WORLD HEALTH ORGANIZATION

INTERNATIONAL WATER AND SANITATION CENTRE

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Management of Operation and Maintenance

in Rural Drinking Water Supply and Sanitation

Prepared by
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A Resource Training Package

WATER SUPPLY AND SANITATION COLLABORATIVE COUNCIL

WORKING GROUP ON OPERATION AND MAINTENANCE

Preface

Operation and Maintenance programmes, according to the approach adopted in this document, are aimed at improving the efficiency of water supply and sanitation resources to achieve the best possible utilization of the existing capacity of the system. Such programmes, despite emphasizing management and operative aspects related to operation, maintenance and rehabilitation, also involve relevant issues related to other areas of expertise. The activities which are normally considered in the formulation of an O&M programme are directed towards the elimination or reduction of the major constraints for the achievement of sustainability and improved efficiency and effectiveness of the water supply and sanitation service. These projects and activities should be organized to be gratefully implemented in accordance with priority requirements and also, in accordance with the financial and technical capacity of the institutions responsible for the provision of water supply and sanitation services.

Operation and maintenance programmes should be considered as a stage of an institutional development process. At this stage efforts should be oriented to the priority areas of the water agencies, to facilitate the implementation of a more comprehensive institutional development process.

This document and the training activities derived from its use are intended for management staff concerned with the challenging tasks of how to organize effective operation and maintenance services in water supply and sanitation programmes.

In addition to the classical management aspects of operation and maintenance, an important concept brought forward in this training document is the participation of communities and of women in operation and maintenance activities, reflecting the present trend in most development sectors to make more efficient use of local human resources for sustainability purposes.

The main approach of this training document is thus to use a participatory methodology, using the input of the course via the facilitator or resource persons, as well as the experience of the participants. The resource training package has been prepared using material and documentation developed by various agencies and institutions, reflecting a global panel of experiences within the sector. It should be used as the source documentation for the assembling of a training package adapted to the requirements of any target population to be addressed. Such an exercise should imply in the characterizing of this target population to be addressed and in the development of additional modules, where required, according to local needs.

Finally, this package has been developed in a process which included a testing exercise in Namibia, and guidance and comments from experts representing selected water and sanitation institutions in developing countries and External Supporting Agencies, members of the Advisory Committee of the operation and Maintenance Working Group of the Water Supply and Sanitation Collaborative Council.

Acknowledgements

This training course package on **Management of Operation and Maintenance in Rural Drinking Water Supply and Sanitation** has been prepared by IRC International Water and Sanitation Centre on the request of the Operation and Maintenance Working Group of the Water Supply and Sanitation Collaborative Council, under terms of reference and financial sponsorship by the World Health Organization.

The modules were developed by François Brikké with the help of Teun Bastemeyer and contributions from Jan Davis, Jo Smet, Phil Evans, Christine van Wijk, Michael Seager, Dick de Jong, Madeleen Wegelin and Jan Teun Visscher. Especial thanks should be given to Mr Hanjörg Drews, from the Department of Water Affairs of Namibia and Dr Harry McPherson, who gave extensive remarks and comments as a result of the testing exercise of the draft version of this package in Namibia. The members of the Advisory Committee of the Operation and Maintenance Working Group should also be thanked for their advice and contributions in reviewing the package, throughout its different phases. Especial thanks should be given to José Hueb of WHO, who provided a continuous and dedicated support to this initiative as well as to Phil Roark of the WASH/USAID project who authorized the use of the WASH Technical Report no. 71 for training purposes. Lay-out was done by Lauren Wolvers.

Special acknowledgement should be made of the generous financial support provided by both the Ministry of Foreign Affairs of Italy and the Swedish International Development Authority (SIDA).

About the resource training package

In general

This resource training package is designed to be a guide for the trainer/facilitator who is going to conduct this course. Its structure is flexible enough to be adapted to local circumstances and needs.

It would have been quite ambitious to deal about Operation and Maintenance (O&M) requirements and implications of all the existing systems coming from all the parts of the world.
However, trends remain the same and this package provides a guideline or methodology which can be used what ever the context and what ever the system.

The module dealing about technical requirements is describing technical requirements and implications of the following systems:

* hand dug well with bucket, rope and pulley
* borehole with handpump
* borehole with electric submersible pump and generator
* gravity piped distribution to standposts
* rainwater harvesting
* chlorination and slow sand filtration
* ventilated improved latrines

This resource training package is however not designed to be a technically oriented manual to be used at operational level, although it gives references to the above systems. Its scope is to include all the elements which a manager could be faced with in his assignment to conceive, plan and implement O&M in rural drinking water supply and sanitation, such as :

* Links between health, water and sanitation
* Analysis of constraints
* Organizational and financial requirements
* Community management
* Human resource development
* Monitoring
* Planning

Finally, this package should be adapted to country situations prior to its use in order to include : country specific case studies; national sector policies; institutional and cultural setting; and technical requirements.

Objectives
The general objective of the course is to contribute to improved management of programmes by enhancing the ability to sustain adequate O&M activities.

The specific objectives are as follow:
* To raise awareness on how to assess O&M needs and constraints at programme level
* To identify strategies to ensure O&M on a sustained basis
* To develop an overview of tools, methods and demonstration relating to key issues in O&M
* To identify O&M requirements for different service options
* To identify roles and actors in O&M
* To develop a management information framework and indicators to monitor O&M
* To develop individual or group action plans

Target group
The target audience for the package is designed to be working level managers including engineers, health and social specialists as well as other specialists involved in the water and sanitation sector.
The ideal number of participants for a course should be 15 to 20 .

The trainer/facilitator
The trainer/facilitator should have sufficient knowledge of the water supply and sanitation sector, since he will be implied in the selection of country specific resource materials.
He should preferably be acquainted with participatory methodologies as this course is not based on the traditional "teacher" type of training methodology.

The trainer/facilitator will find in most cases a set of illustrative overhead sheets which can be used for a presentation, as well as guidelines for group discussions or exercises and supporting material can be used for hand-outs.
All modules include some background information, handy for presentations or hand-outs.
Finally, most of the modules have a list of suggested references for further reading.
The way the facilitator wants to deal with the sequence of modules within each part can be adapted according to local needs and circumstances.

Course duration
The course is designed to have a minimum duration of 80 hours or two week, with possible adaptations according to local circumstances and demand.

Expected output
From experience it became clear that participants benefit the most of a course if they work towards a product. Therefore they are expected to produce an action plan or a strategy paper at the end of the course.

Course structure

The resource training package is designed to be adaptable to all situations and demand, and should be seen as a flexible tool rather than a rigid guide.

The only "strict" requirement is to keep the line of the logic of the training exercise:

1. "Facing O&M" is a thinking process
2. "Knowing more about O&M" is a learning process
3. "Planning for O&M" is a planning process

The first part, **"Facing O&M"**, tries to achieve a common understanding of Operation and Maintenance.
It starts with a presentation of the papers on O&M-related issues the participants were requested to write before coming to the course, and/or a general presentation of the water sector of the country. Main issues regarding O&M will be addressed as well as the links between water and sanitation, using presentations or audio visual materials, with guided discussions. Through elements of the Objective Oriented Programme Planning (**OOPP**) exercise the key issues affecting operation and maintenance of water supply and sanitation are determined and related to each other. This course does not aim in using the whole O.O.P.P methodology, but only parts of it, especially in analyzing constraints and setting objectives.

The second part, **"Knowing more about O&M'**, the most important issues are addressed in detail through lectures and group or individual exercises.
The most recent information from projects, international meetings, etc., is used to give an overview of the current views and approaches concerning the issues. The participants are provided with background materials and a bibliography for further reading.

The third part, **"Planning for O&M"**, is used by the participants to develop an action plan or a strategy paper concerning operation and maintenance management in their programme or department.
The results of the first part and the information obtained during the second part are used for this and the participants receive individual support. The papers are presented to fellow participants and course staff to allow each participant to get feed-back on their proposed plans.

The resource training package also provides suggestions for organizing a field visit.

Course methodology

The package uses as much as possible participatory methods, but also includes background information and overhead sheets which could be used for lectures and presentations, as well as individual or group exercises. Further, some videos are proposed in this package.

Another aspect of the package is to provide information advice in the form of supporting material and selected bibliography.

A daily and final evaluation of the course is proposed in this package and forms are provided.

Course outline

The course is composed of 8 modules, each subdivided into a certain number of submodules. Each submodule gives indications on how to organize each session. It is up to the trainer/facilitator to make use of the information made available in this resource training package.

OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

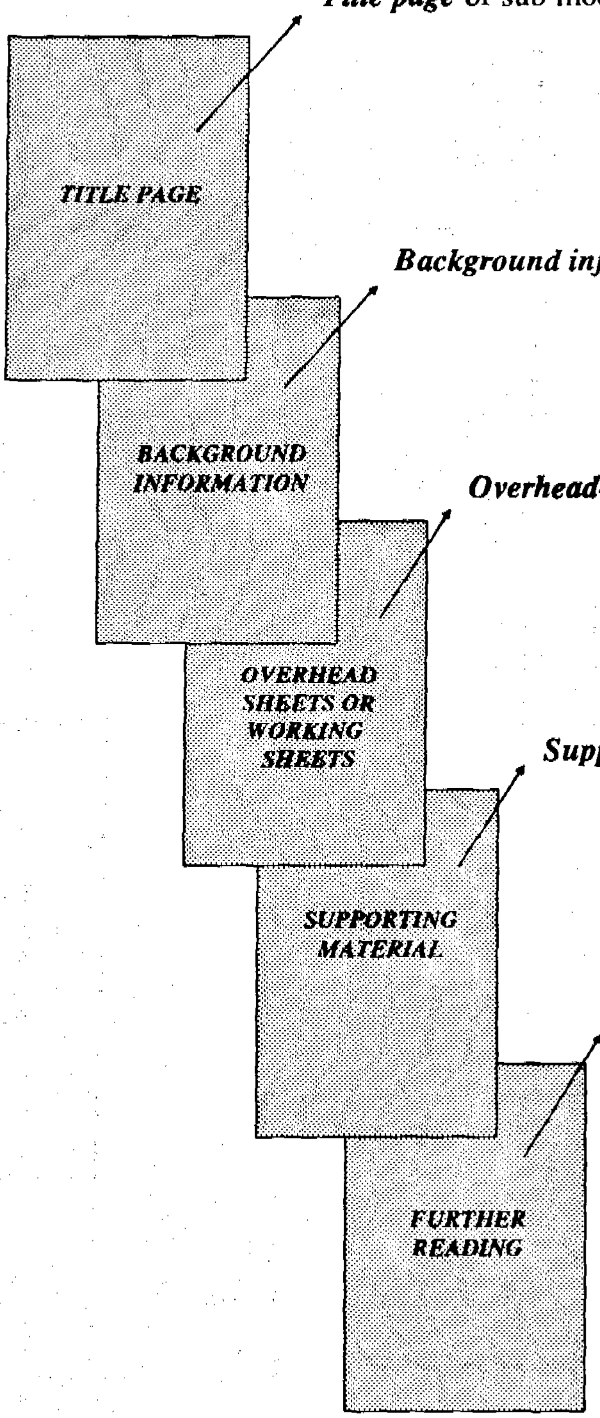
MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

Annex I: Suggestion for field visit

Outline of a Sub-Module



Title page of sub-module with:
- objectives
- outline of sessions
- hand-outs

Background information: suggestions for a lecture/presentation/discussion
Some aspects of the background information can be used for hand-outs

Overhead-sheets or working sheets: to be used during presentation or group/individual working session if provided

Supporting material: photocopies of documents useful for the presentation of sub-modules and possible hand-outs

For ***Further reading:*** some recent bibliographical references for this sub-module if necessary.

Proposed time-table for training

Week 1	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
09.00 10.45	Administration Introduction 1.1	Links between health, water & sanitation 2.2	Strategies (objective tree) 3.2	Actors and roles 5.1	Community management 6.1
11.00	Presentations 1.2	Constraints (methodology) 3.1	Technical requirements (overview) 4.1	Management models 5.2	Involvement of women 6.2
14.00	Country presentation 1.2	Constraints (problem tree) 3.1	Technical requirements (water supply) 4.2	Cost recovery 5.3	Field trip preparation
15.45 17.15	Concepts & Trends 2.1	Constraints (finalization) 3.1	Technical requirements (other) 4.3	Community Management 6.1	Field trip preparation

Every day short evaluation (10 Min.)

Week 2	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
09.00 10.45	*Field trip* Follow-up	Information & Communication 7.1	Methodologies for Planning 8.1	Individual assignment (continued) 8.2	Presentations 8.3
11.00	Local Financing 6.3	Monitoring 7.2	Methodology for Planning 8.1	Individual assignment (research) 8.2	Presentations 8.3
14.00	Human Resources Development 6.4	Monitoring 7.2	Individual assignment (problem tree) 8.2	Writing-up 8.3	Evaluation & Conclusion 8.4
15.45 17.15	Spare parts Provision 6.5	Planning 7.3	Individual assignment (objective tree) 8.2	Writing-up 8.3	

Every day short evaluation (10 Min.)

Preliminary preparation

The trainer/facilitator

If the trainer/facilitator is not acquainted with issues or methodologies presented in this package, it would be advised that he gets some kind of training or briefing beforehand. IRC International Water and Sanitation Centre in The Hague, The Netherlands, organizes special briefing programmes on the use of this package, as well as similar courses on management for sustainability.
Another possibility is to involve one local resource person, or a trainer from IRC to backstop the trainer/facilitator locally especially for this first time.

The training institute

The development of local training capacities on O&M is to be seen as an important second objective of this course.
It is therefore proposed that an appropriate training institute is identified, which could repeat the course and consolidate the training skills and capacities on O&M in the given country.

However, a donor or a specific project might want to use this package only once in order to sensitize its staff on the issue of O&M management. In that case, it would be advised to include in the course a representative from another project or from the concerned ministry, who could benefit from this course and then repeat it somewhere else.

Organization

As a certain amount of preparatory work is required, the date of the course should be fixed well in advance to allow all those involved to fit the course into their own work schedule. Course preparation should begin, preferably, six months beforehand.

One of the first tasks is to fix the dates of the course. In setting the dates of the course account has to be taken of :

- public and religious holidays
- important meetings or events that participants are obliged to attend.

Secretarial support greatly facilitates course organization. A well-ordered file containing all information and correspondence about the planning, running and evaluation of the course is essential.
During the course itself it will be necessary to have the support of a secretary to wordprocess work produced by the participants and the facilitator.
A general support person will also be needed for activities such as last minute arrangements, supply of materials and photocopying during the course.

The trainer/facilitator will have to identify with a sector specialist what are the constraints regarding O&M in rural water supply and sanitation in the country.
(S)he will have to adapt the package to his country's needs and requirements, and most of all, identify relevant information which could be used for the course.
As the sending of material requires some time, it would be appropriate that the trainer/facilitator orders the documents and videos which he would like to use, well in advance.

Accommodation

The accommodation should include :

- meeting room large enough for plenary sessions. Make sure that this room is not noisy, has adequate ventilation and light, and that there is sufficient power points to use an overhead projector, a video . Preferably the room should be available 24 hours a day throughout the course

- separate rooms for each of the working group; each group will need a quiet place with a table and chairs. The meeting room may be used to house two or more groups provided it is big enough to allow groups to work without disturbing one another

- foods and drinks - coffee and tea will be required between sessions and arrangements have to be made for breakfast, lunch and dinner.

Participants

The course is designed for professional staff working in water supply and sanitation. The group of course participants should comprise preferably:

- professional staff from various organizational backgrounds, for example project staff, central, regional, provincial and local government staff, donor/international agency staff, non government agency staff;

- professional staff with various educational and professional background, for example administrators, hydrologists, sanitary engineers, economists, environmental health engineers, community mobilizers;

- men and women

Participants should be invited through the appropriate channels. The invitation should include clear statements of the course objectives, structure and duration, the importance of full time attendance, accommodation and transport arrangements and costs/daily subsistence allowance.

Proposed letter to be sent to the participants prior to the course together with a course curriculum:

Proposed letter to be sent to participants prior to the course

Dear participant,

I am pleased to confirm your participation in the "Management op Operation and Maintenance in rural drinking water and sanitation" course, which will be held .....

A presentation will be done by each participant on the first day of the course.

The purpose of this exercise is to inform briefly the course staff and the other participants about <u>your</u> experience in the field of drinking water supply and sanitation.

The length of the presentation **should not exceed 5 min.**

For your information, contents of <u>one typed written page</u> represent about a 5 minutes presentation.

You may wish however to bring with you documents related to your project (charts, plans, evaluation reports, ...).
These documents will not be presented during this presentation but they can be distributed to the staff and the participants as information material.

Indeed, one aspect of the course is to exchange information and experiences between participants coming from different regions, districts or departments. Furthermore these documents can be used as reference materials for your final presentation at the end of the course.

Outline of a presentation

- Overview of job description
- Overview of experience in the water and sanitation sector
- Overview of expectations regarding this course.

Looking forward to meeting you, ...

Resource persons

One or two persons experience in the field of water and sanitation sector should be invited as specified in the course.

Their main task is to share their knowledge and provide practical information, examples and suggestions. In the invitation letter, their role should be clearly stated.

They should be invited well in advance of the course to increase the chance of their acceptance. They should be provided with the course modules, preferably two months in advance.

If recourse persons are not available, the trainer/facilitator might choose the option of a field visit or a video.

Teaching aids, equipment and stationary

All teaching aids, equipment and stationary should be ordered well in advance of the course. This includes:

- a blackboard
- a flip-chart stand and paper
- an overhead projector and a screen
- a video recorder and monitor
- a large board to pin cards on
- a photocopy machine

Stationary:

- it is proposed to give to the participants a binder in order to put in all the documentation;
- cards of different colour which can be made of big pieces of hard paper;
- note pads, pencils, erasers, adhesive tape, pins.

Certificate

A certificate may be prepared to hand out to all participants at the closing ceremony.

Field visit

Suggestions are given in Annex 1.

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Availability of resource materials

In certain developing countries, it is quite difficult to have access to the relevant information or to get the support of resource persons.
When ordering or obtaining this package, a special request can be made to IRC or WHO who could provide additional material. However, for your convenience, information about most of the cited materials can be obtained from the following addresses, according to their references:

GTZ
Division 414 (water)
Postfach 5180
D-6236 Eschborn
Federal Republic of Germany

IDRC
Communications Division
P.O. Box 8500
Ottawa K1G 3H9
Canada

ILO-Turin Centre
International Centre for Advanced Technical and Vocational Training
Corso Unità d'Italia 125
10127 Turin
Italy

IRC
International Water and Sanitation Centre
P.O. Box 93190
2509 AD The Hague
The Netherlands

UNDP
World Bank Water and Sanitation Program
1818 H Street N.W.
Washington D.C. 20433
USA

WASH Operations Centre
Room 1002
1611 North Kent Street
Arlington, VA 22209
USA

WHO/CWS
World health Organization
Community Water Supply
Division of Environmental Health
1211 Geneva 27
Switzerland

How to get the video-film "People and Solutions", proposed in this package.

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In order to get the video: "People for Health", proposed in this package.

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Canadian Embassies and High Commissions

Many Canadian Embassies and High Commissions carry IDRC titles for loan free of charge to the public. For terms and conditions, please consult the Canadian Embassy or High Commission in your country:

Argentina, Australia, Brazil, Cameroon, Chile, China, Costa Rica, Côte d'Ivoire, Cuba, Ethiopia, France, Gabon, Ghana, Guatemala, Guyana, Haiti, Indonesia, Sri Lanka, Senegal, Israel, Korea, Malaysia, Mali, Morocco, Mexico, Niger, Pakistan, Peru, Philippines, Saudi Arabia, Thailand, Trinidad and Tobago, Tunisia, UK, Venezuela, and Zimbabwe.

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7/F Washington Plaza, 230 Wanchai Road, Hong Kong (phone: 573-2661)
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SF-3, 26 Chung Shan N Road, Sec. 3, Taipei, Taiwan, China (phone: 596-9097)

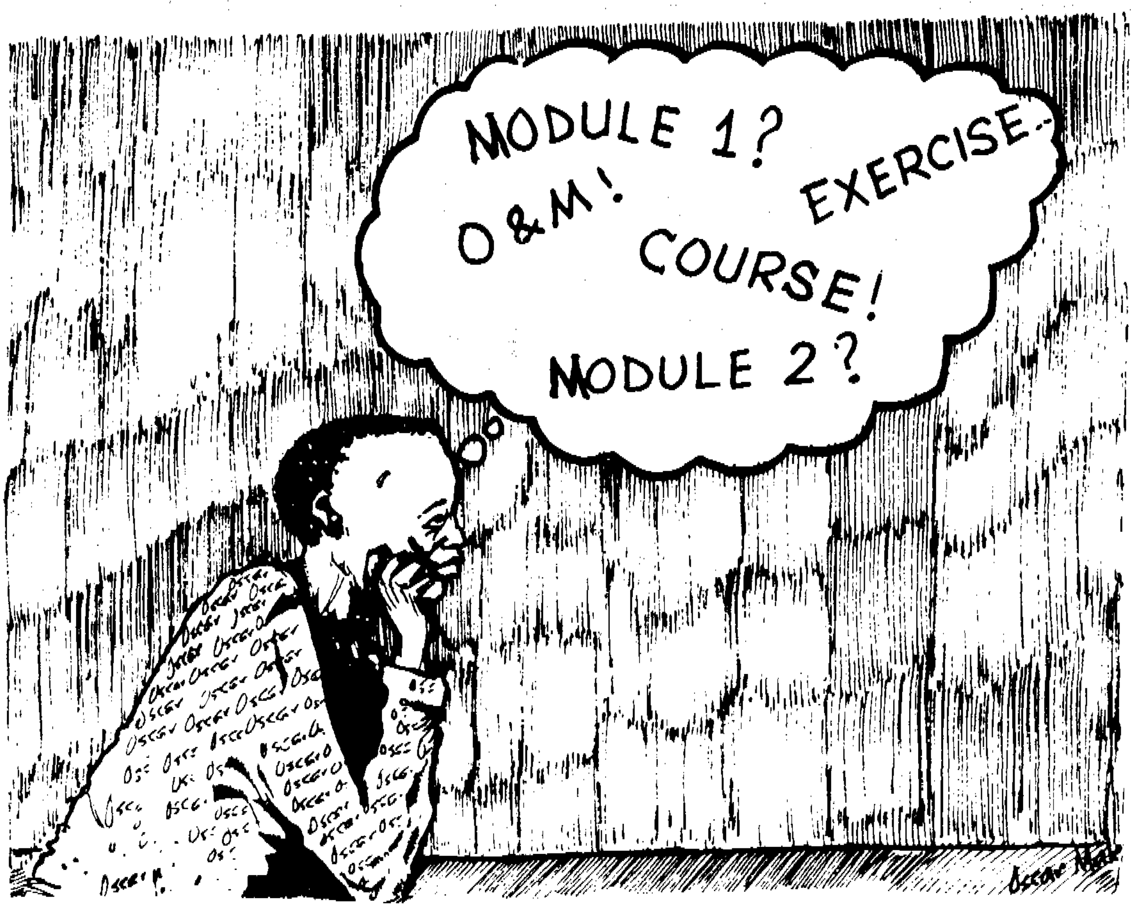
South Asia region

Users in the South Asia region should contact **Centre for Development of Instructional Technology** (D-1 Soami Nagar, New Delhi 110017, India — Telex: 31-5498, Phone: 643-9693) directly to purchase or borrow copies of IDRC films and videos.

PART 1: FACING O&M

MODULE 1

INTRODUCTION



OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1:	INTRODUCTION 1.1 Introduction of course to participants 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
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PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
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MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

1.1 INTRODUCTION OF COURSE TO PARTICIPANTS

Description of session

OBJECTIVES

- To reach a common understanding of course objectives and to obtain an overview of the profile of the participants.

OUTLINE OF SESSION

• After administration procedures done (registration, etc..) a brief welcome will be followed by a rapid round of participants	30 min
• In plenary session presentation of objectives and outline of course plus points of clarification	1 h
	1 h 30 min

HAND - OUTS

- General outline of resource training package

MATERIAL NEEDED

- Overhead projector
- Copies of overhead sheets

Background information

1. Introduction

There is a widespread evidence that though Operation and Maintenance (O&M) is recognized as one of the major constraints for the water sector development, little progress has been made in this field during the past decade.

Sustainability of water and sanitation systems through proper and effective O&M has been recognized by national governments and external support agencies (ESA) as a priority activity in order to safeguard infrastructure investments.

In 1988, in order to focus attention on this issue, WHO assisted by IRC held a one day informal working session in The Hague with ESA representatives. A working group was established with the objective of improving the performance of O&M which held its first meeting in Geneva in June 1990.
Key issues were identified as:

* Inadequate data on O&M
* Insufficient and inefficient use of funds
* Poor management of water supply facilities
* Inappropriate system design
* Low profile of O&M
* Inadequate policies, legal framework and overlapping responsibilities
* Political interference

It was also felt that the link between O&M and water quality surveillance had to be strengthened.
The working group during this Geneva meeting proposed that the following activities be implemented at global and national levels to improve O&M performance: (Overhead sheet No. 2)

* Enhance profile of O&M
* Improve management
* Develop data collection and monitoring system
* Formulate policy and coordination

Subsequently, the working group has asked IRC to produce this resource training package aiming to contribute to management improvement of O&M in rural drinking water supply and sanitation.

2. Purpose and objectives

The purpose of this package is to provide a guide for O&M courses to be held at regional and national levels, in different countries. It is intended to give hands-on material for conducting a course, adapted to local situations and make use of local resource persons.

The general objective of the course is to contribute to improved management of programmes by enhancing the understanding of participants concerning sustainable water supply and sanitation programme and increasing their ability to sustain adequate O&M activities.

The specific objectives are as follow: (Overhead sheet no. 3)

* To acquire skills and knowledge to assess O&M needs and constraints at programme level
* To identify strategies to ensure O&M on a sustained basis
* To develop an overview of tools, methods and demonstration relating to key issues in O&M
* To identify O&M requirements for different service options
* To identify roles and actors in O&M
* To develop a management information framework and indicators to monitor O&M
* To help individual participants to prepare an action plan.

3. General overview of training and its methodology

(Overhead sheet 1)

The whole course is designed to be lasting 80 hours, about 2 weeks, with possibly adaptations according to local circumstances and demand. It uses a participatory methodology, using participants own experience and problems in the context of each issue concerned.
The training is divided into three parts.

The first part, **"Facing O&M"**, is oriented towards achieving a common understanding of Operation and Maintenance. It starts with a presentation of the papers the participants were requested to write before coming to the course, and/or a general presentation of the water sector of the country and its objectives for the coming years. Main issues regarding O&M will be addressed as well as the links between water and sanitation, using presentations or audio visual materials, with guided discussions.
Through the Objective Oriented Programme Planning (**OOPP**) exercise the key issues affecting operation and maintenance of water supply and sanitation are determined and related to each other. The methodology for developing a framework for putting up strategies to address these issues are then dealt with.

The second part, **"Knowing more about O&M'**, provides a summary of the most important issues through lectures and group or individual exercises.
The most recent information from projects, international meetings, etc., is used to give an overview of the current views and approaches concerning the issues. The participants are provided with background materials and a bibliography for further reading.

The third part, **"Planning for O&M"**, is used by the participants to develop an action plan for the strategy of attaining a proper operation and maintenance management in their programme or department. The results of the first part and the information obtained during the second part are used for this and the participants receive individual support. The plans are presented to fellow participants and course staff in order to allow each participant to get feed-back on their proposed plans (see overhead sheet no. 4).

Every day will be concluded by asking the participants to fill out an evaluation form on the day's sessions. At the end of the course, participants are asked to fill out a more extensive form to get a view on how they value the course as a whole.

Overhead sheet 1

OUTLINE OF COURSE

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Overhead sheet 2

Results O&M Working Group June (1990)

Priority Issues (Results)

ENHANCE PROFILE O&M

MANAGEMENT IMPROVEMENT

DATA COLLECTION AND MONITORING
SYSTEM DEVELOPMENT

POLICY FORMULATION
COLLABORATION AND COORDINATION

Overhead sheet 3

General Objective:

TO CONTRIBUTE TO IMPROVED MANAGEMENT OF PROGRAMMES BY ENHANCING THE UNDERSTANDING OF PARTICIPANTS CONCERNING SUSTAINABLE WATER SUPPLY AND SANITATION PROGRAMMES AND INCREASING THEIR ABILITY TO SUSTAIN ADEQUATE OPERATION AND MAINTENANCE ACTIVITIES

Specific Objectives:

> To raise awareness on how to assess O&M needs and constraints at programme level.

> To identify strategies to ensure operation and maintenance on a sustained basis.

> To develop an overview of tools, methods and demonstration relating to key issues in O&M.

> To identify O&M requirements for different service options.

> To identify roles and actors in O&M.

> To develop a management information framework and indicators to monitor O&M.

> To develop individual or group action plans

Overhead sheet 4

Output of the Course

FORMAT FOR ACTION PLAN

Name :
Date :
Job description :
Title of project :

---

1. Background information of project
2. Target groups
3. Objectives
4. Expected results
5. Start and completion dates
6. Operational working relationships
7. Work plan for the coming six months

ANNEXES

Problem/objective tree
References
Resources needed

1.2 PRESENTATIONS

Description of session

OBJECTIVES

- To enable the participants to present their work, reasons to follow the course, and specific interest regarding the project and O&M.
- To allow the facilitator or a resource person to present the water and sanitation situation of the country concerned, as well as the actual or future official policy regarding O&M in rural drinking water supply and sanitation.

***OUTLINE OF SESSIONS:* (2 sessions)**

(can be adapted to local circumstances)

Session 1:

- Brief presentations of the participants regarding their work and the way they deal with O&M.

1 h 45

Session 2:

- Presentation of the general water and sanitation sector in the country especially regarding O&M (lecture done by facilitator or resource person) — 1 h 30

HAND - OUTS

- each participant gives a summary (maximum one page) describing the main points dealt with in his presentation

- one hand - out presenting the official position regarding O&M in the country, prepared either by the facilitator or the resource person

MATERIALS NEEDED

- overhead projector if requested by participants or resource person.

- any other equipment as requested by resource person.

Background Information

1. Presentations of participants

A brief presentation will be done by each participant on the first day of the course. They therefore have to be warned in advance about this exercise. A format is given in the introductory part of this package.

The purpose of this exercise is to inform briefly the course staff and the other participants about the experience of each participant in the field of water supply and sanitation as well as on O&M.

It is suggested to limit the presentations to about 5 minutes.
The participants if they wish can bring along other material only to be distributed.
Indeed, one aspect of the course is to exchange information and experiences between participants coming from different regions, districts or departments.

2. Country presentation

To be done either by the course facilitator or by one or several resource person.
This presentation should include:

* an overview of the water and sanitation sector within the country

* an overview of present and future policies regarding O&M

* time for points of clarification.

This presentation can be the opportunity to get a common understanding of what are the problems in the sector; what are the future prospects regarding the Ministry or local NGOs.
This session can be an excellent tool to disseminate general information in the sector as well.

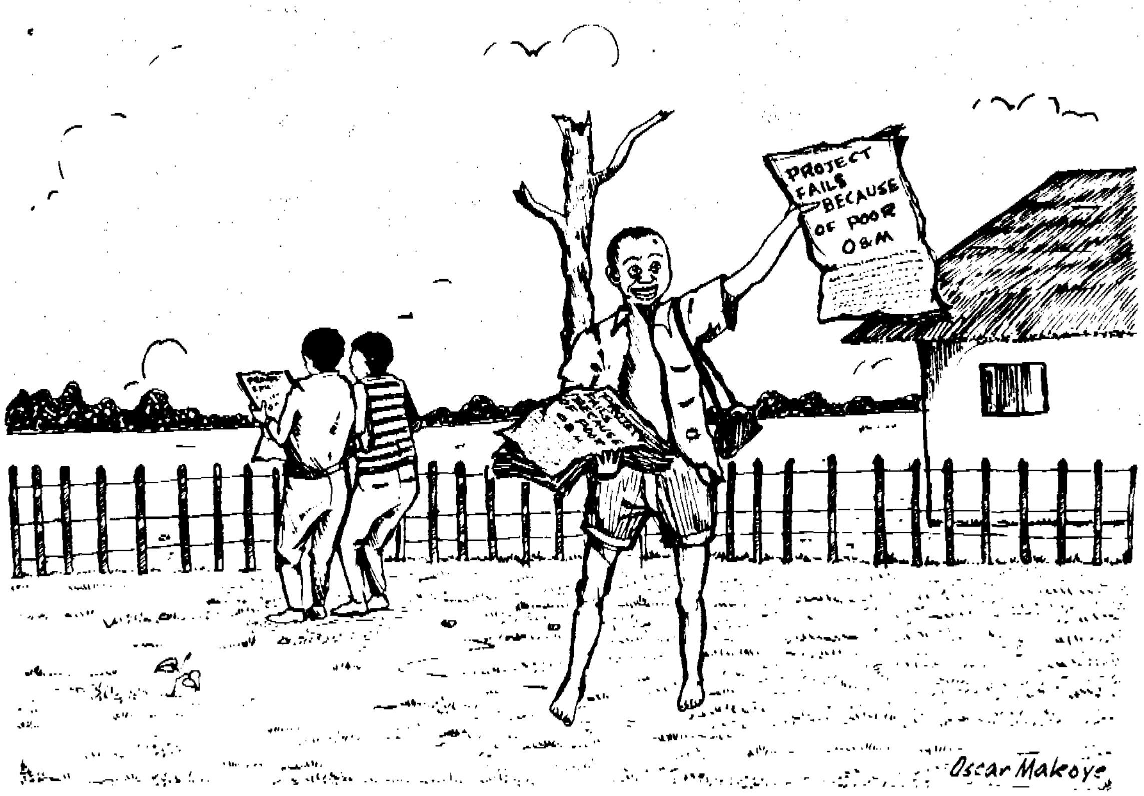
The resource persons could be representatives from the Ministry, but also from a donor or an NGO.

If the session is felt as being too long, same additional information could be forwarded to the participants on how to have access to resource material in the country (libraries, institutions, ministries, NGOs or other special centers).

PART 1: FACING O&M

MODULE 2

THE CHALLENGE OF O&M



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- 6.6 Environment protection

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2.1 CONCEPTS AND TRENDS

Description of session

OBJECTIVES

- To put O&M in the wider perspective of sustainable water supply & sanitation
- To raise awareness on present trends
- To define concepts of maintenance and sustainability

OUTLINE OF SESSION

• The facilitator writes down the following question on a board: "How to reach sustained functioning and effective use?", keeping in mind that this question should trigger responses not only concerning O&M. Participants are asked to write down 2 major points, one on each card provided. Cards are pinned on the wall, and discussed briefly. The facilitator ends up in showing that sustainability is the main objective to reach.	30 min
• Presentation on what is sustainability trends using background information and overhead material and country examples	45 min
• Group discussion on how to define operation and maintenance, Facilitator ends up with showing overhead-sheet on impact of different types of maintenance	30 min
	1 h 45 min

HAND - OUTS

- The New Delhi Statement
- The 10 key elements of sustainability
- "Further reading"

MATERIALS NEEDED

- Overhead projector
- Cards

Background information

1. "How to reach sustained functioning and effective use ?"

This question is to be asked to all participants and is aiming at putting O&M in a more global context as well as showing the relationship between O&M and other key issues. Issues such as education, health, politics, sanitation, donor's policy, finance, etc..., will raise together with O&M, and this small exercise will show that O&M cannot be dealt with in isolation.

2. What is sustainability ?

Sustainability is a term increasingly being used in a greater number of sectors.
It is therefore proposed to give some highlights on what is sustainability, since sustainability is an objective where as proper management of O&M is a mean to reach it.
Sustainability can be seen from different angle :

. the dictionary's point of view
. the beneficiary's point of view
. the project's point view
. the integrated point of view
. the environmental point of view

. the dictionary's point of view :
According to Collins Cobuild English Language Dictionary, something that is sustained is kept up for a long time; or if you sustain something you maintain it and keep it going for a period of time.

. the beneficiary's point of view :
To ensure sustainability is to ensure that water services continue to function reliably and well.

"Functioning reliably", in this context means that the systems function throughout the year with convenient operating times and only infrequent breakdowns, which are quickly repaired.

"Functioning well" implies that the systems supply enough water to meet at least the basic needs of all households in the defined project areas, and that this water is of a consistently acceptable quality. It also means that the systems are expanded in time to cope with the population growth and increased water use, and that enough funds continue to be available to maintain the agreed standards of operation.
(From Partners for Progress, IRC, 1991)

. the project's point of view :
According to the DAC (Development Assistance Committee) of the OECD (Organization for Economic Co-operation and Development), a development programme (or project) is sustainable when it is able to deliver an appropriate level of benefits for an extended period of time **after** major financial, managerial and technical assistance from an external donor is terminated.

The following points were suggested by the DAC along which an evaluation of sustainability could take place :

* Host government policies : development projects operate within the context of national policies.

* Management, Organization and Local participation : Managerial leadership is key in developing sustainable programmes and projects. Local participation is an integral part of continuing the flow of benefits after the termination of a donor's activity.

* Financial factors : sustainability requires a flow of funds to cover operations, maintenance and depreciation of investments to continue the benefits generated by a project.

* Technical factors : the technology chosen must be appropriate to the country's financial and institutional capacities.

* Socio-cultural factors : a project must integrate the social and cultural setting

* Environment and ecological factors : unplanned development, in some cases, has accelerated the depletion of natural resources, threatening the ability of the environment to renew itself.

* External factors : Development programmes and projects operate within the context of existing political, economic, institutional and cultural circumstances.

(Information gathered from the Management for Development Foundation, Ede, the Netherlands)

. the integrated point of view :
According to the Community Water Supply and Sanitation Unit of the World Health Organization (Document produced by the Working Group on Cost recovery, in 1990), 10 key elements of sustainability can be identified , (detailed explanations are given in the supporting material) :

1. Enabling environment
2. Health awareness
3. Strong institutions
4. Felt need
5. Supportive attitude
6. Expertise and skills
7. Appropriate service level
8. Appropriate technology
9. Materials and equipment available
10. Support services

. the environmental point of view :
According to The Hague Report on Sustainable Development (March 1992), there is a growing consensus all over the world that development must meet the needs of the present generation without compromising the ability of future generations to meet their own needs. For example, the Dutch policy follows the "strong" sustainability approach, which says that projects should not harm the environment ("the stock of natural capital should not decrease"). This approach rests on the assumption that environmental decay cannot be compensated by investments in, for instance, water purification installations, trucks and so on.

3. Present trends

"The New Delhi Statement is an appeal to all nations for concerted action to enable people to obtain two of the most basic human needs : safe drinking water and environmental sanitation ". (New Delhi, India, 14 September 1990 (see supporting material).

For countries taking up this challenge :"SOME FOR ALL, RATHER THAN MORE FOR SOME", the New Delhi Global Consultation recommends four guiding principles:

1. Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes.
2. Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions.
3. Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes.
4. Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies.

With the increased emphasis on functioning and use, sound management and financial practices, the profile of O&M will become much stronger both at international and national levels.

This is already partly reflected in the actual trend in many new water supply and sanitation projects and programme where the community and the users are involved in a greater way in O&M activities.

The Declaration of Puerto Rico, adopted in the Regional Conference on Water Supply and Sanitation (September 1990), and published by the Panamerican Health Organization and the Environmental Health Programme of WHO, follows the same direction.

4. The challenge of O&M

It is widely acknowledged that inappropriate O&M is a main cause of failure of water projects. The roots of this state of affairs can vary from political to social, technical and economical considerations, among which problems of inadequate management have been identified as a constraint.

Where pumps and water schemes are not maintained nor repaired further implications can arise such as problems of sanitation in schools, health hazards for users, decrease in productivity, but also high costs of rehabilitation and replacement and therefore decrease in users satisfaction.

O&M seems still in most cases, as an after thought and the real challenge now lies ahead to turn the tables and make it as being one of the most important issues to ensure sustained functioning and use.

5. What is Operation and Maintenance?

Operation deals with the actual running of the water supply and sanitation facilities, eg. provision of fuel, starting pumps etc.. The operation of systems can be divided into:

* Major operations concerning a scheme as a whole. This includes all the operation required to get safe drinking water.
* Control of water collection points.
* Hygienic handling and use of water.

Maintenance deals with the activities which keep the system in proper working condition, whereas repairs concern the replacement of worn or broken parts. Particularly in rural water supply these terms are used together as operators have overall responsibility. It may however be useful to make the distinction when defining the tasks involved and the actors needed to carry out these tasks.

Two different types of maintenance can be described:

- "crisis" maintenance
- preventive maintenance.

2 ***"Crisis" maintenance***

"Crisis" maintenance is only undertaken in response to breakdowns and public complaints. This is commonly practised in developing countries and it is a cheap maintenance option on a short term basis. However, deferring breakdowns leads to increasing frequency of breakdown with age, which, besides increasing costs, reduces service quality and increases interruptions (see overhead sheet no. 5).

This option is also faced with the problem of financial resources, since there is no planification involved, funds have to be raised on an occasional basis, which at each time can seem more important than if there were spread on a regular yearly basis.

Preventive maintenance

Preventive maintenance activities respond to pre-scheduled systematic programmes of inspection, repair and replacement (according to the expected life cycle of the equipment). Although this practice of minimizing future large expenses seems logical, it is still underutilized.

In developing countries, where labour costs are low, this option seems attractive, as long as costs incurred for prevention remain low. Its efficiency is increased with public education, and users commitment.

Overhead sheet 1

WHAT IS SUSTAINABILITY?

- THE DICTIONARY'S POINT OF VIEW
- THE BENEFICIARY'S POINT OF VIEW
- THE PROJECT'S POINT OF VIEW
- THE INTEGRATED POINT OF VIEW
- THE ENVIRONMENTAL POINT OF VIEW

Overhead sheet 2

ELEMENTS OF SUSTAINABILITY (DAC OF OECD)

- HOST GOVERNMENT POLICIES
- MANAGEMENT, ORGANIZATION AND LOCAL PARTICIPATION
- FINANCIAL FACTORS
- TECHNICAL FACTORS
- SOCIO-CULTURAL FACTORS
- ENVIRONMENT AND ECOLOGICAL FACTORS
- EXTERNAL FACTORS

Overhead sheet 3

THE 10 KEY ELEMENTS OF SUSTAINABILITY
(WHO / CWS)

1. ENABLING ENVIRONMENT

2. HEALTH AWARENESS

3. STRONG INSTITUTIONS
   . COMMUNITY
   . AGENCY
   . INTEREST GROUPS

4. FELT NEED

5. SUPPORTIVE ATTITUDES

6. EXPERTISE AND SKILLS

7. APPROPRIATE SERVICE LEVEL

8. APPROPRIATE TECHNOLOGY

9. MATERIALS AND EQUIPMENT

10. SUPPORT SERVICES
    . CUSTOMER RELATIONS
    . COMMUNITY SUPPORT
    . O&M SUPPORT

Overhead sheet 4

THE NEW DELHI STATEMENT

"SOME FOR ALL RATHER THAN MORE FOR SOME"

4 PRINCIPLES

1. PROTECTION OF ENVIRONMENT AND SAFEGARDING OF HEALTH
2. INSTITUTIONAL REFORMS PROMOTING AN INTEGRATED APPROACH
3. COMMUNITY MANAGEMENT
4. BETTER MANAGEMENT OF EXISTING ASSETS

Overhead sheet 5

IMPACT OF "CRISIS" MAINTENANCE

NO PLANIFICATION
(UNCERTAIN FUTURE)

POSSIBLE LONG DELAYS

PUNCTUAL HIGH LEVEL
OF O&M COSTS

FASTER DETERIORATION
OF EQUIPMENT

FREQUENT COMPLAINTS LEADING
TO USERS UNSATISFACTION
(POOR WILLINGNESS TO PAY)

Overhead sheet 6

IMPACT OF PREVENTIVE MAINTENANCE

PLANIFICATION WITH
DECREASE OF UNCERTAINTY

DELAYS SHARPLY
DECREASED

COSTS SPREAD IN TIME

EXTENSION OF LIFE SPAN
OF EQUIPMENT

HIGHER INVOLVEMENT AND DIRECT
SATISFACTION OF USERS
(HIGHER WILLINGNESS TO PAY)

Supporting material

"SOME FOR ALL RATHER THAN MORE FOR SOME"

The New Delhi Statement

Safe water supplies and environmental sanitation are vital for protecting the environment, improving health, and alleviating poverty. Disease, drudgery and millions of deaths every year are directly attributable to lack of these essential services. The poor, especially women and children, are the main victims.

Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. But even this unprecedented progress was not enough. One in three people in the developing world still lack these two most basic requirements for health and dignity.

Every developing country learned its own lessons during the International Drinking Water Supply and Sanitation Decade (1981-1990). The global community must now more effectively combine these experiences with a renewed commitment to sustainable water and sanitation systems for all. Access to water and sanitation is not simply a technical issue; it is a crucial component of social and economic development. Sustainable and socially acceptable services can be extended by using appropriate technologies, adopting community management and enhancing human resources.

Political commitment is essential and must be accompanied by intensive efforts to raise awareness through communication and mobilization of all sections of society.

<u>Challenge</u>

Entering the 1990s, governments face formidable challenges. Population growth continues apace. Infrastructure in many cities is stretched to breaking point. Uncontrolled pollution is putting greater stress on the living environment. Depletion and degradation of water resources are causing the costs of new water supplies to escalate. Without fundamentally new approaches, the broadscale deprivation will turn into an unmanageable crisis.

Creating the right conditions for accelerated progress will often involve profound institutional, economic and social changes, as well as reallocation of resources and responsibilities at all levels.

To achieve full coverage by the year 2000 using conventional technologies and approaches would require five times the current level of investment. However, there is a realistic two-pronged alternative:

Supporting material

(1) Substantial reduction in costs of services, through increased efficiency and use of low-cost appropriate technologies.

(2) Mobilization of additional funds from existing and new sources, including governments, donors and consumers.

If costs were halved and financial resources at least doubled, universal coverage could be within range by the end of the century.

Guiding Principles

For countries taking up this challenge -- "Some for all, rather than more for some", the New Delhi Global Consultation recommends four Guiding Principles:

1. Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes.

2. Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions.

3. Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes.

4. Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies.

Principle No. 1: The Environment and Health

Safe water and proper means of waste disposal are essential for environmental sustainability and better human health, and must be at the center of integrated water resources management.

Rapid population growth and accelerating urbanization, threaten health and the environment, presenting governments with daunting challenges in the 1990s. The poor, especially women and children, will continue to be the hardest hit.

Every day, water related diseases cause the deaths of thousands of children, and untold suffering and loss of working time for millions. Safe water combined with improved hygiene and better nutrition can reduce, and sometimes even eliminate these diseases.

Supporting material

The dramatic reduction of dracunculiasis (Guinea worm disease) has resulted from the provision of improved water supplies and hygiene education in endemic areas. The target of total eradication by 1995 should be fully supported. Affected countries should accord it high priority in investment programmes.

Toxic and industrial wastes pose increasing dangers to the environment in developing countries. They represent a significant threat to human health through direct contact and the pollution of water and soil. Governments and responsible agencies must take steps to control these health hazards.

Improvements to the household environment can be best achieved through the community's involvement as an equal partner with government and sector agencies. This means building on indigenous knowledge, so that policies and programmes are credible and relevant to the beneficiaries. Emphasis must be placed on education, social mobilization and community participation.

Proper drainage and disposal of solid wastes have a major impact on the neighbourhood environment. New solutions are needed which are environmentally appropriate and affordable to the communities they serve and which also conserve water resources and minimize pollution.

Integrated water resources management is necessary to combat increasing water scarcity and pollution. This includes water conservation and reuse, water harvesting, and waste management. An appropriate mix of legislation, pricing policies and enforcement measures are essential to optimise water conservation and protection.

Principle No.2: People and Institutions

Strong institutions are essential for sustainable development.

They require sound management, motivated people and an enabling environment of appropriate policies, legislation and incentives. Institutional development takes time. The short term achievement of production targets should not take precedence over the need for capacity building. The overall objective is achieving sustainable facilities which are used effectively by the beneficiaries.

A changing role of government is envisaged, from that of provider to that of promoter and facilitator. This will enable local public, private and community institutions to deliver better services. Decentralization demands a strong policy and support role from central governments, while local private enterprise can assist in improving the efficiency and expansion of service delivery.

Supporting material

The special role in development of non-governmental organizations (NGOs) and of volunteers must be acknowledged and strengthened. NGOs are flexible, credible, ready and able to experiment with innovative approaches. Governments should support the NGOs in replicating these approaches, and include NGOs, wherever appropriate, as partners in projects.

Human resources development (HRD) at all levels, from community members to politicians, is essential to institutional development. Training of professionals, managers, technicians and extension workers builds competence and confidence. Information, education and communication strategies must be integrated within HRD policies. Women must be trained and guaranteed equal employment opportunities at all levels of staff and management. National professional associations can play an important role in better HRD.

Education is a key part of the new approach. Schools offer a vast, most receptive audience for hygiene education. Polytechnics and universities already include water and sanitation related subjects in their curricula, but must be encouraged to respond to this sector's needs for multidisciplinary skills. Sanitary and environmental engineering curricula should incorporate substantial elements of community development, communications, appropriate technology, and project management.

<u>Principle No. 3: Community Management</u>

Community management goes beyond simple participation. It aims to empower and equip communities to own and control their own systems.

Community management is a key to sustaining services for the rural poor and is a viable option for poor urban settlements. Governments should support community management, through legislation and extension, and give it priority in national sector strategies for the 1990s.

Communities should have prominent roles in planning, resource mobilization, and all subsequent aspects of development. Within these strategies, gender issues will be all important. Women should be encouraged to play influential roles in both water management and hygiene education. Capacity building is necessary to make community management effective and enable women to play leading roles.

Linkages must be established to ensure that national plans and programmes are responsive to community needs and desires. Methods for evaluating community management have been developed for rural areas. They should now be adopted at the national level and implemented through participatory monitoring and evaluation techniques.

Supporting material

Principle No. 4: Finance and Technology

Given the number of people unserved and the growing demand, more effective financial strategies must be adopted in the 1990s for the long-term sustainability of the sector.

Current levels of investment in the sector are about US$ 10 billion per year.It is estimated that approximately US$ 50 billion a year would be needed to reach full coverage by the year 2000, using conventional approaches. Such a five-fold increase is not immediately feasible.

New strategies should aim towards two key objectives:

* Increased efficiency in the use of available funds

* Mobilization of additional funds from existing and new sources, including governments, donors and consumers.

Substantially increased effectiveness in the use of financial resources can yield major gains in sustained coverage. This will require changes in the way service agencies operate, to make them more cost-effective and responsive to consumer needs and demands. Involving consumers in choice of technology and service levels has proved to have a positive impact on cost recovery and sustainability.

A powerful case can be made for greater government and external support agency support. However, economic and social benefits need to be better quantified. Clear sector strategies and action plans increase the likelihood of water and sanitation programmes receiving higher priority in national planning processes. They may also make the sector more attractive for support from external support agencies (ESAs).

The high debt burden of many developing countries makes it particularly difficult for them to consider loans at market interest rates for all investments in this sector. With this in mind, lending agencies and donors are urged to look favourably on requests for grants or soft loans to support water and sanitation programmes. ESAs can also help by developing procedures or guidelines which will reduce project preparation and approval time. Support should also be given for the establishment of financial intermediaries to make credit more widely available.

Restructuring the utilization of funds for sector investments and setting of user charges are key issues in sector finance. Maximum benefits can be accrued by allocating a higher proportion of funds to affordable and appropriate projects in rural and low-income urban areas, where needs are greatest.

Supporting material

Rehabilitation of defective systems, reductions in wastage and unaccounted for water, recycling and reuse of wastewater, and improved operation and maintenance can often be more effective than investment in new services. Choices of technology and levels of service are major factors in determining construction, operation and maintenance costs of new projects. Due attention must be given to operation and maintenance arrangements which will ensure sustainability before investments are made.

Higher budget allocations and recovery of recurrent costs of operation and maintenance to ensure system sustainability are primary goals to be achieved. Effective cost recovery requires that sector institutions be given autonomy and authority. Further, there must be widespread promotion of the fact that safe water is not a free good. Appropriate charging mechanisms must be adopted, which reflect local socio-cultural and economic conditions. Collection should be decentralized so that revenues are available for management and operation of services.

Public sector institutions frequently default on payments for water supply and waste disposal services. For reasons of financial viability and equity, this practice is unacceptable. Increasing collection efficiency must be part of better financial management.

Research and development in developing countries has resulted in widespread application of much improved handpump and on-site sanitation technologies. The momentum established during the 1980s must be maintained and increased in the next ten years. Among the priority needs for the 1990s are improved household technologies for protecting water quality from source to mouth and low-cost wastewater disposal systems for low-income urban areas. Exchanges of information and experience among developing countries (South-South cooperation) must be further developed.

Follow-up

Implementation of the approaches outlined in this Statement will need to be part of country specific strategies.

Countries and ESAs are urged to formulate and implement action plans for water and sanitation incorporating the Guiding Principles of the New Delhi Statement. UNDP is invited to take a leading role in this process, in collaboration with other UN-system agencies.

The Water and Sanitation Collaborative Council, created immediately prior to the New Delhi Global Consultation, offers a new global forum for the exchange of information and promotion of the sector.

Supporting material

from WHO, Community Water Supply "Handbook of financial principles and methods". World Health Organization, Geneva, 1990.

THE SUSTAINABILITY OBJECTIVE

Key Elements

* Enabling Environment
* Health Awareness
* Strong Institutions
  . Community
  . Agency
  . Special interest groups
* Felt Need
* Supportive Attitudes
* Expertise and Skills
* Appropriate Service Level
* Appropriate Technology
* Materials and Equipment
* Support Services
  . Customer relations
  . Community support
  . O&M support

These elements relate to the creation and maintenance of conditions that ensure technical, social and financial project success, subject to availability of resources and adequate sharing of responsibilities between the community and the agency.

Enabling Environment

This element is largely a responsibility of Government. It consists of legal provisions, informal regulations, education, information and other incentives which influence the behaviour of both the community/user and the agency. Developing country politicians and policy-makers should provide an Enabling Environment which involves:

* the promotion and commitment to the provision of WSS services for improvement in health and quality of life of the whole population.
* political will for a genuine commitment to sustainability, which includes the existence of a clear and consistent policy and legal framework, as examplified by the creation of autonomous organizations clearly committed and allowed to improve organizational efficiency, financial viability, reliability of services, and to provide services tailored to the consumers' needs and willingness to pay.
* clearly formulated objectives and standards for construction, operation and use of facilities.
* creation and maintenance of a positive and supportive environment to ensure that new or old WSS facilities continue to function well, giving maximum benefit to the users.
* monitoring and regulation of WSS agencies to ensure that they provide an appropriate service to the public.

An Enabling Environment is not consistent with a "Free Water" policy, for it emphatically requires a commitment to a partnership approach (agency vis a vis the community/user) in the provision and meeting of costs of water and sanitation services.

Supporting material

Health Awareness

For the community /user, Health Awareness implies awareness of:

* the health benefit of improved water and sanitation services, to the extent that the user refuses to use alternative facilities of easier access or lower cost.
* the seriousness of diseases due to lack of adequate water and sanitation, and the effect on personal health of unhygienic practices; this knowledge is particularly important among women, since they have a major influence on the health of children; it should be based on local concepts of water use, hygiene and disease, and the understanding of how specific local conditions and practices can affect health.

For the agency, Health Awareness implies:

* a working knowledge and acceptance of the complementarity of water, sanitation and health;
* a commitment to bring about improvements in health through health education and other promotional activities;
* a continuous cooperation with agencies of the health sector, with mutual transfers of resources.

In addition, on the part of the community/household or user, it means an acceptance of personal responsibility, and willingness to pay or contribute otherwise towards efforts and activities to improve personal and community health.

Strong Institutions

This element covers agency and community-based institutions for the management of water and sanitation services.

For the agency, Strong Institutions mean:

* organizations with clearly defined responsibilities, a sound legal basis, and autonomous control of finances and human resources;
* institutions with adequate financial resources to carry out their mandated responsibilities during the development and the operational phases of any project.

For the community, Strong Institutions mean:

* they have a formal, legitimate and permanent status;
* they are characterised by strong leadership and solid backing by the constituency (especially women);
* they represent all user groups, including women and poor households;
* they have an ability to organize and carry out a planned and agreed programme of activities.

Supporting material

Felt Need

This element is characterised by the existence of a genuine individual/household or community need for improved WSS services, and means:

* an awareness and expressed need of the health, economic and social advantages of improved WSS services;
* a desire to have WSS services that are convenient and time-saving, which also implies the existence of productive pursuits for the time saved.

Felt Need also implies a willingness to contribute to the development, operation and maintenance of WSS facilities.

On the part of the agency it means:

* a willingness and capacity to consult men and women of various socio-economic and cultural sections of the community on their felt needs and priorities;
* a willingness to encourage communities to make improvements in WSS facilities for health, economic and socio-cultural reasons.

While a general Felt Need may be (or is often thought to be) self-evident, needs for a particular level of service may have to be nurtured through health promotion, literacy programmes and general economic activities.

Supportive Attitudes

For the agency, Supportive Attitudes mean commitment to:

* a partnership process for implementation of WSS facilities;
* a genuine desire to work with communities to assist them in finding solutions to their WSS problems;
* policies and institutions which motivate agency staff.

For the community it means:

* the acceptance of responsibilities and a willingness to assume ownership, pay for services and contribute towards the provision of WSS.

These supportive attitudes should be created and maintained among the formal and informal leaders of the community, and the agency. Such attitudes are reinforced by examples of successful WSS projects or of projects observed in other areas. Therefore, the resources mobilisation plan for monitoring performance and progress and allowing timely corrective action should also provide for continuous exchange of experiences.

Expertise and Skills

This element is characterised by the existence of levels of skills required for the development, construction, operation and management of WSS facilities.

At the community level it means:

* technical skills for carrying out minor repairs and routine maintenance;
* skills for organizing cash-raising and managing financial resources;
* organizational skills for mobilising community inputs, identifying community preferences and consulting with agency staff.

Supporting material

The agency should possess not only the necessary technical, administrative and management skills, but also have (or be able to draw upon) resources persons with appropriate skills in social organization, extension work, communications, training. monitoring, follow-up, and review/evaluation. The agency should also have skills to effectively involve women in these activities.

Expertise and Skills also require the existence of training programmes and activities targeted at agency staff and at the community.

Appropriate Service Levels

Appropriate Service Levels should be jointly agreed between the users or beneficiaries and the implementing agency, and reflect appropriateness in the socio-economic and technical context of the project. The concept therefore applies to small communities, but is also useful for larger systems. This element is characterised by the acceptance of responsibilities for development and operational phases inputs. The Appropriate Service Level for a particular situation ideally allows the community to upgrade later to a higher service level, thus encouraging maintenance of the facility until it can be improved.

In reaching appropriate service levels resources are required for:

* comprehensive analysis of alternative service levels;
* consumer surveys;
* communications with communities/users to explain the implications of each alternative;
* paying the extra cost of service levels appropriate to specific situations, which require more than the type of WSS adopted in national policies and plans.

Appropriate Technology

The chosen service level should reflect technology that is practical, economically viable, satisfies the needs of the users and is socially acceptable.

Thus the Appropriate Technology element for WSS is characterised by:

* socio-cultural appropriateness;
* affordability;
* ease of maintenance with the skills available in the agency or community;
* maximum use of locally available materials or spare parts;
* easily understood attributes;
* technical efficiency.

Choice of appropriate technology is thus determined by an array of technical and non-technical factors which should be analyzed, discussed and finally agreed upon by the agency and the community/user.

Materials and Equipment

For the agreed service level and technology choice, there should be adequate resources, jointly provided by the agency and the community, to cover all the required development and operational phase inputs.

The key characteristic of the Materials & Equipment element is the timely availability of necessary inputs.

Supporting material

It implies:

* availability of materials and equipment for new schemes, for rehabilitation and for operation and maintenance;
* close coordination with communities/users so as to guarantee the availability of their in kind contributions.

Support Services

This element covers O&M support systems, extension services and customer relations. Although this element is primarily provided by the agency during the development phase, some inputs should be identified and jointly agreed to come from the community and should increasingly shift towards the community/user at the operational phase.

The O&M support system is characterised by the regular availability of funds, equipment, spare parts and staff to carry out operations of the system.

At the agency level it requires:

* establishment of maintenance teams, leak-detection teams, and technical teams to provide back-up support for community-based water/health committees;
* the existence of monitoring systems and a preventive maintenance programme;
* an O&M training programme for agency staff as well as for community-based operators.

At the community level O&M support requires:

* supervision and payment of local O&M tasks;
* assigned responsibilities for community-based operators;
* monitoring, and reporting on resource coverage.

Community extension services should also be readily available and properly equipped and trained to provide for technical support, training and supervision, as well as promotional work in hygiene and health education.

Extension services would also require:

* multi-disciplinary teams with social, as well as organizational and technical skills;
* a customer-relations service, especially in largely agency-managed systems. This service should provide for fault-reporting, public relations and user education (health, water conservation, security, etc.).

2.2 LINKS BETWEEN HEALTH, WATER & SANITATION

Description of session

OBJECTIVES

- To make the link between O&M and health
- To raise the participants awareness of health related issues in water and sanitation activities
- To assess the importance of sanitation

OUTLINE OF SESSION

• Preliminary discussion: the facilitator asks a series of questions to the participants aiming at exchanging experiences and impressions: - Where do people usually defecate? - What happens to the faeces? - Where do people collect the family's drinking water	20 min
• Presentation of a video "Prescription for Health" from IDRC	25 min
• Participants are divided into two groups, each dealing with a theme, trying to respond to: 1. Where should the water supply be located, and why? 2. Who should pay for and maintain a community sanitation system?	30 min
• Plenary presentation of findings of the groups (15 min for each)	30 min
	1 h 45 min

HAND - OUTS

- "The importance of integrating hygiene education"
- "Cultural variations in defecation practices"
- "Experiences in better water resource management"
- "Extracts from Agenda 21".

MATERIAL NEEDED

- Video

Background information

1. Linking health, water and sanitation

In general
Proper operation and maintenance is contributing to the improvement of the well-being of a population through safe and reliable services. It is the basic right of every individual to have a clean water supply and access to improved sanitary facilities. It is also their basic right to be provided information regarding health education and the potential benefits of these interventions in order to upgrade their living conditions.
(From Water, Sanitation & Hygiene Education, a UNICEF training package, 1991)

Over the years many studies have been carried out to learn more about the relationship between water, sanitation and health. A recent review of 144 of these studies by Esrey et al (1990) showed that demonstrable health impacts affecting all age groups in most of the developing world can be expected from improvements in water supply, sanitation and hygiene. Six diseases were included in this review : Diarrhoea, ascariasis, guinea worm, Sistosomiasis, hookworm infection and trachoma (Boot, 1991).

The improvement in health is an obvious consequence of improved water and sanitation, but it is difficult to measure it quantitatively. The improvement in economic productivity results from a reduction in sickness time. It also results from improved vitality and improved efficiency. In effect, productivity is highly influenced by the health status; and both are highly influenced by the adequacy of sanitation as well as the safety of water supplies. A number of excreta related diseases cannot be controlled by improved sanitation alone without accompanying measures to improve water supply and to promote hygienic use of water as well as to maintain good personal and domestic hygiene. (Wright, 1983)

Non integration
However because of different factors, health, water and sanitation are not always integrated in projects, among which:

- health and water belong to two different ministries and policies, budgets or agendas do not correspond;
- water supply programmes do not feel it is their duty to deal about health issues;
- urgency of water projects do not allow for health aspects to be taken into consideration;
- hardware (construction of sites) and software (health education or community mobilization) do not get along together, because of different logic and methodologies;
- benefits obtained from health education are long and difficult to measure;
- poor profile given to sanitation and health related issues;
- engineers are not trained on social and health related components.

Reasons for the water bias (Wright, 1983)
The tendency to rank water above sanitation is both natural and understandable. For although both water and excretion are physiological imperatives, no one is known to have died as an immediate consequence of lack of latrines. The usual concern about latrines is with smells and houseflies. It is not generally appreciated that poor sanitation is actually a silent killer and a major cause of debility in developing countries. In contrast, it is common knowledge that lack of water leads to the death of men, animals and crops. Water is therefore recognized not only as a life supporting material but also as a prerequisite for economic productivity and development. Consequently, whenever it is unavailable nearby, people are prepared to spend hours fetching it from wherever it may obtainable. This is not the case for sanitation. When formal latrines are not available nearby.

2. About the film: (produced by IDRC, International Development Research Centre of CANADA)

The film "Prescription for health", promotes personal hygiene and community practices that can help to break the cycle of infection. Produced in collaboration with the World Health Organization and OXFAM, the film is aimed primarily at health care workers, and water and sanitation engineers and technicians in developing countries. It is also a prime source of information for policy makers.

The 23 minute film was shot on location in Bangladesh, the Philippines, Sri Lanka, Thailand and Kenya. Extensive animation has been used to illustrate clearly the path of disease and to unify the film's message for audiences of diverse cultural backgrounds.

For inquiries about loans or sales, see following information:

Africa and the Middle East:
IDRC
P.O. Box 62084
Nairobi, **Kenya**
Tel.: 330850
Cable: RECENTRE NAIROBI
Telex: 23062 RECENTRE

CRDI
B.P. 11007, CD Annexe
Dakar, **Senegal**
Tel.: 21-42-31
Cable: RECENTRE DAKAR
Telex: 21674 RECENTRE SG

IDRC/CRDI
P.O. Box 14, Orman
Giza, Cairo, **Egypt**
Tel.: 738760
Telex: DEVCN UN 92520

Latin America and the Caribbean:
CIID Apartado Areo 53016
Bogota, D.E.
Colombia
Tel.: 2558600
Cable: RECENTRE BOGOTO
Telex: 45366

Asia:
IDRC
Tanglin P.O. Box 101
Singapore 9124
Republic of Singapore
Tel.: 2351344
Cable: RECENTRE SINGAPORE
Telex: RS 21076

IDRC
11 Jor Bagh
New Delhi 110003
India
Tel.: 619411
Telex: 31 61536 IDRC IN

Other Regions:
IDRC
Communication Division
P.O. Box 8500
Ottawa, **Canada**, K1G 3H9
Tel.: (613) 236-6163
Cable: RECENTRE OTTAWA
Telex: 053-3753

PURCHASES:
16-mm and video
IDRC
Communications Division
(See Ottawa address)

The film may also be borrowed from Canadian Embassies and High Commissions in the following countries:

English		**French**	**Spanish**
Australia	Korea	Benin	Argentina
Bangladesh	Malaysia	Burkina Faso	Chile
Cameroon	New Zealand	Cameroon	Colombia
China	Nigeria	Côte d'Ivoire	Costa Rico
Ecuador	Pakistan	France	Cuba
England	Papua New Guinea	Gabon	Guatemala
Ghana	Philippines	Ghana	Mexico
Guyana	Sri Lanka	Haiti	Peru
Hong Kong	Tanzania	Rwanda	Venezuela
India	Thailand	Mali	
Indonesia	Zimbabwe	Tanzania	
Jamaica			

The film is also available in many local, national, and regional languages.

3. Protection of water supply

According to the Agenda 21, adopted by the Plenary in Rio de Janeiro on June 14, 1992:

> "Fresh water resources are an essential component of the earth's hydrosphere and an indispensable part of all terrestrial ecosystems .....
> ..... Water is needed in all aspects of life. The general objective is to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities with the capacity limits of nature and combating vectors of water-related diseases."

Hence, while planning or implementing O&M activities, planners and managers should take into consideration the need to protect water resources, water quality and aquatic ecosystems, in order to ensure a good quality of water even for future generations, (Extract of the Agenda 21 are given in the supporting material, as well as extracts from IRC Occasional Paper no. 15, on "Drinking Water Supply Protection".

Supporting material

Extracts taken from "Action speaks: the study of hygiene behaviour in water and sanitation projects" (1993), by Marieke Boot and Sandy Cairncross. IRC, International Water and Sanitation Centre and London School of Hygiene and Tropical Medicine.

2. *Hygiene behaviour and health*

Human behaviour is an important factor in the transmission of water and sanitation-related diseases. Hygiene behaviours, such as the use of a hygienic latrine and the frequent washing of hands, help to reduce disease transmission. In this chapter we explore the links between hygiene behaviour and health.

2.1 Prevention of water and sanitation-related diseases

General preventive measures

Water and sanitation-related diseases include various types of diarrhoea, worm infestations, skin and eye infections and vector-borne diseases. Over the years many studies have been carried out to increase our insight into prevention of the transmission of these diseases (Esrey et al., 1990). These studies indicate that, dependent on the type of disease and local circumstances, the preventive measures listed in Box 1 are particularly helpful in interrupting disease transmission:

Box 1: Major preventive measures

1. **safe human excreta disposal**
2. **personal hygiene**
3. **domestic hygiene (and animal management)**
4. **food hygiene***
5. **water hygiene/consumption of safe water**
6. **safe wastewater disposal and drainage**

The list makes clear that improved water supply and sanitation facilities are important measures. It is not just water quality that matters. Having the right quantity of water available is even more important. Reliable and easily accessible water sources are a precondition for satisfactory personal, domestic and food hygiene.

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* *Food hygiene is the term most frequently used in the water and sanitation sector, though the specialists prefer to describe it as food safety. It is defined as all conditions and measures that are necessary during the production, processing, storage, distribution, and preparation of food to ensure that it is safe, sound, wholesome, and fit for human consumption (WHO, 1988). In this document the focus is only on those aspects of food hygiene/food safety which*

Supporting material

HYGIENE BEHAVIOUR AND HEALTH

Each preventive measure in the list involves a series of hygiene behaviours. For example, personal hygiene includes behaviours such as washing of hands after defecation and before food preparation and eating, as well as bathing and face washing, washing of clothes, use of a clean towel. To take account of this complexity, we call each major preventive measure a 'domain of intervention'. The boundaries between the domains are rather fluid, as the same behaviours may appear in several domains. Thus, handwashing after defecation is indicated both for personal hygiene, and for the safe disposal of human excreta.

Priority preventive measures

Research has shown that behaviours and facilities associated with the safe disposal of human excreta and the use of more water for personal, domestic and food hygiene are among the most important measures for cutting off transmission of several important diseases (Esrey et al., 1986). Having said that, the particular transmission pattern of each disease and the particular local circumstances in an area will always determine what will be the best preventive measure at a certain point of time.

Table 1 summarizes the main transmission patterns and major preventive measures according to type of disease. The transmission patterns can be complex. For example, various disease organisms that cause diarrhoea follow multiple routes from faeces to mouth.

Safe excreta disposal and handwashing after defecation are two important hygiene behaviours. Drawing: WaterAid, Ghana.

Supporting material

Table 1: Transmission patterns and preventive measures for water and sanitation-related diseases

Infection	*Transmission pattern*
Various types of diarrhoeas, dysenteries, typhoid and paratyphoid	From human faeces to mouth (faecal-oral) via multiple routes of faecally contaminated water, fingers and hands, food, soil and surfaces (see Figure 1). Animal faeces (e.g. from pigs and chickens) may also contain diarrhoeal disease organisms.
Roundworm (Ascariasis), Whipworm (Trichuriasis)	From faeces to mouth: Worm eggs in human faeces have to reach soil to develop into a infective stage before being ingested through raw food, dirty hands and playing with things that have been in contact with infected soil. Soil on feet and shoes can transport eggs long distances. Animals eating human faeces pass on the eggs in their own faeces.
Hookworm	From faeces to skin (especially feet): Worm eggs in the faeces have to reach moist soil. where they hatch into larvae which enter the skin of people's feet.
Beef and pork tapeworms	From faeces to animals to humans: Worm eggs in human faeces are ingested by a cow or pig where they develop into infective cysts in the animal's muscles. Transmission occurs when a person eats raw or insufficiently cooked meat.
Schistosomiasis (bilharzia)	From faeces or urine to skin: Worm eggs in human faeces or urine have to reach water where they hatch and enter snails. In the snails they develop and are passed on as free swimming "cercariae" which penetrate the skin when people come into contact with infested waters. In the Asian version of the infection, animal faeces also contain eggs.
Guinea worm	From skin to mouth: The worm discharges larvae from a wound in a person's leg while in water. These larvae are swallowed by tiny "water fleas" (cyclops). and people are infected when they drink this contaminated water.
Scabies, ringworm, yaws	From skin to skin: Both through direct skin contact and through sharing of clothes, bedclothes and towels.
Trachoma, conjunctivitis	From eyes to eyes: Both direct contact with the discharge from an infected eye and through contact with articles soiled by a discharge, such as towels, bedding, clothing, wash basins, washing water. Flies may also act as transmission agents.
Louse-borne typhus, Louse-borne relapsing fever	From person to person: Through bites of body lice which travel from person to person through direct contact and through sharing clothes and bedclothes, particularly when underwear is not regularly washed.
Malaria, yellow fever, dengue	From person to person through the bite of an infected mosquito. The mosquito breeds i standing water.
Bancroftian filariasis	From person to person through numerous bites by infected mosquitoes. The mosquitoe breed in dirty water.

Supporting material

HYGIENE BEHAVIOUR AND HEALTH

	Major preventive measures					
Infection	*safe human excreta disposal*	*personal hygiene*	*domestic hygiene (and animal management)*	*food hygiene*	*water hygiene/ safe water consumption*	*wastewater disposal and drainage*
Various types of diarrhoeas, dysenteries, typhoid and paratyphoid	●	●	●	●	●	
Roundworm (Ascariasis), Whipworm (Trichuriasis)	●	●	●	●		
Hookworm	●		●			
Beef and pork tapeworms	●			●		
Schistosomiasis (bilharzia)	●	●	●			
Guinea worm					●	
Scabies, ringworm, yaws		●	●			
Trachoma, conjunctivitis		●	●			
Louse-borne typhus, Louse-borne relapsing fever		●	●			
Malaria, yellow fever, dengue			●			●
Bancroftian filariasis	●		●			●

Supporting material

A diagram providing a simplified illustration of the various routes of faecal-oral transmission is presented in Figure 1. Faecal contamination of water, fingers and hands, and the environment sets the stage for transmission of disease to a new person. Contaminated water may be ingested directly; it may be used in the preparation of food, leading to contamination; or it may be used to wash utensils, drinking and water storage vessels, as well as foods themselves, thereby contaminating drinking water or food. Contaminated fingers and hands may lead to faecal-oral transmission of diseases through direct contact with the mouth, through contamination of drinking and cooking water, contamination of foods, and contamination of cooking utensils and vessels for drinking water and water storage. Contaminated soil and surfaces are also links in the transmission chain. Flies may contribute to the transmission of diarrhoea as they frequent both faeces and food (Bateman, WP 1991).

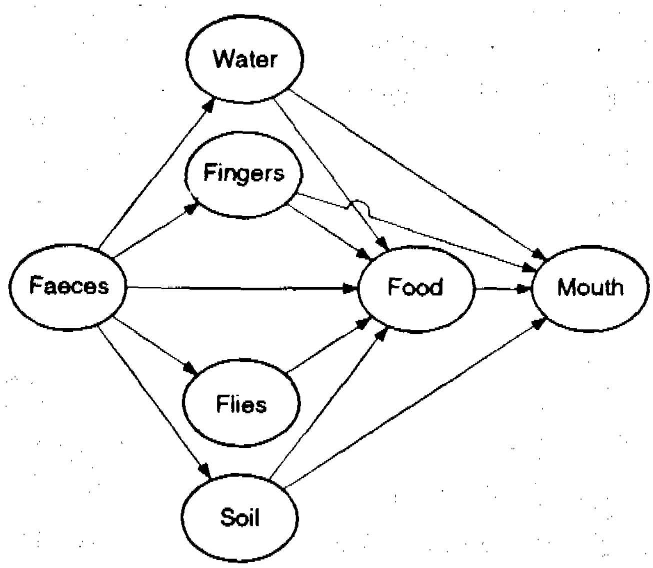

Figure 1: Faecal-oral transmission routes.

It is very important to be familiar with the various transmission patterns, so as to be able to identify which particular hygiene behaviours and measures can help to interrupt disease transmission. In general, preventive behaviours and measures can be grouped under two types of barriers:

(A) The *primary* barrier to disease transmission prevents infectious organisms from getting into the environment in the first place. In the case of faecal-oral disease transmission, the primary barrier is adequate sanitation, such as the proper use of a well-maintained latrine. Effective isolation of faeces eliminates the possibility of faecal contamination of water, soil and surfaces, food, and flies. Prevention of contamination of the environment with animal faeces, through corralling or removal of animals, can also be considered a primary barrier to transmission.

Supporting material

(B) When there is no primary barrier to keep infectious organisms out of the environment, or when, as is typically the case, the primary barrier works imperfectly, *secondary* barriers must be relied on to prevent the transmission of disease. These secondary barriers include: (a) avoiding infectious organisms – for example by avoiding unsafe sources of drinking water and (b) removal or destruction of infectious organisms – for example by thorough cooking of food (Bateman, WP 1991).

For the effective interruption of each water and sanitation-related disease it is usually necessary to perform a series of hygiene behaviours (Table 1, under "Major preventive measures" read horizontally). A singular exception to this rule is Guinea worm, which is effectively interrupted simply by avoiding drinking contaminated water. The opposite is also true: one single hygiene behaviour may interrupt the transmission of several diseases at the same time (Table 1, under "Major preventive measures" read vertically). Handwashing is an obvious example. Whereas handwashing may help to interrupt both some diarrhoeal and eye diseases it is only one measure in disease prevention. This duality has to be kept in mind when deciding on the study of specific hygiene behaviour.

Box 2: Duality in the links between behaviour and the prevention of diseases

ONE disease:
a series of hygiene behaviours will usually be required to reduce one disease

ONE hygiene behaviour:
a single hygiene behaviour may help to reduce the transmission of several diseases

2.2 Evidence of links between behaviour and health

Whereas on a general level we have a fairly good impression about the main transmission patterns and preventive measures of water and sanitation-related diseases, our knowledge about links between ***specific hygiene behaviours*** and health is much more limited. Below are some examples of studies which show evidence of links between specific behaviours and health. They do not claim to provide more than a first insight into the present state of the art. From the available literature it appears that handwashing has been subject to many studies, whereas other specific behaviours have received much less attention. More studies were carried out in Asia than in Africa and South America.

Safe excreta disposal

Safe excreta disposal is one of the primary barriers to the transmission of diarrhoeas and worm infections, as it helps to prevent the disease organisms from getting into our environment. Several studies confirm the importance of preventing faecal contamination

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of the living environment. Rahman et al. (1985) concluded that in households without a latrine, where faeces would be left where first deposited - whether among the bushes in the case of adults or in the courtyard in the case of children - infant mortality was 2.76 times higher than in households where a latrine was used. Clemens et al. (1987) and Han et al. (1990) also found that open defecation by young children in the family living area was associated with a higher incidence of childhood diarrhoea.

Muller et al. (1989) wanted to know how important it is to have a high standard of latrine construction for the safe disposal of human excreta. Ascaris eggs in the soil of the yard and in the faeces of household members were taken as the indicator. It appeared that there was no significant difference between the type of latrine in use and the presence of Ascaris eggs. There was a high count of Ascaris eggs in the yard and in household members, where young children practised open defecation in the living area. Whereas the type of latrine seems to be of little importance, its cleanliness has been shown to be a key factor in reducing disease transmission. Koopman (1978) carried out a study in 14 primary schools and found that unhygienic toilet conditions were related to diarrhoea. It was estimated that if all schools could reach even a modest level of hygiene, diarrhoea could be reduced by 44% and vomiting by 34%.

Contamination of hands and the effectiveness of handwashing

Hands are generally believed to be important vehicles in the transmission of diarrhoeal diseases (Aziz et al., 1981). Han et al. (1986) demonstrated that hands readily become contaminated after defecation. Interestingly, mothers who used water for anal cleaning had more contaminated hands than those who used paper.

Kaltenthaler et al. (1988) point to several other factors that influence the contamination of hands. High humidity correlates with high counts of faecal coliforms and faecal streptococci on hands, showing the need for more frequent handwashing during the humid seasons. Household members with an infant have significantly more contaminated hands, as do mothers who don't have time to attend to hygiene in the family because of extreme poverty.

A person's activity also effects the bacterial counts. People involved in outdoor agricultural activities appeared to have the highest counts on their hands. Those involved in activities using water, such as bathing children, washing clothes and washing dishes had low counts, even though the water would probably be quite contaminated bacteriologically from the child's body, the clothes or the dishes. Whereas Kaltenthaler et al. did not investigate the relation between hand contamination and diarrhoeal disease, this was part of a study by Henry et al. (1990). Their results show a correlation between childhood diarrhoea and the degree of contamination of a child's hands. A study by Pinfold et al. (1988) points in a similar direction. They found a significant tendency for there to be less faecal contamination on the hands of family members with in-house water connections than of households which had to carry their water home. Many studies have shown that in-house water supplies are also associated with greatly reduced rates of diarrhoea.

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Handwashing with soap after defecation and before taking food proved to be effective in reducing the incidence of diarrhoeal diseases in a study by Khan (1982). Han et al. (1989) arrived at a similar conclusion in their study on the prevention of diarrhoea by handwashing with soap. Studies by Alam et al. (1989) and Clemens et al. (1987) indicate that handwashing by mothers is one of the major factors contributing to a lower incidence of childhood diarrhoea. Daniels et al. (1990) concluded that the introduction of latrines produced an overall reduction of 24% in the incidence of reported diarrhoea, but that the impact appeared to be greater in households where mothers reported handwashing after defecation and the use of larger quantities of water.

Results of a study by Lanata (WP 1991) indicate a relation between the use of more soap and larger quantities of water for handwashing by mothers, and a lower diarrhoea incidence in infants of 6-18 months. An interesting outcome was that the number of handwashings per day appeared to be more important than the reasons for it, whether before cooking or eating, or after defecation. This is probably because handwashing works in two ways. First, it washes off potentially dangerous bacteria from contaminated hands. Second, it also removes material ('dirt') which could harbour such bacteria; this reduces the survival time of bacteria which get onto hands by subsequent contamination.

Feachem (1984) examined the effectiveness of handwashing with soap on diarrhoea rates by reviewing three studies from Bangladesh (Khan, 1982), the USA (Black et al., 1981) and Guatemala (Torun, 1982). All three studies showed an important impact of handwashing on diarrhoea rates:

- *a 35% reduction in the incidence rate of shigellosis among all ages in urban families in Bangladesh;*
- *a 37% reduction in the incidence rate of non-*shigella *diarrhoea among all ages in urban families in Bangladesh;*
- *a 48% reduction in the incidence rate of all diarrhoea among children aged 6-29 months in daycare centres in the USA;*
- *a 14% reduction in the incidence rate of all diarrhoea among children ages 0-71 months throughout the year in a Guatemalon village;*
- *a 32-36% reduction in the incidence rate of all diarrhoea among children aged 0-71 months during the peak diarrhoea season in a Guatemalan village.*

More recently, a study by Wilson et al. (1991) in Indonesia found that the promotion of handwashing by mothers and their children reduced the prevalence not only of diarrhoea, but also of conjunctivitis.

Hoque et al. (1991) compared the cleanliness of hands after handwashing using ash, soap, clean mud or plain water only. The results show that all three washing agents were more or less equally effective in reducing faecal coliform hand contamination, while reduction of hand contamination by water alone was not significant. Their conclusion is that the most important factor is not the washing agent itself, but the time spent on handwashing, the rubbing of hands probably doing the trick. Past research by Lowbury et al. (1964) and Sprunt et al. (1973) and a more recent study by Kaltenthaler et al. (1988)

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also point in this direction: more time spent on handwashing with some vigour may be as effective as handwashing with soap. Kaltenthaler et al. add that unless the price and availability of soap is a major obstacle, it is advisable to promote handwashing with soap, as this is easier to implement than prolonged rubbing of hands with water only. A still unpublished study by Pinfold et al. indicates that the quantity of poured water, the length of rubbing and the use of soap all help to increase the cleanliness of hands.

Washing and bathing

Personal and domestic hygiene practices play a significant role in reducing the spread of eye and skin diseases such as trachoma and scabies. Prost et al. (1989) reviewed a number of studies on the transmission of trachoma. These studies indicate that daily face washing can reduce both the prevalence and the intensity of trachoma in children. More water for personal hygiene is the crucial factor. This is also clear from the finding that a shorter distance to a water source is associated with a lower frequency of trachoma. Thus, a trachoma survey in Mozambique found a 19% prevalence of trachoma in a village with a water supply, while the prevalence was twice this figure in another village with no supply (Cairncross et al., 1987). The quality of water does not seem to have an effect on the prevalence of trachoma.

A study on the incidence of scabies by Stanton et al. (1987b) showed that, apart from economic factors, the overall level of hygiene in a family was associated with the risk of scabies. Unfortunately the study did not determine which hygiene factors were strongest related with the incidence of scabies. It has been suggested in various studies that scabies and other infections of the skin can be prevented or reduced by regular body washes, but evidence is not conclusive.

Water hygiene

Safe drinking water is especially important for the prevention of Guinea worm disease and various types of diarrhoea. Guinea worm has only one transmission route and can be successfully interrupted to zero prevalence, just by drinking only uncontaminated water (Huttly, 1990). On the other hand, safe drinking water is only one measure in the prevention of diarrhoeas, and unlikely to be effective on its own (Henry et al., 1990; Rahman et al., 1985; Victora et al., 1988).

Lindskog et al. (1985) found that water easily becomes contaminated between the tap and consumption at home. Other studies, as summarized by Burgers et al. (1988) confirm the risk of water contamination between collection and use through various behaviours, such as collection and storage of drinking water in open vessels, and in vessels which are not cleaned regularly, use of communal cups to draw water, and hands touching the water during collection, storage and use.

The role of such domestic water contamination in the transmission of disease is not clear. For example, Kirchhoff et al. (1982) found that disinfection of heavily contaminated

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water stored in the home has no effect on diarrhoea incidence, while Deb et al. (1986) did find that the use of long-necked water storage jars, preventing contamination of the stored water, did help to protect families from cholera. Yeager et al. (1991) reported that diarrhoeal incidence of children was lower in households using water reservoirs with a tap, and higher when a bucket had to be used to retrieve the water. A study by VanDerslice et al. (1991) indicates that water source contamination is a more important transmission route for enteric pathogens (disease-causing organisms) than contamination of water between collection and use. One reason may be that pathogens contaminating the water source come from 'outside' and therefore create the risk of initiating new infections in the family, whereas pathogens contaminating collected water come from "inside" as they are already present in the household environment.

Food hygiene

Food acts as another important vehicle in the transmission of various diarrhoeas and worm infections (Käferstein et al., 1990). Esrey at al. (1989) reviewed available literature on studies about the relation between food hygiene practices and diarrhoea. They conclude

Food hygiene and handwashing before eating help to prevent the transmission of various types of diarrhoeas and worm infections. Drawing: KWAHO, Kenya/Waterkeyn.

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that there is still a lot to learn about how diarrhoea incidence may be influenced by food handling, preparation and storage practices.

Their literature review showed evidence that poor food hygiene practices contribute to the contamination of food. Handwashing and cleaning of kitchen and eating utensils may result in reduced contamination. Cups and spoons are likely to be less contaminated than bottles and teats. Cleaning of the food preparation area may reduce cross-contamination. Undercooked food or inadequately reheated food may be highly contaminated, not only because bacteria do not get killed but also because with the 'right' temperature bacteria may rapidly multiply. Food is best consumed as quickly as possible after preparation, because food stored outside a refrigerator (as will usually be the only possibility in large parts of the world) will suffer from rapid multiplication of bacteria.

The conclusion of the review is that food is easily and frequently contaminated, and that this contamination may be linked to specific food hygiene practices. The levels of faecal contamination found in foods are often many orders of magnitude greater than usually found in contaminated water. In the circumstances, it is remarkable that relatively few studies were able to demonstrate an association between food hygiene practices and diarrhoea. One of the reasons may be that since diarrhoea is transmitted by many routes, a reduction in food contamination may be offset by the ingestion of disease organisms from other sources, such as water, hands or objects. This is further discussed in the last part of this section.

In a study by Black et al. (1989), it was found that samples taken from raw foods indicated that cereals, dairy products, and meats were the most frequently contaminated with *E. coli*. Samples of evaporated canned milk taken within one hour of opening had a lower frequency of contamination (3%) than those taken after an hour or more of storage at ambient temperatures (43%). Furthermore, after one hour, some of the samples had a very high *E. coli* colony count (20% > 1000 per ml), indicating extensive multiplication of bacteria in the can. Milk and food items specially prepared for infants (cereals and purée) were more likely to be contaminated than foods prepared for the entire family (such as soups, stews and fried foods). However, for most food items, the frequency of contamination was related to the amount of storage time since initial preparation. Teas, which were often given to infants beginning in the first month of life, had a low frequency of contamination after preparation by heating and if served in a cup, but high levels of contamination if served in a baby bottle. Also, a high proportion of baby bottles and bottle teats were contaminated. Other potential sources of food contamination were the utensils used and the hands of mothers or other persons responsible for food preparation.

A literature review by Motarjemi et al. (1992) shows that weaning food is a major risk factor in the cause of diarrhoea and associated malnutrition. Infants and young children are very vulnerable, and if they consume contaminated weaning foods they are likely to contract diarrhoeas. The interaction between diarrhoea and malnutrition is complex, but it is generally accepted that diarrhoeal diseases affect children's growth once weaning is initiated. The sources of weaning food contamination are numerous, the storage of cooked food at ambient temperature probably being the most critical one. The authors therefore

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conclude that it is of the utmost importance to promote breast feeding up to two years and beyond and to promote the safe preparation and handling of weaning food to protect the health and nutritional status of infants and children (see also Annex 5).

Water contact

Schistosomiasis is a water-contact disease and the duration of water contact seems to be an especially important factor in its prevalence. A study by Klumpp et al. (1987) revealed no infections in the 0 to 4 year age group, a rapid build-up of infection to age 14, the peak between age 15 and 19, and then a rapid decline. This curve paralleled the curve for water contact duration. Also, in all age groups above the age of four, water contact for males was of longer duration than for females and included more time playing and wading, and this finding correlated with much higher incidence and prevalence rates of schistosomiasis in males.

Water contact patterns have, however, been shown to vary according to occupational, social and cultural factors. In many studies, female water contact has been higher than that of males, and domestic activities have been important in exposing women to infection. In St. Lucia (Dalton, 1976), washing clothes resulted in the highest duration of contact and the number and duration of all contacts were significantly correlated with the number of persons infected with intestinal schistosomiasis. At the Volta Lake, Dalton et al. (1978) found that both domestic water contact activities and activities associated with fishing canoes were significantly related to infection with urinary schistosomiasis. In other studies, swimming has been shown to be important in the acquisition of infection (Kvalsvig et al., 1986).

The correlation between exposure and infection is not straightforward, and comparisons between infection profiles and water contact profiles can be misleading (Bundy et al., 1990). The risk of infection is influenced by factors other than the duration of water contact: the activity performed, the extent of body surface exposed, the site of contact and the time of day all influence the exposure that occurs. Studies in Kenya (Butterworth et al. 1985) and The Gambia (Wilkins et al., 1987) have shown that water contact patterns alone are not adequate to explain the pattern of infection in older children and in adults. In The Gambia, while the intensity of reinfection increased with increasing exposure in children aged 2-9 years, less increase in reinfection occurred in adolescents (10-14 years). In adult females, even individuals who have high levels of exposure had a low intensity of reinfection. It appears that adults are less susceptible to infection than children and an immune response can be built up slowly through repeated infection. Behaviours leading to exposure may be a major determinant of schistosome infection in childhood, so reducing exposure through changes in such behaviour could be used to reduce infection (Bundy et al., 1990).

In another study on the relation between water contact and the prevalence of schistosomiasis, the influence of a change in working hours of canal cleaners was investigated, based on the knowledge of the life-cycle of the cercariae. The cercariae

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emerge from the snail during sunlight, with a peak at noon. As they are only infective up to twelve hours, the water does not contain infective cercariae in the early morning. The working hours of the canal cleaners were shifted from mid-day to early morning, and this resulted in a significantly lower prevalence of schistosomiasis infection. However, the results would have been even better if the canal workers had not used the canals for bathing and domestic purposes in the afternoon. The authors conclude that changing the working hours is helpful, but clear information on why to avoid canal water in the afternoon should also be provided (Tameim et al., 1985).

Soil contact

Killewo et al. (1991) provide us with an example that wearing some kind of footwear can be effective in interrupting the transmission of hookworm, as the prevalence of hookworm among schoolchildren who had to wear shoes was significantly less than among children not attending school. Yeager et al. (1991) found that whether or not the child was seen eating soil (as reported by the mothers) had significant effect on mean diarrhoeal incidence.

Flies

Flies are generally believed to play an active role in the transmission of diarrhoea, and a number of studies point in that direction. For example, in two studies in the USA, towns sprayed with DDT insecticide had significantly lower fly densities and lower incidence rates of shigellosis and diarrhoeal disease in children, than did matched control towns without fly control (Lindsay et al., 1953). These studies indicate that it is well worthwhile to keep flies away from the living environment (but not by the use of DDT, because of the damaging effect on the environment and the resistance of houseflies to this insecticide). Oo et al. (1989) also conclude that it is worth keeping flies away from kitchens and food to reduce the risk of diarrhoeal diseases, as their study revealed that flies can be carriers of enteric bacterial pathogens, such as cholera, shigellosis and Salmonella infections. Cohen et al. (1991) found that in military camps where intensive fly control measures were implemented (mainly by using fly traps), the soldiers suffered significantly less from diarrhoeal disease, than soldiers in camps where no such measures were taken.

A systematic review of evidence that flies contribute to the transmission of diarrhoea has been carried out by Esrey (1991). The reported studies (mostly conducted prior to 1960) indicate that many pathogens causing diarrhoea in humans can survive on flies for up to 10 days. They can also be carried in the gut of the flies and deposited on the food. Although from the reviewed studies Esrey could not conclude that flies play a role in the transmission of diarrhoeal diseases, it is still a fact that flies are a potential source of contamination of food and water (Motarjemi et al., 1992).

Flies are also known to play a role in transmitting conjunctivitis in various settings, and there is strong circumstantial evidence to suggest that they can also transmit trachoma (Jones, 1975; Prost et al., 1989). It is probably for this reason that improvements in excreta disposal have also been found to be associated with reduced prevalence of trachoma.

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Animal contact

There are many open questions and conflicting information about the role of animals in the transmission of water and sanitation-related diseases. Cows, pigs, chickens and other animals in the living area may or may not influence the transmission of diarrhoeas. Black et al. (1989) found that in the study households more than half of the chickens and cats and 25% of the dogs were infected with *Campylobacter jejuni* and that the infants in these households were significantly more likely to acquire *C. jejuni* infection, indicating that animal faeces is likely to be an important source of infection, transmitted either through direct contact or by family members, objects or food in the house. Clemens et al. (1987) could not find a relation between the incidence of childhood diarrhoea and whether animals were allowed to be in the kitchen.

Lenata (WP 1991) reported that corralling of animals was not effective in reducing diarrhoea rates, suggesting that it is not a primary transmission route. Huttly et al. (1987) surprisingly found that where animals were allowed inside the house, there was a significant reduced risk of diarrhoea, particularly among older children. There seems to be no explanation for this finding. In a study by Jenkins (WP 1991) it was found that the most significant risk associated with the transmission of diarrhoeal diseases was the mother and child sleeping with the family pigs. An observation study by Marquis et al. (1990) showed that children (< 5 years of age) are likely to touch chicken faeces with their fingers when these are present in the living area. They also readily put their fingers in their mouths. The results of this study indicated that children in families where household chickens were infected with *C. jejuni* were 12 times more likely to have diarrhoea than those in homes without chickens. Thus the authors recommend that, to reduce faecal-oral contamination, all poultry should be corralled and not allowed access to the house.

Combination of behaviours

Though in the above studies we have tried to provide evidence of links between particular behaviours and health, more often than not a reduction in water and sanitation-related diseases can only be achieved by a combination of hygiene behaviours (Briscoe, 1984; Esrey, 1991). We have already made this point in Section 2.1 and it is re-emphasized in various recent studies. For example, a study by Alam et al. (1989) shows that a combination of the use of clean water, the absence of child's faeces in the yard, and mother's handwashing after defecation and before food handling, resulted in a reduction of more than 40% in the incidence rate of diarrhoea compared with when only one of these behaviours was observed. Huttly et al. (1987) conclude in their study on the epidemiology of acute diarrhoea that a combination of personal and domestic hygiene and hygienic weaning and feeding practices of young children are important to prevent diarrhoea.

Hurtado (WP 1991) found that the following five behaviours were significantly associated with higher rates of diarrhoea in children: 'mother's hands dirty'; 'water containers in house uncovered'; 'baby bottle on ground or floor'; 'human faeces in living area'; and 'animals in living area'. Several studies indicate that a general high level of a

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The multiplicity of health threats means that a series of hygiene behaviours is usually required to reduce disease transmission. Drawing: KWAHO, Kenya/Waterkeyn.

series of hygiene behaviours is most effective in preventing water and sanitation-related diseases, and that specific behaviours, such as handwashing or washing and drying of kitchen utensils are to be considered as indicators of the general hygiene situation. We will come back to this in Chapter 7.

The significance for health of a specific behaviour depends particularly strongly on the other behaviours which precede or follow it – in other words, on the sequence of behaviours. To take a trivial example, washing one's hands *after* eating is very different from washing them beforehand. Any study of hygiene behaviour therefore needs to consider each action, not in isolation, but as a part of a sequence of activities. In Section 3.3 this issue will receive further attention.

2.3 Cultural perspectives on hygiene and health

Irrespective of bio-medical evidence, everybody has notions about what is good and what is bad for our health. Also, everybody has notions about what is clean, hygienic, or pure, and what is dirty, unhygienic or polluting. These notions may differ per family, local community, nation, or religious, socio-economic or ethnic group. What these notions have in common is that they influence our daily practices and hygiene behaviours.

> *"Hygiene behaviour is likely to be related to fundamental issues about cleanliness that are inculcated and absorbed at a very early age so that one of the first things that small children are taught is the distinction between what is clean and what is dirty. This knowledge becomes almost instinctive and it may therefore be hard for people to (...) be aware of their own patterns of behaviour" (Zeitlyn, WP 1991).*

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Concepts of purity and cleanliness

Purity can be defined as a state of ritual cleanliness, whereas cleanliness itself refers to a physical state. In Hindu and Moslem worlds, concepts of clean and dirty and purity and impurity are well developed and have a strong effect upon personal and household hygiene. Thus, in some Hindu areas the wife will only enter the kitchen in a pure state, that is after she has washed herself and put on other clothes, and not when she is menstruating (Kochar, 1991). In the Moslem world, ritual impurity is the usual state in which one is found. Purification involves washing of one's hands, face, and feet before prayer, and taking a complete bath after sexual contact, menstruation, and childbirth (Simpson-Hébert, 1984). However, purity and cleanliness are not always two sides of the same coin. For example, a person can observe purity rites and wash hands before prayer, but not do this before eating.

Kochar (1978) in his study on hookworm transmission provides us with an example of the relationships between purity and cleanliness. "Among rural people in Bengal, notions of the pure and the sacred, and of the polluted and profane, are in many ways the rules for personal hygiene as well as for ritual. A popular text on daily rituals for orthodox Hindus includes procedures, prescriptions and even sacred chants to go with cleaning the mouth, applying oil, bathing, grooming, and so on. The canons of 'folk hygiene' embody some very powerful notions of personal cleanliness."

In many cultures and societies, human excreta are considered to be polluting and dangerous in ways far beyond or apart from the bio-medical model of disease transmission. At the same time, the excreta of babies and little children are often considered to be harmless in all respects. Also, among many groups of people, the left hand is used for anal cleansing, and no matter how well this hand is washed afterwards, it remains the 'dirty' hand and should never be used for handling and serving food, eating, shaking hands, etc.

Hall et al. (1991) report in their study on water, sanitation and health that "the faeces of a child that is only breast-feeding are not considered to be "dangerous" (when it has diarrhoea) by the vast majority of interviewees. Only four respondents said that infants' faeces were dangerous "from birth". The rest offered different ages (ranging from about two to six) but stressed that faeces become dangerous once a child starts to eat solid foods and the faeces begin to smell. This, they stressed, was the sign of danger. As for the cause of faeces becoming dangerous, a few interviewees suggested the mixing of foods in the stomach. Others said that young children's faeces were not dangerous until they have suffered from serious diseases such as tuberculosis."

What is considered as being clean is also not the same everywhere and for everybody. Kendall et al. (WP 1991) noticed in their study on health behaviour that people considered a face recently wiped by a dirty rag also as being clean, and that mothers did not

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differentiate dipping hands in water from washing hands. Fukumoto et al. (1989) discovered that mothers perceive three kinds of 'dirtiness' that may lead to handwashing:

- ***Perceived 'dirtiness':*** *when hands look, feel or smell dirty to the mother. She washes her hands when they are visibly soiled, smell strongly, for example of kerosene, or when they feel sticky. This is the most common type of hand-washing. Essentially the hands are washed because they feel uncomfortable.*
- ***Contaminating 'dirtiness':*** *when the hands have been in contact with anything considered dirty, such as money, garbage or adult human faeces. All of these are felt to be vehicles of different illnesses. Although mothers report that they wash their hands on these occasions, observation shows that this is not always the case. Baby stools are also not considered to be dirty or contaminating.*
- ***Social 'dirtiness':*** *when mothers wish to improve their general physical appearance. This type of handwashing is very common and occurs before going out, or receiving guests at home. It is associated with aesthetic or social values.*

Perceptions about transmission of diseases

There are many local perceptions about causes, and thus about treatment and prevention of water and sanitation-related diseases. For example in northern Ghana, Guinea worm is generally believed to be in the blood of people, and inherited. It is thought to depend on the resistance of the individual whether or not a person is able to suppress the worm. This explains why although all people drink the same water, some get Guinea worm year after year while others never get it. People also differentiate between natural and supernatural Guinea worms. The former are easy to cure, the latter may be very dangerous and last a long time (Murre, personal communication).

Weiss (1988) made a global review of ideas about causes of diarrhoea and concluded that in a wide variety of cultures, one or more of the following causes are acknowledged:

- foods that are fatty, not cooked adequately, or heavy;
- imbalance of hot and cold that may be associated with foods, exposure to draughts or seasonal changes;
- normal or poor quality breast milk;
- physical factors, such as a fall (in case of a sunken fontanelle due to dehydration), or poor caretaking;
- supernatural causes, including possession, sorcery, witchcraft, divination or evil eye;
- pollution from exposure to or inauspicious contact with ritually impure persons or things;
- moral misbehaviour, including deeds of the sick person or a sick child's parents, for example sexual intercourse or pregnancy while breastfeeding;
- natural consequence of milestones, especially teething, crawling and walking;
- infection, which may be associated with hygiene and sanitation (but which may be difficult to distinguish from ideas about pollution).

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These cultural perceptions about causes of water and sanitation-related diseases result in behaviours for the prevention and treatment of these diseases that may differ from behaviours based on the biomedical perspective. For example, Sinhalese women in Sri Lanka will try to avoid an overconsumption of "hot" and heavy foods during pregnancy and breastfeeding, to prevent their babies from getting diarrhoea (Nichter, 1988). This is quite a different type of avoidance behaviour from the ones discussed as a "secondary barrier" to disease transmission under Section 2.1, eg. the avoidance of unsafe drinking water, or the avoidance of putting unclean objects in the mouth. The opposite may also apply, as some behaviours that we would consider as hygiene behaviours may be practised for quite different reasons. Thus, Kaltenthaler et al. (1988) state that when they asked why handwashing was important as many as 53% of the people mentioned reasons unrelated to the prevention of disease. And Gwatirisa (WP 1991) reports that the persons interviewed in her study attached much more importance to the availability of toilets for convenience and privacy reasons, than for reduction of diseases.

Cultural perceptions about causes of water and sanitation-related diseases will often vary between different groups of people and may change with time.

> *"We found that very few mothers buried their children's faeces. However, from some very old people, we learned that in the past (and in a very limited way today) mothers 'always' used to bury the faeces of breast-feeding infants for a rather peculiar reason. They believed that if a dog ate such faeces the infant would then be inflicted by a serious case of red, foamy diarrhoea (this view is in keeping with more widely held beliefs that a person's excreta, hair, nail clippings and so on, may be used by another to inflict harm against them). These old people claimed that in their youth (i.e. when they were young mothers) there was not so much diarrhoea as one finds today. They attributed this to the consistent burial of infants' faeces.*
>
> *A young mother told us that one day she 'tested' the idea by throwing out her child's faeces onto the ash-heap so that a dog could eat them: 'Sure enough, my child soon had very bad red diarrhoea'. From then on she was very careful to bury them. This mother was an exception. The vast majority simply discard their children's faeces on the ash-heap regardless of the age or health of the child. In other words, old beliefs which inspired (for whatever reason) a sanitary practice are no longer held and the message about burying children's faeces (spread by PHC staff and VHWs) had not been given an equivalent credency" (Hall et al., 1991).*

Beliefs about water and health

Mukherjee (1990) provides us with an example of people's beliefs about good and bad water. Based on a country-wide study in India she concludes that the popular definition of 'good drinking water' is water that is visually clear, tastes sweet (free of unpleasant flavours and odours) and cooks food well and quickly. Conversely, bad water or water unfit for drinking is that which is visually unclear, has a tinge of colour, salty or metallic taste or smell, and water in which grains and pulses take a long time to cook. Thus, the criteria people presently use to distinguish 'good' water from 'bad' can at times cause people to reject safe sources as 'unfit for drinking', for example handpump water which may have a metallic taste or rusty appearance.

The study also revealed that there is a large variety of ideas about how health is affected by bad drinking water. Across the various states of India, 88-95% of the people believe that bad drinking water causes health problems. However, when asked what these health problems are, the majority mentioned fever, cough and colds, sore throats, etc., which are not directly related to drinking water quality. Only 10-18% of the people were aware that unsafe water can cause diarrhoea and stomach disorders. Also, only 11% of the people in fluorosis affected areas were aware of the fluorosis - drinking water link. Some 13% of the people erroneously linked malaria with bad drinking water (Mukherjee, 1990).

In their study on the use of soap and water in two Bangladeshi communities, Zeitlyn et al. (1991) present another example:

> *"An important characteristic of water is its temperature and its capacity to cool. Many substances are classified according to their inherent hot or cold qualities. Cold temperatures are believed to cause many health problems, so people are anxious not to suddenly cool their bodies. Villagers in the Chandpur community never bathe in water from tube wells because they perceive it to be more cooling than pond water. Similarly, a mother whose baby has a cold will avoid drinking well water lest her breast milk becomes too cool. Mothers avoid using soap on their babies because they believe soap makes the water colder. Soap is also seen as an expensive, foreign product to be used as a luxury rather than an everyday necessity".*

Cultural attitudes and beliefs are important motivators for behaviour, but these are not fixed and may be adapted because of other changes. For example, in northeast Thailand the taste of water is an important criterion for selection of a drinking water source. Open shallow wells are the traditional drinking water source, but these are often located well outside the village at a special site where water is said to be 'tasty' (milk colour and sweetish taste). Water from newly made household rainjars is not thought 'good' for drinking as it is flavoured by cement, but the time and effort saved by using this rainwater generally overrules the taste criterion (Pinfold, personal communication).

Implications for study

People's behaviour, hygienic or otherwise, has a meaning and a purpose. We can only understand this meaning and purpose when we take into account the cultural setting in which people live. This requires us to try to see behaviour not from our own point of view but from the point of view of the persons who perform the behaviours. Only then we will be able to carry out a meaningful study. As people's views on hygiene and health will vary, even in homogeneous communities, this should be part of the study, and attention has to be paid to what people in communities already know about disease transmission and

Supporting material

how to prevent water and sanitation-related diseases. There is usually lot of such knowledge in a community, even though it may not be widely shared. Anthropologists are trained to investigate people's culture as the people themselves see it, and it will usually be worthwhile to involve an anthropologist in a study of hygiene behaviour. An important measure which will help to ensure that people's cultural perspective is taken into account is to involve the people themselves in studying their own behaviour. This 'participatory research' approach is discussed further in Section 6.2.

2.4 Socio-economic determinants of hygiene behaviour

Our health-related behaviour is not only determined by a complex mix of our knowledge, beliefs, attitudes, norms, and customs. Socio-economic determinants and even political factors also play a dominant role. Mukherjee (1990) put it as follows: "Among the rural population in India, 'cleanliness' is understood as a holistic concept, emanating from within the person - from one's thoughts and behaviour and extending to one's physical self, home and environment, in that order. However, time and money are seen as major constraints to achieving the desired level of cleanliness. Poor families see cleanliness as a desirable but improbable ideal, to be pursued by those who can spare the effort and resources."

Access to water supply and sanitation facilities

Without the resources to construct and maintain water supply and sanitation facilities it is difficult to attain levels of personal, domestic and environmental hygiene conducive to health. Resources relate not only to money, but also to the availability of land, time, materials, and technical and management skills for achieving improved facilities. There are still a billion or more people who suffer from the lack of safe water and sanitation facilities close to home. Water collection, often a responsibility of women - and usually also children - can be very time-consuming and arduous work. Water carrying over long distances can absorb a quarter or more of the daily food intake. The task thus leaves less time and energy for other essential activities.

Water availability is a major factor in facilitating improvements in hygiene practices. A comparison of domestic water use in two villages in Mueda, Mozambique, indicated that a reduction in the length of the water collection journey from 5 hours to 10 minutes was associated with an increase in average water consumption from 4.1 to 11.1 litres per person per day. Bathing and washing clothes accounted for 70% of the increased total. Bathing of children was a regular nightly event in the village with a water supply but almost unknown in the other. Water used for food preparation also increased, suggesting that scarcity of water may also influence it (Cairncross et al., 1987). But an improved water supply alone does not always lead to the use of more water, as people may not be accustomed to doing so, or there may be other constraints.

Supporting material

Where public/community facilities are present, socio-economic criteria may determine whether people are allowed and can afford to use them. Sometimes, particular socio-economic groups are excluded from access, notably by local elites or political or religious power groups (Burgers et al., 1988). In a number of cases, people lack the money to buy, or the time to collect, sufficient quantities of water for daily needs. The hard fact is that, especially in urban areas, water supply and sanitation in the poor neighbourhoods is often of a much lower standard and at a much higher price than in the well-off neighbourhoods. For example, urban poor who have to rely on water from water vendors pay up to twenty times as much for the same amount of water as the better-off who are connected to the city's piped supply and sewerage systems.

Other socio-economic factors

Hygiene behaviour and the prevention of water and sanitation-related diseases are influenced by socio-economic factors, such as proper housing, nutrition, clothing, education, and time. Although the precise links are difficult to establish, it is not difficult to imagine that families with better housing find it easier to maintain personal and domestic hygiene than do people with poor housing, especially when poor housing is combined with crowding. More and better clothing can be washed more regularly. Better nutrition provides a barrier against disease transmission (although there are many unanswered questions about the relation between diarrhoea and nutrition). Education is a somewhat more difficult factor on the list. Some argue that better education will allow us to develop hygiene behaviours as we are made aware of the biomedical links between behaviour and health. Others see education as a mere indicator of belonging to a higher socio-economic class – a more crucial factor.

The availability of time may be just as important as the availability of water. Sometimes there are too many tasks and responsibilities to have time and energy left for hygiene.
Drawing: CHETNA, India.

Supporting material

(from IRC Occasional paper no. 16, "On-site sanitation: building on local practice", by Madeleen Wegelin-Schuringa)

4. Information Needed for Programme Development

Planning for improvements is done with the community, but before the external agent can fulfil the role of advisor well, an understanding is necessary of several aspects which have direct implication on sanitation behaviour and on the choice of possible sanitation improvements. First of all, this concerns the cultural background of sanitation behaviour and the factors which motivate people to have a latrine. Then, discussions are needed on the options for resource mobilization and on the best way to organize the improvements. Furthermore, information is needed on environmental conditions and on local design preferences.

Although the approach used in this manual is focussed on sanitation in an individual community project, it is also useful as a guide for larger-scale programmes. For these programmes, a community study can be carried out first to come to a classification of the different communities on the basis of the physical, socio-economic and cultural conditions. In Appendix 1 an overview is given of useful socio-cultural data to be gathered for this purpose. The classification can serve to group the communities together and for further programme development, the individual community approach can be used. Thus it can result for instance in communities of type 'A', having programme intervention 1, type 'B' communities having programme intervention 2, or a possible combination of intervention strategies.

4.1 Methods to collect background information

Collecting information on cultural aspects of sanitation behaviour and on factors which motivate people for sanitation, is not easily done through a survey. The sensitivity of the subject requires a less formal approach. It is likely that, at least with some of the people who have assisted in identifying the risks and problems in sanitation, it is possible to build up a somewhat informal relationship where asking sensitive questions is not a problem. But it should always be kept in mind that also these informants have their own interests to consider and that they are likely to push proposals which suit them best, even though for other people different solutions would be better.

By being in the community, it is possible to make observations on the behaviour of the people and it may be possible to discuss motivational factors for having a latrine with the households who have one. To find out where people defaecate, it may be possible to express to have to go for defaecation. By asking this question 'naturally', people will come up with an answer. Thereafter it may be possible to ask more questions about the place visited. Another approach is through 'indirect' questioning, that is asking about the behaviour and attitudes of others.

Discussions with small groups of people, such as neighbourhood groups, in or outside hygiene education sessions, will also elicit information on the subject and can substantiate the information given by the 'key' informants. It is important to approach all different groups identified and to try to have discussions with all of them, even if people do not seem to be interested in sanitation or do not want to talk about sanitation as such. The reasons why they are not interested can be very important for the programme development.

> In a village in Maharashtra in India a survey was done to assess interest in sanitation among the women. Part of the women were interested and part of them not; analysis showed that the women who were interested all lived in the centre of the village, whereas the ones not interested lived at the edges. With the increase of population densities, the distance the women living in the centre had to walk to the traditional defaecation areas was increasing as well, while those living on the edge did not have to go far. Moreover, the women living in the centre all belonged to higher status families, whereas those on the edge were poor. Thus each of the two groups of women had perfectly valid reasons for their interest or lack of it (Sundararaman, 1986).

Because building up a degree of informality is necessary, the collection of information is facilitated by working through or with someone who is already known and respected in the community. Whether this person should be a man or a woman depends on the local situation. For a woman it will be easier to have access to other women and the sensitivity of the subject will be less of a problem, but in situations where it is mainly the men who make major decisions such as sanitation improvements, a male project person will have more influence on the male 'clients'. However, given women's informal role as 'influencers' of male decisions within the family, their role needs to be acknowledged and properly reinforced. In some communities having a male and a female project 'facilitator' may be a solution, but both should be accepted in the community to play this role.

If the project area is too large for an informal approach, it may be necessary to use other data-gathering techniques such as open-ended interviewing and surveys. A very comprehensive overview of these different techniques is given in 'Methods for Gathering Socio-cultural Data for Water Supply and Sanitation Projects' by Mayling Simpson-Hebert. But whether open-ended interviewing or a survey is used, it is important that the questionnaire is designed well, with a very clear idea what information is needed, what the survey is measuring and how it will be tabulated. The questionnaire, of course, needs to be pretested before carrying out the study.

4.2 Cultural aspects of sanitation behaviour

Sanitation behaviour is based on ideas and taboos associated with defaecation and on traditional habits originated in local environmental circumstances. Probably most common in different cultures is the sense of shame associated with defaecation, which is often expressed in a taboo on talking about the subject. But it is precisely this taboo which may have prevented people from changing age old practices although the need for sanitation facilities may be high, like in cultures where women are not supposed to be seen outside their houses.

> In rural Bangladesh women have to defaecate before dawn or after sunset, because they are not supposed to be seen by men outside the direct family circle. They have trained themselves to do this from when they were young. In order to be able to hold out, they sometimes have to skip lunch to delay the urge. If they fail, they have to hastily go in the backyard (Agarwal, 1985).

These circumstances most probably make women interested in having a latrine, but bringing up the subject with the men in their house may be difficult because of the sensitivity. At the same time, it is often the men who decide on having a latrine or not, although they do not experience the same inconveniences as women.

Some of the local practices and beliefs are harmful for the health of the people, but others are neutral or helpful. It may be possible to promote the helpful and neutral ones at the expense of the harmful ones.

> In some parts of Africa where schistosomiasis is widespread, urinating blood is viewed by men as a sign of maturity comparable to menstruation for women. Therefore young adolescents are rather proud to show the symptoms of this disease and there is no sense of it being harmful (personal communication).

Rules and regulations affecting sanitation behaviour are often prescribed by religion, as is notably the case with Hinduism. For people practising this religion, daily life is ruled by notions of ritual purity and pollution; these sometimes coincide with scientific notions of hygiene and cleanliness (bathing after defaecation) but are not synonymous. Also Islam has many rules affecting sanitation.

> The first two water seal latrines were constructed at government expense for the use of the primary school, in an open area in the middle of the school's playground. They were built in such a way though, that the potential user would have to squat with his back towards Mecca - the direction sacralized by the official religion. When this serious shortcoming was noted by the religious leaders, the latrines had to be rebuilt (Kotalova, 1984).

This failure could have been prevented by planning the facilities together with the people and especially in consultation with the religious leaders.

Apart from religious rules, there are traditional habits which directly affect the options for improved sanitation, for instance frequency of defaecation. In many cultures frequent defaecation is the norm; it may be considered healthy to clean out the intestines regularly with laxatives or enema; loose stools may be endemic in certain places and the incidence of diarrhoea is of course high in many developing countries. This directly affects the number of latrines needed in a community, if sharing arrangements are considered. Habit is also the main determinant in the choice of materials for anal cleansing. In most of South East Asia using anything else than water for anal cleansing is considered dirty, while in other parts of the world dry materials such as paper, corncobs or stones are normally used. It is obvious that the selection of sanitation techniques has to take these habits into account: you cannot throw corncobs into a water sealed latrine.

The following table gives an indication of cultural variations in defaecation practices. The left column gives the different aspects of defaecation practices, while the right column indicates the two extremes of the cultural variation.

Table 2: Cultural variations in defaecation practices

	Aspects	*Extent of Cultural variation*	
1.	Choice of preferred site		
	a) location	Open field	Sheltered
		Near or in water	No water contact
		Within the house	Away from the house
		Socially prescribed	Individually selected
	b) visibility of (intention of) use	Allowed	Not allowed
	c) direction of latrine	Prescribed	Not prescribed
2.	Preferred posture	Squatting	Sitting
		Ritually prescribed	Individually preferred
3.	Preferred times of defaecation	Sunrise or sunset	Whenever the need arises
4.	Daily frequency of defaecation per day	Once or less	More than four times
5.	Anal cleansing materials	Only water used	Paper, leaves, sticks, corncobs, stones etc. used
6.	Cleansing after defaecation	No cleansing	(Ritual) bathing
7.	Social organization of defaecation	Strict male/female separation	Less strict
		Communal defaecation accepted	Not tolerated
		Avoidance rules within family	No avoidance rules
8.	Attitude to human feaces	Cannot be handled	Seen as useful resource: used in composting or feeding animals
		Children's faeces considered harmless	Children's faeces considered harmful

Adapted from: Piers Cross, 1982.

4.3 Factors which motivate people to have a latrine

The aim of most sanitation programmes is to improve health conditions in a given area. In a situation where people are aware of the link between sanitation and health, improvement of health conditions may be a motivating factor for the adoption of sanitation improvements. On the other hand, sanitation related diseases may be considered unavoidable and not requiring any change of practice, but for many people, the relationship between health and sanitation is not clear. Diarrhoea or worms may not be viewed as an illness, but as part of a normal pattern, not related to water or sanitation behaviour. As a consequence, people will not consider health improvement a reason to adopt sanitation facilities, unless a course of action is taken such as in the Bhaktapur project (see 2.1) where the community was shown the result (in this case worms) of not having sanitation facilities. This may at least elicit interest in thinking about sanitation. There may, however, be other reasons why people are interested in sanitation. It is essential to find out these reasons, as they may be the key for motivating people to participate in sanitation improvements.

Three main reasons why people are interested in sanitation facilities are convenience, privacy and status. It is of course more *convenient* to go to a latrine near or in the house than to have to walk to a defaecation area or hide somewhere in the bushes, which maybe quite some distance away. This may be less of a burden during the day and when it is dry, but when it is raining it becomes more so, and besides, there may be a problem of accessibility of the designated defaecation areas in the rainy season. When people have to go out at night for defaecation they are an easy target for abuse, and fears of spirits and ghosts, who may be believed to freely roam around at night, may exist, not to mention fear of snakes and wild animals. People are therefore likely to defaecate very near the house after dark.

> Fear of the dark interior and falling into the hole have prevented young children from using latrines in rural communities in Sri Lanka. On the insistence of the villagers, an improved design was developed and installed near the kitchens so that mothers could train and supervise their children more easily (Fernando, 1982).

The most common need with respect to defaecation is probably the desire for *privacy*, although the level of privacy needed may vary. This may be the case even within one community, according to sex or social status. Generally, women have more need for privacy than men and often it is this aspect that motivates them for having a latrine.

> In West Asia it is quite common to see a group of men walk together at dawn to the defaecation grounds for their morning ablutions and squatting next to each other, but it would be only men and male children. The women also go to a defaecation area (probably a different one) as a group, but when it is still dark; they should not even be seen walking there.

In other cultures communal defaecation would be inconceivable. The desire for privacy has even led to rejection or non-use of latrines, when the user was visible through the ventilation space under the door or when the latrines were located in such a way that the user could be seen entering (Burgers e.a., 1988). The privacy offered by a latrine may even be used for bathing purposes. The popularity of VIP latrines in Zimbabwe is not only due to the fact that they are odourless and free of insects, but also because it provides a private place for bathing (Morgan, 1990).

Another important factor influencing interest in sanitation is connected with *status* and *prestige*. Usually the people who already have a latrine constitute the better off segment of society and this status aspect may well be a stimulance for interest, especially for males. Besides, having a latrine is also a sign of being 'modern' and as such it is an attractive facility to have. Status and prestige is to a great extent linked to the design of the superstructure, which very often is neglected by programme planners. The principle that the beneficiaries themselves are responsible for the superstructure is sound, but in some cases may backfire if the facility is viewed as a status symbol. In such cases latrines may be promoted more successfully if different low-cost but prestigious designs are included within the project.

Ownership and use of latrines is invariably associated with enlightenment and respectability. Defaecating in the bush is considered 'backward' and has influenced ownership and use of latrines. Remarks like 'it is embarrassing', 'it is not enlightened' and 'it is not respectable' indicate the high social status associated with latrine ownership in Kibwezi in rural Kenya (Oendo, 1983).

Similarly, keeping up with the rest of the community may become a driving force behind interest in latrines, especially when there is a strong value on community cohesiveness and solidarity. It may then be that the cost of not participating in the improvement effort may be higher in terms of loss of goodwill and deterioration of solidarity than that of participating.

It should be noted however, that if status, prestige or solidarity are the motivating factors behind having a latrine, this does not imply that the people also use the latrine. There are many examples of latrines which are used as storage rooms, or reserved only for visitors or certain members of the family. In such cases, hygiene education should be directed to make people aware of the need to actually use their new facilities.

Interest in sanitation may be influenced by the condition of existing latrines. If they function well, they are viewed as a positive facility. But if the condition of existing latrines is bad, this may become a negative influence on the interest people might have for sanitation. If the only type of latrine people have seen is a dirty, fly infested, foul smelling, dark place, where a broken slab poses a risk of falling in the pit when it collapses, it is not surprising that they are not interested in having such a facility.

In the Philippines an investigation was carried out to see why acceptance of latrines was low. One farmer said; "We like the toilet because we know it is good for our health, but you see we have something better than the odorous thing you are offering. Our latrine is a five hectare area behind my house, where the faecal matter is automatically dried by the sunshine and does not smell. It is even good fertilizer for my plants" (Feliciano and Flavier, 1967).

If in the past a sanitation programme has already taken place, it will have an effect on interest for sanitation in the community, either positive or negative. It is very important to get as much information as possible from the people about the past programme, to avoid making the same mistakes and to use the positive aspects of the programme. The construction of demonstration latrines can be a way to help people overcome disinterest in latrines as a result of a former bad experience with latrines.
A positive consequence of a sanitation programme previously carried out, be it a good or a bad one, is that people may have a better idea of their priorities in sanitation.

The different factors, which motivate people to have a latrine are often not the same for the whole community. That doesn't matter as long as this is taken into account in deciding the intervention strategy to be followed with the different target groups. For instance for some people (women) in the community the interest in sanitation can be influenced by stressing the privacy aspect of a latrine, while for others (men) who put great value on 'being modern',the status aspect of having a latrine may be stressed. A different motivation may also imply the preference for a certain sanitation system (for instance a shiny ceramic toilet bowl for the prestigious value connected with it).

4.4 Options for resource mobilization

The cost of a sanitation programme can be divided into three categories. These are institutional and project delivery costs, material and labour costs, and operation and maintenance costs.

The first category is often omitted in cost analysis. It includes the cost of such activities as community mobilization and development, information dissemination, training and financial delivery; it also includes monitoring and evaluation and technology delivery activities such as logistic support and engineering supervision. In the absence of adequate information, the institutional and delivery costs may be assumed to be 30% of the costs of a project, or about 45% of the sum of material and labour costs (Mara, 1984). The costs belonging to this category are always borne by the government or external support agencies.

Material and labour costs have to be paid by the community, at least to some extent. This may be partly in *cash* and partly in *kind*, depending on the provision of appropriate financing and credit facilities and the total costs of the proposed sanitation improvements. Because the choice of technology will greatly affect total costs, the implications of different options and what each user should contribute have to be discussed with the community during the early planning stage. The community needs to be aware of the various components that make up the total costs. It also has to be clear which part of the total costs are going to be covered by grants or subsidies and do not need to be paid back by the community. Generally, however, most government supported sanitation programmes will not be able to include substantial grants or subsidies, and even the provision of credit facilities may pose a problem.

Contributions in cash

Willingness to pay in cash is directly related to the level of interest for sanitation improvements, but also to the financial capacity of the people in the community. A credit system may be needed because usually people living in low-income areas will not have enough savings to directly pay the total costs required. Yet a down payment should be required to substantiate commitment. The terms and conditions for repayments of the credit/loan have to be clear and acceptable to the users beforehand, i.e. the rate of interest, period and arrangements for repayments, incentives for early repayment and penalties that could be applied in case of default. And even then, chances are high that repayment is bad, if the obligation to pay back loans is not ingrained in a culture. It is usually the extent of social control which is the deciding factor in loan recovery. The involvement of local NGOs, who are experienced with systems of loan recovery, could help to facilitate setting up an appropriate system.

In a way organizing the financial aspects of sanitation is easier than that of water supply because on-site sanitation is usually a private affair and it is thus easier to identify who has to pay what. Yet it also means that the need for differentiation within the community may be larger. This is both valid for subsidies and for repayment terms. For instance, offering subsidies to the first applicants for a latrine as an incentive often has the result that the subsidies go to the wrong people. Those who realize the advantages of early application, are often those who least need the incentive of a subsidy to either become interested or for financial reasons. Repayment terms have to be adjusted to the specific characteristics of the different target groups in the community because payment capacity is dependent on the amount of cash income. This may be fixed for some people, but for most this income will be fluctuating. Not only daily - for people working in the informal sector - but also seasonally, for agricultural labourers.

If the financial capacity of the different target groups within the community differs a lot, it might be necessary to give additional subsidies to those occupying the lower end of the income scale. This requires investigation into the financial resources, physical possessions and other assets (such as labour) of the households applying for extra subsidies. In communities with a certain extent of cohesiveness, often mechanisms exist to help the poorer households acquire facilities. It is therefore important to explore together with the community what kind of financing mechanisms already exist, such as for instance community revolving funds where initial capital may come from a government donation, an NGO or the issue of shares to individual households. Using the initial capital, loans are given to individual households for sanitation. Upon repayment, new loans are given to other members, according to the decisions of the group. Another mechanism is the savings club. Each member of the club (often a women's group) makes a small regular contribution to a communal fund. The group's savings are paid out in turn to each member to finance a major acquisition. In Indonesia and Africa, this is a very widespread mechanism for saving. Usually the groups are quite small, consisting of women living in the same neighbourhood. Because of the extent of social control, default is very low.

Some of the common problems that affect the ability and willingness of the community to invest in sanitation facilities are:

- level of income;
- costs of technology adopted;
- financial arrangements for implementation;
- beliefs and expectations about sanitation project implementation;
- caution in investing scarce funds;
- opposition from local leaders;
- limited interest in improvements;
- inadequate administrative procedures
- lack of understanding of project content resulting from inadequate communications support;
- unfulfilled expectations;
- delays in project execution;
- lack of agency support in providing services for maintenance and latrine emptying;
- lack of agency involvement in training and promotion.
  (Larbi, 1990).

Contributions in kind

Because latrine construction is relatively simple, a considerable degree of self-help is possible, reducing the total costs for the user. In sanitation projects where people are expected to carry out the work themselves, care should be taken that sufficient assistance and supervision from technical staff is given. People have to be properly instructed on how to locate the pits and to dig them to the required dimension.

> In Malawi two people were killed when the pit they dug collapsed. Upon checking, it was found that they had dug to a depth of 20 meters, without supporting the sides. The pit was dug to this depth to last for three generations (personal communication).

Female headed households and older couples often do not have the ability or financial capacity to carry out latrine construction. In such cases special arrangements are needed such as assistance from other households, or help to hire labour. This is also valid for those groups who cannot be involved in the actual digging because of religious restrictions (for instance certain higher castes in India). In each community solutions to these kinds of problems have to be found through discussions within the community, thereby stressing that the highest possible coverage of sanitation improvements is of communal importance.

It is also important that the labour inputs of the people themselves are co-ordinated with the arrival of latrine components required from outside (such as pre-cast floor slabs) to avoid situations where adverse weather conditions could, for example, cause the pit to cave in before the required materials arrive.

Apart from reducing the cost, there are other positive aspects in involving the people in implementation. These are a sense of being involved, proudness of being able to carry out these tasks, a better understanding of the technology and hence a better perspective for future maintenance.

To minimize the organizational aspect of individual implementation, a community might opt for a local labour team, who digs the pits for all and/or locally manufactures building materials, thereby reducing the cost and at the same time providing local employment and expertise. This system also reduces the problem of social acceptability of participating in manual labour.

> In Tanzania villagers were allowed to work out their own system of inducement for the masons who carried out latrine construction. In three of the four villages the masons were paid in cash, but in the fourth village it was decided that the masons would be exempted from their normal village tasks as consideration for latrine construction. A similar approach was adopted elsewhere with a minor modification which provided that beneficiaries would work on the farms of the masons during the period that the masons were constructing their latrines (Wright, 1982).

It should be mentioned that both willingness to pay and willingness to participate in implementation may be adversely affected by other sanitation projects carried out either in the community or near it. A lot of governments and external support agencies initiate sanitation projects by constructing free demonstration latrines or giving large subsidies and expect that once the idea has caught on, people will start building latrines by themselves. But if people know that others have received latrines at no or minimal cost and without much effort, they will expect to get latrines under the same conditions.

The last component in the cost of a sanitation programme is the cost of operation and maintenance of the sanitation facilities. This has to be discussed with the community early in the planning phase, as the choice of technology will have implications for these costs. In most cases operation and maintenance will have to be carried out and paid for by the users (see also Chapters 5 and 6). Cash would be mainly required for repairs and possibly for contracting labour to empty or desludge the pits or to rebuild the latrine at a new location when it is full.

4.5 Social organization for improvements

The feasibility of a community-based approach is to a large extent dependent on the capacity within the community to organize themselves. Although the decision of a household to adopt on-site sanitation is an individual one, the wider implications of sanitation are a communal concern. Improved sanitation only has an impact on health if large scale coverage is achieved and the environmental aspects of sanitation, such as drainage of waste- and rainwater, are mainly a community concern.

In order to effectively organize the sanitary improvements, an adequate organizational framework has to be available or established. This means that at local level a particular group of people (for instance under the name of 'the sanitation committee') has to take the responsibility for the programme. This committee may take many different forms: it can be part of the local government authority responsible for water and sanitation; it may be part of an existing community development committee or existing water committee; it may be carried out by the village health committee; it may be the traditional leadership, the local women organization or any other existing community level organization. Each of these possibilities has its own positive and negative aspects. A drawback can be for instance concentration of power and influence in only a small group. And in cases where the sanitation tasks are an addition to other tasks already carried out by the committee, there may not be enough time available to do the job well. Moreover, these committees are usually not without internal problems. They are not insulated from local politics, nor are they necessarily representing the views of the whole community. An advantage of these committees often is their considerable authority and the respect they carry in the whole village. This is especially the case in smaller communities, where the leadership consist of people who are really part of the community, who have a similar standard of living and who therefore represent the views of the people in general. Thus, here again, the best organizational form depends on the local conditions and has to be worked out in consultation with the community.

Whether an existing committee is used, a subcommittee set up under the aegis of an existing committee, or a new committee established, it should have a balanced representation of the community, including for instance:

- both men (for authority) and women (for direct interest and strong motivation);
- both old people (for authority and respect) and young people (for initiative and drive);
- persons with relevant modern and indigenous knowledge (e.g. a schoolteacher, modern and traditional health worker);
- representatives from all factions and socio-cultural groups.
  (White, 1981).

Care should be taken that the members of this sanitation committee themselves either already have a good sanitation facility or are willing to improve their facility. In case they do not have one, they should be willing to build one. This is necessary to avoid a situation where these people do not practice what they preach, and in the long run loose credibility.

In some societies it may be difficult for women to become part of the sanitation committee, but in view of the importance of their participation, some organizational form has to be found where this is possible. Consultation with local women is needed to find this form. For instance, it may help to have two or more women on the committee for mutual support. The women themselves have to choose who will represent them in the committee, considering aspects such as availability of time, respect, sense of responsibility, social feeling and acceptability to all. Alternatively, women could form their own committee, with a different task than the male committee, but supplementary to it and as a control mechanism.

Tasks of the sanitation committee will have to include:

- to take stock of the needs and priorities of the community with respect to sanitation;
- to act as a sounding board for observations and information gathered during the sanitation walks and discussions in the community;
- to develop design options for improvements or new facilities, together with the project engineer;
- to develop an appropriate programme for health education and motivation together with the responsible project official;
- to liaise between project officials and the community;
- to hold discussions with the community on design options and implementation;
- to develop appropriate financing mechanisms together with the project officials and assist in their implementation;
- to develop appropriate cost recovery mechanisms together with the project officials
- to motivate the community for participation;
- to co-ordinate construction activities together with project officials.

The sanitation committee will have to be trained in preparation for their task. This training not only has to include factual information about sanitation related diseases, improvement options and design criteria, but has to concentrate on methods to convey messages, on ways to induce people to participate in discussions and on the basic principles of a community-based approach.
The sanitation committee has to form the link between the community and the project, and has to make sure that planning for improvements is based on what the community wants. For this purpose they have to discuss the following planning subjects with the community, which can be done in hygiene education sessions:

- types of latrines;
- design preferences and adaptations;
- siting options;
- traditional hygiene and improvement techniques;

- financing and repayment system;
- organization of labour and cash contributions;
- targeted coverage;
- assistance to poor households;
- monitoring of installation, function and use (self-evaluation);
- local hygiene education activities and follow-up.

The functions of a sanitation committee could also be carried out very well by a local non-governmental organization (NGO), if available. Although there are different types of NGOs, most are development oriented and experienced in working with the community towards the goal of sustainable self-improvement. Their strength is the ability to reach the poor, to optimize local resources and arrive at creative solutions with the people, because of their awareness of local dynamics and structures. Moreover, they are usually met with far less suspicion than government field workers. In the past, governments and international organizations were not much inclined to work with or through NGOs, but at present more and more realize that they themselves may not be able to effectively reach the poorer sections of society, and that they need the NGOs to do this.

Private latrine producers also can be involved in latrine promotion. They could be given training in manufacturing different types of latrines and in marketing and provided with soft loans for molds and other equipment necessary for latrine production. Private latrine producers may be much more effective than government staff, because they are more geared towards producing what people want and more responsive to changing designs to adapt to local needs and priorities.

4.6 Environmental conditions

Environmental factors such as water availability, soil conditions, groundwater depth, risks of groundwater pollution, and population densities directly influence the selection of an appropriate technology. Most information on these factors can be obtained through technical surveys, but lifelong experience of the community with these factors has built up intrinsic knowledge. People will for instance know from experience if water sources dry up in the dry season, or if places are liable to flooding in the rainy season. Similarly, people will probably know from experience if the soil is stable enough to have unlined pits. They will also know how much water they approximately need, if they use water for cleansing purposes.

Water availability

Water availability is one of the key deciding factors in opting for a system which requires water to function or one which does not need water. The feasibility of a system which requires water for flushing, either by pouring (by hand) or from a cistern, depends on the reliability and service level of the water supply. In systems which do not require water, the excreta drop through a hole into a pit, vault or other receptacle. An overview of different sanitation systems and water requirements for the systems is given in Table 4, Chapter 6.

Past availability or non-availability of water has probably influenced existing anal cleansing habits. Thus, in traditionally dry areas, people are likely to use solid matter for anal cleansing. But, where changes in water supply have occurred, anal cleansing with water and water seal latrines becomes an option. It will depend on local preferences and attitudes, however, whether a water seal latrine can be introduced or not.

Soil condition

Soil permeability is an important factor in assessing on-site sanitation options. Soils with low permeability such as expansive clays are unsuitable for pit latrines as the liquid fraction of the excreta is unable to infiltrate the soil. This would necessitate frequent emptying of the pit, which is expensive and can lead to unnecessary health hazards, if not properly carried out. In that case, off-site technologies such as small-bore sewerage must be considered. Soil tests to assess the leaching capacity of the soil are given in Appendix 2.

The occurrence of rock or unpickable soil within 2m of the ground surface generally makes latrine construction difficult. Where possible, assistance with mechanical diggers may facilitate the digging of the pits. Alternatively, shallow alternating pit latrines or raised pit latrines may be considered.

For the purpose of pit design, soils can be considered as either stable or unstable. Stability is defined as resistance to collapse and should be assessed (for soil stability criteria, see Appendix 2). The stability of the soil directly affects the stability of a pit. Pits dug in loose and unconsolidated soils are liable to collapse, especially when there is stagnant water in the pit. In such cases proper pit lining is needed, but care should be taken that the lining does not prevent seepage out of the pit into the surrounding soil (Mara, 1984).

Groundwater

Where the groundwater level is high, construction of pit latrines becomes difficult. During construction, a pump may be needed to pump the water out, while the pit will have to be lined to avoid collapsing. Because the pit will always be filled with some water, it may become a breeding spot for culex pipiens mosquitoes, which transmit filariasis. Nevertheless, wet pits have the advantage of lasting longer, as their rate of solids accumulation is lower than in dry pits. Alternatively, it may be possible to build the latrine on a mound to have a greater volume without having to dig below the groundwater.

The higher the groundwater level, the greater the risk of groundwater pollution. The extent of pollution of groundwater arising from pit latrines depends also significantly on the hydraulic loading, the characteristics of the soil and the temperature and flow velocity of the groundwater (which determine the survival and residence time of pathogens in the ground). Therefore, there can be no general or universal rule for a 'safe distance' between latrines and sources of water supply (Lewis et al., 1982). Based on the data available from pollution studies in many countries and particularly in India and the United States, the following rules of thumb can be given (Schertenleib, personal communication):

In *dry pits* and/or unsaturated soil conditions where the distance between the bottom of the pit and the maximum groundwater level throughout the year is two or more meters, the pits can be located at a minimum distance of about 8m from the well used as water supply if the effective size (E.S.) of the soil is 0.2mm or less. (Effective size is the size of the sieve opening through which 10% of the sand grains will just pass by weight). For coarser soils (with E.S. greater than 0.2mm), the same safe distance can be maintained if the pit is sealed off at the bottom by an impervious material such as puddle clay or plastic sheet, and if a 500mm thick envelope of fine sand of 0.2mm E.S. is provided around the pit.

In *wet pits* or saturated soil conditions where the distance between the bottom of the pit and the maximum groundwater level during any part of the year is less than 2m, the pits can be located at a minimum distance of 15m if the E.S. of the soil is 0.2mm or less. For coarser soils, a minimum distance of 15m can be maintained if the bottom of the pit is sealed off and if a 500mm thick envelope of fine sand of 0.2mm E.S. is provided around the pit.

Latrines inevitably pose a pollution hazard to the groundwater resources if unfavourable hydrological conditions prevail, such as coarse sand, chalk formations, high groundwater velocity and/or high groundwater table, and where no envelope of fine sand can be provided. In such instances, advice from a specialist on alternative water supply arrangements should be sought.

Wherever groundwater is used for any purpose and soil conditions vary within the area, on-site sanitation programmes should be monitored with regard to their effects on the quality of the underlying groundwater. Otherwise inadvertent contamination of groundwater supplies and a consequent worsening of community health may be experienced (Ward, 1989).

Population densities

Population densities have an influence both on the technical and on the practical sanitation possibilities. The denser an area is built up the less space is available for latrines to be constructed. There might not be enough space between houses for a latrine, or the proximity of a water well may make latrine construction undesirable. Lack of space may exclude the option for temporary latrines (which are covered when full) so that permanent latrines have to be built, which require emptying services. This situation is found in many low-income urban areas, but might also occur in urban fringe areas or rural areas where densities have increased over time or where small congested pockets may be found within a built-up area.

Communal latrines could be proposed in such areas, but communal latrines need a very specific kind of organization in view of operation and maintenance. Experience suggests that they only function when there is an attendant who gets paid by the users for operation and maintenance; not a government worker who receives a salary anyway, because that doesn't give enough incentive to keep the place well maintained. Privatization may be an option to overcome most problems, as has been done widely in India by Sulabh Shauchalaya International. In any case the location of public latrines has to be carefully chosen together with the community, so as to make ultimate use of available space.

Supporting material

From Agenda 21, chapter 18

> "Protection of the quality and supply of fresh water resources: application of integrated approaches to the development, management and use of water resources:.

This is a final, advanced version of a chapter of Agenda 21, as adopted by the Plenary in Rio de Janeiro, on June 14, 1992, edited by the United Nations Conference on Environment and Development.

C. Protection of water resources, water quality and aquatic ecosystems

Basis for action

18.35. Freshwater is a unitary resource. Long-term development of global freshwater requires holistic management of resources and a recognition of the interconnectedness of the elements related to freshwater and freshwater quality. There are few regions of the world that are still exempt from problems of loss of potential sources of freshwater supply, degraded water quality and pollution of surface and groundwater sources. Major problems affecting the water quality of rivers and lakes arise, in variable order of importance according to different situations, from inadequately treated domestic sewage, inadequate controls on the discharges of industrial waste waters, loss and destruction of catchment areas, ill-considered siting of industrial plants, deforestation, uncontrolled shifting cultivation and poor agricultural practices. This gives rise to the leaching of nutrients and pesticides. Aquatic ecosystems are disturbed and living freshwater resources are threatened. Under certain circumstances, aquatic ecosystems are also affected by agricultural water resource development projects such as dams, river diversions, water installations and irrigation schemes. Erosion, sedimentation, deforestation and desertification have led to increased land degradation, and the creation of reservoirs has, in some cases, resulted in adverse effects on ecosystems. Many of these problems have arisen from a development model that is environmentally destructive and from a lack of public awareness and education about surface and groundwater resource protection. Ecological and human health effects are the measurable consequences, although the means to monitor them are inadequate or non-existent in many countries. There is a widespread lack of perception of the linkages between the development, management, use and treatment of water resources and aquatic ecosystems. A preventive approach, where appropriate, is crucial to the avoiding of costly subsequent measures to rehabilitate, treat and develop new water supplies.

Objectives

18.36. The complex interconnectedness of freshwater systems demands that freshwater management be holistic (taking a catchment management approach) and based on a balanced consideration of the needs of people and the environment. The Mar del Plata Action Plan has already recognized the intrinsic linkage between water resource development projects and their significant physical, chemical, biological, health and socio-economic repercussions. The overall environmental health objective was set as follows: "to evaluate the consequences which the various users of water have on the environment, to support measures aimed at controlling water-related diseases, and to protect ecosystems". 1/

18.37. The extent and severity of contamination of unsaturated zones and aquifers have long been underestimated owing to the relative inaccessibility of aquifers and the lack of reliable information on aquifer systems. The protection of groundwater is therefore an essential element of water resource management.

18.38. Three objectives will have to be pursued concurrently to integrate water-quality elements into water resource management:

(a) Maintenance of ecosystem integrity, according to a management principle of preserving aquatic ecosystems, including living resources, and of effectively protecting them from any form of degradation on a drainage basin basis;

(b) Public health protection, a task requiring not only the provision of safe drinking-water but also the control of disease vectors in the aquatic environment;

(c) Human resources development, a key to capacity-building and a prerequisite for implementing water-quality management.

18.39. All States, according to their capacity and available resources, through bilateral or multilateral cooperation, including the United Nations and other relevant organizations as appropriate, could set the following targets:

(a) To identify the surface and groundwater resources that could be developed for use on a sustainable basis and other major developable water-dependent resources and, simultaneously, to initiate programmes for the protection, conservation and rational use of these resources on a sustainable basis;

(b) To identify all potential sources of water-supply and prepared outlines for their protection, conservation and rational use;

(c) To initiate effective water pollution prevention and control programmes, based on an appropriate mixture of pollution reduction-at-source strategies, environmental impact assessments and enforceable standards for major point-source discharges and high-risk non-point sources, commensurate with their socio-economic development;

(d) To participate, as far as appropriate, in international water-quality monitoring and management programmes such as the Global Water Quality Monitoring Programme (GEMS/WATER), the UNEP Environmentally Sound Management of Inland Waters (EMINWA), the FAO regional inland fishery bodies, and the Convention on

Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention);

(e) To reduce the prevalence of water-associated diseases, starting with the eradication of dracunculiasis (guinea worm disease) and onchocerciasis (river blindness) by the year 2000;

(f) To establish, according to capacities and needs, biological, health, physical and chemical quality criteria for all water bodies (surface and groundwater), with a view to an ongoing improvement of water quality;

(g) To adopt an integrated approach to environmentally sustainable management of water resources, including the protection of aquatic ecosystems and freshwater living resources;

(h) To put in place strategies for the environmentally sound management of freshwaters and related coastal ecosystems, including consideration of fisheries, aquaculture, animal grazing, agricultural activities and biodiversity.

Activities

18.40. All States, according to their capacity and available resources, and through bilateral or multilateral cooperation, including United Nations and other relevant organizations as appropriate, could implement the following activities:

(a) Water resources protection and conservation:

(i) Establishment and strengthening of technical and institutional capacities to identify and protect potential sources of water-supply within all sectors of society;

(ii) Identification of potential sources of water-supply and preparation of national profiles;

(iii) Preparation of national plans for water resources protection and conservation;

(iv) Rehabilitation of important, but degraded, catchment areas, particularly on small islands;

(v) Strengthening of administrative and legislative measures to prevent encroachment on existing and potentially usable catchment areas;

(b) Water pollution prevention and control:

(i) Application of the "polluter pays" principle, where appropriate, to all kinds of sources, including on-site and off-site sanitation;

(ii) Promotion of the construction of treatment facilities for domestic sewage and industrial effluents and the development of appropriate technologies, taking into account sound traditional and indigenous practices;

(iii) Establishment of standards for the discharge of effluents and for the receiving waters;

(iv) Introduction of the precautionary approach in water-quality management, where appropriate, with a focus on pollution minimization and prevention through use of new technologies, product and process change, pollution reduction at source and effluent reuse, recycling and recovery, treatment and environmentally safe disposal;

(v) Mandatory environmental impact assessment of all major water resource development projects potentially impairing water quality and aquatic ecosystems, combined with the delineation of appropriate remedial measures and a strengthened control of new industrial installations, solid waste landfills and infrastructure development projects;

(vi) Use of risk assessment and risk management in reaching decisions in this area and ensuring compliance with those decisions;

(vii) Identification and application of best environmental practices at reasonable cost to avoid diffuse pollution, namely, through a limited, rational and planned use of nitrogenous fertilizers and other agrochemicals (pesticides, herbicides) in agricultural practices;

(viii) Encouragement and promotion of the use of adequately treated and purified waste waters in agriculture, aquaculture, industry and other sectors;

(c) Development and application of clean technology:

(i) Control of industrial waste discharges, including low-waste production technologies and water recirculation, in an integrated manner and through application of precautionary measures derived from a broad-based life-cycle analysis;

(ii) Treatment of municipal waste water for safe reuse in agriculture and aquaculture;

(iii) Development of biotechnology, inter alia, for waste treatment, production of biofertilizers and other activities;

(iv) Development of appropriate methods for water pollution control, taking into account sound traditional and indigenous practices;

(d) Groundwater protection:

(i) Development of agricultural practices that do not degrade groundwaters;

(ii) Application of the necessary measures to mitigate saline intrusion into aquifers of small islands and coastal plains as a consequence of sealevel rise or overexploitation of coastal aquifers;

(iii) Prevention of aquifer pollution through the regulation of toxic substances that permeate the ground and the establishment of protection zones in groundwater recharge and abstraction areas;

(iv) Design and management of landfills based upon sound hydrogeologic information and impact assessment, using the best practicable and best available technology;

(v) Promotion of measures to improve the safety and integrity of wells and well-head areas to reduce intrusion of biological pathogens and hazardous chemicals into aquifers at well sites;

(vi) Water-quality monitoring, as needed, of surface and groundwaters potentially affected by sites storing toxic and hazardous materials;

(e) Protection of aquatic ecosystems:

(i) Rehabilitation of polluted and degraded water bodies to restore aquatic habitats and ecosystems;

(ii) Rehabilitation programmes for agricultural lands and for other users, taking into account equivalent action for the protection and use of groundwater resources important for agricultural productivity and for the biodiversity of the tropics;

(iii) Conservation and protection of wetlands (owing to their ecological and habitat importance for many species), taking into account social and economic factors;

(iv) Control of noxious aquatic species that may destroy some other water species;

(f) Protection of freshwater living resources:

(i) Control and monitoring of water quality to allow for the sustainable development of inland fisheries;

(ii) Protection of ecosystems from pollution and degradation for the development of freshwater aquaculture projects;

(g) Monitoring and surveillance of water resources and waters receiving wastes:

(i) Establishment of networks for the monitoring and continuous surveillance of waters receiving wastes and of point and diffuse sources of pollution;

(ii) Promotion and extension of the application of environmental impact assessments of geographical information systems;

(iii) Surveillance of pollution sources to improve compliance with standards and regulations and to regulate the issue of discharge permits;

(iv) Monitoring of the utilization of chemicals in agriculture that may have an adverse environmental effect;

(v) Rational land use to prevent land degradation, erosion and siltation of lakes and other water bodies;

(h) Development of national and international legal instruments that may be required to protect the quality of water resources, as appropriate, particularly for:

(i) Monitoring and control of pollution and its effects in national and transboundary waters;

(ii) Control of long-range atmospheric transport of pollutants;

(iii) Control of accidental and/or deliberate spills in national and/or transboundary water bodies;

(iv) Environmental impact assessment.

Means of implementation

(a) Financing and cost evaluation

18.41. The Conference secretariat has estimated the average total annual cost (1993-2000) of implementing the activities of this programme to be about $1 billion, including about $340 million from the international community on grant or concessional terms. These are indicative and order of magnitude estimates only and have not been reviewed by Governments. Actual costs and financial terms, including any that are non-concessional, will depend upon, inter alia, the specific strategies and programmes Governments decide upon for implementation.

(b) Scientific and technological means

18.42. States should undertake cooperative research projects to develop solutions to technical problems that are appropriate for the conditions in each watershed or country. States should consider strengthening and developing national research centres linked through networks and supported by regional water research institutes. The North-South twinning of research centres and field studies by international water research institutions should be actively promoted. It is important that a minimum percentage of funds for water resource development projects is allocated to research and development, particularly in externally funded projects.

18.43. Monitoring and assessment of complex aquatic systems often require multidisciplinary studies involving several institutions and scientists in a joint programme. International water-quality programmes, such as GEMS/WATER, should be oriented towards the water-quality of developing countries. User-friendly software and Geographical Information Systems (GIS) and Global Resource Information Database (GRID) methods should be developed for the handling, analysis and interpretation of monitoring data and for the preparation of management strategies.

(c) Human resource development

18.44. Innovative approaches should be adopted for professional and managerial staff training in order to cope with changing needs and challenges. Flexibility and adaptability regarding emerging water pollution issues should be developed. Training activities should be undertaken periodically at all levels within the organizations responsible for water-quality management and innovative teaching techniques adopted for specific aspects of water-quality monitoring and control, including development of training skills, in-service training, problem-solving workshops and refresher training courses.

18.45. Suitable approaches include the strengthening and improvement of the human resource capabilities of local Governments in managing water protection, treatment and use, particularly in urban areas, and the establishment of national and regional technical and engineering courses on the subjects of water-quality protection and control at existing schools and education/training courses on water resources protection and conservation for laboratory and field technicians, women and other water-user groups.

(d) Capacity-building

18.46. The effective protection of water resources and ecosystems from pollution requires considerable upgrading of most countries' present capacities. Water-quality management programmes require a certain minimum infrastructure and staff to identify and implement technical solutions and to enforce regulatory action. One of the key problems today and for the future is the sustained operation and maintenance of these facilities. In order not to allow resources gained from previous investments to deteriorate further, immediate action is required in a number of areas.

D. Drinking-water supply and sanitation

Basis for action

18.47. Safe water-supplies and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty. Safe water is also crucial to many traditional and cultural activities. An estimated 80 per cent of all diseases and over one third of deaths in developing countries are caused by the consumption of contaminated water, and on average as much as one tenth of each person's productive time is sacrificed to water-related diseases. Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. The most outstanding of these efforts was the launching in 1981 of the International Drinking Water Supply and Sanitation Decade, which resulted from the Mar del Plata Action Plan adopted by the United Nations Water Conference in 1977. The commonly agreed premise was that "all peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs". 2/ The target of the Decade was to provide safe drinking-water and sanitation to underserved urban and rural areas by 1990, but even the unprecedented progress achieved during the Decade was not enough. One in three people in the developing world still lacks these two most basic requirements for health and dignity. It is also recognized that human excreta and sewage are important causes of the deterioration of water-quality in developing countries, and the introduction of available technologies, including appropriate technologies, and the construction of sewage treatment facilities could bring significant improvement.

Objectives

18.48. The New Delhi Statement (adopted at the Global Consultation on Safe Water and Sanitation for the 1990s, which was held in New Delhi from 10 to 14 September 1990) formalized the need to provide, on a sustainable basis, access to safe water in sufficient quantities and proper sanitation for all, emphasizing the "some for all rather than more for some" approach. Four guiding principles provide for the programme objectives:

(a) Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes;

(b) Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions;

Supporting material

(from IRC Occasional paper no. 15, "Drinking water source protection, by T.F. Bastemeiier and M.D. Lee)

5. *Experience in Better Water Resource Management*

5.1 Risk assessment

Risk assessment strategies are receiving growing attention from planners of small community water supply systems. It is recognized that water quality can be ensured more effectively when avoiding the risk for contamination by human waste, agricultural chemicals, livestock faeces and industrial discharge (Hubbs, 1985). This is particularly important in rural areas where it is preferable to minimize the necessity for water treatment (Okun and Ernst, 1987). Assessing the risk of source problems requires knowledge of the possible causes of such problems under local conditions at the source and in the catchment area.

Risk assessment is preferably carried out in the planning stage of a water supply system development in which the objectives are to select sites with the lowest risk factor and to plan for preventive actions. Experience has been reviewed in three main areas to date: Source and site selection, catchment protection, and sanitary surveying.

Source selection and siting intakes

Field experience shows that good source selection and adequate siting of intakes contribute to the reliability of the water supply system. Various field manuals and handbooks have been developed for the design of gravity water supply systems, which include basic procedures for source selection and siting of intakes (for instance, Archambault et al, 1987; Jordan, 1980). Often these procedures concentrate on the determination of a safe source yield or the design of the intake structures, rather than on present and future risks to be avoided. Sustainable use of sources requires site and source selection allowing subsequent protection of the source and catchment area (Sundaresan et al, 1982). Lloyd (1982) stresses the environmental factors affecting sources and recommends the following procedure for the selection of surface water sources:

- take water as near to the watershed as possible;
- choose sources with catchments as sparsely inhabited as possible;
- choose supplies that consistently yield low-turbidity water;
- frequently inspect catchment areas for pollution sources; and
- avoid activities that may pollute upstream locations.

The Tanzanian temporary water standard guidelines (Sechu, 1986) state that river intakes should be constructed upstream from villages and industries, and the intake should be in deep water close to a stable bottom. Lake intakes should avoid shore water and be positioned deeper in the lake towards the centre of the depression. This minimises both the chances of pollution and the risks of dry periods.

For the selection of groundwater sources, in particular for small point source supplies, procedures could be more systematic, both in terms of locating high-yielding sites and in terms of avoiding sites with high potential for contamination by seepage from the surface. Low success rates in drilling small diameter wells, and early deterioration of boreholes have caused rural water supply programmes and water agencies to give more attention to this point. However, there are still many projects haphazardly selecting sites for well construction and drilling. Nevertheless attempts are being made to develop more reliable and more economical ways to select groundwater sources. For instance, Poyet and Detay (1988) developed computer software to assist projects in siting and designing wells.

For the siting of shallow drilled and hand-dug wells, the risks associated with faecal contamination from on-site sanitation are still poorly understood and quantified. Where water supply points are located within or adjacent to settlements, two elements have not been adequately addressed with respect to possible contamination by existing sanitation units and/or waste disposal practices. The first element concerns contamination risks to drinking water sources from waste. The lack of criteria for the establishment of safe distances between the water source and possible contamination points is the second element.

Ward (1989) suggests that contamination risk cannot be determined without monitoring groundwater conditions, especially given that research has shown pollution of groundwater is negligible under certain hydro-geological conditions (Lewis et al, 1982). Problems are so site-specific that general guidelines are often ineffective. Ward sees monitoring as indispensable to groundwater development projects where on-site sanitation is also practised. He also considers monitoring within the capacity of developing countries given clearly defined objectives and the elaboration of a simple methodology (Ward and Foster, 1981). Participation of the user communities in the assessment of possible intake and well-sites is important for two reasons. First, local communities have knowledge about variations in water levels and water and land use activities, which are of use in selecting sources that can remain adequate in terms of both quality and quantity. Secondly, source discussions promote a dialogue with the users on environmental risks and protection, which raises community awareness and can develop or problem-solving actions.

With increasing population pressures and expansion of human activities into previously undisturbed catchment areas, risk assessment must take into account both current and projected activities within the catchment area. Awareness of the changing nature of catchment areas is very important, particularly for safeguarding untreated gravity systems, springs and mountain streams.

One of the most successful gravity piped water supply programmes is considered to be the rural water supply programme in Malawi. Sources were located in forest reserves with low risk of contamination. In spite of this, contamination of an increasing number of sources is raising concern. Some of the Malawi rural self-help gravity systems are now being examined by IDRC (1989) to determine the nature of water contamination. Appropriate measures to remedy existing contamination as well as future source protection and site selection criteria are being investigated.

In Danida supported water supply programmes, greater yielding, distant gravity sources are generally selected at higher costs in an effort to meet the future water demand of the target population and to minimize risks of pollution. In principle, these sources are less affected by the user communities and their livestock. Nevertheless, some of the sources have a lower yield than expected or have been found to be contaminated. Lack of long-term data on spring characteristics at the time of selection and rapidly changing conditions in the catchment areas have contributed to this problem. In some areas, the programme installed handpumps because groundwater sources were evaluated as being more reliable than surface sources (Jensen 1989, personal communication). Undisturbed catchment areas for spring development with relatively lower risk and lower exploitation costs are threatened as land is increasingly brought under production. Similar problems are reported from the Punjab in Pakistan and from Colombia. In Colombia, pollution of highland springs feeding gravity pipes has increased the necessity for slow sand filtration systems managed by villagers (van Wijk, 1989 personal communication). These examples show that it is important to assess the effects of changes which are likely to take place in the future. Site and catchment risk assessment enables planners and managers to compare source problem risks for different alternatives.

Catchment protection

Clearly from the above examples, more active protection of catchment areas is required. This involves a systematic appraisal of catchment areas for surface or groundwater sources and the identification of environmental factors, related to land-use. There is a need for practical experience to develop checklists for small sources to be effectively managed by local communities. Such checklists were developed in Sri Lanka, where the Sarvodaya organization prepared yield measurement procedures in addition to using colouring agents to determine pollution risks.

On a larger scale, PAHO/CEPIS has established procedures for the identification and evaluation of pollution risk for regional aquifers in Latin America and the Caribbean (Adams, 1990). Many of the aquifers in the region are vulnerable to pollution from discharge of effluent, solid waste and toxic chemical disposal, and the expansion of agriculture. As groundwater is used to provide drinking water to an estimated 140 million people in urban and rural areas, the protection of aquifers is of critical concern. Important considerations mentioned are:

- Groundwater pollution has a long lasting effect;
- Remedial action is often not feasible or very expensive;
- There are not only immediate, but also chronic health implications from pathogenic or toxic pollutants.

The groundwater pollution risk is the product of the contaminant load applied to the subsurface environment by human actions and the natural pollution vulnerability of the aquifer (Foster et al, 1987). To protect aquifers, it must be clear by which pollutants and pollution sources they are most affected. This knowledge forms the basis for the delimitation of protection zones in which human activities must be regulated.

Protection zones are conceptually important for the design, prioritization and distribution of water resources protection measures. The zones can be delimited with respect to the level and nature of risk, resulting in more coherent and incisive protection strategies. However, those zones may be established even when risk information is incomplete. The following zones are defined as follows:

- the inner zone, defined as the area in which there is a direct risk of contamination,
- the outer zone, defined as the area in which the water may be at risk from indirect contamination,
- the catchment area, the whole area from which water flows to the intake.

Existing water resource protection legislation can be incorporated into zoning to elaborate protection strategies. An example of such effort is a SIDA sponsored study in Botswana carried out in the early 80's resulting in a proposal for new domestic water legislation (Hawerman et al, 1983). The issue of protection areas for drinking water sources is presented in the proposal, but the information lacks detail.

In Sri Lanka, the Sarvodaya organization mentioned earlier, requires communities to establish protection zones of at least one acre surrounding the source before the construction of a system is considered. Often larger areas are set aside of 4 to even 10 acres. The protection zone is demarcated by a fence or shrubs. Mixed tree seedlings are planted within this demarcated area (Heynen, personal communication 1990).

The effectiveness of protection zones relies on local people's commitment to protection measures established. Protected areas are obviously increasingly vulnerable as population densities increase. Local people must therefore be motivated to take effective measures to protect the catchment area. Motivation will be partially a function of their perceived value of the resource. The boundaries of high risk zones can be identified by physical surveys, discussions with community members, and aerial photographs. Areas can be demarcated by fencing or planting a particular variety of tree to act as a differentiating line (Jensen, 1989 personal communication).

Sanitary surveying
Sanitary surveys are a form of risk assessment which examine the technical quality of a water supply point, the manner of use by consumers, the surrounding environmental hygiene conditions and the potential causes of contamination. Their purpose is to minimize the level of risk of on-site contamination by identifying remedial measures that can quickly and easily be taken. Preventive measures may already have been implemented in the planning and construction stage as part of site selection, risk assessment and system construction. Coupled with bacteriological analysis, sanitary surveys provide a methodology on which successive improvements can be made to water supply conditions. The method can also identify where off-site problems contribute to contamination and where remedial catchment protection is urgently required. This is illustrated in the experiences of Lloyd and his colleagues who have developed a sanitary survey strategy in collaboration with WHO (Lloyd, 1990; Lloyd and Suyati, 1989).

Through the Java pilot project, Lloyd and his colleagues, have developed cost-effective methods for sanitary inspection and water quality monitoring that are now being applied in UNEP/WHO projects in Peru, Colombia, Nicaragua, Zambia, Nepal and Vanuatu (Lloyd, 1990. WHO, 1989). A sanitary survey was developed which could be rapidly and accurately completed at the same time as bacteriological sampling and field-testing. The survey report has a checklist of potential contamination sources and quantifies the level of overall risk by a cumulative yes/no score. A sketch of the risks to be left at the site so users can see the site protection measures is elaborated. The strategy classifies the water point on the basis of the sanitary risk, graded from high to low. The survey reveals the sources of highest contamination risk. The sanitary surveys are a tool to enable inspectors to play an active role in the improvement of water sources by undertaking on-site evaluation and providing clear instructions on remedial protective measures. The approach provides a scientific basis for prioritizing remedial actions to protect the consumer from the risk of waterborne disease.

Remedial measures relate to actions taken at the site by the user community, either to make physical repairs or to improve unhygienic practices causing contamination. Continued surveillance allows drinking water sources and supply systems to be improved gradually so they can achieve satisfactory survey results.

To provide a more meaningful assessment of the sanitary status of water sources and the level of risks for waterborne disease transmission, a more appropriate grading of faecal contamination was deemed necessary. Because of the adoption of a realistic and more elaborate grading system (i.e. more than just 0=safe, > 0=unsafe), as well as a quantitative evaluation of potential pollution risks, it is possible to more accurately assess the health risk attributable to every drinking water installation in order to prioritise remedial action (Lloyd, 1990). The grading is based on increasing orders of magnitude of faecal coliform contamination:

Grade of Risk		E.coli-Faecal coliforms/100ml	Risk Factor
A	=	0 (WHO Guideline);	no risk
B	=	1-10;	low risk
C	=	11-100;	intermediate to high risk
D	=	101-1,000;	gross pollution; high risk
E	=	> 1,000;	gross pollution; very high risk

Sanitary risk is plotted against bacteriological risk to give a clear indication of the worst water supply points. Where a low sanitary risk is paired with a very high bacteriological risk, this may well indicate remote source problems such as pit-latrine seepage. When this probable remote contamination is detected, a wider catchment risk assessment is required as explained previously. At a recent IRC meeting on drinking water source protection, participants recommended that the sanitary survey be adopted more universally; preferably in combination with risk assessment in the catchment area and the formulation of protection zones in which human activities are regulated and preventive steps taken (Lee, 1990). Especially for small and scattered community-managed water supply systems, it is essential that community members take a active part in such sanitary surveys, as their help will usually be needed to improve sanitary conditions and to change practices which cause contamination of water sources.

In some countries community-based monitoring systems of the water quality of small community systems are under development. For instance in Colombia, a simple quality testing device has been developed and village water operators are being trained to regularly monitor and record turbidity and E-coli levels as part of a demonstration project on simple treatment methods supported by IRC.

5.2 Technical solutions

Possible solutions to source problems include improved sanitation, physical protection, soil and water conservation, waste water treatment and recycling, artificial recharge and tree planting. In many cases, these must be combined to respond to problems that have more than one cause.

Improvements in sanitation

As mentioned earlier, the problem of user contaminated water supply through poor sanitation and hygiene is widespread. Use of latrines and other sanitary systems reduce faecal pollution risk by excluding contamination of the topsoil or ground surface so that excreta is not washed into surface water or transported by animals (Nordberg and Winblad, 1990). The design of the latrine should in principle ensure that there is no direct sub-surface link between the excreta and the groundwater supply which involves consideration of siting, soil type and depth, and seasonal or daily water levels (Lewis et al, 1980a). Given well designed latrines, adapted to local conditions, improved sanitation requires broad acceptance as well as high use rates by the population.

Figure 10: Users polluting their water source

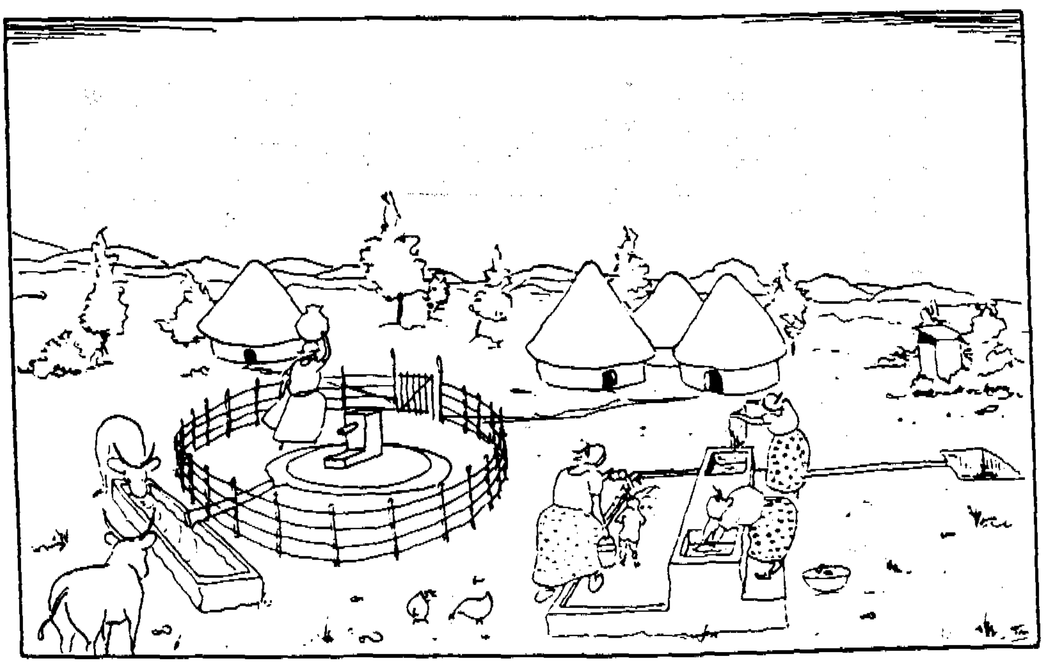

Figure 11: Users protecting their water source.

Physical protection of wells and intakes

Users pollute their water sources due to the lack of awareness about ways and means to ensure adequate physical protection of the supply point (Figures 25 and 26). Community water supply projects engaged in groundwater development through well construction, recognize the importance of simple site protection against pollution. The addition of well-aprons, soak-away drains, covers and hand pumps protect water quality by preventing the inflow of contaminated water back into the well. In addition, the direct input of contaminants is excluded while extracting the water (Boschi, 1982. Nyangeri, 1986. Rogers, 1985. IRC, 1988. Archambault et al, 1987). The benefit of providing well-heads, walls and aprons was clearly observed in Sierra Leone where bacteriological contamination was lower than in traditional shallow wells and fluctuated less seasonally (Wright, 1985). Because proper construction and maintenance of these improvements is required to safeguard water quality through time, it is essential that communities, and women as first users, are involved in the decision regarding the construction and design of aprons, drains etc., and are trained in its relevance for the cleanliness of their drinking water.

The use of wells for clothes washing, bathing and cattle watering and nearby open defaecation, are other sources of water contamination. Absolute prohibition of these practices is often no solution as it forces women and children to either increase time necessary for water collection or limit water-use for hygiene. In many areas, such problems can be prevented by discussing the need for additional washing, bathing and/or cattle watering facilities and coming to clear agreements regarding the design, siting, financing and management of additional facilities for these purposes.

Figure 12: Neighbourhood washingfacility near water point in Tanzania

Pollution also occurs due to the direct use of surface water sources by livestock. This can be prevented by constructing fencing using branches, thorny scrub or hedges of cacti or thorn-bushes, provided there is a watering trough for animals outside the fence. This form of protection is illustrated in the sketches from the SIDA funded HESAWA project (SIDA, 1987) in Tanzania.

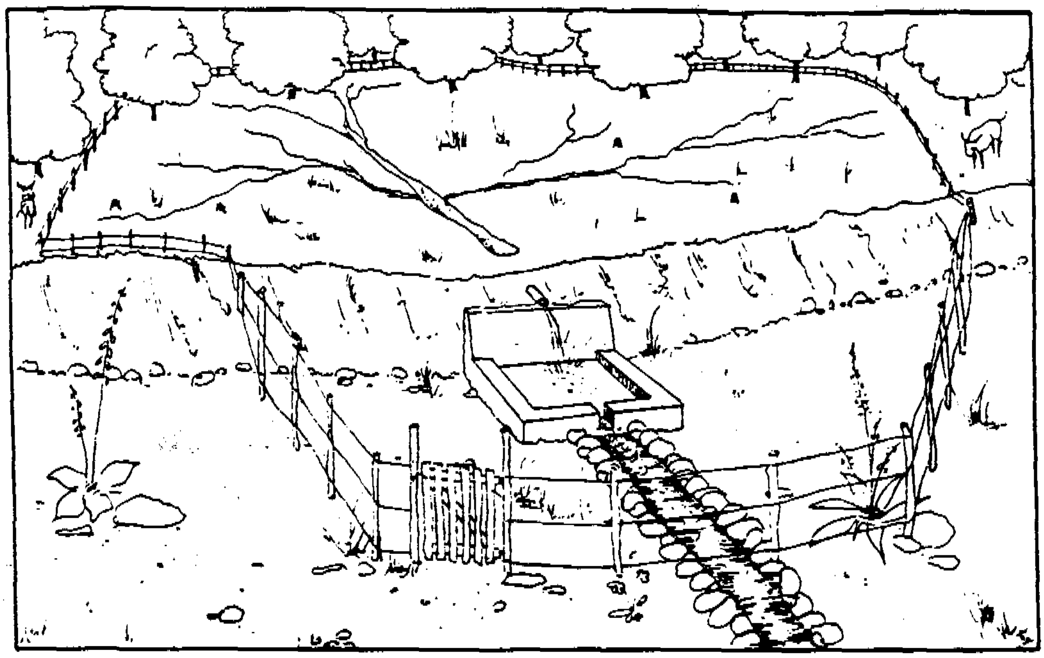

Figure 13: Fencing as well as hedges can be an effective protection measure

Experiences in Haiti, Rwanda, Zaire and Burundi show that physical protection has to be combined with community oriented training and education related to system-use and maintenance, and catchment protection (Archambault et al., 1987; Klomberg, 1988 personal communication).

Soil and water conservation techniques

Soil and water conservation activities can decrease turbidity by preventing sediment transport, increasing groundwater recharge and decreasing surface flow peaks by increasing infiltration. A full range of erosion control techniques and strategies have been pioneered for developing countries and applied with considerable success. Methods include terracing, contour ploughing, infiltration buffers, earth bunds, stone-lines, trash-lines as well as various forms of runoff farming (Wenner, 1981; Morgan, 1981; Morgan, 1985). A prominent example of soil and water conservation to preserve watershed environments and increase agricultural activity is the EEC-assisted Machakos Integrated Development Project in Kenya (Harrison, 1987).

However, soil erosion has expanded at a faster pace than most national governments have been able to cope with. A large proportion of soil erosion problems have resulted from the expansion of shifting cultivation techniques into marginal areas. Additionally, they result from the settling of previously semi-nomadic people who have little history of terrace building or other traditional forms of soil stabilisation. Concentration of livestock around newly developed water supply points such as earth dams has also caused serious soil degradation through over-grazing. Erosion results in rapid siltation and subsequent reduction of the reservoir capacity of dams. A more widespread application of soil and water conservation techniques is clearly required. Institutional capacities and community programs must be stimulated, if control is to keep pace with the growth in population and new land brought under production. These elements have been incorporated in a forthcoming innovative rural water supply programme in the Dodoma region of Tanzania (Stanislawski, 1990 personal communication).

Waste water treatment

Both industrial effluent and domestic sewage should be treated to minimize pollution risk. For domestic sewage, different on-site and off-site technical options are available, but they are not always applied. For developing countries, sewage lagoons and oxidation ditches are among the more economical methods. Automated sewage treatment plants are more difficult and expensive to operate and maintain. It is often technically difficult and expensive to process industrial waste. A variety of techniques exist for mechanical purification and chemical and biological treatment. GTZ commissioned a handbook on waste water technology (Fresenius et al, 1989), which discusses the treatment of domestic, commercial and industrial waste water.

Little experience exists in using simple and effective, low-cost treatment technologies for small-scale industrial polluters; especially for small rural agro-industries. Suitable technological solutions and a system of incentives against discharging untreated waste into national and local waterways appear to be lacking. Many toxic elements originating from industries and the misapplication of fertilizers have no feasible treatment possibilities. Therefore, preventive measures against contamination from industrial and agricultural activities are crucial.

Waste water Recycling

Waste water treatment is complementary with waste water recycling. As such, sewage waste may only need partial treatment to be used on farmland for irrigation or in a range of industrial processes where water quality standards are not critical. Waste water recycling if carried out correctly, can be a form of water source protection as well as conservation. Contamination risk of water sources is decreased through proper recycling and increases the efficient use of the water source. Water is treated by less expensive methods because treatment is to a lower quality level, since only coliforms and helminths need be removed. Less expensive waste treatment ponding is one technology recommended for developing countries. These ponds are adapted to existing technical skills and socio-economic conditions (Laugeri and Hespanhol, 1990). The cost of treatment is reduced compared to that necessary to safely release treated waste into surface water. However, there is always the prospect of groundwater contamination by infiltrating waste water irrigation. In the irrigated area, the most susceptible water supply systems are shallow wells (Laugeri and Hespanhol, 1990).

Several benefits can be derived in groundwater dependent areas for irrigation by recycling waste water. Recycled water, supplements the existing water source by decreasing the use of groundwater. In some cases, waste water can be substituted for fresh water for non-essential uses. Recycling of waste water reduces the risk of contaminating water resources. Health risks to down stream users would be reduced.

The two major financial benefits are the reduction in water supply costs by supplementing waste water for limited supplies of fresh water, and revenues for sewerage works processing the waste water for sale to re-users (Laugeri and Hespanhol, 1990). To effectively and safely carry out waste water recycling, developing countries must considerably improve their operation, maintenance and surveillance practices in relation to waste management.

Artificial Recharge

Groundwater resources can be managed to decrease water table recession and saltwater intrusion by artificial recharge. A range of techniques are available and depend on the geological and topographic conditions of the location, and the size of the aquifer to be recharged (Rushton and Phadtare, 1989). At the small and medium-scale, recharge is predominantly from infiltration ditches, ponds and basins, through retention of river underflow using sub-surface dams, and through retention of river flood-water. Sand storage dams can also be used to increase the dimensions of the shallow groundwater reservoir (Nilsson, 1988).

Siting individual or batteries of wells adjacent to rivers may be effective in filtering out contaminants, as opposed to using water directly from the river. (Huisman and Kop, 1988). General information on small and medium-scale artificial recharge has been provided, for example by Hofkes and Visscher (1987).

In irrigated zones of Punjab in Pakistan, artificial recharge was applied on a considerable scale. In certain areas brackish groundwater can not be used for drinking water. Wells were situated at regular distances along main irrigation channels to draw from the freshwater aquifer around the channel. The water was pumped electrically into a piped system for a rural town and villages. This solution was preferred over pumping directly from the canal in order to combine a safe yield with better water quality.

Recharging groundwater has possibilities in arid zones where potential evaporation and runoff is high. The success of the method obviously depends on local conditions such as the porosity of the aquifer, the depth of the capillary zone through which water can be drawn up to the surface and evaporated, and the retention of the soil and rock.

Reforestation

Reforestation programmes coupled with anti-erosion and soil and water conservation techniques are considered essential to the amelioration of many source problems. However, for the moment many more trees are cut than planted. For example, it is estimated that in South America the rate of tree planting to cutting is approximately 1:10 (Gaskin-Reyes, 1988).

It is important to remember that while it takes only a short time to clear forests to cause soil erosion and to disrupt hydrological processes, it takes a much longer period to counteract these problems. In addition, the environmental benefits accruing from reforestation are not easily recognized by the local population. Their overriding concern is bringing new land under cultivation to increase food production. Short term needs often have priority over long term benefits. Nevertheless there are encouraging experiences. In India, the Chipko movement is considered successful (Bandyopadhyay and Shiva, 1988) and protection of forest areas has helped reduce the intensity of floods and soil erosion, ensuring a perennial water supply from previously threatened local sources. Elsewhere, social forestry programmes have contributed to environmental stabilisation while meeting local resource needs for food, firewood, fodder, building materials and income (Gaskin-Reyes, 1988). Village forestry has also been promoted to help regulate water flows in streams and rivers and prevent siltation in dams and reservoirs.

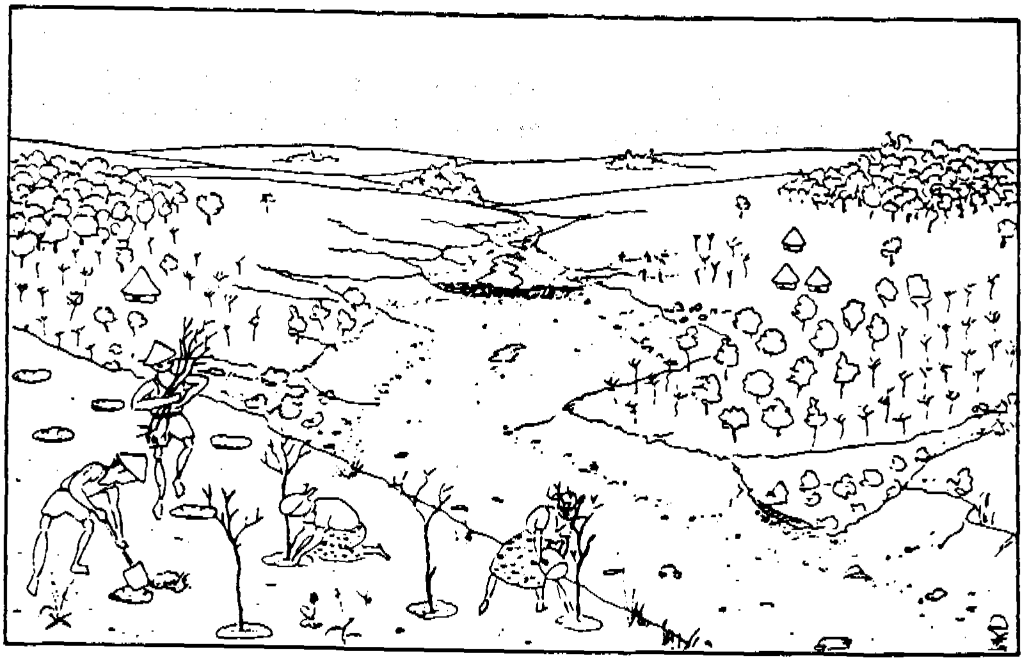

Figure 14: Village forestry

Comprehensive solutions
A single technical approach is often not enough to remedy or protect water sources. Effective drinking water source protection may need to adopt a multiple intervention strategy because usually, gross pollution of drinking water supply has more than one cause. A comprehensive water source protection assessment must be carried out, identifying actual and potential problems, for which protection measures can be suggested (Nordberg and Winblad, 1990).

For example, a high-level committee was established by the Government of Gujerat to report on the causes of increased salinization of groundwater, consequent deterioration of irrigated land and possible remedial measures. The cause was clearly over-pumping of groundwater. The comprehensive remedial measures recommended were: to change crop patterns (to less water-dependent crops); to regulate ground water extraction; to increase artificial recharge with check dams, recharge wells, and recharge tanks; to block salt water intrusion with tidal regulators, fresh water barriers and extraction carriers; and to reforest the upland catchments (Shukla, 1984).

5.3 Institutional and legal aspects of source protection

Community motivation and awareness
Many water pollution problems are due to a lack of awareness of the causes of health problems among local communities (Wihuri, 1989 personal communication). The link between water, hygiene and illness is not strongly perceived since water is assumed to

be beneficial and cleansing rather than a potential avenue for infection (Boot, 1984). Local community awareness raising is often an essential prerequisite to stimulating their motivation for undertaking protection activities.

For example, the Al-Baghari Spring in the Yemen (Ansell and Burrowes, 1981) was polluted by users washing laundry and allowing their donkeys to stand in the water while filling jerry-cans. The spring was believed to have been formed by the prophet striking the ground with his sword and pronouncing it to be self-cleansing. Local village people saw no need to modify their behaviour, considering the water to be free, plentiful, and pure. Much time and effort was required on the part of field workers to involve the community in a strategy to protect the spring and pipe water down to the village. This illustrates the importance of cultural factors and the need for community awareness of the real nature of problems affecting their health and welfare.

Health and hygiene education activities help prevent many water source contamination problems through measures such as:

- preventing open-air defaecation;
- disposing safely of human waste by the introduction and regular use of sanitation systems, such as pit latrines;
- using clean buckets and ropes to extract water;
- excluding washing of laundry, bathing and livestock watering in the drinking water source;
- improving people's understanding of the mechanisms that transmit and cause diseases.

Health and hygiene education methods and experiences are described extensively in IRC publications (for instance, Boot 1984). However, there is little information concerning training of community members and water committees, enabling them to play a more active role in the protection of their drinking water sources.

Partnership between communities and governmental agencies

Reliably functioning water supply systems may greatly contribute to the protection of water sources. Community-based maintenance and management of water supply systems is a good starting point for a more integrated approach to water source protection and environmental conservation. As explained earlier, poor functioning of supply systems limits reliability, and makes sources inaccessible for unacceptable periods. As a result, users may alternatively adopt less sanitary methods of extracting water, which in itself can cause pollution.

There are a few examples of community-based management comprehensively addressing water source problems. An example of effective community management developed with little external assistance was found in Botswana, where a policy of constructing small dams for local rural groups was adopted in 1974. Each dam was intended to water 400 head of cattle and in some cases, provide domestic water (Fortmann, 1983). This was later re-evaluated because planners felt that the risks of water source deterioration were too high. Specifically, they worried about escalating cattle concentrations around dams leading to severe damage and contamination leading to possible health hazards. However, planners found their concerns already accounted for by the local community. The rural groups had developed a four-fold system of source protection in an attempt to maintain water quality and reliability. The following are elements of the community designed water management strategy:

- limiting the number of users to members of the group and occasional non-members from the same community;
- restricting use to domestic purposes and the watering of calfs either permanently or seasonally;
- controlling the manner of use by preventing animals from taking water directly from the dam by fencing and providing watering troughs; and
- rotating reservoir use by exploiting shorter lived sources first.

Similar highly motivated management actions can be found among communities in Asia. In the mountainous Himalayan region of Uttar Pradesh, there is an increasing threat of water scarcity in the rural villages due to the clearing of natural broad-leaved forests (Bandyopadhayay and Shiva, 1988). Rapid runoff of monsoonal rains create floods which are followed by post-monsoonal drying up of springs and streams. The impact of this seasonal water fluctuation has been felt strongly by women who must now walk long distances each day for the family water supply. Inspired by the Chipko (hug-a-tree) movement, village women have begun to protect and regenerate forests in the vicinity of their village to help improve their water, and at the same time, their firewood and fodder situation. In the Song river catchment of the Saklan region, villages have protected and regenerated the oak forests which have reduced the intensity of river floods, inhibited soil erosion, and ensured that springs and streams provide a year-round water supply (Shiva, 1989). In developing effective community-based environmental management, more attention should be paid to local knowledge and traditional management systems already existing in the areas concerned. Local men and women know their environmental socio-economic and cultural conditions well, and can therefore often advise whether a certain strategy is likely to be appropriate. In a Colombian mountain village where an intake was affected by cattle and soil erosion the villagers rejected the idea of fencing or grazing cattle elsewhere. They predicted that the wire would be stolen, and that they did not have enough land and cash to make proper pastures. Instead, they provided voluntary labour to plant prickly vegetation upstream from the intake. This effectively forced the cattle to drink water at lower places along the river and solved the problem.

With regard to traditional management systems, there are indications that regulations on management and use of water sources exist especially in areas with a shortage of water, a high water culture and/or sharing of water points by a relatively small group of families. Women often play an important role in this source management (van Wijk, 1985). Asking users about *how* they manage traditional water sources was found to be the best way of identifying such traditional management patterns (Roark, 1984).

Although community water management strategies are possible, there must generally be direct links between the community and the water source. Communities must be users of the water source or derive some other benefit from the protective action such as commercial benefits from tree-planting or increased crop production following soil conservation. Conflict of interests between upstream and downstream users is a serious problem worldwide. This is true for the next village farming further up the mountain hillside as well as for the industry discharging its waste upstream from a water intake. Neither sees the need to change its polluting or over-exploiting activities since neither experiences the negative effects these activities create. Reconciling conflicts of interest and instituting environmental protection in these situations is the role of the national, regional or local authorities. Government institutions and regional and local authorities should support community efforts to manage and protect their drinking water sources. Support to community-based environmental management can be formalized in regulations and control procedures.

Greater information is required to enable governments to formulate water management policies. Information creates the basis on which planning and legislative decisions can be made. For international support agencies and national governments there is a need to better identify issues and priorities as a basis for strategy development. The development of country profiles of major environmental problems affecting drinking water sources was called for at the recent review meeting at IRC (Lee, 1990).

A recent attempt to formulate a strategy comes from West Java where the Government of the Republic of Indonesia has set up a Water Resources Management Office (GOI/Cowiconsult, 1989). This organization issues licences for water source developments which are used to enforce the Environmental Management Act of 1982 and in particular, the 1988 Control of Groundwater and Surface Water Exploitation and Disposal of Waste Water. To obtain a licence, information must be provided in the form of a "Presentation of Environmental Information" (PIL). The information required consists of general information on the water source, its geological and morphological characteristics, present environmental conditions, and the anticipated changes in the catchment area and source characteristics as a result of exploitation. The sensitivity to pollution is expressed in five relative terms from safe to very sensitive. For each source examined, protection requirements are illustrated on a topographic map showing the source location and the proposed protection area. For springs and small streams, the entire catchment is protected in which polluting activities are to be controlled. For big rivers or irrigation canals, the immediate upstream areas from the intake are designated as a protected zone. For boreholes/wells, the protective area is both the immediate area surrounding the well and the catchment area for groundwater flow.

Legislation and enforcement

Currently, water resource and environmental legislation in most developing countries has evolved through time in response to particular water management problems that have developed with associated economic and demographic growth (UN, 1984). They are directed towards the control of water use from major rivers or lakes which are of economic significance and do not currently provide a good basis for protection of drinking water sources.

From their work on the legal and financial aspects of community water supply development, WHO has listed several legal issues that have recently come to the forefront (Laugeri and Hespanhol, 1990; Laugeri, 1990):

- regulations are needed to ensure that the source exploited for community water supply is the most favourable in terms of quality, quantity and access. The rights and needs of drinking water users should be protected. For example, if there is a deficit in community water supply due to industrial extraction, industry should bear a real share of the cost to the community for having to use more distant or polluted sources;

- regulations are needed to ensure health and environmental protection for waste water use since there are obvious public health hazards. Guidelines are currently being elaborated by WHO based on available experience;
- legal provisions are required to ensure that potential water sources are adequately protected from the deteriorating effects of waste water infiltration;
- fundamental legislation and regulations are needed to ensure that community water supply and sanitation costs are recovered from all water source users, especially those consumers who access common-property sources through privately-owned facilities. This is particularly true where the better sources have been monopolized by a few privileged consumers at the expense of public access.

Some developing countries have prepared new water resource legislation. However, there has been difficulty in the enforcement of these laws. Government staff have insufficient training to carry out their tasks and have little reliable data with which to formulate activities. In general, there is a low awareness on the part of government and the population concerning water source problems. Finally, water source problems are often linked to population growth and subsequent expansion of agricultural activities into marginal catchment areas.

Legal measures need to take into account existing appropriate technologies as well as institutional capacities. Government can enhance awareness of the benefits of improving the living environment, for instance through land-use planning or decreasing pollution risks when developing land for government use and by effectively ensuring the emptying of septic tanks.

It is recognized that environmental regulations remain ineffective if locally perceived interests are not taken into account. For instance, subsistence agriculture may lead farmers to continue clearing more land for agriculture, even being aware of the negative environmental effects and that it is against the law (Smet, 1989 personal communication). It is essential to recognize and address these needs and develop more effective agricultural methods with agro-forestry and soil and water conservation activities. For instance, in Malawi with a population density of nearly a hundred inhabitants per sq km, agricultural exploitation is at carrying capacity. Wood gathering by women is becoming more burdensome due to deforestation. However, fuelwood scarcities are related more directly to agricultural activities than fuelwood collection itself. Consequently, food deficiency appears to be the critical problem, and it is difficult to stop deforestation caused by agricultural activities (Hirschman, 1990).

An important constraint on the enforcement of legal measures is the lack of political priority for drinking water source protection (Nakai, 1989 personal communication). Greater priority is given to the development of the economy. Source problems are felt more directly by those without access to a sophisticated piped water supply service. Consequently, drinking water sources for smaller and medium sized settlements and low-income groups in urban fringe areas are increasingly affected by the pollution caused by larger settlements and economic activities.

Costs and benefits

In many developing countries, national authorities are aware of some of the basic problems affecting drinking water sources. However, in many cases, the solutions are not politically acceptable, especially where they relate to major industries or agricultural producers. The short-term aspect of production or profitability appears to be of higher priority than the long-term effect on drinking water supplies.

It is difficult to measure the cost for example, of allowing farmers to overexploit aquifers for cash-crop irrigation, or allowing industries to dump waste products into a river with respect to environmental damage. The burden of water sources deterioration is usually borne by the users and must include the time lost walking to a safer, or more distant source, or the number of days spent ill and unable to work due to diarrhoea. It is often overlooked that in an economic sense there are costs to the country and the government due to decreased productivity. In some extreme cases, there may also be a financial cost when the government has to bowse in water daily from tens of kilometres away (Bandyopadhyay, 1987).

Unless the benefits of good environmental management and water source protection are perceived, it is difficult to expect developing country governments to improve and enforce water resource legislation. Therefore, it seems appropriate to give high priority to community roles in water source protection. The prospects for effective protection seem best where communities cause their own water source problems. The impact of drinking water protection measures is felt more directly and the communities can weigh the costs in terms of time, money and effort against the benefits they receive in increased quality, quantity and reliability of their water supply.

Helping involve women to attend and speak out during community water planning meetings may be important as they often feel most directly the impacts of deteriorating water quality and quantity. This usually requires special steps, including support from male leaders. Holding meetings for women at suitable times and places, informing and encouraging women to attend, and facilitating their input, e.g. by using local languages, inviting spokes women, encouraging internal discission, or holding separate meetings for women (van Wijk, 1985).

For further reading

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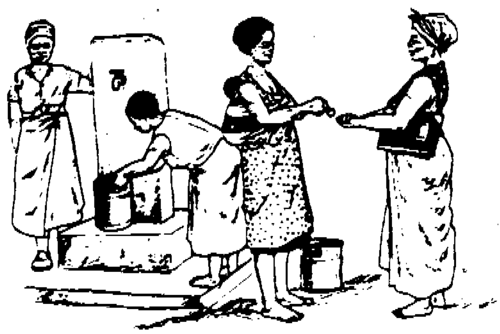
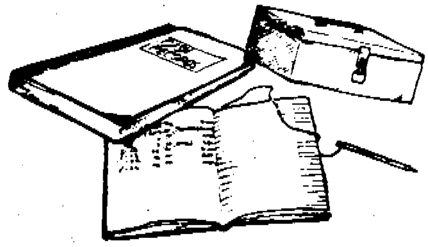
PART 1: FACING O&M

MODULE 3

O&M ISSUES





OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

3.1 ANALYSIS OF CONSTRAINTS

Description of sessions

OBJECTIVES

- To identify main causes and factors affecting O&M
- To identify the effects of poor O&M

OUTLINE OF SESSIONS

Session 1:

• The facilitator explains the technique of O.O.P.P to be used for identifying the constraints and effects of O&M	45 min
• The participants write down on each one of their cards (2/3 maximum), one real and identified problem	15 min
• The facilitator with the help of the participants starts to pin the cards on a board, eliminating non relevant or duplicated cards	45 min
	1 h 45 min

Session 2 and 3:

• The facilitator with the help of the participants establish and finalize the problem tree	3 h

HAND - OUTS

- How to do a problem tree
- Extracts from O.O.P.P. methodology

MATERIALS NEEDED

- cards, markers
- pins or masking tape to put cards on boards/or big sheet of paper.
- very large sheet of paper to put cards on an d to draw lines between cards.

Background information

1. Problem analysis

One of the first tasks of a manager or a group of managers is to assess the situation they are facing. Problems are often mentioned, but rarely analyzed, in a global and precise way. The coming sessions propose to analyze problems linked to O&M in terms of causes and effects, as well as inter-relationships between them, in order to reach a common consensus on O&M constraints.
There are different methods of analysing problems. This course proposes some aspects of the famous O.O.P.P. method, and does not have the ambition to carry a full O.O.P.P. exercise.
This method as far as analyzing problems is concerned, in simple, participative and motivating.

2. The O.O.P.P. method

The German organization for development cooperation GTZ (Gesellsschaft fur Technische Zuzammenarbeit) developed a planning methodology in combining the logical framework, with new communication techniques (Metaplan) into a system which is called **Objective Oriented Project Planning, (O.O.P.P) (originally Z.O.P.P.).** This system has proven to be useful in the GTZ projects and the method is now compulsory for all its development projects.

The goal:
Objective Oriented Project Planning is an attempt to integrate planning and implementation in a way in which communication improves. Planning can only be successful if it is a process of a team. The traditional communication methods, like meetings in which everybody is seated around a table, discussing draft plans etc.. cost a lot of time and usually end with unsatisfactory results. Team-work is a central element in the O.O.P.P. approach.

Analyzing the existing situation:
The first phase of the OOPP is the analysis of the existing situation in terms of problems and objectives. In the "problem "analysis the significant problems in the project environment are structured according to the causal linkages between them. This produces a rough model of the problem environment, expressed as a "problem" hierarchy or **problem tree.**

The "objectives" analysis transforms the problem tree into an **objective tree** representing objectives for the problems identified, (the objective tree will be seen in next sub module).

The next phases of the method will be further explained in the last part of this course during the Planning exercise.

Techniques:

1. Write down on cards problems (depends on the number of participants, if there are many 2/3 maximum) from the perspective of the identified entity : POOR O&M. If necessary, a second round of cards writing can be done.

2. A problem should be expressed as a negative state, for example "poor **know how**" instead of "know how". Problems should be existing problems, and not possible or future ones.

3. For each of the problems above ask "what are the major causes of these problems?". Write any new problems down.

4. For each of the above problems ask " What are the most important problems it in turn causes?" (effects). Write down any new problems.

5. Write each individual contribution you make on a card; pin it up for everyone to see.

6. Only one message per card
Use cards of the same colour size
Write clearly and legibly, maximum 3 lines per card

7. Word your message clearly and distinctly !
Say exactly what you mean, don't use unclear abbreviations.

8. Arrows or duplicate cards can be used to indicate interactions and effects which take place over different levels.

9. Link each card which has been pined up to another one by a logical sequence of cause and effect, identifying clusters.

10. Lines to link related effects should not be drawn until the end.

Building the tree:
Start with the starter problem "POOR O&M"
Causes and effects are developed in a logical way so that a problem tree with cause and effect relations is created:

IN SUMMARY

- Participants write clear, readible, identified problems regarding causes and effects of poor O&M.

- Cards are pined or "scotched" on a board trying to identify a logical sequence of causes and effects between them.

EFFECTS

POOR O&M

CAUSES

- Problem tree is built gradually and then arrows are drawn between cards to establish the relationship.

- During this exercise participants should feel free to express their thoughts.

2. About constraints

Causes and effects of poor O&M vary according to local conditions. However, most causes relate to one of the following main constraints:

- inadequate data on O&M
- insufficient and inefficient use of the funds
- poor management of water supply facilities
- inappropriate system design & technology choice
- low profile of O&M
- inadequate policies
- overlapping responsibilities
- political interference

Effects of poor O&M are that costs increase and benefits of improved drinking water supply are not realized. This weakens the position of the sector.

The following chart is an uncompleted problem tree, but it shows possible groups or sub-groups of problems which could be identified by the participants:

Here is an example of the type of cards which can arise; many others can arise.

INSUFFICIENT FUNDS FOR O&M	INAPPROPRIATE TECHNOLOGY	POOR QUALITY OF SYSTEMS	INSTITUTIONS DO NOT DOT THEIR JOB EFFICIENTLY	USERS DO NOT ASSUME O&M ROLE
O&M COST TOO HIGH	LACK OF INFORMATION ABOUT MAINTENANCE REQUIREMENTS OF TECHNOLOGY	PLANNING AND DESIGN PROCEDURES	LACK OF SKILLED MANPOWER	USERS NOT MOTIVATED
USERS CONTRIBUTION INSUFFICIENT	LACK OF SELECTION CRITERIA	MATERIALS NOT GOOD	NO CLEAR MANDATE	USERS NOT ORGANIZED
GOVERNMENT FUNDS NOT AVAILABLE	PROCEDURES AND RULES FOR SUPPLIERS	IMPLEMENTATION PROCEDURES NOT ADEQUATE	POOR MANAGEMENT	ROLE NOT FEASIBLE
ESA DO NOT INVEST IN O&M	NO MULTI DISCI-PLINARY APPROACH OF INTEGRATION	O&M STAFF NOT INVOLVED	LACK OF ACCOUNTABILITY	RESPONSIBILITIES FOR O&M NOT DEFINED
INEFFICIENT USE OF FUNDS	SOURCE NOT ADEQUATE		NO FINANCE	SYSTEMS ARE DAMAGES BY USERS OR OTHERS
POLICIES NOT SUFFICIENTLY SPECIFIC OR REALISTIC BALANCED	COUNTRIES DO NOT PROVIDE GUIDANCE		POOR MANAGEMENT PLANNING	SUPPLIES ARE NOTREGULAR
NO HARD DATA ON O&M STATUS	OTHER COMMERCIAL AND POLITICAL INTERESTS		POOR EXTERNAL RELATIONS	OVERLAPPING AND UNCLEAR RESPONSIBILTIES
			INADEQUATE STRUCTURE	SECTOR INSTITUTIONS NOT ADAPTING TO NEEDS
				LACK OF COMMUNICATION AND INFORMATION
				INADEUQATE POLICIES AND LEGAL FRAME

The facilitator might want to limit the number of cards, by asking the participants to prioritize what they think are the 3 or 4 main problems, before handing their cards to the facilitator.
"Poor O&M" will be the cental card and all causes will be under it and effects above it.

Overhead sheet 1

PROBLEM ANALYSIS

HOW TO DO A PROBLEM TREE ?

STEP 1. START WITH THE ENTITY "POOR O&M"

STEP 2. IDENTIFY MAJOR GROUPS INVOLVED AND POSSIBLE SUB-GROUPS.

STEP 3. FORMULATE PROBLEMS FROM THE PERSPECTIVE OF ALL THE IDENTIFIED GROUPS EXISTING WITHIN THE ENTITY.

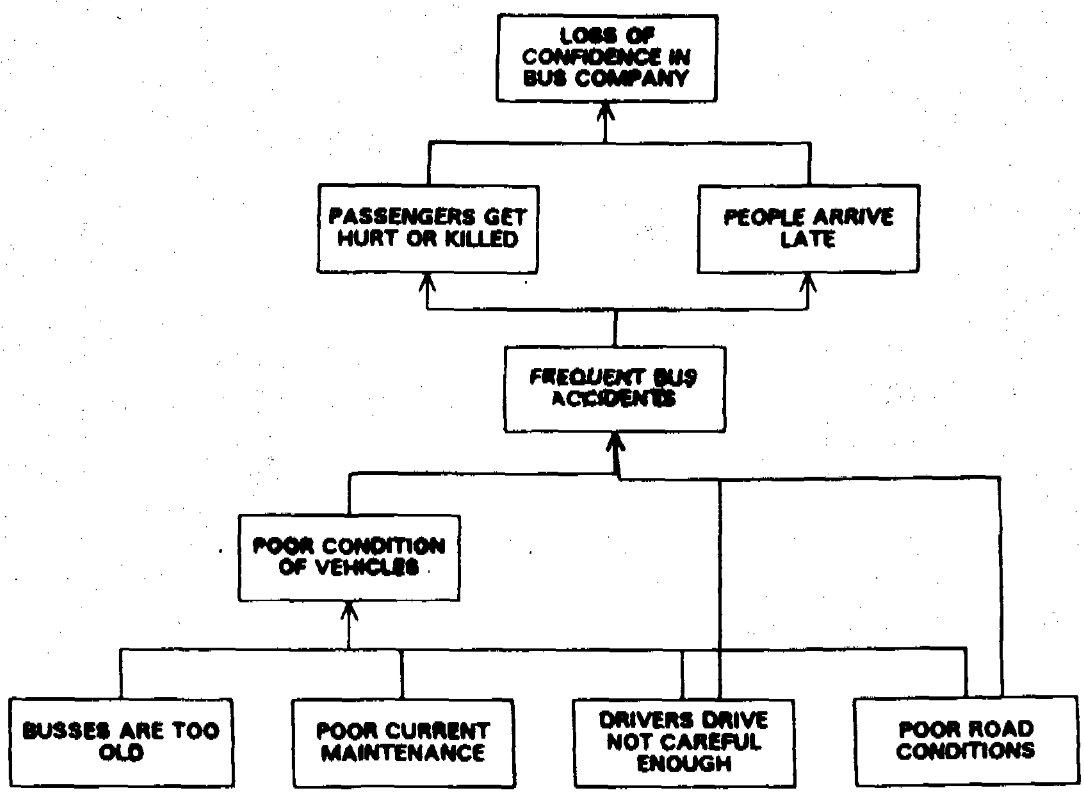
STEP 4. MAKE SURE ALL CARDS ARE UNDERSTOOD BY ALL PARTICIPANTS

STEP 5. FORM A DIAGRAM SHOWING THE CAUSE AND EFFECT RELATIONSHIP IN THE FORM OF A PROBLEM TREE.

Overhead sheet 2

EXAMPLE OF A PROBLEM TREE

'BUS COMPANY' EXAMPLE



Supporting material

The following pages are extracted from the following document:

- ZOPP (an introduction to the method) by GTZ, Deutsche Gesellschaft für Technische Zusammenarbeit.

I. INTRODUCTION

1. The ZOPP planning method was officially introduced at the GTZ in 1983. It is to be applied in planning all project preparation and implementation phases.

   Since 1986 the new commissioning procedure between the GTZ and the BMZ - the German Federal Ministry for Economic Cooperation - has also made the use of ZOPP compulsory in project planning. ZOPP ensures a consistant train of thought and procedure and uniform understanding of the terms used. It thus facilitates communication and cooperation between all parties involved. This does not mean, however, that ZOPP has to be applied in a stereotyped manner in all its steps. The amount of information available, the task to be tackled and the number of persons participating in ZOPP will determine how comprehensively the planning steps can be implemented in each case. To apply the method flexibly, the basic elements of ZOPP presented hereafter must be mastered.

2. ZOPP consists of inter-supportive elements:

(1) The method, which is explained in this brochure and is the guideline for work in the planning group.

(2) The team approach as the framework for studying inter-disciplinary problems and the participation of important interest groups and target groups.

(3) Visualisation - which means the contributions by the planning team and the results of discussions are recorded on cards.

(4) The rules of application, which in the project preparation phase determine the timing, participation and purpose of the ZOPP workshops. The rules are laid down in the GTZ Organisation Manual[1)]

(5) Project management, which is based on ZOPP and has the task of turning planning into practical project work[2)]

The ZOPP method draws on the knowledge, ideas and experience contributed by the team members. ZOPP is to improve the quality of planning, which in turn determines the benefit for the decision-makers and practical project work. In the final instance, the benefit obtained must justify the planning input made.

3. ZOPP is based on a few very simple underlying principles:

(1) Cooperation between the project staff and the partner organisations is smoother and more productive if all involved have jointly agreed their objectives and expressed them clearly.

(2) In development cooperation we try to solve or alleviate problems by tackling them at their roots - their cause. We therefore analyse the problems and their causes and effects. We then deduce feasible and expedient objectives from them.

(3) Problems and their causes do not exist in isolation, but are intimately linked with people, groups or organisations. Therefore we can only talk about problems if we have a comprehensive picture of and insight into the interest groups, individuals and institutions involved.

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1) Cf. Organisation Manual Section 4211

2) Cf. GTZ Project Management - a guide for implementation in project countries.
Management von GTZ-Projekten
Ein Leitfaden für die Durchführung im Partnerland

Supporting material

The following pages are extracted from the following document:

- ZOPP (an introduction to the method) by GTZ, Deutsche Gesellschaft für Technische Zusammenarbeit.

The analysis thus attempts to extract typical perspectives of a situation which in reality is very complex. These characteristics then become tangible and can be analysed and worked on by the planning groups. In the interests of the target groups and project personnel a conscious and pragmatic effort is made to simplify methods, as complex ones are often not applicable in practical project planning.

4. During the analysis phase the work results are recorded in the following documents:
   - participation review (Step 1, pages 4-5)
   - problem tree (Steps 2 and 3, pages 6-9)
   - objectives tree, indicating potential alternative solutions (Steps 4 and 5, pages 10-12)

   The steps of analysis are followed by planning steps in the narrower sense, using a project planning matrix, which contains the overall basic structure of a logical and feasible project (Steps 6 to 12).

   The ZOPP documents become more detailed in the consecutive stages called ZOPP 1 to 5, (see section III.). The overall planning horizon should be a reasonable time-span, more or less covering the entire promotion period. The project planning matrix should encompass the promotion phase under review.

5. This brochure gives back-up material for ZOPP introductory courses. It can also be used as handbook to study the method - nevertheless, participation in a ZOPP basic training course is a must.

Supporting material

The following pages are extracted from the following document:

- ZOPP (an introduction to the method) by GTZ, Deutsche Gesellschaft für Technische Zusammenarbeit.

II. ZOPP IN STEPS

Step 1: PARTICIPATION ANALYSIS - analysis of the project target group and all other persons, institutions etc. participating and involved in the project.

Procedure:

1.1 Write down unsystematically the names of all interest groups, institutions, projects etc. which are located in the region, hold an influential position or may be affected by the problems. Indicate all external influences and interests of all parties involved.

1.2 Scan the groups and persons listed as to whether they consist of homogeneous units or whether sub-groups, sections or sub-units with specific problems or interests can be identified and listed separately.

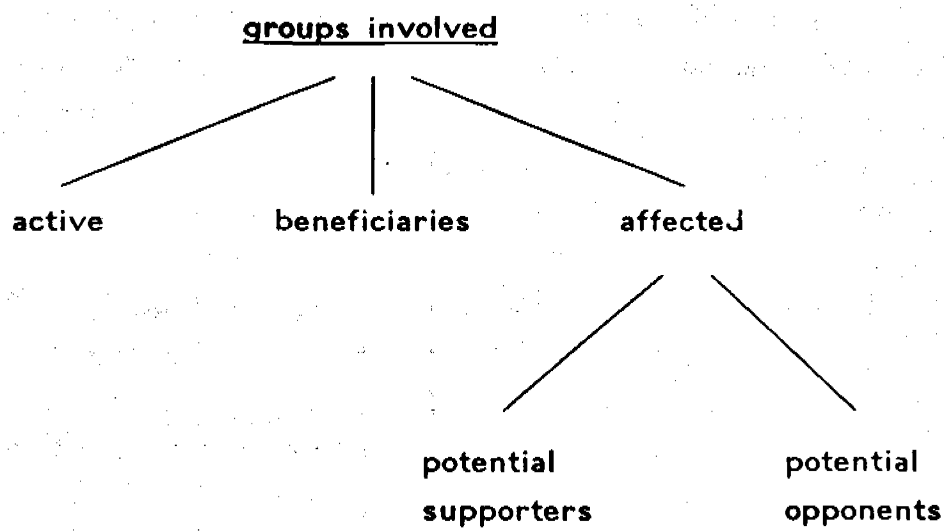
1.3 The planning team decides on the criteria for analysis of all groups, institutions etc.

1.4 When classifying into interest groups, participants etc. always proceed in steps, in the following order:
- collect,
- classify,
- describe,
- analyse,
- evaluate.

1.5 Divide the interest groups and institutions into participants and non-participants.

	Institutions	Interest Groups
Participants		
Non-participants		

1.6 If the planning team feels it is expedient the groups involved can also be divided:



1.7 The planning team discusses whose interests and views are to be given priority when analysing the problems. This leads to the second step and the question: "What is the core problem?"

1.8 Separate in-depth analysis can be made of the internal situation in the institutions or interest groups and their relations with each other.

Step 2: PROBLEM ANALYSIS - Identifying the core problem

Procedure:

2.1 Each member of the planning team first writes down just one problem which he/she deems to be the core problem. Note:
- The problems are expressed as a negative state.
- The core problem must pertinently describe the central point of the overall problematic condition.
- The core problem does not automatically turn into the later project purpose.

2.2 A brief substantiation is then given for each proposed core problem. In the following discussion we try to agree on what is the core problem. The prevailing theme is always the interests and problems of the persons, groups and institutions involved.

2.3 If agreement cannot be directly reached then:
- arrange the proposed core problems above and below each other into causes and effects,
- try again to agree on the basis of the overview achieved in this way.

2.4 If still no consensus is achieved, then
- try brain-storming, role games, or other decision-making aids,
- select the best decision, e.g. by awarding points to determine the preferential solution etc., or
- decide temporarily on one or several core problems, continue work but return to discuss the core problem.

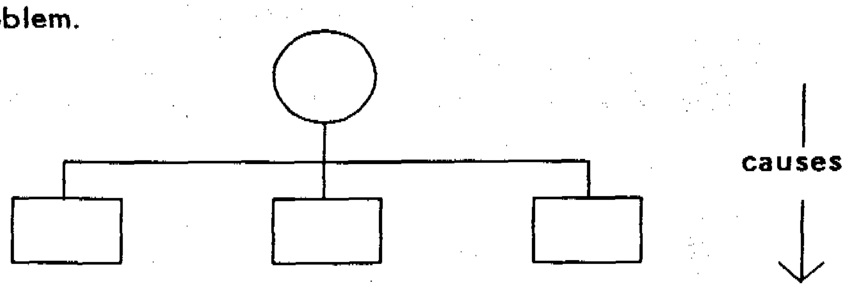
Wherever possible avoid resorting to formal voting to obtain a majority decision.

2.5 To prepare the next step - the analysis of causes and effects of the core problem - it is expedient to list the problems for each institution and interest group. These problem-lists can be prepared in advance by specialists or during the ZOPP workshop by sub-groups, although it must be guaranteed that they are later discussed and processed to a problem tree around a core problem.

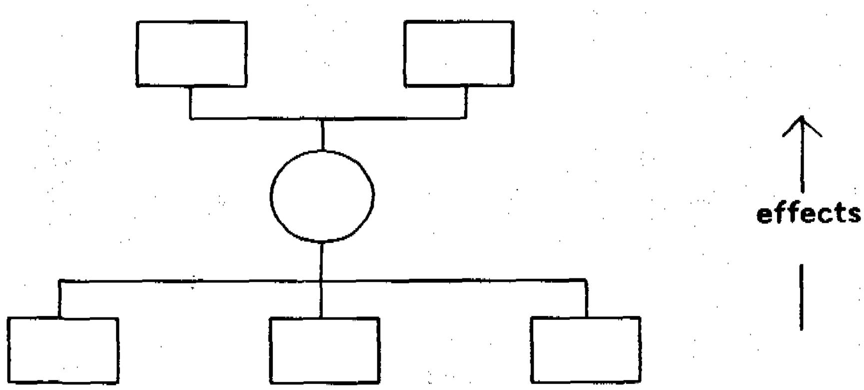
Step 3: PROBLEM ANALYSIS - Analysing the causes and effects of the core problem

<u>Procedure:</u>

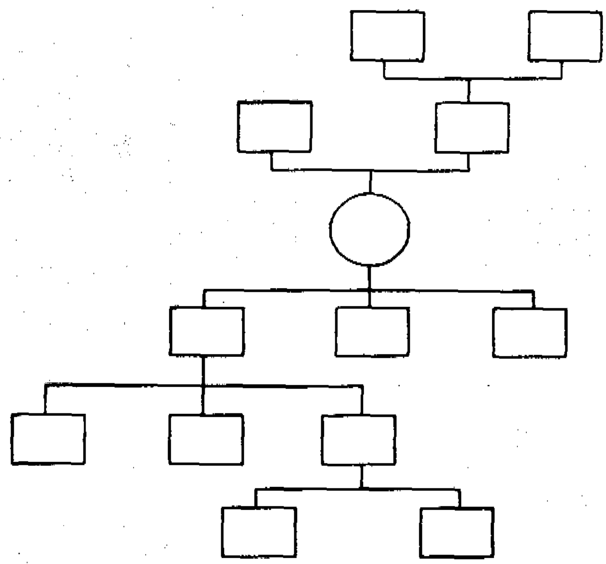
3.1 The substantial and direct causes for the core problem are placed parallel to each other underneath the core problem.



3.2 The substantial and direct effects of the core problem are placed parallel to each other above the core problem.



3.3 Causes and effects are further developed along the same principle so that multi-level causal links and branches are created.



3.4 **The problem analysis can be concluded when the planning team is convinced that the essential information has been used to build up a causal network explaining the main cause-effect relationships characterising the problem situation being analysed.**

Problems can be placed in different cause-effect relationships, depending on the cultural view under which they are considered; to ensure sustainability of the project impacts it is essential to incorporate the cultural background of all project partners.

3.5 **If possible, add indicators to exactly describe the problems.**

3.2 IDENTIFICATION OF STRATEGIES

Description of session

OBJECTIVES

- To identify objectives for O&M
- To identify strategic options for O&M development
- To select 2 or 3 options which will be developed afterwards in the planning exercise

OUTLINE OF SESSION

• The facilitator explains how to make an objective tree	15 min
• The facilitator with the help of the participants translates the problem tree into an objective tree	1 h
• Participants select one or more clusters as a set of project activities, or strategic options.	30 min
	1 h 45 min

HAND - OUTS

- How to do an objective tree

MATERIALS NEEDED

- same as former session.

Background information

1. The objective tree:

Using the problem tree:

1. Working from the top downwards, take each problem and restate the negative condition (problem) into a positive condition to be achieved in the future (objective).

   Don't make objective statements which indicate an ultimate level of improvement, but indicate an improved situation as compared to the problem situation. For example , don't translate the problem "bad roads" into "bad roads", but into "roads improved". During the planning steps later on , we will have to indicate what we mean by "roads improved".

2. Check wether rewording will lead to unrealistic statements, for example insufficient rain fall can become rainfall increases.

3. Ensure that the cause-effect relationships in the problem tree are changed into means-ends relationships. If not, change the relationships till they are logical means-ends relationships.

2. Selection of strategies

Using the objective tree:

1. Identify those objectives which are not within the responsibility of the project or which are unachievable due to resource limitations, and delete.

2. Select high level objective towards which the project will contribute.

3. Identify related means-ends clusters in the objective tree. The means-ends clusters should consist of a number of interlinked objectives.

4. Asses which cluster represent an optimal alternative towards contributing to this objective, using criteria as:
   . resource availability
   . probability of achieving objectives
   . attractiveness for target group
   . relationship with government policy
   . relationship with funding agency policy
   . positive/negative side effects
   . time horizon
   . urgency

5. Select one or more clusters which in our case are considered as possible strategies.

This process of individual or collective selection and identification of strategies will help the participants to determine a future plan of action in the Planning phase.

Overhead sheet 1

HOW TO DO AN OBJECTIVE TREE

STEP 1. Restate all negative conditions of the problem tree into positive reached conditions

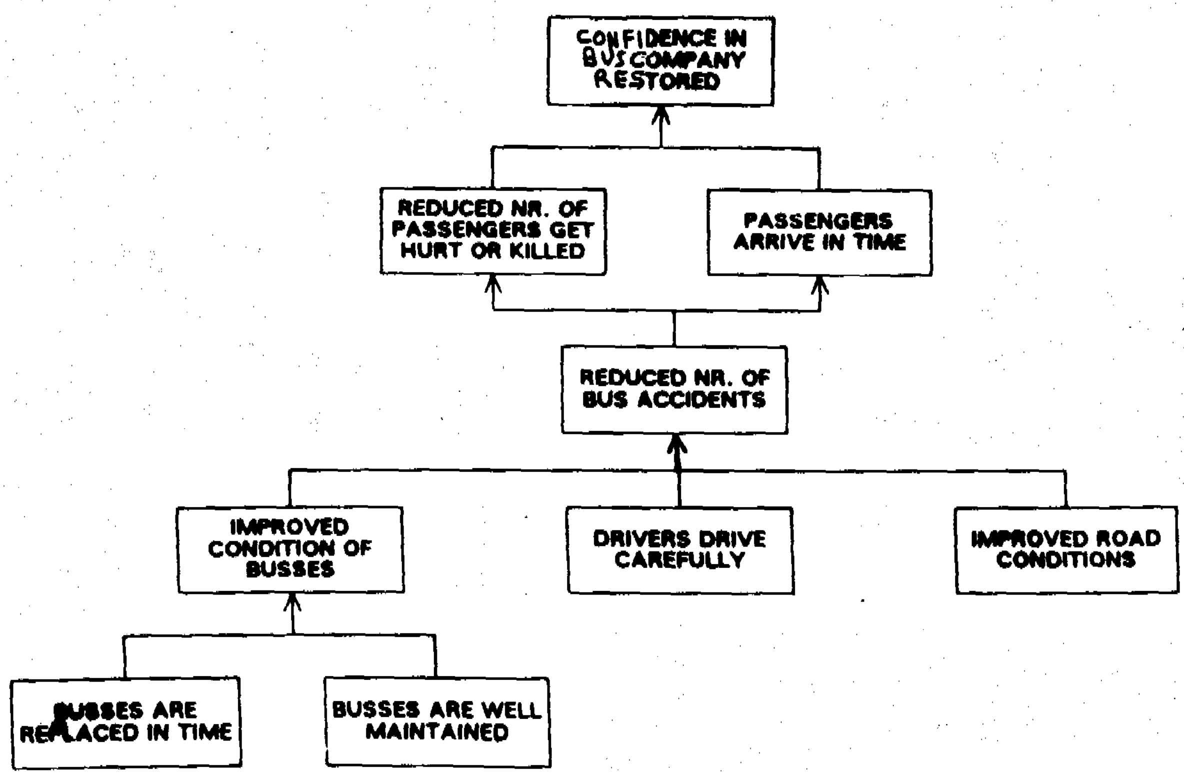
STEP 2. Check wether rewording has led to unrealistic or ethically questionable statements

STEP 3. Examine the "means and ends" relationships thus derived to assure validity and completeness of the diagram

Overhead sheet 2

EXAMPLE OF AN OBJECTIVE TREE

'BUS COMPANY' EXAMPLE



Supporting material

(from ZOPP - an introduction to the method; GTZ, Deutsche Gesellschaft für Technische Zuzammenarbeit)

Step 4: OBJECTIVES ANALYSIS - The hierarchy of problems (problem tree) is transformed into a hierarchy of objectives (objectives tree) and the set objectives are analysed.

Procedure:

4.1 Working from the top downwards we reword all problems making them into objectives.

- Problems worded as a negative condition are to be rephrased to become a positive condition to be achieved in the future (= objective).

- The core problem is transformed into an objective like the others and no longer accentuated.

4.2 Points to check when rewording the problems to make them objectives:

- Difficulties in rewording indicate deficiencies in the analysis of problems; in this case return to discuss the problem ("what did we really mean to say?").

- Check whether rewording will lead to practically non-sensical or ethically questionable statements; in this case write a replacement objective or tranfer the problem unchanged.

- Are the contents set down in the objective sufficient for us to achieve the next highest objective?

4.3 Ensure that cause-effect relationships have become ends-means relationships.

"If cause A, then effect B"

"means X in order to achieve end Y."

Caution: every cause-effect relationship does not automatically become a means-end relationship.

4.4 The objectives tree should be drawn up as an independent, separate overview.

Step 5: DISCUSSION OF ALTERNATIVES - Identifying potential alternative solutions

<u>Procedure:</u>

5.1 Related means-end branches in the objectives tree are identified. (We draw a pencil circle around the means-end branches. The circles can overlap.) These means-end branches constitute the alternative solutions.

5.2 The alternatives are marked (with numbers or labelled with descriptors, e.g. "production approach", "income approach", "training approach", etc.).

5.3 The chief criterion when evaluating and selecting alternatives is whether the project is expedient and realistic. The following aspects can be significant:
- development-policy priorities
- specific conditions in the project country
- suitability of the alternative solution for the Technical Cooperation scheme (in contrast to Financial Cooperation or other instruments of development cooperation)
- funding available
- GTZ's experience in this region or sector
- available manpower
- complementary or competitive activities of other donors

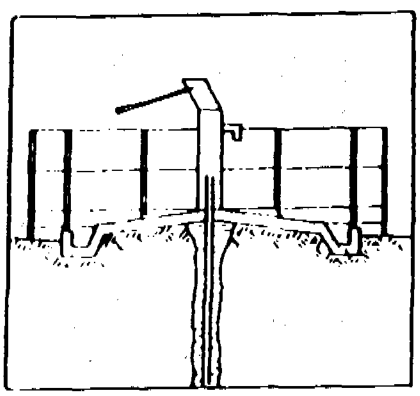
The choice among alternatives can be supported by:
- cost-benefit analyses of alternatives prepared in the scope of appraisal reports and feasibility studies
- additional analysis steps, for example analysis of interest groups and target groups
- group discussions and management decisions

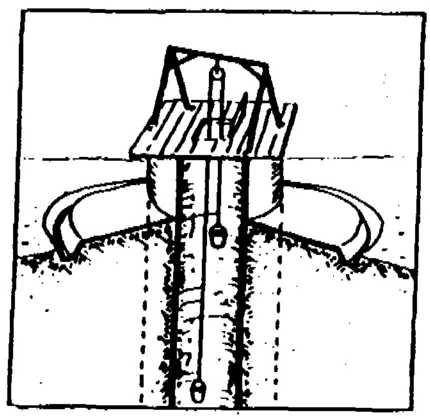
5.4 Even when there are no really viable <u>alternative solutions</u>, we should nevertheless take the alternative approaches into account for options at the <u>implementation stage</u>.

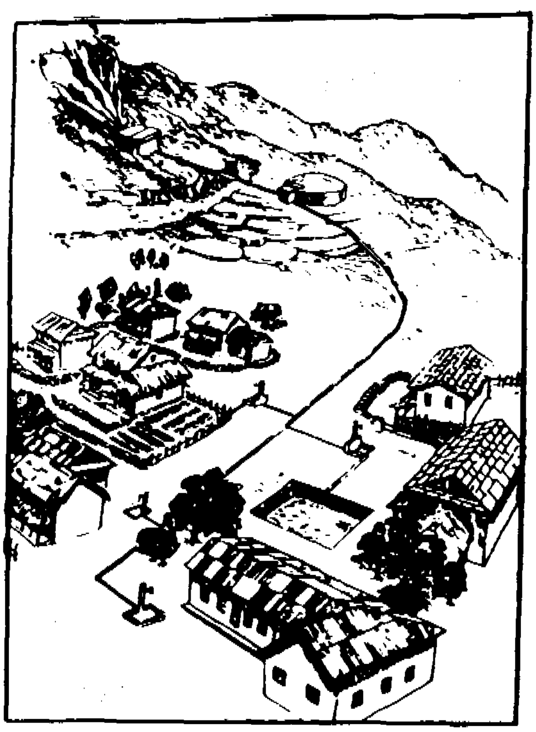
PART 2: KNOWING MORE ABOUT O & M

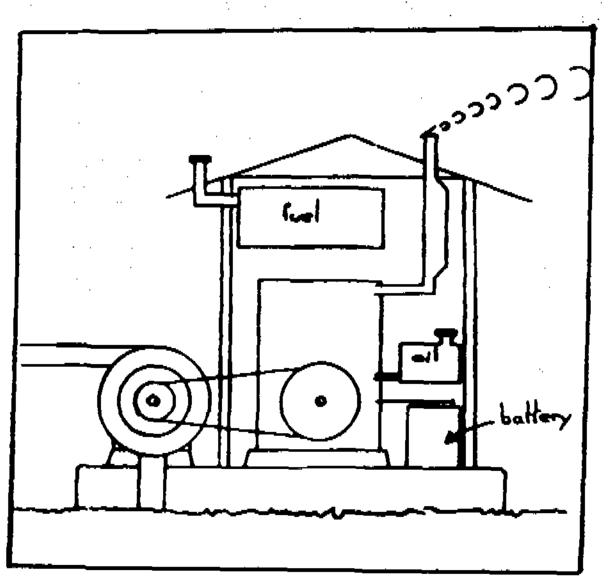
MODULE 4

O & M TECHNICAL REQUIREMENTS









OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

4.1 A SYSTEMATIC APPROACH

Definition of session

OBJECTIVE

- To introduce a systematic approach to identify the technical requirements for effective O & M.

OUTLINE OF SESSION

• The module will be introduced by an overview of rural water technologies and excreta disposal methods appropriate to the country concerned	45 min
• The introduction will be followed by a description of a systematic approach to identify technical O & M requirements. Selected typical water supply and sanitation technologies will be identified on which to base group exercises for the determination of O & M requirements in the subsequent sub-modules	30 min
• Demonstration of the systematic approach in a plenary session using the O & M requirements of a VIP latrine	30 min
	1 h 45 min

HAND-OUTS

- Proposed descriptions of O&M activities and tasks of the supporting material

NOTE: Information provided in the supporting material are to be adopted if needed.

MATERIAL NEEDED

- Overhead projector

Background information

1. Overview of rural water supply and sanitation technologies

(Resource person)
Course participants will normally be fully involved in day-to-day operation and management and have little time to consider alternatives to the water supply and sanitation technologies with which they are familiar. Successful O & M depends very much on the initial choice of technology and therefore it is important for participants to have in mind a range of technical options. The module will therefore begin with an overview of technologies. The facilitator can emphasise the options not normally adopted in the country concerned, if appropriate, in order to broaden the thinking of participants.

The following is a suggested format.

Groundwater sources

- springs;
- open and covered dug wells;
- manual and motorised pumped boreholes.

Surface water sources

- raw water abstraction from rivers, streams, reservoirs, lakes, and ponds.
- sub-surface abstraction from surface water sources; e.g. infiltration galleries.

Rainwater
Rural treatment processes

- storage and settlement.
- roughing and slow sand filtration.
- disinfection.

Distribution

- gravity distribution.
- pumped distribution.

Sanitation

- On-site sanitation.

2. A systematic approach to identify technical O & M requirements

An analysis of O & M technical requirements will be a factor in deciding the most appropriate choice of technologies to ensure the long term sustainability of future projects. For existing schemes, the analysis will clarify the present requirements and therefore be of value in reviewing current O & M procedures.

The technical O & M requirements of different types of schemes vary considerably, depending on local conditions, design and technology choice. Each technical aspect of a scheme will require certain O & M inputs of labour, materials and associated funding.

The systematic approach is based on an assessment of the inputs needed to meet the technical requirements. The approach has been broken down into 4 stages. Analysis sheets are used at each stage. Use of the sheets helps to visualise the O & M requirements in a clear format (see overhead sheets).

1. Description of Scheme

2. Description of O & M Activities

3. Description of O & M Requirements

4. Identification of Tasks

• <u>Analysis sheet 1 - Description of the Scheme</u>

The description is broken down into major components which contain the essential aspects of the scheme relevant to successful O & M.

• <u>Analysis sheet 2 - Description of O & M Activities</u>

O & M activities are described in a schedule so that not only the type but frequency of activities can be clearly seen.

• <u>Analysis sheet 3 - Description of O & M Requirements</u>

The third stage is to identify the labour, material and funding requirements.

Labour may be unskilled, semi-skilled or skilled. These divisions of labour are not always precise but such categories give an indication of the level of skills and the degree of training which may be required.

The 'materials & equipment' category includes spare parts and tools. It may also include fuel for running engines and maintenance vehicles. The sustainability of a scheme very much depends on the availability of materials and equipment.

Finance will be required to pay labour, unless freely provided by the community, and to purchase materials and equipment.

• <u>Analysis sheet 4 - Identification of Tasks</u>

Operation and maintenance comprises several tasks. For each component, certain tasks will be more important than others for sustainability of the scheme. Analysis sheet 4 indicates the importance of each O & M task for each component. In this way the relative importance of each task for sustainability can be clearly seen.

Tasks are categorised as follows:

Supervision & Monitoring	the management, supervision and monitoring of O & M procedures and activities.
Operation	the correct operation of a scheme or component Of a scheme.
Preventive	a planned approach to regular, periodic maintenance servicing and maintenance of a scheme.
Minor repairs	low cost, short time period repairs usually requiring minimal skills.
Major repairs	higher cost, longer repairs, which may require specific skills.

Overhead transparencies of the analysis sheets can be used to explain the terms and how the sheets are completed.

3. Outline of the following sessions

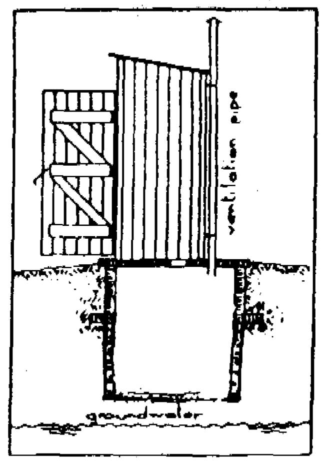
The systematic approach to identify technical O & M requirements can be demonstrated by considering cases of typical rural water and sanitation schemes. The cases can briefly be introduced at the end of this session to prepare participants for the practical groupwork to follow. The cases, or combinations of their components, have been chosen in order to cover most of the situations participants are likely to encounter in practice.

The cases are divided into two sub-modules:

	Sub-module	Cases
4.2	Water supplies	Hand dug well with bucket and rope Borehole with handpump Borehole with electric submersible pump and generator
4.3	Water distribution and treatment	gravity piped distribution to standposts chlorination slow sand filtration

4. Demonstration of the systematic approach: the VIP latrine example

The example can be presented after presentation and discussion of the general systematic approach. In a plenary session, the facilitator can complete the analysis sheets for the VIP latrine with the help of the participants. Following this exercise, the sample analysis sheets for the VIP latrine can be handed out for comparison and kept as a record of the approach.



Supporting material

SCHEME - Ventilated Improved Pit (VIP) latrine

1. DESCRIPTION OF THE SCHEME

Type of scheme: VIP latrine

The pit
- The pit is a rectangular shape of 1.2m x 1.8m, and 2 metres deep.
- The dug soil is piled and compacted around the pit to slightly raise the ground around the latrine.
- The pit is lined from bottom to top with cement blocks.
- There is no floor to the bottom of the pit to allow seepage into the soil.

Squatting slab
- The squatting slab rests on the pit lining wall slightly raised above ground level.
- The slab is made of reinforced concrete.
- There are two holes in the slab - the squatting hole in the middle, and another in a corner through which the ventilation pipe passes.
- There is a wooden cover for the squatting hole.
- Footrests act as a guide for users in the dark.

Ventilation pipe
- Ventilation for the pit is provided by a 100mm diameter x 2.5m long PVC pipe.
- The pipe is fixed in the slab with cement mortar.
- The top outlet of the pipe is covered with a piece of mosquito netting.

Superstructure
- The superstructure is made with cement stabilised blocks plastered with a weak cement mortar mix.
- The roof is an angled piece of galvanised steel sheet nailed to a wooden frame which is wired to the wall.
- Holes have been left in the top of the walls to provide ventilation and light.
- The door is made of wood and hung with steel hinges fixed to a wooden door frame set in the wall. It has a wire to loop over a nail for locking from the inside.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of scheme: VIP latrine

Daily	Check: The door closes properly and can be locked; The door hinges have not come loose - remedy problems if necessary. Clean squatting slab with a little water, if possible. In the morning, place a small amount of ash from the fire of the previous evening down the pit. Ensure the wooden cover is in good condition and is placed over the squatting hole. In the wet season, especially, check for subsidence. Check for gaps between slab and wall lining - seal gaps.
After 1 month	Latrine inspection by health inspector including follow-up health and latrine use education.
Every 6 months	Inspect mosquito net over the vent pipe and replace if showing signs of damage.
Every * years	(* depends on the amount of usage) When pit is full, dig and line another pit. Move cover slab and vent pipe to the new pit. Build a new superstructure using old components if still serviceable. Safely cover old pit with at least 0.5m soil and mark clearly.
Every 2x*years	When the second pit is full, empty original pit. Check and repair lining of original pit. Move cover slab and vent pipe to the original pit. Build new superstructure. Safely cover second pit with 0.5m soil and mark clearly.
Irregular	In the wet season check for subsidence around the pit. If subsidence is found: repair lining from the outside; if impossible, or dangerous, to repair - abandon pit and use a temporary shallow pit until the dry season. Replaster superstructure walls at the end of the wet season. If flies become a problem - smoke them out. Health inspector to check condition of latrine and follow-up health and latrine use education.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of scheme: VIP latrine

Labour	
unskilled	everyday care of the latrine
semi-skilled	building of the superstructure using local skills.
skilled	mason, for building a lining for the second pit only.
Materials & Equipment	
available within the community	superstructure materials basic hand tools
available within the country	cement - for lining and squatting slab. PVC vent pipe. corrugated steel roofing sheet.
only available outside the country	-
Finance	
community funds	all purchases and hire of mason
	government funds
	subsidised squatting slab
	health inspectors

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: VIP latrine

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
The pit	*	--	*	*	**
Squatting slab	**	--	**	*	--
Vent pipe	**	--	**	**	--
Superstructure	**	*	*	*	--

** essential for sustainability
* preferable for sustainability
-- not relevant

For further reading

General Rural Water Supply and Sanitation:

IRC (1986). Small Community Water Supplies in Developing Countries Technology of small water systems in developing countries. Compiled by E.H. Hofkes, The Hague, The Netherlands, IRC, International Water and Sanitation Centre. (Technical Paper Series TP18)

Bastemeyer T.F. and J.T. Visscher (1987). Maintenance Systems for Rural Water Supplies. The Hague, The Netherlands, IRC, International Water and Sanitation Centre. (Occasional Paper Series, OP8).

Ed. Kerr C. (1989) Community Water Development. London, IT Publications.

Rural Sanitation:

Wegelin, M. (1991). On-Site Sanitation: Building on Local Practice. The Hague, The Netherlands, IRC International Water and Sanitation Centre. (Occasional Paper Series, OP16)

Mara D.D. (1984). The Design of Ventilated Improved Pit Latrines. Washington D.C., USA, World Bank. (TAG Technical Note, no. 13)

Pacey, A. (1980). Rural Sanitation: Planning and Appraisal. London, IT Publications.

4.2 WATER SUPPLY

Description of session

OBJECTIVE

- To give participants the opportunity to use the systematic approach to analyse the technical requirements of typical water supply schemes.

OUTLINE OF SESSION

• Three different types of water supply will be analysed by participants in three different groups	45 min
• The facilitator hands out the sample analysis, included in the supporting material, for comparison	15 min
• In a plenary session participants are asked to react to the exercise	30 min
	1 h 30 min

HAND-OUTS

- Descriptions of the typical technologies considered:
  (see supporting material, the descriptions are to be adapted to local conditions)

  Water supply
  - hand dug well with bucket, rope and pulley
  - borehole with handpump
  - borehole with electric submersible pump & generator

- Literature on rainwater harvesting

MATERIAL NEEDED

- Overhead projector

Background information

The typical water supplies considered are:
- hand dug well with bucket, rope and pulley
- borehole with handpump
- borehole with electric submersible pump & diesel generator

Each water supply should be described. It will be noted that the components cover the common water supplies for which O & M can be a problem and need to be reviewed.

Participants divide into three groups and choose one scheme to analyse using the systematic approach described in the previous sub-module. Each group will be given working sheets comprising a description of one scheme and a set of blank analysis sheets.

Guidelines for the group exercise.

- Three groups are formed:

  1. Hand dug well with bucket and rope.
  2. Borehole and handpump.
  3. Electric submersible pump with diesel generator.

- Each group is given a:

  a. description of the chosen scheme;
  b. work sheet on O & M activities to be completed;
  c. work sheet on O & M activities to be completed;
  d. work sheet on O & M tasks to be completed.

Copies of the analysis sheets can be made from the samples included in the previous sub-module.

After 45 min the facilitator will hand out the sample version of the completed analysis sheets for participants to compare with their own analysis.

Groups will react to the comparison and report back, through an elected rapporteur, in a plenary session.

The extensive supporting material describing schemes, O & M activities, requirements and tasks are to be used initially as a reference for the facilitator. These documents can be copied, however, and distributed to the participants once they have completed their groupwork exercise.

Working sheet 1

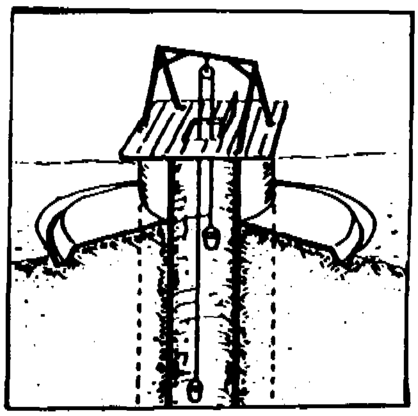
SCHEME - Hand dug well with bucket, rope and pulley.

A description of the scheme is given below

- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

DESCRIPTION OF SCHEME

Hand dug well with bucket, rope and pulley



The well
- The hand dug well has an internal diameter of 1.5m
- The well has a concrete lining from the bottom of the well to the top.
- The well has been completed with a headwall and cover to prevent spilt water, rainfall runoff, debris, people and animals from entering or falling inside.

The well surroundings
- The concrete apron prevents polluted water seeping back down the sides of the well, provides a hard standing for users, and directs water away from the well to a drainage channel.
- There is a fence, with gate, surrounding the well.

Water lifting device
- In this example, the device for raising water is a bucket and rope passing over a pulley suspended from a cross bar supported on uprights.

Record keeping
- The water committee will need a note book and pen to record contributions and payments.

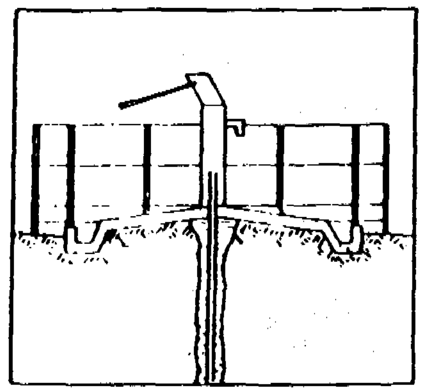
Working sheet 2

SCHEME - Borehole with handpump

- A description of the scheme is given below.
- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

DESCRIPTION OF SCHEME

Type of water supply: Borehole with handpump



The borehole
- The borehole has an internal diameter of 100mm.
- The total depth of the borehole is 55m; the average static water level is at 20m; and the pump cylinder is set at a depth of 35m.
- The borehole is drilled into stable fissured rock and therefore the casing extends from ground level for 5 metres until the stable rock is reached. There is no screen.
- The top of the borehole is sealed to prevent the ingress of surface water polluting the borehole.

The borehole surroundings
- The pump platform directs spilt water to a drain which carries water to a soakaway, 3 metres from the borehole.
- The handpump is mounted on top of the borehole in such a way that spilt water cannot pass back down into the borehole but drain away.
- The platform is designed for convenient operation of the handpump by users who include both women and children.
- The borehole site is surrounded by a fence with gate.

The handpump
- The handpump is rigidly mounted on holding down bolts in the concrete platform.
- The handpump is of the reciprocating type with a lever arm which is operated in a vertical up and down motion.
- In this example, the handpump is of the type in which the below ground moving parts, the piston and valves, can be withdrawn from the surface without removing the rising main.
- The rising main is made of galvanised steel.

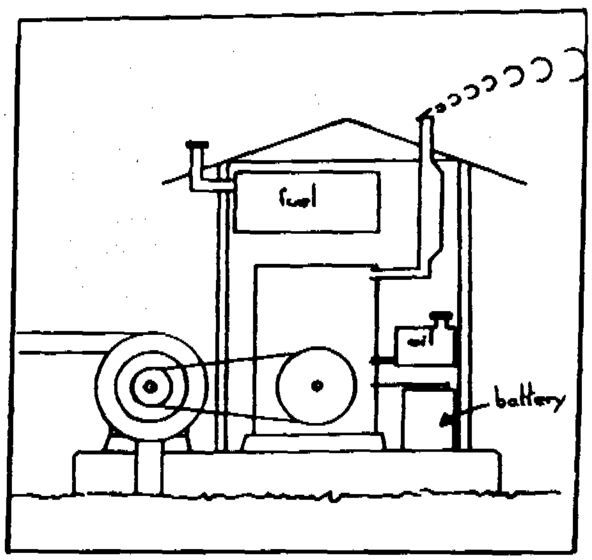
Working sheet 3

SCHEME - Electric submersible pump and diesel generator

- A description of the scheme is given below.
- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

DESCRIPTION OF SCHEME

Type of water supply: Borehole with electric submersible pump and generator



The borehole
- The borehole has a diameter of 150mm.
- The depth of the borehole is 70 m.
- The borehole has been drilled in unconsolidated formations and therefore is fully cased and screened.
- The top of the borehole has been sealed to prevent the ingress of surface water polluting the borehole.

The rising main
- The rising main exits at the top of the borehole through a purpose made cap to prevent contamination of the borehole by surface water and debris.
- An isolation valve and non-return valve have been fitted on a horizontal section of the delivery pipe, adjacent to the borehole.

The pump
- The pump is an electric motor driven submersible, multi-stage, centrifugal pump.

Working sheet for all type of scheme

1. DESCRIPTION OF THE SCHEME

Type of scheme:

The description can simply be in the form of a list of key elements grouped under the main components making up the scheme.

Description given in handed-out explanation of the exercise.

2. DESCRIPTION OF O&M ACTIVITIES

Type of scheme:

Daily

Weekly

Monthly

Annual

Irregular

Working sheet for all type of scheme

3. DESCRIPTION OF O&M REQUIREMENTS

Type of scheme:

Labour
unskilled

semi-skilled

skilled

Materials & equipment

available within the community

available within the country

only available outside the country

Finance

community funds

government funds

Working sheet for all type of scheme

4. IDENTIFICATION OF TASKS

Type of scheme:

O & M TASKS:	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
COMPONENTS					

** essential for sustainability
* preferable for sustainability
-- not relevant

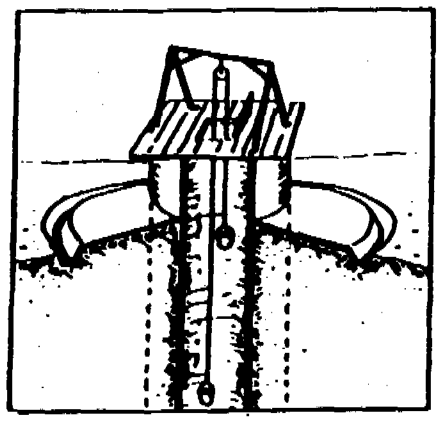
Supporting material

FIRST CASE - Hand dug well with bucket, rope and pulley

Hand dug wells vary greatly in size, shape, depth, lining and the method of raising water. This example considers a community dug well with concrete lining in which water is raised by a simple bucket and rope passing over a pulley.

1. DESCRIPTION OF SCHEME

Hand dug well with bucket, rope and pulley



The well
- The hand dug well has an internal diameter of 1.5m
- The well has a concrete lining from the bottom of the well to the top.
- The well has been completed with a headwall and cover to prevent spilt water, rainfall runoff, debris, people and animals from entering or falling inside.

The well surroundings
- The concrete apron prevents polluted water seeping back down the sides of the well, provides a hard standing for users, and directs water away from the well to a drainage channel.
- There is a fence, with gate, surrounding the well.

Water lifting device
- In this example, the device for raising water is a bucket and rope passing over a pulley suspended from a cross bar supported on uprights.

Record keeping
- The water committe will need a note book and pen to record contributions and payments.

Supporting material

2. DESCRIPTION OF O&M ACTIVITIES

Type of water supply: Hand dug well with bucket, rope and pulley

Daily	check for any debris in the well clean the concrete apron clear drainage, if blocked check the gate can close properly check the condition of: - the rope fastening the pulley to the cross bar; - the pulley rope lifting the bucket; - the fastening of the bucket handle to the bucket; - leaks in the bucket; - the fence. Report any problems to the caretaker
Weekly	Repeat all the daily activities; lubricate the pulley
Monthly	Repeat weekly activities; Replace bucket if necessary Collect contributions to the water committee
Yearly	At the end of the dry season: dewater the well and clean the bottom; if the water table has dropped then deepen and line the well further; inspect the lining and repair where necessary.
Irregular	Check concrete apron and well seal for cracks If cracks develop then repair as necessary Replace support posts for pulley as necessary Repair pulley shaft and bearings when worn

Supporting material

3. DESCRIPTION OF O&M REQUIREMENTS

Type of water supply: Hand dug well with bucket, rope and pulley

Labour

unskilled	Users can carry out the daily activities Water committee for supervision and maintenance and to collect, record and dispense funds for spares and repairs.
semi-skilled	Caretaker can carry out the weekly and monthly activities; Private fitter for pulley repairs
skilled	Private sector mason to work with caretaker and users on yearly and irregular skilled activities;

Materials & Equipment

available within the community	bucket and rope fencing materials support posts brush, digging and hand tools
available in the country	cement pulley & pulley shaft and bearings masonry tools
only available from outside the country	-

Finance

community funds	all labour, replacement parts, maintenance equipment.
government funds	monitoring staff

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: Hand dug well with bucket, rope and pulley

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Dug well	*	--	*	*	**
Bucket & rope	*	**	**	*	--
Pulley	*	*	**	*	**
Fence	*	--	*	*	--

** essential for sustainability
* preferable for sustainability
-- not relevant

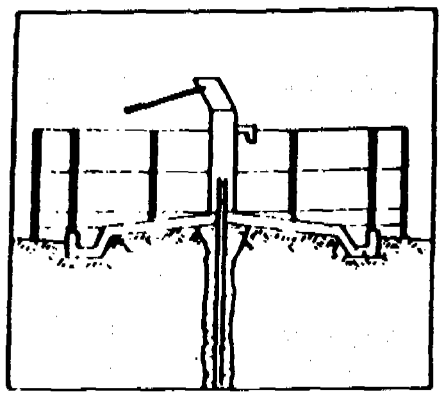
Supporting material

SECOND CASE - Borehole with handpump

Boreholes may be fitted with a variety of pumps. This example considers a small diameter borehole fitted with a fabricated steel, reciprocating handpump made in the country.

1. DESCRIPTION OF SCHEME

Type of water supply: Borehole with handpump



The borehole

- The borehole has an internal diameter of 100mm.
- The total depth of the borehole is 55m; the average static water level is at 20m; and the pump cylinder is set at a depth of 35m.
- The borehole is drilled into stable fissured rock and therefore the casing extends from ground level for 5 metres until the stable rock is reached. There is no screen.
- The top of the borehole is sealed to prevent the ingress of surface water polluting the borehole.

The borehole surroundings

- The pump platform directs spilt water to a drain which carries water to a soakaway, 3 metres from the borehole.
- The handpump is mounted on top of the borehole in such a way that spilt water cannot pass back down into the borehole but drain away.
- The platform is designed for convenient operation of the handpump by users who include both women and children.
- The borehole site is surrounded by a fence with gate.

The handpump

- The handpump is rigidly mounted on holding down bolts in the concrete platform.
- The handpump is of the reciprocating type with a lever arm which is operated in a vertical up and down motion.
- In this example, the handpump is of the type in which the below ground moving parts, the piston and valves, can be withdrawn from the surface without removing the rising main.
- The rising main is made of galvanised steel.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of water supply: Borehole with handpump

Daily	Check pump operation: early morning foot valve test; normal or low delivery. Check handpump: firmly fixed in place; check for loose nuts and bolts. Check pump surround: clean the platform and drain; check the fence and if gate will close.
Weekly	Carry out daily checks and in addition: tighten all above-ground nuts and bolts with a spanner; clean moving parts and only grease parts which require greasing.
Monthly	Same as weekly checks. Collect and record contributions to the water committee.
Yearly	Dismantle pump head parts; Remove connecting rods, piston assembly and foot valve; Inspect all parts; Replace worn or defective parts; Replace piston seals; Straighten bent connecting rods, or replace; Replace rods with badly corroded threads; Replace corroded or missing connecting rod lock nuts. If connecting rods show bad corrosion, remove rising main; Check rising main and replace pipes with badly corroded threads; Clean pipe threads and install rising main. Re-assemble and replace below-ground parts; Assemble pump head and grease where necessary. Check pump operation and pump until the water delivered is clean. Record all significant actions.
Irregular	If cracks appear in the pump platform or drain, repair with cement mortar. If pump mounting bolts become loose in the concrete platform, remove pump, breakout old bolts, and remount in fresh concrete. If pump delivers cloudy water with silt - clean borehole.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of water supply: Borehole with handpump

Labour	
unskilled	Users can carry out the daily activities. Water committee to organise maintenance and collect, record and dispense funds for spares and repairs.
semi-skilled	Caretaker can carry out the weekly checks
skilled	Water agency maintenance team to carry out annual preventive maintenance. Private or water agency mason for concrete work.
Materials & Equipment	
available within the community	sand for mixing cement mortar fencing materials brush for cleaning platform and drain record book and pen
available within the country	cement for platform repairs spare parts for pump repairs tools for preventive maintenance and repairs pipes for the rising main
only available from outside the country	vehicle and fuel for maintenance team
Finance	
community funds	labour and materials for platform repair purchase of handpump spare parts
government funds	maintenance team

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: Borehole with handpump

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Borehole	*	--	--	--	**
Rising main	*	--	*	**	--
Handpump	*	**	**	*	**
Platform	*	--	*	*	*
Fence	*	--	*	*	--

** essential for sustainability
* preferable for sustainability
-- not relevant

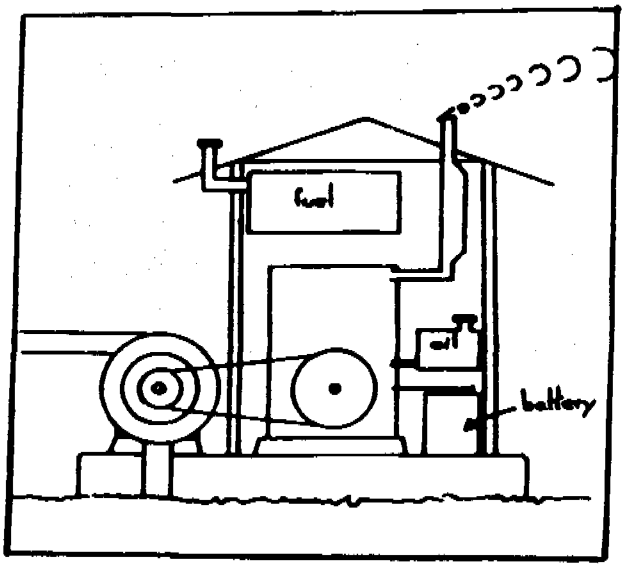
Supporting material

THIRD CASE - Borehole with electric submersible pump and generator

This example considers a borehole of sufficient yield to be fitted with an electric submersible pump powered by a diesel engine powered generator.

1. DESCRIPTION OF SCHEME

Type of water supply: Borehole with electric submersible pump and generator



The borehole

- The borehole has a diameter of 150mm.
- The depth of the borehole is 70 m.
- The borehole has been drilled in unconsolidated formations and therefore is fully cased and screened.
- The top of the borehole has been sealed to prevent the ingress of surface water polluting the borehole.

The rising main

- The rising main exits at the top of the borehole through a purpose made cap to prevent contamination of the borehole by surface water and debris.
- An isolation valve and non-return valve have been fitted on a horizontal section of the delivery pipe, adjacent to the borehole.

The pump

- The pump is an electric motor driven submersible, multi-stage, centrifugal pump.

Supporting material

The generator and electrics

- The diesel generator is placed four metres away from the borehole to avoid any spilt oil or diesel contaminating the borehole.
- The diesel engine is a multi-cylinder, air-cooled, diesel engine with electric start. The air cleaner is of the oil bath type.
- Electric cabling between generator and borehole has been placed inside protective ducting for safety and to avoid damage to the cables.
- A control panel for operation of the electric pump is placed next to the generator.
- The electric controls include the following safety cut-out features:
  under/over voltage; motor winding overheating protection; low-level water controller.
- The generator and control panel are placed inside a lockable, ventilated, generator-house to provide security, shading from the sun, to keep away animals, and to prevent unauthorised persons, especially children, from interfering with the equipment.

Tools, etc.

- Basic mechanics tool set for preventive maintenance and minor repairs.
- Specialist tools (pullers, bearing extractor, etc.) for major repairs.
- Log book and pen.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of water supply: Borehole with electric submersible pump and generator

Note - engine service intervals are usually specified in terms of engine running hours. Therefore, service intervals expressed in days, weeks and months will have to be based on the average number of hours run per day for each installation.

Daily

Pump operator shall:
- Check condition and level of oil in the diesel engine - top-up oil if required and note in log book.
- Check fuel level in tank - top-up if required, note in log book.
- Visual check for fuel and oil leaks - report any leaks.
- Check air cooling passages are not blocked - clear if necessary.
- Check battery water - top-up, if necessary, with distilled water.

Start diesel engine:
- Note start time, or hours run meter reading, in log book.
- Check oil pressure warning light or gauge - report if a problem.
- Check output voltage on volt meter - report if incorrect or fluctuating.

Check isolation valve is closed:
- Operate pump starter
- Open isolation valve
- Check reading on ammeter is normal - stop pump if electric motor is drawing too much current and report problem
- Confirm water is being delivered
- Check for leaks on the rising main

Continue periodic running checks during the day:
- fuel level
- voltmeter and ammeter readings

To stop the electric pump:
- slowly close isolation valve;
- stop pump at control panel;
- report any problems with the valves.

Stop engine, after stopping pump, by closing stop lever
Note stop time, or hours run meter reading, in log book

Weekly

Remove, clean and refill the oil bath air filter
Clean diesel engine, noting any oil, fuel or exhaust leaks
Clean inside of the generator house

Supporting material

*** Monthly**

* This period will depend on the diesel manufacturer's recommendations and the number of hours run per day. (E.g. 31 days at 8 hours per day gives 248 hours per month; service intervals are often stipulated at 250 hours).

Diesel engine:
- Drain the oil sump
- Clean sump strainer
- Renew oil filter
- Refill sump with correct lubricating oil

Record servicing in the log book

Monthly

Collection of water bills

*** Every 4 months** * Depends on manufacturers recommendation, e.g.1000hrs)

Diesel engine:
- Renew fuel filter element
- Remove injectors and test spray - replace if satisfactory
- If injectors are not satisfactory - send for cleaning
- If engine is loosing power - check valve clearance and adjust if necessary

Record servicing in the log book.

*** Yearly**

* Depends on manufacturers recommendation, e.g. 3000hrs

Diesel engine:
- Decarbonise piston, inlet and exhaust valves
- Regrind valves in valve seating and check wear
- Reassemble

Yearly

Electric submersible pump:
- Remove pump and rising main from well and inspect
- Check pipe threads and re-cut corroded or damaged threads
- Replace badly corroded pipes
- Inspect electric cables and check insulation between cables

Record servicing and maintenance in log book

Supporting material

Irregular

The frequency of cleaning the fuel system will depend on fuel quality:
Periodically clean fuel tank and fuel sedimentor
Drain water from fuel filter

Deterioration in borehole water quality:
Remove pump and inspect borehole
De-silt borehole if required

Low level cut-out operates regularly:
Determine if water table is lowering by measuring static water level.
If the water level has dropped: add more pipes to rising main if the borehole is deep enough.
If the water level has not dropped: the screen may be blocked and will require clearing.

Difficulty in operation of electric starter:
check fuses and replace if blown
check starter contacts and replace if necessary

Indications of worn engine bearings - overhaul engine.

Wrong or unstable output voltage - check and replace automatic voltage regulator.

Record all significant problems and actions in log book.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of water supply: Borehole with electric submersible pump and generator

Labour	
unskilled	water bill collector
semi-skilled	pump operator
skilled	pump and diesel engine mechanics
Materials & Equipment	
available within the community	-
available within the country	pipes for the rising main tools for maintenance and repair fuel and oil for operating engine fuel, oil and vehicle for pump and diesel mechanics filters for engine service
available from outside the country	spare parts for engine repairs spares for electrical control panel
Finance	
community funds	payment of water charges to water operating agency.
government funds	maintenance team support subsidise spare parts

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: Borehole with electric submersible pump generator

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Borehole	*	--	--	--	**
Rising main	*	--	*	*	--
Submerdile pump	*	**	*	--	**
Diesel engine	**	**	**	*	**
Control panel & cabling	*	**	*	--	**

** essential for sustainability
* preferable for sustainability
-- not relevant

Supporting material

(from IRC Occasional Paper no. 14. "Water Harvesting in five African Countries" prepared by M.D. Lee and J.T. Visscher)

2. *Water Harvesting Systems*

Different types of water harvesting systems are being applied in the five countries. They can be grouped into the following three categories: rooftop harvesting systems, surface catchment systems, and runoff farming systems. There are both traditional and modern applications of these systems. The number and range of system types used vary considerably. Construction details of some of these systems are presented in the literature, but unfortunately, little information on the socio-economic aspects of their development is available, particularly concerning maintenance and extension.

2.1 Rooftop harvesting systems

Rooftop and tank systems consist of a rooftop catchment area, usually iron-sheet, connected by gutters and downpipes to a storage container. In each of the five countries, it is traditional to practice rudimentary harvesting into pots, pans or drums positioned below the roof eaves to catch runoff (Figure 1), although most mud and thatched roof homeowners do not. No data exists as to what proportion of households practice this or how much water is collected.

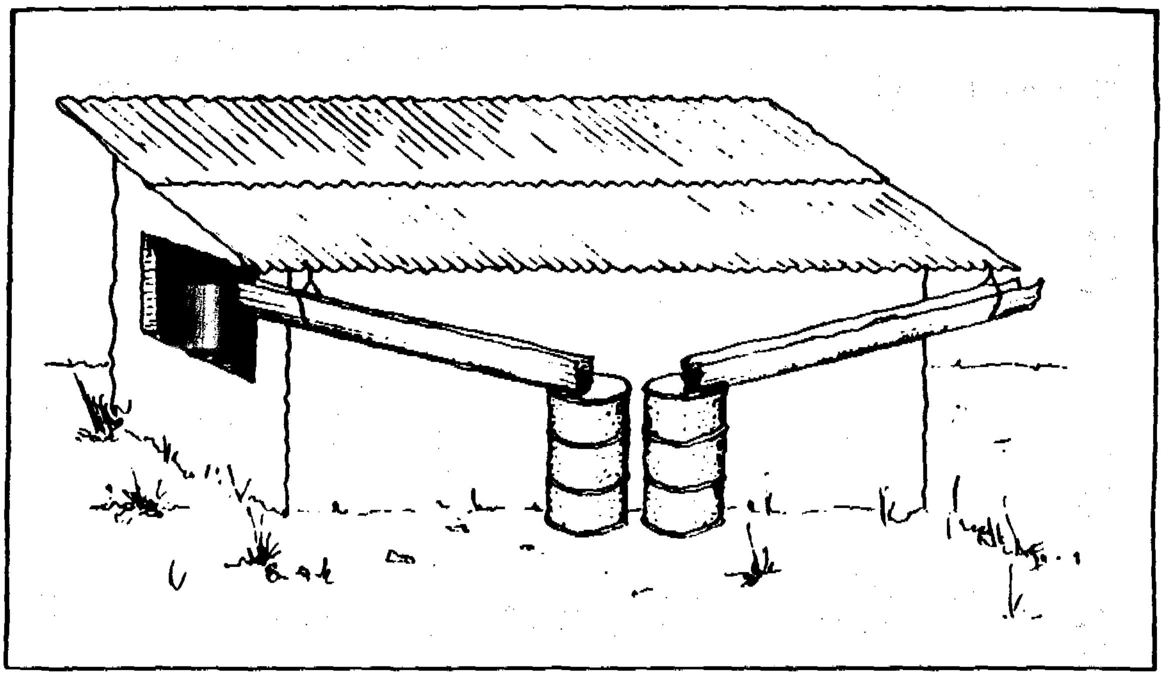


Figure 1: Rudimentary water harvesting (after Pacey and Cullis, 1986).

Improvements have been made to traditional systems. Householders have used a larger storage vessel such as an oil drum or have dug and lined a pit. They have then fixed a simple gutter to their roof to channel water into it. Larger tanks are also more commonly being introduced ranging from small cement-jars (0.5 to 2 m^3) to large ferrocement ground-tanks (up to 110 m^3). In Kenya tens of thousands, in Botswana thousands, in Tanzania and Togo hundreds and in Mali somewhat fewer of these introduced tanks have been built. The exact numbers of each type of rooftop system are not known.

Cement water jars

These 0.5 to 2 m^3 tanks are made by plastering around moulds such as a wet sack full of sawdust. They were promoted by UNICEF in Kenya in the 1970s and several thousand tanks were built to upgrade the householder's rudimentary storage. They are not always of good quality due to inappropriate cement mixing and curing.

Basket tanks

These 4 to 10 m^3 tanks are built from granary stores plastered on the outside and inside so as to make the structure water tight. Several thousand were built in Kenya following publication of construction guides by UNICEF but production mostly stopped in 1987 due to fears of low life-expectancy as cracking was common. Similar tanks are being built by Ghanaian contractors for householders in Togo.

Sub-surface groundtanks

These 10 to 110 m^3 tanks are generally roofed hemispherical excavations lined with ferrocement made from chicken-wire, barbed wire and mortar. A handpump is often fitted for hygienic extraction. In Botswana they range from 8 to 29 m^3, in Kenya from 60 to 80 m^3, in Tanzania from 80 to 110 m^3 and in Togo, more sophisticated reinforced cement is used to build tanks up to 163 m^3. The tanks are being used with both rooftop and surface catchments, the larger ones mostly for schools, health centres or large family groupings. They are considered the best technical option by a number of Kenyan workers due to their relative ease of construction and cost. Aspects of construction are shown graphically in Appendix I.

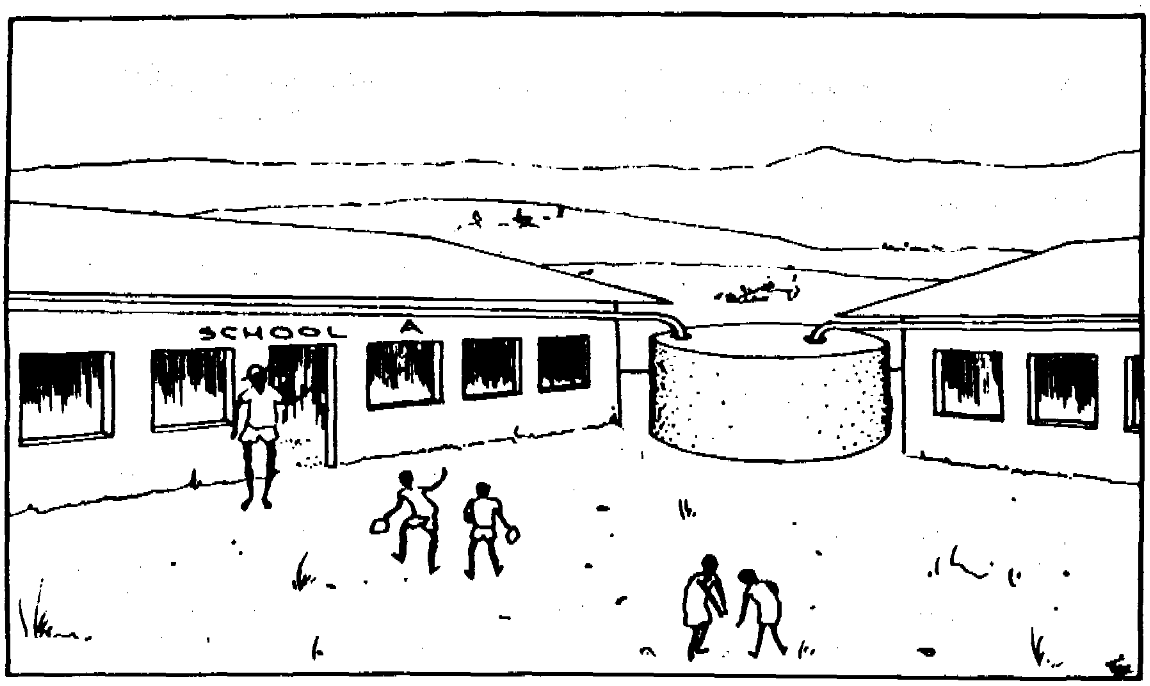


Figure 2: Cylindrical standing tank (after Hasse, 1989).

Standing tanks

There are two main types of cylindrical standing tanks (Figure 2), 4 to 13.5 m^3 tanks made of ferrocement or cement blocks built around reusable formwork, and 20 to 40 m^3 tanks using fairly rigid iron grid-mesh as both a framework and reinforcement. Thousands of the smaller tanks have been built in Kenya, Botswana and Togo. They perform well and appear to be of reasonable quality requiring limited repairs. An example of the costing and construction of a well-proven design from Kenya is included in Appendix II.

Factory-made tanks

Additionally, there are the pre-fabricated 5 to 10 m^3 standing tanks made from galvanized iron. They are increasingly considered poor investments due to their short lifespan and relatively high cost. In Botswana, 7 m^3 polyethylene tanks are being tested by the Ministry of Agriculture as a possible component of a water harvesting package offered to farmers.

Roofing

In many rural areas of the five countries, traditional housing predominates with either thatch or mud roofs. Increasingly, householders are switching to iron-sheet, thus increasing the potential for roof catchment harvesting. To further accelerate this process, some projects are providing roof catchments on pillars to accompany tanks. Recipients can use this structure as the basis of a new home or storage building. An example of such a system from Botswana is illustrated in Appendix III.

Guttering

An integral part of an effective rooftop harvesting system is the guttering. At their simplest, gutters are a short length of iron-sheet suspended in wire hoops below the roof eave, or positioned at an angle by two forked branches stuck in the ground below (Figure 1). The iron-sheet gutters are often too short to harvest sufficient roof area for a large tank and commercial gutters are expensive and unsuited to many low-cost housing designs. In Kenya, a Danida project has therefore pioneered simple, improved low-cost gutters, deflectors and hangers out of iron sheet and wire (Figure 3). In Tanzania, experiments are taking place with equally cheap sisal-cement gutters and deflectors.

Design considerations

Project experiences suggest that the most important factors that should be taken into account when selecting a tank design and size, depending on local circumstances, include:

- the rainfall amount, its distribution and annual variation;
- the length of dry season, particularly in drought years;
- the size and type of catchment area;
- the number of users per tank;
- the water need/use of tank users (drinking, animals, washing, gardening);
- is it what people want?
- the skills of local labour and need for specialist training;
- the distance from material suppliers and availability of transport;

- the affordability of the tank;
- the expected lifespan of the tank;
- the maintenance needs;
- the need to prevent contamination;
- the need for safety (especially with open groundtanks).

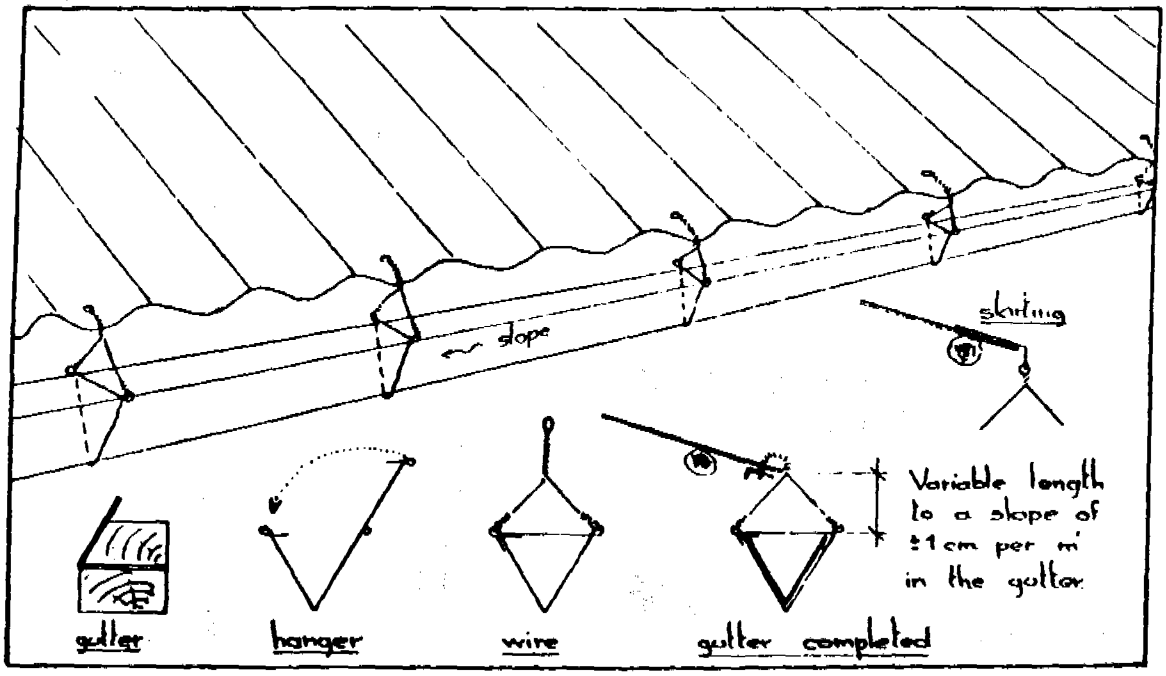


Figure 3: Simple iron-sheet gutters and wire hangers (Danida assisted Mutomo Project).

Recommended standard design features and construction practices

From the review, a number of features and practices can be highly recommended for rooftop tanks both to ensure and preserve water quality and to promote longevity. These are:

- removing overhanging tree branches from above the rooftop;
- provision of an inflow screen between the roof gutter and tank, and a first-flush capacity (such as a detachable downpipe section);
- provision of a sealed roof and lockable sealed entry hatch for cleaning purposes;
- use of a reliable, sanitary and lockable extraction device;
- construction of an hygienic soakaway channel and screened overflow pipe;
- positioning of the end of the outlet pipe above the base of the tank to allow sedimentation;
- inclusion of a flushing pipe at the base of the tank (for cleaning the standing tank);
- provision of effective guttering and deflectors to harvest a sufficient roof area;
- ensuring of an even and solid reinforcement with sufficient reinforcement density to allow good mortar binding;
- use of the correct sand-cement-water mix, careful and even plastering and careful curing;
- application of waterproofing cement solution on the inside of the tank;
- carrying out of swift repairs to leaks or cracks either with bitumen paste or by chipping out, reinforcing and mortaring.

2.2 Surface catchment systems

There are four main types of surface catchment and storage systems: rock catchments, earth dams, excavated reservoirs (which includes groundtanks not linked to roofs) and sub-surface dams. In the case of the first three, rapid runoff from natural or man-made surfaces is concentrated into and collected at strategic locations, harnessing water that would otherwise leave the area or be dissipated through infiltration. The last system harvests water already infiltrated and concentrated through natural hydrological processes into sand-rivers that fill valleys in dryland areas.

Rock catchments

Simple rock masonry gravity walls up to five metres high are constructed on rock outcrops in valleys or around hollows (Figure 4), and stone and mortar gutters are built across contours to channel water from the rock surface. The rocks are normally bare, with only a few small patches of earth and vegetation.

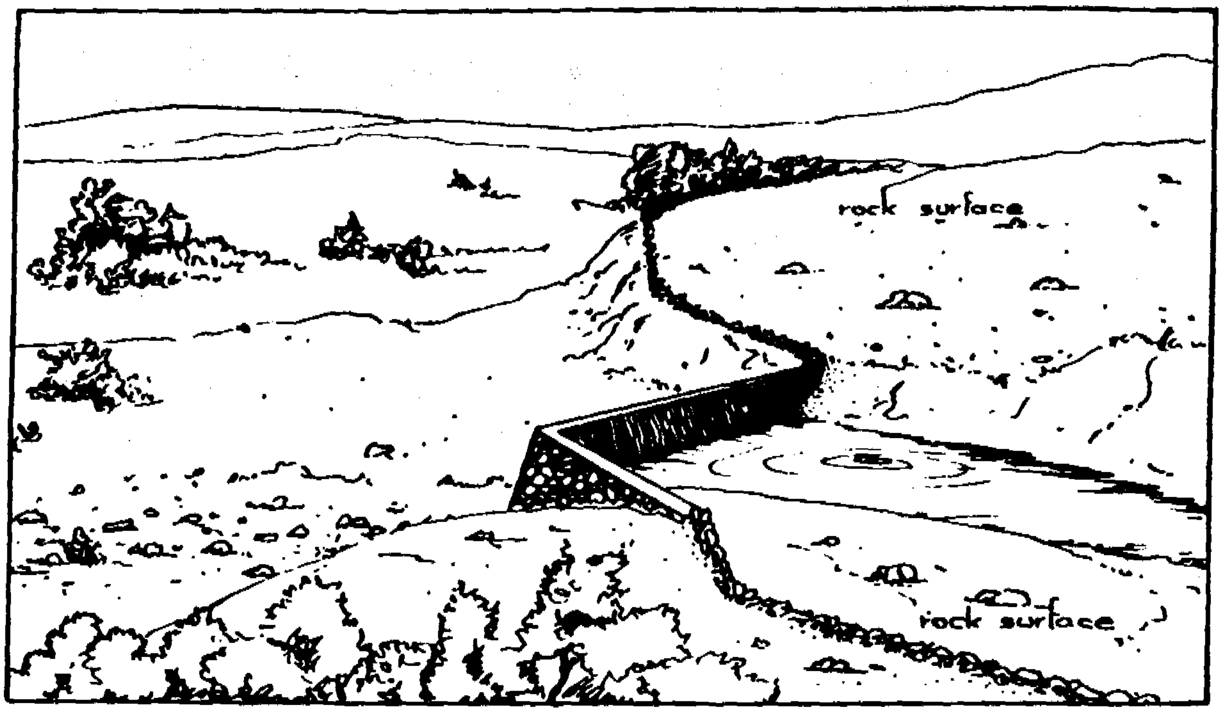


Figure 4: Rock catchment.

With each construction, it is important to ensure that:

- the rock face is cleaned and roughened where the dam is built to allow a solid bind between the dam and rock;
- fissures in the rock are sealed to prevent water loss;
- any earth pockets on the surface are scraped-off along with the vegetation to increase reservoir storage volume and prevent siltation;
- the perimeter of the rock and reservoir is surrounded with a cut thorn-bush fencing to keep out animals;
- the rock is cleaned periodically to prevent contamination;

- water is extracted through a filter box and out-take pipe down to a watering station and not directly by hand;
- the reservoir is as deep as possible with a small surface area to minimize evaporation loss.

Several hundred rock catchments have been built in southern Kenya but are virtually unknown in the other four countries although there may be considerable potential for them.

Excavated reservoirs
These are depressions deepened or excavated to hold a larger volume of runoff water from natural catchments or from man-made surfaces such as village compounds, threshing areas or concreted slopes. At the smaller end of the scale they include the dug and plastered pits used in Tanzania and Togo and the ground tanks used in Kenya and Botswana, and at the larger end, they include Charco dams in Tanzania (excavated reservoir downstream of an earth dam), and banco pits in Mali (large excavations made during mud-brick manufacture). In many cases, due to seepage and evaporation loss these systems only provide seasonal supplies.

Earth dams
Earth dams are raised banks of compacted earth, often with a clay core and stone aprons and spillway, holding back water in a small valley or depression. They are used in each country, usually supplying water for livestock or for irrigation, but often also used for domestic purposes. An example of the design details for a dam built in Mali are included in Appendix IV. Kenya, Tanzania, Botswana and Mali all have on-going earth-dam construction, with up to 50 per year being built. Recognizing their multiple function, many are now fenced and provided with out-takes and downstream water stations for people and livestock. It is common in each country to find many poorly designed, sited or maintained dams which are quickly washed-away or silted-up.

Sub-surface dams
Each sub-surface dam design involves placing a vertical impermeable barrier of either compacted clay or masonry across and into a seasonal river bed. The masonry barrier can be built up gradually in small 50 cm stages. This results in sand being trapped whilst silt is washed downstream. The reservoir of sand is increased and more water is stored in the shallow aquifer created by the dam. It is accessed by a hand-dug lined well and sometimes a gravity pipe. These dams are being widely adopted in Kenya, where perhaps as many as 100 have been built, and have considerable potential in all areas with seasonal sand-filled rivers, particularly Botswana. The principles of sub-surface and sand-dam construction are illustrated in Appendix V.

2.3 Runoff farming systems

A range of runoff farming systems, both simple and complex have been applied in several of the countries to improve direct infiltration and boost crop yields. Their current use is still far below their potential. Each of the countries except Togo have large proportions of their farming populations in areas where conditions can be improved greatly by runoff farming.

Runoff farming systems work on the principle of selective runoff and infiltration. There is a defined catchment (runoff) area, and a defined cultivation (runon) area. A distinction can be made between within-field systems, in which the runoff and runon area are small and occur within a single sloping field, and external catchment systems where water spread onto a particular area to infiltrate has been diverted from more distant sources such as a stream supplied by runoff from another area. These are generally larger in scale and are less common. In Mali there are about 20 projects currently involved with developing soil and water conservation and in Kenya it is a standard component of all development projects in the marginal areas. Although in Kenya and Mali, there has been widespread promotion and adoption of a range of within-field systems through NGOs and government agricultural soil and water conservation services, there are few reliable estimates on the number of hectares that have been developed. In both Botswana and Tanzania, pilot projects are now underway in the use of various crop improvement schemes on farmers fields.

Micro-pits and micro-catchments
Micro-pits are small water collection pockets that fill with surface runoff and into which manure and small pockets of seed can be placed. Micro-catchments are small earth-banks, usually a diamond shape with the apex pointing downslope. Water drains off the interior of the diamond to the lowest point in the apex where it is used to water a tree or a small clump of maize.

Small check-barriers
The fanya-ju is a small earth bank formed by digging a ditch along a contour and throwing the earth upslope to form a small bank (Figure 5). Fanya jus are generally spaced between 5 and 20 metres apart downslope depending on local gradients. One person can dig 3 to 6 metres per day. Bananas or fodder trees can be grown in the ditch and grass on the bank. Water running off the field collects upslope of the fanya-ju and gradually, any soil eroded further up the field is deposited to create a terrace.

Rock and trash strips are built along contours by raking crop residues or stones from the field into lines. These act as permeable barriers allowing runoff water through, but at a much slower speed and preventing concentration into gullies. Similarly, contour bunds are built along contours but they trap water, leading excess flow away to the side of the field. They are generally 0.3 m high with side slopes of 1:3. Assuming the catchment area to cultivated area ratio (CCR) to be 2 to 3 for 1% to 3% slopes, each hectare would require between 150 and 430 cubic metres of earthwork to be completed. Sometimes they are fitted with spillways made of stones to allow water to safely discharge down the field without erosion. In practice, for instance in Turkana, they have been largely unsuccessful. Unless they are built perfectly level, water trapped during heavy rains can flow over the bank at its lowest point creating erosion.

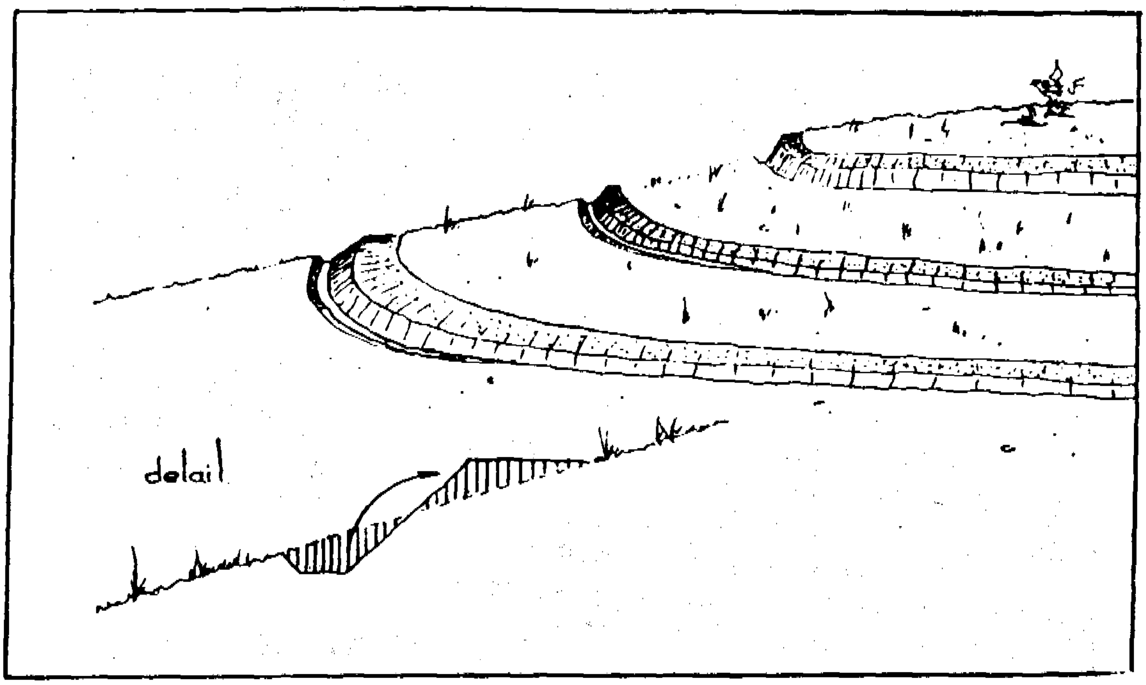


Figure 5: Small earth check-barriers in Kenya.

Medium check-barriers

Semicircular bunds are within-field systems built to cross part of the field, trapping surface water. Banks in the shape of a halfmoon are built, with the round part facing downhill and the two ends of the semi-circle positioned level with each other on the same contour. Assuming a rainfall of 550-700 mm, they should be 10 metres in radius providing a cultivated area of 160 square metres taking 6 to 9 person days to construct. Assuming a CCR of 3, each hectare would contain 16 bunds. Any excess water flows out around the edge of the tips. Bunds are built in staggered formation across and down a sloping field so that the water running out of two upper bunds runs into the lower bund positioned with its apex below their two adjacent ends.

The trapezoidal bund is similar to the semicircular bund except that it is larger and has a u-shape, with a straight bottom and angled sides. The bottom of the u is built along a lower contour and the tips of the sides finish level on a higher contour. Again, excess water flows out around the sides and not over the top of the bank. Trapezoidal bunds are generally 0.6 metres high with 1:3 side slopes and assuming a CCR of 5 to be suitable for 0.5% to 2% slopes, this would require 250 to 840 cubic metres of earthwork per hectare.

Large check-barriers

Large permeable rock barriers have been used in Mali to slow down water moving across alluvial valley bottoms, reducing its erosive force and enhancing infiltration. Application of these external catchment systems has not been widespread or the cost-effectiveness determined.

It has been found in Mali and Kenya that the introduction of runoff farming systems is a slow process. Their labour-intensive construction, coupled with the often high annual labour demands for maintenance seems to be a major constraint on their widespread adoption, especially within communities who have a high seasonal out-migration.

Supporting material
(from "Water Harvesting - A guide for planners and project managers. IRC, Technical Paper Series, no. 30).

ROOFTOP HARVESTING SYSTEM

Management and maintenance

Rooftop catchment tanks, like all water supply systems, require good periodic management and maintenance to ensure that the quality and reliability of the water supply is high. If the various components of the system are not regularly cleaned, water use is not properly managed, possible problems are not identified or necessary repairs are not performed, the roof catchment system will cease to provide reliable, good quality supplies.

The following timetable of maintenance and management requirements gives a basis for monitoring checks:

During the rainy season - the whole system (roof catchment, gutters, pipes, screens, first-flush and overflow) should be visually checked before and after each rain and preferably cleaned after every dry period greater than one month.

End of dry season - the storage tank should be scrubbed out and flushed of all sediment and debris at the end of each dry season just before the first rain comes (the tank should be re-filled afterwards with a few centimetres of clean water to prevent cracking). A full service of all tank features just before the first rains are due to begin, including replacement of all worn screens and servicing of the outlet tap or handpump.

Year-round - if in any doubt about the presence of organic contaminants in the water source (for instance, after an outbreak of diarrhoea), the water can be chlorinated with 10 grams of free chlorine for each m^3 of stored water. Water must not be allowed to leak from tap fittings. Not only will this waste water, but it may also provide a basis for algal growth and lead to the development of bacterial colonies which can make the water supply unsafe. The water tank should regularly be checked for leaks and cracks, which need to be repaired. Only small weeping leaks, which may occur on first filling the tank, need not be repaired since they usually seal themselves.

Supporting material

SURFACE CATCHMENT SYSTEMS

1 Rock catchment dam systems

Maintenance and management

Maintenance and management requirements are geared towards preservation of the quality of the stored water, optimizing water abstraction and use, and the identification and solution of potential leakage problems.

To avoid contamination of the water, a fence of thorn bush can be constructed around the catchment area or the reservoir edge, discouraging people and animals from entering. The rock should be kept clean of debris and water should always be abstracted at the tapping point. If possible, the reservoir should be emptied at the end of the dry season to remove silt and algae.

To avoid mosquito breeding and the possible spread of malaria, Tilapia fish could be introduced to the reservoir (each year if it runs dry). Fish excrement pollutes a reservoir less than if the reservoir had no fish and organisms were allowed to breed unchecked.

Water use management is required to tackle the problems of over-consumption by the community or use by unauthorized passers-by. Additionally, during the rainy season the dam should be regularly checked for possible leaks. Once spotted, cracks should be marked and repaired when the water level in the reservoir falls below the leak. A watch person who lives and farms near the site could be appointed to carry out the maintenance and to keep track of consumption. With different users, this may not be a simple task. Clear agreements therefore will be required with the users and their community organizations. These will have to focus on the one hand on accepting the authority of the watchmen and on the other establish the required understanding concerning water use. A measurement pole can be placed in the reservoir in order that everyone has an indication how much water is still left.

2 Small earth dam systems

Maintenance and management

In order to keep the quality of the water as high as possible and maintain the dam walls, the following guidelines should be adhered to:

- erosion control should be implemented in the catchment area;
- silt traps should be used in the inflow channel;
- bacteriological and chemical contamination of the catchment area and reservoirs should be prevented;
- the dam and spillways should be protected by fencing to exclude people and livestock;
- the pipe and tap should be maintained;
- bank and spillway maintenance should take place by regular examining for cracks, settlement and slides;
- cracks should be filled immediately with compacted clay, and embankment erosion should be rectified by planting grass and filling rills.

Supporting material
(from "Water Harvesting - A guide for planners and project managers. IRC, Technical Paper Series, no. 30).

ROOFTOP HARVESTING SYSTEM

Management and maintenance

Rooftop catchment tanks, like all water supply systems, require good periodic management and maintenance to ensure that the quality and reliability of the water supply is high. If the various components of the system are not regularly cleaned, water use is not properly managed, possible problems are not identified or necessary repairs are not performed, the roof catchment system will cease to provide reliable, good quality supplies.

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Supporting material

GROUNDWATER DAMS

Management and maintenance

The water quality in groundwater dams is generally the highest of all water harvesting systems, since water is stored in the ground and filtered as it moves through the sandy soil. However, opportunity does exist for shallow groundwater contamination by seepage of pollutants from the surface. The precautions listed in Table 10.5 can help to reduce the risk of contamination to a low level.

Once a clay wall groundwater dam is built, there should be little maintenance. After each large flood however, members of the user group should be designated to check the dam site to see if the channel has started to erode away the dam. Any erosion should be corrected by refinishing the clay wall and protecting it again with large rocks, too heavy for the smaller flows to move. With masonry groundwater dams, any channel erosion that might undermine or expose the dam should be arrested by filling with large boulders and using silting traps to catch sandy material. This is similar for raised-dams. With the raised dam, the gravity pipe should be checked frequently along its length for signs of damage or leaks and the tapping station kept in good order. Also with groundwater dams there may be a need to control water use, thus requiring supervision, clear agreements between users and monitoring of storage still available. For the latter a piezometer may be installed which allows a caretaker or watchman to estimate how much water is left and if rationing has to be made more strict.

Checklist of precautions that help to manage and maintain water quality and reliability in sub-surface and sand dams

- No open defecation in/near the river bed upstream.
- No tethering of donkeys at the well.
- No bathing/laundry upstream of the dam.
- No pit-latrines on the bank upstream.
- No unprotected wells in the river bed near the protected well.
- Regular maintenance of the protected well-site and handpump.
- Use and maintenance of a downstream gravity out-take.
- No use of pesticides/chemicals upstream of the dam site.

For further reading

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4.3 WATER DISTRIBUTION AND TREATMENT

Description of session

OBJECTIVE

- To give participants the opportunity to analyse the O & M technical requirements of typical water distribution schemes and methods of water treatment.

OUTLINE OF SESSION

• Participants are divided into three groups (gravity piped distribution; chlorination; slow sand filtration)and complete the blank analysis sheets	45 min
• The facilitator hands out the sample analyses, included in the Supporting Material, for comparison	15 min
• In a plenary session participants are asked to react to the exercise	30 min
	1 h 30 min

HAND-OUTS

Distribution and treatment

- gravity piped distribution to standposts
- chlorination
- slow sand filtration

Background information

The previous sub-module identified the O & M tasks associated with a range of rural water supplies. This sub-module will use the same systematic approach to look at water distribution and basic treatment methods that may be found in rural water schemes. The concern in this sub-module, therefore, is not so much with the sources of water as the O & M of distribution and treatment.

The distribution and treatment methods considered are:

- gravity piped distribution to standposts
- chlorination
- slow sand filtration

As in the previous session, participants can divide into three groups. Each group will be given a description of one scheme and a set of blank analysis sheets to be completed for the scheme allocated.

Guidelines for the group exercise

- Three groups are formed:

  1. Gravity piped distribution to standposts

  2. Chlorination

  3. Slow sand filtration

- Each group is given:

  a. description of the chosen scheme;

  b. work sheet on O & M activities to be completed;

  c. work sheet on O & M activities to be completed;

  d. work sheet on O & M tasks to be completed.

Copies of the analysis sheets can be made from the samples included in the introductory sub-module.

After 45 min the facilitator will hand out the sample version of the completed analysis sheets for participants to compare with their own analysis.

Groups will react to the comparison and report back, through an elected rapporteur, in a plenary session.

The extensive supporting material describing schemes, O & M activities, requirements and tasks are to be used initially as a reference for the facilitator. These documents can be copied, however, and distributed to the participants once they have completed their groupwork exercise.

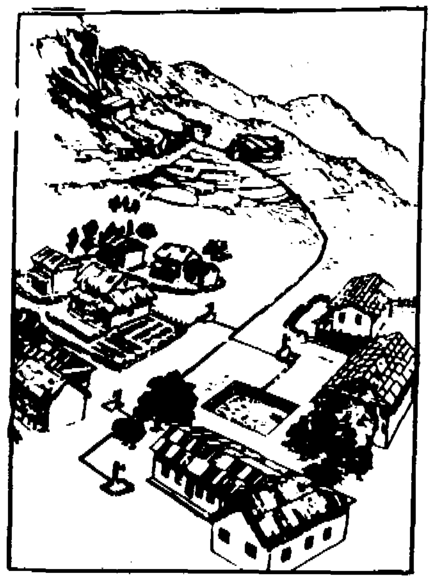
Working sheet

Scheme: Gravity piped distribution to standposts

- A description of the scheme is given below.
- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

Description of scheme

Type of scheme: gravity piped distribution to standposts



Reservoir
- A stone masonry, square reservoir tank of 16 m3 capacity.
- The roof is of corrugated galvanised steel sheet.
- There are three pipes with an isolation valve on each:
  inlet from the source;
  outlet to the standposts;
  washout.
- There is an overflow pipe.

Distribution pipeline
- The pipeline material is a combination of PVC (for buried sections) and galvanised steel (for exposed sections, difficult terrain and connections to tanks and standposts).
- Pipe is buried to a depth of 1 metre.
- Valveboxes protect control valves at the reservoir, on each branch of the system, and at each standpost.

Standposts
- The standpost comprises an upright galvanised steel pipe encased in a concrete pillar.
- A concrete platform directs spilt water to a drain.
- The drain directs water to a soakaway, situated at least 3 metres from the standpost.
- There is one tap for each standpost.

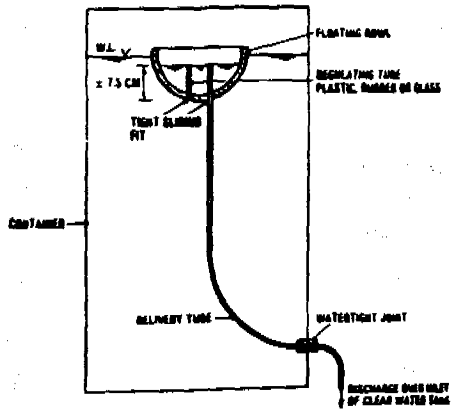
Working sheet

SCHEME: water supply with chlorination

- A description of the scheme is given below.
- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

Description of scheme:

Type of scheme: water supply with chlorination



Dispenser
- The hypochlorite solution is mixed and dispensed from a 200 litre container.
- Hypochlorite dosing is controlled by a floating bowl dispenser.

Storage
- The calcium hypochlorite granules are supplied in 50 kg plastic containers.
- The calcium hypochlorite containers are kept in a dry, well ventilated, purpose built, brick store.

Safety
- Protective clothing is important when handling and preparing the hypochlorite solution. Clothing will include: overalls, rubber gloves and boots to protect the skin;
- eye protectors to protect the eyes from any splashes of hypochlorite solution;
- face mask to prevent excessive inhalation of hypochlorite powder.

Testing, etc.
- The amount of residual chlorine in the system is monitored using a chlorine colour comparator.
- All records are kept in a log book.

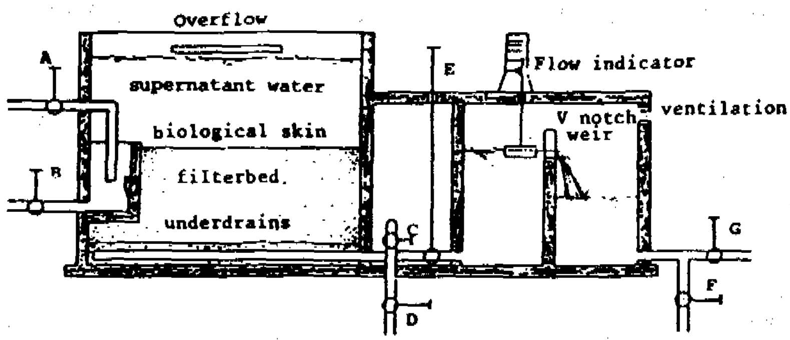
Working sheet

SCHEME: slow sand filtration

- A description of the scheme is given below.
- Participants are asked to complete the working sheets on O & M activities, requirements and tasks.

Description of scheme:

Type of scheme: Slow sand filtration



Filters
- Two outlet controlled rectangular slow sand filters operating in parallel to filter incoming water. During maintenance of one filter the other is kept operating at a higher rate to compensate for the reduced flow during maintenance.
- Pipework.
- Underdrains.
- Graded gravel to support the filter sand.
- Filter sand.

Control devices
- The filter is operated by a combination of valves: inlet, inlet drainage, back-filling, emptying, filter regulation, clear water drainage, distribution.
- Flow indicator for checking the filtration rate.

Tools and equipment
- Clean boots are worn when working inside the filter.
- Simple equipment is used when maintaining the filter bed: ladder, boards, shovels, rake, bucket, brush, levelling board, depth probe.
- Records of operation and maintenance are kept in a log book.

Monitoring equipment
- The turbidity of the inlet water is checked to ensure the water is of an acceptable turbidity to prevent rapid blocking of the filter. Turbidity is also measured at the outlet to check the filter is functioning properly.
- The supervising manager carries out periodic bacteriological tests on the filtered water.

1. DESCRIPTION OF THE SCHEME

Type of scheme:

The description can simply be in the form of a list of key elements grouped under the main components making up the scheme.

2. DESCRIPTION OF O&M ACTIVITIES

Type of scheme:

Daily

Weekly

Monthly

Annual

Irregular

3. DESCRIPTION OF O&M REQUIREMENTS

Type of scheme:

Labour
unskilled

semi-skilled

skilled

Materials & equipment

available within the community

available within the country

only available outside the country

Finance

community funds

government funds

---

4. IDENTIFICATION OF TASKS

Type of scheme:

O & M TASKS:	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
COMPONENTS					

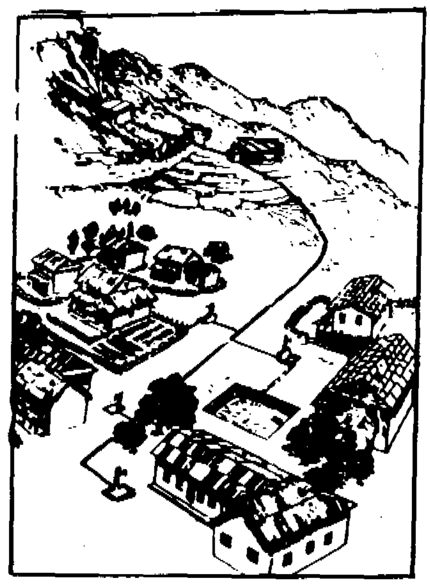
** essential for sustainability
* preferable for sustainability
-- not relevant

Supporting material

FOURTH CASE - gravity piped distribution to standposts

1. DESCRIPTION OF SCHEME

Type of scheme: gravity piped distribution to standposts



Reservoir

- A stone masonry, square reservoir tank of 16 m3 capacity.
- The roof is of corrugated galvanised steel sheet.
- There are three pipes with an isolation valve on each:
  inlet from the source;
  outlet to the standposts;
  washout.
- There is an overflow pipe.

Distribution pipeline

- The pipeline material is a combination of PVC (for buried sections) and galvanised steel (for exposed sections, difficult terrain and connections to tanks and standposts).
- Pipe is buried to a depth of 1 metre.
- Valveboxes protect control valves at the reservoir, on each branch of the system, and at each standpost.

Standposts

- The standpost comprises an upright galvanised steel pipe encased in a concrete pillar.
- A concrete platform directs spilt water to a drain.
- The drain directs water to a soakaway, situated at least 3 metres from the standpost.
- There is one tap for each standpost.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of scheme: gravity piped distribution to standposts

Daily At each standpost:	if use of standpost is controlled by a lockable tap or isolation valve - unlock tap or open valve. check the tap operates correctly; check the flow of water is normal. Attend to any dripping tap. Attend to any leaking valve. Clean the standpost platform, drain and surroundings. Inspect standpost structure, platform and drain - repair any cracks in the plaster with cement mortar.
Weekly Reservoir:	Check - there are no leaks; the overflow is in good order; valves are in the correct position; water is flowing into the reservoir at the required rate. Walk the distribution pipeline:check for pipeline leaks; look for any disturbed sections of pipe e.g. erosion around gulley crossings; check valves are correctly set.
Monthly	Collection of water committee contributions
Yearly	Drain reservoir, clean and inspect. Repair any damage to the reservoir tank. Plaster and make good any cracks in the walls and floor of the reservoir. Check the operation of valves and inspect internal parts if a valve is stiff to operate - repair or replace parts as necessary. Check air release valves. Open 'wash-outs' to flush pipeline. In the dry season, remove soakaway stones - clean soakaway pit and stones before replacing.
Irregular	Repair pipeline leaks; Control erosion around pipes.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of scheme: gravity piped distribution to standposts

Labour	
unskilled	Users carry out daily checks at the standposts Users assist in annual activities Users assist in the repair of pipeline leaks and erosion control Water (tap) committee collects, records and dispenses funds for tap and valve spares, etc. or replacement Water committee officials keep records of leaks and repairs
semi-skilled	Caretaker carries out daily and weekly activities on the distribution system
skilled	Water agency pipefitters to assist in major pipeline leaks Water agency or private mason to repair reservoir Private mason to repair standpost structures
Materials & Equipment	
available within the community	sand for cement mortar; brush for cleaning platform and drain; stone for erosion control; tools for digging up broken pipe
available within the country	cement for reservoir and standpost repairs; PVC and steel pipe for major pipeline repairs; spares for taps and valves; tools for maintenance and repair
only available from outside the country	-
Finance	
community funds	all labour and material costs of tap, valve and minor reservoir and pipeline repairs.
government funds	cost of the pipefitters and materials for major pipeline repairs.

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: gravity piped distribution to standposts

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Reservoir	*	--	*	*	*
Distribution pipeline	**	--	**	**	*
Valves	**	*	**	*	*
Standpost	**	**	**	**	*

** essential for sustainability
* preferable for sustainability
-- not relevant

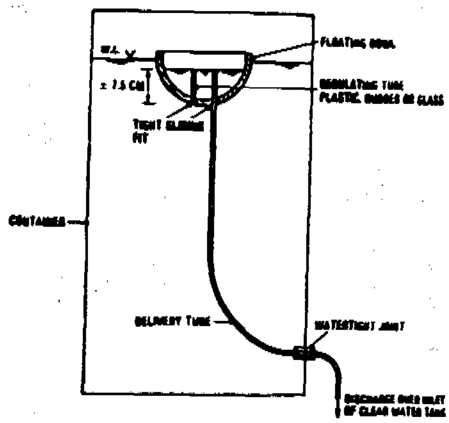
Supporting material

FIFTH CASE - chlorination

There are several methods of disinfecting water supplies. Chlorine, in the form of a liquid/gas mixture is commonly used in medium and large systems. For smaller, rural systems, hypochlorite in a powder or solid form is often preferred. For this case study, disinfection of a clear stream water supply by calcium hypochlorite solution has been chosen. The hypochlorite solution is discharged from a floating bowl chlorinator at the raw water inlet to the reservoir.

1. DESCRIPTION OF SCHEME

Type of scheme: water supply with chlorination



Dispenser
- The hypochlorite solution is mixed and dispensed from a 200 litre container.
- Hypochlorite dosing is controlled by a floating bowl dispenser.

Storage
- The calcium hypochlorite granules are supplied in 50 kg plastic containers.
- The calcium hypochlorite containers are kept in a dry, well ventilated, purpose built, brick store.

Safety
- Protective clothing is important when handling and preparing the hypochlorite solution. Clothing will include: overalls, rubber gloves and boots to protect the skin;
- eye protectors to protect the eyes from any splashes of hypochlorite solution;
- face mask to prevent excessive inhalation of hypochlorite powder.

Testing, etc.
- The amount of residual chlorine in the system is monitored using a chlorine colour comparator.
- All records are kept in a log book.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of scheme: chlorination

Daily	Clean floating bowl, tubes and flexible dosing pipe Mix calcium hypochlorite solution in container Start dosing Check dosing matches inflow and adjust accordingly Monitor dosing throughout the day. Wash protective gloves after use. Check chlorine residual at both the nearest and furthest standposts in the system.
Weekly	Drain and wash 200 litre dosing container.
Half yearly	Order replacement stocks of calcium hypochlorite granules and chlorine comparator reagents.
Annual	Replace floating bowl and dosing pipe.
Irregular	Renew safety clothing and equipment as required.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of scheme: chlorination

Labour	
unskilled	
semi-skilled	chlorine dosing operator
skilled	
Materials & Equipment	
available within the community	-
available within the country	floating bowl chlorinator spares calcium hypochlorite safety clothing and equipment
only available outside the country	chlorine comparator and reagents
Finance	
Community funds	Payment of water charges to water agency
Government funds	Supply of calcium hypochlorite Annual replacement of equipment Payment of operator

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: chlorination

O & M TASKS: / COMPONENTS	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Dispenser	**	**	**	*	--
Storage	*	**	*	*	--
Safety	**	**	*	--	--
Testing	**	**	--	--	--

** essential for sustainability
* preferable for sustainability
-- not relevant

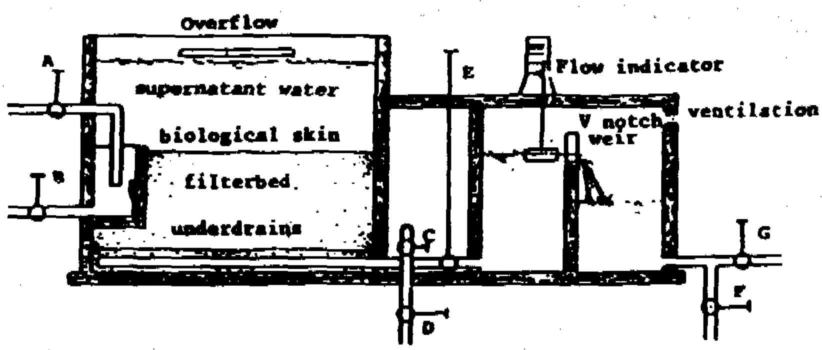
Supporting material

SIXTH CASE - slow sand filtration

Slow sand filtration is an effective, low-cost, system of water treatment if operated and managed correctly. It is normally one component in a treatment process which may involve preliminary settlement of solids and/or roughing filters and post chlorination. A treatment plant operator, or caretaker, may have a number of responsibilities in addition to the operation and maintenance of slow sand filters. Caretaker responsibilities may extend from the initial source of water to eventual distribution. In this exercise, however, only the O & M aspects of the slow sand filter itself will be considered.

1. DESCRIPTION OF SCHEME

Type of scheme: Slow sand filtration



Filters

- Two outlet controlled rectangular slow sand filters operating in parallel to filter incoming water. During maintenance of one filter the other is kept operating at a higher rate to compensate for the reduced flow during maintenance.
- Pipework.
- Underdrains.
- Graded gravel to support the filter sand.
- Filter sand.

Control devices

- The filter is operated by a combination of valves: inlet, inlet drainage, back-filling, emptying, filter regulation, clear water drainage, distribution.
- Flow indicator for checking the filtration rate.

Tools and equipment

- Clean boots are worn when working inside the filter.
- Simple equipment is used when maintaining the filter bed: ladder, boards, shovels, rake, bucket, brush, levelling board, depth probe.
- Records of operation and maintenance are kept in a log book.

Monitoring equipment

- The turbidity of the inlet water is checked to ensure the water is of an acceptable turbidity to prevent rapid blocking of the filter. Turbidity is also measured at the outlet to check the filter is functioning properly.
- The supervising manager carries out periodic bacteriological tests on the filtered water.

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of scheme: slow sand filtration

Daily	Check the rate of filtration on the flow indicator - adjust the rate of filtration, if necessary, by turning the filtered water valve. Check water level in the filter - adjust inlet valve, if necessary, to maintain a constant water level. Remove scum and floating material, if present, by further opening inlet valve for a short period. Check water level in the clear well. Sample and check water turbidity: if inflow turbidity is too high - close the intake; if outflow turbidity is too high - report to supervisor. Complete log book.
Weekly	Clean the treatment plant site.
*** Monthly**	Clean filter unit: remove scum and floating material; brush the filter walls; close inlet, filtered water and distribution valves; drain water to 20cm below the sand level; increase filtration rate in the other filter to 0.2 m/h Clean the drained down filter bed: wash boots and equipment before use; scrape upper 2-3 cm in narrow strips and remove scrapings from filter; check, and service, exposed inlet and drain valves; remove cleaning equipment and level sand surface; check and record depth of sand bed; adjust inlet box to the new sand level. Re-start the filter: open the recharge valve; check sand surface and level if required; when water is 20 cm above sand, open inlet valve; open filtered water valve and stop when filtration rate reaches 0.02 m/h; open waste valve for outflow water to flow to waste; open filtered water valve to increase filtration rate every hour by 0.02 m/h until a rate of 0.1 m/h is reached; adjust and check flow daily until safe to drink; close waste valve and open distribution valve to pass filtered water into the supply; decrease filtration rate of other filter to 0.1 m/h. Wash the filter scrapings and store the clean sand.

Supporting material

*** Yearly**	Check if filter is watertight: close all valves and fill filter box from inlet valve until it overflows - close valve; leave for 24 hrs and check if water level reduces; if filter box leaks, report for repair. Open filtered water valve to fill outlet chamber and when full, close valve. leave for 24 hrs and check if water level reduces; if chamber leaks, report for repair. Open drain valve to empty filter. Clean the clear well in the outlet chamber. Re-start filter as per the monthly clean.
Yearly	Caretaker health checks.
*** Every 2 yrs**	Re-sand filter units: clean the filter as in a monthly filter clean; open drain valve to empty water from the sand bed; remove strip of old sand to one side; place new clean sand on top of exposed gravel, and level; place old sand on top of the new sand to the correct depth of 0.8 m in total, and level the surface; continue in strips until filter is re-sanded level; adjust inlet box to new sand level. Re-start the filter as per the monthly clean.
Irregular	Checks on the functioning of the plant by supervising manager including: turbidity tests with a turbidity meter; bacteriological tests on the filtered water. Caretaker health checks at times of water borne disease outbreaks.

* These periods depend on local conditions affecting the performance of the filters and will vary for different filter systems. Typical periods and filtration rates have been chosen for this case.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of scheme: slow sand filtration

Labour	
unskilled	labourers for re-sanding
semi-skilled	caretakers
skilled	supervising manager
Materials & Equipment	
available within the community	sand (if available locally) basic tools
available within the country	sand (if not available locally) tools - for maintenance of filter bed & valves valve replacement and spares flow indicator turbidity apparatus
only available outside the country	bacteriological testing equipment and consumables.
Finance	
community funds	payment of water bills
government funds	payment of caretakers material & equipment support

Supporting material

4. IDENTIFICATION OF TASKS

Type of scheme: slow sand filtration

O & M TASKS: / **COMPONENTS**	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
Filters	**	**	**	*	**
Control devices	**	**	*	*	*
Tool & equipment	*	**	*	*	--
Monitoring equipment	**	*	*	*	**

** essential for sustainability
* preferable for sustainability
-- not relevant

For further reading

Huisman, L. and Wood, W.E. (1974) Slow Sand Filtration. Geneva, Switzerland, WHO.

IRC (1991) Partners for Progress: An approach to sustainable piped water supplies. Technical Paper series no. 28. The Hague, The Netherlands, IRC Water and Sanitation Centre

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Okun, A.D. and Ernst, W.R. (1987) Community Piped Water Supply Systems in Developing Countries. Technical Paper 60. Washington D.C., USA, World Bank

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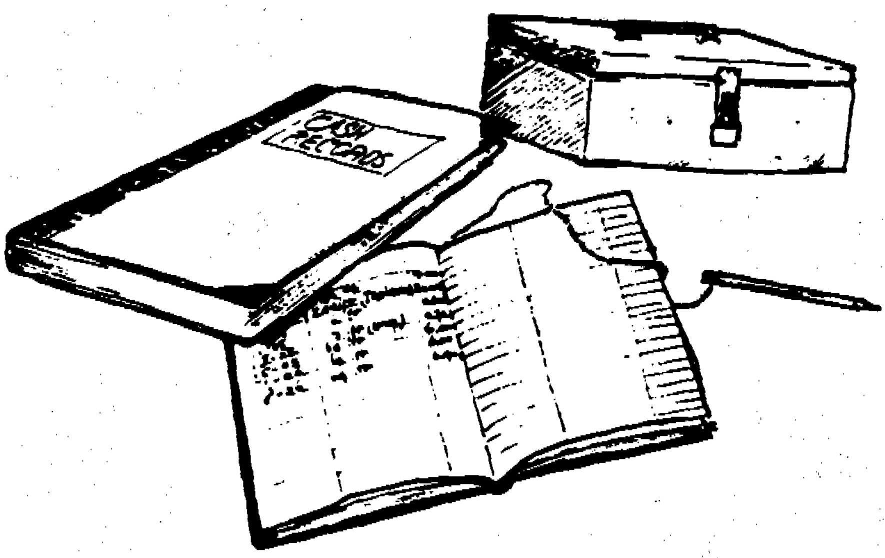
White, G.C. (1986) The Handbook of Chlorination. 2nd ed. New York, USA, Van Nostrand Reinhold.

PART 2: KNOWING MORE ABOUT O&M

MODULE 5

ORGANIZATIONAL & FINANCIAL REQUIREMENTS



OUTLINE OF COURSE

PART 1: FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2: KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3: PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

5.1 ACTORS AND ROLES

Description of session

OBJECTIVES

- To identify actors involved in O&M
- To identify their role in O&M
- To make links between the roles of actors and water supply systems and sanitation

OUTLINE OF SESSION

• Presentation done by the facilitator on actors and their role, using overheads and questions to participants	45 min
• Participants are divided into groups and are asked to fill in working sheets	30 min
• Plenary discussion on the results of the group work	30 min
	1 h 45 min

HAND - OUTS

- Working sheets

MATERIAL NEEDED

- Overhead projector

Background Information

1. Who is involved in O&M ?

A great number of actors are involved in various tasks and roles, each with its own potential and limits.
Four entities can be described though as having a determinant action and influence on O&M activities of rural water supply and sanitation schemes. A *fifth one*, external support, is implied with supporting activities at all level.

Four types of actors directly involved:
- the community
- the public authority
- the water agency
- the private sector

One type of actor involved in supporting activities:
- external assistance

COMMUNITY

PUBLIC AUTHORITY

WATER AGENCY

PRIVATE SECTOR

EXTERNAL ASSISTANCE

A. THE COMMUNITY

THE USERS:

<u>WHO?</u>
Users are collecting water for their household needs, for public use (schools, dispensaries) or for productive use (agriculture, gardening or livestock).
They can be independent individuals or informal groups of neighbours or women. Women often carry the task of collecting water and are therefore often present on water sites.

<u>ROLE?</u>
They can carry out routine maintenance tasks in order to keep water points clean and tidy without any financial charge but their participation will depend on their commitment.
They are an important financial source in the community - based O&M management systems, and their contribution will depend on their affordability and willingness to pay.

CARETAKERS:

<u>WHO?</u>
A caretaker can be appointed by the community, or individuals, women in many cases, can have the task of a caretaker.

<u>ROLE?</u>
A clear job description must be done concerning the daily and weekly routine and preventive maintenance, small operating procedures and minor repairs and /or replacement of parts. With a proper former training and a good keeping of records, the caretaker's task will be optimum.

LOCAL HUMAN RESOURCES:

<u>WHO?</u>
Local mechanics, other craftsmen, shop owners, cooperatives can be also active in O&M activities.

<u>ROLE?</u>
Mechanics and craftsmen can provide their skill for minor repairs and in some cases major repairs and replacement of parts. They should be acquainted though with the technology involved in the water supply scheme.
Shop owners can insure the provision and distribution of parts, but this will greatly depend on the regional and national availability of parts.

TRADITIONAL LEADERSHIP:

<u>WHO?</u>
In many rural areas of developing countries, traditional leaders (chiefs and councils of elders) still have a considerable authority in the community they live in.

<u>ROLE?</u>
They cooperate in the initial decision - making process, but they do not always represent the community as a whole.

TAP COMMITTEES:

<u>WHO?</u>
Formal gatherings of individuals, often women, living in the same neighbourhood, in close relationship with all the other users.

<u>ROLE?</u>
They look for hygiene around the taps as well monitor basic maintenance and repairs. Their advice and cooperation should be included in the higher level decision-making bodies.

WATER COMMITTEES:

WHO?
Formal association representing all the different members of the community (men, women, old, young, teachers, plumbers, mechanics, etc..).
They can be directly elected by the community members or formed by the water agency or the local council, and should represent all shades of local opinion.
The committee is composed of : a chairperson, a secretary, a treasurer, of several other advisory members and in most cases the caretaker.

ROLE?
They represent the community in contacts with the agency.
They organize collection and management of contributions.
They organize and supervise O&M activities and procedures.
They inform the community on activities and expenditures.

DEVELOPMENT COMMITTEES:

WHO?
Formal association englobing a whole range of development projects locally, where the cover area should coincide with the water supply boundaries, the water project being considered as a sub-committee.

ROLE?
Global coordination of activities and expenditures on a local level but these committees may not represent necessarily the view of the community.

LOCAL AUTHORITIES:

WHO?
Local authority boundary can coincide with the project area.

ROLE?
Providing a legal and institutional framework representing sometimes more the interests of the government rather than the interests of the community concerned.

B. THE PUBLIC AUTHORITY:

WHO?
The administrative body is represented at the local, district, regional and national level. They can represent the interests of the Ministry of Health and the Ministry of Water and Natural Resources. A National Development Bank or Development Fund can be present in the sector.

ROLE?
Mainly to provide a legal and institutional framework for the water sector in general and O&M in particular, through a water policy , subsidies, taxing system, control of water quality standards, training of local personnel, promotional activities on health behaviour and ensuring a proper manufacture and distribution network of spare parts throughout the country. The National Bank can allow an access to foreign currency if needed. The National or Regional Development Fund gives an access to loans for development the sector.

C. THE WATER AGENCY

WHO?
In many developing and developed countries, one or several water agencies are operating on a local, regional or national level. They can be public or private. They operate through a network of mobile teams and are organized as large firms.

ROLE?
Mainly to ensure a reliable and sustainable water supply throughout the country or the region, through periodic control and emergency interventions or major repairs and replacements. They have the disadvantages of a centralized system, with a limiting role and responsibility for the community implied. National budget expenditures cuts might affect particularly the O&M sector, being an "unproductive" sector. The present trend is to seek a partnership approach between the water agency and the community, the agency playing a supporting role and ensuring that supplies and back-up services are available when needed.

D. THE PRIVATE SECTOR

WHO?
The private sector's presence in O&M activities of rural water supply schemes lies in the manufacturing and the distribution of parts as well in the commercial banking system.

ROLE?
Spare parts for pumps, engines, filters, piped distribution systems can be manufactured by private firms, which can give indications and technical advices regarding a proper use and maintenance of equipment. In some cases, manufacturers can provide directly for maintenance being a part of the contract negotiated during the purchase of the equipment. Traders and shops can insure a proper distribution and an "always" available provision of parts. Commercial banks can assist important communities in obtaining loans.

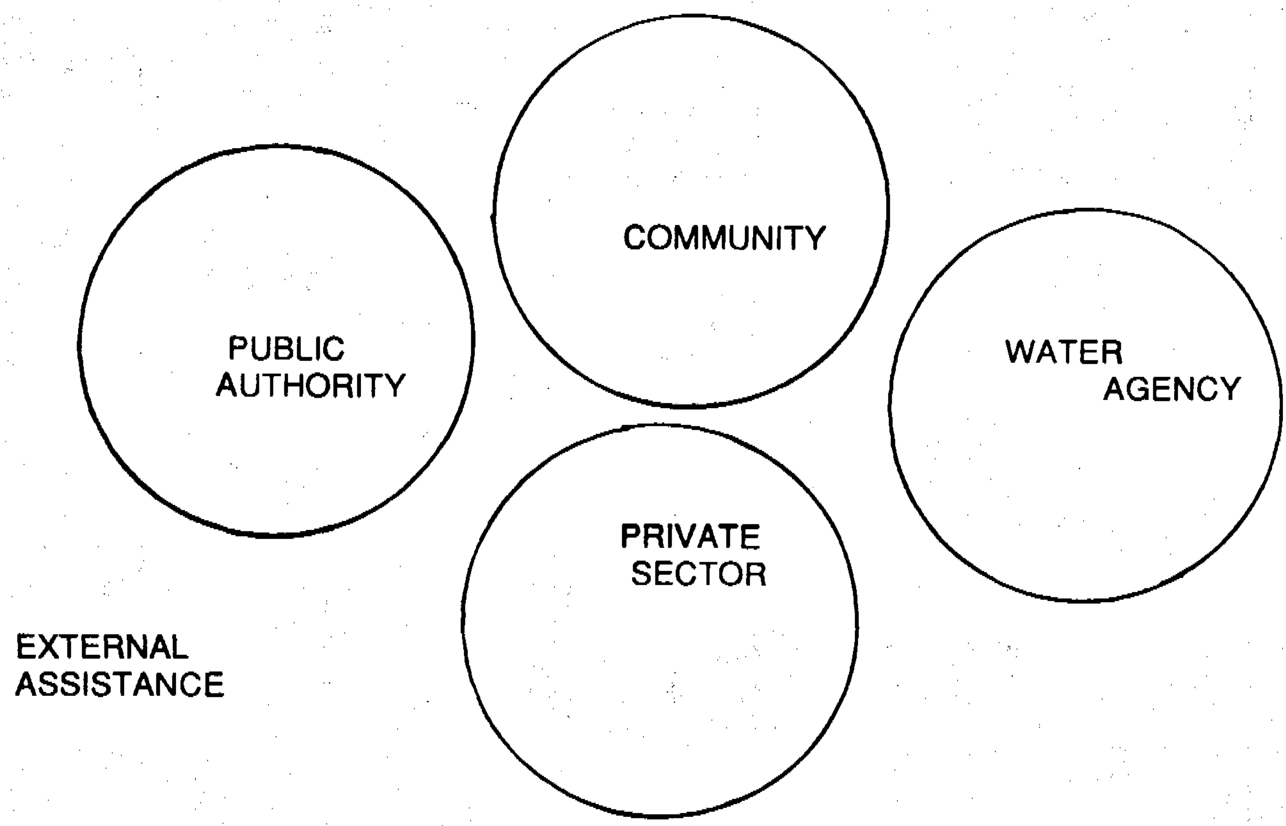
E. EXTERNAL ASSISTANCE

WHO?
Multilateral and bilateral cooperation agreements and aid agencies, support agencies, NGOs and Development Banks.

ROLE?
After the completion of the planning and constructing phase, the general policy of external supporting agencies (ESAs) has been to hand over the projects to the government responsibility. Its main field of activity though continues to be in advising, monitoring and evaluation activities, training activities and foreign currency availability.

Overhead sheet 1

WHO IS INVOLVED IN O&M



Overhead sheet 2

ACTORS INVOLVED PER TYPE OF WATER SUPPLY SYSTEM

Actors / *Water supply*	*Community*	*Public authority*	*Water agency*	*Private sector*	*External assistance*
Dug well with rope & bucket	000	0	0	---	0
Borehole with handpump	000	00	00	0	0
Piped gravity system with filtration	000	00	0	---	0
Motor pump scheme	00	0	00	00	0

000: essential actors
00: important actors but not essential
0: possible participation
---: not concerned

The proposed answers given in this matrix, are just indications for projects trying to enhance community-based participation.
The results may vary according to the importance of the project and to the region concerned.

Working sheet 1

Fill in the table in order to show: actors not involved: 0
actors involved: X

SYSTEM	POINT SOURCE WATER SUPPLY			SANITATION		
COMPONENTS / ACTORS	WELL	HANDPUMP	SURROUNDINGS (FACILITIES DRAINAGE)	LATRINES	WASTE COLLECTION	HYGIENE MEASURES
INDIVIDUAL USERS						
USER GROUPS						
COMMITTEE/VILLAGE DEVELOPMENT ORGANIZATION						
AREA MECHANIC/ INDIVIDUALS						
COOPERATIVE OF MECHANICS						
SMALL SHOPKEEPERS						
STATE ENTERPRISE						
NON-GOVERNMENTAL ORGANIZATION						
LOCAL (DISTRICT) AUTHORITY						
REGIONAL BRANCH OF WATER MINISTRY						
DONOR SUPPORTED PROJECT						
PRIVATE INDUSTRY AND COMMERCE						

Working sheet 2

Fill in the table in order to show: actors not involved: 0
actors involved: X

SYSTEM	(SMALL) PIPED WATER SUPPLY SYSTEM						
COMPONENTS / ACTORS	CATCH-MENT	INTAKE (AND TREAT-MENT)	TRANS-MISSION MAIN	RESER-VOIR(S)	DISTIBU-TION LINES	STAND POSTS	PRIVATE CONNEC-TIONS
INDIVIDUAL USERS							
USER GROUPS							
COMMITTEE/VILLAGE DEVELOPMENT ORGANIZATION							
AREA MECHANIC/ INDIVIDUALS							
COOPERATIVE OF MECHANICS							
SMALL SHOPKEEPERS							
STATE ENTERPRISE							
NON-GOVERNMENTAL ORGANIZATION							
LOCAL (DISTRICT) AUTHORITY							
REGIONAL BRANCH OF WATER MINISTRY							
DONOR SUPPORTED PROJECT							
PRIVATE INDUSTRY AND COMMERCE							

Working sheet 3

Fill in the table in order to show: actors not involved: 0
actors involved: X

SYSTEM	SANITATION				
COMPONENTS / ACTORS	EXRETA DISPOSAL (LATRINES)	WASTE WATER DISPOSAL	DRAINAGE	SOLID WASTE COLLECTION	SOLID WASTE DISPOSAL SYSTEM
INDIVIDUAL USERS					
USER GROUPS					
COMMITTEE/VILLAGE DEVELOPMENT ORGANIZATION					
AREA MECHANIC/ INDIVIDUALS					
COOPERATIVE OF MECHANICS					
SMALL SHOPKEEPERS					
STATE ENTERPRISE					
NON-GOVERNMENTAL ORGANIZATION					
LOCAL (DISTRICT) AUTHORITY					
REGIONAL BRANCH OF WATER MINISTRY					
DONOR SUPPORTED PROJECT					
PRIVATE INDUSTRY AND COMMERCE					

Working sheet 4

TYPE OF SCHEME: ....

Determine which actors can be implied in which task.

TASK / ACTORS	PREVENTIVE MAINTENANCE	SUPER VISION & OPERATION	MINOR REPAIRS	MAJOR REPAIRS	PARTS MONIT. & CONTROL	TRAINING
Users						
Caretakers						
Water Committee						
Local mechanic						
Skilled labour						
Local authority						
Water agency						
Private sector						
Ministry's representation						
Bank						
Trainers						
External support						

5.2 MANAGEMENT MODELS

Description of session

OBJECTIVES

- To present different options for O&M management
- To identify possible options for a concrete case

OUTLINE OF SESSIONS

• Discussion and presentation in plenary session on aspects of management models for O&M, including some examples taken from the proposed case studies in the supporting material	45 min
• Group exercise: first individually, then in plenary, trying to determine the type of management model to use for different types of scheme and different types of scheme (see overhead sheet/exercise sheet proposed)	1 h
	1 h 45 min

HAND OUTS

- case studies
- exercise sheet

MATERIAL NEEDED

- overhead projector

Background Information

1. How is O&M organized?

The way maintenance activities are organized is called a maintenance system.
A maintenance system is choosing to combine the different actors involved in O&M with O&M tasks in an optimum way, minimizing the costs and maximizing the user's satisfaction.
Moreover, it has to be suitable, affordable and culturally acceptable in the specific situation of the region concerned.
Setting up a system cames to asking the question who is doing what? and at which level.

ACTORS INVOLVED WHO?	O&M TASKS WHAT?
Users Caretakers Water Committee Local mechanic	preventive maintenance supervision & operation minor repairs major repairs
Local craftsmanship Local authority	provision of parts
Water agency Private sector Ministry's representation Bank	monitoring & control
Trainers	training
External Support Assistance	

At which level implies:

- the water and sanitation scheme level
- the community or village level
- the district level
- the regional level
- the national level.

In most cases, the agency jointly with the community will have to decide on shares of O&M possibilities.

2. Management models: (from Roark, 1993)

Models for rural water supply and sanitation facilities rage from highly centralized ones managed by government agencies to community systems owned and operated by local organizations. Between these extremes is a continuum of management models that includes participation by government agencies, communities and private entities.

Management models often are characterized by the number of management tiers involved. The first tier is the government agency responsible for O&M at the national level. The second tier represents an intermediate body, either a regional organization or a private group. The third tier is composed of local communities that operate and maintain their own facilities. The relative importance accorded to each tier defines the management model. Most countries use a two or three tier model, with responsibility varying from a strong central government role to a strong community role. Less common are single -tier models where either the government agency or the community has sole management responsibility...

...From this variety of management models, there are several valuable conclusions that may guide planners in selecting the most suitable one for a particular situation:

- involving the communities in project decisions is essential for effective O&M;
- the choice of technology must be congruent with local economic conditions;
- training in management techniques is usually a necessary component of community-managed facilities;
- willingness to pay for rural water supply and sanitation facilities is complex and variable, but individuals usually will be eager to pay for water but reluctant to pay for sanitation;
- spare parts supply rather than the availability of mechanical skills is usually a major problem in O&M;
- despite the increasing emphasis on community control, decentralization and private sector involvement, there always will be a role for government water supply and sanitation agencies, at least to monitor and assess the effectiveness of management arrangements;
- government extension agents are a critical communication link between the government and communities;
- strong national leadership is required to build popular confidence in O&M policy.

A useful means to delineate the differences between O&M management models is to show the relative importance of the various actors involved in managing the systems. A star diagram (see overhead sheet n.2) presents this graphically for the national government agency, the regional government agency, the private sector and the community organizations in each country.

The regional government can in certain countries be replaced by the department or the district.

3. Case studies

The following case studies have been taken from "Models of management systems for the operation and maintenance of rural water supply and sanitation facilities ", May 1992, WASH Technical Report No. 71, Arlington, USA, by Roark P., Hodgkin J., Wyatt A., with the authorization of P. Roark.

The following key issues were considered during the case studies as influencing the development of management models:

* Capacity of traditional community organization
* Skills of key community members
* Education in health and community participation
* Participation of women
* Complexity of technology
* Spare parts availability
* Standardization and local manufacture of equipment
* Commonality with other sectors
* Capacity of private sector
* Cost recovery mechanisms
* Willingness and ability to pay
* National and regional economies
* Logistics and transportation
* Government leadership
* Government agencies and staff
* Regional autonomy
* Policy and legislation
* Communication and information sharing

The WASH study uses a star diagram, where each branch of the star indicates the relative importance that each primary actors play in O&M management, namely:

* national government water supply and sanitation agency
* regional government water supply and sanitation agency
* private sector
* community organization

Although in many countries the water agency is just one main actor, and that other actors could be included (i.e. public authorities, ministries, district councils,...), the star diagram has the merit of showing that a management system is composed of a blend of different actors.

In this sub-module, 3 case studies are proposed: (see supporting material)

1. Botswana, with a one tier system
2. Yemen, with a two tier system
3. Belize with a three tier system

A one tier system, is a highly centralized system, where all activities are undergone by the water agency. Two and three systems are partially or greatly decentralized systems, where two or three main actors are involved.

Overhead sheet 1

From WASH Technical report No. 71.

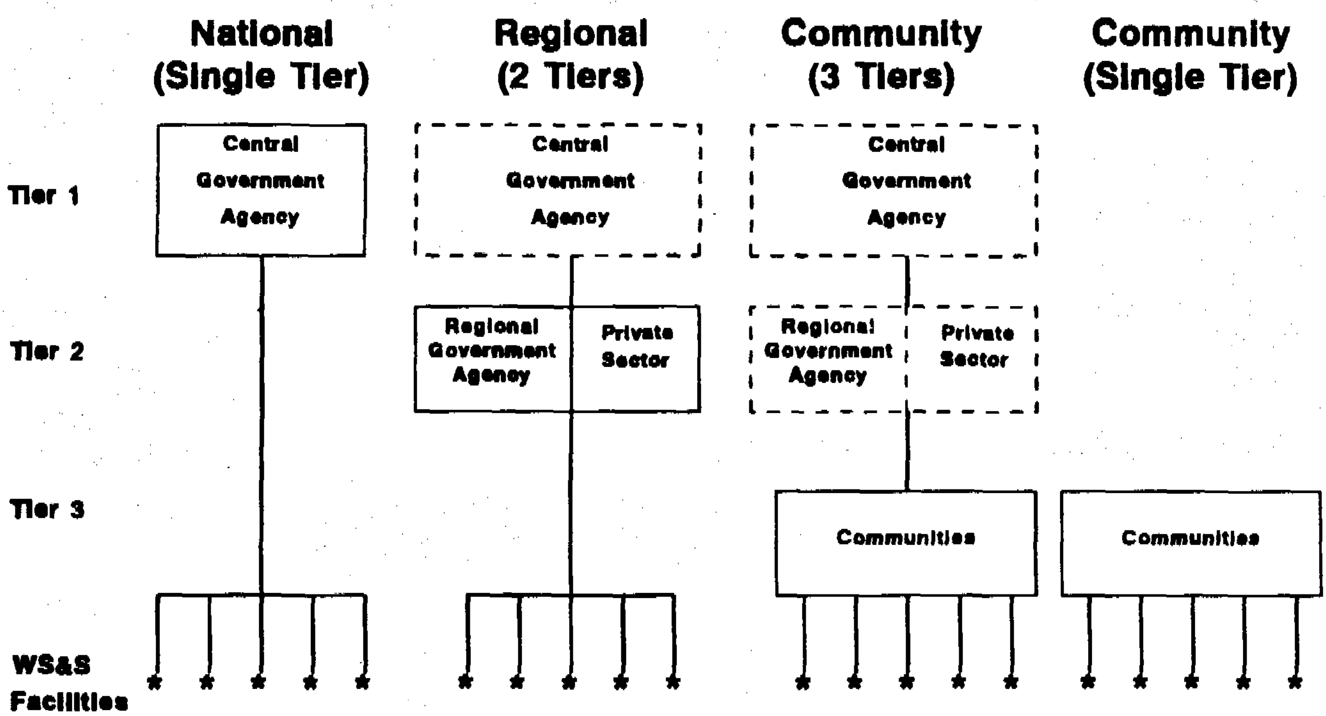
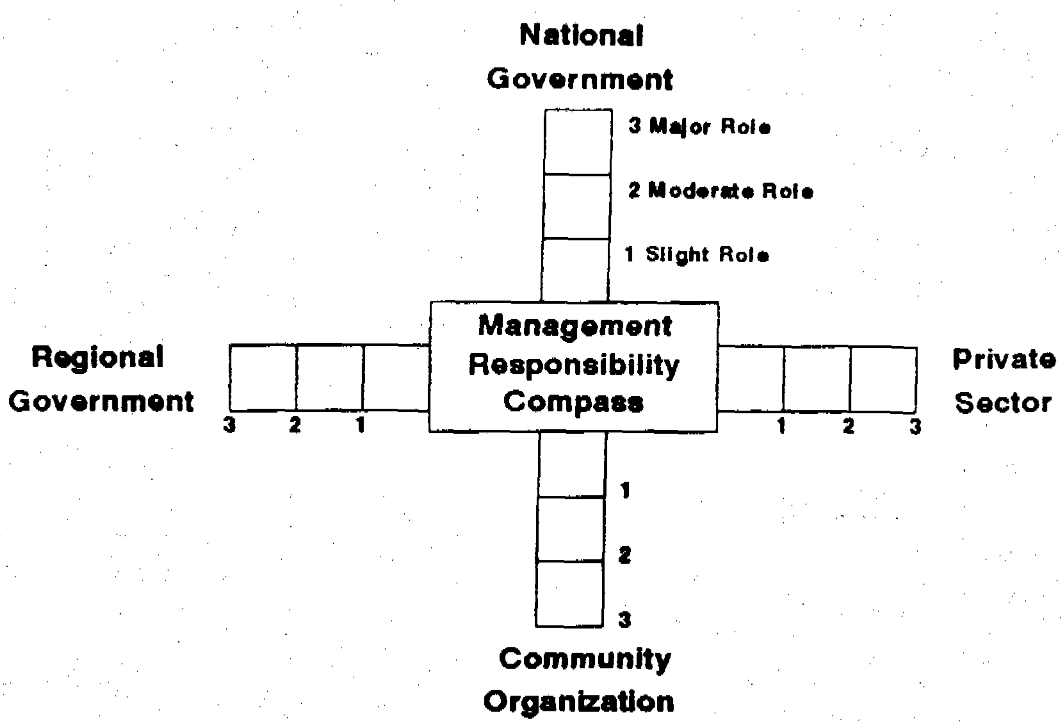


Figure 1

Management Models and Tiers of Responsibility

Overhead sheet 2

From WASH Technical report No. 71.



Star Diagram: Responsibility of Actors in O&M Management

Overhead sheet 3 / Exercise sheet

Type of scheme: ___________________________________
(water supply or sanitation)

MANAGEMENT RESPONSIBILITY TASKS	NATIONAL GOVERNMENT	REGIONAL/ DISTRICT GOVERNMENT	PRIVATE SECTOR	COMMUNITIES	OTHER (SPECIFY)
Preventive Maintenance					
Minor Repairs					
Major Repairs					
Provision of spare parts					
Other (Specify)					

—: not involved
x : partialy involved (specify)
xx : greatly involved

Supporting material

Case study of Botswana, from WASH Technical Report no. 71.

4.1 Botswana

4.1.1 Description of O&M Management System

Background

Botswana was one of the poorest countries in the world until the discovery of diamonds in the 1970s brought about a dramatic change. At first, the effects of this new wealth did not reach beyond the diamond-producing towns. But the Government of Botswana drew up a series of National Development Plans to spread the benefits of mineral exploitation throughout the country. The goals for employment and rural development included the construction and maintenance of water supply facilities in the villages.

Basic Principles

The policy has been designed to:

- provide safe piped water to urban and rural dwellers,
- retain government responsibility for operation and maintenance,
- collect user fees in urban areas, and
- subsidize both construction and O&M costs in rural areas.

It has resulted from a realistic assessment of economic conditions in the country, which, with neighboring South Africa, offers employment opportunities for those with technical skills. Few people with good technical training remain in the rural areas. The government's desire to encourage people to stay and the prevailing lower income levels justify the subsidies to rural water users. The high cost of pumping water and of collecting user fees in these areas has led to increased funding for training, staff, and equipment from national sources.

In the large urban areas, a parastatal (the Water Utilities Corporation) develops water sources, installs water systems, and collects user fees to offset all costs.

Roles and Responsibilities of Parties Involved in Maintenance

Prior to independence in 1966, the few public water supply facilities were operated by District Councils. During the next 15 years, several new facilities (using diesel-driven Mono pumps) were added, initially with donor funds and technical assistance, and later with contributions from diamond-generated revenues. The government, believing that the District Councils would not be able to operate and maintain these new water systems, established the Borehole

Preventive Maintenance Service (BPMS) at 11 depots around the country to provide both preventive and corrective maintenance and repairs for public and private water systems. Although this service was subsidized, bad roads, long distances, and the increasing number of rural water systems (both public and private) conspired to render it ineffective. Planners became convinced that the District Councils would have to develop the capacity to operate and maintain rural water systems themselves.

In 1979-1980, District Council Water Maintenance Units (WMUs) were established as part of the Works Department in each district. By the late 1980s, several of the WMUs were upgraded to full department status within the District Council infrastructure. The WMUs and Water Departments (WDs) have primary responsibility for O&M, work in coordination with other government entities, and are empowered to contract with the private sector for purchase of equipment, supplies, and services. Village organizations have little or no responsibility for their water systems, except to appoint a pump operator who is paid by the District Council.

There are thirteen WMUs and WDs throughout Botswana, one in each district except for the largest district, where five subdistrict WMUs have been created. Several districts have also created subdepots to service water systems in remote areas. The WMUs and WDs have received considerable training and funding support (from both international donors and internal sources) since the mid-1980s, and are providing major and minor repair as well as maintenance services. All District Councils have trained mechanics, vehicles, and spare part inventories. In several of the better organized districts, a regular schedule of preventive maintenance is followed.

There are other agencies engaged in the operation and maintenance of rural water supplies. The water engineer and his staff at the Ministry of Local Government and Lands (MLGL) and the Department of Water Affairs (DWA) within the Ministry of Mineral Resources and Water Affairs (MMRWA) support the WMUs and WDs. The water engineer makes field visits and provides advice, and his office also oversees the budget process, establishing budgets and distributing funds for special projects (such as Drought Relief and Water Supply Rehabilitation), and acts as a liaison with the Department of Water Affairs at the national level.

DWA is responsible for the design and installation of facilities which, once completed, are turned over to the District Councils. The councils, through the MLGL water engineer's office, are given assistance in water system rehabilitation and upgrading when this becomes necessary because of population increases, drought, and aging equipment. Since the District Councils do not have borehole drilling or cleaning capability, DWA provides emergency services when borehole yields decline due to aquifer depletion, borehole collapse, or any other well-related problem. The services of the Borehole Repair Service—the renamed and reconfigured BPMS—are also available but are rarely used.

The District Councils have budgetary discretion to contract for private sector services. Yearly contracts with oil companies for the delivery of fuel and lubricants are typical in Botswana. Council departments also maintain accounts at various equipment and spare parts suppliers. In addition, several specialty repair shops rebuild fuel pumps or provide machine shop services.

Responsible Actors

In Botswana, a few national government employees have sole responsibility for all O&M activities. The responsibilities of these actors are shown in Figure 6.

Their duties are described below:

- *Pump Operators*: complete daily O&M checks including tightening drive belts, cleaning the engine and pump house, changing oil, and making entries in the pumping logbook. (Pumping logbooks have not yet been introduced at all sites.) Report all problems to the senior operator or, in case of emergency or breakdown, directly to the chief technician of the WMU or WD.
- *Senior Operator from the WMU or WD*: supervises all pump operators and reports O&M problems to the chief technician for action.
- *Chief Technician of the WMU or WD*: oversees all O&M operations at the council level. This includes scheduling work crews, procuring spare parts and equipment, prioritizing maintenance and repair work, developing and implementing budgets, maintaining borehole and village water system records at the District Council offices, and maintaining liaison with DWA and MLGL's water engineer at the national level.
- *Water Engineer at MLGL*: oversees the disbursement of funds to the WMUs and WDs for special projects. Oversees the work of the DWA in support of rehabilitation and drought programs.

WMU technicians are responsible to superiors at the District Council level and the water engineer to superiors at the Ministry level. These superiors have final budgetary authority and occasionally bring pressure to bear on O&M issues. While this has not been a significant problem, it has affected decisions.

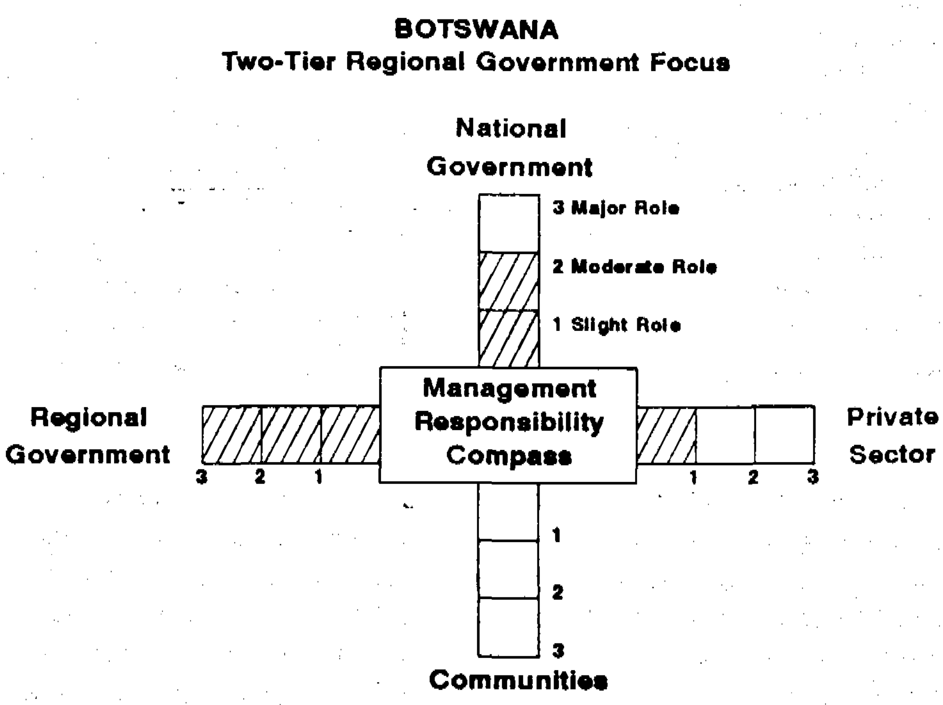


Figure 6

Botswana: Responsibility of Actors in O&M Management

4.1.3 Effectiveness of O&M Management System

In general, the O&M management system in Botswana is very effective. No more than 10 percent of the water systems are out of service at any one time, and response to breakdowns is on the order of two to four days. With a reserve of several days of elevated water storage, some villages continue to have water during breakdowns. Given differences in technician skill and district size, some districts provide more efficient service than others. On average, the number of breakdowns per borehole per year is 3.5. However, in districts with preventive maintenance schemes, the rate has fallen to one per borehole per year.

This success has been gained at considerable expense. In 1987, the recurring cost was $2,500 to $3,500 per borehole, which included salaries, building maintenancr, tools and equipment, spares, and fuel. The per borehole cost for spares alone was between $450 to $650. These costs are considerably more than most governments are willing or able to meet to assure reliable water supplies for rural communities. The single most important factor in the success of the O&M program in Botswana is that the government can afford to bear these costs from the national treasury and does so. Other significant factors include equipment standardization, availability of spare parts, and good communication among District Council technical personnel, the MLGL's water engineer, and the DWA.

4.1.4 Future Problems and Trends

Over the past several years, donor support has largely been in the form of technical assistance, with all capital and recurrent costs being met by the Government of Botswana. The change will have implications for sector capability. In the past, the government has contracted with the private sector for services it has difficulty providing, particularly in the design of water systems. The private sector may be used even more in the future.

Given the success of the rural water supply program in Botswana, there appear to be few problems. However, difficulties could arise from the government's assumption of complete responsibility. Rural dwellers have gained high expectations of service at no cost, and elected officials eager to keep constituents happy could pressure government agencies and District Councils to expand services to ever smaller communities. Already, some villages of less than 300 are scheduled to have their own systems. If the government can no longer finance the construction and O&M of rural water supply facilities, it will be difficult to introduce a fee structure, even for only partial cost recovery.

At present, there is no serious consideration of introducing water user fees in the villages. The emphasis is on completing the construction of systems in progress and rehabilitating existing systems. There also is a growing effort to upgrade training programs, provide career opportunities for skilled individuals at the WMU and WD level, and institute countrywide recordkeeping and preventive maintenance programs. This may be difficult with the withdrawal of technical support from donors (due in large part to the success of programs and the decreasing financial need of the country). Although many Botswanans are very capable, the program has been significantly aided by expatriate skills.

Finally, there are efforts to more closely link the water supply programs to health education and health awareness. The separation of DWA in MMRWA and health workers in the Ministry of Health, as well as the emphasis on the construction and O&M of water systems, have caused this aspect to be neglected. Botswana has a well-focused, well-organized, and well-functioning O&M management system that depends in large part on adequate funding, standardization of equipment, and ease of procurement. This is quite unique in the developing world and highlights the wide range of factors that must come together to make O&M work smoothly.

Supporting material

Case study of Belize, from WASH Technical Report no. 71.

4.4 Belize

4.4.1 Description of O&M Management System

Background

There are two types of rural water supply systems in Belize, which differ greatly in level of service, community involvement, maintenance responsibilities, engineering, and cost. The first are the piped water systems consisting of a water source (drilled well or spring), electric or diesel pump sets, storage tanks, and house-to-house connections. Families install outdoor yard taps or full indoor plumbing according to their means.

Currently, there are 19 such systems in the country, typically serving 500-1500 people through 75 to 200 connections. They have been designed by the urban Water and Sewerage Authority (WASA), constructed by private contractors, and are operated by community water boards with support from the Rural Water Supply and Sanitation Program (RWSSP) in the Ministry of Natural Resources. Much of the funding has come from USAID. The responsibilities of actors in O&M management, for which WASA has prepared a manual, are shown in Figure 9.

The second type of rural water supply uses handpumps, approximately 600 of which have been installed in shallow drilled wells. Many of the larger communities have several handpumps, each serving two to 10 families. The first model of choice was the U.S.-made cast iron Dempster, but more recently the Indian-made steel Mark II model has been favored for its reliability. Prior to 1985, pumps were installed and maintained by the Ministry of Health, but they are now installed by the RWSSP and maintained jointly by the communities and RWSSP regional maintenance crews.

The RWSSP has a central office near Belize City (shared with the main WASA depot) that includes a large store for handpump parts, a vehicle and well rig repair shop, and administrative offices. It also has regional offices in three of the six districts in the country, with each regional crew responsible for two districts. The regional facilities are smaller, but include an office, a depot for vehicles and supplies, and, in some districts, stores with parts and tools.

The responsibilities of actors in O&M management for the handpump systems are shown in Figure 10.

CARE has installed several piped water and handpump systems with support from USAID and UNICEF and follows the same approach as RWSSP. However, CARE has more personnel and resources to support its projects.

While considerable progress has been made in extending coverage, there are still many communities without improved water supplies where families use hand-dug wells, surface water sources, and, most commonly, simple rainwater catchment devices. Recent projections estimate the need for approximately 30 more handpumps to reach full rural water supply coverage.operated by local families themselves. Recent projections estimate the need for approximately 30 more piped water systems and 700 more handpumps to reach full rural water supply coverage.

BELIZE
Piped System: Three-Tier Community Focus

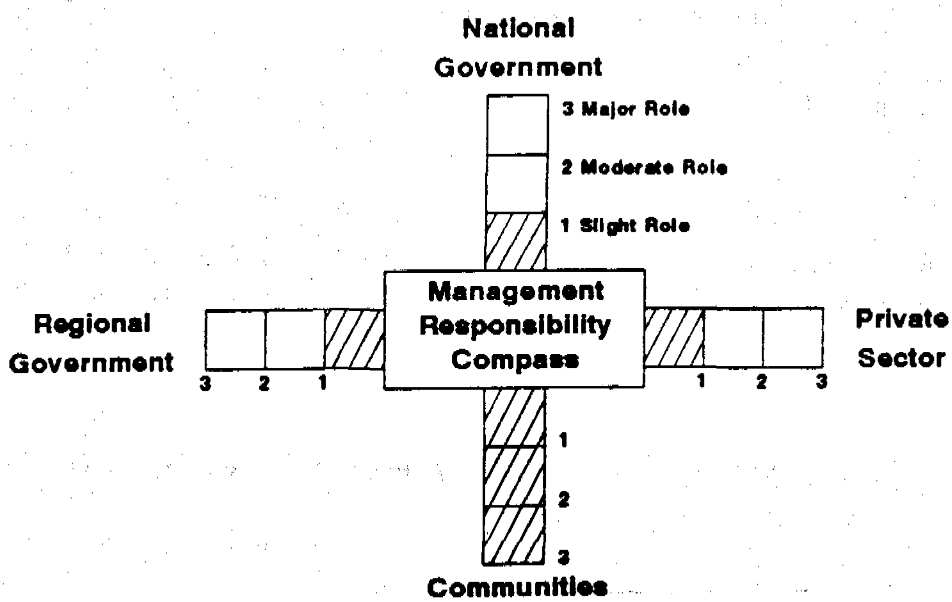


Figure 9

Belize: Responsibility of Actors in O&M Management

BELIZE
Handpumps: Three-Tier Regional Government Focus

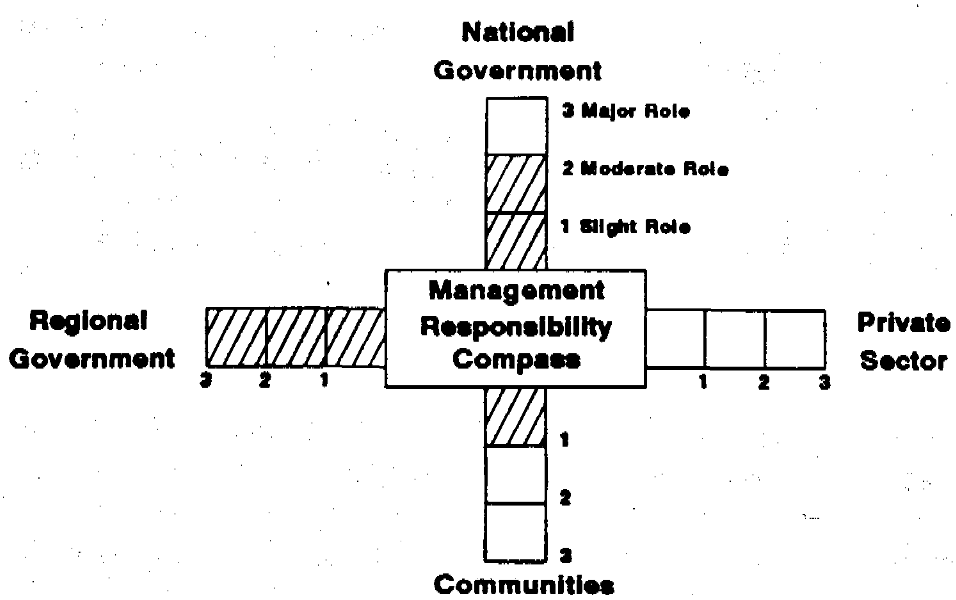


Figure 10

Belize: Responsibility of Actors in O&M Management

Piped Water Systems

The three-tier O&M management of piped water systems places primary responsibility in the hands of community Boards of Management (BOMs). Regional government offices at the second level provide technical and managerial support and training, and the central government at the top oversees regional government operations and sets water and sanitation policies. The communities can use private mechanics.

The BOMs have a manager, treasurer, secretary, several representatives from the community, and a paid staff. These elected bodies set budgets and tariffs, collect and manage funds, and decide on system expansions. The typical system has an operator to run the pump, do minor repairs, keep logs, and perform other basic O&M tasks, a billing clerk, and, in some cases, someone to keep the books and handle cash.

The BOMs essentially are independent of the government, and operate and maintain the systems with their own resources. If the operator has a problem, the BOM will call upon private mechanics or equipment and parts suppliers and solicit the advice of the regional government office. There have been few breakdowns or maintenance problems because the systems are still quite new and most use reliable electric pumps. In the beginning, the regional and even the central government would provide money or equipment to fix a breakdown or other serious problem, but this practice has been discontinued, except when a community has a legitimate need.

Communities with piped water systems benefit from considerable training, technical support, and monitoring in all aspects of system operation, including O&M, budgeting, financial management, administration, community involvement, and health and hygiene education.

The O&M budgeting and cost recovery system is an important element of the piped water management system. The regional offices (or CARE) work with communities to establish budgets in the first year or two, with ample provision for all O&M costs, including electricity or fuel for engine/pumps, chlorine, staff (operator and clerks) wages, maintenance and repair costs, as well as a sinking fund for future replacement of the engine/pump. Communities establish flat rate tariffs in accordance with these budgets and do not hesitate to cut off households that do not pay. Monthly tariffs typically are US$3.50 for basic service, with additional charges if sinks, showers, or toilets are used. The connection fee is US $12.50. These rates are well established and well accepted. Many of the piped systems have been able to build up a reserve of US$1,500-$3,000 in the sinking fund for future outlays.

Handpumps

The O&M management of handpump systems is very different. Communities have nominal responsibility, but regional government crews do most of the O&M work. The central government is obliged to import parts and the role of the private sector is negligible.

In theory, village councils are supposed to organize volunteers for minor above-ground maintenance such as lubrication of handle pivots and other wear points, and cleaning and upkeep of the pump apron or surface drainage/soakaway system. In practice, council members do some of these tasks themselves, or they are not done at all. No fees are collected, there are few tools, and no parts are available locally.

District maintenance crews keep busy chlorinating the wells and performing the more complex down-hole repairs on broken pumps and also spend a considerable amount of time installing new pumps.

Government of Belize (GOB) policy calls for the establishment of "safe water groups" to conduct minor maintenance and ensure cleanliness around handpump wells, but these have yet to be formed in most areas of the country. The policy also calls for an appointed village pump mechanic (with tools) to perform preventive maintenance and minor repairs with the support of the district maintenance team. This three-tier maintenance system operates only sporadically and has not yet been fully developed or formalized.

Fortunately, the handpumps have proved generally reliable to date. The Indian Mark II, installed in the deeper wells, has had an excellent record, while the Dempsters have required somewhat more frequent repairs.

While the extent of community involvement in handpump O&M may seem inadequate, it is a considerable improvement over what prevailed in the early 1980s. At that time, the systems were regarded as the property and full responsibility of the Ministry of Health (MOH), and the people were afraid to touch them.

A significant increase in community involvement in O&M is unlikely. Training and equipping villagers to conduct down-hole repairs would not be cost effective. Given the long period of GOB control of the handpumps, people have never paid for service or repairs. In some locations, the villagers prefer alternative water sources (hand-dug wells or rain water). They do not like the high mineral content of the groundwater that handpumps provide and are not willing to pay anything. Once piped water systems arrive, handpumps may disappear as second-rate technology.

The potential for private sector involvement in handpump O&M is limited. Because the pumps generally have been reliable, the demand for spare parts is low and there is no market for private sector participation in maintenance or repairs.

4.4.3 Future Problems and Trends

O&M management in Belize needs strong community participation in handpump maintenance, which will require more effective extension, training, and community organization. The GOB does have clear policies in this regard but they have not been successfully implemented. Further study can determine how these policies should be applied or whether they need modification.

Maintenance management at the central and district levels also needs to be improved through better planning, preventive maintenance schedules, work order procedures, cost accounting, and system records. The vehicle pool, supplies and parts storage, and distribution facilities could profit from an immediate infusion of resources that would be cost effective in the long run.

There has been considerable discussion about the merger of the RWSSP (which is part of the Ministry of Natural Resources) into the WASA (the semi-autonomous urban water authority overseen by the Ministry). The merger probably will take place soon and will undoubtedly involve some transfer of personnel and disruption of activities. There is a feeling in the RWSSP that this administrative change will adversely affect the RWSSP's field orientation.

Supporting material

Case study of Benin, from WASH Technical Report no. 71.

4.7 Benin

4.7.1 Description of O&M Management System

Background

The Republic of Benin has seen considerable change in the past five years. Recent elections have installed a government that has begun economic reforms to rescue a country on the verge of financial ruin in 1989. Benin offers an example of an O&M management system successfully implemented at the project level and now embodied in national policy.

The Benin Rural Water Supply and Sanitation Project, begun in 1987 as a joint effort by USAID, UNICEF, the Peace Corps, and three government agencies, aimed at improving the health and living conditions of rural populations in selected regions. Its primary objectives were:

- drilling boreholes and equipping them with handpumps;
- constructing demonstration latrines;
- creating and training village committees for self-management of the water and sanitation systems;
- providing education and training in health and hygiene;
- reducing the incidence of guinea worm disease in the heavily infested project zone; and
- establishing a system of O&M with private sector participation in repair and spare parts distribution.

In accomplishing all these objectives, the project has provided a model for a national water and sanitation policy.

National Policy

This policy is guided by the following key principles:

- WSS facilities must be constructed only where the demand for them and the ability to maintain them have been demonstrated.
- The maximum participation of local government and community organizations must be fostered.

- Communities must be given primary responsibility for managing their WSS systems, including financing the O&M and at least part of the capital costs.
- Health education and sanitation facilities must be accorded equal importance with water supply as essential components of health improvement.
- Women must be encouraged to play a larger role in community management.
- Handpumps must be limited to three models to allow competition but still maintain regional standardization.
- Research must continue to seek the cheapest means of providing water and sanitation facilities, with particular emphasis on solar energy, large diameter wells, and piped water systems.
- The private sector and nongovernmental organizations must be given a larger role.

Project-Level O&M

Since the Rural Water Supply and Sanitation Project has been so successful, a description of its operating elements will provide some useful insights into O&M management. At the national level, the Water Agency in the Ministry of Energy, Mines, and Water Supply heads the sector and collaborates with the Ministry of Health and departments of social affairs and sanitation. The project has established an interministerial coordinating committee that includes representatives of the principal government implementing agencies, the Ministry of Planning, and all donor organizations, and the technical assistance contractor. The committee periodically reviews the project work plan and any pressing issues that require approval or solutions.

The regional offices have considerable independence. One position in particular, that of field agent for the various government offices, is critical for the efficient functioning of the sector. The field agent is responsible for day-to-day contact with the communities and is the catalyst for establishing health committees to manage all sector activities at the village level. The agent trains the committees, conducts courses in health and hygiene, monitors ongoing activities, and sees to it that the private sector repairman and the spare parts distributor provide good service. The field agent, in summary, is the pivotal link between the government, the communities, and the private sector.

There is one repairman for about 20 villages, trained and certified by the project and paid at rates fixed by the Water Agency. Preventive maintenance is required every six months, and transportation is provided by the village whenever the repairman is needed. Spare parts are stocked by local businesses within a reasonable distance of the villages. A national level importer assures entry of spare parts and distribution to the regional businesses.

The community maintains a bank account for its O&M fund and potentially may obtain loans, although the processing of community loans has not yet become functional. The community is fully responsible for managing its system as the de facto owner. A health committee oversees O&M activities, ascertains the needs and interests of people regarding water, sanitation, and health, and is responsible for collecting the user fees decided by the community. Communities must establish an O&M fund as a prerequisite to the construction of a WSS system. All management decisions, such as how the system is to be used and who may use it, are made entirely by the community.

When the pump breaks down, the health committee summons the repairman and pays him from the fund or occasionally with money raised at the time. Sometimes the repairman will provide his services on credit. The responsibilities of the various actors in O&M management are shown in Figure 13.

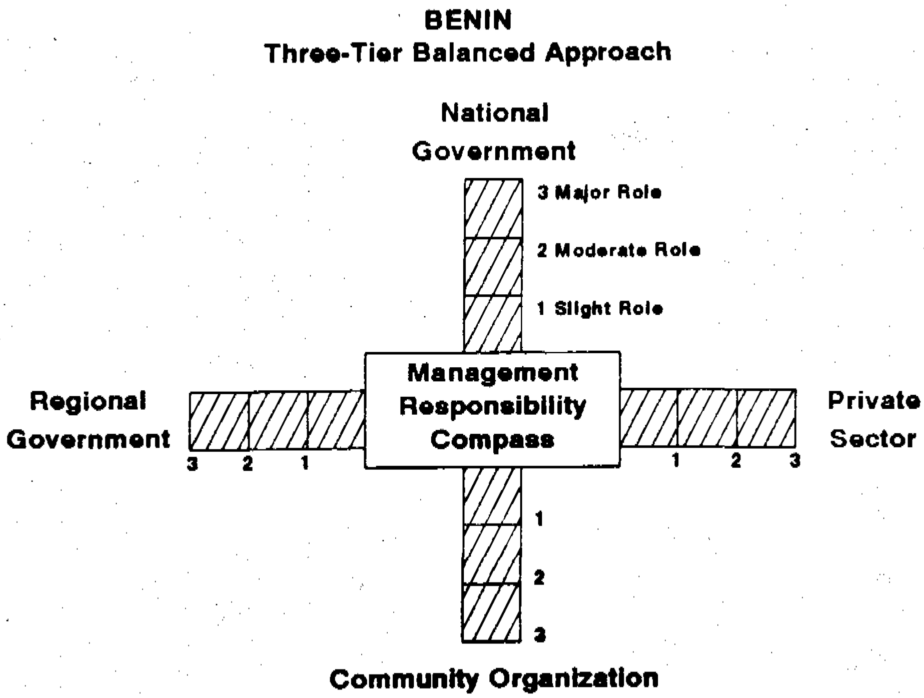


Figure 13

Benin: Responsibilty of Actors O&M Management

4.7.3 Effectiveness of O&M Management System

O&M management under the USAID project is very satisfactory. The health committees take action when needed, pumps are repaired without delay, and the private sector is providing service as planned. However, the project is to be terminated shortly and some reduction in effectiveness can be expected. Other areas of Benin have not all had the degree of inputs that the USAID project has provided and therefore do not function as well. Nonetheless, the present O&M management system is the best in the circumstances.

4.7.4 Future Problems and Trends

The existing O&M system at the project level and at the national policy level is exemplary. All the requisite components are in place including appropriate technologies, community management, education in heath and hygiene, and a well-conceived O&M system. Critical staff within the communities and government agencies have been well trained and are capable of carrying out their duties. However, the national economy is fragile and consequently the maintenance and repair program which is dependent on private market forces is also fragile. As long as the economy continues to improve, particularly in the rural areas, the O&M system should be able to sustain the benefits of the WSS facilities that have been installed.

For further reading

Bastemeyer T., Visscher J.T., (1986). Maintenance systems for rural water supplies. IRC Occasional Paper Series No. 8. The Hague, The Netherlands, IRC International Water and Sanitation Centre.

Konye, A. et al. (1987). Involving the beneficiaries in Operation, Maintenance and Financing of Rural Water Supply, ILO, Geneva.

Roark P., Hodgkin J., Wyatt A., (1992). Models of management systems for the operation and maintenance of rural water supply and sanitation facilities. WASH Technical Report No.71. Arlington, USA, WASH.

Yacoob, M. and Roark, P. (1990). Teck Pack: Steps for implementing rural water supply and sanitation projects. WASH nr. 62, Arlington, USA, WASH.

5.3 COST ESTIMATION AND COST RECOVERY

Description of session

OBJECTIVES

- To identify constraints regarding cost estimation and cost recovery of O&M
- To provide an overview on cost estimation methods
- To work on a practical case

OUTLINE OF SESSIONS

• Participants identify constraints related to cost estimation and cost recovery, using 2 cards, one for each. Cards pined on the board and briefly discussed.	15 min
• The facilitator helps to broaden the scope of the discussion and highlights main points focused by the group	30 min
• Group exercise done in plenary to estimate O&M costs (see §4)	45 min
	1 h 30 min

HAND - OUT

- Extracts of background information and supporting material.

MATERIAL NEEDED

- Cards
- Overhead projector

Background information

1. Constraints

Constraints regarding cost estimation:

* identification of O&M activities not clear
* identification of requirements not clear
* schemes are too small to carry this exercise
* poor awareness of future needs
* no methods of estimation (rule of the thumb, percentage of capital costs, often used)
* spares difficult to find, therefore difficult to price
* no distinction regarding different tasks and actors and involved
* poor knowledge of financial principles
* no bookkeeping
* economic environment too unstable to make any kind of provision
* no links between cost estimation and cost recovery
* engineers, financial analysts and economists have different perceptions of the problem
* cost estimation done on a basis of just financial considerations without considering the economic and social environment
* O&M considerations have been poorly taken into account during the planning phase

Constraints regarding cost recovery:

* community income low
* decrease in subsidies
* national economic policies (for example, impact of structural adjustment policies)
* population pressure
* poor system of collection
* unrealistic/inappropriate tariff structure
* poor willingness to pay
* benefits of improved water supply not perceived
* cultural belief that water is free
* lack of political will
* sector not linked with other sectors
* no cross-subsidization
* available public funds are inadequate to meet recurrent costs
* poor knowledge of locally available resources
* poor links between cost estimation and cost recovery
* decrease of budget allocations
* in a context of economic difficulties, O&M costs are considered as too high for the agency to bear alone
* economic environment unstable
* the cost sharing approach between the agency and the community is not well established
* inadequate links between cash flow and budgeting systems
* poor financial planning
* corruption

2. Cost estimation

The cost sharing or partnership approach is brought forward in this course, where costs and responsibilities are shared between the agency and the community or the users. The reasons for a greater involvement of the community are presented in sub-module 6.1.
The right balance of responsibilities is a pre-condition for the success of the approach. It will depend on the negotiation power of both parties and on a clear identification of requirements and tasks as well as on the willingness of the community to maintain and finance its schemes.

However, procedures in estimating costs for the agency and for the community differ in nature and amplitude, since expenditures which are highly relevant for the agency , such as personnel salaries and allowances or running of vehicles and replacement of equipment, are not for the community.
Furthermore, the community can only undergo certain tasks.

Finally, before proposing a format for cost estimation, some clarification should be made on the services provided by the agency. Are they free of charge ? Are they partially financed by the users ? If yes, in what way ? And for what price ?
Bearing in mind then that a service provided by the agency on request by the community can become a cost for the community.

<u>O&M cost estimation for the agency</u>

The contents of this sub-paragraph on O&M cost estimation for the agency, are taken from the WASH Technical Report No.48, "Estimating operations and maintenance costs for water supply systems in developing countries" (1988), by James Jordan and Alan Wyatt.

The individual elements that constitute O&M costs are :

* Personnel
* Materials
* Chemicals
* Utilities
* Transport
* Private contractors

*** Personnel**
Four elements of staff cost must be determined prior to estimating personnel costs: job classification, number of personnel in each classification, amount of overtime expected, average wages including benefits such as field allowances, vacation and sick pay.

*** Materials**
The operation and maintenance of water systems involves the use of a variety of types of materials, usually considered in two categories - supplies and spare parts.
The basic process for estimating material costs is to determine what items will be needed, how much of each, and the unit cost of each. Thus, information will be needed on:

- details on all equipment, facilities and components of the system
- details on the nature and frequency of O&M tasks to be performed
- unit costs for parts and supplies to be used.

*** Chemicals**
The basic approach to estimating chemical costs will be to determine chemical needs from water sample test results, records and engineering plans. Then using local unit prices, annual chemical costs can be calculated directly.

*** Utilities**
Utility costs are made up of two components power costs and telephone communications. The cost of powering operating equipment depends primarily on three factors - the characteristics of the motors, their daily operating times and the cost of energy. To estimate the cost of telephone service, the planner will need to analyze the way the water board or authority uses its phone system and to obtain a rate schedule from the phone company.

*** Transport**
Estimates of transport costs are based on an assessment of transport needs and unit travel costs per vehicle.
Transport of personnel is for preventive maintenance, repairs of pumps, motors, engines, piping and tanks as well as system inspections, cleaning of intake structures, water meter reading, leak detection programs, water quality monitoring to which should be added transport of materials and supplies.
The next step will be to define the transport needs for each of these tasks with: type of vehicle required, round trip distance to be travelled, frequency of trips.
Once the transport needs are well defined, the transport costs per kilometre must be estimated including the cost of : fuel, lubricants, tires, insurance, maintenance and repairs, driver labour and amortization of capital cost of vehicles.

*** Private contractors**
Private contractors are frequently used to service the equipment and structures that compromise a water system. The first step taken to estimate the cost of using the private sector service is to establish which maintenance tasks will be performed by private contractors and then to inquire about their fees.

For more details, please consult the cited manual.
An additional remark should be made on financial costs
such as :
. repayment of loans + interest rates
. banking fees
. inflation rate
. currency devaluation
These elements can be of such an amplitude that the agency will have to take them into account in the estimation of O&M costs.

<u>Cost estimation for the community</u>

This exercise can be done in four steps:

- identifying O&M tasks for the community
- identifying requirements in terms of labour and materials
- estimating costs
- taking into consideration variations in time and minimizing costs

*** Identifying O&M tasks for the community**
This step has been explained in the module on technical requirements and consists mainly in determining for which tasks the community is responsible.

*** Identifying requirements in terms of labour and materials**
LABOUR Who and what ?
unskilled: users, group of women,community group,maintenance or water committee, caretaker, local mechanic, storekeeper, taking care of regular maintenance + small repair and replacement
skilled: qualified mechanic, private contractor, public service, mobile team, occasional engineer, trainer, accountant, taking care of maintenance activities, major repairs and replacement, training / refresher course,
management, emergencies, laboratory service
MATERIALS what ?
supplies: depending on the type of water system used: cement, sand, bolts, wood, nails,glue, welding rod, lubricating oil, grease, paint, cleaning equipment, stationary. These refer to consumer items, mainly for general use and are often purchased in bulk.
spare parts: these refer to specific components or sub-components of equipment such as: bearings, valves, seals, rising main, pump rod, screens, pipes, pipe connections belts, plugs, engine spare parts etc... and in some cases spare parts for a bicycle or a vehicle.
replacement: after a period varying from 5 to 20 years, according to the life span of the equipment concerned, major parts will have to be replaced, depending on the policy and will of the community.

*** Estimating costs**
LABOUR costs ?
unskilled: . voluntary work (local monthly wage X fraction of time spent)
. salaries (average wage+social security+bonuses)
. incentives in cash or nature
skilled:
. salaries (monthly wage+social security+bonuses)
. incentives
. fees (for mobile team, lab. service, trainer)
The number of interventions in a year can be obtained by comparing similar projects in similar conditions.
MATERIALS costs ?
supplies: Purchase of each supply for replacement of its use monthly or yearly, according to activities specified in the maintenance plan, (subject to variations of price)
. Unit price X quantity used for a year
spare parts: Initially, in many projects, the caretaker or committee are provided with some spare parts. Their need depend on the quality of the maintenance and life span of each item. Information can be obtained from the manufacturer and from records of use of similar equipment in the country.
It is essential then to draw a list of spare parts.
At the beginning, needs will be low, but will increase as equipment gets older. Price is subject to inflation, exchange rate variations and importation regulations.
. per item: unit price X quantity needed for this year

replacement: For a full cost recovery, replacement costs should be included, but if the community's affordability and commitment is low, they could be omitted.
Replacement cost calculations are based on the life span (years) of material used.
The use of a present value of future costs method, including a discount rate, is difficult to use in the context of unstable and fragile economies and at a community level a rate of return of O&M replacement costs has not necessarily a meaning. Simpler depreciation methods could be used.

*** Costs vary in time**
The first year, the amount spent for repairs and replacement will not be the same as the amount spent
during the fifth year. Costs of preventive maintenance activities might be the same though during five years.

*** Minimizing basic costs**
Minimizing costs does not mean reducing the quality or the quantity of water produced.
Minimizing means using local resources in an optimum way in order to reduce costs.
Some examples:

LABOUR
unskilled: voluntary work, food for work, use of extra water for gardening or livestock...
skilled: fixed contract with mechanic, fees determined in advance, incentives, use of one specialist for several water scheme... (economies of scale)
MATERIALS
supplies: use of available résources
spare parts: interchangeability with another model, parts locally made, parts imported from a neighbouring country...
buying with other nearby schemes for economies of scale.
replacement: local production, efficient distribution network, relationship with assistance programme for currency availability.

A remark can be made about the possible long term effect of cultural and social factors on O&M costs.

3. Cost recovery

Again two distinctions can be made wether cost recovery is analyzed on the agency or the community's point of view.

Cost recovery for the agency

According to the WASH field report no.48, Principles of tariff design for water and waste water services, (1991) by David Laredo, methods for cost recovery can be based on :

- metering based on actual use
- flat rates
- water-using fixtures
- taxes/government funds
- surtax on other utility fees
- privatized service
- connection charges and assessments

For more detail, refer to cited manual (and supporting material).

Cost recovery for the community

Financing options available at community level are dealt in sub-module 6.3.

4. Cost estimation exercise

It is composed of four phases:

A. Preliminary phase:
The facilitator will have to choose well in advance which out of the seven schemes analyzed in this course ,is the most appropriate to study in the country
According to this choice, the facilitator will have to inquire about the cost of the different components and services included in this particular scheme and relevant for O&M. A list of cost should be prepared and handed over to the participants.

B. Presentation:
The facilitator presents the chosen scheme and the game He hands over the list of costs.

C. Cost estimation (on a annual basis):
Participants are divided into two groups:
. one representing the community
. one representing the agency
Each group identifies its tasks and requirements.
Each group estimates the costs of these requirements, using the hand-out, on an annual basis and gives simple proposals on how to recover these costs

D. Getting together:
Each group presents its results through a rapporteur, and the facilitator concludes by highlighting the shortcomings and the need for a good partnership in financial planning.

Overhead sheet 2

ELEMENTS OF O&M COST ESTIMATION FOR THE COMMUNITY

LABOUR COSTS?

- UNSKILLED
- SKILLED

MATERIAL COSTS?

- SUPPLIES
- SPARE PARTS
- REPLACEMENT

Overhead sheet 2

ELEMENTS OF O&M COST ESTIMATION FOR THE AGENCY

PERSONNEL

MATERIALS

CHEMICALS

UTILITIES

TRANSPORT

PRIVATE CONTRACTORS

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

Chapter 2

OPERATIONAL ISSUES

This chapter reviews the operational issues involved in establishing or extending tariffs for cost recovery and discusses their applicability to different types of utilities and programs.

2.1 Costs Included in the Tariff

The principle underlying the imposition of direct charges for publicly provided services is that the cost of these services should be recovered from the beneficiaries. Tariffs have become the established mechanism for this recovery.

The costs to be included in tariffs for water and wastewater services are widely debated. Some combination of these costs, which are discussed in this section, is applicable to most utilities. If the total cost of providing service is recovered, the utility can function as a completely self-sustained unit.

2.1.1 Operations and Maintenance Costs

A minimum expected of most tariff systems is the full recovery of O&M costs, which can be classified into the following categories:

- Payroll
- Power
- Fuels, lubricants, and chemicals
- Materials, supplies, and equipment
- Miscellaneous

Payroll

Payroll costs cover salaries, bonuses, and all allowances paid directly to employees for work performed, and the costs of employee benefits such as paid vacation and sick leave, holidays, pensions, and medical, life, and other social insurance.

Supporting material

Power

This category includes the cost of operating pumps and other electrically driven equipment (e.g., air conditioning and office machines) and of lighting. Power costs are related to the level of service provided and only a very small portion of these costs can be considered fixed.

Fuels, Lubricants, and Chemicals

Costs in this category are related to the O&M of vehicles and mechanical equipment, and to treatment processes.

Materials, Supplies, and Equipment

These costs are for items consumed in a given budget year. Equipment costs may include a component for assets that are used for more than one year but whose useful life is relatively short (see Section 2.1.2—Capital Costs).

Miscellaneous

This category serves as a catchall to ensure that O&M costs not included in one of the categories above are part of the total to be recovered through the tariff. Miscellaneous costs can include the following:

- Property/liability insurance
- Regulatory expenses
- Rent/lease payments on properties not easily classified by function
- Bad-debt allowances
- Contributions to working-capital reserve fund
- Contributions to emergency reserve fund

If the utility's accounting practices provide for such allowances and its budget is large, the amount of the last four costs listed can be very high. In general, a bad-debt allowance is the amount charged per year to system users for noncollected revenues of past years or an amount expected during the current year. Contributions to working capital and short-term interest are charges to system users to cover funds spent in a given year to make up for cash-flow shortages. Contributions to emergency reserves are charges to users to cover funds spent on unexpected repairs or to alleviate short-term cash shortages that are difficult to predict.

Supporting material

Most tariff systems ordinarily are designed to recover total O&M costs. **The most important consideration is to ensure that all these costs are identified.** The categories described above have been found convenient, but any comprehensive and logical classification will suffice. The system selected should be one that best suits the individual utility or program.

2.1.2 Capital Costs

The cost of long-term investments in capital assets must be included in financial planning and cost-recovery applications. Capital assets are such items as pumps, pumping stations, and sewage treatment works that have a useful life of several years. Nonphysical assets such as land and water rights, whose useful life has no limit, also represent investments. Accounting conventions use two methods to estimate capital-financing requirements: the cash-flow (cash-based) approach and the assets-valuation (cost-based) approach.

In the cash-flow approach, capital receipts and expenditures are shown as they are received or incurred, followed by outflows in accordance with loan amortization (principal and interest) schedules. Capital costs therefore are sensitive to interest rates, grace periods, and other terms.

In the assets-valuation approach, capital costs are estimated by using depreciation techniques and establishing a required rate of return on assets. Depreciation is the value of fixed assets consumed during the accounting period. It is usually calculated on the basis of historic accounts on a straight-line basis. For example, if an asset is expected to last 40 years, one-fortieth of its cost is attributed to each year for 40 years. Another way of calculating depreciation is by applying a fixed percentage to a reducing balance. The cost of the return on assets is that percentage of the value of depreciated fixed assets (total capitalization representing the cost of capital) equal to the amount required to cover capital costs. The rate of return on assets expected by public authorities can be viewed as a performance regulator. The higher the rate, the higher the cost requirement. Surpluses created by a high rate of return may or may not be sufficient to fund future assets. This will depend on the existing capital structure and cash flow.

Both approaches may involve policy decisions outside the authority of the public utility. The rate of return on capital assets may be based on comparisons with other public utilities in the country or elsewhere. Loans are often negotiated by a national government through bilateral and multilateral agreements, and the details of interest rates and repayment schedules are then passed on to the public utility concerned.

The choice of method used to calculate capital costs will depend on the sophistication of the organization's accounting system. Correct and comprehensive asset valuation will be difficult if its records are not up to date or do not reflect the true depreciated value of capital assets.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

Another point to be considered in setting tariffs is that capital assets with a short life (say automobiles) should be covered by a policy that defines them as either a capital or an O&M expenditure.

Box 2: Costs Included in a Tariff

<u>Operations and Maintenance Costs</u>

Payroll
Power
Fuels, lubricants, and chemicals
Materials, supplies, and equipment
Other
- Operating interest (short term)
- Fund reserves

<u>Capital Costs</u> (annualized)

Physical assets—buildings, treatment plants, vehicles, etc.
Nonphysical assets—land, water rights

2.1.3 Operating Interest Expenses

Operating interest is the cost of short-term borrowing to cover deficit cash flows, which result either from a deficiency in the utility's commercial operations (e.g., billing and collections) or from a failure to set the correct limits for operating funds or to administer these funds efficiently. Operating interest is a legitimate cost for recovery through the tariff. However, if it is historically high or increasing, it may be more prudent to establish special funds (see below) than to continue borrowing.

Borrowing to finance all or large portions of O&M costs is a bad practice, however, and should be avoided. Some utilities post all interest expenses as a single line item, with no differentiation between interest for operations and interest on capital expenditures. If interest is to be recovered by the tariff, care should be taken to classify the type of interest correctly.

2.1.4 Fund Reserves

Many tariff structures allow for revenues to be deposited in special funds. Two examples are funds for O&M expenses (working-capital funds to cover lags in cash flow) and for emergency or contingency reserves (to cover emergency repairs or other unpredictable expenditures, e.g., an increase in the cost of electricity).

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

Other funds are reserves usually stipulated in the terms covering borrowed funds for long-term debt. One such fund is a debt reserve fund, which is set equal to the amortized annual payment required to retire the debt. It may be established as part of the initial amount borrowed or built up over a few years from revenue. However the debt reserve is set up, its proceeds should be used only for debt retirement. Thus, if the utility is unable to cover its debt payments, the fund may be used and then built up again. If the fund is intact throughout most of the debt period, it can be used to retire the debt ahead of schedule.

Another fund is one used to pay off capital investments routinely made but hard to predict. Extensions to water mains or sewer systems and modifications or improvements to structures are examples of projects covered by such funds.

The level of reserve funds may be determined by historical records and the budget planning process. It is important to limit such funds to projects that can be completed (or the investment expended) within a single budget year.

2.1.5 Metering and Connection Costs

House connections and the purchase and installation of meters can result in considerable capital expenditures for utilities. In general, individual connection costs are considered to be the responsibility of the homeowner. Metering and other connection costs can be borne by either the homeowner or the utility, which can then recover them through the tariff. By bearing these costs, the utility can exert greater control through the installation of standardized facilities that lower the initial cost to consumers and thereby attract more customers. The converse is that these costs may be high and thus unduly burden the utility.

2.1.6 Return on Investment

Cost-recovery systems have been designed to include a higher return on investment (ROI) than is necessary for capital-cost requirements so as to create a surplus (see Section 2.1.2), which utilities often use as a contingency against unexpected costs. If a surplus is produced, it can be used to stabilize tariffs in future years, to finance needed capital expenditures, or for debt retirement.

Ideally, the ROI should recover only the opportunity cost of capital. An effective argument could be made for recovering costs without any surplus; most utilities do provide services on a no-surplus basis. The purpose of considering ROI in setting tariffs is to compare the return with that of like investments in other sectors.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

2.2 User Classes

User classes are the categories in which utilities classify their customers. These categories are determined by administrative requirements (e.g., variations in billing, fees, and meter sizes) and the necessity to monitor and regulate the service. Each utility decides on the number and designation of user classes it needs, but almost every utility will have the following categories:

- Residential
- Commercial
- Industrial
- Institutional
- Government
- Wholesale

Box 3 indicates various combinations of user classes within the broad categories identified above.

Box 3: Various User Classes

- Broad Designation of User or Customer Class

  Residential, commercial, industrial, institutional, government, wholesale

- Secondary Designation within Class

  Single or multiple family
  Served via direct connection, inside dwelling or facility
  Directly served via dedicated connection outside of dwelling or facility (e.g., yard tap)
  Indirectly served via standpipe or roadside tank
  Directly or indirectly served via tanker truck or special vendor
  Low-level users (i.e., minimum service)
  Users with private, individual supplies

- Tertiary Designation within Class

  Metered or fixed-charge accounts
  Fire service accounts
  Privately maintained accounts

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

User-class designations will depend on the complexity of the service provided and on any special administrative or legal requirements. For example, a single customer class would suffice for a system serving customers with the same use pattern. By contrast, several designations of users would be required for systems with a diverse customer base in which there are significant variations in water use or in which services are provided to other utilities and industries.

The variation in designations can be readily seen from Box 3. The secondary and tertiary designations indicate the possible subdivisions in user classes based on level of service (see Section 2.3) and administrative legal requirements. Residential users, the largest number of accounts in almost any system, can be subdivided into one or more secondary or tertiary designations such as metered and fixed-charge accounts. A more complex group of user classes would result from dividing the broad user designations into one or more of the secondary designations and further indicating which of these could be described as metered, fixed-charge, or "free account" customers.

Commercial and industrial enterprises are usually the largest users of service and are separately designated as a user class. Utilities with formal tariff systems often use meter size to define these accounts; if a metering system is not used, a special account code is usually assigned.

Institutional accounts (schools, hospitals, houses of worship, and facilities owned by charitable organizations) and government accounts (government facilities and public buildings) often show the same use patterns as residential, commercial, or industrial accounts. They are given a separate designation because of the manner in which they are charged for service or the need to monitor and regulate service. The same is true of the user class designated as wholesale customers, who are generally large users covered by a special contractual agreement with the utility. Generally they are other utilities that are provided with bulk services, but it is not unusual for utilities to have a few extremely large users classified as wholesale users.

The designation of user classes depends on the size and mix of the customer base, the complexity of service provided, the variations in demand, legal requirements or special arrangements, and the method of cost recovery used.

2.3 Level of Service

For water supply, level of service defines the quantity, quality, and pressure levels provided. For wastewater, it defines the adequacy of disposal and treatment. Thus, levels of service can be uniform or can vary with the customer class or the topographical characteristics of the service area. For instance, a utility providing a minimum level of water supply service could provide water for a few hours per day at a single location or at a few locations (say

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

standpipes) throughout the service area. Full service could be viewed as water supply throughout the service area, for 24 hours a day, at adequate pressure, and through a mix of house connections, yard taps and standpipes, and special vending arrangements.

Level of service is a basic consideration for service providers because it is the most significant parameter in determining capital investments and O&M costs. Defining the level of service to existing and new or extended systems requires the consideration of many technical and institutional issues, discussed below.

Institutional Considerations:

- National/regional development objectives
- Financing
- Capability of entity providing service
- Water supply and sanitation demands and expectations of the service population (demand forecasts)
- Willingness to pay for the service by the served population

Technical Considerations:

- Appropriate levels of technology
- Topography of service area
- Capacity of the source of supply
- Quality standards of the service provider (either legislated or adopted as common practice)
- Quantity and quality of water to be supplied and wastewater to be disposed of
- Pressure levels to be maintained (water supply only)
- Method of collection and final disposition of effluent (wastewater only)
- Hours of continuous service

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

2.4 Cost Centers

2.4.1 General

Cost centers provide tariff analysts with a convenient mechanism to determine the components of a utility's total cost of service. For purposes of tariff determination, the cost-of-service analyses for most water and wastewater utilities can be accomplished by disaggregating costs to the level of discrete units or activities and then combining each unit's costs to produce a logical set of cost centers. Use of cost centers facilitates the design of tariffs to cover all or part of the cost of providing service. The key to relating cost-center analysis to tariff design is to select groups of activities and facilities for which costs can be readily determined and which illustrate the cost of providing discrete components of service. These groups can be combined into cost centers and then allocated to user classes.

A detailed explanation of how to establish cost centers and allocate costs is presented in the WASH report, *Guidelines for Cost Management in Water and Sanitation Institutions*, Report Number 2 in the Financial Management Series. Box 4, which shows a sample intersection of organizational structure and cost center structure, is adapted from that report.

In analyzing water supply and sanitation systems, many alternative cost centers can be envisaged. Perhaps the easiest is one made up of discrete subsystems, the costs of which can be determined individually. A more complex system would be a large urban or regional system in which the activities required to provide service often overlap. In this type of system, determining the cost of various activities is obviously more difficult.

Ordinarily, the database for determining the cost of each cost center is documentation that supports the financial accounting and budgeting systems, combined with the engineering and operating data logged as part of the utility's operations. If the analysis recognizes that within a given system or subsystem some user classes benefit more than others, costs can be allocated accordingly.

The choice of cost-center structure and the methods used to determine costs depend on the nature of the service provided. A small system with few user classes may be a cost center in itself. Larger systems may require more than one cost center, depending on the nature of the service. Consider, for instance, a water system that has several discrete distribution systems served from a common source, conveyance pipeline, and treatment plant. Costs related to the distribution systems could probably be directly determined and thus directly allocated to each discrete system. The costs related to source development, transmission, and treatment, however, require an indirect method of allocation. In this case, the average or maximum daily water supply delivered to each distribution system could be used. The overall administrative and engineering costs required to sustain the system would also require indirect allocation to each system.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

Box 4: Sample Intersection of Organizational Structure and Cost Center Structure

	Departments						
	General Manager	Chief Engineer		Maintenance	Finance	Personnel	Customer Relations
Functions		Plant Mgmt	Construction				
General Admin.	√				√	√	√
Supply			√	√			
Water Treatment Raw Water		√	√	√			
Wastewater		√		√			
Water Distribution Installations			√	√			
Repairs			√	√			
Waste Collection Installations			√	√			
Repairs			√	√			
Billings	√						√

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

The analysis described above applies in situations in which costs are recovered totally or partially from the users benefiting from the service. However, the application need not be limited to cost-recovery situations; it has definite advantages in any program providing service. These advantages include:

- Identifying costs for use in program design, including system upgrading or extensions
- Monitoring comparative costs among systems to identify possible inefficiencies
- Identifying the cost of components of sectoral programs or overall sector costs, as well as the level of subsidy required (if such a policy is established) for each component or the sector as a whole

2.4.2 Cost Center Allocations for Centrally Provided Service to Large Urban or Multi-service-area Jurisdictions

The concepts presented above are easily applied to a utility responsible for a single service area with a uniform group of customers. Detailed cost allocations are unnecessary and a single cost center can be established. However, if the service area has several customer classes receiving varying levels of service, costs may have to be allocated to components of the service. The question is: Do service levels vary enough to justify varying charges for customer classes? If they do not, cost recovery can be based on the total cost allocated to the service area.

Many utilities serving large urban areas impose a single tariff even though service levels vary, perhaps because of the difficulty of accurately allocating costs among customer classes. There are also many cases in which service is provided at equal levels but tariffs for large residential users and commercial and industrial users differ from those for smaller domestic users. Higher rates are justified on the basis of income distribution, equity, and high demand elasticity, especially if the water is a very small component of the total cost of production. Lower rates, on the other hand, are justified because they result in economies of scale, reducing distribution and billing costs for a single large consumer.

Difficulties tend to arise when one jurisdiction is responsible for several service areas, providing different levels of service at varying costs. If the jurisdiction is governed by a policy that requires tariffs to be based on actual costs of service, some cost allocations may become complicated. These are costs for:

- Office of the director
- Financial and accounting activities

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

- Billing and collection
- Human resources (including recruitment and training)

They are classified as administrative costs and can be further classified as O&M and capital costs, as explained earlier. For the most part they are O&M costs, except for those related to engineering work and the work involved in acquiring the financing for capital projects, and must be separated by cost center or service area. However, the detailed records to do this are often not readily available. Indirect administrative expenses—for example, administrative support provided by other agencies—are even more difficult to allocate.

In these circumstances, information is usually gathered from interviews with employees; estimates of employee time and other costs by supervisors; work-order analyses; and analyses of the number of employees serviced, records handled, and bills prepared. Subsequently, data can be collected to make these allocations more quickly and accurately, but this would probably require investments in new practices and procedures (see Section 2.7).

2.5 Efficiency of the Operation

An important consideration often overlooked in establishing tariff systems is the efficiency of the operation. Customers will react favorably to good service and will be willing to pay for it. Conversely, poor service will evoke universal opposition to new or revised tariffs.

Utilities must be completely honest in evaluating their standing with their service populations, either through sample household surveys or management audits by the staff or outside consultants. If deficiencies are uncovered they should be rectified, if necessary with additional funding as part of any new financial plan or tariff structure.

2.6 Unaccounted-for Water

A measure of efficiency often used is unaccounted-for or nonrevenue water, which is the difference between the volume of water produced or delivered into the network and the volume of water consumed, whether metered or not. This difference can be determined from the volume billed or, for nonmetered systems, from the estimated volume reaching customers.

Unaccounted-for water is primarily the result of leakage or wastage prior to delivery and inaccurate meter readings. It can also be attributed to the inefficient identification of delivery points and to poor billing systems. High levels of unaccounted-for water represent wasted resources and are symptomatic of poor operational performance. A level of 15 percent or

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

less is acceptable and indicates that a utility has this component of its operation well under control. But levels between 30 and 50 percent are not uncommon.

Utilities can track down unaccounted-for water by leak detection surveys, large-meter calibration programs, and field surveys of large users. Identifying the level and causes of loss is important for tariff design and financial planning. Lowering the level will decrease per-unit production costs and postpone the need for investment in capital works to increase capacity. The utility can often enlist the aid of its customers in identifying wastage and leaks by showing that reduction in unaccounted-for water will ultimately benefit them.

2.7 Institutional Capability

Institutional capability may not be equal to the complexity of a new tariff design for several reasons:

- The accounting and financial systems do not produce data that will allow proper cost tracking and allocations or proper revenue recognition.
- The billing and collection systems are not adaptable to the new tariff.
- Staff members do not have the expertise to implement the new system.
- Customers are confused by previous policy and practices and are likely to oppose a revised tariff.

If utilities have been charging for service and recovering costs from the beneficiaries, there might be few problems. The opposition of customers who are used to paying for water and wastewater service can probably be taken in stride. However, utilities without a commercial orientation must carefully consider the imposition of new tariffs that require new systems and procedures and a transformation of customer attitudes, recognizing that a radical change may cause intra-organizational disruption and may require a transition period and possibly extra investments.

A typical situation would be one in which a governing board or legislative body announces a change in tariffs and expects the utility's operations to continue exactly as before. Implementing the new tariff may require investments for revised systems and practices. While this is going on, revenues may actually decrease (accounts receivable will increase) as customers adjust to the new tariff. The utility's cash flow may slow and operations begin to suffer. If these conditions continue, the deterioration of the utility's physical and

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

administrative systems may advance to the point where it is in worse financial condition than before the new tariff was imposed.

As part of any tariff revision, the socioeconomic impact should be considered as important as the financial justification. For example, willingness-to-pay studies should be conducted to define price elasticities (see Section 2.9). Changes in staff levels or to systems and procedures should be carefully considered, and any extra costs should be included in the new tariffs. The impact of a possible short-term drop in cash flow should also be estimated. If possible, the new tariffs should be phased in only after all customers have been informed.

2.8 Stipulations of External Agreements

When planning changes in tariffs, the utility must also consider the requirements mandated by external agreements, which are often similar to those for special fund reserves (Section 2.1.1). Financial needs may lead utilities to accept external loans without fully considering their effect on tariffs and institutional capability. This can lead to ineffective implementation of tariffs, delays in programs, and lower levels of output.

2.9 Willingness/Ability to Pay

A basic theme underlying the design of most tariff programs is that people are willing to pay their fair share for good service. The key to this is consumer expectations and accepted practice. Expectations differ. What is acceptable to customers in one area may not be at all acceptable to customers in another. Past practice often influences customer expectation. For example, if water and sanitation services historically have been provided for little or nothing, planners cannot expect customers readily to accept the idea of paying what these services cost.

Willingness to pay must be carefully evaluated when designing tariffs based on cost recovery. Past practices, the level of service to be provided, household income, and the amount and types of costs to be recovered should all be considered in this evaluation. (See WASH Field Report No. 306, *Guidelines for Conducting Willingness-to-Pay Studies for Improved Water Services in Developing Countries*.)

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

Chapter 3

STRATEGIES FOR COST RECOVERY

A cost-recovery strategy covers both the systems and practices used to measure the service and those used to assess and collect charges. At one end of the spectrum are the free services provided by many rural systems at a cost borne by the government. At the other are systems that recover all or very large portions of their costs through tariffs.

There are some axiomatic notions about cost recovery and tariff design that are worth reviewing:

- If water and wastewater services traditionally have been provided at little or no charge, the imposition of tariffs will rarely be immediately accepted by the users. Often, educational efforts and improvements in the quality of service are necessary to gain acceptance and ensure timely payment.

- No service is actually free. If it is provided without charge, the service provider must rely on some outside source to supply the funds. For government entities, this involves trade-offs among competing infrastructure sectors, which are necessary to foster national, regional, or local development objectives.

Box 5: Key Cost-Recovery Implementation Strategies

- The bases for imposing charges are easy to explain and the structure and level of tariffs are equitable and easy to understand.

- The collection methods are based on long-standing or accepted practices.

- Prior to implementation the entity imposing and/or collecting the tariffs fully explained the intent and reasons for imposing or changing the tariffs.

- The entity recognized that after implementation, justifiable complaints would arise and established mechanisms to settle such complaints efficiently.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

3.1 Selection of Strategies

There are only two types of cost recovery—direct and indirect. Direct cost recovery relies on a quantification of the units of service provided and charges for these accordingly. Indirect cost recovery is based on the concept that all consumers are entitled to the benefits of water and wastewater services regardless of the cost.

Direct cost recovery for water systems can be based on quantity, pressure, elevation, availability, location, and purity. Generally, if levels of service can be defined easily by user class, quantity provides the most convenient measure. For wastewater systems, the considerations are quantity and biological, chemical, or toxic loading levels. Indirect cost recovery for both water and wastewater may rely on government revenues, various forms of taxation, general assessments, privatized service, or even barter. Some common methods of direct and indirect cost recovery are listed in Box 6.

Box 6: Types of Cost-Recovery Methods

		Usually Applied To	
Charge Basis	Method of Measuring Service	Capital Costs	O&M Costs
Actual use	Metering	√	√
Flat rates	Estimates	√	√
Water-using fixtures	Inventory	√	√
Taxes/government funds	Estimates	√	√
Surtax on other utility charges	Proportion	√	√
Privatized service	Estimates	√	√
Assessments	Estimates	√	-
Connection charges	Estimates	√	-

Successful cost-recovery methods have the following characteristics:

- They are appropriate to the size and complexity of the utility and the socioeconomic context in which the service is provided.
- They are capable of being understood by those who bear the costs.
- They are acceptable to governing bodies and are within their institutional capabilities.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

- They are smoothly implemented and easily administered (see Box 5).
- They show an equitable relationship between the allocation of costs of service and the various user classes.
- They have a built-in mechanism that will compensate for variations in service provided.

3.2 Methods of Cost Recovery

3.2.1 Metering Based on Actual Use

Meters have many advantages, chief among which are that a device to measure a quantity of service implies impartiality, and that the capital and O&M costs of meters are not large in comparison with other utility costs. Water meters are available in a wide range of prices, are relatively simple to install, and require minimal periodic maintenance. The consumption they record appears on a bill, and customers readily understand the cash register analogy. Other advantages are the ability of the utility to exert control by encouraging water sales through use of declining block rates (charging less per unit of consumption as total consumption increases); fostering conservation by increasing block rates; and regulating peak demands (often on a seasonal basis) through pricing policies. The utility can also impose higher charges on large users.

The principal disadvantage with water meters is that minimal maintenance often gets translated into no maintenance. A utility must have a maintenance unit to install, test, repair, and replace meters; storage facilities for new meters; a records system to track installation, repairs, and testing; and specially equipped vehicles for work in the field. Some utilities avoid maintenance by using disposable meters. These are generally inexpensive, cannot be adjusted or repaired, and are used with the understanding that they will be thrown away when they stop functioning.

In addition to a maintenance staff, a utility must have meter readers and a system for transferring meter readings to the billing center and for notifying the maintenance unit of meters in need of repair or replacement. To be responsive to customer complaints, it must be ready to reread meters and to adjust bills if complaints prove valid. Doubts about the accuracy of meters can quickly lead to customer resistance to the cost-recovery mechanism, and, if they are not speedily resolved, can result in attempts to influence meter readers, intentional damage to meters, and illegal connections.

The metering of sewage for the residential, commercial, or small industrial customer usually has been found unsatisfactory. The solids, grease, and other components of the sewage flow have a tendency to clog meters, causing them to misregister or simply stop. Instead, cost

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

recovery is based on the premise that a percentage of the metered water delivered to customers is returned as wastewater. Engineering studies are often used to determine this percentage for the major customer classifications. For wastewater flows generated by large or specialized industrial users, metering may be appropriate and, in some cases, necessary to measure not only the quantity discharged but also the rate of flow.

Metering is favored by international lending agencies, especially for water supply service to medium-sized and large cities. The use of meters has been stipulated in many international development projects because they are seen as a means to control consumption through the pricing mechanism. Meters make the user participate in the marketplace for water, where costs of supply are made explicit through tariffs.

3.2.2 Flat Rates

Flat rate cost recovery is easily implemented, administered, altered, and explained to consumers and provides predictable cash flows. It is appropriate for utilities with a single customer class (or relatively few customers) and no metering capability. All water is sold at a fixed rate, often adjusted to the size of the connection.

The main disadvantage of flat rates is the lack of concern or accountability for waste. This is less of a problem when the majority of the consumers have fairly uniform and limited needs. Special fees can be incorporated into flat rate systems to accommodate extra use, e.g., watering gardens.

Flat rates are more appropriate for wastewater than for water if water supplies are not metered. In metered systems a flat rate as a percentage of the water bill is often charged for wastewater service.

3.2.3 Water-using Fixtures

Cost recovery based on the number of water-using fixtures (e.g., sinks, showers, hot water heaters) is an accepted practice, especially if there is no metering. It has the advantage of appearing equitable, because it is assumed that the fixtures in one facility will use approximately the same amount of water as the same number of fixtures in another.

The major disadvantage is the time and cost required to make the initial inventory of fixtures and to establish customer charges by relating the fixture count to unit flows. Moreover, once such a system is established, it is difficult to update the database at regular intervals. This causes many utilities to neglect this requirement.

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

3.2.4 Taxes/Government Funds

The government entity under which the utility operates may have a policy requiring all costs for water supply and wastewater service to be met from general taxes or other sources of revenue.

Special taxes for water supply and wastewater services are not uncommon in many U.S. cities. For decades the United Kingdom has used a property-tax surcharge known as a water rate. The taxing authority is granted to tax districts by the governing bodies involved. There is little documentation of this practice in developing countries, but neither is there evidence that social taxes to provide basic services are prohibited.

Government funding of basic services relieves a utility of the administrative cost of revenue collections, but it deprives it of the leverage on users through pricing mechanisms and of the motivation to run its operations efficiently. A particular disadvantage in developing countries is that government agencies are not noted for paying their bills to one another readily; seldom do they transfer tax revenues. Further, in times of stringent economic conditions, government cutbacks could lead to underfunding for O&M and, in turn, to the deterioration of systems. At such times, utilities in control of their own finances would be better positioned to react to system needs and to plan for possible underfunding.

3.2.5 Surtax on Other Utility Fees

One of the less common cost-recovery methods is to combine billing for water and wastewater services with that of another utility, most often the one providing electrical service. This can be either a direct fee or a surtax on the primary utility bill.

The problem here is that many households receiving water supply and wastewater service may consume little electricity or none at all. In effect, therefore, large consumers of electricity pay their own share plus part of the low-users' share for water supply and wastewater service. This practice represents a tax on higher income households.

It may produce adequate revenue but is difficult to justify on the basis of equity, because many low-income households will receive virtually free water supply and wastewater services. This approach is valid only with the ability-to-pay argument and requires careful consideration.

3.2.6 Privatized Service

Several methods are used for supplying water to customers who do not have direct connections to water distribution systems. They range from rainwater catchments, deep and shallow wells, handpumps, surface diversions, and standpipes, to delivery by tank trucks, and community storage facilities. Supplies are provided at little or no cost to the users. Many

Supporting material

from: "Principles of tariff design for water and waste water services", WASH field report no. 348. October 1991, by David Laredo.

utilities soon realize that, as the demand grows with population growth in urban concentrations, it exceeds the limits of their ability to provide a free service. They often find a solution by encouraging distribution through private vendors or franchises. Costs are recovered from licenses for vendors and franchise fees. The franchise fee covers all or part of the cost of providing water; the franchisee is responsible for O&M of the facility, usually a public standpipe. Although vending fees also provide a degree of cost recovery, it is difficult to control the amount of water drawn by vendors.

The utility must ensure that water of acceptable quality is distributed and that there is no profiteering at the expense of the users. It must also recognize that vendor charges for services formerly provided free may evoke adverse reactions.

3.2.7 Connection Charges and Assessments

Two methods to defray capital costs are connection charges and assessments. Connection charges are levied per capacity unit, usually a standard dwelling unit. The charge by a water supply system constructed at a cost of $500,000 and serving 2,000 similar dwelling units would be $250 per dwelling unit. It could be paid in a lump sum or in installments. If consumers are allowed to finance their connections, there will be no saving of up-front capital requirements; these costs are best recovered in the general tariff. A variation would be to charge each dwelling unit a flat fee and finance the balance through a loan. Another variation would be to have each homeowner donate an agreed percentage of the capital cost per unit in labor or materials rather than cash.

Assessments are charges that reflect the value added to property by water supply or wastewater facilities. They are based on the area of the property or on the length of frontage along a roadway. The charges are collected in a lump sum, in installments, or in contributions of labor and materials.

3.3 Conclusion

Experience indicates that the most favored methods of cost recovery are metering and lump-sum charges or a combination of the two. But the best method for any utility is the one most suited to its particular needs. Its financial planners should use the broad guidelines discussed in making a choice, always recognizing that any choice will necessitate new administrative systems and procedures—and the expenditures they entail.

For further reading

Evans P., (1992). Paying the piper. An overview of community financing of water and sanitation. IRC Occasional Paper Series No.18. The Hague, The Netherlands, IRC Water and Sanitation Centre.

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World Health Organization, (1990). Handbook of financial principles and methods. WHO, Geneva, Switzerland.

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PART 2: KNOWING MORE ABOUT O&M

MODULE 6

TOWARDS SUSTAINABILITY

OUTLINE OF COURSE

PART 1: FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2: KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3: PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

6.1 COMMUNITY MANAGEMENT

Description of sessions

OBJECTIVES

- To define community participation and community management
- To identify what type of participation from the community can be expected in a water supply scheme; same for a sanitation scheme
- To identify ways to approach the community

OUTLINE OF SESSIONS: (2 sessions)

Session 1:

• Presentation of the video "Solutions and People" from the World Bank (26 min.)	30 min
• Discussion with participants on reasons to involve the community in projects; ask: "Why the community should participate"	15 min
• Presentation of facilitator on community management issues: highlighting:	
- differences between community participation and community management	
- characteristics of community management	
- preconditions for community management	
- task description of water committee	
- planning for community management	1 hour
	1 h 45 min

Session 2:

• Brief presentation of the three case studies divide participants into three groups	10 min
• Group analyzes a case study each each member of the group will go through the proposed case study individually and then in groups highlight:	50 min
- the concept of community management	
- its implementation	
- its limitations	
• Report on findings in plenary session (10 min each)	30 min
	1 h 30 min

HAND - OUTS

- Local knowledge and traditional leadership and other supporting material or background information
- Case studies

MATERIALS NEEDED

- video

Background Information

(most taken from the background paper of the international workshop on "The role of communities in the management of improved water supply systems", held in IRC, The Hague, in November 1992, prepared by Phil Evans)

1. About the video: "Solutions and people"

The World Bank has produced a series of three video cassettes on the theme of "Water Supply and Sanitation in Development":

Film 1: People and problems (29 min)
Film 2: Problems and solutions (42 min)
Film 3: Solutions and people (26 min.)

This course proposes to use the third film which is a good start for giving examples of community participation. This video is available upon request at the World Bank.

Objectives of the film:

* to increase awareness of the non technical considerations of water supply and sanitation project that, if ignored, could undo the whole scheme

* to motivate viewers to carefully plan, design and implement the process of introducing and installing new technology into a community by considering community participation, adequate institutional support and maintenance

* to inform viewers to use an interdisciplinary approach that includes health workers, social workers and engineering personnel during the introduction of a water supply and sanitation project

* to inform viewers about effective health education and community participation techniques

Content:

"Solutions and people" demonstrates the importance of including health education, user involvement and maintenance as critical components of a water and sanitation project. The film begins by describing how a mobile health clinic in Zimbabwe and a health worker in Nepal persuade communities to accept the idea of proper sanitation and personal hygiene.

The involvement of the users is illustrated through several examples:

1. an engineer in Nepal meeting with villagers before a water scheme is introduced
2. engineers in Malawi meeting with community members to determine the location of wells
3. cooperative technicians in Thailand who are aware that success of the project depends on the community accepting and cooperating with the people who initially meet with them to introduce it. In the last case, they describe a low-cost, self financing solution to the water problem: roof catchment tanks.

Positive results of users involvement are also given.

The film shows the importance of continuing care and maintenance, as well as maintenance of cleanliness standards at the standpipe. The critical role women play is explained. The film concludes by emphasizing that community participation is essential, although obtaining that participation is a complex task. The engineer must be sensitive to the feelings of a community, understand the people and gain their trust in order to implement a successful project.

2. Local knowledge and traditional management

The management of water supplies by communities is nothing new. At a common sense level, it is obvious that communities have managed their own water supplies for thousands of years. At the same time, new water supply systems imported from the outside make new demands and may require new approaches.
National, social and economic development can also undermine pre-existing community management systems and reduce their appropriate and effectiveness in new settings.

3. Defining community participation

Community participation can be defined in many different ways, but it is important that all those working in a project have a common understanding of what it means.

This concept can be understood so broadly as to be referring to the entire political and economical process of the country: popular participation then becomes an another term to designate democracy, full employment or access to the means of production, and equitable distribution of income. There is a large gap between these general goals and the kinds of activities typically carried out in the name of participation.

Community participation could be defined as the involvement of the local population in the decision - making concerning development projects or in their implementation.

10 reasons advanced for Community participation

1. With participation, more will be accomplished
2. With participation, services can be provided more cheaply
3. Participation has an intrinsic value for the participants
4. Participation is a catalyst for further development
5. Participation encourages a sense of responsibility
6. Participation guarantees that a felt need is involved
7. Participation ensures things are done in the right way
8. Participation uses valuable indigenous knowledge
9. Participation frees people from dependence on others
10. Participation makes people more conscious of the causes of their poverty and what they can do about it.

(from A. White, 1981, IRC)

4. Defining community management

(From P.Evans, 1992, IRC)
According to the dictionary, to manage is to "organize; regulate; be in charge of something;" and managing is " having executive control or authority".
To participate in the other hand, is to "take part or share in something".

On this basis, community management is more than participation in that it emphasizes the communities' own decision making power over those water supplies or components for which they hold or share responsibility.

Characteristics of community management
Community management is strongly linked to the idea that communities own their water supply system. As owners they have the responsibilities and decision-making power.

Community responsible for:
- * Maintenance and repair
- * Regulation of use
- * Local management organization
- * Financing

Community decides on:
- * Technology choice
- * Service level
- * Form of local organization
- * Use regulations
- * Financing mechanism

Preconditions for Community Management

- * There must be community demand for an improved system.
- * The information required to make informed decisions must be available to the community.
- * Technologies and levels of service must be commensurate with the community's needs and capacity to finance, manage, and maintain them.
- * The community must understand its options and be willing to take responsibility for the system.
- * The community must be willing to invest in capital and recurrent costs.
- * The community must be empowered to make decisions to control the system.
- * The community should have the institutional capacity to manage the development and operation of the system.
- * The community should have the human resources to run these institutions.
- * There should be a policy framework to permit and support community management.
- * Effective external support services must be available from governments, donors, and the private sector (training, technical advice, credit, construction, contractors, etc.).

Source: McCommon et al, 1990.

Top-down, bottom-up, or partnership ?

Choosing community management is more than a simple choice between top-down and bottom-up approach. The idea that the community management should be based on a partnership suggests that limits are recognized. Although communities may be able to take on a very substantial share of management responsibility, agency involvement may always be required to some degree.

The principle agency role in the future has been seen by some to be that of facilitating management by communities (cf. Briscoe and de Ferranti, 1988). This can involve anything from establishing suitably supportive legal and policy frameworks, to providing skills training and ensuring that the necessary spare parts are locally available.

Community management is likely to mean changes in the role of, supporting agencies. Community management capacity needs to be built and supported. Agencies will need to concentrate on new and different inputs than in the past and make the change from being **providers to facilitators.** To do this, they will have to build new capacities of their own, as well as assisting in building capacity in communities.

Capacity building for community management can be seen to have different levels of meaning. As its most basic, it refers to the strengthening of skills in communities to enable them to perform management tasks. This includes the provision of technical training for the performance of routine operation and maintenance, book-keeping and financial control methods, guidance on how to develop and implement community monitoring and evaluation systems, health education, water committee organization and involvement of women, among others.

The growing emphasis on management, rather than participation, has led to the development of innovative and more participatory capacity building methodologies that place the emphasis on developing learning and problem solving abilities rather than simply transferring technical skills.

Water management on a broader scale means that governments will always have an overall responsibility to ensure that national resources are protected and properly used, and national public health standards maintained. Certain technical requirements, such as the maintenance of sophisticated water treatment works or the monitoring of water quality, may also be beyond the capacity of communities to perform.

Ownership or responsibility?

The idea of community ownership raises complex questions. Sometimes communities may not perceive themselves as the owners of systems for the very good reason that from a legal standpoint they do not have ownership rights. The question is not so much "who owns the system ?" as "who is responsible for taking care of it ?" (Wood, 1983). Many business enterprises are run by managers who do not own them, but who nevertheless accept responsibility for their success or failure. Acceptance of responsibility is highly important. In India, communities were found to have a very low level of perception of their own role as managers, with handpumps being seen as the government responsibilities. They therefore did very little to take care of them.

Local knowledge and community management
Although it is often said that development programmes should build on local knowledge and experience, this is not often overlooked in practice. In supporting the further development of community management, more information will be needed about existing traditional knowledge and indigenous approaches to water management.
While it would be a mistake to assume that local knowledge and practices always provide the best solutions, greater efforts need to be made to both acknowledge that local solutions do exist and to make serious efforts to link new approaches to existing ideas.

Local organization for community management
It is generally assumed that new water supply technologies need new forms of local organization to manage them.
Governments and donor agencies typically require communities to establish water committees to coordinate local management of new schemes. As an alternative, the necessary management tasks can be undertaken by existing development committees or other similar organizations.
The degree of autonomy of local organizations can also vary, with some being closely tied to formal government institutions and others being much more informal and independent.

Task description for a community water committee
* To represent the community in contacts with the agency
* To organize contributions by the community, in cash or kind, towards construction, and towards operations and maintenance
* To organize proper operation and maintenance, including supervision of caretakers
* To keep accurate records of all payments and expenditures
* To promote hygienic and effective use of the new facilities
* To hold regular committee meetings to discuss and decide on issues, procedures, and problems
* To inform the community regularly about decisions and to report on revenues and expenditures

Source: IRC, 1991.

5. Planning and community management
To improve the prospects for further success, community involvement should begin as early as possible in project development. If communities are directly involved in planning new schemes and deciding how they are to be run, chances are much better that the development will meet their own felt needs.

Attempts are being made to develop techniques to involve communities more closely in planning, but there is still a lot to learn. At the same time, it is important to recognize that governments may wish to pass management responsibilities to communities long after schemes have been built. In many cases communities may have had little or no involvement in project planning.

However, a practical guideline on how to involve the community could be matched with the actual different steps of the project cycle. Community mobilization in the field then becomes another operational matter which involves health and social workers.

The following has been adapted from Yacoob M., Roark P., (1990) TECH PACK: Steps for implementing rural water supply and sanitation projects. WASH Technical Report no. 62.

At each stage of a typical water and sanitation project, extension agents help the community to develop certain skills and complete certain activities required for each of the four components of the system: the water system, the sanitation system, hygiene education and community development. The engineers and the social scientists charged with the success of the project need to be aware of each other's efforts at each stage. The main activities of each stage are summarized below:

Stage 1 - Contact community
Meet with large and small groups of villagers to explain the possible future project, carry out a household survey together with the geohydrological study. Communities can already be involved in stating needs, constraints and wishes; furthermore a socio-economic survey will help to draw some important conclusions for the sustainability of the project, such as past experiences with existing water points, community's organizational capacity, community's affordability and willingness to pay, social cohesion, craftmanship, involvement of women and hygiene behaviour, for instance).

Stage 2 - Select project
Complete the detailed plans for the project including the future tasks related to O&M (costs, technical requirements, actors and roles, need for training, external support, availability of spare parts), establish selection criteria, make final selection with the community, and develop a work plan.

Stage 3 - Set up Water Committee
Inform the community about the responsibilities of a water committee, select water committee members and arrange contract between the community and the water committee.

Stage 4 - Prepare Water Committee
Train the committee in the skills needed to carry out its initial and future tasks: adopt rules on water use, establishing an O&M fund and a cost recovery mechanism, preparing for construction, selecting a caretaker, and identifying future O&M roles and responsibilities.

Stage 5 - Construct water system (or rehabilitate)
Train all personnel involved in construction, assist water committee to supervise construction and place system in service.

Stage 6 - Review and strengthen basic processes of environmental sanitation
Train extension agents and water committees for their hygiene education work, hold community meetings on hygiene and environmental sanitation, conduct health practices survey, and introduce and plan for latrine construction.

Stage 7 - Operate and maintain systems and handing over
Establish routine work patterns for water committees, pump and latrine caretakers and community members, strengthen cost recovery system, establish procedures for interventions in case of small repairs but also large repairs.
Gradually shift responsibility for the water and sanitation system to the community.

6. Methods to approach the community regarding sanitation
(See supporting materia)

7. Case studies
In the supporting material, 3 case studies are proposed, each illustrating an actual case of community management:

* Guatemala: Agua del Pueblo
* Uganda: Community management systems for rural water supply
* Indonesia: Community self-financing for water supply and sanitation systems.

These three case studies were presented during the International Workshop on the role of Communities in the Management of Improved Water Supply Systems, November 4-10, 1992, IRC, The Hague, The Netherlands.

** Guatemala : Agua del pueblo*
"Community management in rural water and basic sanitation programmes". Fabian Gonon, Agua del Pueblo, Quetzaltenango, Guatemala.

Main points

- Without community management, Agua del Pueblo's projects would not work
- Using a community management approach for water and sanitation improvements opens up many possibilities to promote development in general.
- Community networking and pooling of resources of crucial importance - agency alone cannot meet all support needs.
- Formation of intermediate cadres of trained technicians essential for success Promoting community management has had very beneficial effects for Agua del Pueblo (AdP) in institutional terms. AdP has grown and strengthened as an organization because of its interaction with communities and the learning which has taken place as a result of this. Communities themselves have helped AdP to make the transformation from being supporters, and to understand what a genuine partnership means.
- In reaching agreements with the community, strong emphasis is placed from the beginning on financial sustainability. This is a basic principle, and is reinforced by the signing of contracts between communities and AdP.
- The main lessons learned are that community management is a concept and not a formula. It is very flexible and takes shape according to local conditions, and goes far beyond the "technocratic" approaches.

* *Uganda :*
"Community management systems for rural water supply. Case study in Uganda". Kiwe L. Sibunya, UNICEF, Kampala, Uganda.

Main points
- Team building within an inter-sectoral context is very important.
- "Process" indicators are needed to reward and recognize non-technical inputs and outputs and motivate field staff to actively support the community management approach.
- Communities should be allowed to stand on their own feet. this may mean the agency has to "stick to its guns", even when things may look very shaky. Communities will eventually realize that they have no choice but to take responsibility for themselves.
- There is no prescriptive approach to community management. Flexibility is important, and communities must be allowed to improvise their own solutions.
- Community management should be promoted not just as a means to an end, but a good thing in itself.
- Community management may be more cost effective, but not necessarily cheaper than other approaches.
- To ensure that agencies can provide the necessary back-stopping, more "social" inputs are required in the professional training of technical staff. Project engineers need a broader perspective, and broader skills.
- The questions of integrating hygiene education and sanitation, and strengthening the role of women, still leave much unanswered.
- The case studies in general show that there can be many spin-off benefits from community management. These need to be better understood, quantified and documented.

* *Indonesia:*
"Community self-financing for water supply and sanitation systems. A promising approach to community management and financing of water and sanitation facilities". Hadi Sucipto and Dan O'Brien, CARE, Jakarta, Indonesia.

Main points
- Community management can be implemented in many different ways, depending largely on what the community chooses to do.
- Women's organizations can be a valuable resource for strengthening the role of women.
- Skills are often transferred spontaneously between communities.
- Skills are further developed by people themselves.
- Communities in Indonesia are both able and willing to pay for improvements and have a strong sense of ownership and responsibility.
- Communities have used the funds they raise for water and sanitation for other development purposes, such as the establishment of "health insurance" schemes.
- The private sector is a vitally important resource, including banks and financing institutions to provide capital and credit.
- Community management is difficult but worthwhile, and highly appropriate for developing countries.
- The state has a very important role to play in supporting community management and making it possible.
- Good training/learning tools are very important for the success of community management.

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Overhead sheet 1

CHARACTERISTICS OF COMMUNITY MANAGEMENT

COMMUNITY RESPONSIBLE FOR:

* MAINTENANCE AND REPAIR
* REGULATION OF USE
* LOCAL MANAGEMENT ORGANIZATION
* FINANCING

COMMUNITY DECIDES ON:

* TECHNOLOGY CHOICE
* SERVICE LEVEL
* FORM OF LOCAL ORGANIZATION
* USE REGULATIONS
* FINANCING MECHANISMS

Overhead sheet 2

PRECONDITIONS FOR COMMUNITY MANAGEMENT

* DEMAND FOR IMPROVED SYSTEM
* INFORMATION ABOUT SYSTEM AVAILABLE
* TECHNOLOGY PROPORTIONAL TO COMMUNITY'S CAPACITY AND NEEDS
* COMMUNITY MUST UNDERSTAND FUTURE RESPONSIBILITIES
* COMMUNITY WILLING TO PAY
* COMMUNITY HAS DECISION-MAKING POWER
* COMMUNITY HAD HUMAN RESOURCE CAPACITY
* POLICY FRAMEWORK TO SUPPORT COMMUNITY MANAGEMENT
* EFFECTIVE EXTERNAL SUPPORT

Overhead sheet 3

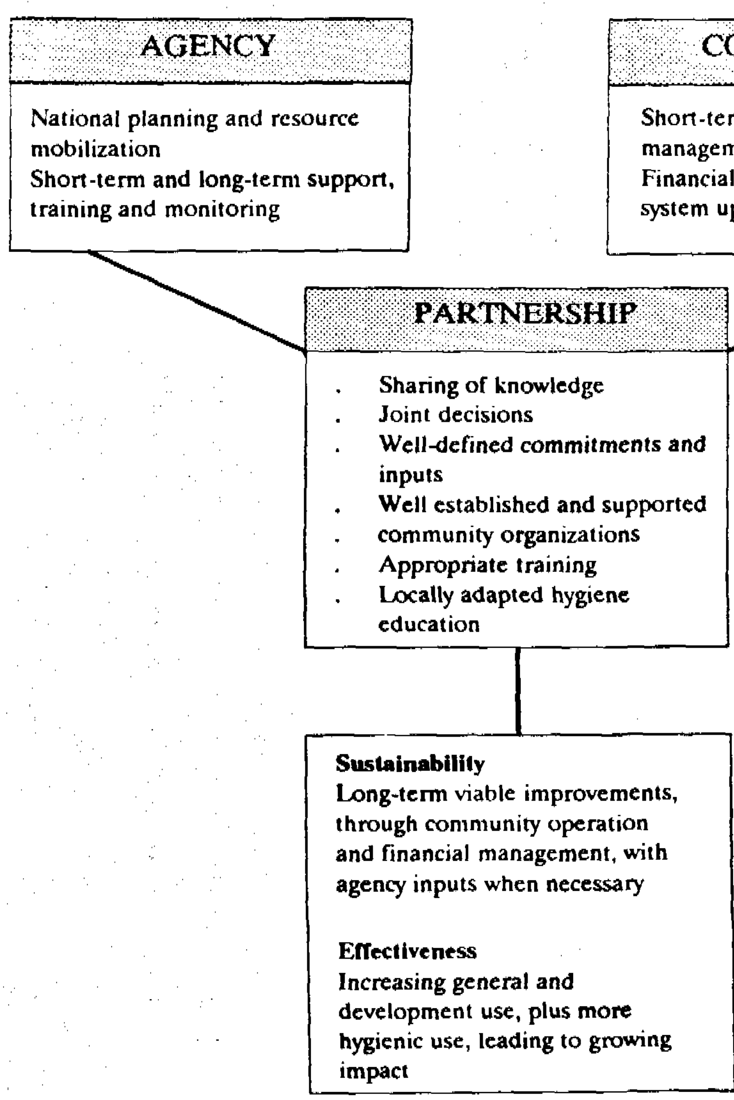
TASK DESCRIPTION OF WATER COMMITTEE

* REPRESENT THE COMMUNITY IN CONTACTS WITH AGENCY
* ORGANIZE CONTRIBUTIONS BY THE COMMUNITY
* ORGANIZE PROPER O&M
* KEEP ACCURATE FINANCIAL RECORDS
* PROMOTE HYGIENIC AND EFFECTIVE USE OF FACILITIES
* HOLD REGULAR COMMITTEE MEETINGS
* INFORM COMMUNITY

Overhead sheet 4

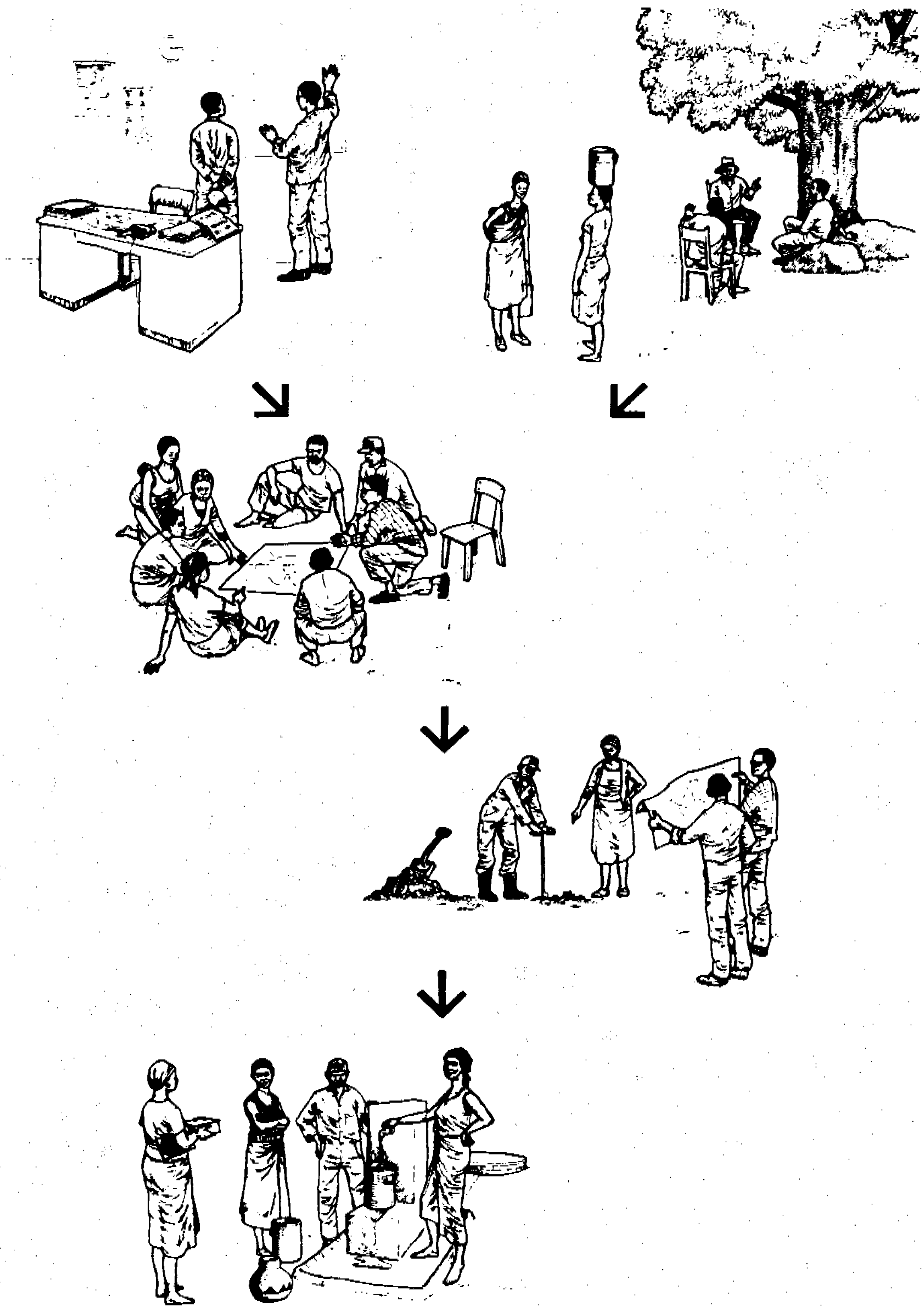
PARTNERSHIP APPROACH

Agency and community partnership for improved water supply and sanitation



Overhead sheet

PARTNERSHIP APPROACH



Supporting material

Local knowledge and traditional management of water supplies. Some examples from Africa.

COUNTRY	PEOPLE	OBJECTIVE AND METHODS
Ethiopia	Borana	*Water source protection*: Silt is cleaned out from ponds, and thorn fences built around them to protect the slopes.
		Water point management: Well users form a council, and delegate authority over the well to a clan elder under the direct supervision of a council of elders. The elder in charge is responsible for organizing use and maintenance of the well.
		Ownership and access to wells: Permanent wells are owned by clans, but access to them does not necessarily depend on clan membership but on negotiations based on manpower contributions to digging and maintenance.
Mali	Tuareg	*Water treatment*: Small holes are dug in ponds and filled with soil from termite mounds to precipitate impurities.
	Bambara	*Ownership of wells*: Deep wells dug through rock, or which need expensive materials to construct them, are usually owned by the village or ward. Shallow hand-dug wells are usually owned by the individual household.
Mauritania	Fulani	*Detection of groundwater*: Use of a broad variety of indicators, based on topography, geology, and presence of certain plant and animal species. Shallow aquifers found in areas of natural ponds, or in mountain depressions, or indicated by the presence of certain tap-rooted trees and perennial grasses. Presence of certain species of wildlife, such as wild boars, caimans, amphibious lizards, tortoise, butterflies, some bird species, and termites, said to indicate moist soils. Well diggers know they must dig all the way through red or grey clays and arrive at a sandy layer before water will be found.
		Assessment of water quality: Good quality groundwater which is clear, sweet, and has a good mineral content is indicated by presence of certain trees and plants, and associated with deeper wells. Similar indicators used to assess quality of pond water. Bad pond water indicated by the presence of the grass *Echinochloa pyramidalis*. Water quality also tested by dipping a leather container into it. Good water does not effect it, but as water quality declines it discolours the leather to different degrees. Water quality is also evaluated by its effect on level of contentment and milk yield of livestock.
Senegal	Fulani	*Water treatment*: Bark of *Boscia senegalensis* mixed with termite mound soil, acidified curdled milk, and salt, added to pond water for human consumption.
Somalia	Somali	*Water point management*: The northern Somali elect committees of 3-20 members to manage communal wells. The committees are responsible for allocating water to community members and visitors, guarding the well, devising and enforcing rules, charging fees, and maintaining the well.
Tanzania	Samburu	*Ownership and access to wells*: Each well belong to the household which dug it. Outsiders must get permission from the owner before using a well, but in practice permission can not be refused.
Zambia	Tonga	*Access to wells*: Outsiders can use wells if they contribute to their maintenance.

Source: Niamir, 1990.

Supporting material

2. Guatemala: agua del pueblo rural water programme

Case study
"Community management in rural water and basic sanitation programmes", prepared by Fabian Gonon (1992).

1. People's Water Association

1.1. People's Water:

It is a non Gobernmental, non profif organitation, established with the purpose of promoting better life conditions for the rural communities, by finding and applying creative - solutions to the Drinkable Water and Rural Sanitation problems with the real and active participation of the community.

In the last years, the technical and organizational capacity of the local committees and Basic Micro-Regional Organizations has been fortified, because of the iniciative and advancement of development and affordable projects.

1.2. Historic Review.

People's Water was founded in San Lucas Tolimán in 1972. It started with the technical assistance for small infrastructuctural projects. It began with the SARUCH programs in Chi--- maltenango in 1975 and 1977 respectevely, in cooperation with the Public Health Ministry and non gobernmental organizations (ONG'S).

The Guatemalan Gobernment recognized Water People's -- Legal Status the 15th of June 1981 and aproved its operation as Association.

1.3. Execution Projects and Achievements:

1.3.1. People's Water:

From 1981 until today, it has built 125 Water Systems - which has beneficiated 93, 741 citizens from 150 rural communities of the country. The systems have been done with different technologies: Gravidity, Handpumping and Mechanical pumping, among others.

1.3.2. Education and Training Programs:

People's Water had developed Health Education Programs - in all the attended communities. It also has created educational materials to work with children, mothers, fathers and -- the community in general.

The Educational Methodology has been shared with Gobernmental, International and ONG'S Institutions. ADP also has trained technical and local personnel (PTL) in diferent dis-- ciplines that are required.

1.3.3. Basic Sanitation Programs:

People's Water has installed 15,200 toilets of different type, and has oriented the community about the use and maintanence of them.

1.3.4. Organization Of Basis Micro-Regional Support Pro--grams.

People's water has strengthened the local organitation - level and technical capacity in 70 communities, gathered in 5 Associations that stand themselves as managers of their own development.

1.3.5. Building Human Sources Program.

People's Water has developed the curriculum and has trained 27 technicians in Rural Aqueducts, trained people for the promotion, organization, planification, design, and construction of water projects in a rural level.

1.4. How Does People's Water Work?

1.4.1. The Water Projects done by ADP, are domestic connec-- tions and by gravidity. Nowadays People's Water is doing the first handpumping and mechanical pumping projects and also it is storaging rainwater.

1.4.2. For the construction of the projects, we have Rural - Aqueducts Techinicians, who are in charge of every stage, with the supervision and advice of qualified personnel in water -- engineering.

1.4.3 The cost of the Water and Basic Sanitation Projects is financed by a downpayment, part of a loan another part from donations to the community.
The financial policy is designed to eliminate the dependen
and to impulse the financial support.

1.4.4 With the execution of the Water and Sanitation Programs in nearby communities, gathered in Basis Micro-regional --- Organizations, ADP tries to execute development projects.

1.4.5 In all the work done by ADP, there is a good community participation, involucring parents, teenagers, and children in the decision making, planification, organization, construction of the system, health education and the maintenance of the project operaion. We maintain a wide approach about changes needed in Sanitation and Development.

1.4.6. For the Health education area and Basis Micro-regional Organizations Suppot, there are experienced Rural Technicians, Socail Workers, Economists and Agronomists, who had worked in the institution for a good while.

1.4.? In the Financial Control Departament, there is a modern, computarized equipment and qualified personnel.

2. People who we work with. Characteristics.

People's water during more than twenty years, [illegible] as a priority the projects of the poorest rural people, that is found in extemely poverty nowadays.

Their main economic activity is agriculture. The 100% of them cultivate corn and beans for their own consumption. Fruit trees, coffee and cardamom are also cultivated, some crops are exported and others consumed locally. 65% of the community people emigrate to big farms in the southern coast of the country to sell their laborship; earning $ 1.75 for 8 hours day-journey or more hours than that. They work in the worst working conditions without work benefits, because they are temporal workers.

The illiteracy rate reaches 95%, and the access to education (first years of Elementary School) it's only accessible to 15% of the school age children population. These people has the highest Infant Mortality Rate and the main reason for that is because of gastrointestinal diseases.

The gobernmental social policy doesn't fulfill the needs of the rural people, because gobernmental institutions are centralized in the capital city. The communities lack of basic infrstructures: Drinking Water, Sewage Disposal and Toilets, things that can help to improve the health status of the people.

The 80% of the people is indigenous, in other words, it belongs to 15 linguistic groups of the 21 living in the country. Most of the people are monolingual, their comunication is only in their maternal language, especially women.

3. Community Action and Water and Basic Sanitation Programs. (People's Water case).

3.1 Community Action in the Water Systems and Basic Sanitation Projects Execution:

The rural communities have a very good participation in Water and Basic Sanitation programs execution, something that helps to amplify the explanation about their health problems. They make desicions and manage their own resources and time. The achievements in this way, fortify their capacities in the organizational and participative structures and also increase their expectations for development.

The proccess tries that people, leaded by their committees, will be attached to their own history. This process begins when the rural citizens show to ADP their water needs, and when their petitions are considered as prior needs, ADP and the community start the first relationship by a visit to the community.

The identification and acomplishment program to communities

(FIAC) sets up the first visit, with the purpose of initiating the discussion and analysis with the community, about the point of view that people has about the problems, the way in which they define their Water and Basic Sanitatin needs; and, together we develop the idea of their project. At the same time we verify technically the viability of the Water System. (Quality of the resource, height, legal permissions on the way the project will go through).

To talk about alternatives for Water Supply: by gravidity, handpumping, hydraulic ram, rainwater storage or combined systems.

The studies of prior feasibility are still being done technically with less precision equipment, to stablish the design bases. In the other hand, the water committee, local authorities and collaborators that make up the community leading managment group, start the analysis and discussion of the social, economic and cultural characteristics of the citizens, with the purpose of making a better comprehension of the particular problems of water and make a relationship among them and also among the general ones.

When we study the feasibility of projects, we also do the final studies with greater precision equipment, then, we do the final design.

We do workshops and meetings with the committees to discuss and define the relationship between their role and responsabilities to the community. During the execution of the water and sanitation projects, the responsabilities are defined. At the same time, we train leaders that can write and read, so we can obtain by them, basic information by inquiring the community. This information then, is given, discuss and analized with the other members of the committee, authorities and collaborators. The results let us know the economical status and their capacity to afford the project, among other issues.

Together: committee, authorities, collaborators and ADP discuss and sign an agreement which stablises rights and obligations for the community and ADP, among these, we set up the down payments, laon, donations and the way and time of the payments.

The community leading managment group and ADP, do a schedule of the activities that the execution of the project involves, trying not to interrupt the economic, social and cultural activities of the community.

After signing the agreement, we do educational activities oriented to involve the community in reforestry and protection of the microwatersheds. Such activities will be often done later on, by the community; while ADP is doing the office work, before the project execution such as designs, plans and purchases.

Before starting to execute the project, the community leading managment group and citizens, elect the local personnel that will be in charge of the operation and maintenance of the system; the same that from the beginning of the execution will be involve in technical matters which mean the construction of the system, so when the constr..uctions is finished, they will have the capacity of taking care of the operation and self maintenance. At the beginning of the project, the committee starts colecting the downpayments of everyone of the people who will be benefited. ADP supports the commitee, doing basic managment workshops, with the goal of having them take control of the money collected, the materials, their finances and time; this way they can inform the community they represent. With the commitee the activities of health sanitation are schedule. This process is directed to parents and children. They participate in the educational process with the use of proper techniques and materials that can make their participation possible. The subjects taught are related to the gastrointestinal disaeses causes and their effects, the importance and use of basic infrastructures in sanitation, water, toilets, enviromental influences and others.

Upon schedule done by the community managers, the letrinization (Toilets) can be done at the beginning or at the end of the project. Generally, it's done in resting periods, in other words, we try not to duplicate community efforts so people can work when they are not working in their fields.

At a community level, other educational activities are being done by sharing experiences with the participation of the local leaders, later with other regions and finally at a national level. The subjects in the last two levels are related to economic, social and political local analysis and their relationship with the structural problems of the country.

The educational activities are done in their cmmunities by technical specialized personnel: Rural Health Technician, Social Worker, Accountant and an Agronomist. However, the person in charge of coordinating the efforts is the Rural Aqueduct Technician (TAR) who is the link between community and ADP's working team. The Aqueduct Technician is a person trained by ADP, specialized in water supply and other elements of basic sanitation, besides that, he knows some basic ele--ments of the other disciplines cited before.

The achievements at the end of the execution of water supply and basic sanitation projects are:

1. It has strengthened at their level, the water committee and also the community structural participation.
2. There are managment capacities.
3. It has been created minimun technical capacities for the support of their own water system.
4. Capacities to do protective activities for the microwater-sheds.

5. A better explanation of community health problems and activities to overcome their limitations.
6. A consolidated community leading managment group with a better view of their problems and grea ter perspectives to impulse the follow up of the water supply and sanitation programs, and alternatives for the economic and social development in local and regional communities.

3.2 Operation, Maitenance and Administration of the Water System

When the execution of the program is done with the participation of the community, the people guided by their community leading managment group, is able to operate and maintain and administrative water supply systems and excretal disposal.

The operation and maintenance of the system is attended by local plumbers, whom the committee gives a salary for their services. Whenever there are greater problems ADP helps wth technical assessorship.

The operatin and maintenance of the system, result in expenses that all the people has to collect, by paying monthly payments that they stablish themselves.

In relation to the maintenance of the system and their proper use, the committee is in charge of. Together with the authorities, they sanction the one who break the rules (some of them written, the other ones decided orally by the group).

until now 80% of the communities have done reforestry work in areas near to the water sources and guarantee that the source is not contaminated with chemicals, excretas or manure. The committee had achieved the recovery of the loan given to every beneficiary and they control it. They also give information about their finances status and pay in ADP's office (in some cases before the date due). The tardiness of some communities are due basically to technical mistakes in the construction of the system and not to the irresponsibility of the community. Besides, they keep an inventory of materials they have. Among all the agreements, particular rights and obligations, they are not written but they had talked about.

At the community leading management group level, new projects are proposed to benefit the community according to the needs and with a better view of their reality. It also has a greater capacity to find out aspirations and goals of the people. It also motivates them to struggle for them.

Even now that communities have water systems and toilets, their use has not been the best.

The achievement in the educational sanitation can be seen in their way of being, better hygienic habits. However, the health impact is being reviewed now.

The community leading management group maintains its capacity to convoke to meetings, it continues having meetings to analyze

and discuss new problems and needs; some are results of the project, other ones are related. The important thing is that they meet to think, discuss and make dicisions. Induditably, when the community does these actions , it has to face the internal and external limitations. In some ways, the water supply and basic sanitation projects support is gotten.
The local capacities are developed and strengthened, and the organizational structures and social participation is increased. All these elements together, represent minimun conditions but enough to start other more complicated projects aimed to benefit the community development. Their fundamental methodology is make up of community leading managment group and community meetings, this way they analize discuss and find solutions about different problems.
Sometimes, the rural techer and local authorities participate to face the different challenges of the community but most of the time the people face the problems by themselves.

Affordable process of Development: Water Supply and Basic Sanitation:

The people gathered in Basis Micro-regional organizations, start to look for their own development on the basis of their capcities, organizational skills, social participation and their own points of view. Obviously, their efforts are according to their reality.

ADP supports this process by training local personnel (FIL), so local capacities can be fortified and in the future people can have their own human sources, taking advantage of their knowledge, technologies and experiences.

Micro-regional Organizations work in the fields and try to put theory into practice: during this process there's a respect for cultural values. They try to build their own development.

The legal support is also necessary, without leaving a blank space for learning their legal rights and obligations stablished by the guatemalan' laws.

The encouragement to educate and to train technically is other way in which ADP helps communities' organizations with the purpose of strengthening local leadership capacities so that they can not be city' dependants.

The financial support is ADP's task. It doesn't have to be the main goal, however, without capacities, organizations and desire to improve life' conditions, ADP doesn't think a project will be successful.

Supporting material

3. Uganda
"Community management systems for rural water supply", prepared by Sebbunya Kiwe (1992)

1 BACKGROUND.

1.1 Community Management Systems in Uganda. Historical and Present National Perspective

Community management (CM) of Rural Water Supply (RWS) is not new in Uganda!. From time immemorial communities through local leadership (chiefs, village headmen etc), have always been responsible for the care and maintenance of their water supply. Law enforcement combined with taboos (harsh retribution from "gods") kept water sources in reasonable conditions.

With the introduction of sophisticated RWS systems, especially boreholes in the 1930s, marked the beginning of centralised maintenance arrangements. These took the form of a network of fifteen regional Borehole Maintenance Units (BMUs) which were manned, financed, equipped and supervised through regional institutions (see map 1).

This was the situation pertaining in 1980, when UNICEF resumed operations in Uganda. An inventory then made revealed that out of the national stock of 5089 boreholes, 75% were not functioning (1). Govt. of Uganda (GOU) with UNICEF assistance embarked on a rehabilitation program of equipping BMUs, training of staff and repair of boreholes. Despite this heavy investment, three years later in 1983, a follow up survey revealed that 67.8% were again broken down!(1).

The Alma Ata PHC declaration (2) which included RWS with strong advocacy for community participation, affordable and appropriate technologies and global economic decline in early 1980s are two major events that influenced GOU and the development establishment in drawing up new strategies for RWS.

Largely due to the above factors, GOU shopped around for a pump that lent itself to Village Level Operation and Maintenance (VLOM) as the pump in use then, dubbed UI (or Uganda one), did not meet VLOM requirements. The Indian mark II, with a record of world success was chosen and 1984 saw the start of a program of replacing all the UI boreholes in the country with UII as the new pump was called.

Early in 1986, UNICEF in response to GOU request for an emergency RWS for returnees in the war ravaged district of Luwero used the opportunity to experiment on CM prior to national implementation. During implementation intersectoral collaboration was introduced with the technical Water Development Department (WDD) incorporating the Community Development Department (CDD) for provision of social mobilisers to assist in community organisation in order to build capacities for CM.

Buoyed and encouraged by the successes of the pilot project, in 1987, UNICEF entered into agreement with GOU to experiment on CM beyond RWS and cover the rest of the PHC elements. The South West Integrated Program (SWIP), as the resulting program was called, is implemented in south western Uganda and aims at establishing community managed PHC or Community Based Health Care (CBHC) and CM systems for RWS.

Later in the same year, the Danish International Development Agency (DANIDA), probably attracted by successes in Uganda on CM conceived a community based RUral WAter and SAnitation program (RUWASA) in eastern Uganda covering seven districts. UNICEF in collaboration with NGOs followed soon after with introduction of CM systems for RWS in eighteen districts under a Water and Sanitation program (WATSAN). Early this year (1992) World Bank signed an agreement with GOU to implement a development program in northern Uganda called Northern Uganda Reconstruction Program (NURP) with a component on RWS.UNICEF is to provide assistance in building capacities for CM.

From the above national perspective it is clear Uganda is on the road to national institutionalisation of CM for RWS.

1.2 South West Integrated Project (SWIP)

The program was launched in May 1987, initially covering 5 districts of south western Uganda but was expanded in 1992 with three additional districts. It covers a population of 4.2 million people. It is jointly funded by Canadian International Development Agency (CIDA), Swedish International Development Authority, (SIDA), UNICEF and GOU. SIDA and CIDA channel their assistance through UNICEF.

By 1995, and in each district, SWIP aims to establish:-

- o A sustainable, replicable system for initiating and supporting community based improvements in health, sanitation and use of safe water supplies integrated into district/community structures.

It is further hoped that the attainment of the above objective will, in the long run, contribute to:-

- o A reduction in under 5 (U5) mortality and morbidity due to diarrhoeal diseases.
- o An improvement of U5 nutritional status.
- o A reduction in women workload.
- o An increased role of women in decision making.

According to SWIP, the above objectives shall prevail if the program produces ten outputs at different stages of the implementation period as a result of program activities.
These are:-

I. Community health,sanitation and water supply improved through:-

1. Communities supplied with and using safe water based on approved procedures.
2. Quality of water source development and construction improved.
3. Sanitation improved through integration into new water source development and established safe water sources according to approved procedures.
4. Environmental changes regarding quantity and quality of water monitored and corrective action taken.
5. CBHC established following approved procedures.

II.Districts capacity to facilitate community action improved through:-

6. Planning, management, supervision and intersectoral collaboration at district level improved.
7. Water, health and sanitation improvements integrated into district institutional framework.
8. District system for obtaining, delivering and accounting for external inputs strengthened.

III.Advocacy for:-

9. National Policies on water, sanitation and CBHC influenced.
10. Integration of gender concerns in community improvements in water, health and sanitation.

Part I focuses on building capacity at community level (first five outputs). Part II recognizes that communities require external resources (physical inputs e.g spare parts, skills e.g management, maintenance etc) which calls for building or strengthening of external resource delivery systems through district institutions (outputs 7,8,&9). The institutions are vital for sustainability of SWIP supported activities especially at the end of the project. The ninth output ensures that SWIP contributes to the development of national legislation and policies that will create an enabling environment for CM. The last output was in recognition of women as primary users of water and chief custodians of family health.

Turning to the water sector, SWIP is engaged in the provision of safe water facilities through:-

- o Drilling of new boreholes.
- o Replacement of UI with UII pumps and rehabilitation of existing dilapidated pumps.
- o Protection of springs.
- o Gravity flow systems.

There are plans to look into possibilities of expanding into other technologies like hand dug and augured wells as well as rain catchment.

The table below gives the current and future status of water facilities.

	Facilities Constructed		**Population Served**	
	June 1992	by 1995	June 1992	by 1995
Boreholes Drilled	1188	2000	356,400	600,000
Boreholes Replaced	247	287	74,100	86,100
Springs Protected	2712	4124	542,400	1,367,200
Gravity Schemes	4	29	20,000	145,000

2. IMPLEMENTATION STRATEGY

2.1 Overview.

In building CM capacities for health and water, SWIP uses a three pronged approach.

- o Building CM within user communities through social mobilisation and training.
- o Building and strengthening district institutions and infrastructures for efficient delivery of community external resources.
- o Assistance to creation of an enabling environment for CM through advocacy, development of policies and legislation at community, district and national levels.

This approach required well motivated, imaginative and relatively well qualified staff in districts. SWIP created a special category of staff called District Project Officers (DPOs), university graduates or equivalent, financed by the program, stationed and working in districts to FACILITATE the installation of the above capacities. This arose because:-

- o Social mobilisation and CM systems were new concepts for district staff and yet were the main program implementors.
- o Training of communities required highly "participatory" adult learning techniques which district staff had not been exposed to.
- o A contradiction arose between SWIP strategy and district staff set up. While it was desirable to have a well motivated, imaginative and relatively well qualified GOU staff at the last interface between govt and communities, the staff set up is such that as you move from district headquarters through counties,sub counties to parish (the lowest established post), the qualities above are decreasing!. Indeed a very good worker at parish level is usually promoted to head a sub county or a county!.

- o Some water systems promoted by SWIP (boreholes and gravity) were new district activities with no institutional set up.

2.2 District Level Strategy.

District authorities (executive and legislature) are mobilised for supportive attitudes to CM through their involvement in drawing up and review of quarterly workplans and reports, exchange visits, attending and bringing forth CM related issues for discussion at district committee and council meetings, official commissioning of water points etc. The mobilisation of this category leads to:-

- o Districts budgeting and disbursement of funds.
- o Acquiring powerful allies in community mobilisation.
- o Enactment of supportive CM legislation and policies.
- o Getting fast response to issues requiring decisions.

District GOU staff are enabled to improve their management capacity mainly through training, study tours, availing information materials etc. These are very important for sustainability of CM systems for efficient delivery of community external resources (organisational, skills to WSCs & CWs, spareparts etc.) especially after SWIP.

Institutional infrastructure for procurement, storage, supply and delivery of physical external inputs like spare parts, tools is established. This is done through provision of a district depot for sale of spare parts and tools to communities. A depot bank account is operated for replenishment of spare parts from WDD. An information system on prices and spares availability is also in place.

2.3 Community Level.

Within communities, SWIP supported activities are promoted through social mobilisation where supportive attitudes for CM and demand for services is created. The social mobilisation is done with the following in mind, that:-

- o Overall management responsibility rests with communities through their Water and Sanitation Committees (WSCs). Local Community Workers (CW) are selected, trained, and equipped by districts/SWIP following CM supportive procedures.
- o The role of districts or SWIP is to FACILITATE and SUPPORT by availing external resources like physical inputs and skills. This is done through a process that promotes community ownership and self reliance.
- o Once these capacities are built to a reasonable degree direct assistance ceases and communities are left on their own to evolve and grow.
- o All user communities are mobilised for health through a communication package of Basic Health Messages (BHM). WSCs and CWs are given communication skills to act as "change agents" and sustain BHMs among their respective users.

Springs protection and gravity flow schemes follow a step-by-step approach with very strong preconditions on sanitation promotion involving community base line surveys etc.

Borehole drilling, on the other hand, follows a different approach where a minimum pre-drilling social mobilisation package is prescribed because of its high speed, abrupt changes in plans due to weather or unanticipated "easy" geological formations and the high opportunity cost of keeping equipment and crews idle. A more intensive package follows after the drilling.

3. COMMUNITY ROLES IN WATER SYSTEM MANAGEMENT

User communities do not have a direct role in RWS system management this being the reserve of Water and Sanitation committees (WSC) which are established for every water source.It is the users, with assistance of district and SWIP staff, who select and determine "terms of reference" of WSC members. It is quite common for similar types of RWS to have different CM arrangements.

SWIP policy is one of "negotiated collaboration" with communities and districts. Preconditions are centered more on viability of sustainable maintenance, sanitation and health promotion rather than meeting fixed "cost sharing percentages" of installation costs. This promotes services to minorities especially poorer communities.

3.1 The roles of communities, districts and SWIP in CM are tabulated below.

Community Roles in Community Management

Water facility Type	Communities	Water and Sanitation Committee (WSC)	Community Workers (CW)	District/SWIP
Boreholes.	o Community Meetings - Roles in CM. o Selection of WSC and CWs o Raise funds - Training fees CWs - Spareparts - Bicycle maintenance - Repair labour costs o Labour - Clear access roads - Asst to drilling/pump installation crews & CWs o Site selection o Local materials	o Resource Mobilisation - labour - funds - local materials o Supervision and payment of CWs o Org.site selection o Monitoring o Change agents community health o Training - Management - Community financing - Operation o Follow up support to communities/CWs o Plan construction supervision	o 3 week training for Pump Mechanics o 1 day training Caretakers o Change agent community health o Refresher training o Preventive and breakdown maintenance o Spares purchase	o Water dev.plan o Hydrogeological investigations o Well/borehole design o Drilling o Pump testing o Water quality analysis o Hydrofracturing o Pump installation o Social Mobilisation o Training WSC and CWs o Follow up support o 2 set of bicycle & tools per subcounty. o 2 sets of spanners per borehole. o ~~[illegible]~~ spare parts • [illegible]
Springs.	o Mobilisation meetings o Participate Technical/Social feasibility study o Selection WSC & caretakers o Participate Community baseline survey o Participate community meeting to draw workplan for sanitation promotion and spring construction o Provide - labour - local materials o Participate construction of sanitary facilitaty & spring o Participate in spring maintenance	o Resource mobilisation - labour - local materials o Organise tech/social feasibility study o Organise community baseline survey o Sign agreement with district o Follow up with community on san.promotion o Supervision of construction of sanitary facilities and spring o Supervise caretaker o Monitor sanitation promotion and spring maintenance	o 1 day training caretakers o Change agent community health o Refresher training o Preventive and breakdown maintenance	o Provide materials - cement - pipes - san plats o Provide technical assistance - san.promotion survey - construction of san.facilities and springs o Train caretaker and WSC o Water quality testing o follow up and support WSC and caretaker
Gravity flow scheme (gfs)	o Participate community mobilisation o Select WSCs o Participate preliminary survey o Participate community baseline o Selection of tapstand sites o Provide - funds - labour - local materials o Participate sanitation promotion and construction of gfs o Participate in maintenance	o Resource mobilisation - labour - funds - local materials o Organise baseline surveys o Organise recruitment supervision and payments for - plumbers - masons - tapstand caretakers - scheme attendant o Organise selection of tapstand committees o Training - community financing - management o Monitor sanitation promotion and gfs maintenance	o On job training for - plumbers - masons - scheme attendant o Construction and maintenance o Change agent for community health o Refresher training	o Technical assistance - feasibility study - detail survey - community mobilisation - training - technical supervision - resource management o Provision of physical external in puts - pipes and fittings - taps - tanks - cement - tools

3.2 Annual surveys (3&4) have consistently shown that over 70% of water systems are functioning properly. Springs and gravity schemes once completed don't present major maintenance problems. The former are maintained by preventive means ie cleaning, slashing, unblocking etc by a trained caretaker whose "pay" is usually exemption from other weekly communal development work. The latter are maintained by a trained tapstand caretaker and a scheme attendant who checks on the intake works and the general line for leakages and trained to carry out plumbing and masonry work. A tap stand caretaker is "paid" as above but the scheme attendant is paid a cash allowance by the WSC.

Boreholes are maintained through two subcounty area based mechanics (PM), selected and training fees met by RC3s (see part5) which is the defacto "WSC". The PMs look after a maximum of thirty boreholes using toolkits and bicycles supplied by SWIP to each subcounty. Each borehole has a user WSC responsible for organising purchase of spare parts and a caretaker who is equipped with spanners to tighten external nuts, greasing and do general cleaning and other preventive maintenance activities. "Payment" is as other caretakers.

It is the management of the PM that presents a problem. Below are some of the arrangements (users pay for spares in all cases).

(i) PM paid per repair by users. Bicycle and tools kept by PM.
(ii) PM paid by RC3. Bicycle and tools kept by PM.
(iii) As in (i) but bicycle and tools kept at RC3.
(iv) As in (ii) but bicycle and tools kept at RC3.

The problem with (i) is that the WSC being ignorant of the level of service given by the PM, who enjoys a monopoly, end up being overcharged.Secondly the PM has no incentive to work on preventive maintenance and has an inherent interest in breakdown!. The bicycle being kept and used for other work by PM meant that the responsibility for its maintenance was PMs'. The advantage of this option,from SWIP point of view, was potential for privatisation.

Option (ii) was used in two districts following outcry by users on overcharging. District councils passed legislation fixing monthly allowances for PM to be paid from RC3 development fund on certification of work, whether preventive or breakdown carried out. The disadvantage was the appearance of a return to dependency on centralised arrangements. Suppose the fund is exhausted in the middle of a financial year?.

Option (iii) raises same issues as in (i) except that the responsibility for bicycle maintenance and replacement lies with RC3.

Option (iv) can be deduced from the first three options.

Of the four options SWIP still pursues the first one through introduction of a more VLOM pump, UIII, (Indian Mark 3), whose maintenance is "simpler" and can be handled by a pump caretaker using a simple and cheap tool kit. This gets rid of "area based" PMs in the short run but introduces other problems.

Like mentioned earlier (2.2) special spare parts and tools that are not available in the private sector are bought by WSCs, PMs or users from a district spares depot. SWIP is slowly influencing the development of the private sector in provision of pump spare parts (5).

4. LOCAL ORGANISATION OF COMMUNITY MANAGEMENT

A WSC is established for every water source. However due to the adhoc nature of WSCs, SWIP, as much as possible builds them into EXISTING community institutional arrangements because:-

- o Existing institutions have stood the test of time and experience and therefore demonstrated viability.
- o Committees expressly set up for projects tend to wither and die with end of projects.
- o Existing committees, if they choose, can frustrate or engage in unhealthy competition for status resulting in conflicts.

SWIP is also mindful of the negative influence of local politicians and dominant groups and their effect on participation of the poor and minorities.

Uganda has a unique grassroots, democratic "parliamentary" system called Resistance Councils (RC) which are formed at cell or village level (RC1) and work their way through a parish (RC2), subcounty (RC3), county (RC4), district (RC5) to national level (NRC). At village level or RC1 all residents are members of the council but day to day affairs are handled by an executive of nine members. The RC1 executives of a parish form the RC2 council and so on up to the district council or RC5. Of the nine executive members, there is a position for a woman member and this is institutionalised up to national level.

RCs are political committees and are charged with the general development of their area. They have statutory and judicial powers and can thus promulgate and enforce bye laws. GOU staff working in an RC area are ex-officio members.

SWIP therefore found a powerful ally in RCs for meeting its objectives. CM is done by WSCs which work hand in hand with RCs. The role of RCs is mobilisation,to assent, amend or reject proposals made by WSCs. This is important as the WSC have no legal powers of their own to levy fees, mobilise local labour and materials, promulgate legally binding rules and regulations or adjudicate conflicts pertaining to water use, access or land use (pollution).

Community meetings are organised to elect members of WSCs with a minimum recommended membership of five comprising a chairperson, treasurer, secretary and two committee members. WSCs for gravity schemes are usually much bigger and have sub committees for every tapstand. Boreholes with subcounty area mechanics are managed by RC3 executives but a WSC is still formed for every borehole. It is very common for RCs to also serve on WSCs.

Members of WSCs are volunteers and SWIP advocates for at least two women members.

Once WSCs are instituted then all assistance is channeled through them. Working through RCs, and with assistance of districts and SWIP, they oversee:-

- The overall planning,construction and maintenance.
- Negotiate and sign agreements on behalf of user communities.
- Organise delivery of preconditions prior to provision of water facilities eg. sanitation.
- Organise raising, using an accountability of funds.
- Receipt, storage and issue of external inputs eg. cement, pipes, fittings, tools etc.
- Organise communities for selection of service points eg. tap stands and borehole sites etc.
- Selection, meet training costs, supervision and payment of salaries for community workers eg. pump mechanics, plumbers, masons etc.
- Organise local labour, access roads and materials during construction and later maintenance.
- Purchase of spare parts and tools.
- Organise for community health improvements and other development activities.

WSCs are usually very active during planning and construction phases but for some water systems like gravity and springs which require very little maintenance they tend to loose momentum. There have been cases of conflicts with RCs over boundaries of responsibility and with communities over financial accountability. SWIP countered the latter with introduction of training for WSCs in simple bookkeeping. This has led to transparency and improvement in relations.

5. THE ROLES OF WOMEN AND MEN IN MANAGING WATER SUPPLY SYSTEMS.

SWIP has met with little success in its advocacy for women involvement in the management and maintenance of RWS. Traditionally household water supply is the responsibility of female family members but have not been forthcoming despite deliberate creation of a gender sensitive environment during community mobilisation.

SWIP is in the process of introducing gender biased preconditions as a way of getting women involvement. Opponents cite the already heavy women work load. "If the men," the reasoning goes, "due to introduction of "modern" water systems, are for the first time attracted to contribute to the family water supply, then they should be encouraged as they are giving relief to women". The proponents argue that women should be on committees and influence decisions eg. location of facilities,allocation of resources etc.

SWIP does not prescribe specific duties and responsibilities for women serving on WSCs or users. However women are specifically targeted during sanitation campaigns and their views sought in planning and location of water facilities.

6. SKILLS DEVELOPMENT, TRAINING AND SUPPORT

The skills available in a community vary within and between communities and also on the type of water system installed. It is therefore very important to make an early skills assessment in order to plan for training.

SWIP training include a large component on health improvements with a mandatory Basic Health Messages (BHM) package for all recipients of a water supply. BHM are life saving information on "safe water chain" (safe water from point of delivery to ingestion), sanitation, hygiene, immunisation, AIDs etc.and delivered in such a way as to effect changes in attitudes and behavior.

In order to enhance sustainability, improve on coverage and get an in-built follow up and support system, all trainees above community level like WSCs, CWs, and community leaders are given training and communication skills so that they become trainers and change agents in their localities.

The table below shows skills development in SWIP.

SKILLS DEVELOPMENT IN SWIP

Skills	Target (Trainees)	Purpose
1. Construction, operation and Maintenance	1.1 WSC 1.2 CW - PM - Caretakers - Scheme attendants - Plumbers - Masons & Spring "fundi" 1.3 District staff	1.1 Overview enable supervision of CWs 1.2 Skills for construction and maintenance of water sources 1.3 Enable them train and follow up on CWs who "drop out" (sustainability)
2. Community financing	2.1 WSC 2.2 District staff 2.3 SWIP Project staff (DPOs)	2.1 Skills to plan, collect use and look after money. 2.2 " to train and support WSC 2.3 " " " " " District staff and WSC
3. Orientation to community based activities	3.1 District staff 3.2 SWIP staff (esp.DPOs)	3.1 Orient staff from "Govt.provider/promoter" to community management 3.2 Orient and give skills to support and train district staff
4. Planning by objectives	4.1 District staff and authorities 4.2 SWIP staff	4.1 Visualise and to produce a district framework for CM 4.2 Enable to train and support districts
5. Communication/mobilisation "Participatory training"	5.1 District staff (TOT) 5.2 SWIP staff	5.1 Skills to staff in highly "participatory" training methods. 5.2 Enable to train and support districts.
6. Water quality analysis	6.1 District staff 6.2 SWIP staff	6.1 Enable carry out tests on RWS 6.2 Support district staff
7. Sanitation and hygiene promotion	7.1 District staff 7.2 WSC	7.1 Enable them plan, implement and monitor promotion of sanitation 7.2 Plan and promote sanitation amongst user communities
8. Basic Health messages	8.1 District staff 8.2 WSC 8.3 CWs 8.4 Community leaders	8.1 Promote attitude and behavior change 8.2 Act as "change agents" in community 8.3 -do- 8.4 -do-

7. FINANCING AND FINANCIAL MANAGEMENT.

It has proved very difficult to come to a detailed cost of installing, operating and maintenance of water systems. This is largely due to problems associated with costing community inputs. In addition to cash, community contributions appear in various forms eg. voluntary labour, in-kind and are highly dependent on local resources and organisational levels.

There was an attempt to cost capital installation costs (6).

boreholes	US$	7000
springs	US$	1200
Gravity	US$	24 per capita or US$. 2500 to 3000 per Km.

A recent unpublished paper(7) in Luwero district found annual maintenance costs for a borehole in terms of spare parts to be approx. US$ 5.

WSCs make proposals to RCs on ways and means of raising funds. The following has been tried and found to work:-

- User fees usually paid by tax payers.
- Connection fees charged for users who wish to get a private service (not common).
- Fines
- IGA
- Grants paid by central govt. and local authorities.
- Local activities Road tolls, tax on business, market tax
- Fund raising door to door appeals, auctions
  Appeals from individuals like politicians, sucessful "sons and daughters" of the community living and working in urban centers, organisations and development agencies.
- Lotteries and raffles

The payment of pump mechanics who cover a subcounty is through a subcounty development fund. Spare parts are usually bought from levies on users either periodically for bulk purchase (especially for communities far from depots) or on beakdown. There are occasions when non community members are charged a fee for drawing water and members with animals being charged extra especially in the dry seasons.Caretakers are paid in kind through exemption from communal work.
SWIP has not experienced problems associated with maintenance affordability.

Installation costs for boreholes is almost exclusively borne by SWIP. 7 to 10% of gravity costs are met by users. SWIP input in springs is provision of cement, pipes and training of committees and caretakers.

8. LEGAL AND POLICY ISSUES

There is no act of parliament which stipulates that RWS has to be community managed. Likewise, as far as my reading goes, there is no explicit act which forbids the establishment of CM or leaves it as an exclusive domain of govt.

However the current political climate strongly supports community initiatives, participation and self reliance as evidenced from grass root political institutions -RCs.
GOU documents (6) calls upon WDD to "shift emphasis from that of Govt. as the provider to that of promoter" through a process that:-
"discourages govt. subsidies ....."
puts "emphasis on involvement of communities ...."
"target user participation in identification, construction, operation, and maintenance of sustainable systems."

The statute which established the RC system empowered them to pass bye laws in their areas of jurisdiction. SWIP has assisted WSCs in making proposals for debate and enactment by RC councils.
Some landmark legislation are:-

- o RC5 decision in one district to pay PMs from subcounty development fund.
- o RC5s decision to exempt all RWS caretakers from communal development work.

At local levels RC1,2&3 have passed legislation relating to:-

- o levy of fees and taxes.
- o Rules, regulations and punitive measures for defaulters.
- o legal status of WSCs.
- o Universal accessibility of water.
- o Land use, environment and pollution.

Despite local levels taking initiatives to enact local bye laws there is still a need to enact explicit national policies and legislation on:-

- o CM
- o Universal accessibility.
- o Pollution and environment.
- o Backup for maintenance beyond districts and communities eg procedures, cost sharing, privatisation, institutional set up etc.
- o Spare parts distribution national to district.

SWIP contribution to enactment of policy and legislation has been mainly advocacy through:-

- o Documentation of field experiences.
- o Writing and presenting position papers.
- o Organise field visits to "success story" areas for decision makers.
- o Presentation of issues to Inter Ministerial Steering Committee (IMSC). The IMSC is the policy making body for SWIP, RUWASA and WATSAN the largest (in area and population) RWS programs in the country.

Recently a paper (5) presented by SWIP on national procurement and distribution of spare parts is being used to formulate policy.
Another paper (8) looking into institutional infrastructures to handle backup maintenance beyond communities

and districts is in final stages of preparation.

9. MONITORING, EVALUATION AND INFORMATION

Organisationally SWIPs entry in the district is through a technical Project Implementation Committee (PIC) chaired by the DES with membership of heads of departments like DMO, DWO, DCDO, DHI, key district administration staff eg. district Treasurer, and some members of the DHC. NGOs supporting RWS projects are also members.

PIC is responsible for drawing up, quarterly workplans which are costed in terms of cash and physical inputs, review reports of the previous quarter and adress implementation bottlenecks. The work plan apportions sources of inputs among the partners (district/SWIP). The workplans are the basis of SWIP monitoring system.

SWIP project officers and district management staff through supervisory field visits monitor progress.

Annual water surveys are conducted to check on the status of water systems. The surveys are conducted with several questionaires to try and establish the following:-

- Physical maintenance and construction workmanship.
- CWs & WSCs eg. their performance, constraints, drop out rate,financial arrangements, user complaints on taste, yield, breakdowns (type, downtime), information system, BHMs (knowledge & communication to users) etc.
- RC1 &RC3 eg. Pump mechanics performance, CM perception etc.

Major findings are:-

- Over 80% of water systems are operational.
- Downtime ranges 7 to 10 days.
- Low level of women involvement.
- CWs retained knowledge on BHMs but were not transmitting to communities.

SWIP also carries out mid term evaluations (last held in Nov. 1990) comprising of donors, govt and independent consultants usually drawn from universities and development establishments. Among the major recommendations were:-

- emphasis on objectives orientation.
- Transition from pilot to a long term development programme that includes sustainablity, replicability, capacity building and donor phase-out objectives.

A baseline survey was done in 1988 to establish impact indicators mainly on health and a follow up survey is planned in 1993.

SWIP is very anxious to start working on community based monitoring. A pump mechanic log book is being established for use by WSCs in paying the PMs. It uses exercise books and contains social and technical information and is filled by the PM whenever a visit is made to a borehole site. Informaton filled is on when s/he was informed, repairs and spares replaced, assistence from community, catchment cleanliness, BHMs etc. Another area being explored is establishment of sentinel sites. This will assist program with "process documentation" on the happenings in the larger enviroment where water sources are constructed.

10. CONCLUSIONS AND LESSONS LEARNT

10.1 There is a tendency for donors, govts and project managers to measure or equate success of CM programs with production of quantifiable inputs- Nos of CWs, WSCs trained, Nos of facilities completed etc. These inputs are certainly very important but should be used with process and output indicators which are more indicative of progress to long term development goals.Building CM capacity is slow, time consuming and laborious. This must be recognised and accepted. "Pressure" on a program to produce inputs can derail it in meeting CM objectives. Monitoring and evaluations should likewise look into "processes" and "outcomes" in the larger environment around water facilities.

10.2 Building capacity for CM requires intersectoral collaboration between "technicians"- drillers, engineers, hydrogeologists etc. AND social workers. It is usual for technicians to want "to get on with it". The social workers on the other hand work at the pace of communities and require communities to demonstrate their "readiness" through meeting some organisational and physical preconditions. Projects intending to develop CM systems need to take time and build TEAMWORK and to get ALL implementors focus on meeting overall project objectives in measuring success.

10.3 "Babying" of communities should be avoided. This takes the form of agencies overstaying in communities even after a reasonable CM capacity has been built. They respond to "baby cries" of WSCs and CWs with free provision of spares etc. In the process they create harmful dependency by failing to "wean" communities and letting them evolve and grow on their own.

10.4 Avoid prescriptive blue print approach to CM. A rapid assessment of CM in the pilot district of Luwero (9) found that communities had adopted innovative and ingenious CM systems which sometimes deviated from original designs.

10.5 CM is sometimes viewed as a cheap way of "offloading" financial burdens from donors & govts to communities. While SWIP has not carried out a comparative quantitative study, intuition indicates that building capacity for CM can be expensive. "CM should be promoted as a desirable end product in itself and not as a means" (10). Sustainable CM systems built on basis of "volunteerism" for members of WSCs and CWs must assume a permanent reservoir of volunteers in user communities. Caution must be exercised as such "reservoirs" barely exist and few people can volunteer permanently.

10.6 CM for RWS requires external inputs- skills, spare parts etc. Trained members of WSCs and CWs can "drop out" due to illness, death, loss of interest, emigration etc. It is therefore very important for projects to look into development of support systems which will sustain CM at the end of projects. Support systems should be geared to development of the private sector say in case of provision of physical inputs like spare parts, or enablement of district staff to take over skills development. Possibilities of linkages with local training institutes for long term provision of community skills can be looked into.

10.7 There should be a concerted effort by CM programs to influence national policies, legislation and political will in order to build an enabling environment for CM. In budgetary allocations, RWS is viewed as belonging to the social service sector. Appropriate social research studies on communities with CM systems may reveal for example economic spin offs which could later be used in advocacy for more resource allocation to RWS.

10.8 Social capital generated in building CM can be utilised for community health improvements especially in promotion of sanitation and safe use of water.

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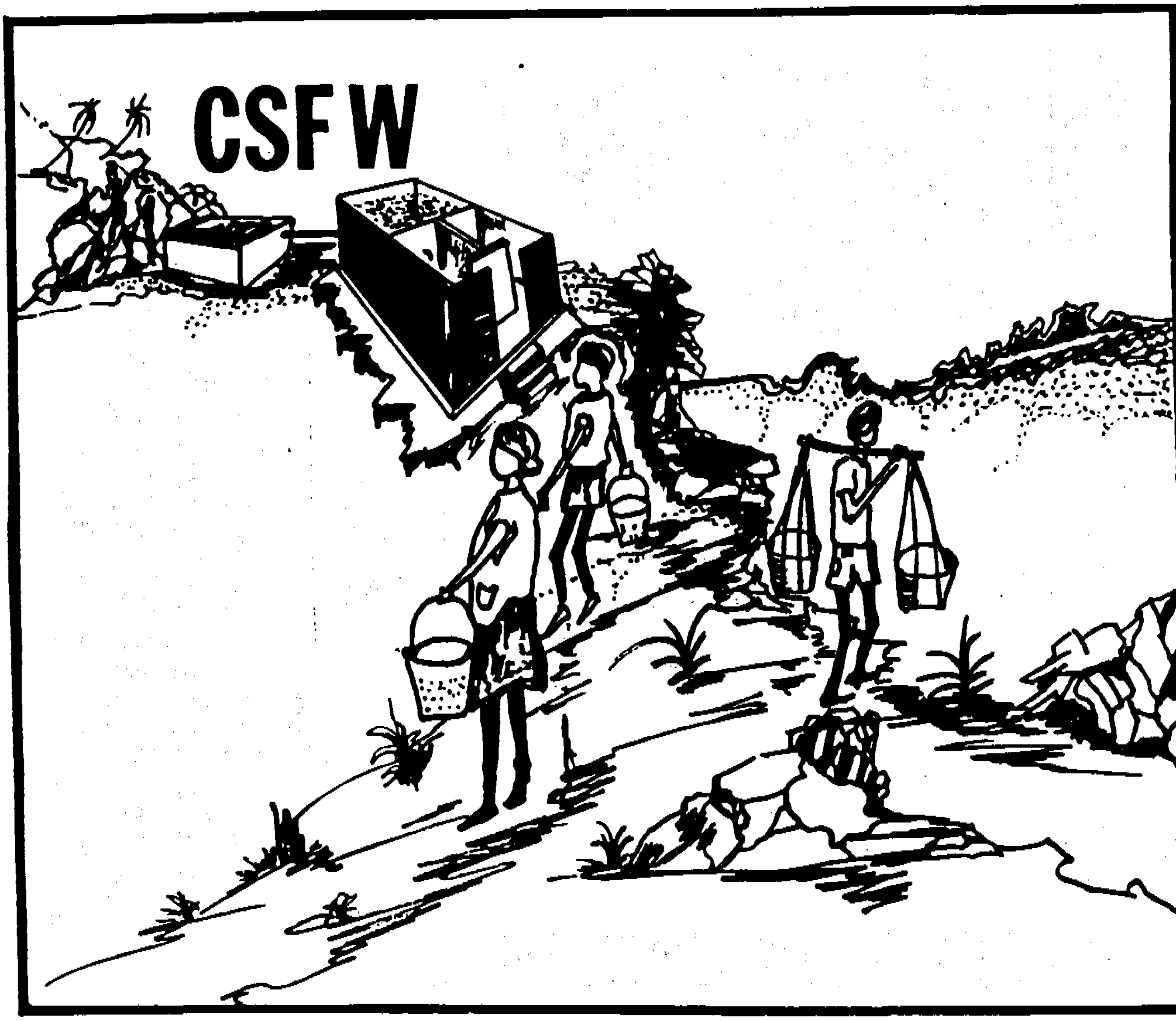
Supporting material

4. Indonesia
"Community self financing for water supply and sanitation systems - a promising approach to community management and financing of water and sanitation facilities" by Hadi Sucipto and Dan O'Brien (1992).



CARE INDONESIA

Supporting material

4. Indonesia
"Community self financing for water supply and sanitation systems - a promising approach to community management and financing of water and sanitation facilities" by Hadi Sucipto and Dan O'Brien (1992).

BACKGROUND

Despite much effort and resources that have been provided to develop water supply and sanitation facilities for rural communities, approximately two-thirds or eighty seven million people still do not have access to sufficient and reliable sources of domestic water or sanitation facilities. The Government of Indonesia and interested international aid donors simply do not have adequate resources to meet the tremendous need.

A fundamental change, therefore, is necessary where communities are encouraged to finance, build, and maintain their water supply and sanitation facilities. This way scarce governement and donor funds targeted for water supply and sanitation projects can be matched by community resources resulting in accelerated access to and use of improved water supply and sanitation facilities.

CARE Indonesia's experience in the water supply and sanitation (WS&S) sector demonstrates that the gap between available resources and water and sanitation needs can be more rapidly addressed if communities are encouraged to manage and finance their facilities. Future efforts within the WS&S sector should take greater advantage of the potential that exists in rural communities to meet the need for improved water and sanitation facilities.

WHAT and WHY CSFW

CSFW is an acronym for Community Self Financing of Water and Sanitation Systems. CSFW is a five-year pilot project designed to demonstrate that communities in rural Indonesia are able and willing to finance their water supply and sanitation systems, create a community management approach, and help bring about important changes in government and bank policy that will facilitate community financing.

Communities participating in the CSFW project finance, build, and maintain their water supply and sanitation facilities with technical assistance and training from CARE. In special cases, CARE and GOI provide partial subsidy to communities who are willing, but too poor to mobilize 100% of the resources necessary to build the systems.

The CSFW project is presently being implemented in 34 rural communities in the provinces of West Java, East Java, and West Nusa Tenggara.

While much effort and resources have been gone into helping meet the need for water and sanitation facilities in rural communities, only about 30% of the rural population have access to reliable sources of water and sanitation facilities.

A fundamental change, therefore is necessary where communities are encouraged to build and self-finance their own water and sanitation facilities. Three primary lessons have caused the concept of community financing to evolve in CARE assisted water supply and sanitation projects. These are:

1. Two thirds of all rural communities in Indonesia do not have access to safe and sufficient water and sanitation facilities. Currently, GOI and donor resources committed to improving water supply and sanitation are inadequate to satisfy the need.

2. CARE has discovered that many communities are able and willing to pay for improved WS&S systems rather than wait for subsidized systems from GOI or other donors.

3. Communities who finance their WS&S systems develop a sense of ownership, which contributes to improved system maintenance and long-term sustainability.

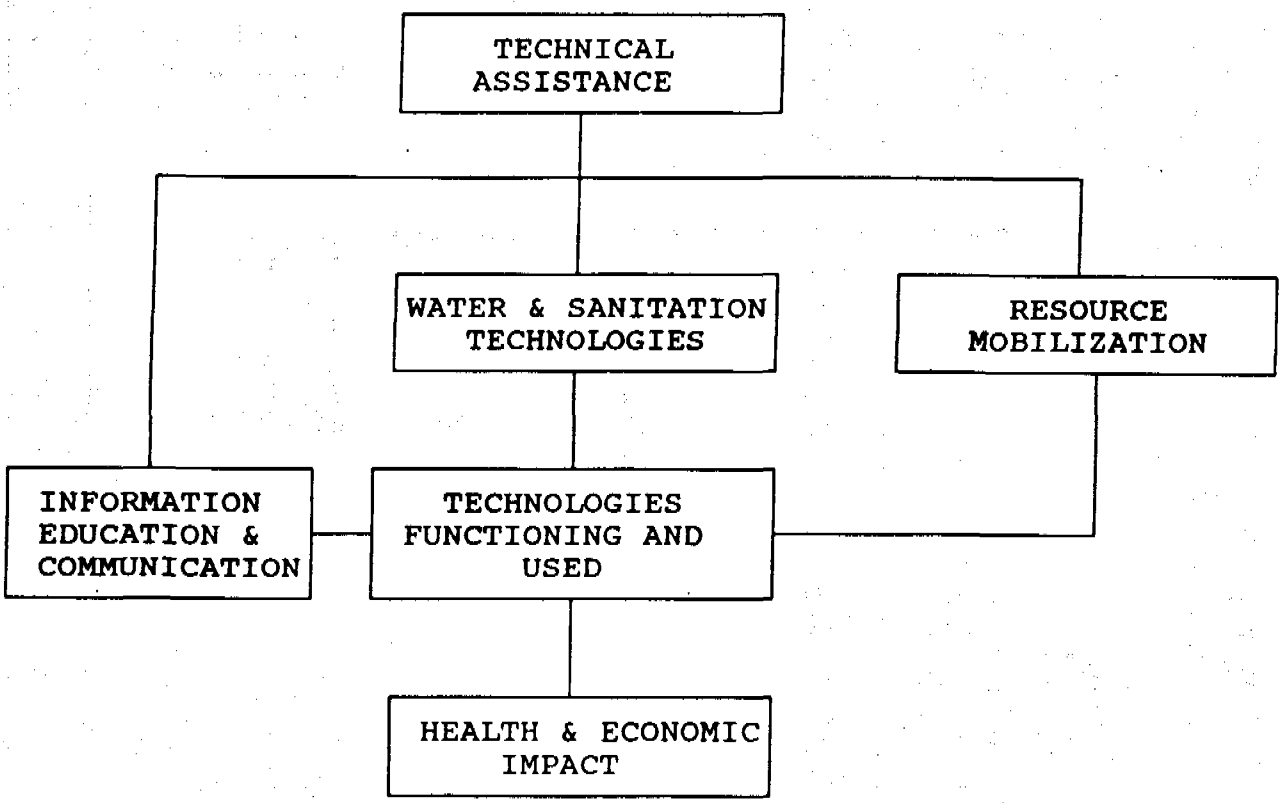
RELATIONSHIP OF CSFW COMPONENTS

Community financing and cost recovery is not the purpose of the project but rather part of a broader community management approach intended to strengthen the skills of communities to finance, build, and maintain their water supply and sanitation facilities.

There are four major components of the CSFW approach: technical assistance, resource mobilization, construction of the water and sanitation technologies, and hygiene and sanitation education.

CARE field staff provide timely technical assistance and training to committees for resource mobilization, construction, and hygiene and sanitation education. Resource mobilization ensures labor, materials, and cash are available to construct the WS&S systems. Hygiene and sanitation education is provided to ensure the technologies are used appropriately to bring about the intended health and economic impacts.

RELATIONSHIP OF CSFW COMPONENTS



CSFW IMPLEMENTATION

CSFW is implemented in six stages:

1. Site Selection.
2. Committee Formation and Negotiation.
3. Planning.
4. Implementation.
5. Operation and Maintenance.
6. Evaluation and Monitoring.

Site selection is conducted once each year to choose potential sites that are likely to successfully implement CSFW. Once final CSFW sites are selected, each passes through the other five stages. Figure 2 on the following page depicts this process.

Each of the stages is summarized below.

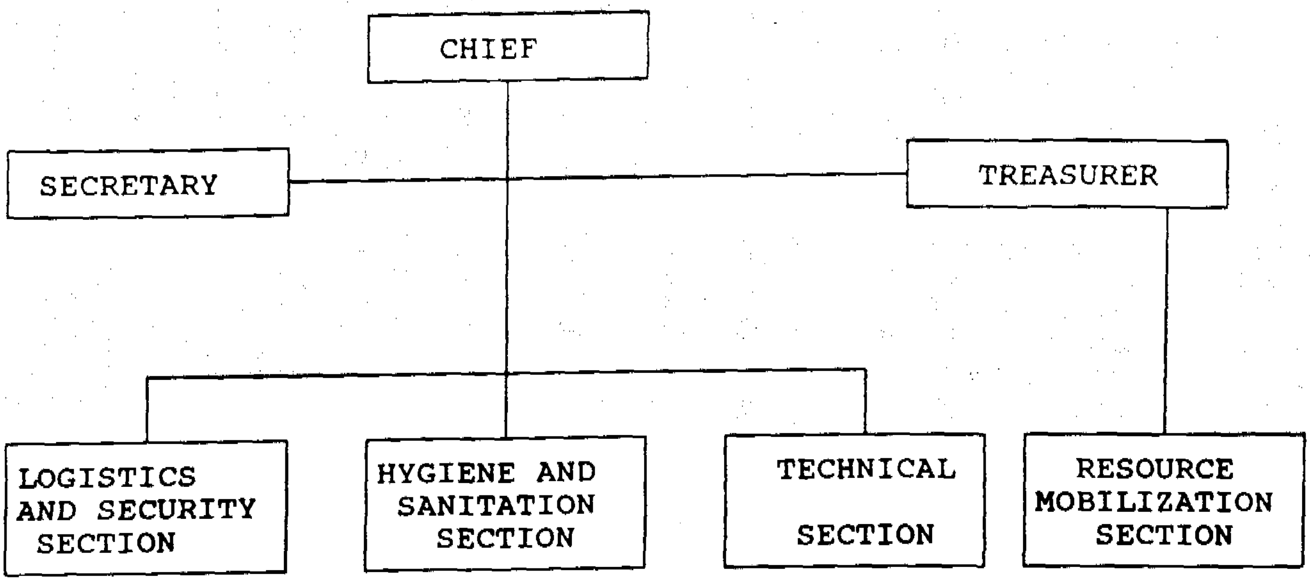
1. Site Selection - CARE and GOI select one or more districts in which to market the CSFW project. The CSFW project is marketed to potential communities and they are encouraged to apply for the project. CARE next conducts willingness and ability to pay surveys in those communities that applied for the project. Based on the results of surveys, potential CSFW communities are selected. CARE conducts meetings in each community to explain the project and answer any questions.

Site selection is probably the single most important step in CSFW. Not all sites are able to successfully complete CSFW. The primary indicators for selecting a community that will likely finish CSFW is effective leadership and organization capability, successful completion of other community projects, willingness to pay, ability to pay, and affordable technologies.

2. **Committee Formation and Negotiation** - CARE conducts another meeting in each potential community to select the water and sanitation committee. Once the community selects its water committee, the water committee negotiates its responsibilities with GOI and CARE. The organization of a typical water and sanitation committee appears in Figure 3.

To form the committee, CARE begins by conducting a meeting with leaders and representatives of the community. During the meeting the basic committee structure and names of all candidates are recorded on flip chart paper. Next, the community leaders conduct a second meeting in which all members of the community participate. The committee structure and candidates are presented and discussed. The final committee structure and committee members are selected.

TYPICAL VILLAGE LEVEL WATER AND SANITATION COMMITTEE STRUCTURE



3. Planning - CARE provides the committee alternative technologies that are appropriate for the community. The committee then chooses the technologies it wants. CARE then helps the committee design and cost the systems, and develop a resource mobilization and construction plan. The water committee holds a community meeting to present the selected technologies and resource mobilization (including costs) and construction plans. During this meeting, a formal agreement between the community, GOI and CARE is signed. After the agreement is signed, CARE trains the hygiene and sanitation wing of the committee how to prevent water related disease and how to conduct the hygiene and sanitation survey. This sub-committee then conducts the survey and plans activities based on the survey results.

4. Implementation - This stage consists of hygiene and sanitation education, resource mobilization, and construction.

- CARE trains the hygiene and sanitation messengers to communicate messages and conduct action planning. After the training the messengers begin to communicate messages and work with other community residents to solve hygiene and sanitation problems. Generally, the messengers are trained to communicate the following messages:

  Keep the home and surrounding area clean
  Keep the public bathing areas clean
  Bathe regularly
  Wash hands regularly
  Store water in a clean container

Health messengers in the villages of Wonoanti and Bangunsari, use traditional Javanese hand puppets (Wayang Kulit) to communicate health messages to community residents, especially building and using latrines. The traditional puppet performance is a popular form of entertainment in rural communities and has proven to be an effective way to change health behavior. Villages using the puppet shows to communicate messages report that more than 80% of the households have built and now use latrines regularly.

o CARE trains the water committee to set up bookkeeping and control systems. After the training, the systems are set up and the committee begins to mobilize cash, human and material resources. Specific training includes bookkeeping systems, financial records (dues, credit cooperative, women's meetings, etc.), and procurement records.

Resource Mobilization is the process of organizing unskilled and skilled labor, collecting local materials, in-kind contributions, raising cash within the community, and using credit from banks or vendors to build the WS&S systems.

Unskilled labor is communal labor required to dig trenches or wells, transport building material, install pipes, build structures, and collect local materials. Skilled labor includes carpenters, masons, brick layers, plumbers, welders, and pipe-fitters.

Local materials needed to build the WS&S systems often include sand, stones, bricks, wood, and bamboo.

Cash can be raised from inside and outside the community. Inside cash mobilization is usually done by cost sharing or savings and loan groups. Cost sharing is based on the cost of the system. Households are divided into three to five socio-economic classes with the wealthier households paying more and the poorer ones paying less. Widows and the very poor households are either exempt or pay very little but are expected to provide labor. Communities manage payment schedules differently. Some collect each month, some at determined stages, and others pay the entire amount at once.

The most common savings and loan association is arisan, an informal savings and loan activity common to Indonesia. Other more formal village savings and loan associations also exist and are used to raise cash for WS&S projects.

Outside cash mobilization occurs through credit from pipe suppliers and banks. Credit from either local vendors or national pipe-suppliers has become a common method of financing for many CSFW communities. Pipe, fittings, and cement are purchased on credit and repayed with cash in installments, usually within two to six months.

Loans from banks are good sources of up-front capital for those communities having the capability to repay. To date CARE has made the following progress with bank policy:

1. Communities can borrow for water supply and sanitation projects;

2. Loans can be classified as investment rather than consumption (lower interest rate);

3. Collateral can be land certificates, user right certificates, GOI employee's salary, 45% cash deposit, or movable property as agreed by bank;

4. Flexible repayment terms.

In-kind contributions are sometimes made instead of cash where cash is in short supply. Two common ways to make in-kind contributions are zakat and perelek or jimpitan. Zakat is a religious tithe where members of a Moslem community are obligated to donate part of their income or agriculture production to support social services.

Various creative and innovative ways to mobilize resources for WS&S systems have been used by communities. For example, the village of Gawang has rented and shown movies as a way to raise money. The movies were extremely popular because community residents rarely have the opportunity to watch current films. The water and sanitation committee used the ticket sales to buy pipe and cement.

Sometimes a piped water system is not possible because the cost of piping water over a long distance is too expensive for the community. When this situation arises, the community must consider alternative technologies as did the village of Kedompol. There was not a near-by spring or river, so CARE introduced the idea of building rain water catchment tanks constructed out of bamboo reinforced cement. The community built 190 tanks for approximately 60 houses (one tank for three houses). After the construction was completed, the women in the community organized meetings to raise money to continue to build tanks. The number of tanks has increased from 190 to 431, completely financed and built by the community.

o CARE trains the water committee to construct the water and sanitation facilities (depending on the technologies selected). Meanwhile construction and hygiene and sanitation activities are monitored and adjusted if necessary.

5. Operation and Maintenance (O&M) - The community selects its O&M committee. The committee develops regulations and by-laws and presents them to the community. Next, the committee develops the O&M budget, bookkeeping system, and training plan. CARE then provides follow-up training to the committee as planned.

Generally, operation and maintenance of the water system is organized according to user groups. For example, one public bathing facility is used by about 10 families who are responsible for maintaining the facility, including paying for any repairs. Repairs are payed for through the collection of user fees which range from about Rp.100 ($.5) to Rp.500 ($.50).

Another use of user fees is to actually construct the water supply and sanitation facilities as done in the village of Dersono. Once construction was completed, the committee continued to collect user fees and lent the money to a neighboring village so it too could build water supply and sanitation facilities.

In addition to user fees, village level savings and loan activities have been used. The women of the village of Wonoanti have used arisan to raise money for water seal latrines. Each woman contributed an amount of money every time the group mets. Once enough money was collected, a lottery was held and one of the user groups was chosen to receive the money to build their water seal latrines.

User groups in the village of Gawang have received a loan from the Family Income Enhancement Project to construct its water and sanitation facilities. FIE is a family planning program designed to help families increase income through village level savings and loans.

6. Evaluation and Monitoring - The final hygiene and sanitation evaluation and close out survey is conducted by the committee and CARE. CARE continues to help the O&M committee monitor the WS&S systems for about one year.

Experience in East Java has shown that communities generally maintain their WS&S facilities because a sense of ownership has been created through the community management and financing approach used by CARE.

Table 1 on the following page provides an overview of the number of beneficiaries, type of water system, total cost, M&E cost, and source of cash for each CSFW community in East Java.

WOMEN'S PARTICIPATION

The CSFW project is intended to be managed by the community; meaning participation in decision making from both men and women. Previous CARE water and sanitation projects tended to focus more on men as the primary decision makers. The CSFW project has attempted, with some success, to involve traditional women's organizations (PKK) in the planning and implementation of the project.

One important way women have been involved in the CSFW project is through resource mobilization. Women are traditionally responsible for managing the household finances. In the village of Worawari, the water and sanitation committee was not able to mobilize sufficient cash resources to begin construction on the water system. The women of the village proposed the idea of using their arisan activities to raise the necessary cash. Over the following year the arisan group continued to raise cash that was used by the committee to buy pipe and cement for the water system. The success the women had mobilizing resources resulted in several of them earning positions on the water and sanitation committee. Based on this experience, women and arisan have been used in other villages to mobilize resources.

Participation of women as decision makers is a trend that continues to evolve in the CSFW project. More and more women are occupying key positions on water and sanitation committees and are being consulted for important decisions.

THE SUSTAINABILITY OF THE CSFW PROJECT

The goal of the CSFW project is to increase access to and use of water and sanitation facilities. The principal strategy to achieve this goal is to convince other organizations working in the WS&S sector in Indonesia to use a community management and financing approach. Since the GOI is responsible for national WS&S policy and overall coordination, this is the institution the CSFW project is trying most to influence.

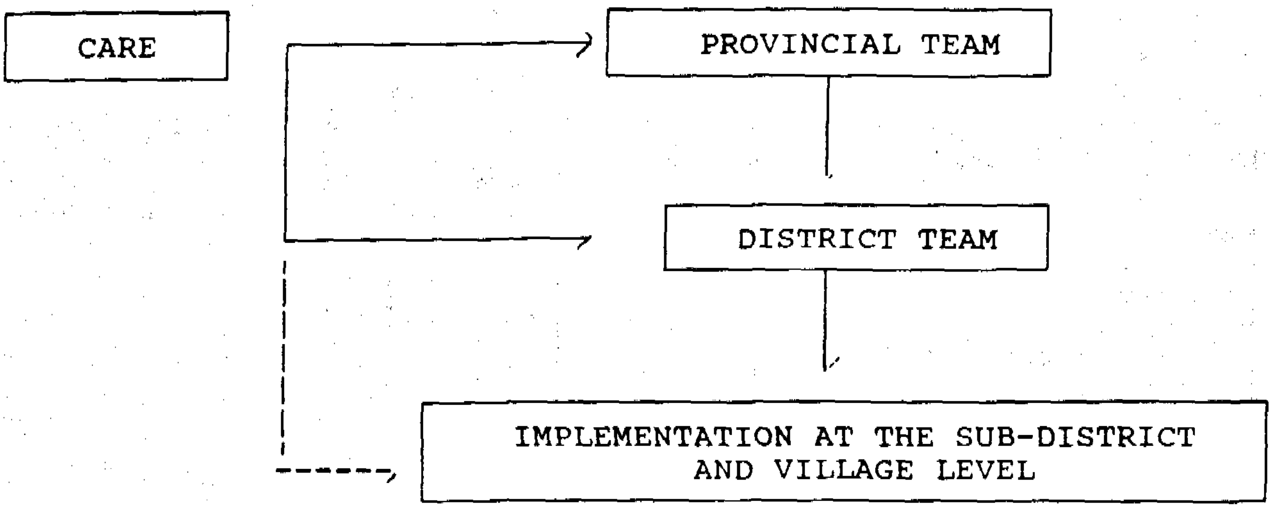
CARE East Java has made exceptional progress in convincing the Provincial Government of East Java to accept and use the CSFW approach to water supply and sanitation. Together the Provincial Government and CARE in East Java have developed a strategy to transfer and sustain the CSFW approach to provincial and district agencies responsible for rural water supply and sanitation. The strategy consists of the following steps:

1. CARE trains the Provincial Government Team consisting of representatives from Public Works, Ministry of Health, Ministry of Community Development, and Bappeda (responsible for area development).

2. The Provincial Team trains District Teams. During this training CARE backstops the Provincial Team. These trainings are on-going.

3. The District Team implements the CSFW approach with backstopping from CARE field staff. This is informal on-the job type training and assistance.

The strategy is depicted in the following diagram.



CSFW CASE STUDY
PAGER AND BULU BESAR

Pager and Bulu Besar are hamlets located in the village of Dersono which is about 40 kilometers south of Pacitan, the district capital.

Before the CSFW project, residents of Pager and Bulu Besar had to walk about one kilometer to fetch water from a spring. The hamlets' residents received a grant from the local government and managed to build a spring catchment and reservoir that served as a rain water catchment tank.

Even though the residents of Pager and Bulu Besar had to walk more than a kilometer to fetch water, they were satisfied with their water supply system. In 1987, a neighboring hamlet (Gesing) received a grant from the local government to build a spring fed gravity piped water system. Because this system delivered water very near to the houses, the hamlets of Pager and Bulu Besar became very interested in the same type of system.

In order to find out more about the Gesing water system, the hamlet leaders from Pager and Bulu Besar visited Gesing and spoke with the village water committee who suggested that the hamlet leaders conduct a village meeting to discuss water supply and contact CARE.

The hamlet leaders conducted the meeting in which residents agreed to the following points:

- o Send a letter to CARE requesting technical assistance and funds for the water project.

- o The hamlets will undertake a water project whether they receive assistance from CARE or not.

- o If funds are not available from CARE or the government, the hamlets will finance the water system through household contributions.

After the meeting, the hamlets' leaders sent CARE a letter requesting assistance. CARE field staff visited the hamlets and reached the decision that Pager and Bulu Besar would finance their water and sanitation systems with technical assistance and training from CARE.

Once this agreement was reached, the leaders called another community meeting to explain the agreement with CARE and what would be expected of the community. This meeting was also used to select the village water and sanitation committee.

The first major activity was a survey carried out by the committee with technical assistance from CARE. The committee measured the flow of water at the spring, distance from the spring to the village, and the number possible placement of reservoir tanks and public water points. Based on these data, the community estimated the system to cost Rp.5.7 million or about $3,000.

After costing the system, the committee met to discuss and develop a resource mobilization plan. The committee decided the bulk of the funds would come from two places; hamlet savings fund and household contributions. Approximately Rp.1.2 million was available from the savings fund and individual households could contribute between Rp.18,000 and Rp.27,0000. There would still be several thousand rupia needed to complete the system

At one point, the committee considered borrowing money from the bank. However, the committee and other residents in the community did not have experience with bank borrowing and felt intimidated. They decided the funds should come from local sources.

Resource mobilization slowed down considerably because of a lack of rainfall and subsequent poor harvests. Finally, the village development committee of Dersono agreed to loan the hamlets the remaining amount with no interest charge.

Availability of the funds together with technical assistance and training from CARE allowed the hamlets of Pager and Bulu Besar to complete their water and sanitation systems on schedule. To date, the water system is functioning as planned and the hamlets have repayed their loan to the village of Dersono. In addition, the committee of the hamlets have decided to build Islamic prayer houses near each public water point by using the same approach to community management and financing they learned from CARE field staff.

LESSONS LEARNED

We have analyzed the progress being made in CSFW communities in East Java as well as in other provinces and have identified several interesting characteristics of successful and less successful communities.

1. Leadership. The successful CSFW communities have strong formal and informal leaders who possess the ability to mobilize the rest of the community. These leaders include elected officials, teachers, and religious leaders. In less successful CSFW communities, strong leadership is absent. Leaders are unable to organize and mobilize the community.

2. Conflict. In several of the CSFW communities that are having difficulty, we have identified conflicts between leaders, especially political leaders. These conflicts have caused groups in the community to divide. On the other hand, conflicts and divisions are not characteristics of successful CSFW communities where the community is united and its leaders cooperate.

3. Community income. We have not been able to identify ability to pay as a significant characteristic of either successful or non-successful CSFW communities. However, the majority of people in CSFW communities won some productive land or have a source of income, even though it is often marginal. Therefore, we assume there exists an "income threshold" and if community income falls below this threshold, the CSFW project will not succeed.

4. Access to water. One of the primary characteristics of successful CSFW communities is that they do not have easy access to a water source. Community members must walk long distances to acquire water. Less successful CSFW communities almost always have a convenient supply of water. These water sources include hand-dug wells, irrigation channels, small rivers, or springs. Community members do not have to walk long distances to acquire water.

5. Water system technologies and design. Successful CSFW communities have built simple and inexpensive water systems. Technologies include rain water catchment systems, spring or river fed gravity piped systems, and handpumps. Less successful CSFW communities use the same technologies, but the designs are more complicated and the systems are more expensive.

For further reading

Evans, P. (1992). Paying the piper. An overview of community financing of water supplies. IRC Occasional Paper Series No.18. The Hague, The Netherlands, IRC International Water and Sanitation Centre.

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McCommon C., Warner D., Yohalem D. (1990). Community management of rural water supply and sanitation services. UNDP/World Bank Water and Sanitation Discussion Paper series No.4, WASH technical report No 67. Washington D.C., USA.

Yacoob M., Walker J., (1991). Community management in water supply and sanitation projects - costs and implications. Aqua, Vol.40, No1, pp.30-34.

White A, (1981). Community participation in water and sanitation. Concepts, strategies and methods. IRC Technical Paper Series No.17. The Hague, The Netherlands,IRC International Water and Sanitation Centre.

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Briscoe, J.; De Ferranti, D. (1988). Water for rural communities. Helping people help themselves, Washington DC, USA, World Bank.

Srinivasan, L. (1990). Tools for community participation. A manual for training of trainers in participatory techniques. PROWWESS/UNDP Technical Series. UNDP.

6.2 INVOLVEMENT OF WOMEN

Description of session

OBJECTIVES

- Provide an overview of experience and constraints in the involvement of women
- Widen perspective on women involvement

OUTLINE OF SESSION

(A resource person, preferably a female social scientist, would be appropriate to address this issue)

• Participants identify constraints to women's involvement, by writing cards which are then grouped and discussed mainly asking: - Why this constraint? - can you give an example? - how can it be solved?	45 min
• Presentation on reasons to involve women as well as on ways to involve women	45 min
	1 h 30 min

HAND - OUTS

- Extracts from the supporting material
- Extracts from the background material

MATERIAL NEEDED

- Cards
- Overhead projector

Background Information

1. Identification of constraints

Examples of typical barriers:

* culture/religion
* attitudes (of male leaders, husbands, women themselves)
* access to information (on the project, project meetings, community tasks)
* participation in meetings (time, location, seating, etc.)
* training
* job execution and remuneration

Cards can be combined under each constraint.

2. Potential involvement of women

(From Training material on Women, Water supply and Sanitation, ILO, UN INSTRAW, UN DTCD)

In view of their most direct interest in improved water supply and sanitation, women often play a large role in innovative approaches to management of water and waste, especially at community or neighborhood levels.

Low - income urban areas

In low-income urban areas, women have been reported to take part in water supply and sanitation management:

a) as members of local committees that manage taps or sanitation facilities.

b) as organizers and managers of water vending ('kiosk system'). United by their need for reliable and affordable water, and their dislike of high water prices from private vendors and licence holders, women of low-income urban neighborhoods in Honduras, Burkina Faso and Kenya have taken on managed their own licensed water vending points.

c) as organizers and managers of neighborhood water supplies and sanitation systems. Water is used for beer brewing, teashops and launderette.

Management in rural areas

When women are involved in management in rural areas, it is mostly in management of water use and hygiene at water points and as members of local management organizations.

Site management

As managers of communal water points, women are concerned with drainage and hygiene, proper use of taps and pumps, prevention of damage by children and livestock, and they increasingly execute preventive maintenance and simple repairs.
In some cases, traditional norms and social control on the use of communal sources and the sense of communal ownership of new facilities are strong enough to guarantee that the individual users take care of the proper use and management of the site.
In other cases, satisfactory site management has been achieved through the organization of women users. Well committees have been formed to supervise use of protected wells. Women have also been encouraged to use the pipeline routes as paths and to report leakages to the village caretakers.

Caretaking
Where women have been involved in maintenance, their role has been closely related to their traditional management tasks. They have been particularly involved in preventive maintenance and the preservation of site hygiene and the control of use at the source. In some cases, arrangements have been made spontaneously, thus preserving their original tasks as users and informal managers. In other cases, special tasks have been formulated in consultation with the agency. These have varied from appointment to a nearby women to look after the water point, to a site committee, user roster, or a team of a male and a female caretaker, with the woman responsible for hygiene and the man for technical matters.

System management
As members of mixed water management organizations comprising both men and women, women are involved especially in financing aspects, e.g. as treasurers and rate collectors.

Much of the work involved in maintenance, in particular the more regular preventive work is particularly suited for women. Reasons given in project reports include:

* the direct concern and personal interest of women in their water supply
* their regular visits to distribution points
* the compatibility tasks of women
* easier communication between women caretakers and women users
* their greater sensitivity to social pressure from other women to do a good job
* the importance of health aspects
* the lower career orientation and labour mobility of women
* the recognition that training in modern technology will contribute to household's water supply and sanitation

(see also overhead sheet 1)

3. Practical ways to women's involvement

* Get consent & support from local leaders to bring in women
* Use local organizations (church, women's groups) to inform women and get them together
* Use several channels to reach women with info on project & meetings
* Organize village meeting with men & women with help of local leaders
* Organize women's meeting with help of leaders
* Facilitate women to reach:
  . by involving female workers to help them speak out
  . by stimulating internal correction
  . by planning meeting proper time & seating
* Assist in choosing female Committee members:
  . get men & women to agree on presence and number of women on Committee
  . women choose Committee members on time, trust and social capability
* Develop local training adapted to male and female Committee members
* Unite women on common interest and help women Committee members act as women's representative
* Involve women in local decisions on:
  . caretakers
  . financial system.

The facilitator might want to use brief examples of case studies regarding involvement of women in water and sanitation programmes.
Some examples are proposed in the supporting material taken from the Annual Abstract Journal no. 1 of May 1991: "Woman, Water, Sanitation" published yearly by IRC, with support from PROWWESS/UNDP and NORAD.

Overhead sheet 1

REGULAR VISITS
TO WATER POINT

DIRECT CONCERN
AS USERS

COMPATIBLE
TASKS

**INVOLVEMENT
OF
WOMEN**

LOWER
CARRIER
ORIENTATION

COMMUNICATION

HEALTH AND
HYGIENE
EDUCATION

SENSITIVITY TO
SOCIAL PRESSURE

Overhead sheet 2

FORMS OF PARTICIPATION OF WOMEN IN LOCAL MANAGEMENT AND MAINTENANCE

SITE MANAGEMENT

* AS INDIVIDUAL USERS
* AS MEMBERS OF USER ORGANIZATION
* ORGANIZED BY PROJECT

CARETAKING

* AS MEMBERS OF MALE-FEMALE TEAMS WITH CULTURALLY APPROPRIATE DIVISION TASKS
* AS CARETAKERS DOING BOTH TECHNICAL AND NON-TECHNICAL TASKS

LOCAL ADMINISTRATION

* AS MEMBERS OF MIXED MANAGEMENT COMMITTEES
* IN SEPARATE MANAGEMENT COMMITTEES FOR MEN AND WOMEN

Overhead sheet 3

PRACTICAL WAYS TO WOMEN'S INVOLVEMENT

* CONSENT AND SUPPORT FROM LOCAL LEADERS
* USE LOCAL ORGANIZATIONS TO GET WOMEN TOGETHER
* USE SEVERAL INFORMATION CHANNELS TO REACH WOMEN
* ORGANIZE VILLAGE MEETINGS (AND FACILITATE ACTIVE PARTICIPATION)
* ASSIST IN CHOOSING FEMALE COMMITTEE MEMBERS
* DEVELOP LOCAL TRAINING FOR BOTH MEN AND WOMEN
* UNITE WOMEN ON COMMON INTEREST
* INVOLVE WOMEN IN LOCAL DECISIONS

Supporting material

4. Women and Maintenance

16.
INSTRAW and UNICEF, (1988). *Women, water supply and sanitation: a national training seminar held at Kadugli, Sudan, 16-21 January 1988.* Santo Domingo, UN International Research and Training Institute for the Advancement of Women.

Sudan has formally adopted participation in its Four Year Plan of 1987-91, the main reason being poor operation and maintenance, causing early failure of new systems, loss of investments and use of scarce resources for rehabilitation and replacement. Informally, participation experiences already exist. Many villages contribute to construction and manage and finance operation and maintenance directly. Expected national savings range between 13% and 22% for construction, and 66% to 100% for O&M, depending on type of technology.

Experiences with women's involvement centre around Kadugli, S. Kordofan. UNICEF used women's views to choose an easy-to-operate handpump and modify its latrine slab design. In the urban district of Kadugli, trained female mechanics maintain over 80 pumps, as they can better educate other women, are more sensitive to their pressure to do a good job, and solve problems about use more easily. While husbands do not like married wives to be trained, most girls continue the work after marriage with their husband's consent. User cooperatives will be formed to help them raise cash for spare parts from users or councils, now a problem. In town, a surtax on sugar will go to pay the women's labour, spare parts and tools. In the villages, parallel women's committees are formed to follow-up pit latrine construction. Their effectiveness depends on their own capacities and male leader support. Hygiene education is introduced through a local women's association. Involvement of men and a careful division of duties for repair and site management between community and agency was found necessary everywhere. Using specific modules, the seminar discussed ways and means to enhance women's involvement on a national scale, and made specific recommendations for adaptation of training curricula, linkage with existing programmes and staff, and insertion of experiences into project and field manuals.

17.
Madsen, Birgit (1990). 'A community-based handpump rehabilitation and maintenance programme'. In : *Waterlines*, vol. 8, no. 3, p. 10-12.

18.
Madsen, Birgit (1988). *DANIDA/ DDF Community-based handpump rehabilitation and maintenance programme : manual for instructors on community participation.* Harare, Zimbabwe, District Development Fund (DDF), Ministry of Local Government Rural and Urban Development.

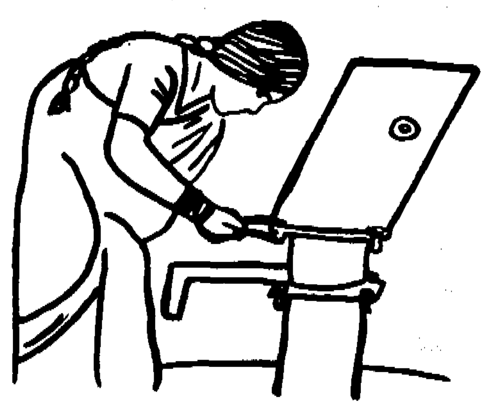
Immediate objective of the programme is to rehabilitate 1800 handpumps and construct proper sanitary headworks (platform, drain, washing slab, cattle trough). While repair is in progress, a community maintenance structure has to be established. Handpump sub-committees are set up, with local women elected as members and one as caretaker for each pump. The committee organizes the users of a pump to assist project staff or the pump minder in the rehabilitation of the pumps, and builders in the construction of the headworks. The roles of the parties concerned are properly defined. To achieve community participation, a manual, based on participatory learning methods is developed. It provides district project facilitators with guidelines and tools for enhancing community participation in project implementation. The manual not only gives the outline for training sessions, but also examples of agreements , terms of reference, criteria for selection of caretakers etc. The facilitators in turn train people at different levels. Since November 1986 about 11,000 people have been trained, from district politicians to pump caretakers. However, attitudes of DDF staff and user groups towards accepting and assuming responsibility for rehabilitation and maintenance are slow to change, for political, logistical, technical, social and cultural reasons. A socio-economic constraint is caused by the fact that women have neither enough time nor money to work voluntarily. Nevertheless project facilitators and other staff-members already indicated their positive experiences with the female caretakers.

19.
Paqui, Hilda (1989). 'Malawian Women keep the pumps flowing'. In : *Source*, vol. 1, no. 2, p. 8-9.

Since 1980, villagers are being trained to perform preventive maintenance of handpumps installed under a UNDP-supported Rural Handpump Testing Project in Livulezi District in Malawi. Each pump is tended by a caretaker and two assistants who make up the village water committee. Training is given for one week. Most caretakers are women who not only routinely inspect the handpumps, but also give health and nutrition messages. In case of major breakdowns, the caretakers report to one of two maintenance assistants in the district. Needed tools and spare parts are transported to the village by the villagers themselves. The community involvement in maintenance has reduced breakdown rate by 75% and cost from $140 to $16 per pump/per year.

20.
Kumar, Yogesh (1989). *Report on community participation in rural water supply programme pilot project in Allahabad.* Lucknow, India, Programme Support Unit, UP Development Systems Corporation.

This pilot project in three villages develops and tests structural improvement to handpump maintenance in Allahabad district, Uttar Pradesh, India. Of the 33 handpumpwells made, 2 or 6% were dry, 33% had technical and 42% drainage problems. Corrective action was slow, as users were not informed; male caretakers were chosen for proximity, not for motivation; and logbooks were not kept for lack of separate columns for caretakers and mechanics. Actual work was done by wives or daughters, as the caretakers themselves were too busy elsewhere. The project first won the men's confidence and broke attitudes of maintenance being a sole government responsibility. It then made several wives the official caretakers, and helped chose new female caretakers. The caretaker selection criteria, logbooks and mailing system have been improved and technical caretaker training planned. Illiterate women use literate family members to keep up the logbooks. In the future, training of local repair men and women (more cost-effective than mobile teams) and organization of local well committees are planned.



21.
Sharma, Hira (1989). *Now women of Tharu Scheduled Tribe ensure drinking water through India Mark-II handpump.* Lucknow, India, Uttar Pradesh Jal Nigam.

22.
Sharma, Hira (1989). 'India Mark-II handpump construction and maintenance camp of Tharu Scheduled Tribe under Trysem Scheme : a detailed report'. In : *India. Sector Rural Water Supply. Report on Mission 22 to Uttar Pradesh.* The Hague, The Netherlands, Ministry of Foreign Affairs, Development Cooperation Asia Department.

This pilot project was set up following an interregional INSTRAW/ESCAP training seminar on women and water. The project trained 15 women in the tribal area of Lakhimpur Kheri for one month in the installation and maintenance of India Mark-II handpumps. The women, who live in an area with a matriarchal system, get a fixed remuneration from the state water authority Jal Nigam for certain types of repairs. They can further work as private mechanics in their village.

Equipment is made available on a 50% grant/50% loan basis. Aim of the project is to provide employment to poor youth and women, and reduce transport costs for handpump maintenance at equal or better effectiveness. Since the publication of the above reports, the agency has replaced its two block mechanics by seven women mechanics, who for the same budget, maintain between 11 and 20 handpumps. Monitoring data on their effectiveness are now collected and the project is replicated in a second district (personal communication).

23.
Devi, Shamala (1988). *A study of the effectiveness of women handpump caretakers programme in Bagepalli Taluk, Kolar District.* New Delhi, India, DANIDA.

Women caretakers in Karnataka, India, are trained for two days to voluntarily maintain and ensure proper handling by users of handpumps, installed in every village in the district by the Department of Public Health Engineering. The evaluation was carried out one year after the training and revealed that the caretakers concentrate on the non-technical tasks (cleaning of surroundings of the pump and instructions on proper use), but the community is not very responsive.

The extent of cooperation is directly related to the socio-economic status of the caretaker. The community has not been involved in planning nor informed about the role of the caretaker, resulting in non-responsiveness to and lack of recognition for the caretaker. Not enough backing is given by the Department. For technical maintenance and communication, men in the community do assist, because they find themselves more suitable for these tasks, but on the whole the community and the caretakers agree that the job should be done by a woman.

24.
Srivastava, J. C. (1990). 'Women and handpump maintenance'. In : *Health for the Millions,* vol. XVI, no. 5, p. 3-7.

Over the years, several developments in the Indian water sector proved to be beneficial for involving women in handpump maintenance. The search for improvements in the cost and operational effectiveness of handpumps resulted in the development of the *VLOM* handpump (India Mark III, *V*illage *L*evel *O*peration and *M*aintenance). There are several advantages when compared to the India Mark II, that enable more women to act as caretakers. Advantages are for example reduction of time needed for maintenance due to easy access to below-ground components; need for fewer tools, which can be carried on a bicycle; requirement of only one additional person (previously two) due to using those tools. An integrated management system for handpump maintenance is considered a solution to problems like poor maintenance.
Encouraging experience has been gained with a two-tier system: mobile teams of mechanics at block level, covering about 100 villages, and one caretaker for each handpump at village level. The caretaker has preventive

maintenance tasks, including environmental sanitation, chlorination of tubewells, water quality testing and reporting of pump failures to the block team. In other instances women have formed own groups to perform the caretaker tasks.
Participatory maintenance generally covers the involvement of women for preventive maintenance. SWACH carried out a cost-benefit analysis of handpump maintenance vis-a-vis women's additional burden as handpump caretaker. It was found that women's resources could not be stretched too far, but that they supported the VLOM handpumps. How women are to be involved in a maintenance system is area-specific and their needs, priorities, education and income level need to be taken into accou[nt]. Systems should stimulate the involvement of women, increase their management capacities, empower them with decision-making and generate cost-consciousness.

5. Women and Managenent

25.
Janssen, Resi (1988). *Vrouwen, mannen en drinkwaterbeheer : een onderzoek naar het funktioneren van pompkomitees in Burkina Faso* (Women, men and management of water supply : research into the functioning of pump committees in Burkina Faso). Wageningen, The Netherlands, Agricultural University, Department of Domestic Science.

In a water supply project in NW Burkina Faso, village level pump committees have been formed for operation and maintenance. They consist of men and women, or of men only. Both types of committees are not functioning well, hence as an experiment two pump committees have been formed with only women. Aim of the study is to see if these committees function better. This is not the case, because their functioning is mainly dependent on external factors, such as the dependency on the pump for water supply, the size of the village, and the location of the pump. Committees functioned best in smaller villages, with no alternative water supply. The functioning of the committees is furthermore determined by internal factors, such as composition, position, motivation and training of the committee and available time of the members.

26.
Poluha, Eva (1990). 'Dodota water supply project'. In : *Development Journal*, vol. 3, p. 39-43.

The Dodota water supply project arose out of discussions with women's groups and was implemented in central Ethiopia between 1982 and 1986. It was meant to provide 56,000 people with sufficient drinking water. The water supply is owned by the Revolutionary Ethiopia's Women's Association. An evaluation was carried out to measure the project's impact and to determine key factors that helped to make the project successful. At the time of the evaluation about 40,000 people were receiving water from the project. In order to enable the women to operate and administer the project, 131 women were trained in management, bookkeeping, fee collection, and construction and maintenance.

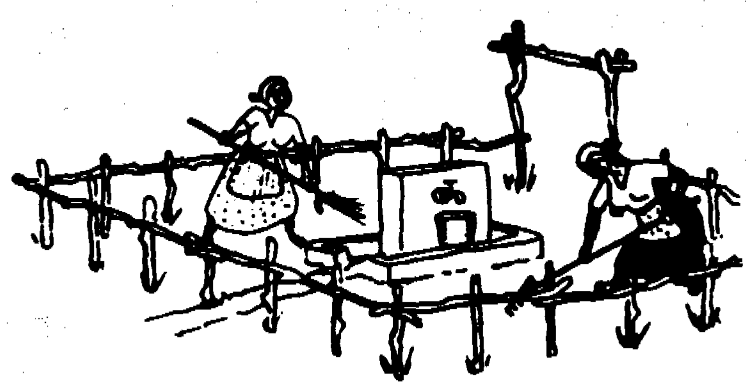
The main impacts of the training were that it prepared women for qualified and salaried employment; the employed women sensed new-found freedom; and local views concerning the ability of women to perform previously unfamiliar tasks changed positively. Above all, the women were able to assume almo[st] full responsibility for the local management of the water system, thus increasing the project's technical sustainability. Economic sustainability, however, would have required more training in financial matters. Some activities had to be discontinued because of financial losses. Water quality was found to be better and water was also used for income generating purposes. The time saved due to reduced walking distances gave women more time to look after their children and to start learning. Some of the other key factors derived from the evaluation are the presence of a real need for the project by those responsible for providing their families with water; a substantial planning phase which allows for gradual and field-based development of the project and good communication between the project parties concerned.

27.
Narayan-Parker, Deepa (1989). *Indonesia : evaluating community management : a case study.* New York, NY, USA, PROWWESS/ UNDP.

Four villages in Timor, Indonesia, were assisted by the national family welfare movement, PKK, to improve existing water sources: springs, piped schemes and handpumps. There was no detailed project proposal; work developed from applied research by university volunteers. Four community development workers were seconded to PKK and liaised with the Ministry of Health for materials and with a technician for designs and supervision. PKK gave training on women's involvement, leadership, bookkeeping and management. After 14 months, many water user groups were formed and 42 waterpoints, including rainwater tanks, built/improved/repaired. All were working, with repairs carried out with spare parts from private markets, but with no records on maintenance and finance reported. Group membership covers 72% of the women and 62% of the men, with 47% and 26% being active. Village contributions saved 40% of PKK's budget. Of the families, 65% now use improved sources, though faecal contamination from source to cup remains a problem and domestic hygiene can be improved further. Use of secondary sources dropped from 36% to 21%, and wet season sources from 24% to 11%. Average collection time almost halved to 22 minutes, but totals remained the same, as the women chose to make more trips. Total consumption rose from a lowest 4.8 l/c/d to an overall 10.2, not counting use at the source. Surplus water is used for fishponds or vegetable growing. The latter grew as important source of income from 62% to 85-100%. Several rating techniques showed a growth for women in project knowledge, self-confidence and leadership, and increased autonomous management of water systems. Long-term results and larger-scale replication are awaited.

28.
Espejo, Norah (1989). *Water committees in Latin America : tasks and training.* The Hague, The Netherlands, IRC International Water and Sanitation Centre.

Latin America has the longest tradition of community-managed water supplies. This report reviews the various types of water committees found in the region, their tasks and the degree to which they are being prepared for these tasks. After reviewing a large number of project reports, evaluations and training materials, the author concludes that water committees are more successful when they have not been imposed by external organizations, but been created by community members themselves for the specific purpose of establishing and running a water system. Neither type of committee is at present sufficiently trained for their managerial tasks, especially with regard to links between water supply projects and broader community development; negotiation and planning with implementing agencies; understanding and managing operation and maintenance; financing and financial management, including accountability of the committee for their management to the tariff payers; and health aspects. Training methods are conventional rather than participatory. They have a narrow individual focus and do not constitute 'learning events' for whole communities or groups. Although women are often the initiators of water projects, especially in urbanization areas, their participation is often hardly recognized. They are providers of food and drinks during construction, and sometimes physical labour. They might also help their husbands, members of water committees, in official duties. Women are sometimes inhibited to participate in training because they cannot travel. Audio-visual materials depict only men in water supply and environmental activities. The report includes a selection of the better training materials, some of them prepared by local communities.



Supporting material

From "Women, Water and Sanitation - policy on an operational footing: main points and checklists" Sector Papers Women and Development no. 2 from the Ministry of Foreign Affairs, The Netherlands.

(This checklist does not aim to be exhaustive. It rather focuses on main points, not avoiding overlap where different perspectives seem useful.)

policy / attitudes

1. What is the policy and the attitude of government, local leaders and project management towards the involvement of women?
2. Do these parties explicitly view women's involvement both as a condition for the success of project improvements and as a prerequisite of genuine advancement of women's interests?
3. Does the project systematically promote sensibilization of local leaders and own staff in this respect?
4. Is this reflected in staff training and staff composition?

baseline

5. Have existing water supply and sanitation practices been thoroughly investigated?
6. Have findings been distinguished for different user categories: men and women, occupational and income groups?
7. Have poor women been directly approached as informants on their own particular roles, needs, problems and possibilities?
8. Has this been done appropriately, i.e. by female interviewers in a sufficiently informal setting, asking how things are actually done rather than who is officially in charge? (see A)
9. Have the following points been investigated to arrive at a detailed picture of what is at stake for women in water and sanitation:
   - women's provision of family health in general;
   - their provision of family hygiene in particular;
   - their educating role in health and hygiene;
   - their tasks in collecting, storing and using water;
   - the extent to which they are aided in collection by children, men and means of transport;
   - their tasks in sanitary arrangements;
   - their problems in ensuring their own sanitary privacy;
   - their traditional contribution to design, maintenance and management of facilities;
   - their informal management role at community level;
   - their access to provisions, relative to men and richer women;
   - their household use of water;
   - their productive / profitable use of water and waste (vegetable gardening, fertilizer, fuel, building material);
   - the competitive demands on women's time and energy in general;
   - the share of time and energy devoted to water and sanitation;
   - the negative impact of this workload on women's own health;
   - the negative impact of this workload on other of women's tasks, such as childcare, vegetable gardening, weeding, harvesting, etc;
   - the negative impact of this workload on women's opportunities to engage in new activities, such as income generation, community work and self-development.

Supporting material

further preparation

10. To what extent do the project objectives address the points enumerated under 9?
11. Have women's desires for changes concerning these points been identified?
12. Has a system been developed to monitor project-induced changes in these points? And does this system rest on continuous consultation of women?
13. Are project targets sufficiently flexible to allow the development of systematic procedures for women's involvement?

participation and workload

14. Does the project contribute to freeing women's time and energy for other tasks they already have and for new activities they want to undertake?
15. Is there sufficient insight in the benefits that do or might accrue from this, to women directly and to households and community as a result? (see B)
16. Does the project sufficiently appeal to the community as a whole, taking care that women are not inordinately burdened? (see C)
17. What measures are taken to overcome cultural / practical obstacles to women's participation? Think of:
    — convenient times and places for meetings;
    — adequate seating arrangements;
    — female intermediaries / project staff;
    — informal settings for women's groups;
    — sensibilization of local leaders.

entry points

18. Can and do women participate on the basis of all of their interests and key roles? (see 9 and D)
19. Is women's local expertise utilized to identify suitable locations and to ensure convenient design of facilities? (see E)
20. Is this done with sufficient attention to social factors, such as ease of access for all, prevention of domination and nuisance, respect for privacy?
21. Are women also consulted to find suitable training candidates for local maintenance and management: people with sufficient time, commitmemt, trustworthiness and skill? (see F)
22. Is women's familiarity with traditional learning systems used as a basis for effective health education and project communication as a whole? (see G)

construction, maintenance, management and actual use

23. Can women assist in low-cost construction of facilities without being disproportionately burdened?
24. What specific skills and insights can they contribute, what voluntary labour can they do, what can they contribute financially themselves and what community funds can they raise? (see H)
25. How can women's traditional maintenance tasks be extended to the project situation?
26. Is their training adequate, is there sufficient compensation for workload increases, is there sufficient back-up service for larger repair and does a substantial share in the overall management ensure that women can actually control maintenance? (see I and P)
27. Has women's existing informal role in management been identified (see A) and does the project build on this by having part of the formal management arise from the group of main users? (see J)

Supporting material

28. Does the project keep close track of actual and adequate use of new facilities?
29. Are at least 80% of the facilities in well-functioning order? Are frequency and duration of breakdowns within set standards?
30. Do users have reasonable alternatives for safe water supply and excreta disposal when facilities are out of order?
31. To what extent does an overall improvement in hygiene behaviour occur? (safe supply, storage and drawing of drinking water; good personal and school hygiene, etc.)

Steps towards women's involvement

32. Have target categories been identified on the basis of felt needs, with special alertness to the needs of poor women? (see L)

33. How can users participate in decisions on at least: (see M)
    - design and location of water sources and sanitation facilities;
    - additional provisions for washing, bathing, cattle watering;
    - additional community funding and manner of payment;
    - control over operation, operating hours;
    - accountability of operating staff to the community.
34. Does health education sufficiently focus on the marketing approach, investigating the needs, interests, problems, capacities and practical possibilities of each target group, in particular women?
35. Does health education proceed from there to the participatory approach, assisting target groups in the joint identification and solution of problems?
36. Do project improvements sufficiently rest on these two approaches to become acceptable and effective? (see K and N)
37. Are men, as part of the community as a whole, also involved in this type of health education?
38. Does the project provide enough user information on the technical, financial, managerial, health and workload implications of various options to enable users to make responsible choices? (see O)

wrap-up questions

39. Can women, and in particular poor women, participate in the design and execution of project activities, not only nominally but also in practice?
40. Do they have practical access to
    - project information / user information;
    - relevant health education;
    - planning and implementation of hygiene education and hygiene action programmes;
    - technical, administrative and managerial skills training;
    - water users associations and cooperatives, as full members with voting rights;
    - maintenance and management positions for water, sanitation and hygiene improvements at all levels;

Supporting material

41. Can women participate in line with their own wishes and potential, without harm to present tasks and new opportunities?
42. Do women have individual or organized influence on the operation, maintenance and management of water and sanitation services?
43. Are project staff at all levels aware of and familiar with the general goals and methods of women's involvement? And does the project recruit enough additional staff and research expertise on women's issues in water, sanitation and hygiene?
44. Can any of the following positive impacts on women be observed:
    - reduction of women's workload;
    - increase of their time, energy and opportunities for childcare, education, income generation, etc.;
    - better personal health and family health;
    - enhanced status, due to share in decision-making.
45. Can any of the following negative effects on women be observed:
    - increased workload;
    - no access to income or products resulting from productive use of water and waste, or from time and energy savings;
    - reduction of traditional authority in water supply, health care and community development;
    - exclusion of lowest-income groups, such as female heads of households, from services;
    - greatest benefits of services to higher-income groups.

For further reading

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6.3 LOCAL FINANCING

Description of session

OBJECTIVES

- To raise awareness on local financing issues
- To become familiar with different financing options within one's own project

OUTLINE OF SESSION

• The facilitator presents a set of different *questions* to be answered by the participants (see background information)	45 min
• The facilitator presents local financing options with their positive and negative aspects, as well as the "summary of community contributions to capital and recurrent costs" (see supporting material)	1 h
	1 h 45 min

HAND - OUTS

- Questions for group discussion
- Local financing options
- Positive and negative aspects of financing options
- Individual working sheets

MATERIAL NEEDED

- Overhead projector

Background Information

1. Possible questions to be asked on local financing

The very first question to be asked is **Why should the users pay?**
Here is a set of possible answers (adapted from Briscoe and de Ferranti, 1988; Katko, 1990, by Evans, 1992):

* Available capital funds are inadequate to achieve full coverage
* Available public funds are inadequate to meet recurrent costs
* State intervention and control has proven to be inefficient and ineffective
* Social and economic benefits of improved water and sanitation are to indirect to justify free services
* Subsidies disempower users by denying them choice
* Subsidies discourage cost-effectiveness and the development of low-cost solutions
* Evidence of demand and willingness to pay is strong with many poor people already paying high rates for services
* Properly regulated user charges would mean the poor would pay less and get better service
* Payments increase sense of value and commitment among users
* User payments maximise the use of available resources
* User payments improve quality and standards of service

Another set of questions could be related to the implication and relevance of decentralizing financial management.
By its very nature water supply is a decentralized activity; in general, water is used near the place where it is produced. The same applies, mutatis mutandi, for sanitation.

- Which aspect of financial management can be decentralized to community level and which should remain under national / regional/district authorities? How can financial coordination be improved between the community and other authorities concerned ?

- **How could it be promoted that village water committees accept responsibility for** financial management of water supply and sanitation services at local level ? What support would this require in terms of information, education, training ?

- Should privatization be promoted ? What financial responsibilities could be delegated to private enterprises ?

- How could Governments be encouraged to establish a proper financial policy for rural water supply and sanitation, based on decentralization ? What support should national, regional and districts authorities provide to the community ? How should this be selected in the development of an appropriate legal framework?

- **Should the financial management of rural drinking water and sanitation be kept** separate or integrated with other revenue systems? Do methods need to be adapted for schemes that include both water supply and sanitation ?

- What are the finance-related factors that should be taken into account in selecting projects ? Should a scheme be rejected for development if it proves impossible to recover recurrent costs from the community ? Is it justifiable to lower the standard of supply to achieve this goal ?

Finally the facilitator may wish to choose simple questions to be asked, such as the ones proposed in the supporting material. (Main questions for village decision making on maintenance financing)

2. Summary of financing options
(see supporting material)

* Community funds
* Rating options
* Commercial options
* Taxation options

3. Positive and negative factors of financing options
(see supporting material)

4. Willingness to pay
Some of the common problems that affect the ability and willingness of the community to invest in sanitation facilities:

* level of income
* costs of technology adopted
* financial arrangements for implementation
* beliefs and expectations about sanitation project implementation
* caution in investing scarce funds
* opposition from local leaders
* limited interest in improvements
* inadequate financial arrangements
* lack of understanding of project contents resulting from inadequate communications support
* unfulfilled expectations
* delays in project execution
* lack of agency support in providing services for maintenance and latrine emptying
* lack of agency involvement in training and promotion
(Larbi,1990)

Overhead sheet 1

FINANCING OPTIONS

* COMMUNITY FUNDS
  - VOLUNTARY FUNDS
  - GENERAL COMMUNITY REVENUE
  - COOPERATIVE FUNDS

* RATING OPTIONS
  - FLAT RATES
  - GRADED RATES
  - MIXED RATES
  - WATER METERING

* COMMERCIAL OPTIONS
  - WATER VENDING

* TAXATION OPTIONS
  - DIRECT WATER TAXES
  - CROSS SUBSIDY

Overhead sheet 2

Questions for discussion	Options
What costs to budget for ?	Remuneration Tools and spare parts Replacement Extension of system
What funds to use ?	Village funds Voluntary contributions Regular user payments
How to collect money ?	Fund raising on breakdown Taking money from a fund Regular collection
When to collect ?	Monthly Beginning of financial year After harvest
Who collects ?	Village water committee User group Community leaders
How to keep the money ?	Village account Water account
How to administer funds ?	Receipts for book-keeping Financial control User feedback
Who to administer the funds?	Village water committee Village accountant
How to pay the caretaker or mechanic ?	Per job Per month (fix + % of sales) Per year after harvest In cash / kind

Supporting material

(all from Evans, 1992 adapted from van Wijk, 1989)

1. Summary of financing options

What?	*When?*	*What for?*
Voluntary funds	In communities with a tradition of fund-raising, seasonal income, and a good knowledge and control of payments according to household capacity and benefits.	Financial contributions to construction; occasional larger contributions to maintenance and repair of simple systems with public water points.
General community revenue	In communities with own sources of income and a water supply with public facilities.	Annual maintenance and repair, financial contributions to construction; depreciation and expansion where possible.
Cooperative funds	Water supply initiated and financed through production cooperative or village revolving fund; no direct payments for water used.	Annual maintenance and repairs; repayment of construction loan; depreciation and expansion where possible.
Flat rates	Families have private taps, or share taps with well-defined social group, have fairly reliable incomes, and benefit more or less equally.	Repayment of community loan for construction annual maintenance and repairs; depreciation and expansion where possible.
Graded rates	In communities with appreciable differences in water use and benefits and sufficient community spirit to divide user households into different payment categories.	Repayment of community loans for construction annual maintenance and repairs; depreciation and expansion where possible.
Mixed rates	In communities with large differences in payment capacity and water use, with hign- and low-income households living in separate sections.	Repayment of community loan for construction; annual maintenance and repairs; depreciation and expansion where possible.
Water metering	In large communities with limited water resources and an efficient administration.	Repayment of community loan for construction; annual maintenance and repairs; depreciation and expansion where possible.
Vending instead of a piped distribution network	In communities where a socially valuable vending system can be improved, where other solutions are technically, economically or politically impossible.	Contribution towards financing of the recurrent costs of the agency, and financing of vendor service costs, including upkeep of hygiene and simple repair.
Vending as part of a piped distribution network	In communities where group connections or cross subsidies between private and public taps have not worked.	Contribution towards financing of the recurrent costs of public taps and the service of the vendors, including upkeep of hygiene and simple repairs.
Coin-operated taps	Not recommended because of their great sensitivity to breakdown and interference.	
Direct or indirect water taxes	In communities where the transfer of sufficient funds to the water organization is assured and taxation can be related to water use and costs.	Annual maintenance and repair; repayment of construction loan; depreciation and expansion where possible.

Source: van Wijk-Sijbesma, 1989.

Supporting material

2. Positive and negative aspects of community options

Managing Cost Recovery: Community Options

Voluntary Funds

Positive factors

- Responsive to seasonal fluctuations in income
- Allows broad range of options (ad hoc collections, bazaars, lotteries, festivals, door-to-door collections, etc.)
- People can contribute according to ability to pay
- Reduced workload for local organization

Negative factors

- May not lead to equity
- Contributions may not be linked to water use
- Non-contribution difficult to control
- Social divisions may arise

Pre-conditions

- High level of community cohesion and social control
- Strong community felt need and commitment to water scheme

General Community Revenue

Positive factors

- Means of avoiding direct payment for water, which may be unacceptable
- Supply is funded from income generating activities, and does not deplete normal household incomes

Negative factors

- Does not ensure equity if access to supplies is uneven
- Income-generating enterprises may not be reliable enough to guarantee adequate funds
- Disputes may arise over proportion of funds devoted to water supply in relation to other things

Pre-conditions

- Access to service should be more or less equal
- Contributions to community revenue should be more or less equitable
- Revenue generated should be reliable and adequate to meet needs

Cooperative Funds

Positive factors

- Payments met through profits from income-generating activities
- Advantage taken of existing local management capacity

Negative factors

- More powerful members may have disproportionate influence
- Not all users may be involved in the cooperative enterprise

Pre-conditions

- Successful cooperative ventures should already be established

Adapted from van Wijk-Sijbesma, 1989.

Supporting material

3. Positive and negative aspects of rating options

Managing Cost Recovery: Rating Options

Flat Rates

Positive factors

- Relatively easy to administer
- No overhead for metering

Negative factors

- *Charges may not reflect access to supply or level of consumption*
- Rates may not reflect ability to pay of all users

Pre-conditions

- All users must be known
- Water needs must be more or less even

Graded Rates

Positive factors

- Charges reflect consumption and ability to pay in a more equitable way
- Poorer members of community can be subsidized by the richer
- Rates can better reflect actual service level

Negative factors

- Disputes may arise over basis for grading
- Higher rate payers may have disproportionate influence over management of scheme

Pre-conditions

- Clear basis for grading
- Recognition that better service should be reflected in higher charge and willingness of richer users to subsidize the less well off

Mixed Systems

Positive factors

- Offers consumers choice of service level
- Rates reflect level of service
- Poor can benefit from subsidized or free basic service

Negative factors

- May be difficult to optimize balance between house connections and standposts

Pre-conditions

- Adequate demand and willingness to pay for house connections

Water Metering

Positive factors

- Charges reflect volume of water consumed
- Encourages more efficient use of water by consumers
- Demand can be regulated, and water resources conserved, by use of progressive rates

Negative factors

- Raises cost of service due to higher overheads for meter reading, billing, collecting payments, policing delinquency
- Subject to fraud, tampering, and illegal connection
- Extra maintenance required to keep meters in working order

Pre-conditions

- Good institutional capacity in service agency
- High efficiency of service to ensure cost-effectiveness and consumer satisfaction

Adapted from van Wijk-Sijbesma, 1989.

Supporting material

4. Positive and negative aspects of commercial options and of taxation options

Managing Cost Recovery: Commercial Options

Vending (inc. coin-operated taps)

Positive factors

- Strong incentive for reliable service and system maintenance
- Transfer of management responsibility to private sector
- Time and labour savings for consumers
- Large range of options, from individual private enterprise to cooperative community management

Negative factors

- Relatively high cost to users
- Water quality hard to guarantee
- Scope for exploitation where source options are limited
- Coin-operated systems vulnerable to tampering and breakdown
- Price levels may prohibit adequate levels of consumption and use

Pre-conditions

- Adequate institutional capacity to control vending practices in interests of consumers

Adapted from van Wijk-Sijbesma, 1989.

Managing Cost Recovery: Indirect Options

Taxation

Positive factors

- Financing of general services streamlined and easier to administer
- Cross-subsidies can be introduced through property taxes, etc.
- Payment can be linked to production and/or income level

Negative factors

- Charges may not reflect levels of service and consumption
- Water agency may not have direct control over finances, and hence cannot guarantee adequate resources
- Users not aware of real costs of services
- Limited scope for community/user involvement in decision making and system management

Pre-conditions

- Good institutional capacity and efficient management in support agencies
- Good coordination and cooperation between different service agencies

Adapted from van Wijk-Sijbesma, 1989.

Supporting material

Summary of Community contributions to capital and recurrent costs (presented at the Hague, International Workshop on community management held in IRC on November 1992)

SUMMARY OF COMMUNITY CONTRIBUTIONS TO CAPITAL AND RECURRENT COSTS

LOCATION AND TYPE OF SCHEME	CAPITAL COSTS	RECURRENT COSTS
CAMEROUN Gravity-fed piped scheme from protected spring	* Trench and pit digging * Carrying local materials (sand and stones) * Cash contributions, CFA 500 per man and CFA 200 per woman * Cash and labour contribution equal to 20% of total capital cost	* All recurrent costs paid by community, in accordance with service level: CFA 500 per taxpayer per year for standpost, CFA 5,000 per year per house connection, and CFA 100,000 per year per institution * Community contributions cover full costs of village plumber, spare parts, and operating costs, at less than cost of service from state water corporation
GUATEMALA Piped schemes with gravity feed or hydraulic ram, handpump schemes, and rainwater harvesting	* Cash contributions for initial down payment * Repayment of a community loan, supplemented by an agency donation * Trench and pit digging * Carrying local materials (sand and stones)	* Users make monthly payments which cover all operation and maintenance costs, including the employment of a local plumber * Community water boards form local associations to provide mutual assistance in solving problems of operation, maintenance, and local management
HONDURAS Borehole wells, communal tank networks, independent communal tanks served by tanker trucks	* Payment of a cash contribution (30%) * Repayment of a loan into a revolving fund for remainder (70%) of development costs * Provision of unskilled and semi-skilled labour for construction * Provision and carrying of local materials * Funding of paid unskilled labour as substitute for own labour contribution	* Payment of a monthly fee, in accordance with service level: US$ 1.75 for use of a standpost, US$ 3 for a yard tap * Monthly payments include costs of water board staff and hiring of a local plumber
INDONESIA Piped schemes and rainwater harvesting, public bathing facilities	* Full cost met by most communities in most cases, through combination of cash and in-kind contributions and establishment of loans and credit * Community members contribute according to socio-economic status, with the poorest members often being exempt * When communities face real difficulties in meeting full payment, grant assistance is sometimes arranged * Provision of skilled and unskilled labour * Provision of local materials	* Full costs met through user fees, depending on service level and system costs: range from US$ 5 to US$ 50 per household per year * Funds also raised through local revolving funds, lotteries, credit systems, entertainments, etc.

SUMMARY OF COMMUNITY CONTRIBUTIONS TO CAPITAL AND RECURRENT COSTS (CONT'D)

LOCATION AND TYPE OF SCHEME	CAPITAL COSTS	RECURRENT COSTS
PAKISTAN Gravity-fed piped scheme from protected spring, with yard taps	* Villagers contribute to a common fund to support the work of the Village Organization (VO) as a precondition of support * Aga Khan Rural Support Programme secures loans or grant assistance for community projects * Provision of labour and local materials * Additional funds raised by fining individuals who fail to meet communal labour obligations * Village funds used to hire local plumbers to assist in scheme construction	* Users meet costs of operation and maintenance through continuing contributions to the village fund * Additional funds raised through the imposition of fines for improper use or wastage of drinking water * Village funds used to hire local plumber to undertake repairs as required * Individuals are personally responsible for maintaining pipes and taps for their own yard connections
UGANDA Borehole wells with handpumps, protected springs, gravity-fed piped schemes	* Community contribution based on negotiation, with no set formula. When made, cash contributions usually only cover a small proportion of costs * Provision of labour and local materials * Where contributions are made, funds collected through cash collections, donations from prominent individuals, holding of auctions, lotteries, and raffles, and imposition of local taxes	* Users pay fees to cover costs of spares and payment of pump mechanic * Volunteer caretakers "paid" by being exempted from communal labour obligations * Additional funds raised through the imposition of fines
YEMEN Piped schemes based on boreholes with motorized pumps	* Communities must have a reliable water source, usually a borehole, before the project begins. This is secured either by the community's own efforts, or by requesting assistance from the government or a donor * Communities meet abou⁺ 30% of the costs of scheme development through labour and other in-kind contributions	* Users pay a monthly metered charge, which is enough to cover the costs of fuel, oil, spare parts, and the salaries of scheme operators * When a major breakdown occurs, special collections are made to pay for repairs

For further reading

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6.4 HUMAN RESOURCE DEVELOPMENT

Description of session

OBJECTIVES

- To determine human resource development per type of task
- To determine human resource development per type of scheme

OUTLINE OF SESSION

• Presentation by a resource person on training needs, institutions and policies in the concerned country	1 h
• Presentation of the different steps needed to develop human resources	10 min
• In plenary session, group exercise on determining human resource needed for each type of task (use of overhead sheet)	20 min
	1 h 30 min

HAND - OUTS

- Case studies
- Elements of the background information

MATERIALS NEEDED

- Overhead projector

Background Information

1. Presentation by resource person

The desired profile of the resource person should be either:

* a professional trainer of trainers
* an official within the department of water affairs responsible of human resources
* the facilitator himself if no one else is available

Issues to be addressed:

* organigram and present staff policy regarding O&M
* human resource development policy in the sector
* training institutions on the country dealing about water supply and sanitation
* training staff and material available
* constraints
* type of human resource needs

2. Exercise in plenary session

One of the overhead sheets at the end of the sub-module provides a global exercise which can be done with the participants, repeating the exercise for each selected type of water scheme and sanitation project.

Building new water schemes or rehabilitating traditional systems as well as other systems will need some trained staff in order to ensure proper operation and maintenance.
Each performed task will require different types of manpower, which in some cases can be found within the community itself, with a possible additional input of training.
The way O&M is organized will also influence the manpower needs such as for example the need of administrative staff for a large water agency.

Human resource needs are by level of qualification:

unskilled labour

basic qualification
caretaker; local mechanic; craftsman; shop owner; driver; mason; secretary

skilled personnel
skilled mechanic; health / social worker; village teachers; accountant / treasurer; administrator; water technician

higher qualification
civil engineer; civil servant; banker; manager; manufacturer; specialized trainer; specialized team (scientific, monitoring, evaluation...)

The distinction between these different levels of qualification will help in a further phase to determine different approaches for training:

Unskilled labour still needs guidance, and it some cases a simple and clear job description.

Basic qualification needs short term training sessions with a basic curriculum being developed, and the assistance of extension workers, as well as possible refresher training sessions.

Skilled personnel requires longer training sessions possibly in a specialized institute and an adapted curriculum.

Higher qualification is taken care of by technological institutes or universities within the country or abroad.

The educational system of the country has to be adapted to these requirements, or can be assisted by some external support.
Within a country, this system in order to operate therefore needs:

* a policy
* teaching/technical institutes
* a documentation centre
* adapted curricula
* trainers
* extension workers

3. About Human Resources Development (HRD)

WHO has published in 1984 a "Human resources Development Handbook" meant to suggest guidelines on HRD for ministries and agencies responsible for water supply and sanitation.
Although this handbook focuses mainly on the agency's point of view, it shows that HRD is a process which comprises:

1. Planning
2. Training
3. Management

One of the approaches proposed in this handbook is the systematic approach in 7 steps:

Step 1: Determine training needs
Study performance deficiencies within the organization. Determine which are due to a lack of skills and / or knowledge and will respond to a training solution

Step 2: Analyze tasks
Study the task. Determine precisely what skills are necessary for its accomplishment

Step 3: Develop curriculum
Determine precisely what the successful trainee must be able to do at the end of the proposed training in order to accomplish the task. Write objectives in terms of observable behaviour. Determine the necessary pre-requisites, the proper sequences of instruction and the instructional system components

Step 4: Prepare environmental support
Ensure that adequate facilities and training aids will be available. Support staff (e.g., secretarial help) should also be considered

Step 5: Conduct training
Conduct training using activities that will enable the trainees to do the task described in the performance objectives

Step 6: Follow-up training
Observe trainees to determine if they have achieved the course objectives and are applying the new skills back on the job. Give reinforcement and feedback

Step 7: Evaluate and adjust training
Assess the training course to determine if it is adequately designed to eliminate the intended performance problem

4. Case studies

These case studies mainly emphasize the training component in the context of community development or community management.

Three case studies are proposed in this exercise taken from IRC Training series No3 on Human Resources Development in Water and Sanitation Programmes (1988), prepared by Donna Flanagan:

* training of field workers and village health committees in Togo
* training of community-owned and managed water users in the Philippines
* rural water supply and sanitation in community development in Thailand

The participants should pay attention to:

* strategies and methods used in the case studies
* possible links to their own project

Overhead sheet 1

7 STEPS TO DEVELOP HUMAN RESOURCES

1. DETERMINE TRAINING NEEDS
2. ANALYZE TASKS
3. DEVELOP CURRICULUM
4. PREPARE ENVIRONMENTAL SUPPORT
5. CONDUCT TRAINING
6. FOLLOW-UP TRAINING
7. EVALUATE AND ADJUST TRAINING

Overhead sheet 2

With the help of the work done during sub-modules 5.1 & 5.2, determine Human Resource needs for each type of water supply scheme and specify in detail

TYPE OF WATER MOTOR SUPPLY PUMP	HAND DUG WELL	DRILLED WELL + HANDPUMP	GRAVITY WITH TREATMENT	GRAVITY WITHOUT TREATMENT
HUMAN RESOURCE NEEDS BY LEVEL OF QUALIFICATION				
UNSKILLED				
BASIC QUALIFICATION				
SKILLED PERSONNEL				
HIGHER QUALIFICATION				

Supporting material

Case study 1: Training of field workers and village health committees in Togo. (IRC, 1988) Training Series no. 3.

SYNOPSIS

COUNTRY: Republic of Togo

SITUATION: Training of field workers and village health committees

RESPONSIBLE AGENCY: Ministry of Public Health and Social Affairs

COOPERATING MINISTRIES, AGENCIES OR INSTITUTIONS: United States Agency for International Development (US AID); Fonds d'Aide et de Coopération (FAC); and Fonds Européen de Développement (FED)

OVERVIEW OF THE HRD EFFORT:

Problem:	How to ensure effective use of new wells
Approach:	Government field agents are trained in problem-solving skills and health knowledge. They then work with village health committees who were responsible for teaching villagers water use and personal hygiene
Points of interest:	The problem-solving learning cycle is the primary method used in training. Therefore, all training and work with villagers emphasizes problem-solving through a personal or village action

OUTCOMES OF THE HRD EFFORT: Government field agents have been trained and are active in project villages throughout Togo. There are village health committees in almost all villages and certain changes in behaviour in the communities are noticeable, for example preventive pump maintenance, and proper water handling and storage.

FACTORS CONTRIBUTING TO THE HRD SUCCESS:

- Motivational and philosophical commitment to the HRD effort: The user/health education component of this project was the responsibility of the Ministry of Public Health and Social Affairs. The ministry had the time, interest, personnel and motivation to devote to the long-term success of the project.

- Complexity of the HRD effort: The HRD effort is a continual training/learning process. The planning is somewhat complicated, but the training/learning itself is not.

- Comprehensive HRD strategy: The HRD strategy is very comprehensive, taking into account the training needs of field agents and the village health committees and the information needs of villagers.

- Self-sustaining training mechanism: A primary aim of the project is to teach villagers a method, a process for solving problems. Therefore, when this aim is achieved, villagers have the means for self-sustained problem-solving.

- Personal efficiency: The project cannot succeed without personal efficiency. In most cases, field agents are interested in the project and are personally committed to its success. Where such motivated people are supplied with regular and economical transport, efficiency is very high.

- Appropriate technology of water system: The foot pumps installed in the project villages are easily used and maintained.

- Adequate funding: US AID funding have covered the cost of training and transport so that the field agents can travel to and work in villages.

TRAINING VARIABLES:

- Analysis of the training needs: The project planners spend considerable time determining training needs for both field agents and village health committees.

- Type of training: Training for field agents comprises primarily 2-5 days workshops or meetings. Participatory methods are stressed. Training for village health committees consists of one formal workshop and many personal visits for coaching/counselling by the field agent.

- Trainee prerequisites: Field agents must be graduates of a 2 or 3 year course in sanitation or social work. They must be Ministry of Public Health and Social Affairs employees.

- Length of training: Training periods are usually short, 2-5 days, and each agent attends four or five sessions per year.

- Training methods: Participatory methods are used with emphasis on practice and problem-solving.

- Training materials: No imported materials are used, locally developed lesson guides and visual materials are used. These are simple to use and to transport.

- Trainers: Trainers of the field agents were originally professional health educators. Field agents who have been with the project a long time now do most of the training. All field agents are knowledgeable about training and do the training/counselling for village health committees.

- Language: Training of field agents is primarily in French because most materials are in that language. However, since all training is participatory and discussion oriented, local languages are also used. Village health committee training is in the language of the members.

- Evaluation and follow-up: Because training is frequent, there are frequent opportunities to discuss successes or problems of previous training. These are opportunities for evaluation and follow-up.

FOR FURTHER INFORMATION:

Ouro Bawinary-Tchatomby
National Coordinator, Togo Rural Water Supply and Sanitation Project
Ministere de la Santé (Affaires Sociales et Assainissement)
Lomé, TOGO

Agents' training follows the five phases of the project as can be seen below. Note the relationship between what the agents learn before each phase and what the village health committees then do during the phase.

PHASE ONE: INSTALLATION OF VILLAGE HEALTH COMMITTEE

TRAINING FOR AGENTS

The problem/challenge:

1. How should we prepare to work with the villagers.
2. What do we need to know to help villagers establish health committees?

What is learned:

1. Community organization techniques (e.g., how a village committee can be selected and what its responsibilities can be).
2. Basic adult education techniques (e.g., the problem solving learning cycle; participatory techniques such as how to lead discussions, how to use role plays, etc.).
3. Methods of making and using simple education materials.

ACTIONS FOR VILLAGERS

During four or more village meetings, villagers learn about the project and select a village health committee of 9 to 13 members.

Meeting 1: Field agents discuss project objectives, activities and mutual responsibilities with village elders.

Meeting 2: Agents and village elders hold a discussion with the village members.

Meeting 3: Villagers select village health committee members.

Meeting 4: The village health committee is officially installed.

PHASE TWO: TRAINING OF VILLAGE HEALTH COMMITTEE PRESIDENTS, SECRETARIES AND TREASURERS

TRAINING FOR AGENTS

The problem/challenge:

1. How should we train the officer bearers of the village health committee?

What is learned:

1. Training methods.
2. How to plan and evaluate training activities.
3. The knowledge and skills that the village health committee officers will need (for example, simple accounting practices).

ACTIONS FOR VILLAGERS

Office bearers of village health committees from several villages are brought together for a one-day training session to discuss and practice:

1. How to organize and run a meeting
2. How to keep records of meetings and activities
3. How to do simple accounting for the pump maintenance fund
4. How to communicate and resolve conflicts among villagers, the committee and field agents.

PHASE THREE: IDENTIFICATION AND ANALYSIS OF VILLAGE HEALTH PROBLEMS

TRAINING FOR AGENTS

The problem/challenge:

1. How can we help villagers determine their own health problems?
2. How can we help villagers understand and use the PSLC to solve their health problems?
3. How can we help villagers organize an action plan (a micro-project)?

What is learned:

1. Methods of conducting village surveys.
2. Knowledge about common health problems.
3. Methods of health education, using stories, songs, visual aids, etc.
4. Methods of planning lessons.
5. Planning skills including assignment of responsibilities, preparation of materials, scheduling, development of maintenance and follow-up plans.

ACTIONS FOR VILLAGERS

Using the problem-solving learning-cycle as a guide, the villagers identify their most common health problem. Then they analyse the causes and develop action plans to combat these health problems:

1. Village health committee members learn and practise a simple method of conducting a house-to-house survey in order to identify common health problems.
2. Committee members analyse the results of the survey and choose one major health problem as their primary target for action.
3. Committees and agents discuss the factors contributing to the problem.
4. Committee members select feasible actions.
5. Committee members develop an action plan (a micro-project).

PHASE FOUR: MICRO-PROJECTS

TRAINING FOR AGENTS

The problem/challenge:

1. What knowledge or special skills do we need in order to help villagers accomplish their micro-projects?

What is learned:

2. Technical skills necessary for micro-project implementation (e.g., latrine construction, gardening, drainage, etc.).

ACTION FOR VILLAGERS

1. Committees make detailed plans for micro-projects.
2. The micro-project is started and carried out.
3. When one action (micro-project) is successfully completed, the cycle of problem solving is started again with another health problem.

PHASE FIVE: HEALTH EDUCATION CAMPAIGNS

TRAINING FOR AGENTS

The problem/challenge:

1. How can we get the message of each health education campaign to the villages?
2. What do we need to learn about publicity and promotion techniques in order to make each campaign a success?

What is learned:

1. Knowledge about the topic of each campaign.
2. The development and use of effective audio-visual aids (pictures, stories, songs, drama and demonstration).
3. The development of health lesson plans for each campaign theme.

ACTIONS FOR VILLAGERS

1. School children, women's groups, literacy groups, etc. participate in campaign activities.
2. Villagers learn what they as individuals can do to improve their health.

Supporting material

Case study 2: Training for community owned and managed water users associations in the Philippines. (IRC, 1988) Training Series no. 3.

SYNOPSIS

COUNTRY: Republic of the Philippines.

SITUATION: Training for community-owned and managed water users associations.

RESPONSIBLE AGENCY: Ministry of Local Government through the staff of the Barangay Water Program (BWP).

COOPERATING MINISTRIES, AGENCIES OR INSTITUTIONS: United States Agency for International Development (US AID); provincial development staff and engineers.

OVERVIEW OF THE HRD EFFORT:

Problem: To develop local cooperatives with the capacity to operate, maintain, manage and finance the new water systems in the barangays (communities).
To develop competent provincial-level staff whose duties include planning and designing the water systems and also a user's association in each barangay.

Approach: Institution building and training.
Provincial-level staff were trained in BWP procedures, and then worked with the barangays to establish Rural Water and Sanitation Associations (RWSA) with officers who could manage and operate a water system.

Points of Interest: As a legal, incorporated body which owns the water system, the RWSA has more responsibility than water or health committees in small communities.

Even though RWSA owns and operates the water system, BWP and provincial staff provide support and follow-up services long after the system is turned over to the community.

What is learned:

2. Technical skills necessary for micro-project implementation (e.g., latrine construction, gardening, drainage, etc.).

ACTION FOR VILLAGERS

1. Committees make detailed plans for micro-projects.
2. The micro-project is started and carried out.
3. When one action (micro-project) is successfully completed, the cycle of problem solving is started again with another health problem.

PHASE FIVE: HEALTH EDUCATION CAMPAIGNS

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3. The development of health lesson plans for each campaign theme.

ACTIONS FOR VILLAGERS

1. School children, women's groups, literacy groups, etc. participate in campaign activities.
2. Villagers learn what they as individuals can do to improve their health.

TRAINING VARIABLES:

- Analysis of training needs: Throughout the project, training needs are assessed and content and methods modified when necessary.

- Type of training: For provincial staff, there are six seminars/ workshops. Training at barangay level is in groups or individual.

- Trainee prerequisites: At the provincial level, a trainee must have a background of water resource analyst, engineer, trainer or water work technician. There are no prerequisites for the barangay level trainees.

- Training methods: Discussion and participatory methods.

- Training materials: BWP national staff provide the provincial staff with guidelines for their work with barangay members. They are also taught to design and make their own simple visual aids.

- Trainers: BWP national staff train the provincial staff who in turn train the barangay members. A Corps of Trainers training is given for provincial level staff each year.

  Language: Tagalog and English.

- Evaluation and follow-up: Provincial evaluation teams should visit each RWSA three times within the first three months of the water system's operation. Thereafter, evaluation visits are on a quarterly basis. In addition, the national BWP staff makes annual visits to each RWSA.

FOR FURTHER INFORMATION:

Project Manager Barangay Water Programm
Merryland Building
1373 E. Rodriguez Sr. Avenue, Quezon City,
PHILIPPINES

Supporting material

Case study 3: Rural water supply and sanitation in community development in Thailand. (IRC, 1988) Training Series no. 3.

SYNOPSIS

COUNTRY: Thailand.

SITUATION: Rural water supply and sanitation in community development.

RESPONSIBLE GOVERNMENT AGENCY: Ministry of Public Health (MOPH).

COOPERATING MINISTRIES, AGENCIES OR INSTITUTIONS: Ministries of Agriculture, Education and Interior.

OVERVIEW OF THE HRD EFFORT:

Problem: How to use village human resources to develop rural communities, including development of drinking water supply and sanitation services.

Approach: HRD for water supply and sanitation and community development is a combination of training and support, supervision and follow-up. HRD is seen as part of an overall approach to community development.

Points of interest: An interesting feature is "each-one-teach-one" approach in which craftsmen in one village taught craftsmen in other villages to make rainwater catchment tanks.

Training was given to village leaders, village craftsmen and village health workers, and also to ministry officials in coordinating development activities.

OUTCOME OF HRD EFFORT:

Village craftsmen throughout the north-east provinces are capable of making rainwater catchment tanks.

Village leaders are learning to be effective managers of revolving funds.

Village members are learning to be effective communicators of health messages.

FACTORS CONTRIBUTING TO HRD SUCCESS:

- Organizational stability: At both community and ministerial levels, there is organizational stability to permit development of human resources.

- Motivational and philosophical commitment to the HRD effort: The Royal Thai Government commitment is stated in the Health Development Plan (1982 - 1986).

- Complexity of the HRD effort: Although overall community development is complex the various individual HRD components are small enough to be manageable.

- A self-sustaining training mechanism: District and subdistrict health officials and district sanitarians have prescribed training duties and training materials and thus training is an integral part of their job and goes on without a formal training organization.

- Personal efficiency: At all levels, district and province, success can be attributed to outstanding personal efficiency.

- Appropriate technology of water system: The water jars and cisterns require only simple technology which is easily taught to villagers.

- Adequate funding: Where success is most notable, there is adequate funding. Without an adequate revolving fund, all villagers may not be able to affort water tanks.

TRAINING VARIABLES:

- Analysis of the training needs: Analysis of the minimum basic needs of villagers determines what actions need to be taken at village level which in turn determines the training needs. This is done informally.

- Type of training: The type of training, varies from hands-on practical training for village craftsmen to classroom training, practical training and home study for village health communicators.

- Trainee prerequisites: none.

- Length of training: varies.

- Training methods: mostly participatory.

- Training materials: For village health volunteers and village health communicators materials are written and produced by the Ministry of Public Health. For village craftsmen training materials are not necessary, the actual equipment is used.

- Trainers: Very few professional trainers are involved in this community development work, but those involved have studied some training and communication techniques.

- Language: Thai.

- Evaluation and follow-up: At all levels, village, subdistricts, district and provincial, there is a built in system of support, supervision and follow-up.

FOR FURTHER INFORMATION:

Ministry of Public Health
Devavesm Palace
Bangkok
THAILAND

For further reading

Haug H.P.; Hack H. (1987). Training modules for water works personnel in developing countries. Eschborn, Germany. Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ)

IRC (1988) Human resource development in water and sanitation programmes. Case studies from Togo, Sri Lanka, The Philippines, Zaire and Thailand. IRC training series No.3. The Hague, The Netherlands, Water and Sanitation Centre.

IRC (1992) A manual on community participation. IRC training series No. 9. The Hague, The Netherlands, Water and Sanitation Centre.

IRC (1991) A manual on operation and maintenance of communal standposts for extension workers and caretakers. IRC training series No. 7. The Hague, The Netherlands, Water and Sanitation Centre.

IRC (1987) Training skills for supervisors. IRC training series No. 4. The Hague, The Netherlands, Water and Sanitation Centre.

WASH (Arlington, VA, USA) (1988). Training guide for operation and maintenance supervisors of rural water systems. Draft. Arlington, VI, USA. Water and Sanitation for Health Project.

WHO/CWS (1984). Human Resources Development Handbook. Guidelines for ministries and agencies responsible for water supply and sanitation. WHO, Division of environmental health, Geneva, Switzerland.

6.5 SPARE PARTS PROVISION

Description of Session

OBJECTIVES

- To show that spare parts are a key component in ensuring sustainability;
- To raise awareness on issues affecting spare part provision;
- To promote the consideration of spare part issues at all stages of the project cycle.

OUTLINE OF SESSION

- Problem identification — 20 min.
  The Facilitator writes down the following question on a board: "What can go wrong regarding spare parts?". Participants are asked to write down two major points, each on a separate card. Cards are pinned up, grouped together and discussed briefly.

- Presentation — 30 min.
  A short presentation is given on spare parts considerations, and issues affecting them. Overhead materials are used. Examples of spare parts are passed around to elucidate the sequence of presentation "This may just be a nut and bolt, but consider ...."

- Group Work: 35 minutes (25 minutes discussion, 10 minutes summary presentations)
  The participants split into two groups, each group assigned to "role play" as like-representatives of the demand side (community, supporting agency, and external support agency) and the supply side (entrepreneur, local manufacturer, distributer, retailer). Each group is given a typical "spare part" and asked to discuss its importance and implications from the point of view of their allocated "interest group". Each group then briefly present their findings, making cross links with the issues raised in the main presentation.

- Group Discussion / Summing Up on the basis of the groupwork results — 20 min.

1 h 45 m

HAND-OUTS

Extracts of background information and supporting material.

MATERIALS NEEDED

- Example spare parts (say four: two water, two sanitation)
- Overhead projector / sheets / pens
- Hand-outs and Reading Lists in sufficient numbers
- Cards, pins and board

Background Information

1. Problem Identification

The question "What can go wrong regarding spare parts provision?" is designed not only to draw out participants own experience of spare parts issues and help them focus on it, but also to show the rather narrow prevailing view of spare parts issues, and the surprisingly low importance attached to it considering the damage its neglect can cause in practice.

2. Presentation

2.1 Orientation

Too often consideration of spare parts is an afterthought to the technical and operational design of a water or sanitation option, instead of being one of the principal items on a check-list for viability. Spare parts provision should therefore be one of the deciding factors of selection, not merely a consequence.

Spare parts should never be seen as just a second level decision. Of course they are a result of and reflect the needs of good operation and maintenance. But spare parts requirements should also be a function of planning, design, and project intervention in their own right. Rather than asking "what spare parts do we need" as an consequence of already-made decisions, we should instead ask "what are the spare part needs of this particular technical and operational option, and how can they best be met?" In other words, spare parts should be viewed as much from the supply side as the traditional demand side. Using sample spare parts to bring the point home, the Facilitator reminds the participants:

- The need for spare parts (demand side) is a function of design, degree of engineering, use and operation, maintenance regime .... etc.

- The availability of spare parts (supply side) is a function of marketing, manufacture, pricing, entrepreneurship, distribution, communication, ... etc.

2.2 Definition

"Spare Parts" can be defined as "all those materials and goods that are necessary for the efficient and sustainable operation of the technical components of a water and sanitation option". As well as the more immediately familiar parts, our definition would therefore include:

Mechanical, hydraulic, electrical and electronic parts
Tools
Seals and washers
Fuel
Lubricants
Paint and preservatives
Chemicals
Protective clothing / first aid
Cleaning materials and chemicals
Parts for essential ancillary equipment
(means of transport, communication equipment etc)
Stationery / other day-to-day needs
Consumables (welding rods etc)

2.3 Issues for consideration and decision

The Facilitator will raise these issues in a logical sequence. Whilst presenting them as "open questions" for the participants to think through and discuss, he will also give some personal views and examples on how we could improve our outlook and take improving actions on each issue.

Bearing in mind the practical operations-focussed interests of the participants, the Facilitator should concentrate on highlighting the ten "key issues". But the oportunity should also be taken of at least mentioning the wider issues, listed under "Secondary and wider issues", bearing in mind the probable future role of participants in programme management, planning and policy setting.

Key Issues:

Spare Part Needs

1. Assessing the spare part needs of a particular technical and operational option, based on judgement and past experience. Improving the accuracy of estimation.
2. The importance of correct diagnosis of problems. Cataloguing and identification of the parts required.
3. How spare parts requirements are affected by the degree the facilty is used, the care with which it is used, and the efficiency of operation and maintenance.
4. Making allowances for emergency repair, accidents, or scheduled replacement.
5. Comparing costs of spare parts produced from abroad with similar spare parts produced locally or in neighbouring countries.
6. Assessing the importance of exchange rate fluctuations on the costs of spare parts.

Local Manufacture

7. Improving the reliability of fabrication (quality control) and improving guarantees.
8. Improving compliance with delivery deadlines through penalties, bonuses and other mechanisms.

Materials

9. Maximising the sourcing of materials from sustainable local sources.
10. Options for recycling and re-use/restoration of worn parts.
11. Improving environmental awareness in fabrication, use, re-use / re-cycling and disposal of spare parts.

Promoting Local Entrepreneurship

12. Encouraging local entrepreneurs or co-operatives to provide spare parts manufacture, distribution and supply services.
13. Making sure there is a committment on a period for which parts are guaranteed to remain available.

Training and Co-operation

14. Training needs for management, manufacture, distribution, supply and use of spare parts as a key "sub-sector" and how it can be provided.
15. Opportunities for learning from the experiences of neighbouring countries / regional partners (TCDC).
16. Integrating the need for spare parts with similar needs in other projects, Districts, or on a Regional or National basis.
17. Possibilities for better standardisation of equipment (or at least their fast-wearing parts) the effects on spare part requirements.
18. Opportunities for increasing the interchangeability of spare parts between similar equipment items, but of different manufacture.

Feedback

19. Improving the monitoring / evaluation of spare parts usage to help determine rehabilitation timing and economic life of a scheme.
20. Improving feedback to manufacturers on the use and weaknesses of spare parts and equipment for future improvements to design.

Planning for spare parts

21. Planning for spare parts provision should start as early as possible in the project life.

Secondary and higher-level issues (OPTIONAL):

Spare Part Needs

How does the need for spare parts on a scheme increase with time? How should we determine an economic "cut-off point", when it becomes more efficient to rehabilitate or replace the facility rather than maintain it?

How critical are the costs of certain spare parts and consumables such as fuel to scheme economics? At what price-point will we have to trigger a review of the operational viability of the scheme?

What are the trade-offs (cost-benefit) of reducing spare part needs by:

- better design (designing to minimise replacements; introducing few "sacrificial" parts rather than many normally-wearing parts)
- better engineering (deliberately over-engineering, at higher initial cost, to reduce long-run O and M requirements (eg deeper pipes and better trench bedding)
- better use (spending more on user education in order to reduce wear and tear and hence spare part needs)

How can we control the security of spare parts and avoid possibilities of there being misused or resold?

Local Manufacture

Building on experiences of local manufacture in other sectors.

How can the proportion of spare parts manufactured locally rather than from abroad be improved? Could improved *specifications* of equipment maximise the opportunities for local spare parts?

Are there experiences of local manufacture in other sectors which can be built on?

How can spare part fabricators best be licensed and monitored without dampening entrepreneurship?

How can the issue of "piracy" and infringement of patents / trade marks be reconciled with the need to encourage low-cost locally fabricated parts?

Promoting Local Entrepreneurship

What options are there for increasing public and private investment in such services?

What short-term incentives can be offered (tax windows, subsidies, preferential consideration against foreign suppliers)?

How should prices and mark-ups (profits) be controlled?

The Marketing Cycle

How can we improve:
- the links between spare part supplier and user (needs v. capacity)
- marketing / business identification and development
- ordering / calling forward spare parts
- stock control
- warehousing
- distribution
- outlet options (shops, government offices, local enterprises, mobile shops etc)
- security / accountability
- reliability / delivery deadlines

Training and Co-operation

To what extent should consumable and fast-moving spares be supplied as a "package" with new equipment, and for what period?

Are there spare part fabricators in other sectors (eg agriculture, irrigation) with whom resources and experiences can be shared?

What are the opportunities for inter-regional co-operation in terms of shared markets, marketing, agreements on prices or division of specialisation?

What are the possibilities for "twinning" with western spare parts fabricators, to include technical, entrepreneurial and managerial training?

Could the links with equipment manufacturers be strengthened?

How can ESAs be encouraged not to store up spare part problems for the future by "tying" development assistance to use of equipment from their own country?

What are the possibilities for promoting local trade or manufacturing associations, for mutual support?

Feedback

What can we learn from monitoring the transitions in spare parts requirements over the life of a scheme?

As a monitoring indicator, what can deviation in spare part up-take from the norms tell us about the use and operation of a scheme?

3. Group Work

This should be an opportunity for open discussion in working groups, and should not be too closely guided by the Facilitator. It is important that under a chairman, each group actively take up the identity of their assigned interest viewpoint (demand side: community, supporting agency, external support agency; supply side: entrepreneur, local manufacturer, distributor, retailer). The spare part given to each group helps focus the discussion, and each group brainstorms on implications and ideas related to it from the viewpoint of their interest group. A rapporteur from each group has the responsibility to report back to the participants as a whole.

4. Planning for spare parts

Planning for spare parts should be integrated in the overall planning of the project right from the start as this issue can become a major bottleneck and therefore have a negative impact on the project.

- During feasibility study: the project should assess:
  - the type of spare parts presently available on the market, locally and in neighbouring countries;
  - the distribution network;
  - the type of equipment used in other regions and other projects;
  - the possibility of interchangeability;
  - the possibility of local manufacture (steel works and plastic works);
  - the costs of space parts once they arrive to the costumer;
  - the level of import taxes;
  - the national policy regarding spare parts provision.

This study could be a key factor in the technology.

- During the implementation of the project:
  - ensuring the provision of spare parts by making sure it is sustainable on a long term basis.
  - there are several possibilities ranging from an extremely foreign dependant live of spare parts provision to an independent type.

It might be important to note that the pricing policy of the donor regarding spare parts might play as an incentive for local distributors, but it might also raise false expectations. This is true especially in the case of parts being highly subsidized while the project is being implemented, and being not subsidized any more once the project "hands over".

The project might want to set up local stores, working on a "revolving fund" type of system, where an initial capital helps to start the availability of parts, and revenues generated from the selling of points helps to buy new parts for the store. Despite the fact that parts have to be anyway available within the region or the country, proper management of such "revolving funds is a crucial issue for its success.

If the project wants to create or use market forces in order to install spare parts provision network, it should remember that market forces rely primarily on profit. If local manufacturers, or local distributors, do not feel that there is a possibility for them to make money they will be hesitant to invest. Furthermore, the market of spare parts has to be attractive not only in terms of profit making but in terms of size. If the demand of a particular part is low, there is nor incentive for the entrepreneur to invest.

The size of the market is an element which might need to be discussed with other projects in the country at a national level. Indeed, the cooperation between different projects, could lead to a better assessment and management of the spare part provision.

Overhead sheet 1

SPARE PARTS PROVISION

IS A FUNCTION OF:

DEMAND SIDE	SUPPLY SIDE
NEED FOR SPARE PARTS	AVAILABILITY OF SPARE PARTS

Overhead sheet 2

KEY ISSUES

- SPARE PART NEEDS
- COSTS
- LOCAL MANUFACTURE
- MATERIALS
- PROMOTING LOCAL ENTREPRENEURSHIP
- TRAINING AND COOPERATION
- FEED BACK
- PLANNING FOR SPARE PARTS

Supporting Material

Brief case studies: extracted from WASH Technical report no. 71. Models of management systems for the operation and maintenance of rural water supply and sanitation facilities".

The availability of spare parts has been a recurring problem for many water supply and sanitation projects. Some have installed hundreds of handpumps and presumed that market mechanics would impel local hardware dealers to provide needed parts. In certain countries government agencies retain this responsibility, in others they import spare parts and rely upon a commercial system for distribution. In any case, the laws of supply and demand do not always work as expected. Too often systems fail because spare parts are simply inaccessible.

The problem of the availability of equipment and spare parts can be overcome by standardization and/or domestic manufacture. The installation of pumps made by several foreign manufacturers has led to a chaotic situation in many countries. Spare parts often are not available and repairmen are not familiar with certain pump designs. This situation is largely the result of bilateral aid that restricts procurement to pumps manufactured in the donor country. Some developing countries, in response, have insisted on specifying which pumps they will accept.

Many of these countries are now developing on indigenous capacity for the manufacture of plastics for pipe and well casing. Locally manufactured equipment and policies that standardize equipment are the best answers to technological choice. Local manufacture also eliminates the need for hard currency, which is always in short supply.

Supporting material
from WASH Technical Report no. 71

Brief case study 1: Botswana

- WMVs: Water Maintenance Units
- WDs: Water Departments
- DWA: Department of Water Affairs

Availability of Spare Parts

Spare parts are readily available for all models of engines and Mono pumps used in rural water systems. WMUs and WDs maintain stocks of drive belts, pipes, and pipe fittings, and most have spare engines for replacement. Any parts not available at the WMUs and WDs usually can be obtained within several days from suppliers in major towns. Since Botswana is a member of the Southern Africa Customs Union and its currency is freely convertible, spare parts are readily obtained from manufacturers or suppliers in South Africa.

Standardization of Equipment

The DWA has standardized all new equipment to include Lister/Petter diesel engines and Mono positive displacement progressive cavity pumps. This standardization has greatly simplified O&M by reducing the spare parts inventory and limiting the training of mechanics to the makes and models in use.

Brief case study 2: Belize

- RWSSP: Rural Water Supply and Sanitation Programme.

Standardization and Local Manufacture of Equipment and Availability of Spare Parts

Because the tiny market makes local production impractical, all pumps are imported and a reliable supply of parts is important. The RWSSP has striven to standardize equipment to simplify procurement and facilitate maintenance and repair.

Brief case study 3: Tunisia

Availability of Spare Parts

Government agencies purchase spare parts and there are reliable private sector suppliers as well, but redtape slows the import of highly specialized low-volume items. Few regional governments stock parts in any rational manner. The approach in the future should be to push communities to stock standard parts, and have the regional governments stock specialized parts for larger preventive maintenance needs.

Standardization and Local Manufacture of Equipment

While the basic designs of water supply systems have been standardized, there is still a great diversity of pumps, motors, and engines in use. The five most common types of pumping systems rely on pairs of components:

- diesel engine/mechanical turbine pump,
- diesel engine/horizontal axis centrifugal pump,
- electric grid/electric motor/horizontal axis centrifugal pump,
- electric grid/submersible motor-pump, and
- diesel electric generator/submersible motor-pump.

However, a recent survey of pump systems in eight regions showed that there were 12 brands of diesel engines, only four of which were manufactured or assembled locally. This lack of standardization greatly aggravates the problem of spare parts.

The Government of Tunisia (GOT) attributes this to the engineers who evaluate procurement bids without the technical knowledge to identify the most appropriate brands offered. Training is the solution.

Brief case study no. 4: Indonesia

Availability of Spare Parts

Gravity-flow systems require few supplies other than replacement pipes, fittings (shutoff valves, taps, float valves), and cement, and the availability of spares does not affect continued system functioning. However, where diesel, electric, or hand pumps are used, the availability of spare parts can be a serious problem, particularly in remote parts of the country.

The Indonesian government is pursuing a policy of promoting growth in the industrial sector, and the rupiah is freely convertible. Therefore,many fairly complex items such as pumps and motors are now being built or assembled in the country, and those that are not can be imported without difficulty although procurement may take time.

Standardization of Equipment

The wide range of technologies required in conditions peculiar to the country permits little standardization of equipment and materials. Cipta Karya does use a consistent design similar to that used by PVOs and others. Standard sizes for pipes and fittings are followed, but these items are supplied by different manufacturers. However, standardization does not appear to affect the success or failure of O&M programs. In fact, experience in the design and construction of water systems for the IKK (district centers) suggests that uniform standards may hamper effective O&M because they are unsuitable in the diverse technical and social conditions prevailing.

For further reading:

Jordan, James K. (1990). Maintenance management (includes index and list of computerized maintenance management programs). Denver, Colorado, USA, American Water Works Association.

FINNIDA (1990). Report on the feasibility study on decentralization of the distribution system of pumps and their spare parts, Kenya. Helsinki, Finland, Kefinco.

Fernandez, Camella (1980). Stores management: a training job manual. Bridgetown, Panamercian Health Organization. Caribbean Basin Water management Project.

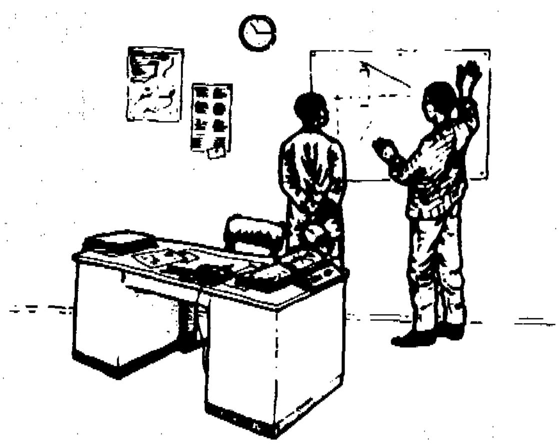
Jordan, James K et al. (1986). Assessment of the operations and maintenance component of water supply projects. WASH Technical Report no. 35. Arlington, Virginia, USA, WASH.

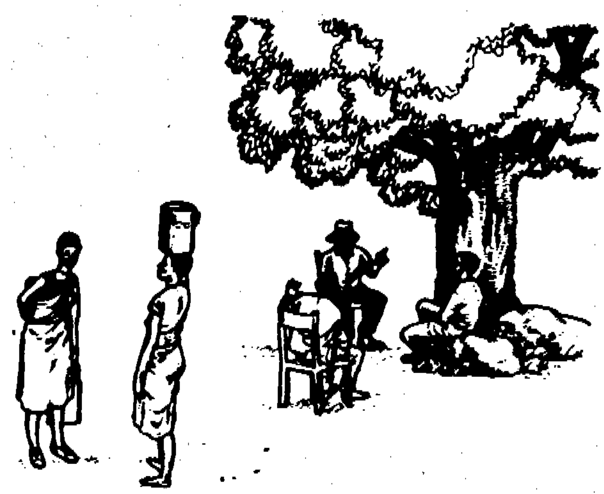
Roark, P., Hodgkin, J. and Wyatt, A. (1993). Models of management systems for the operation and maintenance of rural water supply and sanitation facilities. WASH Technical Report no. 71. Arlington, Virginia, USA, WASH.

PART 2: KNOWING MORE ABOUT O&M

MODULE 7

TOWARDS SOUND MANAGEMENT





OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

7.1 INFORMATION & COMMUNICATION

Description of session

OBJECTIVES

- To explore issues related to differing styles of communication.
- To facilitate the identification of communication problems which commonly occur in water supply and sanitation projects.
- To develop an overview of steps to be taken to establish an effective communication process on O & M.

OUTLINE OF SESSION:

• Introduction by the facilitator on communication issues	30 min
• Group exercise on communication breakdown in water and sanitation projects	30 min
• In a plenary session, presentation of each group and discussion on methods to improve communication	45 min
	1 h 45 min

HAND - OUTS

- Guidelines for appropriate selection of communication methods
- Ghana case study
- Worksheet

Background information

1. Importance of information and communication in O&M

Information and communication are crucial for an O & M system to function properly. A project manager of a water supply project needs to find out and take appropriate action on:
- what information is to be communicated
- with whom this information needs to be communicated
- when this needs to take place
- skills required for effective information exchange and communication.

This sub-module deals with communication aspects of information, and the next sub-module will deal with monitoring the information.

2. Importance of communication

People remember 20% of what they hear, 40% of what they see and hear, and 80% of what they discover for themselves. This fact established in field research might be useful to remember when talking about and planning information and communication efforts in operation and maintenance programmes.

Methods of communication include <u>interpersonal methods</u>, such as person-to-person discussions and group discussions and <u>mass media</u>, such as wall posters, boarding, radio, television.
The communication process involves many different mediums: print, pictures, moving images and the spoken word.

For effective communication, that is to say for the message to be understood and response shown a number of important things have to happen.

a. The sender of the message must plan the message carefully. This means that a good understanding of the target group must be reached, about:
   - the language spoken by the target group
   - the literacy level
   - the existing levels of understandings about the topic to be communicated, for example, on perceptions about the ownership of a pump or tap, or about maintenance
   - the cultural beliefs of the group

b. The sender needs to plan the message to meet the needs of the target group. It must be designed for the purpose intended so that:
   - it is clearly understandable
   - appropriate channels can be selected through which the message can be transmitted
   - feedback can be obtained form the target group

c. The channels of communication must be carefully selected to help the communicator to achieve clearly identified objectives. For example, if the communicator wishes a group of villagers to reach a decision about their involvement in maintenance, then a channel which promotes dialogue should be selected, such as focus group discussions.

d. Where possible the communicator should observe the target group carefully to see if the message has been received and understood. This can be done by listening to what is said and watching for reactions, or more formally by pre-testing messages with reactions from people.
(Laver. 1991)

Communication will be more effective when the sender:
- is trusted by the receiver, being the target group,
- has important characteristics such as sex, age, culture in common with the target group
- has sufficient status and is considered reliable by the receiver.

3. Different forms of communication media

See supporting material

4. Exercise : see working sheet

Worksheet

GROUP EXERCISE

Identification of communication problems which commonly occur in water and sanitation projects (from Laver, 1991)

Exercise:

Using the guide sheet provided, and the Ghana case study, summarise likely communication problems which, in your experience are known to occur in water and sanitation projects.
Give as many examples as possible.

A rapporteur is designed to record discussion on the guide sheet and report back to the main session.

Guide sheet

PROJECT PHASE	COMMUNICATION PROBLEM
Planning	
Mobilisation/Motivation/ Awareness	
Implementation/Activity	
Maintenance/Evaluation	

Supporting material

Communication case study extracted from IEC Journal, January 1992, published by IRC, The Hague, The Netherlands.

4.1 Water and health in Northern Ghana

- **Those who attended village education sessions had a 28% increase in knowledge.**
- **A survey showed evidence that health had improved where communication had taken place.**
- **Maintenance of pump sites improved by 50%.**
- **100,000 people attended water education sessions in 2,000 communities.**
- **The project now has 5,000 Community Water Organisers, and 2,500 pump sites producing safe water.**
- **Changes for the better came about when communication targets were clarified and key messages identified.**

The Water Utilization Project was launched in 1973 in the two Upper Regions of Ghana, bordering on Burkina Faso, where 1.2 million people live in scattered villages and water and sanitation related diseases are responsible for most illness and death in young children.

The first borehole sites were chosen from census figures based on geological criteria, with little consideration of social factors. It soon became apparent that although pumps were well used in the dry season, many women chose to use unprotected water closer to home in the rainy season.

Over the next 18 years, the programme went through a process of evolution and change. The importance of the role of women in making and sustaining change was only slowly understood. Gradually programme organisers realised that the way that knowledge was brought to a rural village; the way messages were devised and delivered; were crucial to the success of the programme, which has now brought safe water to an estimated 75% of the rural population.

As early as 1976 it was decided to add an educational component to the programme, training village education workers to increase understanding of health and water usage. By 1982 a community education programme had been launched in five districts. This campaign made some gains but there was doubt over how effectively messages were being given, and a recognition that too few women were involved.

In 1983 a comprehensive evaluation concluded that the programme was a qualified success. Each pump was used by 400 rural people, and health had improved, with a reduction in guinea worm and diarrhoea. However it also found that too little attention had been paid to selecting messages, developing effective material and building communication links with other rural programmes.

In 1985 Phase II of Project was launched, with priority given to water and health education and to training community based workers and pump caretakers.

Water and health in Northern Ghana - 2

Caretakers had been appointed because they had some technical skill. However the most successful pumps did not lend themselves to local maintenance. There were other roles for the caretakers, including collecting a pump tariff from users to cover maintenance costs. Many villagers felt that pumps should be free of charge, but project organizers believed that if people understood the link between clean water and good health, they would pay a levy.

In 1987, the caretaker post was combined with a newly created Community-based Worker to create a single focus for communication at village level. Water Education for Health (WEFH) trained the Community-based Workers to back up Government field-workers at district and sub-district level, and built close links with other agencies. A rapid increase in training was achieved covering 5,800 Community Water Organizers by 1990.

One decision was to narrow the range of the campaign so that the content of each message was clear and gave villagers achievable targets. This 'lean and clean' approach led Water Education for Health to concentrate on preventing dehydration in children suffering from diarrhoea. This led to a detailed study of the knowledge, attitudes and practices of mothers. Some local remedies such as breast feeding, herbal tea and sugar-salt solutions, were reinforced and oral rehydration salts were promoted, in the hope that effective remedies would naturally drive out ineffective ones (such as mashed cow dung).

Field workers were expected to 'unlearn' technically correct but impractical advice like always boiling water. The aim was "to avoid repeating the same tired messages imploring villagers to be clean and hygienic". Tools included radio, picture books, songs, and dramas. Cassette tapes were prepared by actors improvising dialogue in each of the local languages.

A pilot project in 1986 showed that those who had attended village education sessions had a 28% increase in knowledge. Later evaluation showed that maintenance of pump sites increased by up to 50% after training. During a mass campaign in 1989 approximately 100,000 people attended education sessions in 2,000 pump communities. By June 1990 the project had 5,000 Community Water Organizers at more than 2,500 pump sites. A high proportion of the pumps were delivering safe water. Knowledge of the link between water and disease had increased, and there was evidence that health had improved.

A study prepared for CIDA in 1990 concluded: "Social change does not automatically occur as a result of technical input like the installation of handpumps. Development efforts aimed at improving the quality of life cannot be divorced from appropriate education and a well thought out communications strategy. The experience does serve to emphasize the importance of education and communication in the development of water resources for the urban and rural poor." ■

Supporting material

Guidelines for appropriate selection of communication methods (from Laver, 1991)

GOAL	SUGGESTED METHOD
Knowledge	- chalk and talk sessions - question and answer sessions - seminars - workshops - print media
Awareness Attitude change	- articles in news letters/ newspapers - exhibitions - visual displays - stop and study posters on a particular theme - single glance posters depicting one theme/one message - Programmes on local radio and television - discussions
Behaviour change/decision making	- group discussions - role-play - drama - participatory methods which utlilise stories, visual aids such as picture codes etc
Acquisition of skills	- demonstrations - on job training
Social change	- Work with influential leaders, groups, eminent persons - Lobby policy makers - Workshops

Supporting material

Different forms of communication and audio-visual media (from GTZ, 1989)

Form	Advantages	Comments
Radio	• Easily distributed • Illiterate persons can also be reached • Vide variety of presentation forms available	Topics should be discussed at local meetings and applied to local conditions
Television	• Combination of sound and pictures permits depiction of comlex issues • High degree of attention • Suited for information, motivation and education	Follow-up discussion of broadcasts is difficult without video systems/textbooks
Cinema	• Attracts all social classes	Can only be used indirectly as an educational medium
Newspapers	• Effective for influencing opinions and awareness • Suited for detailed explanations • Important component when combining different media	Long-term impact achievable with article series
Video	• Production in close contact with target population • Viewer participation/ commitment • Good documentation medium • Teaching medium for small groups	When used for educational purposes, it is recommended to combine it with brochures and leaflets
Film	• High degree of attention • High emotional stimulation • Large groups can be adressed • Effective teaching aid with lasting impact	Subsequent group discussions are easy to hold
Slide shows with synchronized soundtrack	• Can be produced for specific topics and target groups • Graphic depiction of topics	Pictures and accompanying text must be coordinated; without sufficient preparation and follow-up discussion the learning effect is minimal
Slides	• Possible to produce, select and arrange topics for specific target groups • Possible to deal with topics in depth	It is essential to avoid redundant information; priority should be given to detailed shots rather than overall pictures
Posters	• Large target groups can be addressed • Simple messages can be rapidly conveyed • Very cost-effective medium	Choice of proper sites is important; careful preliminary testing is necessary
Exhibitions	• Can be used to address specific target groups • Overall depiction of topics with variable use of media is possible • Graphic depiction with broad impact	Limited, permanent and mobile exhibitions are possible; tends to be cost-intensive
Flip charts	• Suited for providing information on specific topics • Inexpensive to produce locally • Easy to transport • Versatile • Can be flexibly combined with other media	Only suited for conveying less complex information; effectiveness depends on the abilities of communicator
Blackboards	• Simple trational medium • Can be used anywhere • Processes and learning steps are illustrated • Direct illustration by means of text and graphics, possibly colors	Structure and style of text and pictures are important

Form	Advantages	Comments
Meetings and lectures	• Easy to organize	Social hierarchy can prevent participation
Group discussions	• Direct and complex exchange of opinions • Provides an overview of the overall problem situation	Dominance by certain individuals can be a problem
Cards/ diagrams	• Illustration of selected topics • Focus on important aspects	Target group must have already received instruction
Models	• Highly effective demonstration of processes and constructions • Encourages imitation	Production is difficult and expensive; transport is problematic
Brochures/ leaflets	• Can be used for specific target groups • Permits graphic illustration and in-depth presentation of topics • Easily combinable with other media • Effective and vivid means of conveying lasting information	Production costs are relatively high; effectiveness depends on graphic and didactic quality
Role games	• Topics can be illuminated from different points of view in the form of a game • Call attention to typical unmeditated behavior	Follow-up treatment of topics is necessary
Drama	• High entertainment value • Stimulates audience to critically analyze the situation	Presentation of too many topics at once must be avoided
Puppet and shadow plays	• High degree of acceptance, since these are traditional media • Puppets are produced locally • Information can be embedded in the cultural context • Impact is enhanced by linking entertainment and learning	Use of puppet and shadow plays requires familiarity with the local culture
Case studies	• Provides incentive for initiative if connections with local phenomena are recognized	Group being addressed should prepare its own case studies
House visit	• Establishment of good personal relations between field workers and target group • Increases community participation • Provides additional source of information	It is recommended that the talks be taped
Demonstrations	• High degree of attention • Encourage and motivate the target group to participate • Practical learning process • Increase receptivity of the target group	Brochures must be distributed after the demonstration

For further reading

- Laver, Sue (1991), Communication skills for trainers ; Manual for trainers, Training Centre for Water and Sanitation

This training guide has been designed to provide personnel working in the water and sanitation sector with some practical guidelines to effective communication. The guide contains a short introduction into learning and communication and a step by step explanation of communication planning. It also contains a range of suggested activities which are designed to assist the user to identify and solve problems in communication.

Available from:
Dr. Paul Taylor
Training Centre for Water and Sanitation
Department of Civil Engineering
University of Zimbabwe
P.O. Box MP 167, Mount Pleasant
Harare
Zimbabwe

- Gorre-Dale, Eirah, De Jong, Dick and Ling Jack (1992) Resource booklet for communication in water supply and sanitation, Core group on IEC, IRC, The Hague

This booklet is intended for all those who are assigned to plan and implement communication efforts in and for water supply and sanitation programmes. Pages 16 - 22 contains basic elements for messages which have to be adjusted to local needs relevant for policy makers, sector professionals and user communities.

Available from
J.M.G van Damme
Chairperson IEC Working Group
c/o IRC
P.O. Box 93190
2509 AD The Hague
The Netherlands

- GTZ 1989, Different forms of communication and audiovisual media, Tool no. 18 CPHE series no. 3, in: Community participation and hygiene education in water supply and sanitation, GTZ, Eschborn

This tool provides advantages and comments on a wide range of media. It may facilitate the decision on which media could be useful. pp 38 - 40

Available from
GTZ
German Agency for technical Co-operation
Division 414 (Water)
Postfach 5180
D-6236 Eschborn
Germany

7.2 MONITORING

Description of session

OBJECTIVES

- To identify the purpose of monitoring
- To develop objectively verifiable indicators
- To evaluate possible use of monitoring data

OUTLINE OF SESSIONS **(2 sessions)**

Session 1

• Introductory lecture aimed at identifying the purpose of monitoring	1 h
• Group exercise aimed at developing indicators (See background information #5) The facilitator presents the methodology and divides the participants into 3 groups, each group trying to determine indicators for a different type of scheme	45 min
	1 h 45 min

Session 2

• Group exercise continued	45 min
• Plenary discussion for the review of indicators (15 min for each group)	45 min
	1 h 30 min

HAND - OUTS

- Basic performance indicators for O&M (examples)
- Managerial indicators for O&M (examples)
- Policy implementation indicators for O&M (examples)
- Guideline for group exercise

MATERIAL NEEDED

- Overhead projector

Background information

1. Purpose of monitoring

Monitoring O&M aims to provide information to be used to maintain or improve O&M performance, to ensure or increase efficiency, and to establish favourable conditions for organizational sustainability. Users of monitoring data can be classified in two groups:

- Actors in O&M (Including community members etc)
- Managers and planners at different levels

For a monitoring system to serve its purpose, its users should be involved in deciding which information is essential and which data will be collected to serve these information needs. Therefore, while developing monitoring systems, the main purpose of the programme or organization concerned must be kept in mind. The purpose of O&M organizations or programmes for rural water supply and sanitation is to ensure the functioning of installations for the design life of systems and beyond. Management of O&M aims to achieve this purpose efficiently by minimizing costs and involving different partners or actors in such a way that O&M will be sustained in the future.

The volume of data collected should be as small as possible. The data should be easy to store and analyze to make them accessible for the above target groups.

In the past, efforts to develop monitoring and management information systems for O&M in rural areas have often failed because the developed monitoring systems were not sufficiently simple, too costly and not user friendly. Most of these systems were top down and followed a blue print approach. As it was often not sufficiently clear what information was really needed for those who carry out O&M tasks and for day to day management of O&M, the data were not used. Another reason has often been that the monitoring data were not reliable and not verifiable. Thus, for successful monitoring the following principles need to be applied:

Keep it simple and do not collect more data than really needed.
Make sure in advance that these data can be processed and used timely without increasing over-all costs.
Ensure flexibility by a bottom-up approach.

For an operational monitoring system, it is essential to develop a set of monitoring indicators which are accepted and used both by actors in O&M and managers at various levels in the organization or organizations concerned. Some of these indicators would be used more specifically for a management information system. The various indicators must measure the performance of the O&M system, its efficiency and if possible progress towards organizational sustainability of O&M. Indicators are often developed by first defining targets or results in terms of quality, quantity, time and place.

2. Types of indicators

Basic performance indicators for O&M in rural areas mainly relate to the state of functioning of installations and to the functioning of key components of an O&M system, such as the provision of spare parts. These indicators serve to monitor progress towards planned results (Progress monitoring in result areas)

Managerial indicators combine the above basic performance indicators with data reflecting the use of human and other resources (Resource monitoring). These indicators are important for a management information system. Often monitoring of costs (Financial monitoring) is a good way to monitor the use of resources.

In construction programmes this would compare with monitoring
of physical progress (basic performance of a programme) in combination with financial progress.

Policy implementation indicators may be used to monitor progress towards organizational sustainability along policy lines. Use of policy indicators may help to strike a balance between achieving long term sustainability of O&M and short term improvement of O&M performance.

Policy implementation indicators relate to the impact of an O&M programme on its institutional environment (impact monitoring). In construction programmes this compares with monitoring of socio-economic impact (health, wellbeing, income) of drinking water supply and sanitation provision.

In the case of O&M programmes and organizations concerns progress the desired impact or long term goal is to ensure the organizational sustainability of O&M. This term has been defined in other modules (see working sheet)

Examples of the above three types of indicators are given on "supporting material" pages of this sub-module.

3. Methodology

A monitoring system for O&M is developed by :

- identifying which information is needed by those who carry out or supervise the actual O&M tasks,
- determining how they could realistically collect and store this information, and
- defining who will verify the information and how.
- ensuring that this information can be easily processed and used by managers and planners

The above implies that the information needed at the field level suits the needs of managers and planners provided it is processed and combined with other information concerning the use of resources.
In practice, monitoring systems are developed locally by trial and error. It is often useful to consult other programmes and compare basic indicators. Testing indicators and data collection mechanisms on a small scale is essential.

Those who collect and verify the information are the actors in an O&M system. Monitoring systems requiring additional field personnel are not sustainable.

An example of the setting up of a monitoring system is the WASAMS monitoring system developed by WHO & UNICEF, see supporting material.

4. Summarizing lecture

This summary aims to highlight the main issues and to propose an approach to develop a monitoring system for O&M.

Use of monitoring data
It is important to concentrate on data which really measure the performance of O&M. Not all information can be included in the monitoring system. Data will be collected if they are of direct use to those who collect the information. For more elaborate data collection, evaluation studies are needed. Evaluation studies may show if monitoring data are reliable and meaningful.

Indicator development
There are different types of indicators. Basic performance indicators form the basis of a monitoring and management information system. The number of indicators must be kept small. An indicator which is not objectively verifiable is not an indicator, and should not be included in a monitoring system. Social or behavioral aspects of O&M cannot really be dealt with in a monitoring system as they are not objectively verifiable. These aspects can be covered as part of evaluation studies.

Towards monitoring of O&M
The suggested approach towards better monitoring of O&M is to work from the bottom up, and to start small.
The following steps are proposed:

- Identify the basic O&M tasks including provision of equipment and spares
- Identify the information needed to organize the work of staff at the lower levels.
- Identify basic performance indicators for O&M
- Test the indicator at a small scale for a limited period and ensure that the intended users of information give feed-back.
- Carry out evaluation study to verify if the monitoring data are significant (reflect the status of O&M in the area concerned).
- Adapt the indicators and apply at larger scale
- Start building up management information system including development of management indicators, and also policy implementation indicators if appropriate.

5. **Group exercise on monitoring** (Methodology adopted from Charles de Montchy, Management for Development Foundation, Ede, The Netherlands.

Once groups are formed, they will have the duty to:

a) define the project in brief words, with the objectives, type of schemes, and type of management structure.

b) formulate information needs by answering to the question: "What do I want to know on O&M as a manager?
In order to answer to the question, the group will first brainstorm and then select the most relevant information needs (maximum 5)

c) determine indicators for each information need, by first brainstorming on type of indicators and then select quantifiable, reliable and precise indicators.

d) define the information flow, determining the way the data is going to be collected, the way it is going to be processed and the way it will be used.

Sharing information with other groups (15 min for each group) will help to see the diversity and see the difference for different types of schemes.

BASIC PERFORMANCE INDICATORS FOR O&M (EXAMPLES)

BASIC PERFORMANCE INDICATORS FOR O&M (EXAMPLES)	*FORMULATED AS TARGET*	*WHO COLLECTS DATA*	*WHO VERIFIES*	*METHOD OF VERIFICATION*
WATER SUPPLY SYSTEM FUNCTIONING ACCORDING STANDARDS *)	X% OF SYSTEMS FUNCTIONING IN REGION TO EXCEED 90% BY JANUARY 1995	USERS OPERATORS	LOCAL AUTHORITIES HEALTH DEP. PROJECT	CHECK DATA SHEET WITH ACTUAL SITUATION WHEN VISITING VILLAGE
WATER SUPPLY SYSTEM (OR COMPONENT) REPAIRED PROMPTLY AFTER BREAKDOWN OCCURS	BY 1995, MAXIMUM DURATION OF BREAKDOWN REDUCED TO 2 DAYS IN ALL VILLAGES	VILLAGERS OPERATORS	LOCAL AUTHORITIES BOOK KEPT BY WATER	SAMPLE SURVEYS COMMITTEE
ESSENTIAL SPARE PARTS REGULARLY AVAILABLE AND SOLD AT MARKET PRICE	ALL*) SPAREPARTS AVAILABLE IN SUFFICIENT QUANTITIES*) AT AGREED PRICES IN EACH DISTRICT HEADQUARTERS BEFORE 1994	SHOPKEEPER STOREKEEPER	VILLAGERS, OPERATORS LOCAL AUTHORITIES	- BUY SPARE PARTS - VISIT STORE OR SHOP WITH LIST OF SPAREPARTS AND CHECK
ESSENTIAL SPARE PARTS REGULARLY AVAILABLE AND SOLD AT MARKET PRICE	TURNOVER OF SALES OF SPAREPARTS INCREASED TO X USD BY 1994	SHOPKEEPER STOREKEEPER	- PROGRAMME - SUPPLIER	- CHECKING FIGURE OF SUPPLIES TO SHOPS

*) TO BE SPECIFIED

MANAGERIAL INDICATORS FOR O&M (EXAMPLES)

MANAGERIAL INDICATORS (EXAMPLES)	*FORMULATED AS TARGET*	*WHO COLLECTS DATA*	*WHO PROCESSES DATA*	*METHOD OF VERIFICATION*
AVERAGE O&M COST OF FUNCTIONING SYSTEMS*)	AVERAGE O&M COST OF FUNCTIONING SYSTEM TO DECREASE BY 30% BEFORE 1995	- VILLAGE ORGANIZATION - PROGRAMME MANAGEMENT	PROGRAMME MANAGEMENT	- MANAGEMENT INFORMATION SYSTEM - SEE BASIC PERFORMANCE INDICATOR
NUMBER OF WATER USERS/O&M STAFF RATIO (EMPLOYEES PER 1000 CONNECTIONS, USERS)	THE NUMBER OF O&M STAFF PER 1000 CONNECTIONS (100 HANDPUMPS) TO DECREASE BY 50% BEFORE 1995	PROGRAMME MANAGEMENT	MINISTRY	- MANAGEMENT INFORMATION SYSTEM - LIST OF STAFF
NUMBER OF DAYS SUPER-VISING O&M STAFF SPENDS IN THE FIELD	SUPERVISORS SPEND AT LEAST 50% OF TIME IN THE FIELD BY 1993	INDIVIDUAL STAFF MEMBERS	MANAGEMENT	MANAGEMENT INFORMATION SYSTEM (TIME REGISTRATION)

*) O&M COST ARE LOWEST WHEN NO REPAIRS ARE CARRIED OUT. THEREFORE IT IS IMPORTANT TO SPECIFY THAT SYSTEMS FUNCTION (SEE BASIC INDICATORS)

POLICY IMPLEMENTATION INDICATORS (EXAMPLES) FOR O&M

POLICY IMPLEMENTATION INDICATORS FOR O&M (EXAMPLES)	*FORMULATED AS TARGET*	*WHO COLLECTS THE INFORMATION*	*WHO VERIFIES*	*METHOD OF VERIFICATION*
COMMUNITY FINANCING OF O&M EFFECTIVE	COMMUNITIES TO PAY 100% OF O&M COSTS BY 1998	COMMUNITIES	LOCAL AUTHORITIES PROGRAMME	- BANK ACCOUNT
PRIVATE SECTOR MAKES PROFIT ON SALES AND REPAIRS WITH SUFFICIENT TURNOVER	ALL AGENTS TO MAKE SATISFACTORY PROFIT BY 1995	PRIVATE SECTOR AGENTS	PROGRAMME	- DISCUSSION
LOCAL AUTHORITIES CONTRIBUTE TO O&M SUPPORT SYSTEM	LOCAL O&M FUND CONTAINS MINIMALLY X$ BY 1995	PROGRAMME, LOCAL AUTHORITIES	LOCAL COUNCIL STEERING COMMITTEE	- ACCOUNTS

Overhead sheet 4

GUIDELINE FOR EXERCISE

DEFINING A MONITORING SYSTEM ON O&M

A. DEFINE PROJECT
- OBJECTIVES
- TYPE OF SCHEME
- MANAGEMENT STRUCTURE

B. FORMULATE INFORMATION NEEDS, BY ANSWERING TO THE QUESTION: "WHAT DO I WANT TO KNOW ON O&M AS A MANAGER?"
- BRAINSTORM
- SELECT MOST RELEVANT INFORMATION NEEDS

C. DETERMINE INDICATORS FOR EACH INFORMATION NEED:
- BRAINSTORM ON INDICATORS
- SELECT QUANTIFIABLE INDICATORS
- DETERMINE RELEVANCE (PRECISION, SENSITIVITY) IF INDICATORS

D. DEFINE INFORMATION FLOW, FOR ALL DATA:
- WHERE AND HOW IS DATA COLLECTED?
- WITH WHAT METHOD
- WHO WILL PROCESS DATA?
- HOW AND WHEN WILL YOU BE INFORMED?

Supporting material

The following is extracted from:

PEOPLE IN FOCUS, A human resources development case study,
No: 5 in a series of WHO.

The document present a series of managerial indicators, mainly relating to a programme aiming to increase efficiency. It shows how indicators can be formulated as targets in the form of graphs or tables showing progress over a certain period. It further shows how the action plan is linked to the achievement of results as defined in the form of indicators.

Managerial indicators

Results Areas	Indicators	Unit	Past Results 1979	Past Results 1980	Past Results 1981
1. User satisfaction	1. Provision of water	%	80	80	83
	2. Provision of sewage services	%	32	32	33
	3. Completion of facilities on time	%	62	91	55
	4. Total complaints per month	%	4.2	3.3	2.8
	5. Negative reports received per day		0.23	0.17	0.13
2. Innovation	6. Expenditure on exploration	%	73.9	71.2	69.6
	7. Per capita investment				
	7.1 Water supply systems)	US$/per inhabitant	174.4	112.57	101.38
	7.2 Sewerage systems)		269.95	188.73	159.79
3. Productivity	8. Employees per 1000 connections	employee	5.59	4.84	4.30
	9. Payroll/operational receipts	%	40.1	45.3	44.11
	10. Water losses	%	37.78	35.10	33.50
4. Physical resources	11. Maintenance stocks per 1000 connections	US$	2350.87	1822.03	1586.03
	12. Current liquidity		1.25	0.71	0.76
	13. Punctuality of payment	%	100	97	100
5. Financial resources	14. Bills received	%	74	41.0	35.0
	15. Efficiency of collection	%	96.2	99.2	98.4
	16. Indebtedness		2.43	2.20	2.33
6. Employee attitude and performance	17. Staff turnover	%	10.17	9.58	6.51
7. Public responsibility	18. Contracts in Paraná	%	87	92	100
	19. Quality of final product	%	96	97.2	94.8
	20. Per capita consumption (litres/day)		125	119	115
8. Profitability	21. Return on investment (assets)	%	(0.98)	2.6	3.6
	22. Operating account	%	92.0	87.0	85.71
	23. Trading account	%	110.5	100	99.5
	24. Trading results		(99.0)	(62)	121

Supporting material

This monitoring system could be used as an example by the facilitator, if found necessary.

WASAMS COMPUTER SYSTEM

WASAMS is a sector management tool. It has been developed to improve monitoring at the country level through systematic coordinated reporting within the framework of sector strategies and goals. It was designed to facilitate the collection and aggregation of data from the lowest level of administration, through to national level.

The system has been developed as an open ended "add-on" to the broader CESI+ Country Statistics Monitoring System (CESTAT) developed during the IDWSSD[1] by WHO for the purpose of monitoring the water supply and sanitation sector and has therefore the potential for continuous modification, expansion and upgrading to correspond to specific country needs. The limited number of core indicators remain a permanent feature to ensure regional and global standardization.

The WASAMS computer application is an information management system developed on relational data base. It is primarily intended to facilitate water supply and sanitation sector monitoring, planning and management at country level. The system was developed in 1990-1991 in response to needs for enhancement of sector monitoring at country level identified during review of the sector situation at the end of the IDWSSD by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF).

The microcomputer application is an on-line, interactive, real time and menu driven system. As a user you will find out that there are built-in controls and validations for most fields and there are also "look-up and/or select" functions to help you to enter or edit information.

The system operates on three data bases: PRODUCTION, SIMULATION and TEST/CONTROL. The "production data base" is where the verified data is stored. The "simulation data base" is a subset or full copy of the first one. It can be freely modified for analysing the resulting changes - simulations. The "test/control data base" is used to load data received and to examine it. Once it is checked and eventually corrected it can be moved to the "production data base".

To learn more about WASAMS functions and how to use the programme, a WASAMS tutorial is available, but to find out more about installation, operation requirements, logical and physical data base characteristics and other more technical issues, please refer to the TECHNICAL MANUAL.

[1] International Drinking Water Supply and Sanitation Decade

The WASAMS monitoring system is a computer system to enter, store, maintain, exchange, process and present Water Supply and Sanitation Sector information.

The information is collected in the countries or any administrative, political or data collection sub-level and forwarded on a questionnaire (or on a diskette) to the national level (National Monitoring Unit).
This information, some 290 data items, is the input to the computer system, WASAMS, and provides the basis for national, regional or local reporting and analysis.

WASAMS works with three databases: PRODUCTION, SIMULATION and TEST/CONTROL. The PRODUCTION database contains the actual data. The SIMULATION database is a subset, or a complete copy, of the PRODUCTION database. It can be freely modified for any purpose, such as training, or for analysing various assumptions about possible changes - simulations. The TEST/CONTROL database is used to load data received from a "sub-level", and to examine it. Once it is verified (and corrected), it can be transferred to the PRODUCTION database, or sent back for appropriate corrections.

WASAMS is adapted to fit the country's administrative structure. Some countries have a number of administrative sub-levels (eg. states, republics, regions) which collect sector information. The data from any sub-level within a country can be merged to produce the appropriate data record for the next higher administrative level.
The country record should periodically be sent to a WHO or UNICEF regional office and/or to the headquarters.

WASAMS is a user-oriented computer system. It is completely menu driven and has many help features and an extensive validation mechanism which reduces data entry/edit errors. There are also "look up" and/or "select" functions (window overlays) to help with data entry and with making selections.

To learn more about WASAMS functions and how to use the system, read the WASAMS TUTORIAL and the WASAMS USER GUIDE.

There are a number of options to choose from the WASAMS main menu, providing the user with all that is needed to store, maintain, search, analyse and present the sector information.

Some of the main WASAMS features are:

- An extensive built-in validation mechanism, to help prevent errors during data entry/edit.
- A merge facility, which creates a record as the sum of the existing records at the next lower administrative level.
- Reference tables of national sub-level names and locality codes.
- Reference tables of regional groupings (for reports).
- A number of standard reports, as well as the provision to to create user defined reports.

Subsystems

The system was designed to give the user quidelines even in its main menu. The order of the modules or subsystems (main menu options) is actually the task order when using the system.

The subsystems (main menu options) are:

1. Data entry/edit
2. Data view
3. Report creation
4. Report lookup/printout
5. Data merge/aggregation
6. Localities and regions
7. Reference tables
8. Application utilities

A. Data utilities
B. System utilities
C. Go to DOS
S. System overview

X. Quit

Data entry/edit module

Countries which don't use the WASAMS system can provide the information by completing a questionnaire.
Those countries which are using WASAMS will be able to use the data entry/edit module to enter and maintain their information.
The download utility programme can be used to copy selected data t diskette which can then be mailed to higher or lower administrativ levels.

At any level, the data will be entered manually if it is received on a form, or uploaded from a diskette if WASAMS computer system is in operation.

The DATA ENTRY/EDIT module is divided into 5 parts. Each part is very similar to the corresponding part of the questionnaire. The screens are almost identical to the questionnaire parts, the only restriction being the size of the screen and for that reason additional screens are being used.

In addition, there is a review function to check what has so far been entered into the system. This function provides the option to print a questionnaire for specified country and year with all the data entered.

There are also a number of features assigned to "F" (function) keys. F1 is for reading special definitions (comments) to the questionnaire parts. F2 is used for deleting a form. F4 invokes a lookup/selection feature. For example, when entering/editing a 3-letter country code, pressing F4 will cause a window to appear giving a list of the valid codes from which a selection may be made.

Data view module

The data view option is very similar in appearance to the data entry/edit option, but no changes are allowed, and it is much faster. There is one major difference. In the view option, one can move around (view different localities) in only one file at a time (next, previous, first or last record) corresponding to a specified form part (0, 1, 2, 3 or 4). In the entry/edit option, one can move between the different parts of a specified locality's questionnaire.

In either case, one can move between the various screens for each part of the questionnaire (part 0. has 1 screen, part 1. has 6 screens, part 2. has 3 screens, part 3. has 4 screens, and part 4. has 1 screen.)

Report creation module

Once the data is entered reports can be generated. All the reports generated by the system are saved for later viewing and/or printout. Each report takes several pages. Many reports can be generated and saved. A systematic use of file names facilitates retrieving the reports. Reports can be deleted when no longer needed.

There are five standard reports:

- Population and System Utilization
- Coverage
- Management (operation and maintenance costs)
- Number of people served (by facilities managed by different institutions)
- Funding

The reports can be national, regional or local. Local reports show the data for all of the localities at the next lower sub-level. Regional reports show the data for all of the localities in a specified (user defined) region. National reports show the data for all localities grouped by the user defined regions.

Data merge module

The data merge option is another important feature of the system.

The data records for any locality (except at the lowest administrative sub-level) can be created by merging (aggregating) the data from the next lower sub-level.
For example, the data for the states of India can be merged to create the Indian country record. The system provides for up to five sub-levels below the country level. The names of the sub-levels (for example: state, county, zone, municipality and precinct) must be entered into the data base by the user, and al the 3-letter codes and locality names within each sub-level (for example, there might be 50 states, 900 counties, 3,000 zones, 12,500 municipalities and 100,000 precints in a large country).

Application utilities

The utilities subsystem consists of a number of functions used in everyday work.
Note the utilities for data download and upload, which are used for data export and import (for sending and recieving data between sub-levels within a country).

System utilities

One of the utilities, "database choice", is used to switch between the different databases (production, simulation and test/control).

When data is received on a diskette, it should first be uploaded into the test/control database and examined there. Once the data is confirmed as correct (after it is corrected), it can be transferred to the production database.

Sub-national administrative levels

The feature of specifying country sub-national levels and their components, and monitoring water and sanitation indicators on any level, makes the WASAMS country-oriented management information system.

This module is described in detail in the WASAMS TUTORIAL.

Regional sub-divisions

WASAMS computer system allows the user to specify an unlimited number of different regional sub-divisions (set-ups) eg. Ministry of Health Regions, Ministry of Education Regions, Water Commission Regions, etc.

Reports can be generated for any region type, by its regions, or for any region by its localities.

Logical structure

An analysis of the proposed data collection questionnaire and the data items resulted in an OBJECT-RELATION type data model.

Further analysis of the system requirements gave the final structure of a normalized form database.

The data model shown on the next page is an OBJECT-RELATION type model.
The OBJECTS are data items with unique identifiers, like sub-level (name), report type and region. They all have a unique identification code. One of the most important OBJECTS in the WASAMS system is the locality itself. Each locality has a unique 18-character identification code: its own 3-letter code, prefixed by the codes for all of the levels above, and padded at the end with blanks.

To "describe" each object a database file is needed. The object's unique identifier is the record key field while the rest of the information on the object are attribute fields.

The objects are related to each other. Each relation results in a file with a key inherited from the object files. For technical reasons, some relations will result in more than one file. For example, the relation COUNTRY <-> YEAR is described in the four files: 0_PART, 1_PART, 2_PART and 3_PART. In each of them, the key is: LOCALITY + YEAR.

This data modelling technique helped achieve a stable structured database, unaffected by changes in data processing procedures or output requirements.

For further reading

IRC, International Water and Sanitation Centre (1991). Partners for progress : an approach to sustainable piped water supplies. IRC Technical Paper Series No.28. The Hague, The Netherlands, IRC International Water and Sanitation Centre.

Ministry of Community Development, Women Affairs of Tanzania (1992). Reporting and Monitoring on Operation and maintenance : Shinyanga Region. Dar es Salaam, Tanzania.

National Industrial Development Corporation. (1988). Integrated monitoring system for rural water supply : executive summary. New Delhi, India.

World Health Organization (1989). People in Focus. A human resources development case study, No 5 in a series. Geneva, Switzerland.

World Health Organization/UNICEF (1992). Water and Sanitation monitoring system. WASAMS, WHO, Geneva, Switzerland.

7.3 PLANNING

Description of session

OBJECTIVES

- To develop an overview of O&M relating to planning and design
- To gain knowledge concerning experience in planning and design for better O&M

OUTLINE OF SESSION

• Introductory presentation on overview of planning and design factors with examples of experiences coming from the participants (see par.6)	45 min
• Work in plenary session aimed at elaborating a checklist (see par.7)	45 min
	1 h 30 min

HAND - OUTS

- Proposed steps in developing an operation and maintenance system.
- Extracts from background information

MATERIAL NEEDED

- Overhead projector

Background information

1. Integrated water resources development and management

Planning for O&M cannot be done outside the general context of the water resources or sanitation management. There is a tendency to promote an integrated approach in planning for water supply and sanitation. This tendency is reflected in the following document which represents the thought of the human conscience on this matter.

(From the Agenda 21, chapter 18, adopted by the Plenary of the Earth Summit in Rio de Janeiro, on June 14, 1992)

> Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization. To this end, water resources have to be protected, taking into account the fucntioning os aquatic ecosystems and the perenniality of the resource, in order to satisfy and reconcile needs for water in human activities. In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged appropriately.
>
> Four principal objectives should be pursued:
>
> 1. To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of fresh water supply, that integrates technological, socio-economic, environmental and human health considerations;
>
> 2. To plan for the sustainable and rational utilization, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy;
>
> 3. To design, implement and evaluate projects and programmes that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth, indigenous people, local communities, ion water management policy-making and decision making;
>
> 4. To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth.

2. Planning for O&M right from the beginning

(From WASH Technical Report n. 71)

> The project cycle is an ordered progression of activities designed to produce benefits over time.
> At the start, organizational matters take precedence and there are no project benefits before construction begins. A properly planned project will incorporate

O&M at the design stage. As each facility completed, O&M activities begin and benefits start to accrue. When the projects ends, it should leave in place an O&M system that will maintain or even increase benefits. Such a projects is said to be sustainable, a state that is primarily dependant upon achieving a proper O&M management system.

The activities in the project cycle are listed below in order of occurence. Some reordering an overlap may occur under specific circumstances:

* Design of Water Supply and Sanitation system
* Training to import needed skills
* Financial management
* Construction
* Operation and maintenance
* Health education
* Repair
* Rehabilitation and extension
* Monitoring and evaluation

Design covers the detailed planning of not only the physical plants but also the institutional structure and management arrangements. Government agencies design the facilities, with input from the community. (The technology must be compatible with the local cultural setting and users wishers).

Training is provided to equip the community with skills to support the activities specified in the project design. Specialized agencies must design training according to community needs. Training may include such subjects as leadership, accounting, pump repair and hygiene.

Financial management is the control of O&M funds and should be entrusted to the community if it is given the responsibility for meeting O&M costs.

Construction covers the building of the facilities and depending on the technology, may be a joint effort by a government agency, private entrepreneurs and the community. The technology must be compatible with the manager's ability to control and utilize the facilities.

Operation and maintenance covers the efficient day by day working of the facilities, regular preventive maintenance and the assurance of proper use. The communities are the logical choice but other actors have a potential role depending on the situation.

Health education is intended to promote hygienic use of the facilities and tends to be an ongoing activity to reinforce positive user attitudes and practices, which in turn will facilitate O&M management. Specialized government agencies, usually within the

Ministry of Health are normally responsible.

Repair, as opposed to preventive maintenance, covers the replacement of damaged parts and typically is a joint effort between the government, the private sector and the community.

Monitoring and evaluation is the formal assessment of the effectiveness of the system and its benefits to the community. The community itself is the logical evaluator but government extension agents also should closely monitor the evaluation to ensure the public good. An essential purpose of monitoring and evaluation is to use the results to modify activities if needed.

Rehabilitation and extension completes the cycle by replacing worn out segments of the facility or extending it to accommodate changed needs. This should not be necessary for several years after the project has been completed and will depend on the effectiveness of the O&M system. The community plays a prime role in this process but may need assistance from government agencies and the private sector.

3. Technology choice

Choice of technology and determining service levels is the most obvious factor which is dealt with in planning and design, and which affects the success of O&M because it determines the O&M requirements and has a bearing on institutional, organizational, financial and socio-cultural factors affecting O&M. Concerning community-based water supply, a useful principle which evolved during the 80'ties is that the technology chosen should give the community the highest service level that it is willing to pay for, will benefit from, and has the institutional capacity to sustain. Environmental considerations may to some extent diminish the validity of this principle (Water resource constraints, poor sanitary conditions resulting from high water use), but over all it is a better starting point to end up with appropriate solution than to look for low-cost or cheap solutions.

4. Accepting varying needs

Different communities are not uniform in their needs and capabilities, and even within communities the demand for services and the readiness to contribute may vary considerably. Though it is impossible to meet all demands optimally, a mixture of technologies and service levels may be the right answer.
Please note that even when there seems to be only one feasible option, in decisions concerning construction details, much can be done to comply with specific needs and demands, for instance, by site selection, site improvements around tap points, by decentralizing storage, by determining user groups which are served from their own branch line etc. Thus, design options should be developed and discussed with communities and user groups.

5. Making choices with users

The choice for a final option should normally be determined by an assessment of benefits in comparison with investments in time, cash. and energy. Often discussions concentrate on the construction phase. In fact, it is far more important to concentrate on choice, all partners in the process must have the same information upon which decisions can be based. Bridging knowledge gaps is needed both ways, and can be achieved by going through a systematic selection process to determine the technology and the service levels. See table 1 from " Partners for Progress", which is attached.

6. Presenting examples in plenary session

Each participant, including trainer and resource persons if present will draw upon their experience to give if possible three practical examples as follows:

- An example where O&M was taken into account in planning and design
- A case where O&M was neglected in the planning phase
- A practical example of design of systems influenced O&M.

This last example relates to technical design options and technology choices as far as system components are concerned.
For each example they will indicate the effects by discussing the present status of O&M.

7. Group work on listing O&M considerations

The facilitator jointly with the participants will determine the activities to consider when developing an operation and maintenance system.
Technology choice and service levels first have to be defined.

Four steps are proposed :

A. Review present status of water supply and sanitation coverage and sustainability of existing systems
B. Identify maintainable water supply and sanitation improvements
C. Testing the feasibility of O&M system
D. Expansion of O&M system along with programme implementation

A detailed overview of activities implied in each step is given in the supporting material

Overhead sheet 1

Integrated approach (from Agenda 21)

Four principal objectives

1. **PROMOTE INTERACTIVE MULTISECTORAL APPROACH**

2. **PLAN FOR SUSTAINABILITY**

3. **DESIGN AND IMPLEMENT PROJECTS BOTH ECONOMICALLY EFFICIENT AND SOCIALLY APPROPRIATE**

4. **STRENGTHEN INSTITUTIONAL, LEGAL AND FINANCIAL MECHANISMS**

Overhead sheet 2

Activities in the project cycle (from WASH Technical Report)

- **DESIGN OF WATER SUPPLY AND SANITATION SYSTEM**
- **TRAINING TO IMPORT NEEDED SKILLS**
- **FINANCIAL MANAGEMENT**
- **CONSTRUCTION**
- **OPERATION AND MAINTENANCE**
- **HEALTH EDUCATION**
- **REPAIR**
- **MONITORING AND EVALUATION**
- **REHABILITATION AND EXTENSION**

Supporting material

Steps in developing an operation and maintenance system
(Technology choice and service levels to be defined)

Steps	*Activities*
I. REVIEW PRESENT STATUS OF WATER SUPPLY AND SANITATION COVERAGE AND SUSTAINABILITY OF EXISTING SYSTEMS.	Make inventory of present technology options and service levels (including traditional systems) Define coverage in terms of technology and service level Collect data on functioning and use of existing systems Identify present constraints in ensuring O&M Assess institutional, financial and legal implications of extended coverage Assess the human and organizational potential for O&M in communities, government agencies, and private sector Review financial systems and resources for O&M.
II. IDENTIFY MAINTAINABLE WATER SUPPLY AND SANITATION IMPROVEMENTS	Approach local authorities (districts, provinces, municipalities) to discuss partnership approach Agree on basic service levels and technology options including improvements of existing systems Elaborate a long-term (10-15 year) indicative programme aimed to increase coverage and ensure sustainability through investments and O&M system development, including a pilot stage or demonstration phase Inform communities in selected area about pilot activity Elaborate procedure to prepare community requests for improvements Channel requests through local authorities and apply criteria for selection of communities to be considered Identify key O&M tasks and estimate costs Organize communities to review O&M roles and financial obligations, and to choose realistic options Organize (training) workshops for local authorities, project staff, and community members involved in O&M Execute demonstration schemes at sufficiently large scale

Supporting material

from Saul Arlosoroff et al. Community Water Supply, The Handpump Option (1987), the World bank, Washington, D.C., USA. (Chapter 2 of this publication presents a good overview of service options for community water supply and considerations for technology choice).

Options for Community Water Supply

Step	Type of Service	Water source	Quality protection	Water use LPCD[a]	Energy source	Operation and maintenance needs	Costs	General remarks
5	House Connections	Groundwater Surface water Spring	Good, no treatment May need treatment Good, no treatment	100 to 150	Gravity Electric Diesel	Well-trained operator; reliable fuel and chemical supplies; many spare parts; wastewater disposal	High capital and O&M costs, except for gravity schemes	Most desirable service level, but high resource needs
4	Yardtaps	Groundwater Surface water Spring	Good, no treatment May need treatment Good, no treatment	50 to 100	Gravity Electric Diesel	Well trained operator; reliable fuel and chemical supplies; many spare parts	High capital and O&M costs, except gravity schemes	Very good access to safe water; fuel and institutional support critical
3	Standpipes	Groundwater Surface water Spring	Good, no treatment May need treatment Good, no treatment	10 to 40	Gravity Electric Diesel Wind Solar	Well trained operator; reliable fuel and chemical supplies; many spare parts	Moderate capital and O&M costs, except gravity schemes; collection time	Good access to safe water; cost competitive with handpumps at high pumping lifts
2	Handpumps	Groundwater	Good, no treatment	10 to 40	Manual	Trained repairer; few spare parts	Low capital and O&M costs; collection time	Good access to safe water; sustainable by villagers
1	Improved traditional sources (partially protected)	Groundwater Surface water Spring Rainwater	Variable Poor Variable Good, if protected	10 to 40	Manual	General upkeep	Very low capital and O&M costs; collection time	Improvement if traditional source was badly contaminated
0	Traditional sources (unprotected)	Surface water Groundwater Spring Rainwater	Poor Poor Variable Variable	10 to 40	Manual	General upkeep	Low O&M costs (buckets, etc); collection time	Starting point for supply improvements

a. LPCD = liters per capita per day

For further reading

Arlosoroff, S. & co, (1987). Community water supply: the hand pump option. World Bank/UNDP, Washington D.C., USA.

IRC, International Water and Sanitation Centre (1991). Partners for progress : an approach to sustainable piped water supplies. IRC Technical Paper Series No.28. The Hague, The Netherlands.

Mann, L. (1984). Maintenance management. Revised edition. Lexington Books, Massachussets, Toronto.

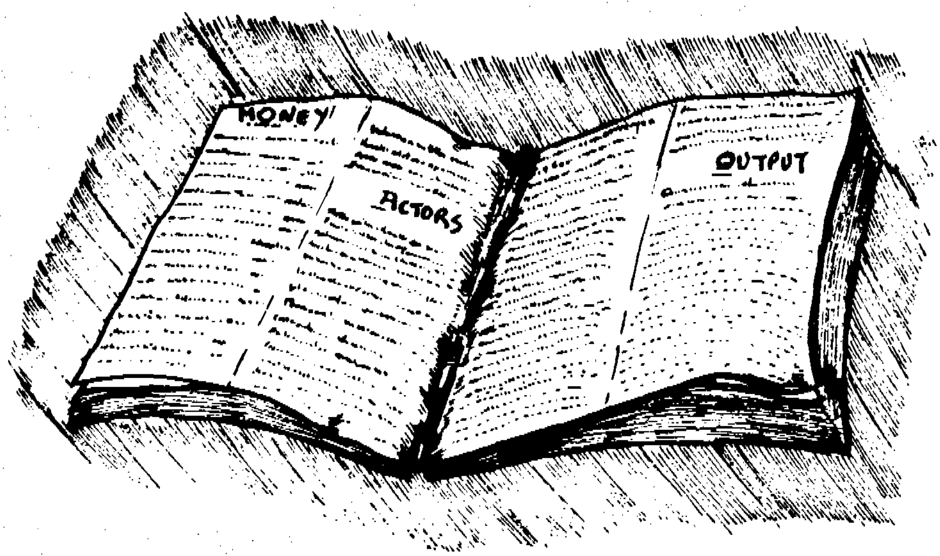
Mukoyogo, S.M. (1987). District planning-budgeting and management of operation and maintenance of water facilities : management training seminar for programme implementors. Mzumbe, Tanzania, Institute of Development Management.

Okun, A. Daniel; Ernst, Walter R. (1987). Community piped water supply systems in developing countries : a planning manual. World Bank Technical Paper No.60. Washington, DC, USA.

PART 3: PLANNING FOR O&M

MODULE 8

ACTION PLAN AND CONCLUSION



OUTLINE OF COURSE

PART 1 : FACING O&M

MODULE 1: INTRODUCTION
- 1.1 Introduction of course to participants
- 1.2 Presentations

MODULE 2: THE CHALLENGE OF O&M
- 2.1 Concepts and trends
- 2.2 Links between health, water and sanitation

MODULE 3: O&M ISSUES
- 3.1 Analysis of constraints
- 3.2 Identification of strategies

PART 2 : KNOWING MORE ABOUT O&M

MODULE 4: O&M TECHNICAL REQUIREMENTS
- 4.1 A systematic approach, with VIP latrine example
- 4.2 Water supply
- 4.3 Water distribution and treatment

MODULE 5: O&M ORGANIZATIONAL AND FINANCIAL REQUIREMENTS
- 5.1 Actors and roles
- 5.2 Management models
- 5.3 Cost estimation & cost recovery

MODULE 6: TOWARDS SUSTAINABILITY
- 6.1 Community management
- 6.2 Involvement of women
- 6.3 Local financing
- 6.4 Human resource development
- 6.5 Spare parts provision

MODULE 7: TOWARDS SOUND MANAGEMENT
- 7.1 Information and communication
- 7.2 Monitoring
- 7.3 Planning

PART 3 : PLANNING FOR O&M

MODULE 8: ACTION PLAN/CONCLUSION
- 8.1 Methodology for planning
- 8.2 Individual assignment
- 8.3 Writing-up and presentations
- 8.4 Evaluation and conclusion

8.1 METHODOLOGY FOR PLANNING

Description of session

OBJECTIVES

- To introduce the third part of the course
- To present a methodology for the work plan
- To do an exercise on planning

OUTLINE OF SESSION

• The facilitator presents the third part	5 min
• Presentation of methodology for planning	40 min
• Group exercise using information coming from the objective tree done previously on planning	1 h
	1 h 45 min

HAND - OUTS

- Planning methodology

MATERIALS NEEDED

- Overhead projector

Overhead Sheet 2

METHODOLOGY FOR PLANNING

1. DEFINE THE OVERALL OBJECTIVE

2. DEFINE THE PROJECT PURPOSE

3. DEFINE THE RESULTS TO BE ACHIEVED

4. DEFINE THE ACTIVITIES TO UNDERGO

5. DEFINE INDICATORS FOR THE RESULTS

6. FOR THE ACTION PLAN, SELECT ACTIVITIES WHICH ARE FEASIBLE WITHIN THE COMING 6 MONTHS

7. HUMAN AND FINANCIAL CONSEQUENCES

8. EVALUATION

Overhead Sheet 1

OUTLINE OF THIRD PART

1. INTRODUCTION ON PLANNING METHODOLOGY
2. INDIVIDUAL PROBLEM TREE
3. INDIVIDUAL OBJECTIVE TREE WITH IDENTIFICATION OF OVERALL OBJECTIVE AND PROJECT PURPOSE
4. IDENTIFICATION OF RESULTS/OUTPUTS AND ACTIVITIES
5. BIBLIOGRAPHICAL RESEARCH
6. ACTION PLAN
7. PRESENTATION
8. EVALUATION

3. Methodology for planning

Taking the identification of clusters which was done in sub-modules 3.2, the facilitator will identify with the help of the participants :

- The overall objective
  This objective indicates what the reason for the project is, the broader sectoral objective towards which the efforts of the project are directed.

- The project purpose
  The project purpose indicates what specific effect the project will achieve within its lifetime if the project is completed successfully

- The results
  These are the products of completed activities. The combination of these results should be sufficient to achieve the project purpose.
  (it is suggested in this particular part not to take too much time, but just enough to illustrate what is meant by results). Some of the objectives of the objective tree can be considered as results.

- The activities for each result to be achieved.
  These are the actions, the research, the tasks to be carried out by the project staff (brainstorm, then order them logically).

This methodology is the start of a Project Planning Matrix.
This matrix can then be strengthened by adding some **objectively verifiable indicators** for the project purpose and for the results.

It might also be strengthened by listing **assumptions**.
These are key factors which are outside the direct control of the project, but which are essential for the success of the project.

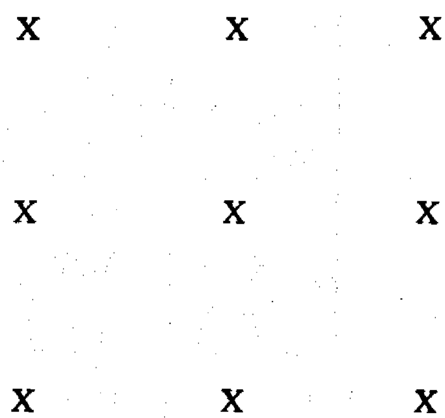
Project Planning Matrix:

OVERALL OBJECTIVE				
PROJECT PURPOSE	+ INDICATOR			
RESULT 1 + INDICATOR	RESULT 2 + INDICATOR	RESULT 3 + INDICATOR	RESULT 4 + INDICATOR	------
Activities	Activities	Activities	Activities	
Activities	Activities	Activities	Activities	
Activities	Activities	Activities	Activities	
Activities	Activities	Activities	Activities	

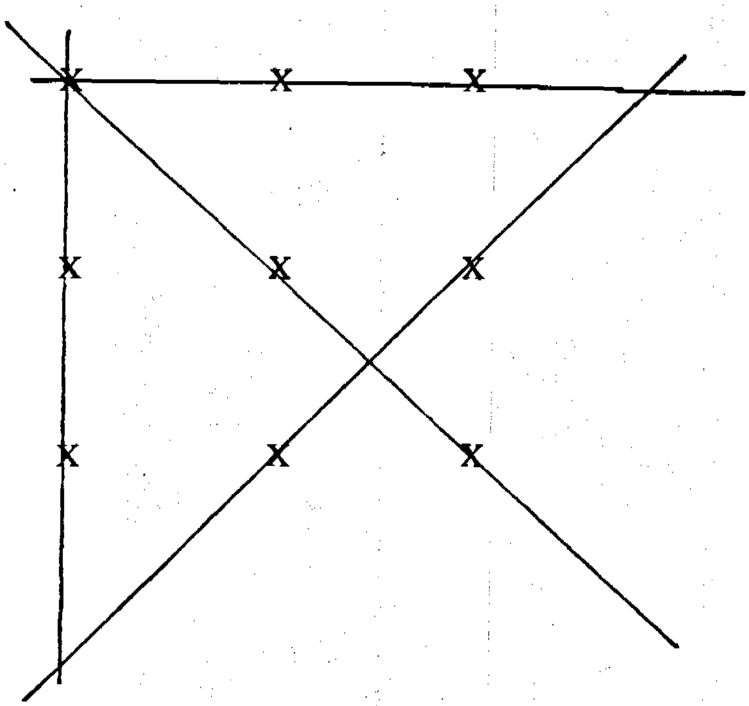
2. Attitude in planning

It is suggested to the facilitator to start with a simple exercise which will illustrate the need for the participants to broaden their normal way of thinking. Indeed, most professionals have an attitude proper to their work which is tied with their everyday activity and intellectual routines. Let us say that we see the world as we have learnt to see it. In order to plan new activities, it is useful to expand the normal way of thinking.

Proposed exercise: With only four straight lines, try to pass by all the points only once.



Solution: It is impossible to find a solution unless we go out of the model, such as shown:



Going outside the model has helped to find a solution. While planning, we should try to think sometimes in the same way, by going beyond our normal way of working.

Background information

1. Introduction of third part

The purpose of the third part is to use all the information and knowledge gathered during the two first parts into making an action plan suited for improving O&M in the personal job situation of each participant.

This part is therefore focused on individual work with the guidance of the facilitator or other staff, as well as reference to a documentation centre or manuals if available.

The outcome of this part is to have each participant presenting an action plan in a plenary session.
Therefore the participants have to produce a document in the form of a project planning sheet, with eventual supporting documents.

OUTLINE OF THIRD PART

1.	Introduction by facilitator and group exercise	1 h 45
2.	Individual problem tree	1 h 45
3.	Individual objective tree with identification of overall objective and project purpose	1 h 30
4.	Identification of results/outputs and activities	1 h 30
		End of day
5.	Continued and bibliographical research	1 h 45
6.	Continued and bibliographical research	1 h 45
7.	Introduction by facilitator on outline of output and ways to present Start on action plan	1 h 30
8.	Continued on action plan	1 h 30
		End of day
9.	Presentations of action plan	1 h 45
10.	Presentations continued	1 h 45
11.	Final evaluation and closing ceremony	2 h
		End of course

Supporting material

Planning procedures

1. Select the project purpose of the project. This objective indicates what specific effect the project will achieve within its lifetime. This objective can be found at the top (and within) the selected the objective tree done during sub-module 2.2.

2. Select the overall objective of the project. This objective can be found outside the selected cluster above the project purpose.

3. Select the results of the projects. results are achievements which contribute towards the project purpose. These results can be found under the selected project purpose in the objective tree.

4. Identify other results to reach the project purpose that cannot be derived from the objective tree but are effective ways of achieving the project purpose. These results are solutions which are no translation of problems, but new elements.

5. Check whether the interrelated impact if the results is appropriate, necessary and sufficient. to achieve the Project purpose.

6. Write down all the activities which are necessary to achieve the results

7. Give activities and results consecutive, related numbers by order of importance and logical sequence.

Supporting material

(from ZOPP - an introduction to the method, of GTZ)

The project planning matrix

Step 6: PROJECT PLANNING MATRIX - We develop an overall description of the project

Procedure:

6.1 The chosen project is derived from the objectives tree and transferred into the first vertical column of the planning matrix (see p.15). We proceed as follows:

- start at the top and work downwards,
- decide on one overall goal and one project purpose,
- if necessary, review the wording in the objectives tree and make it more accurate.

6.2 The project purpose describes the intended impacts or the anticipated benefits of the project as a precisely stated future condition. The project purpose contributes to achieving the overall goal.

6.3 The results/outputs are expressed as objectives which the project manager must achieve and sustain. Their combined impact must be appropriate, necessary and sufficient to achieve the project purpose.

6.4 We write down those activities which are necessary to achieve the results/outputs, noting that to ensure clarity:

- we do not list too many detailed activities, but rather indicate the basic structure and strategy of the project,

- in contrast to the objectives levels, we express the activities as an action, e.g. (activity) train counterparts (objective) extension service in operation.

6.5 Activities and results/outputs are given consecutive, related numbering. The numbering can be used to indicate the sequence of events or the priorities.

6.6 The column entitled summary of objectives and activities must describe the operational means-ends relationships in the project structure,

- the activities are implemented in order to obtain the results/outputs,

- the results/outputs are necessary and (together with the assumptions) sufficient basic requirements to achieve the project purpose,

- the project purpose is a prerequisite to obtain the overall goal.

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PROJECT PLANNING MATRIX (PPM)

Project Title:

Project No:

Est. Project Duration: Country:

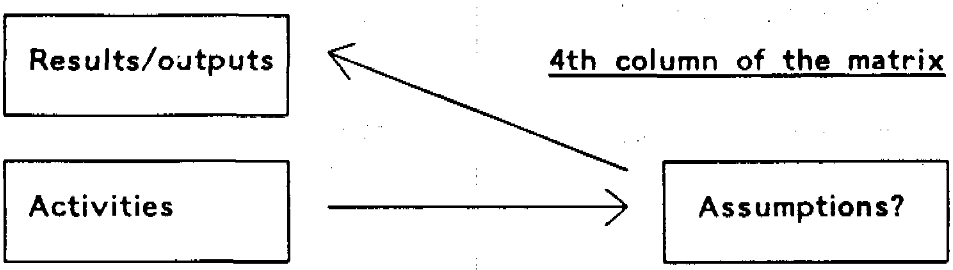
PPM prepared on (date)

	SUMMARY OF OBJECTIVES/ACTIVITIES	OBJECTIVELY VERIFIABLE INDICATORS	MEANS/SOURCES OF VERIFICATION	IMPORTANT ASSUMPTIONS
DEVELOPMENT HYPOTHESIS: If the project purpose is achieved, then a contribution is made towards the overall goal	OVERALL GOAL to which the project contributes 1. How do we word the OG, taking into account the results of the analysis of objectives?	INDICATORS that overall goal has been achieved 9. How do we define the contents of the OG (in the various phases), i.e. the contribution to the achievement of the OG, so that they become measurable? Note: Quality, quantity, time and possibly location and target group.	12. Which database is available, or which documents have been drawn up or can be obtained elsewhere, to prove that the OG has been achieved?	for sustaining objectives in the long term 8. Which external factors will have to occur in order to assure sustained continuity of the achieved contribution to the OG in the longer term?
If these results/outputs are obtained, then the project purpose is achieved	PROJECT PURPOSE 2. With which PP (independent of factors manageable by the project management) will we make a considerable contribution to the achievement of the OG?	INDICATORS proving that the project purpose has been achieved (end-of-project status) 10. How do we define the contents of the PP (in the various phases), i.e. the achievement of the project purpose, so that it becomes measurable? Note: Quality, quantity, time and possibly location and target group.	13. Which database is available, or which documents have been drawn up or can be obtained elsewhere, to prove that the project purpose has been achieved?	for achieving the overall goal 7. Which external factors will have to occur for the anticipated contribution to the overall goal to actually take place?
MANAGEABLE FACTORS: If these activities are carried out, then results/outputs are obtained	RESULTS/OUTPUTS 3. Which results/outputs (as a whole and in effective combination) will have to be obtained in order to achieve anticipated impact (the Project Purpose)?	INDICATORS proving that the results/output, have been achieved 11. How do we define the contents of each individual result/output (in the various phases) so that they become measurable? Note: Quality, quantity, time and possibly location and target group.	14. Which database is available, or which documents have been drawn up or can be obtained elsewhere, to prove that the results/outputs have been achieved?	for achieving the project purpose 6. Which important assumptions in relation to the results/outputs 1 to ..., that cannot be influenced by the project or have been consciously defined as external factors, must occur in order for the project purpose to be achieved?
	ACTIVITIES 4. Which activities (also as complex packages of measures) will the project have to tackle and implement in order for the results/outputs 1 to ... to be obtained?	SPECIFICATION of inputs/costs of each activity 15. What does it cost and what inputs are needed (including personnel inputs in man-months) in order to implement each individual activity?	16. What records voucher for the costs entailed, consumption of materials, use of equipment, inputs of personnel etc.?	for achieving the results/outputs 5. Which important assumptions in relation to the activities 1 to ... that cannot be influenced by the project or have been consciously defined as external factors, must occur in order for the results/outputs to be obtained?

Step 7: PROJECT PLANNING MATRIX (PPM)
- Determine the important assumptions

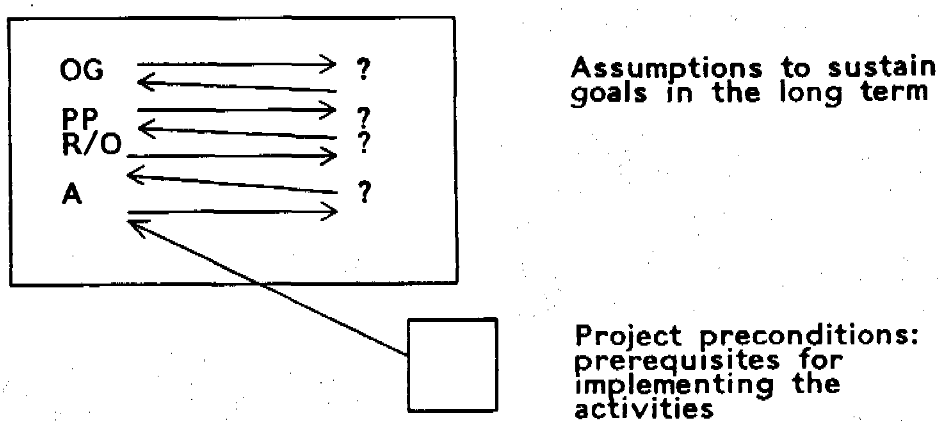
<u>Procedure:</u>

7.1 We examine whether activities directly generate the desired results/outputs or whether an additional event must also take place outside the project (assumption).



7.2 Some important assumptions can be derived from the means-end relationships in the objectives tree which were not incorporated into the project.

7.3 We make the three-step check (see 7.1) at all levels starting from the bottom in order to verify that the concept is logically conclusive and complete. Each level must contain the necessary and sufficient conditions (including assumptions) for the next highest level.



Note: The fourth column of the project planning matrix "important assumptions" lags one level downwards in relation to the "summary of objectives/activities." The preconditions for implementing the activities are thus outside the normal PPM and the top right-hand square is used for the assumptions necessary to sustain the overall goals in the long term.

7.4 Ensure that:

- important assumptions are expressed in the same way as objectives (as a positive condition)

- the important assumptions are described in such operational detail (with indicators if possible) that we can exactly see whether these external conditions have occurred or not.

- only important assumptions are stated which are logically-necessary, additional conditions.

7.5 Assumptions which are important but improbable are "killer assumptions" and cannot be planned!
If killer assumptions exist, planning must be changed or the project must be abandoned.

Step 8: PROJECT PLANNING MATRIX - Wording our indicators

Procedure:

8.1 The indicators define the contents of the objectives (OG, PO and R/O). Either the objectives or the indicator must also contain
- the time period,
- the region,
- the target group or
- the partner institutions.

8.2 The details in the indicators allow us to exactly measure how far the objectives have been achieved at different periods in time. We must also quantify the quality factors as far as possible. To do this several direct indicators are usually required, plus, if necessary, additional proxy indicators, substitute indicators etc.

8.3 When the contents of the objectives have been fully incorporated we must state how to measure them and set the quantities required.

8.4 The prescribed measuring process must be accurate enough to make the indicator objectively verifiable. An indicator is objectively verifiable when different persons using the same measuring process obtain the same measurements quite independently of one another.

8.5 A good indicator is

- substantial, i.e. reflects the essential content of an objective in precise terms

- objectives-oriented, i.e. the means-ends relationships between the levels on the PPM suffice in terms of quality and time to achieve the next highest level.

- plausible, i.e. the changes recorded can be directly imputed to the project,

- independent, i.e. it differs in content to that on the level in the PPM immediately below it, so that the degree to which the objective has been achieved can be measured directly, and quite independently of the inputs made.

8.6 At an early stage of planning indicators are just guiding values which serve to quantitatively analyse the project concept. We examine what inputs should be used to achieve quantifiable results/outputs or impacts. These guiding values must be reviewed again on location, and where necessary replaced by project-specific indicators.

8.2 INDIVIDUAL ASSIGNMENT

Description of session

OBJECTIVES

- To prepare step by step an action plan

OUTLINE OF SESSION

- STEP 1 : Work on individual problem tree — 1 h 30 min
- **STEP 2 :** Work on objective tree with identification of overall objective project purpose — 1 h 30 min
- **STEP 3 :** Identification of results and activities, indicators and assumptions — 1 h 30 min
- **STEP 4 :** Continued plus bibliographical research — 1 h 30 min

HAND - OUTS

None

Background information

STEP 1: Individual problem tree

The participants will take their own working environment or own future project as the context for creating their problem tree. Furthermore, they have to specify problems which they are really and personally facing and not stay in the general problems regarding the sector and O&M.
This tree should be focused on O&M.
The methodology used is the same as the one used during session of sub-module 3.1.

STEP 2: Individual objective tree with identification of project purpose

For the identification of the project purpose, the participants should make sure that it is relevant to their work.

STEP 3: Identification of results and activities, as well as indicators and assumptions.

It is advised that the facilitator recalls in a plenary session the main points regarding this session and its methodology before the participants go on with their work, and in order to clarify some misunderstandings.

STEP 4: Continued plus bibliographical research

Participants should be given the opportunity to make further inquiries about references either by consulting manuals made available by the facilitator or by consulting the local documentation centre.

8.3 WRITING UP AND PRESENTATIONS

Description of session

OBJECTIVES

- To give a format for the action plan
- To let the participants prepare their action plan
- To give some suggestions for the presentations
- To let the participants present their action plan

OUTLINE OF THE SESSION

• The facilitator presents the format with which the participants will work and participants start to work on it	1 h 30 min
• Participants keep on working on their action plan and eventually prepare some supporting material	1 h 30 min
• Presentations (15 to 20 min) for each participant	3 to 4 h

Background information

1. Format of action plan

See proposed format in the supporting material

Sometimes participants are reluctant and hesitant to write and action plan. The facilitator must provide guidance and support to motivate them to write a plan.
After they have written and presented their action plan they usually consider it to be a useful exercise.
If an agreement cannot be reached, the preparation of an alternative document can be discussed, eg. summary of strong and weak areas of their project, list of questions and constraints.

2. The action plan

Participants might wish to have their action plan typed, in which case the facilitator should ensure that either typing machines are accessible or that secretarial services are available. Duplication of material might be a wish of the participants as well.

3. Presentation

The purpose of the presentation is to five an overview of individual results. It is meant to be a **tool** and not a test. It helps to identify possible information gaps and to trigger discussions about the subjects and approaches presented.

The presentation is attended by all the participants and the facilitator and eventually some resource persons.

Some suggestions for presentations; the presentation should include:
- introduction
- constraints/problem identification/analysis
- activities planned
- conclusion.

Participants might want to prepare some overhead materials.

To make efficient use of time, presentations will be short and emphasize main subjects which require attention. Total time reserved for each participant is 20 minutes:

presentation : 10 min
discussion : 10 min.

Supporting material

FORMAT OF ACTION PLAN

Name :
Date :
Job description :
Title of project :

---

1. Background information of project
2. Target group
3. Objectives
4. Expected results
5. Start and completion dates
6. Operational working relationships
7. Work plan for the coming six months

ANNEXES

Problem/objective tree
References
Resources needed

8.4 CONCLUSION

Description of session

OBJECTIVES

- To get to know how participants value the course
- To give a certificate of attendance and close the course

OUTLINE OF SESSION

• The participants are asked to fill an evaluation form	20 min
• The participants are asked to write two positive short comments and two negative short comments about the course on cards of different colors	10 min
• The facilitator shares all the comments in a plenary session and summarizes them	30 min
• The facilitator with the help of an external resource person hands certificate of attendance and closes the course	1 h
	2 h

HAND - OUTS

Evaluation forms

MANAGEMENT OF OPERATION AND MAINTENANCE IN RURAL DRINKING WATER SUPPLY AND SANITATION

EVALUATION FORM

Please tickmark where applicable

1. **What do you think of the length of the course?**

   - ☐ *Far too long*
   - ☐ *Too long*
   - ☐ *Just right*
   - ☐ *Too short*
   - ☐ *Far too short*

2. **In this training course you worked from Monday till Friday, from 09.00 am until 17.00 hrs. What is your opinion about this time schedule?**

3. **How do you think the time was distributed among the different ways of working in this course:**

	Far too much	*Too much*	*Just right*	*Too little*	*Far too little*
Lectures					
Exercises					
Discussions					
Individual work					
Leisure, recreation					

Any further comments can be given below.

4. **How do you consider the integration of the course within the country's setting?**

- ☐ *Excellent*
- ☐ *Good*
- ☐ *Reasonable*
- ☐ *Poor*
- ☐ *No integration at all*

Comments:

5. What do you think of the balance between theory and practice:

- ☐ *Far too much theory*
- ☐ *Too much theory*
- ☐ *Just right*
- ☐ *Too much practice*
- ☐ *Far too much practice*

6. In general I think this course was:

- ☐ *Too difficult*
- ☐ *Difficult*
- ☐ *Just right*
- ☐ *Easy*
- ☐ *Too easy*

7. Please try to remember what you expected of this course when you applied to join it. How were your expectations met?

- ☐ *Completely*
- ☐ *Largely*
- ☐ *Partly*
- ☐ *To some degree*
- ☐ *Not at all*

8. To what degree, in your opinion, did this course achieve its objectives *?

*Objective**	*Completely*	*Largely*	*Partly*	*Hardly*	*Not at all*
1. Refresh knowledge					
2. Upgrade managerial skills					
3. Train identifying key factors					
4. Information and documentation					

* Objective of the course:

1. To *refresh* the participants' *knowledge* on operation and maintenance aspects of integrated water supply and sanitation programmes.
2. To *upgrade management skills* with regard to operation and maintenance of water supply and sanitation projects.
3. To *train* the participants to better *identify key factors and indicators* for operation and maintenance in their own projects.
4. To *identify information sources* and *select documentation* relevant for the work of each individual participant.

9. Consider the specific requirements of your own job. How useful do you think the course has been:

- ☐ *Very useful*
- ☐ *Useful*
- ☐ *Of some use*
- ☐ *Of limited use*
- ☐ *Not useful*

10. Below list gives the topics dealth with during the course. Please give a mark per topic with regard to the usefulness for doing the job (from 1 to 10).

Topic	*Mark*
Introduction to course	. . .
Presentations	. . .
Concepts and trends	. . .
Links between health, water and sanitation	. . .
Analysis and constraints	. . .
Identification of strategies	. . .
A systematic approach, the VIP latrine example	. . .
Water supplies	. . .
Water distribution and treatment	. . .
Actors and roles	. . .
Management models	. . .
Cost estimation	. . .
Community management	. . .
Involvement of women	. . .
Local financing	. . .
Human resources development	. . .
Information and communication	. . .
Monitoring	. . .
Planning	. . .
Individual assignments	. . .

12. You probably have gone through most of the handouts and reading material provided. On average how relevant do you consider it to be?

- ☐ *Highly relevant*
- ☐ *Quite relevant*
- ☐ *Of some relevance*
- ☐ *Of limited relevance*
- ☐ *Not relevant*

13. How did you appreciate the professional support from the staff while preparing your final results?

- ☐ *Excellent*
- ☐ *Good*
- ☐ *Reasonable*
- ☐ *Moderate*
- ☐ *Poor*

14. Please name any technique or method that you learned, which you may consider to introduce or apply within your organization:

15. Please indicate any key subject or issue presented, which will improve your professional performance or your project:

16. Suppose we visited your organization in 3 months time. Would you be able to show us changes in the way you work as result of this training?

17. What in your experience are the major professional problems in your work which HAVE NOT been discussed sufficiently in this training course?

18. How do you rate the library support and the support in selecting information:

- ☐ *Excellent*
- ☐ *Good*
- ☐ *Reasonable*
- ☐ *Moderate*
- ☐ *Poor*
- ☐ *Not applicable*

19. During the course, yoc might have made an excursion.
Do you have any remarks or suggestions concerning this excursion?

20. What was your experience of working relations with:

	Difficult	*Distant*	*Neutral*	*Cooperative*	*Stimulating*
Coordinators					
Facilitator					
Other training staff					
Other participants					

21. How do you rate the internal organization and logistical support during the course?

- ☐ *Excellent*
- ☐ *Good*
- ☐ *Reasonable*
- ☐ *Poor*
- ☐ *Not applicable*

22. Were you satisfied with the accommodation:

- ☐ *Very much*
- ☐ *Much*
- ☐ *Reasonable*
- ☐ *Not much*
- ☐ *Not at all*

23. Do you have any suggestion for improving this course or the way it is organized or general remarks which have not been made before?

ANNEX I

SUGGESTIONS FOR A FIELD VISIT

This course has not been originally designed to included a field visit, mainly due to the time factor, however if the facilitator wishes to include such an exercise, the following pages give an outline on how to organize a short field visit.
The ideal time for it would be during the weekend separating the two weeks, right after the modules on community management and involvement of women.

FIELD VISIT

OBJECTIVE

To give participants the opportunity to investigate the O & M aspects of a water supply scheme. The experience can be used in course sessions to provide practical examples for the discussion of methods considered in the course.

OUTLINE OF FIELD VISIT

1. Field visit programme
2. Preparation of participants
3. Preparation of the receiving community

HAND-OUTS

Interview and observation sheets

1. FIELD VISIT PROGRAMME

The purpose of the visit is to give the participants an opportunity to look at the operation and maintenance arrangements in a particular community. The field visit programme will depend on the proximity, size and willingness of local communities to be involved in the course in this way. The course group will have to divide into smaller groups in order to work efficiently and to reduce the disturbance of the community to a minimum.

If a community is large enough to accept the complete group then only one community need be contacted and prepared for the visit. However, if the course group is large and communities small then it may be necessary to allocate course sub-groups to different communities. This may entail more time in preparation but it will be better for the purposes of the field visit. It will also allow participants to compare their findings from different communities within the same locality. This, in itself, may indicate different aspects of O & M and therefore be of value to the course.

It is suggested that visits by the sub-groups can be made in the morning. This will be followed by a general meeting in the afternoon where all the sub-groups meet with district staff of the government agency responsible for water. This will give an opportunity for participants to meet separately with users, local operators and caretakers, community leaders and government staff. Within each community visited, participants should divide into smaller groups in such a way that each of the above actors can be observed and interviewed on their own, if possible, to avoid them influencing each others responses.

The timing of the morning visit may be crucial to the usefulness of the field visit as a whole. Many of the activities associated with rural water supply take place very early in the morning. Women may traditionally collect water before, or at, sunrise. Operators will open valves, start pumps, dose tanks with chlorine, etc. at the start of the day to have sufficient water for early collection. The next peak of water collection may be in the late afternoon/early evening which will be too late for the field visit. Arrangements may have to be made to ensure an early arrival in the community, or communities, selected to visit and participants should appreciate the importance of an early start!

Participants will not be asked to give a formal report back on the visit. It is intended they should use the experience and the information gained in discussions and groupwork which will follow in the remaining modules of the course. It will also help to focus some of the issues already considered in the previous modules.

2. PREPARATION OF PARTICIPANTS

1. Introduction

Participants should see the field visit as a way of focusing on practical O & M issues but not to become involved in a detailed criticism of the specific scheme visited.

It is important to have an approach to the field visit which will allow participants to concentrate on the O & M issues. There are techniques of information collection which are appropriate to a short group visit and these should be outlined by the facilitator as discussed later.

A large group of people arriving in a rural community can be disruptive to the normal pattern of life in a village. Participants should be aware of the need to minimise this impact as far as possible. This can be done by preparing the community for the visit (discussed later) and dividing the course participants into small groups working separately. Participants may decide that each sub-group will concentrate on specific issues on which to gather information and this can be arranged beforehand in this preparation session.

2. Information Collection

During the field visit each group will collect information concerning community water supply O & M activities. What techniques of information collection can be used in a short field visit? Detailed questionnaires are inappropriate due to the time required for preparing, completing and analysing questionnaires. For this field visit, therefore, the techniques of observation and interviews are considered.

2.1 Observation

Observation can be used for the collection of information on physical conditions and behaviour patterns. The technique is illustrated by the following series of sample observation questions. The questions correspond to the sample cases considered in module 4.

• ***Physical conditions***

What is the physical condition of the water supply - is the supply designed for efficient operation and is it maintained?

Efficient operation:

- is the pulley on the hand dug well positioned correctly; is a full bucket of water too heavy for children to raise?

- is the handpump handle at the correct height for users, both adults and children?

- can the operator of the electric submersible pump read the ammeter when the pump is started?

- can containers be placed close enough under standpost taps to avoid undue splashing and water loss?

- do the arrangements for mixing hypochlorite solution allow for easy and safe handling of the hypochlorite granules?

- can the flow indicator of a slow sand filter be easily read by the operator?

- can a pit latrine be safely used by a small child?

Adequately maintained:

- is the well drainage clear and free flowing?

- is the oil level in the diesel engine correct?

- are there any dripping or broken taps?

- are the pipes in the chlorine dosing equipment kept clean?

- is there too much algae floating in the slow sand filter?

- are there any cracks between the latrine floor and lining?

• ***Behaviour patterns***

Careful observation can provide valuable information about behaviour patterns. Do people use the facilities and how do they use and operate them? There may be limited time to observe maintenance activities but operators can be asked to demonstrate procedures which can then be observed.

Operational use of facilities:

- a general observation for all schemes will be: do people use the facility? If not, is it an operational problem?

- is the well bucket placed on the ground or kept in the well?

- is the handpump handle operated in the correct manner, too fast, jerky, short strokes, etc.?

- is the outlet valve closed before stopping the electric submersible pump?

- are taps left open for any length of time?

- is the test for residual chlorine done correctly?

- is the slow sand filtration rate set correctly?

- is there any evidence of pit latrines being used for the disposal of solid waste?

Maintenance procedures:
- is the procedure for well pulley repair satisfactory?

- does the handpump caretaker know how to use the maintenance tools correctly?

- does the operator wash the oil bath air cleaner when changing the oil?

- is the correct procedure followed to repair a leaking tap?

- are the correct safety precautions taken when mixing hypochlorite solution?

- how does the slow sand filter operator adjust the filtration rate?

• **Factors influencing observation**
Observation is not as straightforward as it might seem if we are to use what we see to analyse a situation. For example, if several people are asked to describe a picture they will mention and emphasise different aspects of the picture. This reaction is because we select different aspects of the picture due to our individual preferences. In addition, we interpret what we see in a variety of ways. This leads to different conclusions.

It may be that the more familiar we are with a situation the better will be our observations. However, familiarity might lead to carelessness as we might assume we know what is happening - check to see if it really is happening. Unfamiliarity with a situation may mean we do not know what to look for and important things can be missed. Alternatively, we may be more curious over a new situation which may lead to more careful observation.

It is not possible to remember everything, especially when making many observations in a short period of time. Therefore, a notebook is recommended for recording observations during the field visit. Recording observations almost immediately means there is less pressure to make an interpretation before all the facts are known. Observations should be recorded, interpretation will come later.

There may be no time available to prepare observation sheets for the field visit. However, simple sheets can be an aid to systematic recording of observations. An observation sheet for latrines is included in the background information as an example.

Finally, it must be stressed that the situation observed is influenced by the observer. Participants must be aware that their presence alone will influence the behaviour of people in the community. The fact that the field visit has been organised in advance may mean that the community have made a special effort to, for example, clean the well surround. Visitors will attract attention. People may react in a way which they feel will satisfy the visitor rather than react in their natural manner. Participants should remember this when making their observations and drawing conclusions.

OBSERVATION SHEET - LATRINES

Community:

Date:

1. Type of latrine:	simple pit	....	
	VIP	....	
2. Floor material		....	
3. Floor condition	good	....	
	cracked	....	
	holes	....	
4. Floor cleanliness	clean	....	
	soiled with faeces	....	
	soiled with urine	....	
		material	***condition good or bad***
5. Wall		....	....
6. Roof		....	....
7. Ventilation pipe		....	....
8. Pipe screen		....	....
9. Door		....	....
10. Squatting hole cover		....	....
11. Flies present			yes/no
12. Gaps between cover slab and lining			yes/no
13. Subsidence around latrine			yes/no
14. Level of faeces in the latrine pit			full/not full

2.2 Interviews

There are several types of interviews which can be used in information collection.

• ***Free interviews***

In a free interview the topic is introduced but then the discussion and subjects covered are left to the respondent to decide. In this way the interviewer gets a good idea of what the respondent thinks is important, not what the interviewer has decided is important. However, the interviewer has to be a good listener and questioner. Questions have to motivate the respondent and need to be followed up with carefully worded responses and further questions which do not reflect any bias the interviewer may have. This type of interview is for experienced field workers with interviewing experience.

• ***Focused interviews***

For a focused interview a checklist is prepared and the respondent is asked to provide information about the items on the list. A checklist will help to ensure that all items are covered, and that the interviewer is not diverted away from the essential information required.

In the course of a focused interview it may happen that the respondent may give information or want to discuss an issue not on the list. It is important to give respondents the opportunity to contribute their own thoughts and this can be done at the end of the interview after going through the checklist first.

In the short time available it will not be possible to collect a great deal of quantitative data. Questions requiring numbers for answers might be included in a focused interview. However, participants must be realistic about the information they will be able to gather. They should not expect, for example, community members and supply caretakers to be able to readily give such information. Records may contain sensitive information. Only if people seem willing to show them should participants ask to see any log books and record sheets.

Participants should choose people to interview carefully. Ask caretakers about the difficulties they encounter in their maintenance activities, and ask the users how often the system is broken down. The same questions can be asked of different people. If the caretaker and then a user are asked the question: "how often is the system broken down?" the answers may be different. The caretaker may want to give the impression of a job well done. A user will want to indicate the difficulties in the hope of improving the supply.

• ***Aids to effective interviewing***
The following suggestions are to aid the collection of information through interviewing.

Prepare a checklist
As in the focused interview, prepare a checklist of the information required. The list need not be in great detail but used as a prompt and guide. Use key words as a reminder of the main issues and particularly important bits of information required.

Introduce yourself
Participants may feel under pressure to gather as much information as they can in a short period of time. But they should not rush in with a long list of questions. Participants should at first introduce themselves and explain what the field visit is about. It is important to explain how the information will be used. If people feel, for example, their answers may result in higher water bills then responses may be affected as a result.

General to the specific
It is recommended to start with general questions and move to more specific questions later. General questions help to set the scene and put into context the more specific questions. This helps to avoid misunderstandings about what it is the questions are about.

3. Follow-up

In a plenary session, participants with the facilitator discuss on what lessons can we learn on O&M constraints, and on what can be done to impose the situation.