other developmental steps have also been undertaken and these include preparation of a quantitative manpower inventory, intensive on-the-job training for the Assistant Training Co-ordinator based in Barbados and circulation of the 2nd draft of a training policy to the various participating countries. Steps were also taken to familiarise the various utility Training Co-ordinators with the preparation of a manpower development plan.

Training of Trainers

The objective of this phase of the T.D.S. was stated as "to provide technically trained personnel with the necessary communication skills and instructional techniques required to assist with or carry out training at their own utility as well as to assist with instructional programmes in their specialties at other locations".

This activity was conducted by two teams of itinerant instructors departing from Barbados as a base. Team 1 completed a circuit from Barbados to Antigua, Montserrat, St. Kitts/Nevis, British Virgin Islands and Anguilla, and back. Team 2 went via Grenada, St. Vincent, St. Lucia, Dominica and back to Barbados. These teams met with the Project Manager every four weeks to share their experiences and make any necessary adjustments before the next round.

The activity consisted of a series of one week workshops, with a four week interval between them and each daily session lasted for 4 hours. Altogether, 142 participants from the 10 countries participated in these workshops and of this number 102 were certified.

Throughout the "Training of Trainers" emphasis was placed on performance-oriented training and a specialist in this area was hired to direct the development and application of performance-oriented instructional materials. Four West Indian nationals were also hired as instructors to conduct the workshops. These instructors spent the first two weeks developing the instructional materials required for the first workshop with the specialist serving as a resource person. During the week prior to the first workshop each instructor presented one of the lessons to the project team and this presentation was followed by a critique. In this way each instructor got a very constructive evaluation of his presentation from his peer-group.

Selection of the participants was very crucial to the success or failure of the "Training of Trainers" and to assist each utility in this exercise certain criteria were suggested. Suggested selection criteria are listed in Appendix II. These participants were for the most part senior field and office staff who had shown some ability to improve the performance of their subordinates on the job. It was also important that they were individuals with enough service left that the utility could benefit from their participation. One interesting feature of these workshops was that they were open to supervisory personnel from other Government institutions outside the water utility.

The content of these "Training of Trainers" workshops fully reflected the emphasis on performance oriented training. Appendix III outlines the contents of each of the three workshops. Almost every lession was accompanied by handouts, worksheets and assignment sheets. During the 4 week intervals between each workshop trainees were expected to work on their Home Study Assignments with each local Training Co-ordinator being used as a medium through which the instructors monitored the progress of each trainee.

From the outset it was decided that certification from these workshops would be awarded on the basis of performance and not merely attendance. In addition to attending a minimum of 75% of each of the 3 workshops each trainee had to complete at least predetermined minimum amounts of each of two Home Study Assignments and make two presentations - one of 15 minutes duration, the other of 45 minutes duration. The table below summarises the results of these workshops:

	NO. OF PARTICIPANTS			NUMBER	PERCENTAGE
	W/SHOP 1	W/SHOP 2	W/SHOP 3	CERTIFIED	CERTIFIED
ANGUILLA	2	2	2	2	100%
ANTIGUA	11	11	10	10	91%
BARBADOS	35	29	21	21	60%
BVI	10	(cancelled)	(cancelled	0	0%
DOMINICA	13	12	11	11	84%
GRENADA	14	11	11	11	78%
MONTSERRAT	14	14	14	14	100%
ST. KITTS/NEVIS	15	13	9	9	60%
ST. LUCIA	13	11	10	10	77%
ST. VINCENT	15	15	14	14	93%
TOTALS	142	122	102	102	72%

Development of Training/Job Manuals and Job Aids

During the preceeding activity viz. the Training of Trainers, instructors were expected not only to conduct workshops but also to compile a list of participants having potential for future roles in the development of Training/Job Manuals and Job Aids. This phase of the T.D.S. was seen as vitally important because performance oriented instructional materials suitable for use in training waterworks personnel were nonexistent. The objective of the phase was to produce such instructional material and manuals appropriate to local conditions and the academic level of the trainees.

As would be expected, the type of manual or job aid developed was determined by the training priorities of the respective water utilities. These training priorities were determined by the Managers and Chief Engineers of the various water utilities at a meeting held in 1977. At the final stage of the "Training of Trainers" prospective manual developers were sounded out and in each case they agreed to participate.

All manuals were developed according to a standard format which is shown in Appendix IV. To assist them in their preparations, each developer was given a package of instructional material and had at his/her disposal several manuals that had already been developed according to the same format. Developers also got an "initiation" at a one-week workshop during which they were assisted in applying the guidelines on an individual basis.

Job aids development was an independent activity and did not follow any special format. The challenge here was to find a suitable means of illustrating in pictorial form the sequence of operations in the task to be undertaken.

Altogether, this phase took about 9 weeks to complete. The first week was an orientation workshop, the last week a "wrap up" workshop and the 7 week interviewing period was used by each developer to complete the draft of his/her manual. To date the following manuals and job-aids have been completed.

Training/Job Manuals Completed

1. Installation, Operation and Maintenance of a Floating Chlorimator.
2. Basic Water Quality Test for Water Treatment Plant Operators.
3. Leak Detection in a Water Distribution System.
4. Installation of New Water Services.
5. Maintenance and Testing of Domestic Water Meters.
6. Public Education.

Job-Aids Completed

1. Water Meter Repair Flow-Chart.
2. Waterworks Standard Detail Drawings.
3. Water Main Laying.
4. Water Main Repair (Cast Iron)

Although conditions of operation in these islands are generally similar there are nevertheless certain differences peculiar to each island and there was an awareness from the beginning that a manual developed in one island might not have complete application in another. However, it was felt that, when proper cognizance was made of this constraint, manuals and job-aids still had very useful regional application.

IMPACT OF THE T.D.S.

The T.D.S. has had a very far reaching impact on waterworks training in the Eastern Caribbean. First of all it ushered in a fundamental change in the whole philosophy of training and was more in keeping with the modern notion of helping people to help themselves. Because of its non-traditional features, the project has gained international recognition by being nominated by WHO Geneva in the last quarter of 1978 as a demonstration site for other developing countries.

It has strengthened links between the Eastern Caribbean water utilities through the O.T.C. and has facilitated through workshops, in-house training attachments and otherwise, greater interaction between water utility personnel than ever before. There is also increased contact between existing training institutions and water utilities in respect of the provision of certain facilities and such institutions have shown interest in the T.D.S.

The T.D.S. has also performed a strategic role in waterworks training with the drafting of a Training Policy and the preparation of a manpower inventory and a manpower development plan for the region. Adoption of the Training Policy would represent a long-term committment to training on the part of the participating countries whilst the information collected for the manpower inventory and the manpower development plan will be used to chart a strategic profile for the upgrading waterworks personnel.

CONCLUSION

Throughout most countries today, no matter how small, there is a great desire to strive for self reliance. I conclude that the T.D.S. as outlined above offers us a great chance of becoming self-reliant in one important area of national/regional effort viz waterworks training. We should endeavour to extend this spirit of self-reliance to other areas.

APPENDIX I

FUNCTIONS OF THE OFFICE OF TRAINING CO-ORDINATION (O.T.C.)

At The National Level:

(a) to monitor and forecast national manpower requirements in the water industry.

(b) to evaluate training materials from other training offices or the International Reference Centre and modify as required to meet the specific needs of the country's trainees.

(c) to develop training manuals and teaching aids.

(d) to make contractural arrangements for the utilization wherever feasable of local and national or international training resources e.g. institutions, instructors, courses etc.

(e) to maintain up-to-date information on local, national, regional and international training options.

(f) to select and develop the instructions and trainers who will form part of the national Training Delivery System.

(g) to plan, organise and co-ordinate local and national training programmes.

(h) to establish an "accountability" system for providing the T.C. and top management with evidance of the training effectiveness giving due consideration to cost/benefit indicators.

These duties are also duplicated in each territory through a local training co-ordinator.

At The Regional Level:

(a) to facilitate the interchange of information regarding training development e.g. manuals, availabe courses, training methodology teaching aids etc.

(b) to optimise the utilisation of training resources with the region by maintaining and disseminating a master list of specialists and a schedule of programmed courses in the various countries of the region.

(c) to collaborate with water utility T.C. on the basis of requests for advisory services e.g. short term consultants, instrumental seminars, observation tours etc.

(d) to co-ordinate, where practicable teaching courses within the region inorder to avoid duplication.

(e) to assist the various water utility training of training of trainers and key water personnel.

APPENDIX II

SUGGESTED SELECTION CRITERIA FOR TRAINING OF TRAINERS WORKSHOPS

The participant should:

1. As a minimum educational requirement, have attained a School Leaving Certificate.

2. Be a key person who will make a substantial contribution to training activities

3. Be someone with enough remaining service time that a "return" can be realised from the training investment.

4. Be a person who has demonstrated an ability to improve employee performance on-the-job.

5. Occupy a position that has authority over other people (or will in the near future.)

Further it is important that:

6. At least 20% of the participants be available for occasional short periods in the future to develop instructional materials.

7. The local Training Co-ordinator be a participant.

8. A reasonable balance be struck between senior office staff and senior field staff.

9. That the manager of the utility participate in the training sessions to the maximum extent possible.

In addition:

10. It may be found desirable to include some employees who are exceptions to the above suggestions.

11. Utilities are encouraged to arrange for the participation of potential trainers from outside their ranks e.g. existing technical or trade school and other Departments of Government.

APPENDIX III

OUTLINE OF CONTENTS OF TRAINING OF TRAINERS WORKSHOPS

Workshop No. 1

(a) Task Analysis (TA)

Task analysis concepts
Definition and Identification of Tasks
Definition and Identification of Operations
Job Structure Flow Chart
Analysing the Task
Operation Breakdown

(b) Performance Objectives (PO)

Definition of and Reasons for Performance Objectives
Performance Objective Components
Writing and Evaluating Performance Objectives

(c) Presentation Techniques

Principles of Learning
Factors Affecting Learning
Instructional Methods
The Instructional Plan

Critique Form and Home Study Assignment

Workshop No. 2:

(a) Review of TA and PO

Review of Task Analysis
Review of Performance Objectives

(b) Presentation Skills

Communication
Feedback

(c) Instructional Media

Introduction to Instructional Media
Graphics

(d) Questioning Techniques

Oral Questioning Techniques

(e) Presentation Preparations

Selecting site and Trainees for Presentation
Training Prerequisites
Organising the Presentation
Critique of Presentations

(f) Performance Evaluation

Introduction to Performance Evaluation
Preparing Evaluation Devices

Critique Form and Home Study Assignment

P.T.O.

Workshop No. 3:

(a) Review of Preparations for Presentation

Review of Task Analysis
Review of preparations of Instructional Plan

(b) Training Problems

Training Facilities
Training Participants
Government, Management and Labour Corporation

(c) Training Delivery System (TDS)

The TDS Concept
EC Water Utility TDS

Award of Certificates

TRAINING / JOB MANUAL FORMAT

Title of Manual
Unit Number
What is this unit all about
Why does the trainee need this
What does the trainee need to know before beginning
What equipment and supplies are needed
Number of lessons and total instructional time
Instructional plan for each lesson

	Title of Manual
	Unit number
	Lesson number
	Estimated Time
	Prerequisites
Performance	Objectives
	Performance
	Condition
	Standard
Training	Resources
Training	Activities
	Trainer Activity
	Trainee Activity
	Evaluation Activity
Trainee	Handouts
	Information Sheet
	Worksheet
	Assignment Sheet
	Operation Sheet

Overhead Transparencies, slides, Flip Charts, etc.
Resource material for Instructor
Nonclass activities
Home Study activities

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7. AMRO - 2174 Project - Caribbean Basin Water Management Programme of Activities
   by Eng. Neil F. Carefoot
   Mr. John L. Lay

8. Instructor's Manual and Planning Guide For Training of Trainers
   by Prof. John H. Austin, Jeffrey Barrow Quincy Francis, Stanford Graham, Dorian Whittington

9. Proposal For Project Extension - Caribbean Basin Water Management Project
   by PAHO/WHO

10. Proposal For Developing The Organisational Structure Of The Eastern Caribbean Water Utilities Training Delivery System
    by Mr. John L. Lay.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Bolivia

J. Lizarazu Valdivia, Division of
Hydro Resources

La Paz-Bolivia, May 30, 1980

BOLIVIAN HIGH PLAIN BASIN
CUENCA DEL ALTIPLANO BOLIVIANO

By: José Lizarazu V.

INTRODUCTION

This zone comprises the Northern and Central part of the Bolivian Highplain which goes from the Titicaca Lake on the North, to the city of Oruro on the South.

The East and West boundaries are the Real mountains and the Occidental mountains respectively.

This study intends to evaluate the groundwater resources, its volume, its distribution and its quality, that in the near future will be the sources of water supply to fulfill the municipal, agricultural and industrial demands of the region.

Taking into consideration the physiographic, geologic and hydrologic regional, the efforts were concentrated on the North and Centre of the region, while on the South in the Department of Potosí, the information is very scarce.

NORTHERN BOLIVIAN PLATEAU BASIN
CUENCA NORTE DEL ALTIPLANO BOLIVIANO

Geomorphology - Geology

The basin of the Bolivian plateau is located between the Oriental and Occidental Mountains, Structurally it is a

braben, which has as one of the most important features the Coniri Fault, which put in contact the Paleozoic rocks with Tertiary rock.

The oscillations of water level of the Titicaca Lake give origin to lacustrine - fluvial and fluvial-glacial depositions by snow melting (mostly) and rainfall in the high mountains.

The most important aquifers of the region are constituted by the fluvial-glacial formations. The moraines and Lacustine sediments are impermeable. The lacustine terraces are associated to artesian conditions.

The Tertiary rocks of hidrologic importance are formed by sand-stones and conglomerates, especially the Taraco Formation.

The Paleozoic rocks constitute most of the impermeable embasement of the Northern plateau.

The Paleozioc outcrops are composed by devonian and carboniferous rocks (mostly lutites, siltstone and sandstone) and finally by few outcrops of Permian rocks constitutes by lutites, marl and limestone.

Hydrology

The Bolivian Highplain is an intermountain basin, where all the rivers flow toward the Titicaca Lake and Poopo Lake.

The Northern part of the Bolivian plaeau (Bolivian Highplain) belongs to the basin of Titicaca Lake, where the outlet of groundwater occurs.

The surface water and groundwater of the zone are in general fed by snow melting priginated on the Teal Mountain (Oriental Mountain).

Hydrologically, the area of study is subdivided into smaller sub-basins which were formed between the Tertiary and Paleozoic mountains. The thickness of the quaternary sedimentary pack on the Northern part of the Highplain is very reduced reaching in average from 100 m to 150 m. From these only 50 m - 80 m can be considered as aquifereous.

The area of the sub-basins is very small and their recharge zone very reduced.

Taking into consideration that the annual precipitation is realtively low (annual average 525 mm) and the losses by evapotranspiration very high (85% - 90%), it is evident that the basic conditions for groundwater reserves are very scarce.

In all sub-basins there is discharge of the groundwater in the low and central parts in form of springs. Most of this discharge is lost by evapotranspiration and a minor part goes to Titicaca Lake by underground flow.

The reserves of groundwater are not too big, but since the water is concentrated on the central part of the sub-basin, its explotation is economically feasible with the construction of shallow wells (50 m - 100 m).

The pumping test revealed the following values for the hydraulic parameters of the aquifer:

Transmissibity: 50 - 620 m^2/day
Specific Capacity: 1 - 4.3 1/sec/m
Storativity coeff: 1 x 10^{-6} - 1 x 10^{-2}

For artesian wells the average value of the specific capacity is 1 1/sec/me and on phreatic aquifers the specific capacity is 8,9 1/sec/m.

Through the coefficient of storativity it was found that most of the aquifers in the region are under confined and semiconfined conditions.

Water Quality

The groundwater of the Pucarani sub-basin constitutes the most representative of the Northern Highplain. It corresponds genetically to the zone of oxidation with active circulation of water and chemical changes.

Among the anions, bicarborates and suphates are present. Among the cations calcium predominates on alkalis.

Hydrochemically, the basin can be divided into five sub-basins.

1. Edge of the basin (Sub-zona borde de la cuenca)
2. Highland of the basin (Sub-zona parte alta de la cuenca)
3. Central part of the basin (Sub-zona parte baja de la cuenca)
4. Low part of the basin (Sub-zona parte baja de la cuenca)
5. Titicaca Lake (Sub-zona del Lago Titicaca).

1. Edge of the Basin

It is an aereation subzone, the edge of the structure, and is lixiriated. Dominant are the soft and medium hard water with an alkaline character, (pH = 7) of temporary hardness.

The dominant compounds are: bicarbonates, alkaline chlorides and terrous alkaline sulfates are present in small quantities.

The amount of dissolved silicates of the aereation zone is small and the maximum T.D.S. is 150 mgr/l.

2. Highland of the Basin

In this sub-zone the groundwater is influenced by dissolution and descomposition of neovocanic materia. The dominant coumpounds are alkalis, terreous alkalis and bicarbonates. The SiO_2 content is 40 mg/l and the pH = 7.7.

The groundwater which flows towards the central part of the basin changes its chemical composition, due to the mixing with the low mineralized waters coming from the borders of the basin.

3. Central part of the Basin

This sub-basin is influenced by the Titicaca Lake waters. The groundwater is temporarily hard, approximately neutral. The main compounds are sulfates and terrious alkalin bicarbonates. In the lower part of the oxidation zone hydrochemical changes are produced, which includes the central part of the basin.

The groundwater is suitable for drinking and agricultural purposes.

4. Sub-zone low part of the Basin (Sub-zona parte baja de la Cuenca)

The origin of the groundwater in this basin is the same as the present sub-basin (case 3), also being hydrochemically influenced by the Titicaca Lake. The chemical characteristic of the water is that of mineralization is bigger, (more than 300 mgr/l (T.D.S.) presenting a gradual change from bicarbonate - sulphate water to sodio - sulphate water. This change is due to the continuous variations by infiltration of the water type Na^{+}, CI, SO_4^{-2} from the Titicaca Lake.

5. Sub-zone Titicaca Lake (Sub-zona del Lago Titicaca)
It comprises the waters of the Titicaca Lake, with type Na^{+} Cl^{-} SO_4^{-2}, and solid contents around 700 mgs/l (T.D.S.). It is possible that in longer dry periods the mineralization will be bigger than 1000 mgs/l (T.D.S.)

The quality of the groundwater is good, however the degree of mineralization increases from East to West. The influence of the Titicaca Lake on the quality of the groundwater reaches only about 2 km far from the lake.

The groundwater in the northern plateau is suitable for drinking, irrigation and industrial purposes.

CENTRAL HIGHPLAIN - ALTIPLANO CENTRAL

This region comprehends the vicinities of the Oruro city.

The basin is divided into two small sub-basins, i.e. Caracolla - Oruro and Patacamaya - Eucaliptus - Toledo. The last one is also known by basin of the lower Desaguadero River, both basins have their outlets in the Poopo Lake.

Geology

The outcrops are formed by Paleozoic and Terciary rocks as well as Quaternary sediments. The Paleozoic is characterized by the dominance of lutites which form impermeable

beds. There are some intercalations of sandstone and quartzites.

The terciary rocks are composed of conglomerates, lutites, sand-stone, gypsum, marl in the lower part and acidic lava, ashes and volcanic breaccias in the upper part.

The quaternary deposits are constituted by glacial and fluvio-glacial sediments, alluvial fans and extensive deposits of sands and dunes. They contain sand beds that form the aquifer of the basin.

These beds are intercalated with silt and clay beds of lacustrin origin which are the confining beds.

The thickness of the quaternary deposits due to the irregularities of the Paleozoic-Terciary embasement varies between few maters up to 125 m. These Paleozoic and Tertiary rocks by its lithology present very low permeability.

Hydrology

The precipitation of the zone is low with an annual average of 300 mm. The aquifers in the Oruro sub-basin are found in quanternary sediments under confined, semiconfined and phreatic conditions.

In the eastern part of the Oruro city, the productive zone varies between 5 and 25 m. The wells in this area are

not artisian but the storage coefficient obtained indicates that the aquifer is confined or semi-confined.

On the north part of the Oruro city there is a productive aquifer bed between 17 and 20 m. depth. It is confined and the wells are surgent.

Considering the well N°B.P - 106 as representative of the drilled wells in the area, from which the obtained hydraulic parameters are:

a) Transmissivity (T) = 122 m^2/day
b) Storage coefficient (S) = 1.3 x 10^{-2}
c) Specific capacity a,29 1/sec/m.

The piezometric map (1.973) indicates that the groundwater movement in the southern part of the basin (Challapampa - Oruro - Vinto) in general is WSW.

The sub-basin of Oruro is recharged by rainfall, see page from streams and infiltration of the snow melting.

The discharge of the sub-basin occurs mainly by evapotranspiration which is high, subsurface flow and by the use by the Oruro County.

Chemistry and Water Quality

The hydrochemical analysis of Oruro sub-basin shows a horizontal hydrochemical changes. The water discharged

in the higher part of the basin and in its Oriental border presents an average mineralization of 300 - 600 mg/l with low chloride contents, less than 50 mg/l of the type Na^{+}, Ca^{2+}, HCD_3^{-}, SO_4^{2-}.

The thermal and gaseous waters which feed the basin along the oriental border of the basin present a high mineralization of more than 2000 mg/l (T.D.S.).

In the lower part of the basin, the quality of the ground water is affected by the waters which contain metallic minerals and poisonous compounds originated from the neighbouring mines (Chacanilla Mines; La Joya Mines; San José Mine, etc.)

Almost from the Oruro City to the south the water does not meet the drinking and agricultural requirements.

In the preliminary studies in the lower part of the zone it was identified waters of high mineralization (10,000 mg/l; T.D.S.) with high chloride content (5000 mg/l), and metallic minerals.

In the northern part of the sub-basin, from Pastacamaya to Eucaliptus the groundwater is found in large amounts and it is of good quality for drinking and agricultural activities.

Towards the south, from Eucaliptus to Uru Uru Lake, the water quality is poor and it is not suitable for drinking or agricultural purposes.

CONCLUSIONS

The conditions for the formation of the groundwater reserves in the area of study are considerably limited by the scarce precipitation. However the important contributor to the basin is the water which coming from the continuous snow melting of the high mountains.

The thickness of the quaternary sediments in the North reaches 100 - 150 m, from which only 50 to 80 m are considered as aquifers. The central zone of the sub-basins are the ones that offer better conditions for water exploitation, because they present larger thickness of saturated layers.

In the Central part the thickness of the quaternary pack varies between 5 to 25 m of depth.

In both principal sub-basins the most of the aquifers are under confined and semiconfined conditions, although there are also phreatic aquifers.

The quality of the water in the North meets the requirements for drinking, agricultural and industrial purposes. Its quality becomes gradually poor from North to South.

From Oruro city to the South it does not meet any longer the standards for the above-mentioned purposes. The origin of the undesirable elements come from the neighbouring mines, from the termal and gaseous water, which come from the Real and Occidental Mountains.

United Nations
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Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Botswana

M. J. Gopolang, Department of Water Affairs

UN/D.T.C.D Seminar on Rural Water Supply to be held in UPPSALA - Sweden from 6th to 16th October, 1980

INTRODUCTION:

The Department of Water Affairs has in its present rural Village Water Supply programme to construct water reticulation systems varrying in size and based from the 1971 population census. The Department construct these rural Village Water Supplies for District Councils and they have been divided into the following projects:-

WB.17 - Major Village Water Supply with population of over 1500 inhabitants, and is operated by Depart- of Water Affairs.

WB.26 - Rural Village Water Supply with population from 500 to 1500 and is operated by District Council.

WB.30 - Small Village Water Supply with population of up to 500 inhabitants and is also operated by District Council.

For WB.26 and WB.30, application for private water connection is not encouraged as the District Council is not fully equipped with staff and tools to carry-out such work requests. However, this kind of application can still be considered incase of application in connection of running a business to serve the public centres like a shop, butchery, Chemist etc.,

The Department of Water Affairs consists of the following Sections:-

(a) Drilling Section

(b) Design and Construction Section

(c) Operation and Maintenance Section

( ) Borehole Repair Service

(e) Water Apportionment Board.

(f) Stores Supplies Division

(g) Hydrology Section

(h) Training Section.

(i) Transport Section.

(j) Administration Section.

I would like to address myself to the first three mentioned Sections only (ie., a, b and c).

(a) Drilling Section:- responsible for siting and drilling of boreholes for Government , Districts and farmers.

(b) Design and Construction:- to design and construct Rural Village Water Supply and then hand it over to operations and maintenance sections. This could be handed over to O & M in Districts or in the same Department, depending on the size of the supply.

(c) Operation and Maintenance Section:- for Major Village Water Supply. - full responsibility to operate and maintain. - to see that pricing and Water Works Area Policies are implemented.

Operation and Maintenance Forms: - Major Village Water Supply records are always recorded on O.M forms listed below:-

OM.1 - form for Monthly returns

OM.2 - form for Borehole readings

OM.3 - form for Pumping performances

OM.4 - form for Annual Summary

OM.5 - form for Stand pipes Readings

OM.6 - form for Chlorine Residual readings

OM.7 - form for Private Water Connection readings

OM.8 - form for Monthly Summary

OM.9 - form for Application for Water connection

OM.10 - form for Water connection to the Compound (top part)

OM.10 - (Bottom part) for completion of a new private connection.

Monthly returns from each Water Supply are sent to H.Q each month with enclosure of forms OM. 1, 2, 5, 7, 8 and 10 together with log books of pumping , fuel requisition forms, Revenue Collector's cash book and paying in Voucher, Government Purchase Order forms and invoices, etc.,

All these records are checked by Senior Officers in H.Q, kept safely and then compiled together at the end of the financial year to produce a report.

WATER TREATMENT AND CHLORINATION: The two Major Village Water Supplies have got Treatment Plants as follows:-

MOSHUPA W/S:- The Supply of water is from a dam and the treatment plant purifies water with alminium sulphate and

Soda Ash solutions - Gas chlorination is in operation, with spare pump of Chlorine solution. The operation is satisfactory.

KASANE W/S:- The supply of water is from Chobe river and the treatment plant is fitted with Sand filter. Water is purified from Alminium Sulphate, Po ly Electrolite and Lime solutions.

HTH - Chlorine Solution is injected by pressu e feed pump. The operation is satisfactory.

Other Major Village Water Supplies, - Chlorine solution or Chlorine tablets are added by means of Radio feeder Chlorinators or a system with chlorine solution dripping into the main reservoir and by Fletch Flow chlorinators respectively. The pipelines and reservoirs are also disinfected accordingly.

PRICING - POLICY:-

(a) Water drawn from public stand pipes and filling points - supplied FREE

(b) WaterSupplies to Private connection consumers charged at P0,30 thebe per $1m^3$ (1,000 litres).

(c) Where Department of Water Affairs sells water to the District Council for use by livestock, the charge is P0.15 thebe per $1m^3$. - where the water is re-sold to the public by the Council, the charge is P0.20 thebe per livestock unit per month.

(d) The fee payable to Department of Water Affairs for a private connection within the Water works area is P110,-

(e) The fee payable to Water Affairs for private connections outside the Water Works Area is at cost.

The pricing policy can be reviewed from time to time by the Government.

PRIVATE WATER CONNECTION - in a Major Village Water Supply during its operation and maintenance, many application are received. The Officer-in-Charge replies to each application and once the payment has been done. The connection is given a P/C No. and then the work done. The applicant and Government representative sign "agreement form" for supply of water. In case of many application paid for and are still pending, the Department hires Casual labourers to speed up the work.

No self help work is expected from the public as government has not yet emphasised on this point.

A private water connection is brought into the boundary of the owned or occupied plot, can be varied, but normally is one metre inside.

All the private connections and major extensions of the reticulation system, are only carried out within the Water Works Area.

For the expansion of the water works area the meeting has to be conveyed by the concern parties. Then it will be approved and gazzetted.

TRAINING:- This is necessary for all the staff, especially Mechanics, where their training ceased in 1978 and it looks as if the Department is facing some difficulties in recruiting the right man. (This should be a mechanical man who will be responsible for training Borehole mechanics and conduct higher trade tests for the existing mechanics.

Without proper training and inservice training, one can not be expected to run a rural Village Water Supply satisfactorily, with this morden world, where by every work or piece of machinery is modified daily.

I still maintain that the success of running any rural village water supply satisfactorily, depends on the adequate training of its staff in general.

I would like to give below, the staff and duties of a Major Village Water Supply:-

THE STAFF AND DUTIES:

A. Officer-in-Charge:-

(1) Full responsibility of the water supply.

(2) Supervision, co-ordination

(3) Maintenance

(4) "Preventive"Maintenance

(5) Executive only as a Mechanic

(6) Map and records

(7) Planning

(8) Extension and improvement of the system.

B. Plant Operator (or Mechanic)

1. Full responsibility of the 'Treatment plant' together with pumping machinery.

2. Pumping records

3. Maintenance of plant and machinery

4. Supervision of pumpers.

C. Meter-Reader - full responsibility to read once a month all meters (including Borehole and booster pump meters).

- prepares reports:

- Form OM.2 for borehole, booster or well point meters.

- " OM.5 for public stand pipes (water) - meter.

- " OM.7 for private water connection - meter when meters out of order leakages he enters in duplicate-book provided for such reports.

Checks on filing system.

D. Revenue Collector:- Follows financial instructions

- Every month - checks water consumption from 0.7 forms for private water connection and then calculate monthly water charges.

- prepares invoices

- enters in Cash book and personal file for each consumer.

- receives payments

- list of private connection for disconnection

- when account is over due. When an invoice is issued, notice is also given on same invoice for a month's period.

- New private connection entered in file PC. No. given. form OM. 10 for water connection application (top part) and bottom part for completion of connection etc.,

E. Pipe-fitter:-

- install new new private connections

- repairs any leakages

- checks every month - gate valves, air valves dead ends, lowest points, tanks.

- install more stand pipes when required

- checks meters: for Borehole and Booster pumps once a month

- Checks meters for stand pipes - twice a month.

- " " for private connections - once a year.

- Keeps stock of all fittings and pipes by checking on storeman.

F. Pumper:- Operates pumps as per "instructions" given by plant operator (mechanic).

- fills log-books. pumping daily, before starting.

- Keeps pumphouse and surroundings perfectly clean.

- Checks water level in the storage tank when necessary and also keeps surrounding of fenced tank clean.

- Reports immediately any defects, abnormal running.

- Meter out of order - must record on log-book and report to Mechanic.

- Keeps fuel and oil in store-room and lock.

G. Store-Keeper:-

- Maintains stock cards.

- Keeps store clean and in order

- Informs Officer-in-Charge when items are running short.

- Maintains tools and equipment.

H. Watchman:-

- Works during the night and silent hours.

I. Labourer:-

- Keeping the Water Affairs yard clean
- Work on connection of private connection, stand-pipes, repair and maintenance, cleaning of tanks etc.,
- Any duties attributed by Officer-in-Charge.

Many problems always arise in running any Water Supply and are delt accordingly.

Yours faithfully,

M. J. Gopolang
SENIOR TECHNICAL OFFICER(O & M)

MJG/mgm.

The Provisional Military Government of

Socialist Ethiopia

Ethiopian Water Resources Authority

Thematic Paper on Community Water Supply.

September 1980
Addis Ababa

International Seminar on Rural Water Supply

A Contribution to the Preparation of the Water Decade

Annex 1

Answer to Questionnaires in Annex 1

1. Planning

a & b) Policy guidelines are provided by the Central Planning Supreme Council to Ethiopian Water Resources Authority forwater sector planning. The planning is drafted by EWRA and submitted to the Central Planning Supreme Council. The draft plan is reveiwed in the light of national goal, strategy and available resources. The reviewed draft is finanlized by the Ethiopian Water Resources Authority with the assistance of the Department of Energy and Water Resources of the Supreme Council.

The Planning and Programming Office of the Ethiopian Water Resources Authority receives considerable inputs from various departments of EWRA during the preparation of the plan. The contribution of the final consumers to the planning has not been encouraging. To date participation of consumers both in the planning and operation stages has minimal. It is expected that they would be given the opportunity to participate more actively in the future.

The annual implementation programmes is worked out by the Planning & Programming office of EWRA in detail then, it is presented to the supreme council along with the annual budget request. Upon the approval by the Supreme Council, the PPO of EWRA invites the branch office managers for detail programming. Based on the results of the discussions with the branch office managers and EWRA head office officials, the annual work programmes are translated into final implementation.

c) The field activities are often the results of the thorough investigation of water availability and indentification of water needy villages. Those villages which experienced severe water thortages and sanitation problems receive priority in water supply programmes. The depletion of ground water or other environmental problems have not been considered seriously. It is hopped that more attention will be given to these problems in the future.

1. Problems

a) The main problems in providing adequate quality water to the rural areas:

i) Lack of trained manpower in all fields

ii) Inadequate domestic finance

iii) Shortage of construction materials, drilling machineries and associated equipment, vehicles, etc.

iv) Inadequate maintenance and operation activities

v) Lack of reliable basic data

vi) accessability for vehicles and drilling rigs to water needy areas.

vii) A high fluoride content of the ground water in some areas (Rift Valley)

viii) Difficult hydrogeologic conditions

b) The impact of the above problems:-

Though it is difficult to quantity the impact of water supply problems on living condition, it is apparent that they are impending of accelerated rural water development. It is likely that many water-borne diseases could have been under control, if the above problems were removed. And as a result many rural inhabitants could have enjoyed a limited healthy environment. It should be noted here that water supply alone cannot bring all social well being unless it is supported by other social services.

To alleviate skilled manpower problems, the EWRA has accelerated training programmes both in the country and abroad. Regarding financial problems, it could be stated that the Government has given great attention to solve all problems pertaining to domestic finance. Community participation for operation and maintenance and contribution of labour during construction and introduction of appropriate technology for pumping water will be inhanced.

3. Organization

a) The Ethiopian Water Resources Authority (EWRA) is under the administrative control of the Ministry of Mines, Energy and Water Resources. EWRA has three main bodies to carry out its responsibilities. They include, the Urban Water and Sewerage Agency, which is responsible for planning and implementation of water supply schemes and sewerage in all urban areas (except, Asmara and Addis Ababa) while Rural Water Development Agency is responsible for water supply schemes in rural communities. The third is the Land and Water Studies Agency and is responsible for Water Resources investigation. EWRA has also the task of technical supervision of the Government owned water Drilling Agency.

b & c) The Ethiopian Water Resources Authority was found to be inefficient in its activities and required changes to increase its performance capability. As a result a new authority has been established in August 1980 to accelerat rural and urban water supply activities in order to construct water works in an orderly and efficient manner.

d) A proclamation which provides for the establishment of the Ethiopian Water Work Construction Authority has been issued on 16th of August 1980 and it is expected that the powers given to the new Authority would provide a solution to the problems experienced to date. No additional steps will be desirable at this stage.

e) The present approach of water revenue collection is not systematically done. For example, water is supplied freely in many drought affected areas. In some parts of the highland the rural communities pay 2½ as much the same price what the urban dewellers are charged.

In short water tarift is tariff is not established for the rural communities. The Planning and Programming Office is reviewing the present system and it is expected that an alternative pricing procedure which takes social, financial and economic aspects into account will be produced soon.

4. Financing

a) Currently, rural water supply is totally financed by the Government. Only few communities are charged nominal fee meet operation and maintenance costs.

b) The rural communities role in water supply activities in general and in self-help programmes remained insignificant. The Ethiopian Water Resources Authority is now attempting to involve the consumers in water supply activities starting from the planning stage.

c) Presently the rural water supply projects are financed directly from the government's annual budget and no revolving funds was considered for this activity.

d) Foreign assistances and loans have played an important role in financing water projects in Ethiopia. At present the UNDP, UNCDF, UNICEF, ILO, SIDA, EEC, and Canadian Government are assisting water supply programmes in different regions while Federal Republic of Germany, China etc. have given loans to water development programmes.

5. Staffing

a) Ethiopian Water Resources Authority is encountering a cronic shortage of qualified technical and administrative personnel.

b) Some measures has been taken to alleviate skilled manpower shortage of the Authority. At present there are 80 civil engineering students abroad who will be assigned to various water supply activitie when they return home. Another 80 students are expected to be sent very soon. Engineering aids are being trained at the A.A.U.

c) Regarding the self-help schemes no special training has been envisaged. The Authority, however, has planned to open a section in all eight regional offices which will deal primarily with selfhelp programmes and revitalizing public participation in water supply programmes.

6. Aid

The bilateral and international Agencies which are assisting most of the existing programmes are expected to continue their invaluable assistances for sometimes to come.

It is hoped that those assistances would increase in future to meet the increasing costs. Some assistances, such as UNDP, UNICEF, EEC and Sweden will continue up to 1982. Ethiopian Water Resources Authority is expected to gain some benefits from other developing countries experiences such as self-help programmes etc.

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Exchange Rate (1 July 1978)

Monetary Unit	=	Birr
1 Birr	=	0.48674
1 US$	=	2.0545

Annex II

1. Present and Projected Water Supply and Sanitation Coverage

1.1 Geography and Climate

Ethiopia, one of the largest countries in Africa, has a total land area of about 1.2 million sq. km. comprising a central highland surrounded by lowlands and bordered by the Red Sea and neighbouring countries of the Sudan, Kenya, Somalia and the Republic of Djibouti. The highlands, which comprise about two-thirds of the total land area, extend from 1,000 m. to above 4,000 m. in elevation. The lowlands, mainly in the northeast and southeast, include the hot and arid Danakil Depression which descends to below sea level. The population is estimated to be 30.8 million.

The climate, varies from mild to very harsh. Annual precipitation varies from less than 60 mm. to more than 2,8000 mm., with approximately half the country experiencing annual rainfall amounts of less than 600 mm. The seasonal distribution of rainfall varies significantly according to location; the dry season for most of Ethiopia is from October through March. The south-eastern part has most of its rainfall in April-May and October-November. The Red Sea coastal lowlands have some rain in December and January and the rest of the country from June through September.

The south-west has a heavier and longer rainy season than other parts. Rainfall decreases from south-west to north-eats, the areas of Danakil and Red Sea having the lowest rainfall in Ethiopia.

Some fresh water lakes, rivers and streams, mostly in the highland areas offer a certain limited potential for the development of water supplies; there are also possibilities of providing water supplies by means of spring improvements. Shallow ground water occurs in certain areas but yields are often small except in some alluvial deposits.

1.2 Economy

Ethiopia with an estimated GNP per capita of US$120 in 1979 is one of the least developed countries in the world.

Over the last six years fundamental political, social and economic changes have taken place. Since 1974 the Provisional Military Government of Socialist Ethiopia has introduced fundamental changes in rural and urban land ownership systems thus transforming these sector into public ownership. Major industries, modern sector enterprises, new systems and institutions of government, both central and at the grass roots level have been established.

The most remarkable aspect of Ethiopia's recent economic development is the apparent increase in agricultural prooouction during a period of radical change in land ownership system. Good weather plus government action in organizing fertilizer distribution, tractor ploughing, the mass media and use of university graduates and students as motivators and educators ('Zemetcha' campaign) are all reasons behind these increases in the agricultural and industrial sector production.

1.3 Health Status and Sector Coverage

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Since drinking water is the more common vector of dysentries, provision of adequate quantities of safe water to or within reasonable distance from dewlling houses and in the improvements of existing water supplies should significantly reduce the prevalence of these diseases. Correlation between inadequate water supply and waste collection and/or disposal facilities, and the prevalence of diseases is not feasible on the basis of the statistics, but it is obvious that there is a need for considerable improvement in these two important facilities if there is to be a reduction in water related diseases and in those attributable to unsatisfactory waste disposal. Proper excreta disposal could assist to control Schistosomiasis.

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Ethiopian Water Resources Authority which is under the administrative control of the Ministry of Mines, Energy and Water Resources has three major bodies which are responsible for planning and implementing of rural water development. Urban water supply and sewerage and land & water studies in the country. EWRA has established eight regional offices which are undertaking the tasks for which the EWRA bears responsibilities.

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It is expected that a number of schemes which were established several years ago and handed over to the local communities concerned will be found to be out of order.

The Ethiopian Water Resources Authority (EWRA) has taken the first concrete steps to start in some of the regions a systematic inspection and maintenance service of rural water supply schemes which is expected to result in a better assured functioning of these schemes.

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The EWRA has launched in 1977 an "Indicative Five year Programme for the Development of Rural Water Supply" ending 1982. This document established a general target of 3 million people to be provided with reasonable access to safe rural water supply schemes, or about 11 percent of the rural population projected by the end of the period. The programme foreses a gradual building up of the country's capacity for implementing such schemes. Excluding Addis Ababa and Asmari 40 towns with a total population of 1,040.000 people have some form of water supply but many schemes need improvement or expansion. In addition there are 74 towns having a size of between 6,000 and 10,000 people with a combined population of 564,200 people. Out of these 36 towns with a combined population of 265,000 people have some form of water supply, but quite a few of these need improvement.

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The current efforts to strengthen the EWRA headquarters and to improve its efficiency will continue simultaneously with the building up of the EWRA regional offices and the intensification of rural water supply construction activities in these regions. It is realized that significantly increased efforts will need to be made to halt the growing back-log of the population needing improved water supplies and sanitation services. At the same time, it is considered unrealistic to expect that the institutions required to supply such services could suddenly increase their output several times.

The question of tariffs need urgent attention. Experience has clearly shown that in the rural areas the current tariff level and present practices of fee collection can be an important constraint on the actual use being made of water points. After the onset of the rains the number of users of a water point may drop to about zero, water from unsanitary sources such as pools and rivulets for which no fee need to be paid being used instead. The present tariff system in rural areas seems therefore, at least in part, self defeating, New proposals for a tariff policy in rural areas and small communities are under preparation.

Several steps have been taken to alleviate the current severe constraints caused by the shortage of trained staff on various levels. In order to compensate for the limited intake capacity of the Department of Civil Engineering of the Faculty of Technology of Addis Ababa University, arrangements have been made by EWRA with the help of Canada and Sweden for students to study civil engineering and water supply in India. At present there are 80 students in India and it is planned to send another batch of 80 this year. Further, in cooperation with the Addis Ababa University courses have started for diploma-engineers in civil engineering with stress on rural water Supply. The

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To overcome the acute shortage of skilled manpower at all levels an intensive training programme has beem launched both locally and abroad. In addition a special training school has been set up in the head quarter to train pump attendants, driller, mechanics and electricians.

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Currently the water sector receives financial and technical assistance from bilaterial and international donors. In view of the decade plan it is anticipated that more assistance will be obtained.

The decade plan, as per the very preliminary estimates will require an annual investment of about 50 million US dollars for rural water supply only. At the end of the 10 year period, the costs of operation and maintenance of the rural schemes would amount to the equivalent of 14 million US dollars annually at current fuel and other prices.

2.3 Sanitation

Concerning sanitation, action is being taken to evaluate the existing situation and to prepare plans for the sanitation sub-sector.

The Provisional Military Government of

Socialist Ethiopia

Ethiopian Water Resources Authority

Thematic Paper on Community Water Supply.

September 1980
Addis Ababa

International Seminar on Rural Water Supply

A Contribution to the Preparation of the Water Decade

Annex 1

Answer to Questionnaires in Annex 1

1. Planning

a & b) Policy guidelines are provided by the Central Planning Supreme Council to Ethiopian Water Resources Authority forwater sector planning. The planning is drafted by EWRA and submitted to the Central Planning Supreme Council. The draft plan is reveiwed in the light of national goal, strategy and available resources. The reviewed draft is finanlized by the Ethiopian Water Resources Authority with the assistance of the Department of Energy and Water Resources of the Supreme Council.

The Planning and Programming Office of the Ethiopian Water Resources Authority receives considerable inputs from various departments of EWRA during the preparation of the plan. The contribution of the final consumers to the planning has not been encouraging. To date participation of consumers both in the planning and operation stages has minimal. It is expected that they would be given the opportunity to participate more actively in the future.

The annual implementation programmes is worked out by the Planning & Programming office of EWRA in detail then, it is presented to the supreme council along with the annual budget request. Upon the approval by the Supreme Council, the PPO of EWRA invites the branch office managers for detail programming. Based on the results of the discussions with the branch office managers and EWRA head office officials, the annual work programmes are translated into final implementation.

c) The field activities are often the results of the thorough investigation of water availability and indentification of water needy villages. Those villages which experienced severe water thortages and sanitation problems receive priority in water supply programmes. The depletion of ground water or other environmental problems have not been considered seriously. It is hopped that more attention will be given to these problems in the future.

1. Problems

a) The main problems in providing adequate quality water to the rural areas:

i) Lack of trained manpower in all fields

ii) Inadequate domestic finance

iii) Shortage of construction materials, drilling machineries and associated equipment, vehicles, etc.

iv) Inadequate maintenance and operation activities

v) Lack of reliable basic data

vi) accessability for vehicles and drilling rigs to water needy areas.

vii) A high fluoride content of the ground water in some areas (Rift Valley)

viii) Difficult hydrogeologic conditions

b) The impact of the above problems:-

Though it is difficult to quantity the impact of water supply problems on living condition, it is apparent that they are impending of accelerated rural water development. It is likely that many water-borne diseases could have been under control, if the above problems were removed. And as a result many rural inhabitants could have enjoyed a limited healthy environment. It should be noted here that water supply alone cannot bring all social well being unless it is supported by other social services.

To alleviate skilled manpower problems, the EWRA has accelerated training programmes both in the country and abroad. Regarding financial problems, it could be stated that the Government has given great attention to solve all problems pertaining to domestic finance. Community participation for operation and maintenance and contribution of labour during construction and introduction of appropriate technology for pumping water will be inhanced.

3. Organization

a) The Ethiopian Water Resources Authority (EWRA) is under the administrative control of the Ministry of Mines, Energy and Water Resources. EWRA has three main bodies to carry out its responsibilities. They include, the Urban Water and Sewerage Agency, which is responsible for planning and implementation of water supply schemes and sewerage in all urban areas (except, Asmara and Addis Ababa) while Rural Water Development Agency is responsible for water supply schemes in rural communities. The third is the Land and Water Studies Agency and is responsible for Water Resources investigation. EWRA has also the task of technical supervision of the Government owned water Drilling Agency.

b & c) The Ethiopian Water Resources Authority was found to be inefficient in its activities and required changes to increase its performance capability. As a result a new authority has been established in August 1980 to accelerat rural and urban water supply activities in order to construct water works in an orderly and efficient manner.

d) A proclamation which provides for the establishment of the Ethiopian Water Work Construction Authority has been issued on 16th of August 1980 and it is expected that the powers given to the new Authority would provide a solution to the problems experienced to date. No additional steps will be desirable at this stage.

e) The present approach of water revenue collection is not systematically done. For example, water is supplied freely in many drought affected areas. In some parts of the highland the rural communities pay 2½ as much the same price what the urban dewellers are charged.

In short water tariff is tariff is not established for the rural communities. The Planning and Programming Office is reviewing the present system and it is expected that an alternative pricing procedure which takes social, financial and economic aspects into account will be produced soon.

4. Financing

a) Currently, rural water supply is totally financed by the Government. Only few communities are charged nominal fee meet operation and maintenance costs.

b) The rural communities role in water supply activities in general and in self-help programmes remained insignificant. The Ethiopian Water Resources Authority is now attempting to involve the consumers in water supply activities starting from the planning stage.

c) Presently the rural water supply projects are financed directly from the government's annual budget and no revolving funds was considered for this activity.

d) Foreign assistances and loans have played an important role in financing water projects in Ethiopia. At present the UNDP, UNCDF, UNICEF, ILO, SIDA, EEC, and Canadian Government are assisting water supply programmes in different regions while Federal Republic of Germany, China etc. have given loans to water development programmes.

5. Staffing

a) Ethiopian Water Resources Authority is encountering a cronic shortage of qualified technical and administrative personnel.

b) Some measures has been taken to alleviate skilled manpower shortage of the Authority. At present there are 80 civil engineering students abroad who will be assigned to various water supply activitie when they return home. Another 80 students are expected to be sent very soon. Engineering aids are being trained at the A.A.U.

c) Regarding the self-help schemes no special training has been envisaged. The Authority, however, has planned to open a section in all eight regional offices which will deal primarily with selfhelp programmes and revitalizing public participation in water supply programmes.

6. Aid

The bilateral and international Agencies which are assisting most of the existing programmes are expected to continue their invaluable assistances for sometimes to come.

It is hoped that those assistances would increase in future to meet the increasing costs. Some assistances, such as UNDP, UNICEF, EEC and Sweden will continue up to 1982. Ethiopian Water Resources Authority is expected to gain some benefits from other developing countries experiences such as self-help programmes etc.

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2.3	Sanitation	

Exchange Rate (1 July 1978)

Monetary Unit	=	Birr
1 Birr	=	0.48674
1 US$	=	2.0545

Annex II

1. Present and Projected Water Supply and Sanitation Coverage

1.1 Geography and Climate

Ethiopia, one of the largest countries in Africa, has a total land area of about 1.2 million sq. km. comprising a central highland surrounded by lowlands and bordered by the Red Sea and neighbouring countries of the Sudan, Kenya, Somalia and the Republic of Djibouti. The highlands, which comprise about two-thirds of the total land area, extend from 1,000 m. to above 4,000 m. in elevation. The lowlands, mainly in the northeast and southeast, include the hot and arid Danakil Depression which descends to below sea level. The population is estimated to be 30.8 million.

The climate, varies from mild to very harsh. Annual precipitation varies from less than 60 mm. to more than 2,8000 mm., with approximately half the country experiencing annual rainfall amounts of less than 600 mm. The seasonal distribution of rainfall varies significantly according to location; the dry season for most of Ethiopia is from October through March. The south-eastern part has most of its rainfall in April-May and October-November. The Red Sea coastal lowlands have some rain in December and January and the rest of the country from June through September.

The south-west has a heavier and longer rainy season than other parts. Rainfall decreases from south-west to north-eats, the areas of Danakil and Red Sea having the lowest rainfall in Ethiopia.

Some fresh water lakes, rivers and streams, mostly in the highland areas offer a certain limited potential for the development of water supplies; there are also possibilities of providing water supplies by means of spring improvements. Shallow ground water occurs in certain areas but yields are often small except in some alluvial deposits.

1.2 Economy

Ethiopia with an estimated GNP per capita of US$120 in 1979 is one of the least developed countries in the world.

Over the last six years fundamental political, social and economic changes have taken place. Since 1974 the Provisional Military Government of Socialist Ethiopia has introduced fundamental changes in rural and urban land ownership systems thus transforming these sector into public ownership. Major industries, modern sector enterprises, new systems and institutions of government, both central and at the grass roots level have been established.

The most remarkable aspect of Ethiopia's recent economic development is the apparent increase in agricultural production during a period of radical change in land ownership system. Good weather plus government action in organizing fertilizer distribution, tractor ploughing, the mass media and use of university graduates and students as motivators and educators ('Zemetcha' campaign) are all reasons behind these increases in the agricultural and industrial sector production.

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United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Haiti

G.J. Felix, Service National d'Eau Potable

DESIGN - CONSTRUCTION AND RURAL PROJECT MANAGEMENT AT LOCAL, REGIONAL AND NATIONAL LEVEL

Ladies and gentlemen,

I feel proud of being invited to address my concerned issues on design, construction and watersupply project management at local, regional and national level for the rural area.

For many decades, the construction of watersupply systems has been concentrated on urban areas. Very little attention has been directed toward the rural areas. The efforts which had been done in the past were always individual. The attempt made by the developed nations despite of their greatness didn't reach the level of 100% of coverage. It is a great subject of thinking when you realize that, at the middle of 1980, almost 60% of the world population are located in rural areas, living with a minimum of sanitary facilities. We all recognize it, but the solutions are not that easy. Our desire to curb the situation should be our best hope.

A - D e s i g n

First of all, the design of a rural watersupply system is not difficult. The choice of the appropriate system is the burden. It requires good knowledge of ground and surface water resources, with only few data available.

Appropriate design criteria should be established as we are dealing with special condition of living. Very often the population are dispersed and meet only at certain point, for commercial exchange or religious activities. The site topographic conditions are not always easy, sometimes flat, sometimes hilly. The climate is sometimes humid, with few precipitation, sometimes windy.

Other facilities like electrical power, sewer, are not available, so the Design Engineer should make a proper economic,social and technical survey before selecting the appropriate system.

At the level of a national program, we still can use the service of many local engineering firms.

B - E x e c u t i o n

This is not the case when you consider the execution of the program. The planners should be careful in planning the execution. Local contractors could be used for specific works only, and not for building a system like in urban area. The community participation is the biggest imput to the overall success of the program. Working with the community participation is not that easy. Working

without him is a total failure. So it is recommandable to plan for the total community participation:

1) General motivation is the first step to follow.
2) Organizing non specialized labor for their participation on the job, is a good step to undertake. They don't work on a permanent basis. They are available during certain days of the week and during certain seasons of the year.
3) Develop program on a regional basis to train specialized labor needed like plumber, masons, carpenter etc....

Such program should take care of skilled labor needed only, so that, they can be used for the construction of the job; and at the end, be used as maintenance and operation personnel. The inconvenience to that, is: they should be paid during the time of training, during the construction and for the time they will spend to maintain and operate the system. Such action can result in a conflict, as unskilled labor of the same community are not paid for their work.

Some countries have adopted the system "food for work" which brings about good result. However, the ideal situation is: to pay the unskilled labor: half in food, half in cash. This will help them to balance their diet, at the same time, they will have the opportunity to make some money to buy fertilizers for their crop.

Whatever the situation the burden should be taken by the state organism who is sponsoring the program. He should plan for a lot of personnel for supervision and execution.

Construction of the system without community participation is not recommanded. Past experience have shown, it's a total failure. In Haiti, reservoirs, public fountains and pumping stations are still there like monuments. And it is very difficult for us to rehabilitate the systems now.

The construction of such projects in rural areas are facing transportation, road access, difficulties; inexistence locally , of construction materials like cement, lumber, structural steel. They should be brought up on site, which increase transportation cost. In many cases, aggregate like sand, gravel, are missing. They have to be taken off site. It is more advisable to use precast material which could be assembled on site.

P r o j e c t M a n a g e m e n t

Project management is the resort of a good planning. However operation, maintenance and management of the systems themselves require good institutional structure which has to be set up at the time of the execution of the program.

Projects built with community participation are best to manage. Personnel for operation, maintenance and management should be chosen among those who built them. Unfortunately the adoption of a tarif system is not that easy, so, founds for maintenance and operation are not sufficient.

The situation could be approached many ways:

1) It is possible to accept voluntary or fixed contribution from the population. Such system has to be finansially supported by the government because the funds are always unsufficient.
2) The state water organism may drain part of the benefits obtained from other systems to financially support maintenance and operation of other rural systems. This can be considered only where industrialization of the country is at an appreciable level.
3) Set up a national tax for rural watersupply such as, to have permanent funds for construction, operation and maintenance of the systems.

Although the present situation in Haiti is similar to the first case, I am strongly in favor of the last one. This will certainly lessen the amount of money we have to borrow if we want to reach the objectives of 100% coverage of the decade. Considerable amount of money is going to be needed and the reimbursement is going to be a burden if we cannot adopt a good taxation policy.

The structural organization needed to meet those objectives should follow the scheme of a local, regional and national level tight together. While a watersupply committee along with perception office could be set up locally, some units like enineering, laboratory, management, garage maintenance and repair shop, should be regional with coordination at a Central Office.

With international cooperation and motivation of high level government officials we hope, we will do a lot for the decade.

Thank you,

Guy Felix,
M.S. Env. Eng.

RURAL WATER SUPPLY IN INDONESIA

Thematic Paper Prepared for
Interregional Seminar on Rural Water Supply
Uppsala, Sweden - 5 - 17 October 1980.

The Government of Indonesia has adopted, within the framework of its Repelita III (1979-1984) National Developmant Plan, the objectives of improving the overall standard of living and reducing the incidence of water borne disease through the provision of safe water in sufficient quantity to meet daily needs to an increased proportion of its rural population. Specifically, during the period 1979-1984, the Government intends to attain the following levels of safe water service in the rural areas :

1979		1984		% Increase
Pop. Served.	%	Pop. Served.	%	
20.597	18	27.3	22	33

Pop. served are given in millions of rural inhabitants.

In Indonesia, three Ministries have responsibilities for the administration and implementation of the rural water supply improvement programme. The Ministry of Health, through the Directorate-General of Communicable Disease Control (DGCDC) and its Directorate of Hygiene and Sanitation (DH&S) has primary responsibility for overall planning, guidance and allocation of Central Government Budgets, including foreign loans, grants, and other forms of international assistance. The Ministry of the Interior, through the Provincial governors and the Regency (Kabupaten) heads (Bupatis), is responsible for implementing the projects. The Ministry of Public Works, through the Provincial and Kabupaten offices of Public Works, has responsibility for

.... assisting

assisting in design and construction of rural piped water systems, especially those of more than simple design such as those utilizing surface water as the water source and requiring subsequent treatment.

In general, the rural water supply improvement programme relies on the installation of five types of facilities :

1. Rainwater Collectors - provided where climatic conditions are favo - rable and the scarcity of potable quality ground water renders wells unfeasible. These collectors are promarily provided for single family units or for small community use.

2. Spring Protection - a system which collects good quality water from a proven spring source and serves the population through a tap or taps located at, or near to, the spring. Each system is expected to serve approximately 500 persons.

3. Artesian Wells - a system which collects potable quality water from a artesian well, and makes the water available through a storage tank and public taps. This system also serves approximatelly 500 persons.

4. Well Protection - construction of properly designed and sealed ground water wells, with installation of efficient and durable hand pumps. Both deep-well pump (more than 5 meters in depth) designs and shallow-well pump (less than 5 meters in depth) designs are utilized. Each pump is considered to serve approximately 100 people.

5. Piped Systems - these can be further sub-divided into two groups :
   a. Small, simple schemes, usually gravity flow but occasionally with motor-pump sets, serving a single village of between 3000-5000 people, and requiring no treatment of the water.

b. Larger, ...

b. Larger, more complicated water systems, often serving several villages, usually requiring pumping facilities and occasionally requiring com - plex water treatment operations, particularly when the source of - supply is from surface water. These system may serve as many as 50,000 or more people.

The numbers and types of rural water supply systems which have been provided under the INPRES Programme (funds from the Central Government, administered by DGCDC, under special Presidential Instructions) are shown in the following table :

Number of Water Supply Systems Installed

Year	Rainwater Collectors	Spring Protection	Artesian Wells	Handpumps Shallow	Handpumps Deep	Piped Systems
74/75	163	81	33	10.127	-	96
75/76	445	160	50	14.199	-	146
76/77	500	150	25	14.175	-	150
77/78	500	200	30	18.120	1.061	150
78/79	500	200	50	25.000	2.000	150
79/80	500	200	50	23.000	2.000	150
80/81	500	200	50	25.000	2.500	150
81/82	10.000*	700	25	70.000	3.500	150
82/83	10.000*	860	50	75.000	4.000	190
83/84	10.000*	900	50	75.000	4.000	200

* = Ferrocement 10 m^3

The years from 80/81 onward are projected, based on plans for meeting the targets mentioned earlier.

It is .....

It is recognized that the first four types of rural water supply facilities referred to above should be viewed as interim measures to the overall attainment of safe and adequate water supply by the entire population. However, these facilities reprecent appropriate technology for many regions in our country, and must be heavily relied on. This reliance will continue for several years, because such facilities can be more universally installed at this point in Indonesia's development. Increasing emphasis will be placed on the installation of piped systems, but because of the shortage of trained manpower required to design, construct and operate piped systems, we must continue the installation of the more traditional, albeit interim, facilities in order to meet our targets.

The shortage of skilled manpower referred to above is the major constraint in pushing a head with piped water systems in rural areas. However, another constraint which is often encountered is resistance at the local level. Community involvement plays a very important role here. Although we have trained several hundred Kabupaten and Kecamatan (township) level workers in design and supervision of simple piped water systems, they often encounter considerable resistance from the villagers who do not completely understand the principle of flow in pipes, storage needs, pump and motor selection, etc. Accordingly, our training programmes must be directed not only to the development of manpower for implementation of the work, but we must also adequate the general public to not only accept the piped water systems, but also to maintain and make proper use of them.

Water quality control, up to now, has received only necessary minimum attention in Indonesia. Before a source can be developed for supplying water to the public, it must be analysed and must meet existing national water quality standards. Routine follow-up analyses after the systems have become

..... operational

operational is not now required. It is believed that our present policy of emphasizing the provision of an adequate quantity of relatively safe water, rather than the dilution of our limited resources to include routine water quality monitoring, is sound, and should continue for the next few years.

The above paragraphs briefly describe the rural water supply situation in Indonesia at this time, and introduce some of the problem areas which we are facing. It is hoped that this paper will stimulate discussions during the Inter-Regional Seminar on Rural Water Supply which may help us in our efforts to attain our goal providing safe abundant water to all population.

REPUBLIC OF KENYA

MINISTRY OF WATER DEVELOPMENT

EVALUATION OF RURAL WATER SUPPLY PROGRAMMES I, II AND III - THEMATIC PAPER FOR DISCUSSION AT THE INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY AT Uppsala, Sweden 6-16 October 1980

The Director,
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SEPTEMBER 1980

INTRODUCTION

Although rural water supplies have been constructed in Kenya around and before 1960's, the first major impetus to rural water supply development was given by the 1970-74 Development Plan in which the National Target was first defined. The plan stated that : "The Government will mount a large rural water supply programme, commencing in the first year of this plan (1970) with the objective of bringing acceptable water supplies to all the rural population before 2000". The Target has been restated in the subsequent Development Plans of 1974-1978 and 1979-1983. The Rural Water Supply Programmes are still progressing.

Since in the past emphasis was on urban water supplies where the concentration of population was high, only a small portion of rural population is having access to an improved water supply. As such the Government has an enormous task of providing water to the greater portion of the rural population. Due to the water resources, manpower and financial constraints, it was realised that the target could only be accomplished in stages. So far the Rural Water Supply Programme Phases I and II (RWS I & II) have been completed. Rural Water Supply Programme Phasess III and IV are currently under implementation and RWS V and VI are in the planning stage. By 1976 it was estimated that about 1.5 million rural people had access to improved water supply. It is estimated that by the end of the current Development Plan when all RWS IV projects are expected to be operational, a further 1.5 million rural people will be served by an improved water supply. According to the provisional 1979 census, Kenya has a population of about 15 million. About 90% of the population, or nearly 13.5 million people, live in the rural areas. Considering that the rate of population growth in Kenya is one of the highest in the world, with an average of about 3.5% per annum, then assuming the rate of population growth will not decrease, the total rural population by the turn of the century will be about 26 million. It is therefore evident that the task ahead of us of providing potable water to the rural population is enormous. This is further complicated by the escalating inflation, the uneven distribution of water resources in Kenya and the lack of adequate technically qualified manpower.

In June 1976, the Kenya Government decided to carry out an evaluation study to determine the efficiency of the water policy and to reflect on the impact of the massive efforts expended in the water sector over the last six years. The following is a short summary of the findings and recommendations of that study.

OBJECTIVES OF THE STUDY

The objectives of the evaluation study are as follows:-

(i) To assess the operating efficiency of completed schemes;

(ii) To provide feedback to planners on the validity of the original planning assumptions;

(iii) To provide feedback on appropriateness of current means of water development in light of current Government objectives;

(iv) To justify the efforts being made with a view to attracting resources and stimulating further investment;

(v) To indicate areas where complementary inputs could improve the overall efficiency and effectiveness of rural water investments.

FINDINGS AND RECOMMENDATIONS

(i) Scheme Selection

The present scheme selection criteria as used by District Development Committees was found to be effective and should be continued. Self help contributions should be given greater priority.

(ii) Planning and Design

a) It was found that an uneconomic level of capacity was being installed in some cases and therefore more attention should be paid to phasing.

b) Some designs were found to be based on inadequate hydrological data thereby resulting in insufficient yields at certain times of the year. More comprehensive hydrological investigations and regular gauging of sources was recommended. More funds and transport facilities are required for this.

c) The existing guidelines on demand forecasting are adequate but the concept of maximum land carrying capacity was found to be unrealistically rigid and should be abandoned.

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d) Design and operation of scheme treatment works are generally satisfactory. Treatment works programme should however be extended to cover all schemes in order to comply with W.H.O. standards and minimize the risk of cholera outbreak.

e) Design of distribution network should provide consumption point storage. Flow restriction devices or metering should be used to minimise wastage.

f) Adequate standby capacity should be provided at pumped schemes but at borehole schemes provision should be made for increased storage to supply water during breakdowns.

(iii) Construction

The major shortcoming is in the quality of supervision. The Construction Division should be further strengthened to cope with the expanding workload.

(iv) Operation and Maintenance

The O & M Branch should be strengthened to cope with the increasing workload. Increase in recurrent budget, manpower, transport, technical support, training and management systems is called for.

(v) Water Sales and Pricing Policies

The present policy is sound but improvements in revenue collection and accounting should be enhanced.
Rates should be increased by about a third to ensure sufficient revenue to cover the O & M costs of the whole rural programme.

(vi) Socio-Economic Benefits

There are substantial social benefits resulting from improved rural water supplies. However, it is difficult to quantify these in monetary terms and therefore an economic evaluation is difficult. Provision of clean wholesome water enhances other developments like dispensaries, dairy industries and livestock development. Increased leisure is another social benefit.

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(vii) Assessment of the RWS Programme

The programme has been behind schedule since its inception. The main causes of delay are late delivery of materials, shortage of materials, weather problems, cumbersome and inefficient tendering and accounting procedures, import restrictions and inadequate staff and transport. Following the recent Management Study Report, the Ministry is taking steps to overcome most of these problems.

CONCLUSION

With steps already in hand to overcome most of the problems outlined above the target of serving the whole rural population by the year 2000 should be realised. A lot of international cooperation is therefore called for.

Interregional Seminar on
Rural Water Supply
Uppsala University

Working Document
Country Thematic Paper Session
9 October 1980

SHORT SUMMARY ON COUNTRY THEMATIC COUNTRY PAPERS

AGGREGATED DATA ON COUNTRIES COVERED

Country	Pop mill	Runoff mm/yr (order of magnitude)	Per capita availability m^3/p yr 1971	2000 calc
Liberia	1.6	1000-4000	198000	89600
Tanzania	17.1 (1978)	50-100	5700	2400
Sri Lanka	12.7 (1971)	20-1000	4700	2800
Thailand	45 (1980)	200-4000	4800	2000

1. RURAL WATER SYSTEMS DEVELOPMENT IN LIBERIA: AN INTEGRATED RURAL DEVELOPMENT STRATEGY (J Yarsiah)

The paper reports on the Rural Water Programme (RWP), which aims at alleviating poor health conditions of rural people. Key agencies in the water section are Liberia Water & Sewer Corporation and the Rural Water Programme under the Ministry of Action for Development and Progress. The former caters major towns with piped water, the latter installs simple hand-pump-operated wells for villages. RWP was initiated on a pilot basis in 1974 (formerly the Well Drilling and Toilet Construction Programme). In 1979, 335 wells and 95 pumps had been fitted with handpumps. However, 30% of the wells do not operate at present, due to lack of spare parts, acute shortage of transport equipment for the logistical support goods and services, and lack of formal training programmes, which also has the effect that sanitary considerations are usually disregarded, resulting in unhygienic water supply. At present, a 4-year Socio-economic Plan starting in 1980/81 and aiming at decentralization with full participitation of local people, is being scrutinized . It includes plans for rural water training centers for the water works personnel, which will hopefully develop into a regional centre for En glish-speaking west African countries. The plan includes three technical centres outfitted with warehouse/maintenance facilities. The Rural Water Programme is of an integrated nature, and part of the rural development strategy. It is later to be expanded to rural agricultural programmes with low-cost irrigation systems to local cooperatives.

2. THE EXAMINATION OF ISSUES RELATED TO THE ORGANIZATION, INVESTMENT, PLANNING AND IMPLEMENTATION OF RURAL WATER SUPPLY PROGRAMMES IN TANZANIA (B K C Bali)

The paper reports on the commitment to provide the entire Tanzanian village population with potable water by 1991, easily accessible within 400 m walking distance from dwellings. In 1979 7 mill had accessto potable water as compared to 2,4 mill five years earlier. Major inputs are survey and investigations, manpower and material inputs. The former include the launching of regional rural water master plans and the establishing of data collection networks in a number of regions. Support with technical equipment was facilitated by a reorganization of the Central Water Stores Dept in Dar es Salaam. Education and training is secured through a Water Resources Institute in Dar es Salaam to cope with an increased inflow of students, 130 engineers have been trained abroad. Administration bodies involved in the overall supervision and coordination are the Prime Minister's Office, the Ministry of Water, Energy and Minerals on the central level, the Regional Water Engineer who in his turn relies upon the District Water Engineer (DWE), the ultimate implementation of projects. The DWE-office is staffed with a blend of technical staff, procurement officers and craftsmen. Donor collaboration forms an important part of the implementation structure, both by financial support, and material inputs and man power. In the Third Five-Year Plan, 5% of the total budget and 45% of the total investment in the social infrastructure sector has been allocated to the Rural Water Supply Programme. The strategy of the programme includes the utilization of low-cost solutions, particularly shallow well schemes. In some places it would be easier to dam small rivers or to use gravitational methods. Projects that require large amounts of money are however given second priority, unless it is in the interest of a large number of village inhabitants. Generally, beneficiaries are required to participate fully, particularly on small projects.

3. CURRENT SITUATION OF RURAL WATER SUPPLY IN SRI LANKA (G E Kumarage

The paper reports on existing water supply situation in rural areas, and the plans for the Drinking Water Supply and Sanitation Decade. At present there are 80 piped water supply schemes but the water was bacteriologically safe only in 25% of these schemes, the rest being unsafe due to poor operation and maintanance, lack of competent staff and sufficient funds. The rest of the rural sector is supplied through wells. Community wells are popular but liable to pollution as they are used for bathing as well. In the dry zone covering 2/3 of the island, communities are generally small and deep tube wells have to be used in the absence of surface water sources. The paper summarizes the financial and economic aspects of providing piped water and handpump-operated wells. Present practice of financing the capital cost is described for minor, medium and major water supply schemes. For the water management, five different ministries are involved and the National Water Supply and Drainage Board carries

broad responsibilities. Efforts are being made to charge the water directly by installing water meters. Central Government is prepared to allocate appropriate resources for the water supply projects now being planned and attention is gradually spreading into district level. Targets for the Decade cover 8 mill of rural people and are to provide 60% of the population by 1990, and 100% by 2000 mainly through protected wells. Health education, community involvment, effective legislation and well organized operation and maintenance considered important parts of the Decade programme.

4. RURAL WATER SUPPLY IN THAILAND (S Pissathanporn)

The paper reports the successive development since 1961 of piped water supplies for 412 rural communities in Thailand, started with the help of a US consultant and regarded as part of the Mission's Public Health Support Program, focusing especially more politically sensitive areas of the Northeast. The actual output has fallen short of the original goals although statistics are missing. In 1979, about 400 rural systems had been completed, and for the next 10 years about 450 systems are planned. The goal has been focused on health improvement through improved water sources, better nutrition, increased usage of water sealed privies, and increasing quantity of water for sanitary practice. The village committee channels the governments concern the population. The implementation process is started by a local initiative from the villagers themselves. Villages selected are to be readily accessible by road, and willing to assist in the construction work. After construction, the plant and water system are turned over to local government who delegates a district officer, village chief or Sanitary District, as appropriate, to operate and maintain the installations. Training is provided for plant operators. The systems are sophisticated piped water systems, built to US design criteria and based on surface water or groundwater. They include chlorination of the water but a few systems have discontinued this practice. As for the pricing of water, most of the systems had originally public taps with a flat fee per household. Many communities failed to pay, however, and almost universally the systems were changed to metered private connections, public taps being closed leaving those not prepared to install meters unserved. Many systems are now selfsufficient as far as operation and maintenance costs are concerned. User's willingness to make the high initial investment for private connection, and to take the running costs is taken as a sign of their esteem. The availability of piped water has had beneficial health impacts including decreased skin diseases and diarrhea, and sanitary practices facilitated include use of water-sealed privies. The villagers do not always drink the piped water, however, the acceptability varying from region to region. Among a large proportion of villagers, collected rainwater still remains the first preference, while other villagers fetch their drinking water from traditional sources.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Liberia

J. M. Yarsiah, Ministry of Action for
Development and Progress

RURAL WATER

SYSTEMS DEVELOPMENT IN LIBERIA:

AN INTEGRATED RURAL DEVELOPMENT STRATEGY

Prepared By:

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L I B E R I A

June, 1980

Prepared as a Thematic Paper for the INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY, Uppsala, Sweden 6 - 16 October 1980 - Organized by the United Nations and the Government of Sweden

COUNTRY BACKGROUND :

Liberia is a country off the West Coast of Africa with a land area of some 43,000 square miles, a tropical climate and an immense natural reserve of iron ore, gold, diamond, and vast forest land for agricultural production, particularly rubber and palm products. These form the basis of its exports in a predominantly import-export, free enterprise economy. The staple food is rice, most of which is imported.

With a population of about 1.6 million, and in spite of its natural reserves, Liberia ironically has stood tall among those Third World Nations which continue to be trapped in the webs of underdevelopment - its economy being import-export oriented as mentioned above, remains dominated by foreign capital (i.e. led by U.S. and followed by other Western, European, Labenese and Asian interests). The ruling class in the past 133 years served foreign interests, isolated itself from the broad population, which experience 85 percent illiteracy, rising cost of basic commodities, unemployment, inadequate health facilities, low wages, etc.. These conditions gave way to the first military take-over in Liberia on April 12th.

Today, Liberia under the military has some U.S. $700 million debt and is at the same time endeavoring to explore all avenues for the speedy development which has been lackened in the country for over a century.

English is the accepted national language and the school system is patterned after that of the United States of America. There are many ethnic groups however which come to make up the nation.

Liberia has had a republican form of government with three main branches, namely Executive, Judiciary and Legislature. Its foreign policy has attempted to pursue a course of non-alignment, favoring diplomatic and friendly co-existence with all peace-loving nations of the world.

Liberia's Ministry of Action for Development and Progress (A.D.P.) is entrusted with the implementation of the Rural Water Programme, one of the executing arms of the Water Sector.

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KEY AGENCIES IN THE WATER SECTOR:

The Water Sector involves two major executing agencies - the Liberia Water & Sewer Corporation (LWSC) and the Ministry of Action for Development & Progress' Rural Water Programme (RWP). The former is a public corporation which cater to cities and major towns with minimum population of 5000, by the provision of piped water. The latter installs low-cost, simply - operated hand pumps for villages and small towns with population up to 2000. Deep (drilled) wells and shallow wells are two major sources that have been given priority in the life of the Programme thus far.

Over 70 percent of the population in Liberia lives in the rural areas. This percentage has been deprived of the basic facilities of healthy livelihood, most notably safe drinking water systems. The LWSC is not equipped at present to serve this entire populace. To date, only six cities in rural Liberia are being provided with piped water by LWSC. The greater percentage of the rural population which will not be beneffited by that scheme therefore constitutes the target group of RWP.

Unlike the urban dweller, the rural man survives on an annual average income of not more than U.S. $70.00. He is therefore not being required to pay for water received by hand-pumps. His contribution is generated in the form of goods and services which has proven very encouraging and supportive of the self-reliance aspect in rural water development.

There are other agencies, private development organizations and religious institutions that have made and continue to make positive efforts in development of rural systems. Owing to thee absence of a national policy-making body in the past, very little has been known of these various projects.

THE RWP AND ITS ROLE IN RURAL DEVELOPMENT:

As mentioned above, over 60% percent of Liberia's population (rural residents) had not been included among the beneficiaries to receive piped, modern water facilities provided by LWSC, due to obvious reasons.

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Water-borne diseases therefore continually plagued the rural inhabitants, contributing to a decline in their health conditions and an increase in infant mortality. This situation gave rise to a series of negotiations by the Government of Liberia (GOL) with the UNDP, UNICEF, and U.S. Peace Corps, aimed at providing an alternative water systems development that would cater to the rural populace.

Consequently, the Rural Water Programme (formerly the Well Drilling and Toilet Construction Programme) was initiated on a pilot basis in late 1974. At the onset the Programme was a small unit comprising a team of five (5) driller trainees, a UNDP Drilling Expert, a U.S. Peace Corps Administrative Officer and supportive staff, along with UNICEF supplied Percussion (English) drill rig, drilling materials, pumps, etc..

In December, 1979, there were eight (8) drill crews, seven (7) shallow-well crews, two (2) spring catchmemt development teams and a concomitant increase in the supportive maintenance and administrative groups. The Rural Water Programme (RWP) has registered 335 drilled and dug wells fitted with handpumps and 95 spring catchment systems to date. Regretably however, about 30 percent of our wells are at present not operational, principally due to inadequacy of spares for maintenance purposes. Although, donor agencies giving assistance to the RWP now include the EEC and US/AID, the problem of spares still remain.

The problems which are faced by the RWP are more than just the inadequacy of spares. There is at present an acute shortage of transport equipment to dispatch the necessary logistical support goods and services to project sites on time. This problem is further aggravated by the lack of communication equipment, thereby necessitating unnecessary travels to and from project sites and a more speedy depletion of available transport vehicles.

Equally chronic is the problem of the lack of a formal training program for drillers and other personnel. Most training activities up to the present were carried on in an ad-hoc, on-the-job and unsystematized manner. Moreover, a large number of those who now construct our water systems have little education or none at all. This is attributable to the low wages and the

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hard work the projects entail, which do not attract Liberians who have gone through secondary school grades.

The lack of education has created serious technical and social impediments to our Programme. Technical standards in wells construction as well as sanitary considerations are usually disregarded, resulting into poor well construction and unhygienic water supply.

Although negotiations are currently underway with donors to provide some urgently needed materials, much of RWP's problems are expected to be tackled in the implementation of the upcoming 4-year Socio-Economic Plan of FY 1980/81 - 1983/84. This plan is being scrutinized by the Central Planning Agency for budgetary allocation.

In the context of this 4-Year Plan, there are budgetary requests to GOL for activating a centre for training all Liberian rural water-works personnel. As a long-term objective, the Centre will hopefully become a Regional Rural Water Training Centre, especially for English-Speaking countries in the West African Region. GOL has already made available a tentative training campus, where renovation works have commenced. Donor assistance to the tone of US $2,000,000 is being solicited to establish the centre.

The RWP's plan is our first decentralization plan which is to be gradually implemented over the four (4) year period FY 1980/81 thru 1983/84. Three Regional Centres will be established, outfitted with warehouse/maintenance and office facilities, to be coordinated by three (3) Project Supervisors. In-service training and study tours will feature prominently in our manpower development efforts.

The overall goal of the plan is to lay the organizational basis and to establish the administrative mechanism towards meeting the goal set by the United Nations' International Water Supply and Sanitation Decade (IWSSD); the provision of safe drinking water to the world's population by the year 1990. Financial requirements for the plan is put at US $13,000,000, $6,000,000 as GOL input and $7,000,000 as Donor Agencies' input.

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RWP's DIRECT IMPACT ON INTEGRATED DEVELOPMENT:

The Rural Water Programme (RWP), by working towards the provision of portable water to the rural people, is promoting Government of Liberia (GOL'S) rural development strategy. By its very integrated nature, the RWP enjoys the technical services of the Ministry of Lands & Mines' Hydrologist, UNDP Hydrogeologist, Advisor and Programmer, as well as the Ministry of Health and Social Welfare's Water Quality and Health Education expertise. Although, the Health Assistants have contributed little or nothing in the past, it is now even more hopeful that their contribution will make significant impact in the coming period.

As the Programme becomes even more effective, and technical knowledge increased, deliberate attmepts shall be made to explore the possibilities of making the RWP servicable to rural agricultural programs, e.g. by providing low-cost irrigation systems to local cooperatives.

This integrated approach, GOL has realised, is both a means of minimizing expenditures and serving the rural people through speedy and simultaneous development. More importantly, a calculated strive towards the fullest participation of the local people in all development activities, thereby installing in them a sense of self-reliance is a guiding working priciple in Liberia's rural development.

The experiences of RWP over the last five years convincingly testify to the fact that no workable rural development program including rural water development - can be a successful venture in the absence of popular participation by the beneficiareis concerned. It has also become crystal clear that the lack of an integrated approach to rural development gives rise to the dilemma of rising expectation that cannot be satisfied by sporadic development initiatives.

It is against this background that RWP hopes to pursue a strategy of integrated development and popular particiaption in the construction of the water systems to help in alleviating the poor health condition of rural Liberians. This strategy dictates

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in the first place, the maximum utilization of all our domestic resources and secondly, as the need arises, we solicit the material and moral support of all international, bilateral and philanthropic donors, as we work towards the great task of providing all rural Liberians with portable water by the year 1990.

/jdk

United Nations
Department of Technical
Co-operation for Development

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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Malawi

P. J. Marcello, Department of Lands,
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GROUNDWATER RESOURCES DEVELOPMENT IN MALAWI

Position:

Malawi lies south of the Equator between latitude 9° 45' and 17° south and between longitude 33° and 36° east. It is 560 miles long, varying in width from 50 to 100 miles and covering an area of 45,747 square miles of which 36,400 square miles is land area. It is bordered by the Republic of Tanzania to the north and northeast, by Mozambique to the south and southwest and by Zambia to the west.

Physiography:

Malawi is dominated by an enormous lake that covers one third of the country. The lake lies in the rift valley trough that extends from the south to the north as part of the East African Rift Valley system. To the west of the lake rise plateaux that are between 3,000 and 4,000 feet above sea level. Above the plateaux are the highlands of Mulanje, Zomba, Viphya and Nyika that range between 5,000 and 8,000 feet. Mulanje peak in the southern region is the highest peak at 10,000 feet.

Climate:

Malawi has a tropical continental climate with some maritime influences due to the presence of the lake. Temperatures vary between 54°F and 64°F but in the rift valley absolute maximum may reach 100°F. There are three major seasons: the dry, the cool, and the wet. June and July are the coldest months while october and November are the hottest.

The rainy season (wet) begins in November and lasts until April. Annual rainfall varies between 25 and 120 inches according to altitude and position.

Population:

The population of Malawi now stands at 5,561,821 as shown from the population census that was carried out in 1977. The intercensal growth rate from the 1966 census was 2.9% per annum. The average population density was 153 persons per square mile.

The population distribution is rather uneven by region reflecting defferent histories, stages of economic development, and topographies. The following is the breakdown by region:

Northern Region	-	62 persons/square mile
[illegible] Region	-	154 " " "
Southern Region	-	228 " " "

As economic development spreads northwards there will be a redistribution of population to offset these figures.

GEOLOGY:

There are four main rock types in Malawi: basement complex (Precambrian), sedimentary rocks of Jurassic age, young igneous intrusions and recent alluvial sediments;

Basement Complex:

Over 90% of the country is underlain by Precambrian basement complex rocks which are composed mainly of charnokitic granulites and gneisses, biotite - hornblende gneisses, Quartz - feldspathic gneisses, marbles and perthosites. Because these have been stable for a long time they have developed a deep weathered zone in some cases as deep at 150' deep in the plateaux areas.

Sedimentary Rocks:

These are composed of Jurassic sandstones, unlithified siltstones and shales interlayered with coal beds. Their occurence in Malawi is restricted to the extreme south and extreme north. They occupy less than 1% of the total land area. Dinosaur fossils are found in these rocks.

IGNEOUS ROCKS:

These intrusions are relatively younger. They are composed of syenites, nepheline syenites and granites. The synites are in the south while the granites are in the centre and north. They occupy about 3% of the land area and form the highland massifs of the country. Volcanics, mostly basalt and andesites occur in the north and south and are related in age to the Jurassic sediments.

Recent Sediments:

These rocks are restricted to the rift valley and are of alluvial and lacustrine origin. They are composed of gravels, sands, silts and clays all interfingering. The Lower Shire Valley in the south is dominated by these recent deposits.

HYDROGEOLOGY:

Malawi can be divided into three major hydrogeologic units. These are:

i) The plateaux zone,
ii) The Escarpment zone,
iii) Rift Valley Recent Sediments.

The Plateaux:

These cover large extensive areas of the Central and Northern Region. The water is extracted from the deeply weathered zone and fractured gneisses. 6" boreholes average 150' in depth and give yields that vary from 300 gallons per hour to 1,000 gallons an hour. Average yields are about 700 gallons per hour depending upon the geology, structural history and rainfall.

The water quality is generally good with a few incidences of high iron content.

The Escarpment:

The Escarpment areas are those at the margin of the rift valley so include north-south trending structures on either side of the rift trough.

These are characterised by a dissected landscape with deep incised valleys. They have a narrow to non existent weathered profile. Even though fractures exist they are usually dry because of the steep slopes and lack of recharge area. The yields are usually small averaging 300 gallons per hour. The boreholes are usually less than 100 feet deep as it becomes hard drilling in fresh rock.

The Rift Valley Sediments:

This is where we find the geology of the recent deposits show interfingering between gravels, sands, silts, and clays. As a result the yields are variable from place to place as does the chemistry and so the water quality. In the north, in Karonga area the aquifers are basically sands and silty sands. The groundwater potential is very high. Boreholes have been drilled to an average of 100 ft with average yields of 1,000 gallons an hour. It is known that if it was necessary more water could be extracted but there was no need as the boreholes seem to be adquate for the rural communities.

Some incidences of saline water have been encountered where the sequence went into the Jurassic sandstones. But this was on rare cases.

In the Lower Shire in the south where groundwater development has been at a larger scale because of an agricultural project the situation is different. This is where interfingering is most prominet. Boreholes vary in depth between 100 feet and 250 feet. The gravel and sands are only stringers and narrow bands holding little or no water. In the successful boreholes the aquifers are usually sandy clays. Yields vary between 200 gallons per hour and well over 1,000 gallons per hour. The average yield is about 500 gallons an hour. However, there are certain restricted areas with particulary good aquifers and high potential for groundwater where yields are in excess of 2,000 gallons an hour and with high specific capacities: 5 gallons per hour per foot as compared to our national average of .2 gallons per hour per foot.

GROUNDWATER EXTRACTION:

The Groundwater Division of the Department of Lands, Valuation and Water is the only agency that is responsible for groundwater exploration, extraction, research and development both for the Government and the Private Sector.

Groundwater extraction started in the late 1930 as part of the then Colonial Government policy to supply water in administrative government posts in the country. Naturally this was restricted to only a handful of boreholes a year. Our records show that between 1930 and 1960 the total borehole population was at 508. Since the country got independent a lot of effort has gone into implementing government policy which is to supply clean potable water to the rural communities. As a result the borehole population now stands at 4,300 with an annual budget of about K2,000,000 ($/ 1,620,000). Since only 2 years ago due to high costs of boreholes, hand-dug shallow wells development has been given a high priority and already 500 shallow wells have been dug at a total cost of about K200,000 ($/162,000).

BOREHOLE PROGRAM

The borehole program is financed by a revolving Treasury Fund. Every year the fund surveys about 350 sites and drill about 300 boreholes. There are 3 survey teams and 2 teams are always in the field at a time. The fund has 7 percusion rigs 6 of which are used at any time leaving the seventh as a spare one. In addition, government sub-contracts 100 boreholes a year to a private drilling company to cope with the demand.

Requests originate in the village which are channelled through Councillors, chiefs and members of Parliament to the District Development Committee (DDC). The DDC is a very important committee in District Administration as it is the direct link between government and the people in the rural communities. If the DDC approves the request the chairman who is the District Commissioner sends these requests to headquarters for approval and financial aid. After a donor is identified the Department of Lands, Valuation and Water (DLVW) is directed to survey and drill the sites. If the request comes direct from government i.e. a Ministry or Development Project the request comes straight to DLVW.

The geophysical method, resistivity, uses a modified werner configaration to suit the local conditions. Two types of instruments are used: a megger Earthtester, and an ABEM Terrameter. On rare occasions is there need to use IP Macphar equipment to get to greater depth and where investigations requiring high precision are called for.

SHALLOW WELLS:

It was felt by government that the efforts put into providing clean potable water for rural communities could be improved by exploring the possibilities of shallow wells (15ft depth). However its development took a different line of approach from the borehole program. Extension work was carried out first by acquanting the communities the need for good clean drinking water and emphasizing the health hazard if unprotected water is used. Again District Development Committees were used as the carriers of the message from Government to the people. Action groups were formed inside DDC who would be monitoring the program. Government requested that if the communities were prepared to supply labour in digging the well, government would supply the cement, and pump. Once nuclei villages had their wells it was easy to

follow up in the surrounding villages. Thus to date there are over 500 wells with the construction rate increasing every year. We are currently trying to modify the geophysical survey method to include the shallow wells. Deeper shallow wells are also being considered in the areas with low water tables but these are still in an experimental stage in terms of design and construction.

THE ROLE OF GROUNDWATER IN ECONOMIC DEVELOPMENT

Relative to its importance in the survival of the human race water is the most abused resource that man has. Maybe this is because we grow up with it and therefore it fades into the background of our minds. As a result it is taken for granted. This is a dangerous situation as its impact can be reflected at all levels of national development especially in a developing country.

One of the aspects of national development is to improve the communities' standard of living by making its members healthy so that they can join in economic Development. In a country dependent solely on agricultural production it is difficult to dissociate water from economic development. If the community is going to spend half the day hunting for water then there will be little time and willingness to work in the field. As life becomes harsh in the rural areas a mass exodus to the few urban centres is almost unaboidable. But this would only create congestion, unemployment and before long we will have inherited the social problems of the western cities. If we are going to convince the rural communities to stay on in the rural communities, then we must provide water for them, water for their animals and water for their crops. Water then becomes one of the building corner stones to National Economic Development.

CONSTRAINTS:

The biggest constraint in groundwater development is manpower especially in the Technical Officer grade and limitation of funds. However because of the creation of the new department this may be solved towards the end of the decade as it plans creating its own water school. Engineer level of training will still have to be handled abroad.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Nepal

S.N. Sharma, Department of Water Supply
and Sewerage

EXECUTION AND ADMINISTRATION OF PROJECTS AT LOCAL, REGIONAL AND NATIONAL LEVEL

Thematic paper prepared for Inter-Regional
Seminar on Rural Water Supply,
Uppsala, Sweden, 6 - 16 October 1980

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July 1980

EXECUTION AND ADMINISTRATION OF PROJECTS AT LOCAL, REGIONAL AND NATIONAL LEVEL

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I. Introduction

The Kingdom of Nepal lies on the southern slopes of the Himalayas and is bounded to the North by the Tibetan Region of China and to the South, West and East by India. The area of Nepal is 140,700 sq km, extending 880 km from east to west and 240 km from north to south. Nepal exhibits a wide range of terrain, with more than 80 percent of the country covered by hills and mountains and remaining 20% by plains and lowlands.

The total population of Nepal as per 1980 estimate is 14 million; of which 10% live in the hills, 52% in the midlands and the remaining 38% in the terai (flat land adjoining Indian border). Ecologically the country is divided into three main geographical regions: the hill area, the midland and the terai. The hill region is generally above 2000 m in altitude and is sparsely populated. The major part of the country's population is thus in midlands and terai.

Administratively the country is divided into four development regions, namely the Eastern, Central, Western and Far Western Regions. The dividing lines run north south and each region comprises of a part of the hills, midlands and terai. The four development region concept was conceived with the view to achieve reduction of inter-regional disparity, balanced growth, regional integration and to make the fruits of progress available to the majority of the population of the country. The strategy for regional development planning was introduced in 1970, i.e. the beginning of Fourth Five Year Plan as the practice adopted till then by according priority to the investment programmes in the relatively more advanced parts of the country could not generate economic gains and benefit the people equally. Regional approach has enabled implementation of balanced sectoral development programmes by integrating development adtivities at the regional level. All development efforts in Nepal necessarily involve rural development as the number of urban centres are not many and the urban population is only 6% of the total.

II. Administration Set-up

As mentioned above the country is divided into 14 zones and these are in turn divided into a total of 75 districts for administrative and electoral purpose. The districts are again divided into

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panchayats and there are at present 23 Nagar Panchayats (NP) and 2911 Gram Panchayats (GP). Under the commonly used nomenclature the communities living in the Nagar and Gram are classed as urban and rural respectively.

A GP is the executive committee of a Village Assembly which exercises the corporate powers of the assembly. Village Assembly comprises of the five elected members from each ward. GPs are under general obligation to provide the services to the community and these are detailed in GP Act (1962).Nagar Panchayats (NP) may be loosely translated as "Town Council". The NP Act (1962) also defines, amongst other things, the powers and duties of the Panchayats to provide Water Supply and collect revenues. However the provision of these facilities are severely restricted due to lack of financial resources and the technical know-how.

The District Panchayat (DP) is responsible for supervising the activities of NP and GP. The DP has been charged with the responsibility for planning and implementing all the district level projects. The district level projects fall under three categories and they are (i) projects identified and funded by the centre (ii) projects planned for implementation from their own resources and (iii) projects carried out with grants provided by the centre. Community water supply projects especially those planned for the decade will fall under the 1st category.

In every district there is an office of CDO(Chief District Office). CDO is the administrative head of the district. The district administration has to play two main important roles and they are formulation of district development programme and maintaining law and order in the district. The district Public Works Section (PWS) which is the technical wing of the District Office is supposed to be responsible for the preparation of annual programme of development works and have them implemented as per calendar of operation and execution plan. As the PWS is not adequately manned with the required technical personnel most of the projects funded from the centre are carried out by specialised agencies of the government. Water supply projects are carried out by one or other of the three agencies.

III. Organization

There are principally three agencies of His Majesty's Government of Nepal, responsible for the provision of community water supplies. They are under two Ministries and are as follows:

(i) Ministry of Water Resources (MWR)
- Department of Water Supply and Sewerage (DWSS)
- Water Supply and Sewerage Board (WSSB)

(ii) Ministry of Local Development (MLD)
- Local Development Department

DWSS is responsible for providing water supplies to all rural compact communities with population 1500 and over in the hills and midlands as well as the zonal and district headquarters. This department is also responsible for the provision of shallow tube-

wells in terai areas of the central and far western development regions. The department will also run a deep tubewell programme to serve the large rural communities in the terai.

LDD is responsible for providing water supplies to rural compact communities with population under 1500. This department will also be responsible for the provision of shallow tubewells in terai areas of eastern and western development regions.

WSSB, though primarily concerned with providing water supplies to urban centres, has been also taking care of immediately adjoining rural environs.

Very recently a new ministry to be specifically in charge of Rural Development was established and LDD has been placed under this new Ministry. It is expected that the change over will provide additional impetus in the development of rural water supply programmes.

IV. Execution and Administration of Water Supply Projects

National Development Programmes of the country is implemented under successive Five Year Plans. A national programme for constructing water supply systems in Nepal was initiated during the First Five Year Plan in 1956. The current plan, which is the Sixth, covers the period 1980-1985. One of the major objectives of the Sixth Plan is to meet the basic minimum needs of the people. Such minimum needs include increased supply of drinking water amongst other things. The Sixth Plan (1980-1985) Approach Paper by National Planning Commission clearly emphasizes the need to deal with the problem of absolute poverty by meeting the minimum basic needs of the people.

The Government, being aware of the unsatisfactory conditions prevailing in the rural areas due to lack of access to safe and adequate water within reasonable distance, and the high incidence of water borne diseases, has been planning and implementing water supply schemes with funds provided entirely by Government. HMG's water supply programme has been and is continuing to receive in increasing measure external assistance both from multilateral and bilateral agencies.

HMG Policy about Rural Water Supply: HMG policy in the hills and midlands is aimed at reducing the water collection journey, improving water quality and providing and adequate supply. The schemes undertaken in these two topographic regions are mainly gravity flow type. Other forms of water supply systems such as pumping schemes and water rams are generally not favoured, because of the fact they are expensive and need well trained manpower. These also require a much higher level of maintenance than is presently available. The terrain and geological conditions rule out any possible use of shallow tubewell handpumps except in a very few cases.

Rural water supplies in Terai will depend entirely on the geology and aquifer levels in each area. Wherever possible, shallow tube-

wells with handpumps will be used; where deeper deep set tubewell handpumps will be used.

Beginning of a Project: The project makes a beginning when a request for the same comes from the GP or community directly concerned. This beginning may also be the outcome of requests from political leaders. The department also takes up projects on its own as in the case of the district and zonal headquarters following the government policy that these places shall be provided with water supply.

Usually GP establishes the need for the project and submits an application for its implementation to the DP. DP considers the application with other similar applications and these approved are forwarded to the concerned departments (DWSS or LDD) for inclusion in its development programme. Implementation of water supply projects require the accomplishment of a series of technical and managerial steps such as reconnaissance survey and preparation of preliminary report. Initial approval of the project by the concerned ministry, detailed investigation, final engineering design and report and submission to the National Planning Commission and Ministry of Finance for inclusion in the following year's work plan. The annual plans are prepared based on the sector programme as reflected in the current Five Year Plan. The fund allocation is made at the beginning of each financial year.

The construction works are carried out either departmentally or through contractors. The contruction is supervised by the departmental staff. For this purpose a field office is established at each project site. The manpower needed to administer the project would depend on the magnitude of the works and also the method of execution. The duration of construction varies from one to three years.

The implementing procedure of HMG-UNICEF projects executed by LDD is different to that of DWSS. The construction of the project will commence only after the signing of the set agreement with GP. The agreement clearly reflects the amount of government assistance including the pipe materials to be provided by UNICEF and the commitment of the village towards the construction. GP should also undertake to operate and maintain the system once it is completed.

A village committee generally comprising of the chairman of GP plus the ward members of the areas served by the project, plus one or two eminent social workers from within the project area is formed for mobilising village cooperation needed during the construction period. Though the responsibility of planning and implementation of water supply projects lies with HMG, an attempt is being made to progressively develop a sense of self-reliance in the village populace by decentralizing the processes of planning, construction and maintenance.

Priority: While fixing the priority of projects mainly social benefits and regional balance are taken into account. The criteria of economic feasibility is not strictly applied and also priority will be accorded to these projects which are simple, small and likely to generate more peoples participation. However health requirement, scarcity of safe drinking water in the area, physical hardship and length of time taken for the collection and transference

of water, places of religious, tourist, historical and educational importance including the public institutions, ability and willingness of the benefitting community to participate in the implementation and thereafter to take over the project for operation and maintenance are also considered in the project selection process.

Generally the request from a village for a piped water supply system would stem from one or more of the factors stated above. A site visit and filling up of the set questionnaire form gives adequate information to see whether the request is really a felt need. This is done as a part of the reconnaissance exercise.

Peoples Participation: It is HMG policy that local participation shall comprise an essential element in rural water supply programme launched by the government. In accordance with the practice, that is being adopted, the benefitting community is required to provide, free of cost, the needed unskilled labour, transportation of imported materials by headload and collection of locally available materials such as sand, rubble, timber etc. Sometimes the land for the reservoir and watchers quarter are donated by the people. In monetary term this participation amounts to 15 to 20 percent of the total cost of the project. It has been recognized in principle that the assistance of HMG for local level projects will be limited to the provision of imported materials, skilled labour and technical advice.

Integrated Rural Development (IRD): HMG has now clearly spelt out a policy for integrated rural development, which includes more or less agricultural facilities, improved transportation, afforestation and conservation of soil, minor irrigation, improved social services, i.e. education, health, drinking water and sanitation, development of cottage industries and other non-agricultural activities.

As already mentioned elsewhere HMG has taken up regional development as an important tool to attain the broad national development targets. The IRD concept, which concentrates its efforts on the needs of a defined area is a necessary corollary to the broad regional development strategy. There are at present 19 districts covered by IRD projects. The international lending agencies like World Bank and ADB appear to be rather reluctant to extend loans to the rural water supply projects in isolation because of its non-economic return value. However IRD, which comprises water supply as a substantial component, is receiving more and more attention of multilateral as well as bilateral agencies. It is hoped that IRD concept will enhance the possibility of expanding the water supply activities in the country.

V. Operation and Maintenance of the Water Supply Project

The operation and maintenance of the rural water supply schemes pose a big problem and it is frequently felt that they are easier to install than to keep them running. Though it is HMG policy that recipient community should operate and maintain their own supplies on completion, it is not being followed in a number of cases.

Though the operation and maintenance of the water supply projects completed by LDD are being placed under the care of GP, it is not functioning well. This is mainly due to the fact that GP is unable to raise revenue as a service charge from those benefitted by the system. Lack of supervision leads to several abuses including breakage of pipes and fittings and wastage.

No mechanism has yet been developed for the rural area to raise the revenue from the consumers, who essentially receive their domestic supply of water from the public stand posts. In areas, where there are some private connection holders, the numbers are not adequate to produce that level of revenue adequats to meet the operation and maintenance cost. It is the accepted policy that all rural water supplies shall be essentially stand post supplies.

Since the proper operation and maintenance of the rural water supply schemes is essential to the success of the programmes, the completed projects can not be left ignored and unattended. Evidence has shown a number of systems construction by DWSS have had to be taken back and operated by DWSS. This has put a disproportionate burden on DWSS, which is partly reflected in its operation and maintenance budget and partly in the relatively high manpower level it requires. DWSS strongly feels that this operation and maintenance must be reverted back to the community and failing which to the District administration. It is proposed to have the District administration play a leading role in providing technical and management assistance to local authorities.

Though the government tries to ensure the involvement of the recipient community in the project implementation and GP has been empowered to levy the charges, the problem of operation and maintenance stands unabated. It appears that lack of responsibility feeling, understanding, communication and motivation among the villagers has created the problem, which is further a aggravated by the lack of funds, absence of management capability and the inability to retain the trained technician in service.

The bilateral and multilateral lending agencies which are willing to cooperate with Nepal in her attempt to expand water supply activities by extending soft loans or grants wish to see some sort of mechanism evolved to charge the water service tax from the users of public stand posts. HMG is now giving serious consideration a method to fix an equitable and fair charge and also the mechanism to collect the charge made.

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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Nigeria

E.O. Okeke, Federal Department of Water Resources

WATER - A RARE COMMODITY!

RURAL WATER SUPPLY IN NIGERIA BY ENGR.(MS) E.O. OKEKE

The Federal Republic of Nigeria has a Presidential system of Government and has its seat in Lagos (population 4.5 million). Nigeria is divided into nineteen (19) states, each state being governed by a Governer, (see attached map).

Nigeria lies within the tropics between latitudes 40 (fourty) and 140 North of the Equator and longitudes 3° and 140° east of the Greenwich Meridian. It is bounded on the west by the Republic of Benin, on the north by Niger Republic, on the east by the Republic of Cameroon and washed on the south by the Atlantic Ocean.

The country which has an area of 913,072.64 sq km is well watered by the Rivers Niger and Benue and their tributaries.

Its climate varies from tropical at the coast to subtropical further inland. There are two well-marked seasons - the dry season lasting from November to March and the rainy season from April to October. Temperatures at the Coast seldom rise above 32°C but humidity can be as high as 95%. Further North, the climate is drier and extreme of temperatures are common, sometimes ranging from 36° to 12°C.

The population of Nigeria is 80 (eighty) million and is multi-ethnic. The growth rate is 2 (two) to 3 (three) per cent. The principal ethnic groups are the Hausa, Fulani, Igbo, Yoruba, Edo, Efik Ijaw, Tiv and Kanuri.

Most of the people in Nigeria live in the rural areas. Of the 80 (eighty) million population twenty eight per cent live in the urban areas while the remaining seventy two per cent live in the rural areas and depend on Agriculture.

A place is considered urban when it has a population of more than 15,000 people and has such facilities as Electricity, Water Supply, Post Office and a local government head-quarters.

The Water Resources of Nigeria is mainly from rainfall (both surface and groundwater).

The average annual rainfall varies from 400 mm (fourhundred millimetres) in the Northern fringe to 4000 mm (four thousand millimetres) in the Southeast corner. Two peaks noticed in the monthly distribution in the South is explained by the arrival, in June from the West of the trough of low pressure which causes the July/August 'Droughts'.

All these years the tendency has been for a lot of money and attention to be centered on the urban areas, so Urban Water Supply has often been taken care of through grants or loans while that of rural areas have been fairly neglected. Rural Water Supply is supposed to be provided by the State and Local Government bodies, but experience has shown that much of the facilities are provided for by the State Governments.

But in the rural areas, communities out of desperation, contribute money for providing their water supply, or individuals will drill their own boreholes, shallow wells or arrange for tankers to bring water to them or the women and children will have to walk for miles to streams to get water. It is in such situations that the per capita consumption might fall as low as 6 (six) litres of water per day.

In order to help the states with their water supply problems, in 1975, the Federal Government introduced the matching grant, in which she provided fifty per cent subvention of the total cost of each new Water Supply Projects, but the subvention was misused so this was stopped in the 1977/78 financial year.

Apart from the efforts being made by the State/Local Governments to develope rural water resources, the Federal Government in July 1975 created a Federal Ministry of Water Resources with the Federal Department of Water Resources as its sole Department; in 1978 it was merged with Ministry of Agriculture but in October 1979 it was once more made a separate Ministry.

The responsibilities of the Department is to unify nation wide the Water Resources Data collection system, give technical advice to the 11 (eleven) River Basin Development Authorities (these are the executing arms of the Ministry - see attached map), advisory role in water resources development and supporting data for policy formulation.

The Department has water supply as one of its duties, but not directly involved in its execution, as this is the duty of the States Water Boards/Co-operations.

The Department saw the need for improved Water Supply in the Country and also the demands of the United Nations (UN) Water Supply and Sanitation Decade.

She also welcomed the Government's new policy of integrated rural development and the provision of shelter for all. To achieve this policy there must be an aboundance of water for drinking, irrigation and industrial use etc, and because of all these, she embarked on these actions:

1. The River Basin Development Authorities are now advised to lay emphasis on minor Irrigation Schemes, and through these provide sources of drinking water to the rural areas, while the State and/or Local Government Agencies undertake the treatment and distribution of water from such sources. A good example is the sinking of boreholes in the Chad Basin Development Authority area by Chinese Technical Assistance. 36 (thirty six) of such boreholes have already been drilled and more are to be cited in some of the Southern Basin Authorities.

2. The Department in the 4th National Plan period 1981-1985 intends to harness the surface water resources through a system of small impundments, these will cater for small rural communities of 1 (one) million population. These will be storage reservoirs of MCM; there will be a minimum of 5 (five) numbers of such in each of the 19 (nineteen) States. These reservoirs will be designed by the staff of the Department and Construction would be by direct labour.

These, apart from providing the much need commodity, will make a desirable social impact on the rural areas. Their general outlook and standard of living will be improved. Water borne deseases will be eradicated.

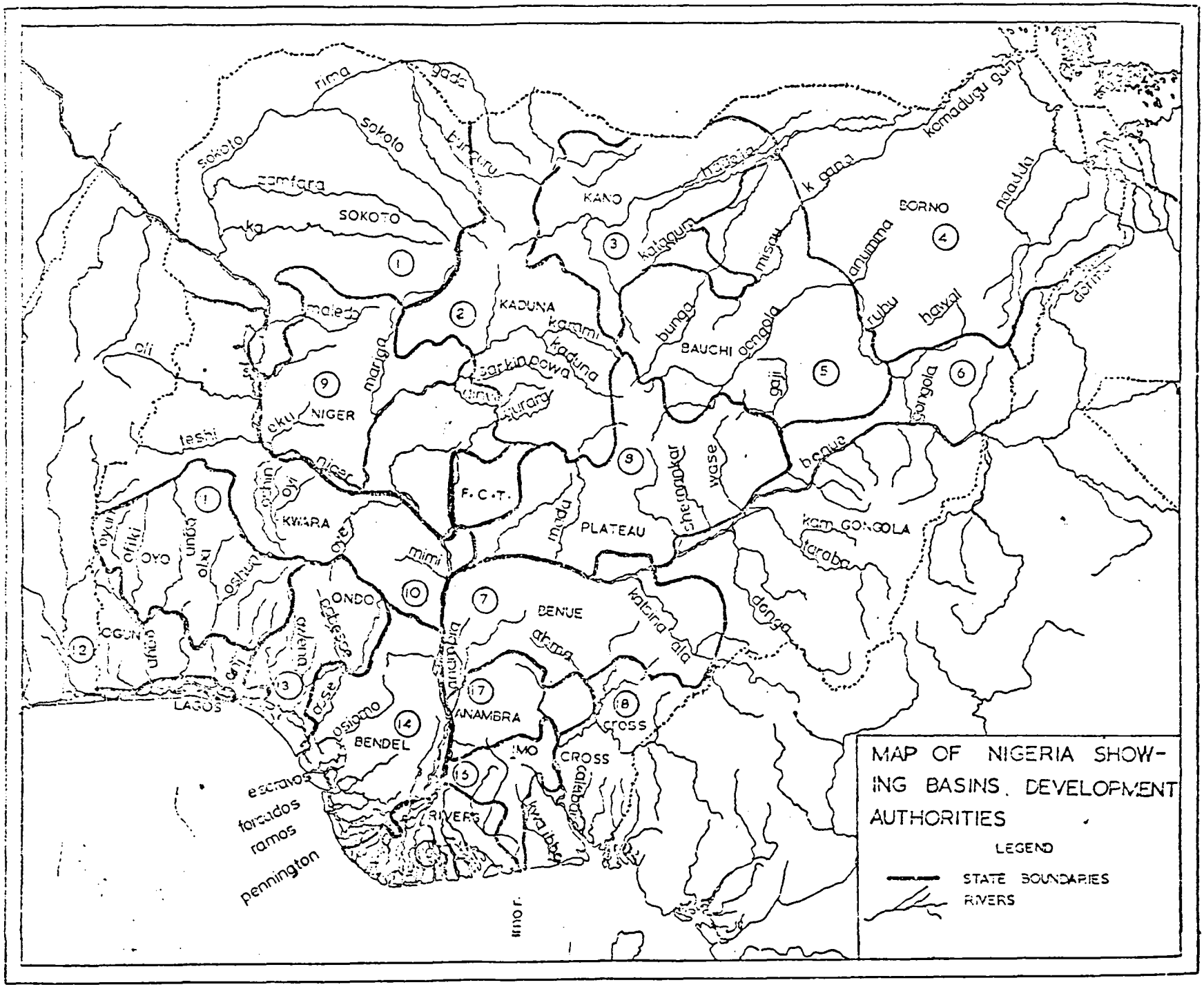
3. Drilling brigades have now been set up; for the 4th plan period 1,500 boreholes are to be drilled all over the Country in addition to reactivating and maintaining existing ones. An atlas of underground water resources will also be published.

   As of now the Department has one drilling rig and geophysical equipment. Apart from the boreholes, a moderate monitoring system of the aquifers of the Country is being set up and also the drawing up of a Provisional Master Plan and Atlas.

   Each River Basin Authority is to be provided with 4 (four) drilling rigs.

ENGR. E. O. OKEKE,
PRINCIPAL WATER ENGINEER,
FEDERAL DEPARTMENT OF WATER RESOURCES,

May 1980



MAP OF NIGERIA SHOWING BASINS. DEVELOPMENT AUTHORITIES

LEGEND

STATE BOUNDARIES

RIVERS

COMMUNITY WATER SUPPLY
COMPARISON OF SERVICES 1975 AND 1980

URBAN POPULATION SERVED												RURAL POPULATION WITH REASONABLE ACCESS TO SERVICES				TOTAL			
BY HOUSE CONNEXIONS				BY PUBLIC STANDPOINTS				TOTAL URBAN											
1975		1980		1975		1980		1975		1980		1975		1980		1975		1980	
N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%	N X1000	%
4815	30	6859	35	11236	70	12747	65	16051	100	19596	100	1108	11	8964	89	17160	23	28561	34

Reasonable Access: In the Urban area a public fountain or standpost located not further than 200 metres away from house be considered as within reasonable access to that house.

In Rural Areas reasonable access would imply that the housewife or members of the household do not have to spend a disproportionate part of the day in fetching the family's water needs

\+ Very Negligible

Only few institutions and establishments enjoy such facilities and in some cities, construction work is in progress.

RAPID ASSESSMENT OF WATER SUPPLY IN NIGERIA

STATES	AREA KM 2	POPULATION	NUMBER OF URBAN COMMUNITIES	NUMBER OF VILLAGES	EXTENDED URBAN POPULATION	EXTENDED RURAL POPULATION	URBAN GROWTH %	% OF URBAN POPULATION IN THE STATE	RURAL GROWTH RATE	% OF RURAL POPULATION IN THE STATE	NUMBER OF URBAN WATER SCHEME IN OPERATION	NUMBER OF URBAN WATER SCHEME BEING EXTENDED TO 1978	NUMBER OF URBAN WATER SCHEME UNDER EXTENSION IS PLANNED	NUMBER OF URBAN WATER SCHEME UNDER CONSTRUCTION	NUMBER OF NEW URBAN WATER SCHEME PLANNED	TOTAL POPULATION SERVED BY URBAN WATER SCHEME IN OPERATION	URBAN POPULATION SERVED BY THE WATER SCHEME (% URBAN SERVED)	RURAL POPULATION SERVED BY URBAN ELEMENT (% RURAL SERVED)	POPULATION IN RURAL AREA SERVED BY URBAN WATER SCHEME	NUMBER OF PIPED GRAVITY SYSTEM	NUMBER OF PIPED SYSTEM FROM SURFACE SOURCES	NUMBER OF DEEP BORE-HOLES WITH POWERED PUMP	NUMBER OF DEEP BORE-HOLES WITH HAND PUMP	NUMBER OF ARTESIAN WELLS	NUMBER OF PROTECTED SHALLOW WELLS	TOTAL RURAL POPULATION (% OF RURAL POPULATION
ANAMBRA	17,514	9,886,062	32	370	2,614,045	3071,017	5	16	2.5	54	8	?	4	3	12	989,995	963,294 36.84	86,701	26,701	33 (1,823,748)	9 (1 no)	25 (ind)	N	NIL	164 (117,300)	1,992,949
BORNO	116,389	4,530,690	18	567	1,560,000	3,794,690	5	17	2.5	63	9	NIL	9	NIL	N	528,100	10		NONE	NONE	N	N	N	300	-	710
BENUE	48,339	3,531,000	14	660	298,014	3,232,986	2.5	8.43	2.3	91.57	10	7	NIL	4	4	238,400	238,400	0	0	24 (215,000)	1 (ind)	24 (ind)	NIL	NIL	27 (57,000)	272,000 8.2 %
CROSSRIV	28,172	5,083,907	19	3,150	1,245,673	3,838,314	4.3 2.7	24.5	2.5	75.5	16	12	NIL	4	3	1,064,379	85 %	180,000 15 %	180,000	NIL	NIL	3 (39,700)	NIL	NIL	NA	219,900 5.7 %
SONGOLA	99,749	3,727,183	17	MANY	100,000	2,800,000	5	19	2.5	81	8	NONE	6	2	12	215,000	31	NIL	NIL	N	N	5	N	N	NIL	60,000 2 4
IMO	12,689	5,000,000	9	334	59,364	4,406,379	5	12	2.5	88	9	4	3	NONE	NONE	650,000	600,000	50,000	50,000	N	3 (70,000)	53 (510,000)	N	NIL	4.85 (250,000)	880,000
KADUNA	69,506	6,395,686	22	893	1,653,333	4,142,352	5	26	2.5	14	9	3	2	2	6	718,632	511,533	207,099	207,533	NONE	N	47	490	N	1 (spring)	600,000
KANO	43,072	8,363,714	20	NA	4,163,000	NA	4	49	2.5	51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
KWARA	154,593	2,703,769	21	1,656	868,205	1,832,564	4.91	32	2.38	68	9	4	4	2	4	778,000	738,000 85%	40,000	40,000 (2,189)	2 (6000)	10 (72,000)	6 (30,000)	N	N	370 (62,800)	231,000 13 %
LAGOS	33,577	8,530,000	4			4,260,000	4.5	27	3.5	50	4	NIL	1	NIL	4	2,180,000	2,180, 000	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NA	NA	12,000 4.44 %
OYO	22,342	1,600,000	24	7200	1,400,000	5,200,000	2.5	18	1.5	82	25	7	4	1	15	6,000,000	79	0	0	N	N	N	N	N	Too many	-
OGUN	16,220	2,600,000	16	7 100	643,000	1,957,000	4	24.7	2.5	75.3	9	6	4	3	S	841,200	643,000 100%	198,200 10 %	N	N	N	7 (65,000)	N	N	(9000)	274,600 14 %
PLATEAU	58,385	3,190,191	19	215	680,346	2,509,845	4.9	42	2.9	83	18	1	5	7	3	668,146	668,146 83 %	NIL	NIL	NIL	2	NIL	NIL	NA	1	7,500 66 %
RIVERS	28,000	2,020,000	13	944	472,650	1,547,350	5	23	3	77	9	1	7	4	NONE	329,000	312,332 95 %	16,868 (5 %)	16,668	NIL	NIL	7,169,428	600 (2,280,000	NIL	NIL	546,176 (26 %)
SOKOTO	64,000	6,548,000	36	5265	432,000	396,000	4	8.47		91.5		6	3	NIL	NIL	132,000	132,000			NIL	N	220 (1,980,000	NIL	NIL	364 (1,000,000	1,980,000 40 %

INTERGIONAL SEMINAR OF RURAL WATER
SUPPLY, UPPSALA, SWEDEN, 6-16 OCTOBER, '80

THERMATIC PAPER ON RURAL WATER SUPPLIES IN P.N.G. (Papua New Guinea)

By

Mr. Matt P. Matango - PH/Engineer.

PNG is a small tropical country in the South Pacific, with a land area of about 82,160 sq. miles. The topography of the mainland of PNG varies from the vast coastal swamps to the central core of complex system of mountain ranges separated broad upland valleys, and highland plateaus.
The main islands of the bigger island groups are very mountainous, with the mountain ranges running the length of the island. With such diverse topographical features, there is accordingly a considerable variety in the climate of the country.

Most of the country has high rainfall of over 100 inches (25000mm) per year. This high rainfall together with the topography produce in many places a perculiar drainage pattern of short swift flowing rivers. The high rainfall also produce vast quantities of underground water resources.

With such abundance of water resources the only constraint in the development of rural water supplies is mainly money and transportation which is quite difficult due to rugged terrain and high rainfall. In the coastal areas transportation of water supply materials and equipment is made easy by use of coastal vessels and ships. The sources of water for development in rural areas are mainly underground water through dug wells and those springs which can be tapped and piped by gravity to village outlets.
The rural water sources are particularly emphasized on dug wells and springs because these sources are nearly always naturally pure in quality, although they may have high mineral content. The qualities of other sources are questionable and are often avoided as much as possible.

The impact of the rural water development on the environment is quite minimal and is hardly noticed in PNG. The pipes are normally laid underground and covered in narrow trenches and for those dug wells, nothing significant is recognisable as regards environmental impact. Soil erosion and sedimentation is a big factor. The high rainfall and other natural disorders result in large landslides and soil erosion constantly ending up onto rivers and stream gorges, as well as mountain valleys and plains.
Soil erosion and sedimentation is also being aided by developmental activities like, road building, timber deforestation and mining.

The health and social aspects of water development need not be questioned. In PNG it has been found that lack of safe water for drinking and washing is an important factors in the spread of diarrhoeah diseases, dysentery, and various skin ailments like sores and scabies, which are common afflictions among the rural people. Indequate supply of water also leads to poor personal hygiene and is a contributing factor to skin diseases. Such water-borne and water-related diseases are preventable through development of adequate safe water supplies which will not only reduce the incidence of such diseases and prevent their spread, but will also relieve the rural people of the tiresome daily chores of fetching water from far away sources, and enhance their social well-being.

To provide water that is safe in rural areas in order to reduce the high incidence of these water-borne disease is quite difficult especially when conventional water treatment facilities are limited to urban areas only. This is because of the cost and the need for proper operation and maintenance skills required in the water treatment works.
Even a simple sand filtration unit and chlorination require some form of skill for proper operation and chlorine application. This is rarely available in rural areas.

The technique is therefore to obtain water which is naturally safe. Springs and underground water are the main sources which meet this requirement.

The underground water is normally made available by use of simple suction hand pumps. Hydraulic rams are also used in PNG. These hydrams are mostly commercial types. However with the development of scientific and technology in this field home designed Hydrams from pipe fittings have already been developed and used. These have been found to operate equally well like any other commercial types.
Water-wheel for lifting water is also been designed and

made with local timber. However this is not been used extensively in the provision of rural water supplies. In any case the priorities is rural water development is to find ways of providing water which is naturally safe and by making this water available to the people by use of inexpensive and simple technologies that may be available. Historically such advancement in scientific and technical development and research has been started only within the last ten years.

B. Social and Economic Aspects.

In PNG for the last 20 years there has been so many water supply installations in the villages. These installations have been provided by Government, Local Government, Church groups and other agencies. These installations have been subjected to failure after a short period of time. Many factors play a part in such failures of water supply installations. The following are just the few reasons why these failures occur.

a) The villagers did not want the water supply to start with and the reasons given are many and varied.
b) The water supply was "given" by some group to the villagers because it was considered by the suppliers that a water supply was needed.
c) The water supply was installed by some level of Government or Agency to show the people that they were not forgetten.

Many suppliers are "given" to the community and this places a burden on the community to provide a person to maintain the system and to pay for repairs of running costs. This explains why so many supplies are left unserviceable when they break down. The community were not prepared to shoulder the burden of maintenance running costs.

In certain cases the installed water supply is perfctly operable but the people tend not to use it because the source of water is considered unsafe by the people due to some custom or belief that the water source is from a sacred site which the installation team did not know about. All these relations partly explain some of the weaknesses that exist between consumers and the suppliers in PNG.
The access to safe water and sanitation facilities are open to the rural people, but the people should be the ones to initiate the projects with advice and assistance from the respective Government Departs. Public Health Education and other related health improvement activities would also aid to overcome the above mentioned problems. This focuses on the importance of local planning rather than central in the provision of rural water supplies.

Apart from the above, those educationally advanced Provinces have good water supply and sanitation facilities. Any maintenance or operational expenses are initiated by the people and their health standards are generally good.

In the majority of the rural areas in PNG water for domestic uses are still fetched by women in all sorts of receptacles like bamboos, buckets, pots, drums, etc. Such is a daily hardship for the womenfolk, inconvenient and a waste of time. This tidious exercise gives limited time to attend to food gardens and as such a distinct decline in food production is noticable.

The benefits and the improvement of healthconditions of rural water supply system is hard to quantity. But the provision of adequate and safe water for the rural population does contribute to their well-being, comfort and productivity. In particular the following benefits can accure from such rural water supply provision in villages.

1. Reduction of the incidence of water-borne diseases.

2. Prevention of spread of diseases

3. Adequate water supply encourages washing and good personal hygiene, and reduces their diseases;

4. Elimination of daily hardship, inconvenience, and waste of time in fetching water of doubtful quality from far-away sources.

5. Enhancement of personal comfort and well-being;

6. Improvement of productivity.

Differential Access to Water.

The problems of equity arising from such factors as pricing policies, types of local participation in planning, and types of ownership is hard to evaluate since no such policy mechanisms exist in PNG as regards rural water supply systems. The Government simply provides the funds for the installation of a water supply in a village and expects the people to maintain and meet any operational costs. The priority of selections is based on the socio-economic status of the community involved. This mechanism is not understood by the village people andas such complaints such as lack of equal development and distribution of resources is voiced often by those who do not get such services.

Cultural and Behavioural Aspects

PNG is one of the last countries to be discovered and as such it is still rich with its cultural heritage, traditional beliefs and taboos. Their cultral aspects in terms of water quality, water use, sanitation and health are many and varied. The people are so used to their traditional sources of water; be it chemically or bacteriologically unsafe they would not be bothered with any moves in reverting to any other sources. A piped water near their doorstep is appreciatable for the conveniency of it.
The health aspects of a piped water supply is not considered as the main factor. As such if the piped water breaks down, the people will not hesitate to revert to their traditional sources instead of raising money and to seek assistance to repair the fault. This also explains why many of the water supply installations are not operable in certain circumstances. Other traditional beliefs do not permit people to drink water which may be a spring, that is bacteriologically and chemically safe in quality and the source of which is from a traditionally sacred area.
Sanitation in rural areas are often poor. Where there is no proper sanitation facility in the rural areas, the people will either;

1) discharge their faecal wastes into streams, rivers and other water sources, thus polluting such waters or
2) defecate indiscriminately on land.

Since most villages depend on springs, streams, and rivers for their sources of water supply the insanitary system of faecal wastes disposal maintains the continuation and the spread of water-borne diseases which affects their health. Defecation on land may be washed into water supply sources. It even maintains the continuation of the cycle of infection for various parasitic diseases of the bowels like hookworms, roundworms, threadworms, which mainly afflict children who play on such faecal contaminated ground, but adults are affected too. Such diseases reduces the resistance to infection and greatly lowers their productivity.

Marketing of water and the concept of safe water will take a long time unless people realise the need for safe water. This is lacking in most rural communities of PNG.

Social Impact Assessment of Rural Water Supply.

The methodological problems of cost/benefit analysis of social impacts of water development is difficult to quantify. In PNG the Government simply emphasizes that each rural water supply development should be initiated by the village people themselves, with advice and assistance from Provincial Health Inspectors, and the Local Government Enginners, but also generally with co-operative effort and guidance of Extension Officers of other Government Department and Local area Authorities, interested and involved in rural development for the welfare, health and economic enhancement of the rural people.

The village people requesting assistance for development of a specific water supply of their particular villge, will have to participate in its development by supplying unskilled labour for excavating, concreting, pipe laying and other contribution in kind or in cash.

The materials and equipment should be simple and must be obtained locally. In PNG, excepting for sawn timber, sand and gravel, all other materials like cement, steel wire-reinforcement, fittings, and the equipments like simple hand operated suction pumps and force pumps are all imported. The choice of these equipment is based on their simplicity of use and replacement of worn-out parts. These materials and equipment are currently in use for rural water supply work in the country.

C. Planning

Apart from the major water supply schemes for the urban centres the whole water sector for the rural areas in PNG has had no direction and very little planning and has been left to individuals or agencies to push it along. This is thought to be no longer good enough and the Government has already approved the setting up of a National Water and Sanitation Authority. In this plan the Department of Health is to be responsible for all rural water supplies. This is the first step towards proper planning and administration of all water developments in the country. The main responsibility of the Health Department in the rural water supply is to help programme for installation of water supplies that will be;

1) Used
2) Keep running
3) Be safe
4) Improve health

Some headway is already being made in seven Provinces which have undertaken to provide water and sanitation facilities to selected Health Centres, Health sub-centres,

Aid Posts and Community Schools as working demonstrations of what can be achieved. The response of these projects has been a demand by villagers for water supplies in their own alreas and has been accompanied by cash in hand to pay for the supply and a guarantee of free labour. This tends to overcome the problem of mainenance because where communities request, pay for and install their own supplies it has been found that the supplies are looked after and generally kept in working order.

D. Institutional Aspects

The role and performance of institutions, individuals and other agencies in the planning, execution, operation, maintenance, and administration, are of paramount importance in rural water supply and sanitation programme. Such involvement should have a central executing and administrative control body so as to direct the overall programme and evaluate the impact of such development schemes on the people and the environment. This is important in the case of PNG simply because of the general attitude of the people towards such services which have already been specified.

Co-operation between foreign agencies in the exchange of technologies and experts should be increased to share ideas and other relevant information for greater success and achievement of rural water supply and sanitation.

E Education and Training

In PNG the environmental health activities of the Department of Public Health are carried out mainly by the Health Inspectors. Some of the simpler and more routine executive functions like the supervision of workmen engaged in the consfruction of wells and rural latrines are delegated to Health Inspector Assistants.

The Health Inspector trainees are given 3 years training course at a Paramedical Training College. The Health Inspector Assistants have no formal training course. They simply receive some in-service training on the job and obtain practical experience by working directly under the Provincial Health Inspectors.

The present set-up is strengthened by the recruitment of two civil engineers who are being trained to become Public Health Engineers. Their task would be to give effective technical advice and support to Provincial Health Inspectors engaged in rural water supply and sanitation activities. The provision of rural water supplies is also being aided by the Local Government Engineering Section of the Department of Works and Supply, where a close collaboration between these two Government Departments is usually maintained.

The above information simply indicates the level of manpower who are engaged in the construction of rural water supplies in PNG. From this it can be seen that there is a noticeable lack of trained technical manpower with expertise in environmental health activities requiring sanitary engineering knowledge or application. The gap is therefore qquite wide in terms of population coverage. Hence there is still a large scope in the training and education system to prepare the manpower resources to tackle this often neglected environmental health improvement systems.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Papua New Guinea

U. Oti, National Public Service
Department of Works and Supply

SEMINAR ON RURAL WATER SUPPLY

WATER AND LIVING CONDITIONS IN PAPUA NEW GUINEA

1. INTRODUCTION

1.1 THE COUNTRY

Papua New Guinea is a Commonwealth nation with the present population of approximately 3 million people. This tropical country lies between the equator and 12°S Latitude and 141°E and 160°E Longitudes, having a total land area of about 461,693 square kilometres. This includes the eastern half of the mainland New Guinea, the Bismark Archipelago, Bougainville and Buka Islands, Main islands of Manus, New Britain and New Ireland and the many small islands in the Milne Bay Area.

The country offers wide range of scenery ranging from rugged mountains to mud flats, tropical forests to tropical islands.

The climate is generally hot and humid with average coastal temperatures from 20°C to 30°C. However, in the Highlands where mountain peaks range from 3200m to 4690m elevation, the nights can be quite cool. The annual rainfall varies from 2000mm to 5000mm for which the monsoon winds bring the most rains.

2.0 THE PEOPLE

The people of Papua New Guinea live in 3 different life styles namely 1. traditional village life; 2. Hamlets and 3. Urban Centres and Townships. The three main groups and their life style with regard to Water Supply are the main topics for discussion.

2.1 TRADITIONAL VILLAGE - (a population centre generally consisting of below 500 people).

Approximately 77% of Papua New Guineas 3 million people live in this life style. Unfortunately they are so scattered that they get the worst of the services such as water supplies.

Village water Supplies consists of a) shallow wells with hand pumps or b) simple diversion of water from a river, stream or spring, which is sometimes piped into the villages to a central place where the villagers pick it up in containers; (this is normally done by women and girls).

This water is generally polluted and no treatment is provided because of lack of maintenance expertise, but because of its importance as a convenient quantity of water, it is appreciated by the people.

.../2

The above leads to the main problem faced by this sector of people i.e. the repeated occurance of gastro-enteritis and other intestinal disorders.

Unfortunately the people do not understand the value of good quality water and its relationship with good health, One of the reasons why this is so is because people have been drinking from any water source as long as it is palatable, for generations.

The problem to solve for this sector of the population is educating the people about the importance of the quality of water. But again this is difficult because the people are so scattered that it will take a tremendous effort to educate all of them, and also the slow process in training enough national staff to produce good quality water to this people.

2.2 HAMLETS & INSTITUTIONS - (population centre with population between 500 and 3,500 people).

This sector covers about 6% of the whole population. Origionally these people had similar water supply schemes as those in traditional villages, but at present their supplies have been improved.

Typical source considered is surface water, for which the treatment required is slow sand filter, and in some cases chlorination. Collection of rainwater from roofs into household tanks is common. The quality of service provided is generally individual service connections for high covenant, low covenant and self help houses, institutional establishments while standpipes are provided for no-covenant and village type houses.

However, there is still the problem of sufficient national staff to operate this water supplies.

2.3 URBAN CENTRES AND TOWNSHIPS - (population centre with more than 3,500 people).

This sector covers 17% of the total population.
The water supply services provided to this sector are the best i.e. the water is fully treated:-

a) for surface supplies treatment includes flocculation, sedimentation, filtration, chlorination and sometimes flouridation.

b) for ground water - chlorination and flouridatión.

3.0 PROBLEMS

3.1 In Traditional Villages: The main problem of supplying adequate water to many of the villages is because of the locality i.e. most people prefer to build their houses on the ridge tops, which makes it impossible for simple gravity feed systems; while some live on islands surrounded by the sea where the only source of water is from the rain.

3.2 General Problems:

The main problems of suppling adequate quality water are:-

i) Financial Restrictions - because of limited funds available the planning and design of water supply schemes have to be as simple as possible at the same time producing safe and adequate water.

ii) Staff Shortage - At the moment there is a great shortage of qualified staff to train national staff to perform all the functions of a Water Supply Scheme. This problem will have to be dealt with by the National Government through the Public Services Commission in recruiting procedures.

iii) No Central Authority - At the moment there is (a) no standard for construction of water supplies; (b) no system for tarrif collection. These problems are likely to be solved by the current legislation which will make all water supply schemes a national function.

4. NATIONAL GOVERNMENT GOAL

One of the National Governments goals is decentralisation - i.e. encouraging people to remain in the villages. For this to be successful, the government has to provide such basic services as water supply to the people in the villages.

CONCLUSION:

For Papua New Guinea to be successful in providing as much of its population with adequate good quality water it must now look forward to making legislation which will authorise a Central Authority which will control all water supply schemes, and set standards so that village people (77% of Papua New Guinea) can be assured of good quality water. This Central Authority should have a better chance of securing loans from the World and Asian Development Banks. Once the funds are secured the second problem could also be easily solved i.e. training of national staff in all aspects of water supply Planning, Design, Operation and Maintenance.

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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Somalia

M.E. Yusuf, Water Development Agency of the
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FUTURE PLANS FOR WATER RESOURCES DEVELOPMENT IN THE RURAL AREAS OF SOMALIA

A contribution to the Inter-Regional Seminar on Rural Water Supply to be held at Uppsala, Sweden, 6-16 october 1980.

1.

Shortage of water supplies is a major limiting factor in the economic development of Somalia. The development of water resources to meet human and animal needs is therefore essential for the well being of the country.

2.

Water shortage is most acute in the rural area and these are the very areas that support the bulk of the country's livestock population. Since the country relies heavily on the livestock sector for its continued advancement, Government views investment in rural water development schemes as a priority.

3.

The current Three Year Development Programme (1979-1981) has outlined Government plans for borehole drilling in the rural areas by the Water Development Agency (WDA). With some External Aid it is proposed to construct 170 deep boreholes in these regions to alleviate water problems. The location of the watering points will be determined with due regard for existing and proposed range development projects. In this connection, the recently promulgated Range Development and Management Act should ensure proper consultative procedures are adopted. Under the Act, the National Range Agency (NRA) is charged to:

i) provide advice on the carrying capacity of the Rangelands;

ii) issue licences for drilling to proceed in the rural areas;

iii) ensure an adequate spacing of watering points (approx 30 kms wherever possible);

iv) register all water systems (boreholes, wells, dams etc..).

NRA also has the power to close down a borehole or other water system if it is deemed in the national interest to do so. These powers are far-reaching and if properly applied should eliminate indiscriminate drilling in the rural areas of Somalia.

The development of water resources, more especially groundwater, should follow detailed geological and, where applicable, geophysical investigations. Failure of many wells in the past has been due to inadequate investigation preceeding their construction.

4.
Over considerable areas of Somalia borehole drilling may not be the answer to the problem of water shortages. This is essentially true if there is:

i) a very deep water table, e.g. 250 m in parts of the Haud, leading to excessive drilling and maintenance costs;

ii) a preponderence of brackish or saline water, e.g. parts of the Lower Giuba, where water quality is often unsuitable for stock as well as humans;

iii) "fossils" water is present, i.e. water entrapped in the rocks during earlier rainy periods but receiving negligible present day recharge, so that development of such a resource is equivalent to "mining" the water.

In these areas emphasis should be on harnessing rainwater. The Department of Community Development and Social Welfare in the Ministry of the Interior has in the past been charged with constructing small sized cement tank "wars" and shallow wells in rural areas. Such schemes are well suited for self-help efforts and should be further encouraged.

5.
Selection of sites for such rainwater harvesting should take into account:

i) favourable topographic and geological conditions;

ii) dependable rainfall, even if slight;

iii) grazing or other agricultural potential.

Small gently-sloping catchments are most efficient. Poorly designed schemes can lead to soil erosion, soil instability or even local floods. Streams running into the Nugal Valley in Northern Somalia and drainages such as Lac Dera and Lac Anole in the Lower Giuba offer considerable potential in this respect.

The utilisation of rainwater could result in rapid numerical development of stock and improvement of its quality, but care must be taken not to overstock the rangelands. In Somalia the carrying capacity of natural pastures is low and falls rapidly as aridity increases.

Concluding Remarks

Where groundwater is available, surface and groundwater supply and delivery systems should be considered in combination for optimal use of the total water resource. Although groundwater is likely to be the main source of supply in the rural areas of Somalia in the past, insufficient importance has possibly been attached to the harnessing of rainwater. Even if stored in relatively small quantities, it could be an inestimable wealth for Somalia and assist rural development.

Improved technologies are emerging for enhancing water supplies in arid and semi-arid areas like Somalia. These include:

i) irrigation with saline water, unless removal of salts from the root proves to be a major obstacle;

ii) recycling irrigation water run-off, again if salinity is not excessive;

iii) well-digging improvements, using new materials and construction equipment and, especially, improved liners to protect against caving and collapse. This also prevents polluted water entering the well.

iv) solar distillation, whereby the sun's rays pass through a transparant cover onto a source of brine; water evaporates from the brine and vapor condenses on the cover which is arranged to collect and store it.

v) remote sensing, particularly the use of photographs from aircraft and satellites. These are important reconnaissance tools for planners in arid regions. Springs, seeps and even shallow groundwater in alluvial channels are mappable.

vi) rainfall augmentation, cloud seeding, by adding ice, carbon dioxide and silver iodide, is still not clearly understood and its application is still in the embryo stage.

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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

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Rural Water Supply in Sri Lanka

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INTERNATIONAL SEMINAR ON RURAL WATER SUPPLY

UPPSALA, SWEDEN. - OCTOBER 1980.

REPORT ON THE CURRENT SITUATION OF RURAL WATER SUPPLY IN SRI LANKA

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REPORT ON RURAL WATER SUPPLY PROGRAMME IN SRI LANKA

1. Introduction

1.1 The primary social objective of the Government is to improve the quality of life of the people of Sri Lanka. Provision of good potable water for drinking in adequate quantity where safe water is not so available, the provision of such water continuously without interruption and the provision of the water within reasonable access to the consumers and at a reasonable price, fall within this social objective to improve the quality of life.

2. Geographical and Climatological status

2.1 The Republic of Sri Lanka (Ceylon) is a tropical Island situated in the Indian Ocean between the latitude 5°N and 10°N and between longitude 79½°E and 82°E. The Southern tip of Sri Lanka is a little more than 400 miles North of the Equator. The country's area is 25,332 sq miles (65,610 sq km) nearly as large as Belgium and the Netherlands combined. A large part of the Island is covered by dense jungle. The northern part of the Island is quite flat but the mountains in the South Central Region rise to 8282 feet.

2.2 The climate is dominated by Indian Ocean trade winds known as monsoons. There is a concentration of rain in the South West quadrant of the Island generally called the wet zone. The other parts of the Island, i.e. the North and the South east parts, are called the Dry Zone. The average rainfall for the whole Island based on 40 years record is 75.6 inches per year.

2.3 The heaviest rains occur during the South West and North East monsoons. The outset and duration of the monsoons especially the North East vary a good deal from year to year but the normal period of the South West monsoons is from May to September and for the North East from November to March. During the transitional months October and April convectional rains are generated by the difference of temperature between the sea and the land.

2.4 Climatically the Island can be broadly divided into two zones viz the wet zone and dry zone. The terms are merely relative and the difference between them is marked. Climatically the wet zone has a relatively satisfactory integration of temperature, humidity and rainfall and is therefore endowed for the production of major exports crops tea, rubber, coconut and cocoa and for a fair range of other crops of lesser significance. It represents, however only about one quarter of the land area of the Island.

2.5 The dry zone extending over about three quarter of the Island is climatically far less favoured. Here the amount, effectiveness and distribution of rainfall vary considerably according to the particular region, while the degree of unrealiability of the effective rainfall is high.

2.6 Average annual temperatures over the Island do not vary greatly throughout the year. The three divisions are:

i. Warm to hot in the lowlands
ii. Moderately warm in the intermediate elevations
iii. Cooler in the uplands and maintain regions mean temperature below 75^{o} Fahrenheit.

3. Population

3.1 The Island's population according to the 1971 census was 12.7 million of which 2.8 million are Urban, 8.7 million are rural and 1.2 million in the estate sector.

3.2 The urban population is generally taken as these dwelling in Municipal Council, Urban council and Town Council areas. People living in Village Council areas are classed as rural.

3.3 According to population projections, the population of Sri Lanka will be 17.4 million in 1990 of which 12.7 million will be in the rural sector.

4. Existing Water Supply Situation

4.1 In Sri Lanka, today, there are 684 local bodies consisting of 12 Municipal councils, 38 Urban councils, 85 Town councils and 549 Village councils.

4.2 In the Urban Sector out of the 135 councils only 77 of them have a piped water supply in 1979. Some of the Urban Communities get 30 or more gallons per capita per day and this varies widely in different Urban areas.

4.3 In the rural sector only 5% of the house hold had piped water supplied in 1971. 82% of the rural population was supplied from wells. In estate sector 75% of the household had access to pipe water 15% used wells whilst the others used other sources such as rivers and springs.

4.4 Piped water supplied in V.C. areas serve only a small part of the V.C. area concerned, through standposts and few service connections. Often the market centre and institutions such as rural hospitals, schools and other public buildings are provided with service connections. There are 549 Village Councils covering around 18,800 rural communities and there are a total of 80 piped water supply schemes in these V.C. areas.

4.5 The quantity of water available in these rural piped water schemes is satisfactory in the wet zone hill country areas but is poor in the dry zone areas. The quality of water supplied also varies widely. Bacteriological reports prepared for 20 UNICEF schemes showed the water to be safe only in 25% of the schemes while in 50% the quality was suspect and in the other 25% fæcal pollution was evident. The poor quality of water in rural water supply schemes is due to poor operation and maintenance of the schemes by the Local Authorities as they do not have the competent staff and sufficient funds for this purpose.

4.6 In the rural sector water supply is primarily through wells. According to 1971 census 82% of housing units used private or common wells. The community wells are popular in rural areas but the wells are liable for pollution as these open wells are used for bathing as well. However, these wells could be the cheapest and quickest method of providing water to rural areas provided the wells can be made safe against any pollution.

5. Resources

5.1 It is important to consider the following aspects in the development of a plan for water supply:

5.1.1 Financial and economic aspects

The capital cost of providing pipe borne water is high. According to current prices the per capita cost of providing water is very roughly as follows:

Rural piped water schemes	- S.L. Rs 1,000/= - Rs 3,000/=p.c.
Community wells	- S.L. Rs 200/=p.c.

The wide variation is due to such factors as variation in supply level, treatment process, location and type of raw water intake and density of population in water served area.

There is a rapid increase in capital and recurrent expenditure for piped water supply projects during the last few years. In 1979 the allocation for rural water supply schemes was Rs 27 million while in 1980 it has been increased to Rs 102 million inclusive of UNICEF contribution of about Rs 20 million.

The cost of a protected sanitary well with a hand pump has been found to be about Rs 15,000/= assuming 75 people use one well the per capita cost work out to Rs 200/=.

A rough estimate of capital investment on this basis will be in the order of Rs 3,500 million at current prices to cover the rural areas with only about 20% piped water supply.

Present practice of financing the capital cost of water supply projects is as follows:

(a) A minor water supply scheme is to be defined as one which caters to a population of not more than 1,000 persons and costing not more than S.L. Rs 500,000/=.

(b) A medium water supply scheme may also be called a Rural Water supply scheme and which caters to a population of between 1,000 - 5,000 persons and costing not more than S.L. Rs 1,500,000/=.

(c) A major water supply scheme is one costing more than Rs 1.5 million irrespective of the number of persons to be served.

(d) The total cost of a minor water supply scheme to be met fully from the allocation from the D.C.B. or from Govt. grants allocated by the C.L.G.

(e) In the case of medium/rural water supply scheme and major water supply scheme the cost of the head works to be met by the Central Government and the total cost of the distribution system to be shared equally between the Central Government and the respective local Authority.

(f) The Central Government to meet the total cost of the augmentation and improvements to Head Works and likewise the local authorities to meet the full cost of the distribution system.

(g) Where assistance is being provided by way of materials from a foreign agency e.g. UNICEF the local costs in respect of the headworks and the distribution system to be borne by the Central Government and/or the local Authority in the manner set out in para (d) and (e) above.

The financial viability of all rural water supply constructed with UNICEF assistance is examined and a grant given to 1.A. which cannot operate and maintain them on a financially viable basis, the amount of such assistance to be determined on the basis set out in (d) above.

5.1.2 Technological aspects

Climatically the island is broadly divided into 2 zones viz wet zone and dry zone. The North East monsoons brings about 30-75 inches of rainfall per year in the dry zone areas in addition to the wet zone. The S.W. monsoons brings rain mainly to the wet zone, whilst many areas in the dry zone get little or no rain. In some areas of the dry zone in the N.W. and S.E. fringes of the island rainfall during this monsoon falls below 10 inches. Such areas are badly affected and drinking water has to be

found through deep tube wells in the absence of any surface water sources. The entire dry zone covers about 62% of the island and has about 24% of its population while the wet zone covers the balance 30% of the area and has 76% of the population. Thus the provision of water for the dry zone has to take into account not only the scarcity of water but that fact that the communities to be served are generally small.

Rivers provide the main source of surface water. There are 103 rivers in the island which offers natural sources for obtaining water for human requirements. The average volume of rainfall over the island is estimated at 107 million acre feet and there is a surface water potential of about 45 million acre feet per annum. The balance component forms the underground water resources. Studies are being carried out regarding availability, quality and scientific exploitation of ground water.

5.1.3 Institutional and Legal Aspects

The National Water Supply and Drainage Board is responsible for the investigation, design and construction of water supply schemes. The programme for the construction of protected community wells is directly handled by the Ministry of Local Government, Housing and Construction.

Maintenance and operation of water supply schemes is done either by the National Water Supply and Drainage Board or by the Local Authority concerned.

Among the other institutions in the water supply sector is the Water Resources Board under the Lands Ministry. Water Resources Board provides country wide information on exploitation of ground water resources.

The provision of water in estates is the responsibility of the Ministry of Plantation Industries and likewise the provision of water to new settlements is the responsibility of the Ministry of Mahaweli Development.

Ministry of health is responsible for health education. Presently National Water Supply and Drainage Board is engaged in a large number of rural water supply projects with UNICEF assistance.

These programmes of work have resulted massive demand upon the Institution to respond both by way of organisational structure changes as well as increasing man power resources and by restoring different types of technologies.

5.1.4 Socio - cultural aspects

Majority of the population live in rural areas and are accustomed to obtain water from dug wells. Sometimes in the villages it is very common to have one well for drinking and the other for bathing. Sometimes the villagers have to go several miles to collect a bucket of drinking water. People tend to think that open wells are better than the covered well and the water should be available free and without any payment. Unless water is paid for in piped water supply schemes, the scheme cannot be maintained and operated satisfactorily without a subsidy from the Government. In most rural water supply schemes the water is charged for only indirectly by including the tax in the annual assessment rates of the properties. Efforts are now being made to charge for water directly by installing water meters and amending the existing local authority laws.

5.1.5 Political aspects

At the Central Government level there is appropriate attention in the allocation of the resources for the water supply projects. Now the attention is gradually spreading into the district level too. Local level of politician could also look into the problems of providing safe drinking water in an appropriate terms.

6. Rural Water Supply plan

6.1 According to the plan for International Drinking Water Supply and Sanitation decade (1981-1990) of the Ministry of Local Government, Housing and Construction it is proposed to supply a safe, adequate and reliable supply of water within easy access to the entire population. The targets for the Decade 1981 - 1990 as regards the Rural water supply is to provide a 60% coverage for the population, in 1990 and 100% by 2000 the supplies being predominantly through protected wells, to provide the minimum safe water requirements. These targets will cover a rural population of 8 million.

7. Recommendations

7.1 The following recommendations are considered important in the implementation of the above programme:

1. Pipes water supply systems should be considered only for rapidly developing areas and where a source is rapidly available at close proximity. The balance areas to be provided only with sanitary wells with hand pumps.

2. Educational Programme in health education to be launched to disseminate information regarding environmental health.

3. Communities to be closely involved in planning, construction, operation and maintenance.

4. To get donor agencies to finance a greater share of the cost, both local and foreign, as compared to the present practice of financing only the foreign component.

5. Government should make effective laws and enforce same for the conservation of water and prevent wastage.

6. Under the Ministry of Local Government, Housing and Construction, a separate section in the National Water Supply and Drainage Board to be set up for operation and maintenance of water supply schemes to provide an adequate and satisfactory services to the community.

THE EXAMINATION OF ISSUES RELATED TO THE ORGANIZATION, INVESTMENT, PLANNING AND IMPLEMENTATION OF RURAL WATER SUPPLY PROGRAMMES IN TANZANIA

A paper Presented to the International Seminar on Rural Water Supply - to be held in Uppsala, Sweden 6 - 16 October, 1980.

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The views expressed in this paper are those of the author and may not necessarily represent the official viewpoints of the Government.

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AN EXAMINATION OF ISSUES RELATED TO THE ORGANIZATION, INVESTMENT, PLANNING AND IMPLEMENTATION OF RURAL WATER SUPPLY PROGRAMMES IN TANZANIA.

1. Introduction:-

"My Ministry has been entrusted with the duty of providing Water to our people - water which is hygienically and easily accessible to every person. The work done in this field so far is praiseworth although the workload is immense. Provision of water to the people was not a priority before Independence. Our Government has had to start from scratch because no foundation existed in this field. In general, there was no policy which could have been of any interest to our people. Having realized this anomaly the Government, under the direction of the Party started making appropriate changes with the distinctaim of providing water to all the people, espcially to the villagers who had completely been forgotten"- an extract of the opening speech made by the Honourable Minister of the Ministry of Water, Energy and Minerals when presenting his Ministry's expenditure estimates for the 1980/1981 plan year to the Tanzanian Parliament.

This short extract of the Minister's speech aptly states the urgency, committment and apositive sense of direction for Tanzania's determination to wage a frontal onslaught on the rapid implementation of rural water supply projects implementation program, inorder to attain the laid down objective of providing the entire Tanzanian village populace with potable water by 1991. Water which can easily be obtained within 400 metres walking distance from the nearby cluster of villagers dwelling place.

As at 1979, the fourth calendar year or in terms of planning cycle the third, since the launching of the 3rd five year plan - 1976/77 to 1980/81 - it is estimated that 7 million of the village populace have access to potable water. The figure attained is indeed worth of praise when compared to a figure of 2.4 million five years ago.

The Government during the 3rd five year development period has wide, through deliberate and positive implementation attempts of resource allocation succeeded to achieve significant success on the three major inputs required for effective rural Water Supply - Survey and and Investigations, Manpower, and material inputs.

(1) Survey and Investigations and determination of the quality and quantity of rural water supply and also geared to establishing the available water resources. With the generous assistance, in terms of finance, material inputs and trained Manpower, from friendly Scandinavian countries notable among them being Denmark, Norway the Government has launch Regional Rural Water Master Plans, establishing of hydro- meteorological stations almost simultaneously in a number of regions.

11) A re-organization of the Central Water Stores department in Dar es Salaam inorder to enable it to cope with ever increasing orders of pumps, fittings, pipes etc emanating from the rural water implementors.

The Government on its part has succeeded in avoiding long delays in the disbursement of funds to the implementors.

111) Expansionary work undertaken at the Water Resources Institute situated in Dar es Salaam to enable it to cope with an increased inflow of students. The Government with the co-operation of the beneficial development assistance emanating from Sweden has opened a fresh outlet on the training horizon, by sending students to be trained in oversees Water Engineering Institutes. The first batch of 130 trained engineers had arrived in the country in 1979 and have been posted to the regional centres.

Section 11 & 111 The Prime Minister's Office and the Ministry of Water Energy and Minerals are jointly responsible for ensuring the overall supervision and coordination on the rural water Supply project implementors. In the regions the Regional Water Engineer (RWE) is responsible for coordinating the implementation of regional based rural water schemes. The Regional Water Engineer relies on the District Water Engineer (DWE) for ultimate implementation of the projects. Efforts are being made to adequately staff the District Water Engineers office with the relevant blend of technical staff - engineers, procurement officers, and craftsmen of varying type of engineering and construction skill to ensure smooth implementation of the projects. The Ministry of Water, Energy & Minerals coordinates and supervises implementation of its share of the rural based water supply programmes - usually large schemes requiring heavy resources outlay and financial committments - by relying on the DWE for overall district supervision and by despatching its own cadre of ministerial technicians.

A third type of project/programme implementation structure is that involving donor (external finance agency) colloboration. The donor supplies the bulk of the finance and material inputs, including the manpower to implement the schemes and relies on the Ministry or Regional implementation agency to provide the links between the donor agency and the people. eg of such schemes are the Singida Rural Water Supply Scheme (Australians), the Morogoro and formerly the Shinyanga shallow wells scheme (Netherlands Government), Mtwara-Lindi rural Water Supply scheme (the Finnish Government), and a host of other ministerial and Regional based rural water programmes (the Swedish Government).

Section IV:

In the third five year plan the entire Rural Water Supply Programme (in corporating both the Ministerial and Regional Programmes) has been allocated over the years - five year period - Tanzanian shillings 1.092.47 million; Compared to the overall Government investment of 21 billion Tanzanian shillings this represents 5% of the total and 45% of the total planned investment in the social infrastructure sector in the five year period.

- See format 1 & 11 for additional analytual information.

Project/Program Implementation during the period - four year - for which actual and estimated data is available has clocked 70 - 80% implementation achievement on the financial side. A Good deal of the high financial achievement could be attributed to escalating prices of material inputs and other factors, but never the less 50 - 60% of the implementation rating could be safely attributed to sound project/programme implementation efforts, of the regional, Ministerial and donor implementation staff.

Section V:-

In the thirdfive year plan period the strategy conceived at the onset was utilisation of methods that are not taxing on the meagre financial and material resources of the country. In this context the Governments original strategy of sponsoring shallow wells schemes has begun to pay dividends and Government intends to encourage implementors and donors to utilise this particular technological mix in areas which favour its utilisation. The recently announced resolutions of the Morogoro wells conference held in Morogoro - August 18 - 21 heralded this particular stand point.

In some places it would be easier to dam small rivers while in others gravitational methods or piping water from dams and lakes could be used. Projects that require large amounts of money will be given second priority, unless it is in the interest of large number of village populace - e.g. the recently constructed Monduli Juu Dam in Arusha Region (estimated to cost the Government over T. Shs. 24 million). The Handeni Truck Main (financed by West German assistance) and is expected to clock over a T. Shs. 100 million, and they just started Kyarano Dam Scheme (estimated to cost the Government T. Shs. 30 Million).

To speed up implementation of rural water supply programmes, beneficiarres will be required to participate fully particularly on small projects. Village government will investigate best strategies of meeting part of the Water Supply costs for their water schemes.

ANNEX 1

PATTERN OF INVESTMENT ANALYSIS IN THE RURAL WATER SUPPLY SECTOR OUTLINING PLANNED INVESTMENT COSTS, ANNUAL INVESTMENT ALLOCATION VIDE THE DEVELOPMENT BUDGET AND ANNUAL EXPENDITURE ATTAINED FOR PERIOD COVERING 3RD FIVE YEAR PLAN - 1976/1977 to 1980/1981.

(All Figures expressed to the nearest Million)

IMPLEMENTATION AGENCY & PROGRAMME NAME	ACTUALS 1976 - 1977			ACTUALS 1977 - 1978			EST. ACTUALS 1978 - 1979			EST. ACTUALS 1979 - 1980			ESTIMATES 1980-1981		IMPLEMENTATION RATING %				TOTAL 1976/77 1980/81
	PLANNED INVEST-MENT	ANNUAL BUDGET ALLOCATION	EXPENDI-TURE	PLANNED INVEST-MENT	ANNUAL BUDGET ALLOCATION	EXPENDI-TURE	PLANNED INVEST-MENT	ANNUAL BUDGET ALLOCATION	EXPENDI-TURE	PLANNED INVEST-MENT	ANNUAL BUDGET ALLOCATION	EXPENDI-TURE	PLANNED INVEST-MENT	ANNUAL BUDGET ALLOCATION	1976 / 1977	1977 / 1978	1978 / 1979	1979 / 1980	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
A. - Ministerial Programmes (Surveys & Water Master Plans)																			
1. Surveys & Investigation	0.50	5.70	5.78	-	-	-	-	-	-	-	-	-	-	-	101%	-	-	-	101%
2. Hydromet West Tanzania	3.15	3.15	2.53	2.53	3.00	3.00	-	4.55	4.00	-	5.30	5.30	-	1.00	80%	100%	88%	100%	9[illegible]
3. Water Master Plans	35.37	34.30	25.73	29.00	29.00	21.75	10.00	27.41	20.56	15.00	61.15	45.86	30.00	57.05	73%	75%	75%	75%	74%
4. Hydromet West Lake	0.80	0.80	0.82	0.80	0.80	0.80	0.80	0.80	0.80	0.80	1.00	1.00	0.80	1.00	102%	100%	100%	100%	100%
Sub-Total Surveys A& Water Master Plans	39.82	43.95	34.86	32.33	32.80	25.55	10.80	32.76	25.36	15.80	67.45	52.16	30.80	59.05	79%	77%	77%	77%	78%
(Rural Water Supply Programmes)																			
1. Water facilities Expansion	10.85	13.75	13.20	13.20	13.20	10.19	6.12	13.44	8.74	1.66	4.34	3.39	1.33	3.00	96%	77%	65%	78%	79%
2. Mara Trunk Main II	-	-	-	-	-	-	-	3.53	2.47	-	4.80	3.12	-	3.50	-	-	70%	65%	68%
3. Boreholes (Well Drilling)	10.28	8.43	9.31	10.64	10.64	10.73	6.75	10.30	7.73	8.75	8.00	6.00	12.75	3.50	110%	101%	75%	75%	90%
4. Dam Construction	3.83	3.87	1.79	3.88	3.88	4.05	3.03	5.02	3.77	3.03	5.00	3.75	3.03	3.00	46%	104%	75%	75%	75%
5. M wamashimba Water Supply	2.50	3.00	2.52	3.00	3.00	0.95	3.50	4.35	2.44	-	4.30	2.80	-	3.50	84%	32%	56%	65%	50%
6. Shallow Wells - Shinyanga	11.90	11.90	8.93	15.24	15.14	12.87	1.00	-	-	1.00	-	-	1.00	-	75%	85%	-	-	80%
7. Wangingombe Water Supply	-	-	-	-	-	-	-	10.50	8.93	10.00	15.20	11.40	8.00	4.20	-	-	85%	75%	80%
8. Rondo Water Supply	0.75	0.75	0.74	-	4.82	3.86	-	-	-	-	1.08	0.81	-	0.80	99%	80%	-	75%	85%
9. Dodoma Villages water Supply	-	-	-	5.18	4.82	3.62	-	5.63	3.66	-	2.80	1.82	-	1.70	-	75%	65%	65%	68%
10. Singida Rural Water Supply	-	-	-	8.37	8.37	6.70	-	6.20	4.03	-	8.50	5.35	-	4.00	-	80%	65%	63%	69%
11. Kyarano Water Supply	-	-	-	2.00	1.20	1.27	-	1.00	1.00	-	8.50	8.50	-	28.00	-	105%	100%	100%	100%
12. Morogoro Rural Water Supply	-	-	-	6.93	6.93	5.89	-	6.20	4.65	-	32.80	22.96	-	24.25	-	85%	75%	70%	77%
13. Kanga Group Rural Water Supply	-	-	-	-	-	-	0.50	1.50	1.00	0.50	2.00	1.85	1.00	3.00	0	-	67%	93%	80%
14. Mtwara Rural Water Supply	-	-	-	-	-	-	-	-	-	-	21.80	18.53	-	19.00	-	-	-	[illegible]	[illegible]
15. Bulenga Nanga Water Supply	-	-	-	-	-	-	-	4.00	2.60	-	3.05	2.07	-	1.50	-	-	65%	68%	67%
16. Training Rural Water Supply	6.50	6.50	4.10	8.00	8.00	5.20	6.00	10.93	7.65	3.00	3.60	2.70	3.00	3.50	63%	65%	70%	75%	69%
Sub Total Rural Water Supply	[illegible]	[illegible]	[illegible]	76.44	80.00	65.33	26.80	80.60	58.67	74.[illegible]	[illegible]	85.05	80.1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
B. - (Sanitory Programmes)																			
1. Sanitory System - D'Salaam & Morogoro	0.97	3.00	3.46	2.00	1.35	0.90	20.00	4.00	4.00	20.00	5.40	5.00	14.00	2.95	115%	67%	100%	83%	83%
2. Sanitory System - Tabora - Mwanza	0.75	1.50	1.00	2.00	1.15	0.81	15.00	3.00	3.00	25.00	4.60	4.00	18.00	2.29	67%	18%	100%	83%	83%
3. Sanitory System - Arusha & Moshi	-	-	-	-	-	-	1.00	4.00	4.00	3.00	3.60	3.00	3.70	1.24	-	-	100%	83%	83%
Sub Total Sanitory Programmes	1.72	4.50	4.46	4.00	2.50	1.11	36.00	11.00	11.00	48.00	13.60	12.00	25.70	12.48	99%	44%	100%	83%	83%
A Sub Total Ministerial Programmes	88.20	96.65	79.91	112.77	115.30	91.99	73.70	126.36	95.03	91.74	306.82	159.21	96.61	176.98	93%	80%	77%	77%	81%
B REGIONAL RURAL WATER SUPPLY PROGRAMME.																			
1. ARUSHA REGION	2.01	2.01	1.90	2.84	2.84	2.77	4.50	3.66	3.57	3.70	1.62	1.22	4.49	2.45	95%	88%	99%	75%	91%
2. COAST REGION	2.19	2.19	2.15	1.93	1.93	2.19	5.68	2.09	2.08	6.22	3.92	2.94	7.00	4.12	98%	113%	99%	75%	96%
3. DODOMA REGION	1.68	1.68	1.49	3.03	3.06	2.49	4.03	2.08	2.02	4.98	2.06	1.75	4.95	2.84	89%	81%	70%	65%	71%
4. IRINGA REGION	1.91	1.91	1.98	2.74	2.74	2.82	1.56	4.06	3.84	2.57	5.14	3.85	2.69	5.75	104%	103%	95%	75%	94%
5. KIGOMA REGION	4.36	4.36	6.40	3.77	3.77	4.03	5.02	4.14	2.70	6.54	3.11	2.49	7.08	3.16	147%	116%	63%	50%	101%
6. KILIMANJARO REGION	4.10	4.10	4.30	3.85	5.04	4.56	4.12	5.10	4.34	4.18	4.50	3.38	4.74	4.36	105%	90%	85%	75%	89%
7. LINDI REGION	2.76	2.76	3.03	3.91	3.54	3.45	2.87	4.74	5.67	4.14	6.03	4.82	1.49	6.38	110%	97%	130%	80%	102%
8. MARA REGION	4.17	4.17	4.32	3.92	4.45	5.14	3.69	5.70	6.41	5.54	4.80	3.84	5.55	3.90	104%	116%	110%	80%	103%
9. MBEYA REGION	2.85	2.85	2.88	3.35	3.43	2.50	3.27	5.32	5.44	3.72	4.50	3.38	3.50	3.79	101%	73%	100%	75%	88%
10. MOROGORO REGION	1.90	1.90	2.23	2.96	9.09	6.82	3.72	4.09	3.07	4.76	2.81	2.11	4.46	3.43	117%	75%	75%	75%	85%
11. MTWARA REGION	2.91	3.91	3.44	4.18	4.13	5.26	6.68	8.39	12.48	6.68	11.15	9.48	6.68	5.61	88%	127%	149%	85%	110%
12. MWANZA REGION	2.72	2.72	2.93	2.21	2.21	2.25	2.87	2.87	2.44	2.87	2.70	2.03.	3.01	2.03	108%	100%	85%	75%	92%
13. RUVUMA REGION	2.35	3.31	3.31	2.69	2.69	2.70	0.83	2.84	1.35	1.06	2.90	1.89	1.20	16.99	100%	99%	65%	65%	82%
14. SHINYANGA REGION	2.09	2.09	2.07	3.37	3.37	3.41	2.47	4.98	3.74	3.88	4.30	2.80	2.76	2.97	99%	101%	75%	65%	85%
15. SINGIDA REGION	3.20	3.20	2.92	3.10	3.10	4.59	3.90	3.57	3.88	4.85	4.20	3.15	4.85	4.55	91%	148%	109%	75%	106%
16. TABORA REGION	3.24	3.24	2.56	2.89	2.89	2.17	5.42	3.44	3.51	4.20	2.62	1.97	6.44	1.72	79%	75%	99%	75%	90%
17. TANGA REGION	3.36	3.36	3.51	3.65	3.64	3.69	3.35	3.57	3.07	3.25	4.34	3.26	3.20	3.55	104%	101%	86%	75%	94%
18. KAGERA REGION	2.45	2.45	2.36	3.00	3.00	2.25	3.58	3.45	2.59	3.58	2.95	1.92	4.48	3.11	96%	75%	75%	65%	78%
19. DAR ES SALAAM REGION	1.01	1.01	0.64	1.47	1.47	1.90	2.50	1.25	1.24	5.50	1.45	1.09	3.50	1.82	63%	129%	99%	75%	92%
20. RUKWA REGION	2.70	2.70	2.70	2.40	2.40	2.52	4.05	3.05	2.29	3.99	3.48	3.22	4.30	4.17	100%	105%	75%	75%	89%
B. Sub Total Regional Programmes	53.96	55.92	57.12	61.25	68.75	67.71	74.71	79.39	76.43	86.17	78.58	60.59	86.37	87.72	106%	110%	102%	70%	97%
GRAND TOTAL (A + B) RURAL WATER SUPPLY MINISTERIAL & REGIONAL PROGRAMMES	142.16	152.57	137.03	174.02	184.05	159.70	222.11	205.75	171.46	177.91	285.40	219.80	182.98	264.70	94%	87%	83%	77%	83%

NOTES TO FORMAT No. I

1. ACTUALS - Relate to figures that have undergone scfutiny by Auditor General
2. EST. ACTUALS - Relate to figures that are extracts from reports sent by Implementor.
3. ESTIMATES - Relate to current year figures and are thus devoid of any expenditure figures.
4. IMPLEMENTATION RATING - Is a nemrical figure in % derived by dividing the expenditure attained per yearly with the figure provided in Annual Budget Allocation also yearly.
5. TOTAL - (Column 20) is an average of the four years of the plan period.

SOURCE OF INFORMATION :

1. THIRD FIVE YEAR DEVELOPMENT PLAN (Vol. II) INVESTMENT ANALYSIS 1976/1977 - 1980/1981 - MINISTRY OF PLANNING & ECONOMIC AFFIARS
2. APPROPRIATION ACCOUNTS OF TANZANIA FOR YEARS - 1976/77 & 1977/78 - AUDITORS GENERAL OFFICE.
3. FINANCIAL PROGRESS REPORTS FROM IMPLEMENTORS - MINISTRY OF WATER, ENERGY & MINERALS AND REGIONAL REPRTS.
4. DEVELOPMENT BUDGET ESTIMATES FOR YEARS - 1976/77 to 1980/81 - MINISTRY OF PLANNING & ECONOMIC AFFAIRS.

(For Comparison in International Units of Currency (8.14 TANZANIAN SHILLINGS EQUIVALENT TO 1 U.S.A.$.)

FORMAT NO. 2

ACTUAL v/s PLANNED INVESTMENT IN THE FIVE YEAR PLAN PERIOD 1976/77 - 1980/81

(expressed to the nearest million)

IMPLEMENTATION AGENCY & PROGRAMME NAME	PLANNED INVESTMENT IN THE FIVE YEAR PLAN PERIOD 1976/77-1980/81	ACTUAL INVESTMENT VIDE DEVELOPMENT BUDGET ALLOCATIONS IN THE PLAN PERIOD 1976/77 - 1980/81	DEVIATION (+ or -) IN % $\frac{2-1}{1} \times 100$
(MINISTERIAL PROGRAMMES)	(1)	(2)	(3)
1. Surveys & Water Master Plans	129.55	236.01	+82%
2. Rural Water Supply Programmes	208.05	442.02	+112%
3. Sanitation Programmes	125.42	44.08	-65%
(REGIONAL PROGRAMMES)			
1. Regional Rural Water Supply Programme	362.46	370.36	+ 2%
TOTAL= MINISTERIAL + REGIONAL PROGRAMMES:	825.48 (4%)*	1,092.47 (5%)*	+32%

NB: Above figures in Tanzanian Shillings and to the nearest millionth.
(8.14 Tanzanian Shillings equivalent to 1 U.S.A. $)

/% *Percentage figures in brackets refers to the proportionate/allocations of Rural Water Programmes (Ministerial and Regional) when compared to the total Planned Government Investment in the plan period of over 21 billion T. Shs.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in the United Republic of Tanzania

N. K. Msimbira, Ministry of Water, Energy and Minerals

1.0. In Tanzania mainland about 90 percent of the total population of live in about 8000 villages in the rural areas. According to the 1978 National Census the population was 17.1 million people at annual growth rate of 2.9%. Agriculture and livestock production which is the single major contributor to the National Gross Product (GNP) is the main activity in the rural areas.

Water is an indispensable item for life of human being and for social economic development. Where there is no permanent source of water, people, particularly women traverse long distances in search of water.

In order to sustain the country economy and improve the health of the people the responsibility for the provision of a source of clean and potable water near the villages becomes more eminent realizing the fact that the greater the walking distance to fetch water the lesser is the time spent on productive activities.

For considerable time even after independence in 1961, more attention had been paid to the urban and large settlement areas. Rescheduling of this trend was thus necessary so that more attention is paid to the rural areas. The provision of whole some water is a prerequisite to any rural development and that without it, would create stagnation of the National economic growth and above all cause health problems.

With this view in mind in 1971 the Party directed the government to formulate a 20 year programme so that by 1991 all people will be provided with clean, potable water and within easy reach at an average distance of about 400 metres. By 1975 the government had accomplished the villagilization programme where by 8000 villages were formed. This process necessitated the acceleration of the water supply programme so that all village would be provided with clean and potable water source by 1981. To date about 30 percent of the villages have been provided with a source of clean and potable water.

2.0. The Rural Water Supply Programme:

With an annual growth rate of 2.9 percent the 1978 of 15 million people would reach 21.2 million people by 1991. At the end of 1979 it had been estimated that about 6.1 million people had been served with clean, potable water as shown in table 1. This represents about 34.9 and 25.5 percent of the 1979 and 1991 population respectively. This means a backlog of 15.1 million people without clean and potable water.

At the initiation of the 1991 programme it had been planned that annually about 1.0 million people would be served. At this rate the total population that would have been covered by 1979 was 10.6 million people. This means that from 1971 to 1979, 9.0 million people should have been served. Instead only about 4.5 million people were supplied with water by end of 1979.

2.1. Constraints:

In order to successfully carry out this gigantic task the present Implementation capacity has to be increased by minimizing the major constraints. The constraints include inter alia lack of financial resources, trained technical manpower, efficient equipment and transport facilities, proper institutional set up, availability of data, selection of proper technology and technilogical mix and proper operation and maintenance procedures.

2.1.1. Financial Resources:

The 20 year programme as mentioned earlier aimed at serving about 1 million people annually. This means that from 1971 to 1979 about 9.0 million people would been covered at investment cost of around 1980 million Shillings (US $ 247.5 million).

Unfortunately due the scrarcity of financial resources the total number of people served with water in the rural areas by 1979 is only 55% of the 1971 target.

Table 1 People Served with water by end of 1979

Region	Rural Population in 1979	Rural population in 1971 at 2.9% growth	Rural Population Served 1979		
			Number	% of Total Pop. 1979	1991
Arusha	961,495	1,316,780	389,207	40.5	29.5
Coast	531,838	728,359	199,814	37.5	27.4
D'Salaam	96,907	132,716	66,000	68	49.7
Dodoma	836,931	1,146,129	521,680	62	45.5
Iringa	890,722	1,219,856	242,500	27.2	19.9
Kagera	959,395	1,313,905	113,445	11.8	8.6
Kigoma	607,277	831,674	141,530	23.2	17.0
Kilimanjaro	857,085	1,173,790	454,510	53	38.7
Lindi	515,111	705,452	233,197	45.3	33
Mara	699,015	957,311	140,863	20	14.7
Mbeya	813,147	1,113,616	368,429	45.5	33
Morogoro	966,426	1,323,533	415,000	42.9	31.3
Mtwara	744,189	1,019,178	421,730	56,7	41.4
Mwanza	1,477,045	2,022,834	473,074	32.	23.3
Rukwa	405,524	555,370	147,285	36.3	26.5
Ruvuma	529,739	725,486	187,787	35.4	25.9
Shinyanga	1,291,123	1,768,212	900,900	69.8	50.9
Singida	574,324	786,545	321,508	56	40.9
Tabora	772,426	1,057,848	92,982	12	8.9
Tanga	917,912	1,257,094	295,843	32.2	23.5
Total	15,447,634	21,155,750	6,127,284	40.37	29.48

An average of about 250 million shillings ($31.2 mill) has been provided annually for the rural water supply programme representing about 0.8 percent of the GNP.

In order to cover the backlog of 15.1 million people by 1991 including the rehabitation of the existing schemes, it is necessary to serve an average of abcut 1.5. million people annually from 1980. This would require an annual investment of about 675 million shilling ($ 84.4 million) or approximately 2 percent of the annual National Gross Product (GNP). In other words the present allocation has to be increased by 2.7 times in order to meet the programme target.

The financial requirement outlined above clearly indicates the magnitude of the task and the urgent need to diversify approach to such problem. The approach include choosing inter alia proper technological mix with emphasis on least cost solution, involvement of the rural population through self help participation in the running of the scheme increasing the investment level or rescheduling the programme target.

Tanzania has been able to solicit funds from International and bilateral agencies through loans and grants. Currently about 83 percent of the rural water supply development programme investment is supported from external resources. It is unlikely this contribution would increase considerably. So far no funds are generated by villages to support the operation and maintenance of the schemes.

2.1.2. Technological Mix

As indicated earlier the implementation of the 1991 programme would depend upon overcoming some of the constraints mentioned above. It is evident that the level of funding for the rural water supply sector would not increase considerably because the resources are limited, within and externally. It is thus necessary to reschedule the current water supply development system by emphasizing;

on least cost alternatives so that more people would be served with the meagre resources available. With the available data provided by Regional Water Master Plans being carried out in each Region, it is possible to work out an appropriate technological mix for each of the Region. The feasibility of mix will vary from Region to Region and will depend on the ground water and surface water potential in each area.

The least cost solutions include shallow well development, gravity schemes, boreholes with short rising and distribution mains etc. In choosing the type of technological mix water quality both chemically and bacteorologically is taken into consideration. The comparison of investment for development cost for various alternatives given below roughly indicates the type of ~~cost~~ mix that can be choser.

Table 2: Comparison of development cost for various options.

	Development cost per person - Shs.
Well with hand pump	80
Borehole 90m with pump	276
Gravity surface water supply with long transmission main	320
Surface water supply diesel pumped	365
Dam pumped	500

Table 3: For the 1991 programme these figures are up dated as below:

	Development Cost per Person
Gravity Supply	575
Pumped surface water supply	715
Boreholes (pumped)	540
Shallow wells	150
Dam pumped	980

Several large shallow wells programmes are successfully being implemented in the country as a least cost alternative. These include the Shinyanga Shallow Well project in Shinyanga Region; Lindi/Mtwara in Lindi and Mtwara Regions and Morogoro Shallow well project in Morogoro Region. There are also small programmes in various other regions.

The Shinyanga shallow well and the Lindi/Mtawra project are implemented as follow-up of the Regional water master plans studies recommendations. In Shinyanga and Lindi/Mtwara 900 and 550 shallow wells respectively have been constructed by the end of 1979. These programmes are continuing.

In Morogoro programme 250 shallow wells have been constructed. Under the two year programme it is planned to construct 500 shallow wells. Organisational set up have been established in Shinyanga and Morogoro for the fabrication of hand pumps and various hand drilling augers bailers, extension rods and handles. It has been established that it is possible to construct 20 - 25 wells in a month. The training of expertise from other Regions is also being done by the Morogoro shallow wells project.

Each shallow wells can supply water to about 250 - 300 people. It is tentatively estimated that more than 50% of the total rural population could be covered with water from shallow wells.

In Singida water supply project and other Regional pumped water supply projects, emphasis is being put on short rising and distribution mains with a few domestic points around a mall storage tank of about 25 cubic metres of water.

Also charcos are being constructed for both cattle watering and for people. Where people have to use the water a shallow well is constructed at least about 100 metre away from the water line or a small slow sand filtration is provided. The latter is not commonly used at present.

In additional several gravity schemes are under implementation in lieu of pumped water supply project. These include the East Kilimanjaro Trunk main in Kilimanjaro Region, Handeni Trunk main in Tanga Region, Wanging'ombe in Iringa Region and Kanga Group in Mbeya Region to mention a few. Each project is estimated to serve more than 60,000 people. However these scheme involve construction of large treatment plants which are expensive to run.

Thus by using a technological mix as shown below the investment requirement is about 58175 million Shs. or about 484.5 million shillings ($ 60.0 mill) annually.

Table 4: Cost estimate for Rural Water Supply by 1991

	% of Mix	Population served mill. people	Percapita Cost Shs.	Total Cost in Mill. Shs.
Gravity Water Supply	15	2.265	575	1,302.4
Surface water pumped	20	3.02	715	2,159.5
Borehole	15	2.265	540	1,223.1
Shallow wells	50	7.550	150	1,132.5
Total	100	15.1		5,817.5

2.1.3. Technical Manpower:

Training of local expertise is carried out both locally and abroad Locally, the Engineers are trained at the University of Dar es Salaam and the technical cadre are trained at the Dar es Salaam Water Resources Institute which has an intake of 120 student annually. The grass root technicians training is conducted in the Regions through Regional Water Engineers.

From abroad engineers and technicians are trained through bilateral agreements. For example in 1979, 119 Civil engineers graduated from Roorkee University in India.

2.1.4. Lack of Equipment and Materials:

It is a known fact that in Tanzania as well as in other developing countries construction equipment, machinery, pipes pumps engines, spareparts etc are procured from abroad. The supply of these equipment and materials always takes a long time. As a result of this set back the project takes a long time to implement. In addition to frustrations to beneficiaries the project cost escalates.

The foreign exchange availability for the important of equipment and materials is a major problem. The allocations are generally insufficient for the procurement of necessary materials and spare-parts.

To minimize this problem it is appropriate that external loans and grants should be utilized for the procurement of equipment and material (and training). The internal funds should be used to meet the Local expenses and ~~training of~~ less funds should be utilized for technical assistance. This is in line with the third worl demand on transfer of technology from the developed to less developed nations.

2.1.5. Lack of Data:

The availability of sufficient and reliable data is necessary for proper development of the water resources. The data is vital for design and planning of water supply projects. The data required include both hydrogeological and hydrometeorological.

The Regional water water plan studies is part of the efforts being made in data collection. However for data to be meaningful and useful it must be of long duration, systematic and reliable. In most cases such data is not available. This result in designing projects such as dams through guess work.

For this the Ministry of Water, Energy and Minerals is in the process of establishing data bank system through which data would systematically be collected and preserved. Water master plan coordination unit has been established in order to standardize methodology of data collection.

2.1.6. Lack of Transport Facilities:

The availability of efficient and reliable transport system is one of the major pre-requisite to the proper planning and implementation of the programme. The existing road, railway and Sea transport transport facilities do not suffice the demand. The availability is sometimes insufficient erratic and unreliable.

Road transport is mainly used to ferry metarials from railway stations or from main stores to the project sites in the remote areas.

Apart from the fact that most roads are bad and that some projects can not be easily reached during net season, most vihecles are always in a breakdown list due to lack of compentent mechanics proper planning spareparts, fuel foreign echange etc. Consequently materials and personel can not reach the sites in time. This causes considerable delays in completing and running of the water schemes. Vihecles are purchased on project by project basis instead of no programme needs basis and no not meet the requirements.

2.1.7. Rehabilitation:

It has been estimated that about 50% of the existing schemes are not in operation. There are several causes to this sad situation. These include deficient operation and maintenace system viz and vis insufficient financial resources, lack of proper trained manpower in quality and quantity; transport, spareparts, involvement of the

beneficiaries use of sophisticated equipment, poor design; [illegible] stardization etc. The recurrent funds provided is not commensurate with the increase of completed projects annually.

For instance the Lake Regions, Mwanza, Mara and Kagera (West Lake), Water Master Plan study carried out in 1978 found out that about 78 million Shillings would be required for rehabilitation of the existing schemes in the three regions as shown below in table 5.

Table 4: Status of existing schemes in Mara, Mwanza and Kagera Regions.

	Mara	Mwanza	Kagera (West Lake)
Number of scheme operating	17	48	47
Under Construction	5	4	10
Others	24	22	24
Design Capacity (in thousand m^3/Year)	2,276	2,220	2,375
Water Deilivered %	59	54	65
Cost of rehabilitation (in thousand Shs)	23,184	27,891	26,797

This is the general feature of the existing schemes in all the Regions. The government is seriously studying causes and ways of overcoming this problem so that the projects completed continue operating as desired. Ways of maintaning the scheme continously in operation include using less sophisticated equipment, training of grass-root technicians to operate the schemes, involving the community participation in running the schemes and by allocating more funds for operation and maintenance and rehabilitation of dilapidated schemes.

3.0. Drilling and Dam Construction:

In order to accelerate the provision of a source of water to the villages the government procured a number of drilling rigs and Earth moving equipment in order to develop both surface and surface water resources.

To date Government has 55 different types of rigs as shown in table 5. It was anticipated that the fast drilling rotary rigs could drill a minimum of 25 boreholes each with an average depth of 100 metres. However the performance has been rather discouraging. The out put is so far between 100 and 150 boreholes annually from all the rigs. The performance ~~per~~ by rotary rigs is less than 20% of their potential capacity. Some of the major factors contributed to this low performance include lack of funds, transport, proper supervision, trained personel, proper planning, coordination, Spareparts, workshop facilities.

Table 5:

Type	Total No.	In Operation	Out of Order
Percussion	17	13	4
Pilcon	11	7	4
Bomag	2	1	1
Tone 750	1	1	-
CME (Auger)	1	1	-
EDECO	2	2	-
FA 12 (Romania)	1	1	-
Schramm	20	14	6
~~Schramm Wagai Project~~			
Total	55	40	15

Further the government has 5 medium size dam construction and 18 small charco construction teams. The medium size team comprise of 2 scrappers of 8 cubic metres capacity and two D.6 bull dozers including the auxillary equipment. The small teams include one D.6 bull dozer a wheel leader two 7 ton tippers and land rover.

Like the drilling equipment the dam construction teams performance is even much lower. The problems are identical to those of drilling activities.

4.0. Community Participation:

Tanzania is committed to the policy Ujamaa and self reliance. The establishment of Ujamaa villages is in line with this political ideology. All villages need to be self sufficient regarding requirements such as water, food and other social and economic development activities.

Thus the involvement of the villages in the development and running of the water supply schemes is a major input to the programme. The achievement in the implementation of the programme would depend upon among other things as mentioned above the participation of beneficiaries through self help.

However in order to have an effective community participation involvement of the authprities concerned at village, District and Regional levels in mobilization and mass education is vital. For this endervour to be successful it is necessary to Institute a proper organisational set up at the village District and Regional levels. For this village, District and Regional Water Supply committees were created. It is hoped that this system will stimulate the community in the programme at all levels.

5.0. Assessment of Water Resources Available:

Tanzania which is situated in the southern hemisphere has an area of 937062 square kilometres out of which 53,483 square kilomitres 5.7% comprise of water. It has common borders with Kenya, Uganda, Rwanda, Burundi, Zaire, Zambia, Malawi and Mozambique. Its borders also touch the Indian Ocean, Lake Nyasa, Lake Tanganyika and Lake Victoria.

The climate is generally tropical with tropical rains, but with considerable variation in Regional climatic conditions from the coastal area to the central plateau. The Central plateau has the lowest presipitation with average annual rainfall of 500 millimetres. There are two difined seasons dry and Wet. Generally the coolest month is between May and July.

The top of Mount Kilimanjaro, the highest in African (5895 metres above sea level) is covered with snow most of the year.

The river system belong to five drainage basins: the Eastern basin which drains into Indian Ocean, the western draining into Lake Tanganyika, and into Altantic Ocean, Lake Nyasa basin, the Inland basin, the Lake Rukwa basin, and the North West basin which drains into Lake Victoria and the Nile into Mediterannean.

It is estimated that Tanzania has an annual surface run off of about 74 billion cubic metres of water draining into the above mentioned basins. It is also estimated that the underground water is available through it is generally saline with high concentration of flourides. Unfortunately these quantities of water were not evenly distributed in each region.

The identification, planning and exploitation of this water resources requires much efforts. In order to meet the urgent the exploitation of water resources has been on adhoc basis. This is both unconomical and time wasting.

The obvious option was to embark on a programme for the assessment of the water resources available in space, time, quantity and quality.

Under this programme Regional Water Master Plans are being prepared in order to assess the available water resources in each region. These regional water master plans will be syntherized to form one national water master plan. Twelve Regional water master plans have been completed. Ground work is in progress for the remaining of the 8 regions. Water master plan unit has been formed to coordinate and standardize the informations and studies.

The government has embarked on the follow-up programme in implementing the water master plan recommendations, in coordination with the donor countries or agencies which assisted in financing the water master plan studies in the same line as the Shinyanga and Lindi/Mtwara programmes.

6.0. International Drinking Water Supply and Sanitation Decade - 1981 - 1991

Tanzania has actively participated in the Habitat Conference in Vancover in May, 1976 and the United Nations Water Conference in Mar del Planta in Argentina in March, 1977. Also Tanzania has attended various Regional meetings and workshops on the implementation of the Habitat and the UN water conference recommendations.

Tanzania is fully committed to the implementation of the Decade which is in fact in line with one National programme. The government is now in the process of the formation of the national action committee which will coordinate all the activities of the Decade. Already the technical sub comittee has been meeting to formulate stratargies. The committee for instance prepared a country report to the Economic and Social Council for the United Nations General Assembly to be convened in November, 1980.

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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

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Rural Water Supply in Thailand

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PREPARATORY AND PLANNING PHASE OF SAFE DRINKING WATER SUPPLY IN RURAL AREA COLLABORATE WITH THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE IN THAILAND

REPORTED BY

MRS DEVARUGSA KRUERKLAI

1. Introduction

In July 1979, the Cabinet of the Royal Thai Government approved Thailand's participation in the International Drinking Water Supply and Sanitation Decade thus accepting the objective of the Decade that ALL PEOPLE OF THAILAND SHOULD HAVE BY THE END OF DECADE (2534 B.E. or 1991) ACCESS TO SAFE DRINKING WATER AND SANITARY EXCRETA DISPOSAL.

Table 1 Phases of the Decade in Thailand

I	the Preparatory and Planning phase	1979 to 1981 (2522 to 2524 B.E.)
II	first half of the Decade (5th Five Year Plan)	1982 to 1986 (2525 to 2529 B.E.)
III	second half of the Decade (6th Five Year Plan)	1987 to 1991 (2530 to 2535 B.E.)

During the Preparatory and Planning phase, which in Thailand covers 1980 and 1981, it is intended to initiate the planning process for each sector and to prepare the implementation.

1.1 The Decade's objective is in effect a health objective.

1.2 It is estimated that during the Decade 80% of the total population will have to be provided with access to safe drinking water and 62% with sanitary excreta disposal. Most of the population to be served inhabits the rural areas and fringes of the urban areas which are rural in character.

1.3 With regard to the water part of the problem it should be remembered that all people already have access to the drinking water sources. These sources are not always conviniently located. The large proportion of these sources are unsafe. This creates a major health problem which must be resolved during the Decade.

1.4 It is considered that during the Preparatory and Planning phase of the Decade in Thailand (1980/1981) the following approaches should be tried and evaluated:

I as the first step, all existing drinking water sources should be identified, then those which are unsafe but which can be made safe should be arranged into a conversion programme, if at all possible on a self-help basis.

II a genuine community participation and self-help.

III in the selection of methods and technologies for the Decade the simplest and least expensive but adequate to achieve the Decade's objective will be given priority.

1.5 It is considered that if these approaches are used the achievement of the Decade's objective in Thailand will be possible.

2. Agencies involved in the Rural Water Supply Project

The responsibility for the rural water supplies in Thailand is shared by a number of organizations.

I. The Accelerated Rural Development Office, ARD, operates in 56 provinces and in the sensitive areas. It constructs:
   a. large diameter tube-wells equipped with hand-pumps
   b. shallow dug-wells, not neccessarily equipped with hand-pumps.

II. The Department of Community Development, DCD, provides funds for self-help water supply projects. The safe water supply programme of the DCD mostly.

III. The Department of Local Administration, DOLA, provides funds for the improvement of water supplies in areas not covered by ARD. These improvements can be implemented by other technical organizations, or by private contractors. Where groundwater is not available it finances the installation of the rain water cisterns.

IV. The Ground Water Division, GWD, of the Department of Mineral Resources constructs large diameter tube-wells which are either equipped with hand-pumps, or with power operated pumps. This is the major large diameter tube-well drilling organization which also conducts the hydrogeological investigations and evaluation.

V. The Provincial Water Supply Division, PWSD, of the Department of Public Works constructs large diameter tube-wells which are either equipped with hand-pumps, or with power operated pumps. The PWSD is responsible for piped water supplies in smaller Sanitary Districts and in large rural communities.

VI. The Provincial Water Works Authority, PWWA, is responsible for the provision of piped water supplies in small Sanitary Districts and in those rural communities which can undertake operation and maintenance of such schemes. There are of present 550 piped water supplies of this type. These receive the technical support of the PWWA.

VII. The Rural Water Supply Division, RWSD, of the Department of Health, DH, is responsible for the construction of dug-wells, small diameter tube-wells equipped with hand-pumps, piped water supplies in communities with less than 2,000 inhabitants and water supply in hospitals and Public Health Institutes.

VIII The Sanitation Division, SD, of the Department of Health, DH, is responsible for safe water supply to schools, wats (temples), religious institutes and health centres. These are small institutional supplies and are normally not used by the general public.

3. Pre-Decade situation

The inhabitants of the rural area in Thailand are still suffering from the lack of the safe drinking water. It is estimated that,at the end of 1979, 30% of the rural population has access to drinking water. Total rural population is 37 mill.(outside municipality area).

3.1 In Thailand, the intensive past activities in the fields of water supply can provide a wealth of experience which can be very useful for the preparation of the decade. Some of these experience are positive, others are negative.

3.2 Number of approaches employed in the past programmes appear to be inappropriate for the achievement of the Decade's objectives. These approaches were relying almost entirely on the Royal Thai Government (RTG), for the decisions what and where to implement, for the implementation and even for the maintenance of the facilities provided.

3.3 In number of cases the technology employed was too sophisticated and inappropriate for the social and economic conditions existing in the rural and in the semi-urban areas. For instance, the RTC financed the construction of sanitary wells by contractors. These wells were equipped with heavy metal hand-pumps which could not be maintained, nor repaired by villagers without special tools and lifting equipment. Because villagers were not participating in the decision making and in the implementation of those schemes they were not interested, or motivated to maintain, or even to use these schemes.

4. Approaches for the Decade

4.1 In spite of the enormity of problems the achievement of the Decade's objectives is possible, but only if certain conditions are fulfilled. These conditions can be summarized as follow:

4.1.1 the population plays a meaningful role in the planning and in taking decision about the selection of the scheme,

4.1.2 the population takes the fullest possible responsibility on a self-help basis, for the development, and operation and maintenance of the scheme, and

4.1.3 the simplest, least expensive technologies, but adequate to achieve the Decade's objective, are employed in the schemes.

4.2 Thus, to achieve the Decade's objectives it is necessary to develop new approaches. These approaches should be based on the fullest possible community participation, where applicable on the self-help, and on the simplest, least expensive but adequate technologies.

4.3 The communication and collaboration with communities should be maintained through village primary health care volunteers and communicators.

4.4 It is recognized that priority will continue to be given during the Decade to the economic development of the country. It is unlikely therefore that any dramatic increase will occure in the allocation of the resources from the national budget of from external sources for the Decade activities. Therefore resources necessary for the implementation of the Decade will have to come from the population. The available budgetary resources will have to be directed towards the planning, motivation, training, management, evaluation and surveillance of the Decade's activities, and to the implementation only in those areas where the population absolutely cannot meet the cost of the scheme.

4.5 The developed drinking water sources will only be considered safe if the testing of safety water is carried out on a regular, routine and continous analysis.

4.6 The objectives of the Decade will only be considered achieved when the epidemiological surveillence will indicate that the employed solutions are effective from the health point of view.

4.7 After the end of the Decade the process of upgrading of the community water supply schemes and of the sanitary facilities with respect to convenience and quality will continue to match the progressing socio-economic development of the communities.

5. Solutions likely to be used during the Decade in Thailand

5.1 In the selection of the safe drinking water supply and sanitary excreta disposal solutions for a given community, or any part of it, the following basic criteria shall be used.

That solution shall be accepted which:

I. is the simplest, least expensive but adequate to achieve the Decade's objective.

II allows where at all possible the implementation on a self-help basis, or other form of community participation, and

III employs appropriate technology which will permit the community to maintain and to repair the scheme.

5.2 This approach means that a more sophisticated solution would only be considered when a simpler and less expensive adequate solution is not possible.

5.3 Thus, at the end of the Decade at the end of the employed solutions there will exist very simple schemes and at another end quite sophisticated scheme. However, these schemes will have one thing in common, all the people will have access to safe drinking water and all the families will have their own sanitary excreta disposal facilities.

6. Community Participation

One of the major concerns of the Rural Water Supply Project is to ensure the fullest possible community participation in all steps of the development of schemes and later on in the operation and maintenance of these schemes.

6.1 The genuine involvement of villagers achieved in the pilot project, created a sense of pride of ownership. The villagers were involved in taking the decision to implement the scheme, and in the implementation by contributing all the necessary materials and labour. This results is the willingness to maintain the scheme in operation.

7. Appropriate Technology

We have to try on a large pilot project scale various simple technologies. This is being undertaken in collaboration with the major national universities.

The genuine community participation and the appropriate technology are inseparately.

Planning for the Decade in Thailand is expected to become a planning process which will extend throughout the decade and beyond.

The planning work is undertaken by the organizaion responsible for the sub-sectors and is co-ordinated by the National Economic and Social Development Board, NESDB. The NESDB is the national focal point in Thailand for the Decade.

United Nations
Department of Technical
Co-operation for Development

Swedish International
Development Authority
Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in Thailand

S. Pissathanporn, Department of Rural
Water Supply, Provincial Water Works
Authority

Rural Water Supply in Thailand

By S. Pissathanporn,
Department of Rural Water Supply,
Provincial Water Works Authority.

I Water resources

Thailand is situated in Southest Asia in the tropical Zone between latitude 5° 37' N, 20° 27' N and longtitude 97° 22' E, 105° 37' E. Generally, the weather is wet and dry. In the South, the yearly temperature is rather inflexible ranging about 27 - 28° C, whereas, the flexibility temperature in the North and Northeast varies a lot in summer and winter. The average temperature in Bangkok during the hot season climbs up to 30° d and falls down to 26° d in winter. The average yearly rainfall intensity is 1,837 mm.

There are eight main rivers passing through the Northern areas of the country, five one flowing over the Central areas, four ones in the West, four ones in the Northeast and four ones in the South.

Mostly ground water sources gather from a number of intensified rainfall and penetrate to storage in the underground layer, some emerge from river basins sources. In accordance with their nature and characteristic measurements, the ground water sources can be classified into 2 types; that is, one found in the layer of unconsolidated rocks covering about 80 percent of the overall areas of the country, and the other in the layer of consolidated rocks spreading over the remaining areas. Each deep-well dug from the unconsolidated rocks yield water of approximation 5 to 10 cubicmeters per hour, rarely found rise up to 100 cubicmeters per hour. One dug from the consolidated rocks supply water of about 20 to 450 cubicmeters per hour.

II Water development and environment

In 1961, The Thai Government drew up a preliminary 15 year plan for the development of piped water supplies in 412 communities of rural Thailand, and requested the help of a U.S. consultant. The Potable Water Project, which started in 1962, and has also been regarded as part of the Mission's Public Health Support Program in Thailand, is an outgrowth of this initial request with adjustment to focus more on the politically sensitive areas of the Northeast. The Potable Water Project was originally designed to build 250 piped systems reaching 600 villages

II.....with a.....

with a combined population of 600,000 to 1,000,000 by 1971 and assist the Sanitary Engineering Division of the Ministry of Public Health to develop the capacity to plan,design,construct and maintain a network of potable water systems.However the actual output of projects fell short of the goal although it is difficult to determine accurately the total number of plants built with AID funding.There were in addition over $ 600,000 of AID financed project commodities that had not yet been installed at the end of the Project.These consisted of diesel engines,water pumps with electric motors,and water pumps with gasoline engines.In the period between project termination in 1971 and the year 1979 approximately 400 systems have been completed.There are presently more than 600 piped water systems in rural areas (settlement of less than 5,000 population)and an additional 191 systems serving communities of over 5,000 population.Most of these were designed and constructed under the direction of the Rural Water Supply Division.(Presently named as Rural Water Supply Department,Provincial Water Works Authority).

In the next 10 years,the Provincial Water Works Authority plans to build up about 450 systems covering the Sanitary Districts areas and in big communities with population approximation 1,500 to 5,000.

The ample supply of water facilitates a more hygienic household enviroment. No negative impact is apparent.

III Water and living conditions

The Project's goals have been focused on health status improvement through the provision of potable water,with the intention of

a) improving water sources
b) better nutrition
c) increasing the usage of water seal privies as a result of easier availability of water.
d) increasing quantities of water for sanitary practice.

The Potable Water Project reinforces participation in the village-level organization,especially the village committee who will apparently demonstrate the concern of the Government for the villager's welfare.

III.....IV Water.....

IV Technologies

The installation of a village water system has been planned to proceed as follows;

- The initiative for obtaining a potable water system must start with the villagers themselves or the local authority.

- Villages selected are to:

a) have an exishing but not potable source water;

b) be readily accessible by road;

c) have a high interest in obtaining a potable water system as indicated by a willingness to assist in construction;and

d) be willing to develop a rate structure which will be paid for the operation and maintenance costs as well as provide for future expansion.

- Once the village is selected,a reconnaissance report is made,including information,such as: water sources,population to be served,village contribution and power availability.

- A site survey is made

- Based on the reconnaissance survey and site survey,standard plans and specifications developed are assembled and sent for advertising for bids.

- Following the receipt of bids and award of a construction,contract to the lowest responsible bidder,the plant is constructed under the supervision of a construction technician.

- When the construction of a water treatment plant is completed,the plant and water system are turned over to the local government,in turn,can and usually does delegate authority to the district Officer or village chief or,where applicable, to the Sanitary District to operate and maintain the system.

- Meanwhile,training is provided for a water treatment plant operator who will be responsible for the proper opration of the system.

- Following completion and formal transfer of the system to the local government authorities,the engineers will visit the plant to give the operator follow-up instruction and to insure that the plant is operating properly.

IV.....-Further.....

- Further follow-up advice and inspection are given by the engineers as necessary and to the extent possible.

The systems are sophisticated pipe water systems using both surface and ground water.All systems included chlorination of water prior to distribution although a few of the communities have discontinued this practice.The systems are built to U.S.design criteria established by the American Water Workers Association.

Social and Economic Aspects

Originally,most of the systems provided community-wide access to the water through public taps.Under this condition virtually all socio-economic groups benefitted more or less equally.The schedule for collecting revenue from the public taps was in most communities,a flat fee per household or person. Most communities failed,however,to pay the full fees.As a result,systems almost universally changed to metered private connections and most systems closed all public taps.This has generally meant that those who did not install meters are no longer served.

Many systems are completely economically self-sufficient with users paying the full cost of maintenance and operation through fees collected for water delivered.It was impossible to determine whether other systems are self-sufficient. All systems,however,....whether self-sufficient or not...are being supported by general revenues if not by specific fees for water used.Water costs vary from two to five baht per cubicmeter which is higher than presently charged in Bangkok,but is acceptable to users of the systems.The fact that the Central Government has established an authority with wide powers....(PWWA)....indicates a high level of commitment that should assure even greater fiscal stability.Users regard the system with esteem as indicated by their willingness to make the high initial investment for the private connection as well as the continuing monthly charges.All praised the systems for the great convenience they provide.

The assumption is that villagers,once provided with potable water, will of course drink it.This do not always happen.The acceptability of water from the piped system varies from region to region.Some villagers do not drink

V.....the chlorinated...

the chlorinated water provided by the piped system.Among a large proportion of villagers,however,domestically....collected rainwater remains the first preference for drinking while many other villagers still fetch water for drinking from a traditional source,the shallow well.Villagers report have had beneficial health impacts,including decreased skin diseases and diarrhea.Sanitary practices facilitated by greater availability of water include bathing,washing of clothes,washing of utensils,washing of food before consumption,use of water-sealed privies,and improved infant and child care.

Women and children are the main bearers of water in Thailand.In those households now served by piped water,women and children now have extra time which is generally used for activities,such as,weaving and gardening etc. that either generate income or raise the household subsitence level.

Planning

This paper is prepared and written in collaboration with the Central Government Organizations involved in water supply and sanitation sectors,perhaps does not reflect adequately the determined policy of the Roval Thai Government which states that the local authorities and the rural communities will be increasingly taking over the responsibility for planning,implementation,operation and maintinanec of schemes.This policy foresees the increasing participation of the specialist Central Government Agencies in these activities in a role of the technical collaborators of the local authorities and communities.

The financial participation of the population is considered essential for the achievement of the Decade's objectives.It is realized that to the very important fiscal consideration.Such participation will ensure that the proposed scheme fills the local need,because it is inlikely that people will put their own money into a scheme which does not meet their requirment and priorities.

Planning for the decaed in Thailand is expected to become a planning process which will extend throughout the Decade,and beyond.

VI.....The Planning....

The planning work is undertaken by the organizations responsible for the sub-sectors and is coordinated by the National Economic and Social Development Board,NESDB.The NESDB is the national focal point in Thailand for the Decade.

The planning process will generate the implementation programme for each sub-sector for two-five year development plans as follows:

1 st half of the Decade - 5 th Five - Year Plan 1982-1986 (2525-2529 B.E)

2 nd half of the Decade - 6 th Five - Year Plan 1978-1991 (2530-2534 B.E)

The planning process will also formulate detailed project proposals.

During the preparatory and Planning Phase,which in Thailand covers 1980 and 1981,it is intended to initiate the planning process for each sector and to prepare the implementation programmes for the 5 th Five - Year Plan, 1982 - 1986, and to formulate detailed project proposals for at least the first year of the 5 th Five - Year Plan,i-e.,1982.

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United Nations
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INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in People's Democratic Republic of Yemen

S. A-R Ba-Abbad, Public Water Corporation

RURAL WATER SUPPLY SCHEME IN P.D.R.Y., BY S.A. BA-ABBAD

The People's Democratic Republic of Yemen PDRY is in the South West Coast of the Arabian Peninsula, occupying an area of about 337 000 km with its present population of 1,909,000 approx (in accordance with the census of the year 1973 it was 1,590,000) distributed as follows:

33% urban

57% rural

10% nomadic and seminomadic

The country is one of the least developed countries and its availibility of water resources is poor in comparison with other countries in region. It has neither rivers, nor big lakes upon which it can rely. However if we take into consideration some natural springs and streams that are scattered, they are of limited effectiveness. Moreover the country's seasonal rains which are scarses average 50 mm in the coastal areas and 300 mm in the interior upperland, in the Northern areas as well as in desert area, rains are nearly nonexistant.

Flood are considered to be the basic resource for the country's limited irrigation which forms 1% of the total area of the Republic. The drinking water is dependent upon open wells which the country has traditionally known from the ancient times. Although, recently in the large thickly populated towns few tube wells meet the daily drinking water requirements.

The Present Situation in Rural Areas

Until the day of Independence 30th Nov 1967, there were no associations or central bodies which deal with the water affairs and regularise there utility both for agricultural and drinking purposes. Hence, the available flood water goes away in vain and very little use is made for agriculture. Rain falls,also go in vain but comparativelly they are better.

For this reasons, need has arisen for the adoption of the Planning system not in the sector of water but in all economic and social sectors where all available resources and possibilities may be accomulated in order to accomplish the requisite development.

The actual planning for the drinking water particularly for Rural areas began in 1970 as in that year a water decree No 19 was enacted for the establishment of the Public Water Corporation to be as an independent Corporation both financially and Administratively responsible for drinking waters through out the Republic. Its objectives as stated in the Decree are as follows:

1. Regular and sufficient supply of fresh potable water within the available resources to all inhabitants of the urban and rural parts of the Republic.

2. To ensure the potability of the water and its proper and Hygienic way of storage.

3. Development of potable water schemes in the Republic so that the citizen may obtain his need of water at a favourable and reasonable rate.

4. Participation in the General Development Plan by making available water suitable for industrial schemes on commercial basis.

a. To commence with its function in accordance with the terms of reference referred to in the decree as is stated above, the Public Water Corporation Aden face several great difficulties above which is the country's severe backwardness both economically and socially. No hydrogeological studies existing to define the whereabout of sites and capacity of the underground water reservoirs, there are no data informations and statistics showing human and animal numbers (population) and demography and the rains and flood measures are scantly kept in records. However, with the above obstacles in hand as well as the shortage of staff and labourers and with limited possibilities PWC was able to accomplish many matters during the years 70-78. The PWC, Aden has undertaken the study, planning developing and execution of about 36 water supply schemes inside several districts of the Republic costing a total of YD £ 2,6 millions(about USA 7 millions) which represents a very big amount. The number of population who benefitted from these water supply schemes up to the year is 710,000 person of whom 21,9% are the Rural and Nomad (beduin) people.

b. <u>The spheres and Goals for Development</u>

The Republic throught the Public Water Corporation, nowadays carries out a comprehensive survey of all means of water supply and its quality and quantity as well as the means of reservation at its different and various levels through out the Republic districts. This comprehensive survey is about to be completed and its results and data informations will be conveyed soon. WHO, UNICEF, ECWA and other UN Organizations with a view to participate in the rendering of aid take part in the preparation of the U.N.O Programme to make drinking water reach every village in accordance with the resolutions and recommendations by UN Water Conference held in the Argentines in 1977.

The preliminary results of the a/m exist survey of the PDRY have indicated that in the country there more than 200 water supply schemes of which 40% are considered to be major schemes which may benefit more than 1000 person. Such major schemes are under the auspice and supervision of PWC HQ Aden. The remaining 60% are very minor schemes running by private individuals companies or co-operative societies and the beneficients of their water generally do not exceed 100 persons at the minimum. These schemes are operating in villages and in some towns but sometimes more than one schemes

in the single town or village can be found for example the Seiyun town where there are more than ten private privates interprises water supply schemes that supply dwellings.

On the light of this result the PWC Aden is preparing its plans and schedules of schemes along with the General Master Plan of the country's Economic and Social development (1981-85) whereby it will give priority to the completion of water supply schemes.

As a matter of fact the Rural Nomadic area inhabitants constitute a large percentage e.g. 67% of the countrys total population, of this percentage 21.9% gets drinking water by means of Public Water Centres, while the others get it from open wells streams or springs and sometimes through flood bed pools ENANKED KARIEFS which are generally full of germs and bacteria, yet such water quantities in some of these areas are not adequate and the people have to obtain more water from far distances (several times) usually women handle this job either on their back or on the backs of animals.

c. From our observation Rural Water Supply operated by individual companies or persons are very small in their category. They are also unable to function satisfactorily due to shortage of funds, skilled manpower in the area, poor organisation and management.

In view of the above difficulties some of the Water Companies stopped functioning and the Government has taken the whole responsibility in order to keep the system alive, in a modified and proper manner. Consequently, the state has to initiate a permanent long term policy for the Water Supply continued services for all inhabitants.

The aim of the policy should fullfil the following:

(1) Giving more priority to the water supply development schemes than to other development projects.

(2) In the case of limited water resources preference is given to drinking water supply.

(3) Emphasis must be given to the necessity of improving water supply in the PDRY in the National Health Program.

(4) In the Design and implementation of water urban water supply projects due allowance is made to provide water to the distant villages at standpost.

(5) In selecting water projects priority must be given to projects where the necessity for water supply is greatest and not on economical or cost considerations and central Gov or local Municipalities subsidize water supply schemes.

(6) It is essential to create a training programme for PWC staff at all levels to enable them to manage the water supply schemes so that they may not be subjected to stopping due to the maladministration and inferior maintenance.

While undergoing the planning and execution the rural water supply schemes in our country we have experienced many difficulties which are:

(a) Shortage of geological and hydrological studies from which we can detect the exact position of the water resources sites their quantities and qualities.

(b) Lack of entire and partial data on which we can draw out the basic demography about the expansion of population settlements industries livestock and other animals.

This factor has lead to the improper planning of these schemes and hence they appeared to be incomplete and very costly.

(c) Lack of staff not obly those to handle the planning and execution but also those who can operate the executed schemes with a reasonable qualification.

(d) Lack of the necessary financial allocations to establish and develop new schemes and the present operating schemes specially the privately owned ones since most of them are about the face bankrupcy. The schemes which are run by PWC and the Municipality are getting the support of the Government.

We believe that if solution are made to overcome the above mentioned difficulties the PWC Aden would be in position to safeguard upgrade and develop them in the interest of a great number of PDRY citizen.

Taking this opportunity we consider it useful that the International Organizations concerned whether those of the United Nations or relative Organization as well as Advance Countries Government should play a great role in offering assistances to the developing countries of whom the PDRY is one, either in the form of material assistances by way of long term loans of limited rate of interest, grants or financial aids or in the method of providing advisers & experts to draw out the planning & participate in the execution of such water supply schemes and in the training so that the PWC may transmit the connect water to most of the villages if not to all inaccordance with UN Water Conference which was held in Mar Del Plate in Argentines in 77 in view of the hard situation which dominates all the financial, social and technical sides in this country.

United Nations
Department of Technical
Co-operation for Development

Swedish International
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Uppsala University

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY

Uppsala, 5 - 17 October 1980

Rural Water Supply in the Republic of Zambia

P.A. Zulu, Department of Water Affairs, Ministry of Agriculture and Water Development

INTERREGIONAL SEMINAR ON RURAL WATER SUPPLY, UPPSALA 6-16 Oct 1980.
WATER AND LIVING CONDITIONS. HEALTH ASPECTS OF WATER DEVELOPMENT.

The Department of Water Affairs in the Eastern Province of the Republic of Zambia is responsible for construction and maintenance of most rural Water Supplies in the entire Province.

The duty of providing water to the people calls for absolute carefulness in ensuring that clean water is always available for the people. The Department runs rural township water schemes, i.e. Nyimba, Petauke, Chipata, Katete, Chadiza, Lundazi and Chama. The Department has also constructed Dams, weirs boreholes and wells for people of different walks of life.

There are four townships whose water comes from Dams. These are

a) Chipata - Lutembwe Dam
b) Lundazi - Lundazi Dam
c) Nyimba - Chikuyu Dam
d) Chadiza

The rest of the townships are supplied by borehole Water. Water from these Dams is not safe for human consumption. Therefore it must be treated before it is supplied to the people.

If for example we take Chipata which is the biggest rural township in the Eastern Province, we find that there is a lot of development around the dam and also there are a lot of peasant farmers close to the banks of the Lutembwe river up to the source of the river. The result is that water is contaminated by the effluent which comes from these inhabited places. This is a most unfortunate development which should have been avoided by the respective authorities. This pollution problem has prompted the Department to intensify its water treatment processes.

The Lutembwe Water Works treatment plant was commissioned in 1970 and has a capacity of treating about 40,000 gallons per hour. The raw water comes from the Dam by gravity into the treatment plant. It then goes into the sedimentation tank after aluminium sulphate has been added before the clearer water goes for filtration through slow sand filters. The clean water then goes to the Chambers in the clear water Wells where liquid chlorine is added by using a chlorinator before it is pumped by two high lift pumps to a distance of about five kilometers into the high level tank ready for distribution to wherever it is required.

The supply of Water at the above plant has its own problems. The following are some of them.

(1) The chlorinators sometimes do not function properly. This is evident when Chlorine residual tests are taken at the different points. At certain times amount of chlorine dissolved in the water is excessive. This may affect the health of the people using this water. The opposite is also true at certain times these chlorinators supply inadequate guantities of chlorine which may not completely exterminate the bacterial organisms which bring disease to man.

These complicated machinery are serviced by experts who stay in large cities, many kilometers from Chipata e.g. Ndola about 1000 km away. In case of a breakdown in the chlorinator, Powdered or granular chlorine is used, but at one time it was not available in the country and as such water was not properly treated at all, because bacterial were still in the water.

(2) Liquid and granular chlorine are very difficult to obtain due to dealers who always insist on paying cash before delivery and this results in the unnecessary delay in the aquisition of these materials since government transactions are very complicated before a cheque for payment can be issued.

(3) Most of the parts at Lutembwe Water Works have been modified due to oversight on the availability of spares, e.g. the rubber wheels which turn the clariffloculator (sedimentation process) could not march with the original ones which were worn out and had to be obtained from Kitwe but they could not fit until modifications were made.

The prices of the Chemicals i.e. Chlorine, powdered and liquid, Aluminium sulphate or alum are always on the increase and limited amounts can only be bought as funds are released quaterly and if the allocation is exhausted no more funds can be given until the three months elapses. This poses a challenge to the consumer as water tarrifs are likely to be raised up again. e.g. the Minimum consumption charge for Water was K5.40 in 1978 and it has risen to K6.40 in 1980.

(4) It is observed that certain high level storage tanks are not regulary cleaned and steralised. This was evident when on certain days coloured water which looks brownish comes off the taps, but when the tanks were cleaned water become clear again.

(5) Burst pipes are usually witnessed when certain portions of old galvanised iron rusts and gives way to a burst. These are easily noticed by dampness at certain points on the pipe line, but may not be easy to identify under buildings where they pass through thick vegetation.

When burst pipes occur, for workers to repair, the gate valves are closed. During this period water in the pipe may be contaminated by storm water carrying a lot of debris through the burst part of the pipe.

The only remedy to burst pipes may be the regular replacement of pipes, but this goes along with the availability of funds which are in very short supply.

The smaller townships e.g. Katete and Petauke use boreholes for their water supply. This water requires very little treatment only chlorine is added in the high level storage tanks. Here granular chlorine is added. Apart from mechanical break downs very little can go wrong in the supply of clean water to the people.

In Petauke a certain number of School Children suffered from desentry. The immediate suspect was water supply, but it was later found that the cause was the contaminated food supply.

The boreholes and wells which are provided to certain villages are only checked for water analysis after completion. When a borehole is completed, a water sample is taken for analysis for physical and chemical test. These are not done in the province but, the samples are taken to Lusaka 600 km away since there are no facilities for analysing the samples locally. Bacterial analysis are only done where water is suspected to have been contaminated by either sewage disposal or industrial effluent. From the above it is noted that transport should be made available to send these samples for analysis some 600 km away and back. Transport is not available all the time, therefore these samples are not taken immediately and due to chemical change the results obtained can not be relied upon.

The example attached on St. Monicas secondary school shows an excessive amount of lead in the water, but there are boreholes within 90 meters which show no evidence of any lead.

Occasional analysis on the existing boreholes is not done mainly due to the following:

(a) Shortage of Personnel.
(b) Lack of transport to collect these samples from most boreholes regulary.
(c) No local laboratory facilities exist to enable the local officers to carry out tests.
(d) No trained man power are available do the tests locally.

At the moment water samples for analysis are collected by drillers and in case of wells the workers at the site collect the sample after complection of the well.

It is important to note that due to movement of underground water the borehole which was completed and water samples were analysed and found fit may be polluted due to movement of organic or chemical subtance from one place to another. This may be the case of St Monica Secondary School where original samples showed no signs of pollution but recently we found that the water was contaminated by an excessive amount of lead which makes the water unfit for human consumption.

N.B. See attached appendix I.

Bacteriological analysis are only done when the source of water is suspected to be polluted as already mentioned. In this case the example on attached appendix II shows us a water supply analysis result which is unfit for human consumption. This is water which was taken from a place near Chipata and this water was being used for human consumption. The people concerned were alerted and it was found that they had run short of Chlorine to treat this water. Their problem was lack of transport to bring chlorine from a place called Livingstone about 1000 kilometers away. Also when transport was made available for them to collect these chemicals it was found that the firm had nothing in stock. This was the only place where they could collect chemicals from. This poses a great danger to the lives of the people who are quite innocent, for an epidemic can easily spread and a lot of people would die.

In Zambia chlorine can be purchased from a few places but in most cases it is not available at the time it is needed. The sellers who are private companies always stick to strictly cash terms which is not possible for the Department of Water Affairs to raise the cash as government transactions are carried out on what are called Local purchase Orders. This evidently results in the delay of purchasing the materials and complicated and long processes of accounting procedures have to be done before the purchasing of these chemicals can be done.

In certain parts of the province we find that after a borehole is drilled the water analysis results show the presence of saline water. This is illustrated in appendix III. Chichele Lodge is in the game park and this building is unique for it carters for tourists from different parts of the world. When these tourists taste this water they definately are discouraged to stay longer at the lodge and move to another lodge at Mfuwe where the water is fresh. If Mfuwe is fully booked they make quick arrangements to return back to their respective places because they can not drink this saline water. These results in the loss of revenue for the government and there is no attraction for more tourists to visit this particular game park.

In this area any borehole drilled has saline water. This lodge was not properly planned as it was first built before the water qualities were investigated. The lodge could have been constructed elsewhere, with an abundant supply of fresh water.

These are some of the problems that we are confronting to supply adequate and fresh water to the masses. Most of them are caused by lack of proper planning as the case above illustrates.

P.A. Zulu

Z A M B I A

APPENDIX I.

/COPY/

HYLO 1/3/5

DEPARTMENT OF WATER AFFAIRS

Office of the Chief Water Engineer,
Data and Planning Division,
P.O. Box 530,
LUSAKA.

29th January, 179.

The Regional Hydrological Officer,
Water Development Department,
P.O. Box 94,
CHIPATA.

Attention: Mr. S.C. Chokan:

RE: WATER SAMPLE FROM ST.MONICA'S

Dear Sir,

The following are the physical and chemical analysis results of the sample, reference No B/H No 99 (31-42)78 from the above source received on the 9/1/79.

pH	8.2
Appearance	Milky
Turbidity	38 NTU
Conductivity	55 Ohms
Total dissolved solids	150 p.p.m.
Total suspended solids	221 p.p.m.
M.O. Aikalinity	25 p.p.m.
Total Hardness	15 p.p.m.
Sodium	11 p.p.m.
Potssium	4 p.p.m.
Nickel	Nil
Calcium	4.2 p.p.m.
Copper	Nil
Cadmium	Nil
Manganese	0.4 p.p.m.
Magnesium	5.0.p.p.m.
Lead	0.5.p.p.m.
Iron	Nil
Zinc	0.4 p.p.m.
Chloride	12.92 p.p.m.
Sulphate	7.04 p.p.m.

REMARKS: The amount of lead is excessive and turbidity is above permissible due to dissolved and suspended solids.

Please try to clean the Bore-hole and send a sample again for another analysis. N.B. In futre try to use correct sampling bottles and NOT whisky bottles if good results are to be obtained.

Yours faithfully,

(SND)
S.D. TEMBO
(C H E M I S T)

/COPY/

APPENDIX II

DP/Hydro/2

DEPARTMENT OF WATER AFFAIRS,

Office of the Chief Water Engineer,
Data and Planning Division,
P.O. Box 530,
LUSAKA.

24th January, 1980.

The Provincial Water Engineer,
Box 94,
CHIPATA.

Dear Sir,

I hereby forward to you the chemical and Bacteriological results for the water samples received from Chipata General Hospital on 7th January, 1980,

BACTERIOLOGICAL ANALYSIS

Colony counts

REFERENCE	AT 37°c	MPN Coliform	MPNE Coliform
FAS/DSP/2/50	1080/ml	None	None
FAS/DSP/1/50	73, 000/ml	93/100ml	43/100ml
FAS/DSP/4/50	5/ml	None	None
FAS/DSP/3/50	1280/ml	None	None

REMARKS:

Water sample FAS/DSP/1/50 showed pathogens positive. The water is unfit for human consumption.

Yours faithfully,

(SND)

LEVY MWITWA
for/CHIMIST.

.B. Attached is the chemical analysis results for Chipata Hospital (Kitchen).

kh.

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/COPY/ APPENDIX III DP/SIL/S/2.

DEPARTMENT OF WATER AFFAIRS

Office of the Chief Water Engineer,
Data and Planning Division,
P.O. Box 530
LUSAKA.

21st August, 1979.

RE: WATER SAMPLE FROM: CHICHELE LODGE.

SAMPLE DATE: 24/5/79

Reference:	R151
Appearance:	Not clear
Ph	8.9
M.O. Alkalinity (mg/1)	150
Total Hardness (mg/1)	142
Total Dissolved Solids (mg/1)	1600
Total Suspended Solids (mg/1)	6.9
Phosphate (mg/1)	1.2
Turbidity (j.J.U.)	N/D
Conductivity (Ohms)	N/D
Nitrate (mg/1)	0.3
Sulphate (mg/1)	875
Aluminium (mg/1)	Nil
Calcium (mg/1)	79.7
Chloride (mg/1)	462.0
Chromium (mg/1)	Nil
Copper (mg/1)	Nil
Cobalt (mg/1)	Nil
Iron (mg)1)	Nil
Lead (mg/1)	Nil
Magnesium (mg/1)	12.8
Manganese (mg/1)	Nil
Nickel (mg/1)	Nil
Potassium (mg/1)	10.2
Zinc (mg/1)	Nil
Solium (mg/1)	5.2
Cadmium (mg/1)	Nil

Remarks: There is too much Chloride, Sulphate and the Water is hard. Try to soften the water and send a follow up sample for analysis.

(SND)
S.D. TEMBO
CHEMIST

Interreginal Seminar on
Rural Water Supply
Uppsala University

Working Document
Country Thematic Paper Session
8 October 1980

SHORT SUMMARY ON COUNTRY THEMATIC PAPERS

AGGREGATED DATA ABOUT COUNTRIES COVERED

Country	Popul mill	Runoff mm/yr	Per capita vailability m^3/p yr 1971	2000 calc
China	900	1-1000	3800	2700
Papua New Guinea	3	1000-3000	No data	
Zambia	6	20-200	22300	8500
Bolivia	6	20-500	60800	28700

1. EXPERIENCES OF GROUNDWATER SEARCHING IN SOME DEFICIENT AREAS OF CHINA (Fei Jin)

The paper is a comprehensive report on rock ground water exploration in different water-scarce parts of China. Many professional hydrogeological teams were involved for the geological work, benefitting from participating masses of people for the water supply installations. Geomechanical principles were applied in the North in looking for the best water bearing structures in the bed rock formations. The studies aimed at a better understanding of structural fractures, tectonic systems, composite relationships between structures, and analysis of different mechanic properties of rock formations in the searching for structural fissure water. Several cases are reported from the hilly areas of N China, where fissure groundwater was available in quantities large enough to satisfy not only community water supply but also irrigation schemes. In the karst areas in Southwest, groundwater exploration is a question of studying the formation and characteristics and developing methods of searching the subsurface groundwater flows which is concentrated into trunks and branches of what may be looked at as underground rivers.The work includes surface reconnaissance, deep-cave survey, pumping tests, observations of groundwater regime and karst-cave connecting tests, The studies revealed interesting relations between surface water and ground water in some cases. In the flood seasons, groundwater level is high and the underground rivers overflow into the main streams, whereas during dry seasons the flow goes in the opposite direction. Reconnaissance includes inventory of the so-called top-windows or skylights, that create the hydraulic connections between the underground water and surface water systems. In recent years, hundreds and thousands of underground rivers have been found, and ample amounts of groundwater made available for water supply for domestic use and farm irrigation.

2. WATER AND LIVING CONDITIONS IN PAPUA NEW GUINEA (U. Oti)

The country has tropical humid climate with very high precipitation (2000 - 5000 mm/yr). It includes not only the eastern half of mainland New Guinea, but also numerous islands. National policy includes decentralization in order to encourage people to stay in the villages. Water supply development is therefore an important tool in fulfilling these aims. The water supply problems differ considerably between different main living forms. Traditional villages contain most of the population (77%), but are scattered with many houses situated on ridge tops and on islands. This creates special difficulties from the point of view of water supply. Village supplies consist of hand-pumpoperated shallow wells or simple diversions from surface waters and springs. The water is often polluted, causing high frequency of water-related diseases. People do not yet understand the value of good quality water. Therefore no treatment can be provided due to lack of operational and maintenance capacity. Medium size population centres cover 6% of the population and are typically supplied with surface water with simple treatment, although lack of local staff for operation created special problems. Collection of rainwater from roofs is also common. Urban centres and townships cover 17% of the population and are served from fully treated water supply from surface water or groundwater aquifers. Main constraints creating problems with adequate water quality are financial restrictions, staff shortage (including water staff teachers), and lack of a central water authority. Legislation is needed, authorising a central authority to set standards and secure external funding.

3. WATER AND LIVING CONDITIONS. HEALTH ASPECTS OF WATER DEVELOPMENT (in Zambia) (P A Zulu)

This paper reports about water quality problems in the water systems for a number of rural townships in the Eastern Province of Zambia, some of them based on surface water from dams, others on borehole water. Most of the problems are caused by lack of proper planning. In the dams water easily gets contaminated from settlements on the banks and from effluents from inhabitated places, which creates need for water treatment. Numerous problems are however reported in this respect, including malfunctioning of chlorinators, delivery problems for chlorine and for spare parts to the equipment. Borehole-supplied systems creates less water quality difficulties. Nevertheless three cases are reported where the groundwater had been locally polluted or was of inferiour quality from a drinking water aspect: lead pollution in the water supply of a secondary school, bacteriological pollution of a hospital water due to chlorine delivery interruptions, and problems of saline groundwater in a game park, otherwise attractive for tourism.

4. BOLIVIAN HIGH PLAIN BASIN (J Lizarazu Valdivia)

The paper reports on the groundwater resources of the Northern and Central parts of the Bolivian High Plain on which water supply for communities, industries as well as agriculture in the area, is to be based. The plain is a rather dry part of the country with low groundwater recharge and surrounded by mountain ridges. All rivers flow toward the Titicaca lake and Poopo lake. In the Northern Plateau Basin snow melting is an important source for groundwater recharge. The groundwater discharges in numerous springs, most of the water being lost by evapotranspiration. The central part of the subbasin can be exploited with wells 50-100 m deep. Most of the aquifers are under confined or semiconfined conditions. The paper gives details about the groundwater quality in five hydrochemically different subbasins. Two of these basins have good quality water, suitable for drinking water purposes. The Central High Plain covers the vicinities of Oruro city. The aquifers described are found in quatenary sediments under confined, semiconfined and phreatic conditions. Only in some parts of the area is the groundwater quality suitable for drinking water purposes. In other parts, the mineralization is high or the water polluted from neighbouring mines.

Interregional Seminar on
Rural Water Supply
Uppsala 6-16 October, 1980

Working document
Country Thematic Paper session
13 October 1980

Malin Falkenmark

AGGREGATED DATA ABOUT COUNTRIES COVERED

Country	Pop mill	Runoff MM/yr (order of magnitude)	Per capita availability m^3 / p.yr 1971	2 000
Indonesia	140	50-3000	13 000	6 700
Papua New Guinea	3	1000-3000	no data	
Nigeria	80	20-1000	4 700	2 400
Cuba	9,8 (1980)	200-500	3 100	1 800

1. RURAL WATER SUPPLY IN INDONESIA (W Widodo)

The paper reports on the rural water development progress and philosophy in Indonesia. The objectives of the Third 5-year National Development Plan is to provide safe water to another 6,7 million rural people in order to arrive at 27,3 Mp being served in 1984. Three Ministries are involved: Ministry of Health for planning and financing, Ministry of Interior for implementation, and Ministry of Public Works for design and construction. Five types of supply facilities are used: rainwater collectors, protected spring water, artesian wells, protected wells, and piped systems, either small with untreated water, or larger with complex treatment facilities to serve populations of 50 000 or more. The first four of these types are seen as interimistic measures, representing the appropriate technology to rely upon for several years before increasing emphasis may be placed on piped systems. The most important constraints are lack of skilled manpower and resistance at the local level, the population not completely understanding the principle of flow in pipes, storage needs, pump and motor selection etc. Training programs have therefore to be directed also to the general public in order not only to accept the piped water systems but also to maintain and make proper use of them. Water quality control has up to now received only minimum attention: sources chosen have to meet existing national quality standards but routine analysis is not required after installation.

2. THEMATIC PAPER ON RURAL WATER SUPPLIES IN PAPUA NEW GUINEA (M P Matango)

This paper complements the paper presented by Mr Oti (8 Oct) and concentrates on health aspects. The present situation is characterized by high incidence of water-borne diseases. Sanitation in rural areas is poor with people in some areas defecating into the streams. In most rural communities people do not realize the need for safe water. Some headway for development of safe water supplies has been taken in seven provinces

where selected health centers and community schools have been supplied for demonstrating purposes. Response has been registered in the form of demand from villagers for water supplies. During the last 20 years, many water supply installations in villages have been subject to failures after short time, the main reason being that the supply had been "given" to the community, placing a burden on it to provide a person to maintain the system and to pay for the repairs and running costs. In other cases, installations may be operable but they are not used because the sources is considered unsafe due to some custom or to the belief that the water is from a sacred site. Therefore it has been found that people themselves should be the ones to initiate projects. In other words, in the provision of rural water supplies, focus should be placed on local planning rather than on central planning. The general strategy at present is to provide water that is naturally safe, as treatment facilities for proper operation and chlorine application depend upon skills rarely available in rural areas. Springs and dug wells are therefore the main sources used, and the water is made available by simple suction handpumps or hydraulic rams mostly commercial at present but increasingly using home developed designs fabricated from pipe fittings. As a first step towards proper planning and administration, the government recently approved the setting up of a National Water and Sanitation Authority with a Dept of Health to be responsible for all rural water supplies. The paper also gives some information on the training of health inspectors involved in the construction of wells and rural latrines.

3. WATER - A RARE COMMODITY! RURAL WATER SUPPLY IN NIGERIA (E O Okeke)

The paper reports mainly on the administrative aspects of water development in Nigeria, especially rural water supply. In 1975 the Federal Government introduced a 50 % matching grant for each new water supply project. The subvention was however misused and the system stopped in 1977/78. During the period 1975-80 the water supply in rural areas developed from 11 % to 89 % of the population served with reasonable access, this implying "that the housewife or members of the household do not have to spend a disproportionate part of the day in fetching the family's water needs". The Federal Ministry of Water Resources with its only Dept of Water Resources was created in 1975. The department is to unify national wide the water resources data collection system, and to give advice to the eleven river basin authorities which are the executing arms of the Ministry. Water supply is however executed by the Water Boards of the 19 States. In response to the Government's new policy of integrated rural development, the River Basin Development Authorities are to emphasize minor irrigation schemes including the provision of drinking water to the population, the State being responsible for the treatment and distribution of portable water. Drilling brigades are to be set up in order that, for the plan period 1981-85, 1 500 boreholes are to be drilled all over the country. A moderate monitoring system of the aquifers is being set up, and a provisional water master plan and an atlas of underground waters will be prepared. In addition, the Department intends to harness surface resources through a system of minimun 5 small impoundments in each state to cater for small rural communities of 1 million population.

EXPERIENCES IN WATER SUPPLY IN RURAL AREAS IN CUBA (L Sotto Andraco)

The paper reports on water supply development in Cuba since the revolution in 1959. The aquifers are to a large extent karst aquifers with open connection to the sea. This introduces the special problem of balancing against saline intrusion into the aquifers. Two principal experiences in improving the conditions of life in rural areas are focused in the paper: the villagilisation programme, and the rural system of secondary schools. The villagilization implies grouping of the peasants in small villages or cooperatives of the size of about 600 people. The villages are located close to the original dwellings in order to reduce, as far as possible, social troubles from the new habitats. In the villages, which are built up in cooperation with local people, there are installations for good quality water supply, waste water disposal system, schools, medical services, as well as guarantee for job for the inhabitants. The other experience consists in the organization of rural schools close to important plantations for fruits, tobacco etc. In these schools the children, between 12 and 16 in age, combine 40 hours of school work with 3 hours of work in the farm. There are about 700 pupils in each school and about 650 such schools at the moment, which gives good life conditions for a total of 500 000 young people. The water supply installations are generally based on groundwater with chlorine treatment. The waste water disposal is based on oxidation ponds. The location of villages, cooperatives and schools is decided by the National Institute of Planification.

Interregional Seminar on
Rural Water Supply
Uppsala 6-16 October, 1980

Working document
Country Thematic Paper session
10 October 1980

Malin Falkenmark

SHORT SUMMARY ON COUNTRY THEMATIC PAPERS

AGGREGATED DATA ON COUNTRIES COVERED

Country	Pop mill	Runoff mm/yr (order of magnit)	Per capita availability m^3/p yr 1971	2000(calc)
Botswana	0.8	1-500	13800	7200
Ethiopia	30.8	1-50	4600	2100
Nepal	14 (1980)	1000-2000	11000	5600
Bangladesh		700-2000	1800	900

1. CONSTRUCTION, OPERATION AND MAINTENANCE OF RURAL WATER SUPPLY SCHEMES IN BOTSWANA (M J Gopolang)

Botswana is a country with extreme water shortage and women may have to walk several kilometers for water. The construction of village water supplies began in 1972 with a government target - which has recently been reaffirmed - of providing each village with reliable water supply by 1985/86. The Dept of Water Affairs is the body in charge of the water supply development. The development advances in project form, distinguishing between water supply of major villages, intermediate villages and small villages, the different categories being supported within different aid programs by different donor countries. At present 41 small and 27 intermediate villages remain to be supplied whereas all major villages schemes have been completed. High priority is given to operation and maintenance of completed water supplies. Private connections are not encouraged at present. The paper describes the Dept of Water Affairs and the different forms and routine procedures used in the operation and maintenance work. Two major village water schemes have got treatment plants, described in the paper The pricing policy is reviewed from time to time. No self help work is expected at the present time as government has not yet emphasized this point. Training is considered esssential but the training in mechanics ceased in 1978, causing recruitment problems. The paper ends by giving some details about the staff and duties of a major village water supply unit.

2. THEMATIC PAPER ON COMMUNITY WATER SUPPLY (Ethiopian Water Resources Authority)

The paper discusses the planning procedure, the problems, organization, financing and staffing issues of the rural water development in Ethiopia. Policy guidelines for water sector planning are provided by the Central Planning Supreme Council

and the planning is carried out by the Ethiopian Water Resources Authority. The contribution from the consumers is however neglectable at present, and will be improved in the future. By investigations on water accessibility in the villages the villages with most severe water shortages and sanitation problems are chosen. The depletion of groundwater has not yet been taken seriously. The main problems in providing adequate quality water in rural areas are lack of trained manpower, inadequate finance, shortage of materials and equipment, inadequate operation and maintenance, lack of reliable basic data, transport problems but also difficult hydrogeological conditions and high fluoride content of the groundwater in some areas. Community participation both in planning, construction, operation and maintenance and introduction of appropriate technology will be enhanced in the future and vitalized from eight regional offices of the central authority. The Water Resources Authority, has however been found inefficient and a new authority has recently been established to accelerate the water supply activities. Rural water supply is now totally financed by the Government without any revolving funds, Foreign assistance and loans play an important role. The present approach of water revenue collection is not systematically done, and water is supplied freely in drought affected areas whereas quite high price is paid in some parts of the highlands. An alternative pricing procedure is now being contemplated. Measures are taken to alleviate the skilled manpower shortage, and training programmes are accelerated, 80 students are now being trained abroad and another 80 are to be sent quite soon.

3. EXECUTION AND ADMINISTRATION OF PROJECTS AT LOCAL REGIONAL AND NATIONAL LEVEL IN NEPAL: (S N Sharma)

94 % of the population live in rural areas. A national programme for constructing water supply systems was initiated during the First 5-year Plan in 1956. One of the major objectives of the present Sixth plan (1980-85) is to meet the basic needs of the people including drinking water. Projects are funded entirely by the Government, and supported by external assistance. The provision of water supply facilities are severely restricted due to lack of financial resources and technical know-how. Community water supply projects are supervised from the District Council who is responsible for planning and implementing all the district level projects. The District public work section (PWS) is the technical wing of the District Office, but not adequately manned with the required technical personnel. Most of the projects are therefore carried out by specialised agencies of the government. Three agencies are involved in carrying out water supply projects. Different authorities are responsible for water supply of rural communities according to their location in the hills, midlands and terais and the size of their population. Very recently a new ministry has been created to take care of Rural Development including rural water supply programs. The policy in the hills and midlands is to reduce the

water collection journey and improve water quality. Schemes in these two topographic regions are mainly gravity flow type. In the terai water supply depends on geology and aquifer levels. Wherever possible shallow tubewells with handpumps are used. The paper also describes the general procedure of implementing projects: the request comes from the village council or community concerned. A village committee is formed for mobilising village cooperation in the construction work. In the finding of priority of projects, social benefits and regional balance are taken into account. The benefitting community is required to provide unskilled labor, transportation by headload and collection of locally available materials. The policy for integrated rural development includes agricultural facilities, improved transportation, afforestaion and conservation of soil, minor irrigation, education, health improvement, drinking water and sanitation, and development of local industries. According to the policy the recipient community should operate and maintain their own supplies after completion. In a number of cases systems have however been taken back and operated by the DWSS. This operation must however be turned back to the community. The agencies giving external support to the country wish to see some sort of mechanism evolved to charge the water service tax from the users o public stand posts and this proposal is now being seriously considered.

4. RURAL WATER SUPPLY IN BANGLADESH (M H Khan)

90% of the population live with groundwater aquifers at reasonable depth. At the creation of Bangladesh in 1971 one public tubewell was available for an average of 400 people. Water related diseases constitute a large burden on the population, studies indicating that nearly 60% of rural children suffer from some sort of water borne diseases and that 80% of the diseases in all age groups are water related. The Government therefore felt necessity of improving the rural water supply conditions and the First Water Supply Construction Project was started in 1973. By the end of 1976 there was an average of one public well for 250 people. The Second Programme, started in 1978, aims at one well for each 180 people and that 75% of the population will have access to a well within 700 ft from their dwelling. There are sufficient good foundries manufacturing hand pumps and spare parts and a great number of drilling squads with experts in indigenous simple methods of well installation without machines. The target for the Decade is to provide one tubewell for every 100 people by 1985 and one for every 75 by 1990. Due to the good availability of aquifers handpump tubewells are the best possible solution for providing safe water at present. To implement the present targets 50 000 wells have to be sunk every year, out of which 25 000 are needed to cope with the population increase alone. It has been observed

that on the average one tubewell gives good service for 10 years. In other words 10% of the wells get choked-up every year, and have to be withdrawn and resunk with partly new materials. By 1990, there will be 1 million public wells in the country and 100 000 will have to be resunk annually, besides a new sinking of 25 000 wells to cope with the population increase. To foster self reliance,industries will be setup to manufacture all tubewell materials. At present 90% of the material is imported. Due to aquifer problems nearly 10% of the population can however not be served with hand-pump wells. This has created the idea of infiltration galleries for infiltrating rainwater in the Southeast where the groundwater is highly saline. As to attitudes to wellwater, a survey in 1978 revealed that literate people favour use of tube-well water to a much larger degree than illiterate people. Many people complain about mineral contents of the water, about inconvenient platforms etc. A special cultural problem is that free movements of adult women are not well accepted by the society. This makes it difficult for women to utilize the public wells as they are located so that they do not easily give room for privacy. For these reasons the longer the distance the lesser the use of tubewell water for other purposes than drinking.

Interregional Seminar on
Rural Water Supply
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Malin Falkenmark

SHORT SUMMARY ON COUNTRY THEMATIC PAPERS

AGGREGATED DATA FOR COUNTRIES COVERED

Country	Pop mill	Runoff mm/yr (order of magnit)	Per capita availability $m^3/p \cdot yr$ 1971	2000 (calc)
Yemen	1.9	1 - 20	(700[x])	(300[x])
Kenya	15 (1979)	20 - 500	3400	1200
Barbodos	0.5	no data	no data	
Haiti		200 - 500	1400	800

x) all countries of the Arabian Peninsula

1. RURAL WATER SUPPLY SCHEME IN PEOPLES DEMOCRATIC REPUBLIC OF YEMEN (S A-R Ba-Abbad)

The paper reports about the rural water supply development in Yemen, particularly the plans for 1981-85. The actual planning started in 1970 with the Water Decree and the creation of the Public Water Corporation (PWC) to be responsible for drinking water development to all inhabitants throughout the republic. The PWC should also participate in the General Development Plan by making available water suitable for industrial schemes on a commercial basis. In spite of severe constraints such as lack of hydrological and hydrogeological data, lack of statistics on population and animals, and shortage of staff, the PWC in the period 1970-78 installed water supply schemes serving 0.7 mill out of which 150000 were rural and nomad people. According to a comprehensive survey to be completed shortly and covering the whole republic, there are about 80 schemes serving over 1000 people and supervised by the PWC, and about 120 minor schemes in villages and small towns run by private individuals, companies, or cooperatives. Out of a rural population of about 1.3 mill only 22 % get water from public water centres, the rest depending upon open wells, streams, springs and sometimes even highly polluted flood bed pools. It has been observed that schemes operated by individuals or private companies are often unable to function satisfactorily due to lack of funds and skilled manpower or poor organisation and management. The PWC in its planning for the period 1981-85, along with the General Master Plan for Economic and Social Development, will give priority to water supply schemes. The Government has taken full responsibility and, in selecting schemes, will give priority according to need rather than to cost considerations. Central Government or local municipalities will subsidize the costs. It is considered essential to create a training programme for staff at all levels in order to secure proper operation and maintenance. International

organization as well as bilateral assistance organizations might play a great role in offering assistance in the form of long-term loans, material assistance or by providing advisers and experts.

2. EVALUATION OF RURAL WATER SUPPLY PROGRAMMES I, II AND III (in Kenya)

The paper focusses on the evaluation of the strategy followed in the rural water supply development since 1970 in Kenya. The 1970-74 Development Plan introduced the later restated target of bringing acceptable water supplies to all the rural population before 2000. So far the phases I and II of the programme have been completed, III and IV are currently under implementation, and V and VI are in the planning stage. It is estimated that when stage IV has been completed 3 million out of a rural population of 13.5 million will have access to improved water supply. By 2000 the total rural population is calculated to have increased to about 26 million which makes the task enormous. In 1976 the Government decided to determine the efficiency of the present water policy, and to study the impact of the massive efforts expended in the water sector in the last six years. The evaluation study was to assess the operating efficiency of completed schemes, the appropriateness of current means of water development, and indicate areas where complementary inputs could be useful. The study revealed that the selection criteria were effective but that self help contributions should be expanded. In some cases the level of capacity was uneconomic, and some designs based on inadequate hydrological data had resulted in insufficient yields at certain times of the year. The treatment works were generally satisfactory but should be extended to all schemes. Provision should be made for installing consumption point storage as well as storage to supply during breakdowns. Flow restriction devices or metering are desirable to minimize wastage. The quality of supervision during construction as well as operation and maintenance should be strengthened, and this calls for increase in recurrent budget, manpower, transport, technical support, training and management systems. Revenue collection should be improved and rates increased by about 30 % to cover the operation and maintenance costs. It turns out that water supply enhances other development like dispensaries, dairy industries and livestock development. It is diminish realistic to reach the target of serving the whole rural population by 2000.

3. TOWARDS THE EVOLUTION OF A TRAINING DELIVERY SYSTEM FOR THE EASTERN CARIBBEAN (D K Yearwood)

The paper reports abat a regional training system for a teachers in the Eastern Caribbean. An assessment in 1977 of the water utility training in the region revealed a gross imbalance between the training of different categories, most resources being laid on engineers and technicians whereas semi-skilled and unskilled employers constitute over 80 % of the total work force. The existing nucleus of technically trained people could be used as a basis on which to build a self-sustaining training capability in the region. A Training Delivery System (TDS) was introduced in the region and supported by ten countries. The idea is to train trainers who can then go home and train on a national basis.

Barbados was chosen as the most suitable location, taking in the Waterworks Dept with its staff of 1000 persons and in existing training institutions. All participating countries appointed a training coordinator to form the link between the central office of the system in Barbados and the respective national bodies. The training aims at communicating skills and instruction techniques, and is realized through a series of one week workshops with 4 week intervals. Out of 142 participants from the ten East Caribbean countries participating, 72 % certified according to performance oriented tests. A number of Manuals and job aids were developed within the TDS by participants selected from the trainees and following a standard format presented. The work was organized as an introductory 1 week workshop, followed by a 7 week period for interviewing and writing and a final 1 week workshop for wrapping-up. Six manuals and four job-aids have been completed so far. The paper concludes that TDS as outlined offers a great chance of becoming self-reliant in waterworks training.

4. DESIGN - CONSTRUCTION AND RURAL PROJECT MANAGEMENT AT LOCAL, REGIONAL AND NATIONAL LEVEL (G J Felix)

The report discusses the difficulties of rural water supply development in a developing country like Haiti, were very little attention has been directed towards the rural areas. The choice of appropriate system is a burden because it is dependent on good knowledge of surface and groundwater resources. Planners have to be careful in planning the execution of projects. Local contractors could be used for specific works only, and community participation should constitute the biggest input. It has however to be very well planned: the first step is to create a general motivation, among rural people, the second to organize the non specialized labor which is normally available only during certain days and certain seasons. Programs should be developed on a regional basis to train specialized labor needed like plumbers, masons, carpenters etc. Only the skilled labor needed should be trained. After the construction they should be used as operation and maintenance personnel. Unskilled labor is sometimes paid according to the system "food for work" although "half in food, half in cash" is more favourable by opening possibilities for the locals to buy fertilizers for their crops. Non-functioning reservoirs, public fountains and pumping stations, difficult to rehabilitate, stand as monuments of schemes that failed because the importance of community participation had been overseen. The financing of operation and maintenance presents special problems and a tarif system is not easy to adopt. In Haiti, voluntary or fixed contributions from the beneficiaries are insufficient and have to be complemented by the government. A better system might be to set up a national tax for rural water supply to have permanent funds for consstruction, operation and maintenance costs.

Interregional Seminar on
Rural Water Supply
Uppsala 6-16 October, 1980

Working document

Country Thematic Paper Session

7 October 1980

Malin Falkenmark

SHORT SUMMARY ON COUNTRY THEMATIC PAPERS

PAPERS COVERED

The summary covers thematic papers from the following four countries:

	Pop mill	runoff[x] mm/year	per capita availability[xx] (m^3/year) 1971	2000 (calc)
Malawi	5.5 (1977)	50-100	2000	1000
Somalia		0-20	3900	1800
Tanzania	17.1 (1978)	50-100	5700	2400
Thailand		200-500	4800	2000

x) Order of magnitude only. Source: Water Resources Atlas of the World (Ed. Korzoun et al, Moscow, 1974).

xx) Source: Lvovich , Global water resources and their future, Moscow, 1974

1. GROUNDWATER RESOURCES DEVELOPMENT IN MALAWI (P J Marcello)

The paper starts by describing groundwater aquifers in the three major hydrogeological regions of Malawi. Government policy is to supply clear potable water to the rural communities as a countermeasure to a mass exodus to urban centres. A groundwater extraction program has increased the number of boreholes from about 500 in 1960 to 4300 in 1980. The last two years, due to the high costs of boreholes, shallow wells have been given priority, and 500 such wells have been dug. The borehole program is based on requests originating from the villages and channelled to the District Development Committee (DDC), which is the regional link between government and rural people. In the shallow well programme, government, through the DDC, acquainted local people with the health hazard of unprotected water, promising them to supply material as well as equipment if only communities themselves supplied labour for digging. The programme has expanded rapidly starting from a number of nuclei villages. In areas with low water table a deeper version of dug wells have been needed. The biggest constraints for the programme are manpower and funds. The former will be met by a planned water school for training technical officers, whereas engineers will still have to be trained abroad.

2. FUTURE PLANS FOR WATER RESOURCES DEVELOPMENT IN THE RURAL AREAS OF SOMALIA (M E Yusuf)

The paper describes government plans for borehole drilling (170 deep boreholes) in connection with rangeland development projects. Care must however be taken not to overstock the rangelands, due to the low carrying capacity of natural pastures. The legislation prescribes licensing for drilling and charges the National Range Agency to ensure adequate spacing of water points (approx 30 km) as well as to register water managing devices (boreholes, wells, dams etc). The basis for development is detailed hydrogeological investigations. Over considerable areas the water table is however very deep (250 m in some places) and the ground water therefore brackish and even saline. In these regions harnessing of rainwater is a better alternative well suited for self-help efforts. Sites are to be selected using data on dependable precipitation and choosing small gently sloping catchments for the harvesting. The paper finally mentions number of emerging techniques for expanding scarce water resources: by irrigation with saline water, local recycling of irrigation surplus, and solar destillation to desalinate saline water.

3. RURAL WATER SUPPLY IN THE UNITED REPUBLIC OF TANZANIA (N K Msimbira)

The paper reports about the villagilisation programme of rural development, involving the creation of 8000 self sufficient villages. This necessitates acceleration of a water supply programme, running parallell with the Decade. A national action committee for the Decade is now being created. 15 mill people remain to be supplied before 1991. To achieve this, the major constraints have to be minimized. Least cost alternatives are considered preferable, including shallow wells, gravity schemes, shallow boreholes etc., the reason being that such alternatives will allow a larger number of individuals to be supplied. A feasible technological mix is worked out for each region, based on the local water availability conditions. Missing hydrogeological and hydrological data create difficulties in the programme, and projects such as dams have so far to be designed on a basis of guess work. A data system is therefore being developed, including a water master plan coordination unit with the task to standardize data collection methodology. About 50% of existing schemes are not operating at present, due to poor design, too sophisticated equipment etc. A rehabilitation programme is therefore now being prepared. Community participation constitutes the foundation of rural development policy in Tanzania, based on "ujamaa" and self reliance, and the villagers themselves contribute considerably to the water supply programme.

4. PREPARATORY AND PLANNING PHASE OF SAFE DRINKING WATER SUPPLY IN RURAL AREAS (in Thailand) (Mrs D Kuerklai)

This paper discusses not only water supply but also excreta disposal, the government having accepted policy that all people should have access to safe water and sanitation in 1991. 80% of the total population will have to be served with safe water and 62% with sanitation. Eight different agencies are involved. Past government approaches have been found inappropriate, due to a too sophisticated technology for the social and economic conditions, and have now been abandoned. As long as villagers did not participate in the decision making, they were not motivated to maintain, or even use the water schemes. The new policy is based on fullest possible community participation, self help where applicable, and on the simplest least expensive but still adequate technologies for water supply as well as sanitation. It is stressed that genuine community partipation and appropriate technology go inseparable. The communication with communities are being channeled through primary health care volunteers and communicators. Budgetary resources being very restricted, the resources necessary for implementation of the programme have to come from the population. After the Decade, the schemes will be upgraded to match the progressing socio-economic development.