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**Management for Sustainability
in Water Supply and Sanitation Programmes**

**September 7 - 27, 1996
Kandy, Sri Lanka.**

SUSTAINABILITY ISSUES

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Block 2 : Sustainability issues

- ✓ - TECHNOLOGY OPTIONS AND SELECTION CRITERIA FOR WATER SUPPLY AND SANITATION
- ✓ - OPERATION AND MAINTENANCE SYSTEMS
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- SANITATION TECHNOLOGY OPTIONS
- WORKING IN A GENDER SENSITIVE WAY
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Block 2 : Sustainability Issues

Saturday, September 14, Session A and B

- Subject title** : Technology options and selection criteria for water supply and sanitation
- Type of session** : Lecture and discussion
- Objectives** : - Participants gain an overview of considerations and steps needed to come to proper technology selection and service levels.

The selection of technology and service level of water supply is very often done by others than the eventual users of the systems. This approach may cause serious problems in acceptance and O&M. Different technology selection approaches are presented and discussed.

Institutional technical, environmental and community criteria should be taken into consideration when selecting technologies and service levels. Planning steps to be taken are to be determined and the possible community input defined. Technology and service level options need to be clear, in order to give the community the information it needs to choose properly.

- Hand-out** : - Summary of lecture and lists of criteria, planning steps and technology and service level options.

September 7 - 27, 1996, Kandy, Sri Lanka

MANAGEMENT FOR SUSTAINABILITY IN WATER SUPPLY AND SANITATION PROGRAMMES

TECHNOLOGY OPTIONS AND SELECTION CRITERIA FOR WATER SUPPLY & SANITATION

The selection of technology and service level of water supply and sanitation is often done by others than the eventual users of the systems. This approach may cause serious problems in acceptance and O & M .

A system implemented thus, is susceptible to quicker disuse, deterioration and abandonment, a situation quite unaffordable to a developing country with poor economic standing.

Furthermore, it tends to create a breakdown in the social structure of the communities concerned, whilst not facilitating any change of behaviour in terms of improved health and sanitation, nor, providing any benefits to those communities to whom it is intended for.

A wide range of technology options are available globally for adaptation in water and sanitation at community level. Selection of the most appropriate for a particular situation needs to be done with utmost care giving due consideration to the prevailing conditions and the specific situation. Most of the mistakes made in the past in technology selection are results of non-community based approaches. Community-centred or user-centred approach may be what is required to overcome these problems.

Institutional, technical, environmental and community criteria should be taken into consideration when selecting technologies and service levels. Planning steps to be taken are to be determined and the possible community inputs defined. Technology and service level options need to be clear in order to give the community a chance to choose.

1.0 INTRODUCTION

Technology transfer from industrialized countries to developing countries without considering the prevailing conditions had resulted in many community WATSAN project failures. In numerous other instances direct copying of successful project experiences from one developing country to another, or even within a country from one region to another had been the general practice. This did not automatically lead to a new success. Conditions vary greatly from one country to another, one region to another, one district to another and even from one community to another. It is therefore imperative that technology selection should be Project/Locality specific.

Some common mistakes made in technology selection:

- * Insufficient or no consideration of existing situation, conditions and capacities.
- * Not building on experiences with present rural WATSAN Projects
- * Adaptation of new technology that are not sustainable under prevailing conditions.
- * Needs and preferences of future users not seriously considered.
- * Economic and financial capacities of the community unknown.
- * Realistic O&M costs for short and long-term unknown.
- * Too optimistic assumption that O&M costs will be covered by State.

It is evident from the above that most of the mistakes mentioned are results of non-involvement of the community in project planning and implementation. To overcome these problems a community-centred or users-centred approach is required.

2.0 FACTORS INFLUENCING TECHNOLOGY CHOICE AND SUSTAINABILITY

2.1 DONOR-SUPPORT APPROACHES

Parallel Organizations.

Too often in most of the donor assisted WATSAN Project, the donor insists on the creation of a parallel organizational structure in the water authority for implementation of its supported Projects. They aim at short term success and most cost-efficient approaches and solutions. Their main concern becomes output figures, coverage and speedy implementation.

Here, the technology choice is made in this parallel organizations, based on past experiences or experiences of the experts involved. This approach overlooks the cost effectiveness of the investment, replicability of the approach and institutional capacity development of the water authority or the community.

Institutional Development

A better approach may be that the Donor supports (through financing) and further structures (through advice) the existing water and the other relevant departments and the private sector, the development of feasible approaches and its activities.

This approach will eventually result in a more sustainable project approach and sustainable WATSAN systems.

2.2 DECENTRALIZATION

Most countries have introduced a policy of decentralization of implementation capacities on WATSAN activities, particularly the management of systems including O&M. However, the main planning remains at national and regional/provincial level. The district and local authorities are often only involved in the handing over stage.

Common problems in such situations are that the local authorities:

- * are not willing to take over.
- * are not financially/technically/organizationally capable to take over.
- * are not adequately equipped.
- * are not agreeable with the selected technology.

2.3 RESOURCE-DRIVEN VERSUS DEMAND-DRIVEN PROJECT APPROACHES

Resource-Driven Projects

These are projects for which The National Water Authority possibly with external support from a Donor has allocated a certain amount of money for certain geographical area and time period.

Pre-selection of the intervention area may be done according to any of the criteria given below.

- * National policy and political decisions.
- * Spread over a large area covering a bit in every village.
- * A few villages given full coverage.
- * Concentrate on easily accessible villages with reliable and readily available water sources.
- * Concentrate on remote villages having serious problems in water availability.
- * Political promises by visiting politicians.

Community organizations are arranged and contributions from the community is expected financially/physically according to project criteria.

Here too, selection of technology is based on successful experiences of the Donor in other countries or based on provincial experiences, where other conditions may prevail.

These approaches and criteria have implications on the sustainability of projects particularly in terms of community acceptance, functioning and use.

Demand-driven Projects

In the case of a demand-driven project the community identifies related problems and the needs for WATSAN improvements and on their initiative approach the agency/water authority requesting for support. This request may be preceded by awareness raising by extension workers.

The advantage is that motivation of the community to participate in planning, implementation and O&M phases is probably high and community based management is easier as there is a high sense of ownership. Community will demand for full involvement in the planning process.

After the initial phases the community can express its views on technology preferences and service levels. On the basis of socio-economic and technical information collected, the agency/water authority analyzes the feasible options. The agency then discusses the possible technical options and service levels and their technical/financial implications. It should be clear to the community what they can realistically expect from the agency in the O&M phase. Roles and responsibilities of each party must be spelt out clearly. Community will then decide on the technology and service levels considering their capacities and preferences. Community contributions in the implementation phase in financial, material and labour should be clearly decided.

Roles of the agency/water authority (partner organization/NGO) could include:

- * to develop and support community organization and community management in the start-up phase (project development phase)
- * to train community members.

- * to develop standard designs and bills of quantities for technology options.
- * to implement the physical construction part in collaboration with the community.
- * to supervise and commission the water supply systems.
- * to provide technical and organizational backstopping to the community in O&M through monitoring of functioning and use, refresher training etc..
- * to raise awareness on hygiene and water source contamination and initiate community-based water source protections and practical hygiene education for behavioural change.

3.0 PARTICIPATORY COMMUNITY-CENTRED TECHNOLOGY SELECTION PROCESS

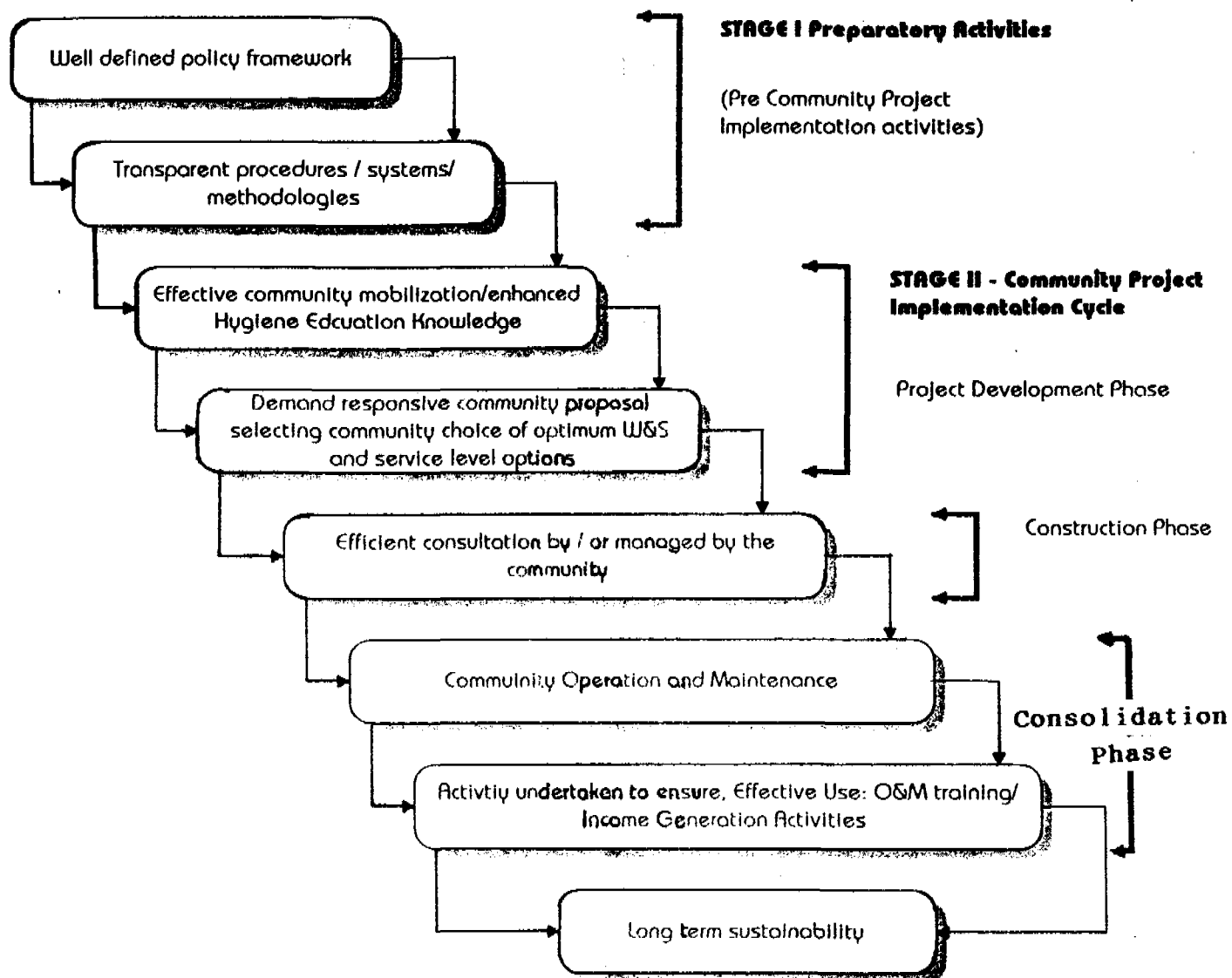
- Step 1 - Community mobilization, awareness raising
- Step 2 - Community identifies problems and needs for WATSAN improvements.
- Step 3 - Community requests the agency support for WATSAN developments.
- Step 4 - Community participatory survey.
- Step 5 - Need and problem analysis with communities (village self assessment)
- Step 6 - Analysis of data by agency leading to most potential technologies and service levels.
- Step 7 - Presentation and discussion of selected most potential technologies with the community.
- Step 8 - Community decides on the technology option of their preference considering implications.
- Step 9 - Agency completes designs and cost estimate for the selected technology options.

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IMPLEMENTATION

CASCADING FLOW OF PROJECT IMPLEMENTATION

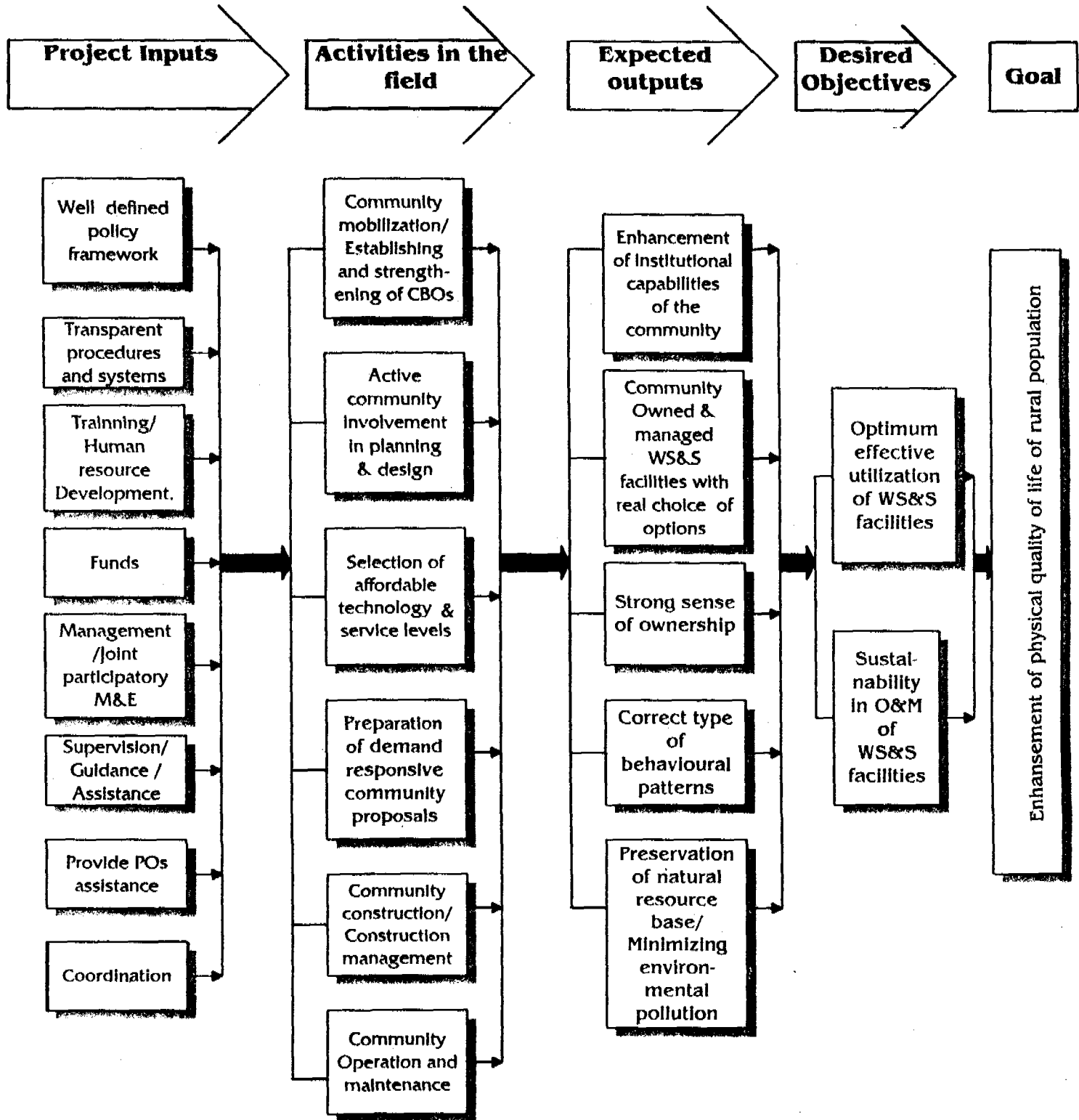
PHASES IN A WATSAN PROJECT CYCLE



Adapted from CWSSP

CONCEPTUAL FRAMEWORK OF A COMMUNITY

WATSAN PROJECT



Adapted from CWSSP

4. CRITERIA AND CONDITIONS FOR TECHNOLOGY SELECTION

The areas of criteria/conditions for technology selection include:

- community criteria
- institutional criteria
- technical criteria
- environmental criteria

The conditions and capacities at community level should best be assessed using a **participatory community survey**. Also the higher support levels have to be checked for existing or potential support capacities.

Each of these areas comprise an extensive range of items to be assessed in the project planning phase:

- community criteria/conditions:

- * water consumption figure (l/cd and other uses)
- * population growth, trends in migration
- * settlement pattern
- * tenure pattern (ownership)
- * preferred service levels
- * ability and willingness to recover O&M costs
- * level and preparedness in community participation (as experienced)
- * organizational capacity (leadership/ committees)
- * managerial capacity
- * cultural aspects (sites as mosques, markets; special uses etc.)

- institutional criteria/conditions:

- * at several levels: neighbourhood, community, ward, district
- * available and required technical capacities at these levels
- * support for supervision, quality control, maintenance, repairs, spare parts
- * organizational and managerial capacity
- * training capacity for community cadres and private sector (organization, managerial, technical)
- * need for departmental co-operation
- * co-operation between departments
- * private capacities for water supply systems installation and construction
- * private capacities for repairs
- * private sector capacities in manufacturing, distribution of spares

- technical criteria/conditions:

- * required service level
- * present water sources
- * reliability of water sources and capacity (season-relation/long term)
- * topography
- * infrastructure level (roads, electricity etc)
- * technical capacity community
- * availability of suitable local construction materials

5. WATER SUPPLY TECHNICAL OPTIONS

GROUNDWATER

- * spring
 - point source
 - distribution; gravity or pumped / storage tank
- * dug well
 - point source; handpump or other water lifting devices
 - distribution; pumped / storage tank
- * borehole
 - drilled/jetted
 - point source or distribution
- * galleries
 - point source or distribution

SURFACE WATER

- * rivers
 - point source or distribution
 - dams with reservoirs
 - water (hydro)- ram
- * lakes
 - point source or distribution

RAINWATER

- * surface runoff collection
- * roof collection from
 - house
 - public buildings

DISTRIBUTION SYSTEMS

- * supply by
 - gravity
 - pumped
- * energy source:
 - electricity - diesel - solar-energy - wind-power - hydro power
- * service levels:
 - standposts (small group, neighbourhood), yard connections, house connections (single tap; multiple tap)
- * size schemes:
 - single community
 - trunkline with community connections

WATER TREATMENT OPTIONS

- * central treatment system
 - conventional chemical treatment (coagulation/flocculation/sedimentation/ rapid sand filtration/ disinfection
 - pre-treatment and slow sand filtration
 - disinfection with on-site generated chlorine
- * household treatment systems
 - household filter (cloth or sand)
 - prolonged storage
 - UV-radiation
 - boiling
 - disinfection (chlorine tablets)

TECHNOLOGY SELECTION MATRIX PER LOCATION

- * cost level of investment,
- * cost level of operation and maintenance
- * local availability of skills
- * level of operational attention (level of complexity of system)
- * level of maintenance attention
- * need for and reliability supply of chemicals
- * need for and reliability supply of energy/fuel

- environmental criteria/conditions:

- * water-shed sustainability
- * water quality
- * potential risks for pollution of water source
- * potential solutions for protection of water source
- * pollution risk of waste water on environment
- * major prevailing water/sanitation related diseases

MATRIX ON WATER SUPPLY TECHNOLOGY SELECTION ISSUES

TECHNOLOGY	GENERAL ISSUES			CONSTRUCTION ISSUES				O&M ISSUES			
	WATER QUALITY	WATER QUANTITY	UPGRADING SERVICE LEVEL POSSIBLE	TECHNOLOGY LOCALLY KNOWN	SKILLS LOCALLY AVAILABLE	MATERIALS LOCALLY AVAILABLE	COST LEVEL ACCEPTABLE	COST LOCALLY AFFORDABLE	REQUIRED STAFF AVAILABLE	SUPPORT AGENCY NEEDED	IMPORTED PRODUCTS NEEDED
1. GROUNDWATER											
1.1 SPRING/GRAVITY											
1.2 SPRING/PUMPED											
1.3 DUG WELL											
1.4 DUG WELL/HANDPUMP											
1.5 BOREHOLE/HANDPUMP											
1.6 GROUNDWATER/MOTORPUMPED											
2. SURFACE WATER											
2.1 GRAVITY/NO TREATMENT											
2.2 PUMPED/NO TREATMENT											
2.3 GRAVITY/TREATMENT											
2.4 PUMPED/TREATMENT											
3. RAINWATER											
3.1 SURFACE RUNOFF											
3.2 ROOFWATER											

○○○ = HIGH, ○○ = MEDIUM, ○ = LOW

6. SANITATION TECHNOLOGY OPTIONS

Sanitation is narrowed down here to human excreta disposal technology.

The most common options are:

ON-SITE SANITATION HOUSEHOLD FACILITIES

- simple pit latrine
- ventilated improved pit latrine
- single pit off-set latrine
- twin-pit (alternating) latrine
- compost latrine
- single (leach) pit pour-flush latrine
- twin (leach) pit pour-flush latrine
- aqua-privy
- pour/cistern-flush toilet with septic tank and soakaway
- pour/cistern-flush toilet with septic tank, anaerobic upflow filter and soakaway/drainage

OFF-SITE SANITATION HOUSEHOLD FACILITIES

- pour/cistern flush toilet with septic tank and small bore sewerage
- pour/cistern flush toilet with shallow sewerage
- pour/cistern flush toilet with full sewerage

OFF-SITE SEWAGE TREATMENT

- area/group septic tank and effluent treatment
- oxidation ponds
- waste stabilization ponds
- aerated lagoons
- anaerobic upflow filters
- reed/wetland application
- upflow anaerobic sludge blanket treatment
- biological filtration
- activated sludge
- oxidation ditches

COMMUNITY LATRINES

PUBLIC LATRINES

SCHOOL LATRINES

7. SANITATION TECHNOLOGY SELECTION MATRICES

Factors to consider in sanitation technology selection are technical, social and economic in nature.

See also criteria for water supply technology selection.

Typical criteria are:

- water availability
- soil condition
- cleansing materials used

Social factors include:

- exotic factors arising from beliefs and taboos
- privacy particularly for women
- easy access during the night

Economic costs:

comparison of mean annual economic costs per household relative to conventional sewerage (according to World Bank studies):

- | | |
|-------------------------------|------|
| • improved pit latrines | 10% |
| • pour-flush toilets | 10% |
| • sewerred pour-flush toilets | 40% |
| • vault toilets | 50% |
| • conventional septic tanks | 90% |
| • conventional sewerage | 100% |

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Technical Brief No.49: Choosing an appropriate technology

The initial selection of an appropriate technology from a range of possibilities is the key to the successful operation of any facility — technologies are unlikely to function adequately if inappropriate choices are made at the outset. Although this is understood by many, people often underestimate how difficult the choice can be.

This technical brief is intended as a guide to selecting the most appropriate options, taking as its example the selection of water-treatment facilities. It should *not* be seen as a guide for the design of individual treatment processes.

The process contained in this brief can be applied to the selection of single treatment facilities, or as a guide to the development of a *strategy* for a whole area. The process can be used both by people with direct responsibility for making the decisions, and also by other parties to ensure that the right issues are addressed by the decision-makers.

The method described below can be applied to any decision-making process — for example, to identify the technologies for a development project, such as a water supply, sanitation, or refuse-collection scheme.

Case study: water treatment (see, for example, Schulz and Okun, 1984)

There are many different types of water-treatment process to choose from. Table 1 describes some of the more common. Many of the treatment processes used in the South, however, do not work properly.

Table 1. Common water treatment processes

<i>Water-treatment process</i>	<i>Description</i>	<i>Comments</i>
Plain sedimentation	Allows settlement of heavier particles, which may include much of the solid pollution, and animal (including some very small pathogenic (disease-causing) material).	Very simple and requires no power or chemicals. At its most basic, can be simple storage.
Roughing filter	Filtration through a coarse bed of gravel or coarse sand.	Good for removal of major solid particles and for highly turbid waters.
Slow sand filter	Filtration through a sand bed. Slow flows through the bed ensuring the build-up of a biological layer on the surface of the sand which is an essential part of process.	Removes solid materials and pathogens effectively. Simple to operate. Requires no backwashing of sand to clean — usually only drainage of water and scraping off top biological layer when filtration rate is too slow.
Rapid sand filter	Faster filtration rates through a sand bed — does not have biological-growth layer.	Removal of pathogens not as good as slow sand filter. Requires cleaning by backwashing — passing of water up through filter to remove solid particles that are blocking the flow. Sometimes cleaning by air scouring is also necessary.
Aeration	Water aerated, usually by artificial means — a mechanical device in the tank agitates water — or by spraying.	Good for removal of certain pollutants such as iron and manganese. Requires power.
Coagulation	Addition of chemicals such as alum or lime to bring out pollutants in water — pollutants stick to chemicals and fall to bottom of the tank when allowed to settle.	Requires chemical and power input and control.
Disinfection	Addition of chemicals such as chlorine to kill off disease-causing organisms.	Requires chemical input and control.

Technical Brief No.49: Choosing an appropriate technology

Water-treatment process selection

The problem is that many of the treatment processes are *inappropriate* for their use and/or their location. For example, many were developed in the cooler climates of the North, making direct transfer to tropical climates unsuitable. The spare parts, maintenance, and power consumption required by many treatment processes makes them unrealistic options for many parts of the world.

All locations are unique; what is required is not a common *solution* to a problem, but a methodology for the *analysis* of problems.

Figure 1 shows three stages for the selection procedure.

Stage 1: Objectives

The *purpose* of the treatment process must be established. What are you trying to achieve, and why? Is it achievable, is it a realistic goal, is it the main problem? There may be a need to *prioritize* the problems. This stage is often underestimated or taken for granted. For example, in the case of water treatment, the priority in developing countries often should be a low-cost, low-maintenance system.

Stage 2: Analysis

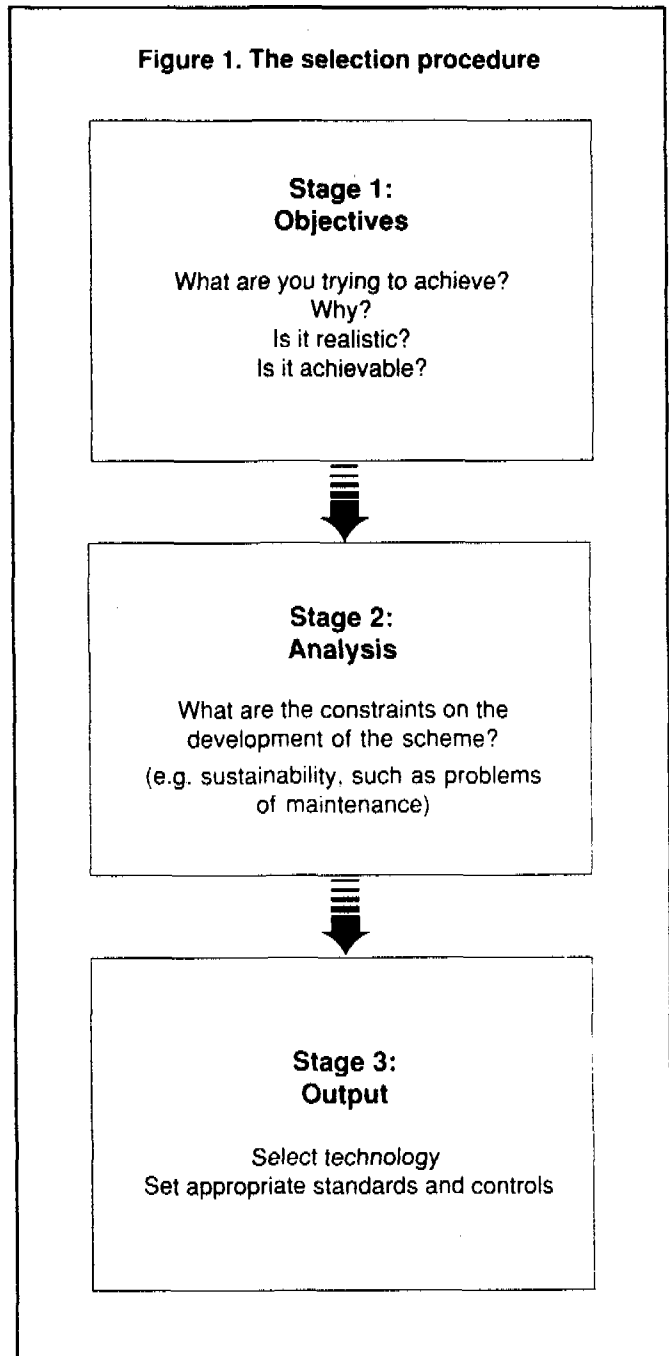
The *constraints* on the proposed development have to be identified and this can only be done by looking at the particularities of the individual case. Often, physical constraints such as water resources and land availability will be taken into account, but other fundamental factors which contribute to the success or failure of a scheme are not adequately addressed.

For analysis purposes we can group the issues to be addressed into the 'SHTEFIE' criteria, developed at WEDC by Richard Franceys, Margaret Ince and others as a tool to help with analysis of development programmes.

- S — SOCIAL
- H — HEALTH
- T — TECHNOLOGICAL
- E — ECONOMIC
- F — FINANCIAL
- I — INSTITUTIONAL
- E — ENVIRONMENTAL

From these groupings, a checklist of factors to consider may be drawn up. Table 2 shows an example of the sorts of issues that could be used for selecting water-treatment options (you should be able to draw up one of your own for your own situation). Think of it as a thought-provoker to ensure that all the relevant factors are taken into account; the SHTEFIE criteria can be useful in this context.

Figure 1. The selection procedure



Stage 3: Output

After all the relevant issues have been addressed, the *output* can be evaluated. In the case of water-treatment and most other processes, it is important to realize that there will be *two* main outputs. The first is the technological options themselves. But these are dependent on the methods used to implement and regulate them — usually the water-quality standards set. Often, unrealistic and unattainable standards are laid down with the severely detrimental effect of encouraging people to invest in technologies which are inappropriate for their community. *Options* and *targets/standards* must be considered together, therefore; only then will *appropriate technologies* be selected.

Table 2. The 'SHTEFIE' criteria

S — SOCIAL factors

- Housing facilities: type, distribution
- Public desires and preferences: aesthetic considerations, pressure groups
- Welfare and equity considerations
- Willingness to pay: ability to pay
- Water tariffs, methods and ability to pay
- Population distribution (age, location; growth rates)
- Migration, urbanization
- Cultural and religious aspects, including attitude towards water recycling and sanitation practices
All of above may affect consumption
- Education levels; structure of workforce; training
- Influence ability to operate and maintain

H — HEALTH factors

- Health statistics, morbidity and mortality rates
- Significant faecal-oral (and other) diseases
- Health services available

T — TECHNOLOGICAL factors

- Water demand and use
- Availability of spare parts and materials
- Availability of local knowledge and expertise
- Present water supply and sanitation facilities; proposed future investments
- Design life of treatment facilities
- Raw water characteristics: source, quantity, quality, availability, and reliability
- Water-quality standards
- Power requirements

E — ECONOMIC factors

- Structure of economy, output by group, industrial and agricultural component
- Major employment sectors
- Foreign-exchange earnings (exports)
All affect priorities for water supply
- Size of economy, future prospects, balance of payments, trade relations, isolation of economy and vulnerability, distribution of incomes
All affect ability to pay

F — FINANCIAL FACTORS

- Finance available: method of funding
- Ability and willingness to pay

I — INSTITUTIONAL factors

- Existing roles and responsibilities for organization and management
- Relationships between organizations
- Legislation, policing and regulations

E — ENVIRONMENTAL factors

- Climate, rainfall, hydrology
- Soil conditions, geology, groundwater characteristics
- Water-resource availability
- Impact of any plant: noise, smell, insects, visual impact, health considerations
- Sustainability

Example

A village currently obtains its water from a large stream, source 1, about 50 metres away. Although the stream water is highly turbid, and the incidence of diarrhoeal disease is high, villagers are used to obtaining their water from this supply because it is close by.



The local health worker has recommended that a 'cleaner' water supply should be sought, as she believes that this would improve the health of the villagers significantly. There is a second water source on the other side of the village, about 500m away (source 2). This source is not used very often because of the distance, but it appears to be much less turbid than the first source.

What would you recommend as a suitable course of action?

Note that the example given here is simplified. In normal situations more factors will usually have to be considered. It is used only to illustrate how the selection process may be applied.

Stage 1: Objectives

To improve the health of the villagers. Requires a cleaner water supply, probably requiring treatment to remove pathogens — but all at an acceptable cost.

Technical Brief No.49: Choosing an appropriate technology

Stage 2: Analysis — using SHTEFIE

Factor	Effect	Outcome
Social Social desires for increased convenience of supply mean that many villagers want a piped water supply to standposts — to be of better quality than the existing supply	New water supply must appear better than old or people will not accept it	Removal of turbidity is a priority so new source appears to be better — sedimentation, filtration or coagulation may be suitable
Health High incidence of diarrhoeal diseases in village	Pathogen removal required	Process needs to include pathogen removal — possibly slow sand filtration and/or chlorination
Technological Chemicals and spare parts difficult to obtain	Process to be simple and not reliant on chemicals or power	Rules out coagulation and possibly chlorination. Also rules out rapid sand filters.
Economic Large amount of agriculture in area requiring irrigation water	Large amount of reasonable (not drinking-water standard) quality water required	Possibility of using higher-quality source for drinking-water supply and lower-quality source for irrigation.
Financial Income levels still low in village	Ability to pay is low	Need for inexpensive options
Institutional There is little involvement of water agencies in the area	Operation and maintenance capabilities are likely to be low	Need for simple options
Environmental Rainfall is fairly even throughout the year	Need to check reliability of flow in streams	May need to have further source of water supply if flow is low.

Stage 3: Output

Of the main treatment options listed in Table 1, the analysis has revealed that sedimentation and slow sand filtration are probably the most appropriate treatment options because of the operational and maintenance requirements. Chlorination could be considered if completely safe drinking-water were required, but the chemical requirement might mean that this option is not appropriate. Water from source 2 could be used for drinking-water supplies after treatment, leaving the water from source 1 for irrigation purposes. Otherwise, the very high turbidity in water source 1 would mean that a pre-treatment stage such as roughing filtration may have to be employed. Water-quality targets should be to remove turbidity and pathogens to acceptable levels, and to perform the routine operational tasks for the slow sand filter when required. (For further details about the operational requirements of slow sand filters, refer to *The Worth of Water*.)

Conclusions

So, when selecting any technology, consider the following:

- Objectives:** *What is required? Why? Is it realistic?*
Analysis: *Can it be achieved? What are the limitations?*
Output: *What technologies and controls are appropriate given the problem and the constraints?*

Further reading

Pickford, J. (ed.), *The Worth of Water*, IT Publications, London, 1991.

Shulz, C.R. and Okun, D.A., *Surface Water Treatment for Communities in Developing Countries*, John Wiley & Sons/IT Publications, London, 1984.



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Forty-ninth in a series of Technical Briefs for fieldworkers. Technical Briefs Nos.1-32 are available in book form. *The Worth of Water: Technical briefs on health, water, and sanitation* (ISBN 1 85339 069 0) is available at £10.95 plus £2.50 P&P from IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK. Fax: +44 171 436 2013 Email: itpubs@gn.apc.org
World Wide Web: <http://oneworld.org/itdg/publications.html>

Block 2 : Sustainability Issues

Saturday, September 14, Session C and D

- Subject title** : Community Management
- Type of session** : Introduction, group activity, discussion and joint literature reading
- Objectives** :
- Participants gain insight into possibilities and difficulties of community participation and management.
 - Participants understand requirements for change capabilities.

The session will start with a group exercise ('The Objective'), which gives a starting point for a discussion on different aspects of community participation and management of water supply and sanitation programmes. The discussion will focus on understanding community management from the perspective of the partners involved and the role of the outsider/facilitator in guiding processes of change and necessary conditions at agency and community level.

After joint literature reading some key issues and actions which could be taken to create an enabling environment for community management are identified.

- Hand-out** :
- David Werner, "Helping health workers learn", page 6-11, 6-12 and 6-13
 - Community Management Today - the role of communities in the Management of improved water supply systems, OP papers no. 20

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CHARACTERISTICS OF COMMUNITY MANAGEMENT

The Community decides on:

- * technology choice
- * service level
- * form of local organization
- * use regulations
- * financing mechanism

The Community responsible for:

- * maintenance and repair
- * regulation of use
- * local management organization
- * financing

Thus, the Community owns the system

GOALS OF COMMUNITY MANAGEMENT

The goals of community management are to:

- * Improve system reliability
- * Improve the attainment of health and other benefits
- * Ensure more appropriate choices of technology and service level.
- * Promote greater democracy and equity in the development process.
- * Promote a more prominent role for women in development.
- * Reduce the costs to agencies of improvements by making better use of local resources, skills and knowledge.
- * Build community confidence and capacity to undertake further development activities.

FACTORS CONTRIBUTING TO EFFECTIVE COMMUNITY MANAGEMENT

- * strong leadership
- * a programmatic approach
- * realistic appraisal of resources
- * a functioning water committee
- * women's involvement

COMMUNITY MANAGEMENT RAISES MANY ISSUES !!

- * finding the most appropriate forms of local organization
- * strengthening problem-solving skills of communities and agencies
- * establishment of financial and other management systems
- * building of local capacity for operation and maintenance

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)

THREE LEVELS OF PARTICIPATION:

- * as a means to facilitate the implementation of external interventions;
- * as a means to mediate in the decision making and policy formulation of external interventions;
- * as an end in itself, the empowerment of social groups towards access and control over resources and decision making.

In the latter, participation is a goal and not a means,

- * community management implies acceptance: people to a large extent identify and modify their own solutions to their needs.

Common characteristics of successful community management include:

- community decision making
- community responsibility, backed by legitimate authority and effective control
- community mobilization of resources
- community access to and control over external support (public or private), to supplement local management capacity.
- agency acting as facilitator and supporter and helping to build community self sufficiency.

Changes required at agency level

- motivation of communities and mobilization of community resources takes time, this must be allowed for in schedules.
- learning is a two-way process.
Staff assisting communities acquire new knowledge, adjust their advice and support
- confidence and trust are key aspects of successful community management
- local staff knowing local language and culture generally have more success in building trust and confidence and communicating new ideas.
- staff cannot function properly without adequate resources (transport, materials)
- women's involvement is an important element this will not be achieved unless the support staff include women.
- community management of improved water supply offers opportunity for communicating health and hygiene messages.
Agency staff need appropriate knowledge and skills to do this.
- improved water supply is not the only potential use of scarce community resources. Staff must be aware of the risk of distorting community priorities.
For right decisions, communities need to be well informed on commitments of both community and agency.
- switch from providers to facilitators needs new set of performance indicators, so that staff progress can be recognized and rewarded.

CASE STUDY: MR TEMBO AND THE PUMP MINDERS

Mr. Tembo is a newly qualified Field Officer. As part of a big move towards decentralizing pump maintenance, his Ministry assigns him, along with a Donor Agency to work with the Kabanga community on a long term pump maintenance project. This idea is new to the Kabanga community, Mr. Tembo is pleased about his responsibility, eager to please his superiors and excited about the big task ahead.

Tembo calls a meeting at community level and reads out a long document containing details of the proposal. He also explains that to start this programme it would be necessary to undertake a survey to find out the location of all the new pumps so that the community could be sure to select pumpminders who live close to the water points. A spokesman for the community tells Tembo at the meeting that the people had recently participated in such a survey and therefore do not see the reason for another, which in any case takes time. It is also reported that as many men were working in the town, it would mean that pumpminders would not necessarily be those who lived close to the water point. Mr. Tembo points out that he has been instructed by his Superiors to carry out the survey and that it would have to go ahead without fail. He takes pains to explain that he is new at the job and pleads with the people to show confidence in him, the new project and to therefore participate. Mr. Tembo then sets the survey date for the following week and says his farewells promising that there will be some form of "Celebration" when it is all over. Feeling a sense of relief he returns to the city for the weekend.

The following week Mr. Tembo arrives in the community accompanied by his superiors and is surprised to see that no one has arrived at the meeting place. He calls at various houses only to find that people were out in the fields or have gone in to the nearby junction to drink beer. Tembo is amazed and embarrassed. Did the community not understand the importance of the Pump Maintenance Project and how vital it is to please the Officials who have obviously spent so much time planning the programme? What could have gone wrong?

COMMUNITY WATER SUPPLY AND SANITATION PROJECT (CWSSP)

THE EXPERIENCE OF THREE COMMUNITY BASED ORGANIZATIONS (CBOS) IN THE RATNAPURA DISTRICT

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The Community Based Organizations (CBOs) in Kathlana-Bopitiya, Ambagahawatta and Dandeniya supported by CWSSP were studied in May 1995. The three CBOs have undergone extensively a lengthy process of community mobilization in 1993 and 1994, commencing from small group formation leading to development CBOs into institutionalized and registered organizations. It was transpired that despite the level of participation and change taken place has varied, the three CBOs have adopted the same process in the three villages as summarized below.

Learning Process for CBO Development

Activity	Purpose
1. Group formation and community awareness raising	To create hygiene awareness to gather round common interests, collect information and, form into small groups and core-groups.
2. Participatory Survey Village Self-analysis/assessment	To increase the understanding about the present status, encourage villages to analyze and assess their situation and form into a CBO.
3. Village participatory planning	Initial investigation of options, feasibility, final design and community proposal in water supply and sanitation and seek legal recognition for the CBO.
4. Improvement of facilities and construction management	To prepare a construction plan by CBO organize self-help work and manage construction activities.
5. Discussions on consolidation phase	To further strengthen Community Based Organizations, ensure effective use of facilities, undertake repairs and look after facility as everyone's responsibility.

This has required the respective communities attending a number of village events and meetings. They have created opportunities for participation and sharing ideas. The number of such meetings conducted are summarized below.

Table 1
Frequency of CBO Meetings

Name of CBO	1993	1994	1995
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	20	24	07
Praja Jala Ha Saniparakshaka Samithiya Ambagahawatte	17	10	02
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	16	09	06

These meetings have been both formal and informal discussions limited about 4-5 hours at a time. In addition to these meetings hygiene education and training events have taken place on numerous occasions in the form of informal participatory discussions. The CBOs accepted and even valued the positive contributions made by the CWSPU, Dept. of Health, school set-up and Partner Organizations (Pos) to make their programs a success. The target group for these meeting have been mostly women specially mothers. Such events taken place are summarized below.

Table 2
Hygiene Education and Training

Name of CBO	1993	1994	1995
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	8	9	1
Praja Jala Ha Saniparakshaka Samithiya Ambagahawatte	10	11	2
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	11	7	4

Implementation of Programs and Improvement of Facilities.

The three CBOs initially implemented community actions in order to establish team spirit and develop positive attitudes for working together. These activities included events such as renovation of existing wells (Kathlana-Bopitiya) rehabilitation of rural roads (Ambagahawatta) and conducting health clinics (Dandeniya).

The focus of program implementation was water and sanitation facility improvements. A series of Shramadana activities had also been organized for facility improvement with voluntary labour. As expected by the CWSSP, the CBOs have carried out hygiene education programs during all the three phases first targeted at project development and CBO formation and subsequently at behavioural change. Sanitation facilities were expected to be improved through revolving loan funds. Two CBOs implemented sanitation programs in small scale while one could not commence the programs. The three CBOs implemented piped borne gravity water supply schemes with yard taps. The status of facility improvements has been summarized below.

Table 3
Improvement of Water & Sanitation Facilities

Name of CBO	No of House Holds	Status Improved Water Supply	Stated Improved Sanitation
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	205	74 yard taps (gravity water supply scheme)	-
Praja Jala Ha Saniparakshaka Samithiya Ambagahawatte	89	70 yard taps (gravity water supply scheme)	10
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	136	95 yard taps (gravity water supply scheme)	8

Improvement of facilities was a collaborative effort with financial resources and technical guidance of CWSPU. The members of communities have agreed to contribute by unskilled labour between 19-30 days as well as materials valued between Rs.90,000 - Rs. 100,000. The expenditure incurred by the CWSPU for project development as well as improvement of facilities are given below.

Table 4
Cash Contributions made by CWSPU

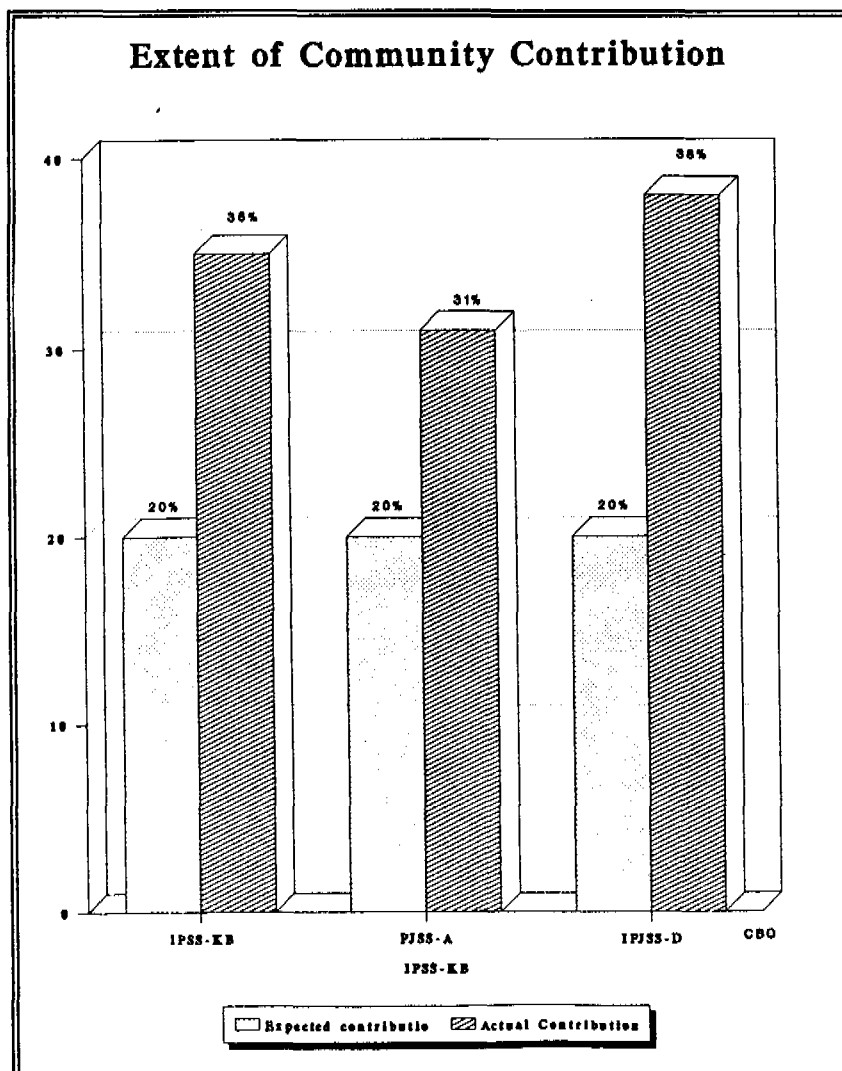
Name of CBO	Estimated (Rs.)	Actual (Rs.)
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	1,359,000/-	964,202/-
Praja Jala Ha Saniparakshaka Samithiya, Ambagahawatte	419,600/-	285,832/-
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	489,600/-	332,170/-

Communities were expected to contribute upto 20% of the total estimated cost for improvement of facilities. This contribution has been made by way of unskilled labour and materials. The value of community contributions are summarized below.

Table 5
Community Contributions

Name of CBO	No. of unskilled labour days per family	Approximate Value of Unskilled labour (Rs.)	Approximate value of Materials and other service performed
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	30	522,000	100,000
Praja Jala Ha Saniparakshaka Samithiya, Ambagahawatte	22	1,95,000	90,000
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	19	199,500	95,000

Figure 6



Institution Building

As a part of institutional strengthening the three CBOs have attempted to develop their financial capacities in the following manner.

- i. Collection of membership fees @ Rs. 10/- per month.
- ii. Charging @ Rs.100/- per labour day from new water consumers in lieu of initial labour contributions.
- iii. Regular contribution of money to maintenance funds and reimbursement of expenditure on maintenance.
- iv. Initial grant of Rs. 10,000/- from CWSPU and recovery of loans and interests of sanitation revolving loan funds.
- v. Crediting to the fund proceeds of other economic activities undertaken by CBOs.

The status of fund raising and financial capacity is summarized below.

Table 7

Financial Capacity of CBOs - Revolving Fund

Name of CBO	Maintenance Fund (Rs.)	Sanitation Revolving Fund (Rs.)	Total (Rs.)
Isuru Praja Sanwardane Samitiya Katlana, Bopitiya	6862	10,000	16862
Praja Jala Ha Saniparakshaka Samithiya, Ambagahawatte	20,000	10,000	30,000
Irahandapana Praja Jala Ha Saniparakshaka Samithiya, Dandeniya	6000	10,000	16,000

Studies were carried out to ascertain the level of institutional development of CBOs. It has been revealed that all the three CBOs have undergone several positive changes towards institutional development. Most of these changes were intra-organizational changes as facilitated by CWSPU and PO with training and education of key office bearers of CBOs. Key features of changes taken place relating to institutional development have been summarized below.

Changes Toward Institutional Development

Stage	Activities
1. Project development (during VSA and VPP)	<ul style="list-style-type: none"> - Recasting of CBO constitutions and setting broader objectives - establishment of financial discipline - Attempting maintenance systematic minutes/records etc. to establish transparency of activities.
2. Towards end of construction phase	<ul style="list-style-type: none"> - Development of work ethics and organizational norms and setting standards. - Attempts to improve technical capacity - Taking up additional responsibilities like credit, nutrition.
3. At the beginning of consolidation phase	<ul style="list-style-type: none"> - Requests have been made to CWSPU to recognize CBOs as partner organizations - Developing linkages in the other government agencies and NGOs of the district. - Developing a network CBOs in the close proximity to exchange resources (eg. experiences volunteers and TOs of Kathlana Bopitiya have been provided to other CBOs to facilitate their work.

Technical Capacity for Operation and Maintenance

The three CBOs have already implemented following activities in order to improve their technical capacity and to systematize maintenance work of Water Supply Schemes.

- Maintenance workers have been appointed. The maintenance workers selected by CBO have been exposed to operation and maintenance training by the CWSPU. They have also received hands on training during construction phase by getting involved in construction work on full time basis. Except in Ambagahawatte, the maintenance workers are being paid a monthly allowance out of community funds (eg. Rs.750/- pm in Dandeniya and Rs.500/- pm at Kathlana-Bopitiya).
- Maintenance workers have been provided with minimum required tools and the three CBOs have requested CWSPU to give them further Technical training.
- Additional technical skills available in the village have been identified. The piped fitters and other mechanics available in the village have been required to ensure their support if and when required.
- Supportive committees for maintenance work also have been established.
- The three CBOs have also attempted to prepare maintenance schedules. When interviewed CBO members and maintenance workers listed following maintenance issues and expected solutions on the basis of their experience over a period of six months.

Expected Maintenance Problems and Proposed Solutions

	IPSS - KB	PJSS - A	IPJSS - D
Problems	<ul style="list-style-type: none"> ● Leaking pumping main ● Misuse of water (eg. use of water for purposes other than drinking) ● Vandalism ● Wastage of water 	<ul style="list-style-type: none"> ● Regular cleaning of water tanks ● Blocking of water source due to heavy rains/floods. ● Cleaning of algae ● Examination of gate valves ● Instant unexpected repairs 	<ul style="list-style-type: none"> ● Leaking storage tanks. ● Replacement of valves ● Prevention of abuse (eg. Use of drinking water for washing vehicles) ● Wastage of water (eg. Prevention of running open water taps). ● Leaking from joints due to lack of levelling of drains ● Drainage problem around yard taps due to water clogging



Solutions	<ul style="list-style-type: none"> ● Services of paid and voluntary maintenance workers ● Supportive vigilant committees in all the hamlets (each consisting about 5 - 6) ● Reimbursement of maintenance cost by the community on case by case basis. 	<ul style="list-style-type: none"> ● Service of volunteer maintenance workers. ● Establishment of 12 groups to report maintenance requirements on daily/ weekly and monthly basis 	<ul style="list-style-type: none"> ● Service of paid and volunteer maintenance workers. ● Committee to assist maintenance work. ● Basic tools provides to maintenance workers.
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Responsibility, Authority and Control of CBOs Activities

Functioning of individual CBOs in the three villages was studied in detail in order to ascertain the level of their responsibility authority and control over improved water supply, sanitation and other village development activities. The level of responsibilities varied depending on the sense of ownership. For example in Dandeniya CBO was confident that the supply scheme belonged to members of the community. In Kathlana - Bopitiya and Ambagahawatte CBOs maintained that there are several tail activities yet to be completed with the support of the CWSPU. Therefore, the CBOs cannot claim that the scheme is fully completed in order to feel sense of full ownership. However, these CBOs claimed 95% of ownership of improved water supply schemes in those two villages. Having the above level of ownership in mind the three CBO have passed by-laws and entered into contractual obligations with members relating to cost recovery, operation and maintenance.

The three CBOs have now been registered with the Ministry of Housing Construction & Public Utilities and recognized as independent legal entities. A number of important decisions have been taken by these CBO either to watch the interests of members and refuse conditions unfavorable to them. For example CBO in Dandeniya has refused twice involvement of political leadership at the opening of its water supply scheme. In fact this CBO decided to do away with formal ceremonial openings and commissioning of the scheme as and when it was complete. This CBO has also decided to put up an additional storage tank on their own with the capacity of 10,000 Cu.M. Similarly, CBO in Ambagahawatta has decided to extend the scheme to cover additional 15 households and attend to rectifications of a technical defect of the water supply scheme.

The CBO in Kathlana-Bopitiya has decided to utilize the available capacity of the water supply scheme and cover additional 25 households even if the CBO is unable to get further support from CWSSP. These decisions have been unanimously approved by the general membership.

The extent of control of CBOs over their affairs was studied in detail. The three CBOs have acted in three different instances very wisely. For example in Dandeniya an instance of illegal tapping of pumping main has been reported. The incident warranted even litigation. Yet the CBO has resorted to discussion and resolved the problem. Eventually the chairman was requested to resign. In Kathlana - Bopitiya a case of vandalism has been reported. Incident was about to be reported to police for investigation. Yet the CBO conducted an awareness program and resolved repetition of such incidents. In Ambagahawatte an incidence of misuse was prevented by community consultation and showing alternative ways of water collection (eg. rain water) for domestic purposes other than drinking. Repetition of this incident was prevented by appointing vigilant committees to represent each and every small groups.

Challenges to Overcome

It is clear from the foregoing explanation that there are several factors to be taken into consideration in order to ensure community managed operation and maintenance of improved water and sanitation facilities and to broad base the role of CBOs to other development activities.

a. Improvement of Technical Capacity of CBOs.

The views expressed by members of CBOs revolved round skill development with specific technical abilities of their members. For example training of few a plumbers, masons and mechanics who could be useful as volunteers. In lengthy intimate discussions female members expressed their need to improve technical skills to commence cottage industries as additional source of income. Some of them particularly mention about the Industrial Development Board and their search for new knowledge and technical skills to produce marketable goods for income generation purpose.

Some of the youth wanted to be trained as electricians and motor mechanics so that they could go out and work in sub-urban areas and in towns and bring home a regular income.

b. Creating External Climate Conducive to CBOs

The CBO members interviewed either expressed or implied following requirements.

- Creating conditions to obtain technical inputs from outside market for example obtaining services of private technicians. This also meant educating hardware shops to make available relevant spare parts materials etc to evaluate CBOs to pay them when required.
- Facilitating more NGO participation in credit, nutrition and income generation activities.

- Financial support from donor agencies and flow of resources from existing government organizations.
- Bringing other CBOs in nearby villages for collaborative efforts.
- Facilitating them to work as Partner Organizations
- Marketing facilities by way of purchasing their future products and making available necessary support.

c. Developing Managerial Skills of CBOs

As expressed by many a CBO members interviewed management development of a CBO includes following components.

- Organization of the CBO

This apparently meant development of a set of procedures, code of discipline and setting acceptable norms and high standards of moral and work ethnics. It also included re-structuring of organizational set-up and setting a process in motion to enable members of the organization to contribute for its development by way of greater voluntary participation.

- Training CBOs to give management skills

This meant giving key office bearers general management skills relating to handling men, money methods, materials etc.

- Financial discipline, credibility and management

Most of the CBO members interviewed expressed their concern over financial credibility of the Organization. They apparently did not support their organizations acquiring a lot of financial resources without transparent financial procedure,s records and discipline. Their views included a request to CWSSP to further support their organization to establish financial credibility so that they could subsequently prove their creditworthiness to local banks to raise loans for further development activities.

- Expanding the horizon of CBOs

Most of the CBOs expressed interests on their possibility of expansion to other development areas. Their organizations have now been recognized as water sanitation and health related organizations. But there are other communities priorities vis-a-vis their own experties in the filed of water and sanitation. Apparently this meant they wanted to expand their horizon encompassing other development activities. Most of the CBO members interviewed particularly mentioned self- employment, housing, credit facilities and building community centers to enable them to commence some form of vocational training.

Beramada - Village

Beramada is about 15 km. off Badulla town in the Uva Province, Sri Lanka. Located in a hilly area close to a mountain range there are 228 families living in the village. Majority of families depend on subsistence agriculture, some as tenant farmers. Considerable member of men and women also work as labourers in adjacent tea plantations. Beramada lacks basic infrastructure facilities. The distance to the nearest medical dispensary is about 8 km. One third of the families receive government food subsidy. In this sense this is a remote and poor village.

In 1989 Uva Rural Assistance and Development Foundation (URAD) interacted with the village through its community education programme. A few girls and boys were trained as catalysts for implementation of food, nutrition and environmental conservation activities. In 1993 the village requested URAD some form of assistance for improvement of water and sanitation facilities. This assistance was extended to the village through CWSSP towards end 1994.

URAD started a community mobilization program for water and sanitation in the village through a community facilitator. Small groups consisting about 10-15 families were formed. These groups were brought together in the form of a coregroup and subsequently developed into a community based organization (CBO) end 1994.

URAD in collaboration with CWSPU trained key members of the CBO in community mobilization techniques, organization of skilled and unskilled labour, construction management, taking care of facilities and community based resource management. By mid 1995 the CBO was able to complete eight small scale gravity water supply schemes and 108 toilets.

A trained caretaker has now been placed and a maintenance fund has now been established to look after water and sanitation facilities. Towards end of construction of water and sanitation facilities, (December 1995) URAD facilitated a forward planning sessions of the CBO in order to address issues relating to CBO sustainability. Members of the CBO expressed their concern about long-term stability of the CBO. They felt that the CBO has now become less fruitful to the community because it does not address practical problems related to their day-to-day community living.

The members appreciated the fact that since Mr. Martin left the CBO to join Samurdhi movement as a Niyamaka (Facilitator). Mr. Tilakaratne was comfortably walked into his shoes because recent constitutional changes encouraged youth to take up responsibilities and new challenges. The members of the CBO felt that the financial capacity of the CBO should mediate be developed.

In order to raise additional funds, following extra activities were commended in January 1995.

- Hiring of left over tools used for construction work of the water and sanitation project for a nominal fee.
e.g. (wheel barrows, steel pans, mammoties, pick axes etc).
- Purchase of two spray machines and hire them at a nominal fee.
- Commencement of a small farmshop to sell seed vegetable, grains fertilizer and chemicals.
- Saving scheme for the members compelling each family to save a fix amount and deposit in a Rural Bank.
- Credit systems for member to obtain loans upto about Rs.1000/= either to meet emergencies or to start petty income generating activities.
- Purchasing products of members in bulk and marketing them on whole sale to prevent middlemen making profits.
(e.g. Kitul Jaggery and treacle produced by members are collected and marketed by the CBO).

CBO has understood that most of the activities so far introduced are related to existence and function of the CBO and not largely connected with opportunities for community survival. Therefore income generation activities targeted at creating employment opportunities for members of CBO are being considered by the CBO at present. Some of the following proposals for this purpose are being considered now.

- Flour milling packing and marketing them. (e.g. Kurakkan, green gram etc.)
- Small scale cottage industries (e.g. production of joss sticks, ratton baskets, clay pots, poultry farming etc.)

The CBO has now been re-structured with several committees functioning as follows to address diversified community interests.

- Death donation and welfare committee.
- Women & income generation committee.
- Health & Environmental committee.
- Security and legal committee.

The CBOs supported by URAD are being brought together to form a new network of CBOs, the active functioning of which would allow URAD to phase out its inputs.

Ginnaliya Village

The CWSPU, Matara came to know Ginnaliya through Dharma Vijaya Foundation (DVF), a temple based national level NGO. As for back in 1990 DVF had started a Dharma Vijaya Samaya, at Ginnaliya temple to facilitate a spiritual advancement and social development program.

Ginnaliya North was the most backward part of the village. DVF started mobilizing this community in January 1993 for improvement of water and sanitation facilities. A trained community facilitator of DVF resided in the village and promoted formation of small groups to ensure participation of each and everyone in the village. A participatory survey was facilitated and conducted by the small group representatives. The survey results revealed that 90% of the house hold did not have sufficient water supply and 68% did not have basic sanitation facilities. DVF further promoted formation of a community based organization (CBO) through a process community mobilization recommended by the CWSPU.

Activities went ahead smoothly through village self-analysis and community mobilization assessment until village participatory planning (VPP) started. VPP called for inputs of a technical officer for calculation of water demand, source measurement, study of options, feasibility studies and preparation of technical plan etc. DVF found it extremely difficult to manage provision of technical inputs for planning water and sanitation facilities. DVF, therefore, informed the CBO of its inability to support these activities.

This happened when participatory planning had just begun. Inevitable result was to stop participatory planning indefinitely. This created a disappointment among the members of the community with following consequences.

- Interest of the community started fading away.
- Members of the communities began to disbelieve partnership agencies.
- Emerging community leadership shattered.
- Small groups had started fallen apart.
- Linkages of the CBOs with partnership organizations relaxed.
- The hope of the community for improved water and sanitation facilities became nearly a dream.

The CBO Ginnaliya subsequently approached the Sathmaga Participatory Development Forum (SPDF) in 1994 to remedy this situation. Believed in community empowerment for no poverty and no affluence society. SPDF agreed to re-mobilize the community and provide required support. Its facilitators had already been trained by SPDF and CWSPU trainers.

Mr. Sanjeewa was specially picked up by SPDF to meet this challenging situation. He resided in the village and started experimenting ways and means of bringing the project back to normal.

The first few community meetings facilitated by him became futile. Then he started studying social organizations, their structures and ramifications etc. He realized that members of the community could be re-organized by utilizing their inter-connected social relations.

In Ginnaliya most of the families were interrelated due to blood relationships and marriage relationships within the community. He started motivational programs to reach members of the community through these relationships. In fact he resided in a family nucleus which facilitated his work. He also tried to identify informal groups and communicated through them to establish formal relationships. He played the role of a facilitator helping people to cure sick people, select high breeding seed varieties, chemical, fertilizer and to train selected youth in modern farming practices etc. He also brought useful institutional contacts to the village for community financing and entrepreneur development etc. Through this process he could revive small groups formally established by DVF and re-oriented them to form a revised CBO.

Meanwhile SPDF supported Sanjeewa with necessary guidance and closely monitored his activities and made available Mr Sunimal, a full time technical officer to assist the CBO for participatory planning. With this support the CBO was able to motivate the community and finalize VPP and undertake construction work.

The CBO has now completed two gravity schemes 20 shallow wells and 125 toilets. SPDF is guiding the CBO to prepare maintenance schedules, place trained community care takers at work, raise maintenance funds. An integrated development package has been developed by the CBO having thrust on rural credit agriculture and agro forestry.

Pallegama Village

Pallegama is an isolated mountain area near Sinharaja tropical rain forest in the Kotapola Divisional Secretariat Division, Matara District. Socio-Economic and Environmental Development Institute (Seedings), a regional based NGO first developed its contacts with the village in 1991 under its community management training program. Pallegama is legally protected by environmental conservation laws of Sri Lanka since it forms a part of catchment area of Gingaga and Nilwala river commencing from Sinharaja.

Pallegama contains many species of animals and plants thus representing wide diversity of flora and fauna and ecosystems. The availability of high natural forest canopy and unique natural habitat with bio-diversity demanded this village special attention by forest authorities.

Despite the natural streams and water falls in the village members of the community suffered perennial drinking water scarcities over the last decade. Therefore, they requested assistance from Seeding for improved water and sanitation facilities.

The community facilitator of Seeding promote a participatory survey by the small group representatives and found 490 house holds lack sufficient drinking water facilities. Besides people were walking long distance from one hamlet to another to fetch drinking water.

After series of community meetings, the Community based Organization (CBO) decided to tap the water source of the Diyadawa forest reserve. The CBO approached the regional forest officers and requested permission to :

- Use Diyadawa Ihalankande and Kotuwadola springs and use 2% of water to provide water to the village through three gravity schemes.
- Construct three storage tanks.
- Construct a diversion canal for 100 meters.
- Have access to the water source and storage tanks for maintenance purpose.

The forest authorities agreed to this proposal verbally. Yet, they did not want to give permission in writing. Asked whether the CBO could proceed with proposed work the forest authorities simply said "yes".

The CBO therefore, proceeded with initial work and started construction of the storage tanks. Unexpectedly, an injunction preventing the CBO proceeding with work was served. Repeated discussion with forest authorities by the CBO officials to go ahead with work proved futile. Seedings helped CBO to devise a four stage strategy to resolve this issue.

- Revival of environmental education program and creating greater environmental awareness in the village.
- Invite forest authorities to observe environmental conservation program implemented by the village and demonstrate environmental friendly activities inclusive of street theater drama.
- Prepare a written representation addressing all possible concerns of the forest authorities and confront them with counter arguments.
- Resort to legal action if first three steps fail.

This strategy was adopted over a period of eight months during which time CBO started inventorizing all resources available in the forest reserve in question. They were also able to identify environmental friendly income generating activities (e.g. medicinal plant growing in home gardens, production of herbal seed oil). The CBO was able to launch a public awareness campaign against illicit timber felling and established vigilant committees. The CBO was also able to demarcate boundaries of communities which would depend on the forest for survival.

On completion of the first three stages forest authorities were convinced that activities of the CBO would eventually result in conservation of this strict forest reserve. The request of the CBO to utilize the water source in the forest reserve was, therefore, allowed by the forest authorities without resorting to litigation.

Pallegame has now completed 3 small gravity schemes, 1 tube well and 26 shallow well to serve 537 families. The CBO is now engaged in source protection and income generating activities to keep up the spirits and interest of the members of the community.

Block 2 : Sustainability Issues

Sunday, September 15, Session A and B

- Subject title** : Hygiene Promotion
- Type of session** : Lecture with short working group exercise, followed by discussion
- Objectives** :
- Participants will be able to describe their role and indicate some crucial activities in the project cycle, including organizational conditions, with relation to hygiene promotion.
 - Participants struggle with the new concept of hygiene promotion and the need for all staff to work on it.

Hygiene Education is more and more recognized as an important project component if project benefits are to be brought about and sustained. Field experiences have revealed a large number of valuable insights with regard to making hygiene education effective. This session will start with an identification of the area of hygiene education and will then deal with how to increase the effectiveness of hygiene education.

- Hand-out** :
- Chapters from "Just stir gently"
 - Planning for better hygiene : the importance and use of motivational factors (van Wijk, C. and Murre, T.)
 - Hygiene promotion : improving health and hygiene through participatory environmental health engineering and programmes for behavioural change, Discussion Paper, April 1994, DGIS.

September 7 - 27, 1996, Kandy, Sri Lanka



Planning for Better Hygiene: The Importance and Use of Motivational Factors

Although many health education programmes still concentrate on increased knowledge and general messages, this alone seldom changes people's behaviour. In their joint paper commissioned by WES Section, UNICEF New York on planning for better hygiene, Christine van Wijk and Tineke Murre discuss local economic and cultural conditions, gender factors and provide other insights into influences on behaviour. Although their suggestions about applying lessons learnt focus on hygiene, they can also be seen as suggestions for further practical steps in implementing Agenda 21 through integration, capacity-building, advocacy, evaluation, research, documentation and exchange of information. A brief edition of their paper is presented here.

by Ms Christine van Wijk and Ms Tineke Murre, International Water and Sanitation Centre (IRC), The Hague

Common fallacies of conventional hygiene education

While improved water supply and sanitation facilities help, their introduction does not have a health impact by itself. Proper hygiene practices are more crucial than the presence of facilities as such. Yet many hygiene education programmes

still focus on increasing people's knowledge, assuming that when people get information they will drop unhygienic practices. However, this is often not the case.

The first reason is that the given information may not be relevant, complete and realistic if it fails to take into account local insights and circumstances.

Secondly, the communication process may be ineffective to create behavioural changes. Many health messages are given in the forms of lectures or through one-way mass media. People are only told "what to do" without the opportunity to think it over, to discuss it and to identify it with their own concerns, so they do not remember or apply the information.

Thirdly, many conventional hygiene education programmes are limited to information and promotion and fail to address actual risks of transmitting diseases associated with poor water supply, sanitation and hygiene. This means measurably reducing or eliminating risky conditions (see Figure 1) and improving hygiene at the local level.

Insights on achieving behaviour change and reducing transmission risks

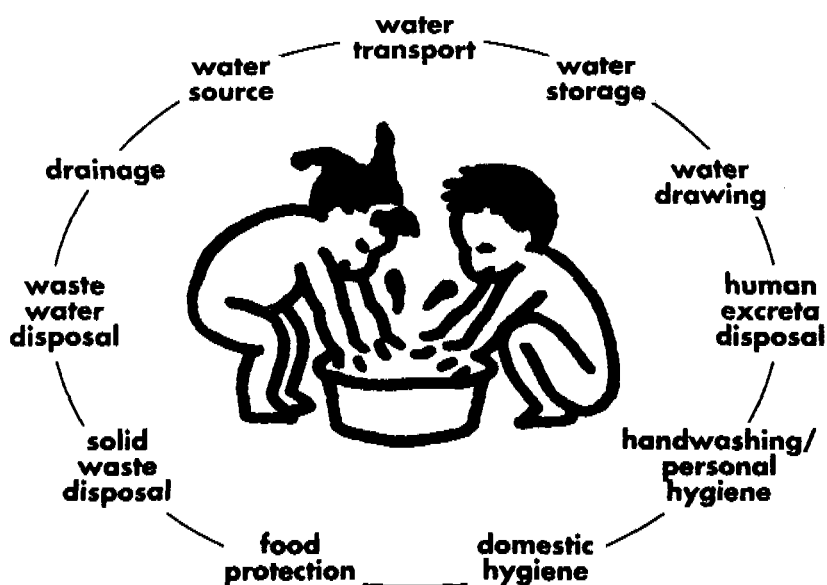
What has been learned about people's health behaviour and transmission risk during the last ten to fifteen years is that, for one we need to understand individual behaviours. All people already have their own knowledge, beliefs and values, hence before adopting a new practice, people will ask themselves how it fits into their ideas and affects their lives. Behavioural change is a process comprising several steps, each with different considerations (beliefs, values, influence of important others and enabling factors). A model for understanding this is shown in Figure 2 (page 15).

We also need to understand that some environmental health hazards can only be reduced through communal behaviour change. Typical examples are school sanitation, Guinea worm and schistosomiasis eradication. Non-compliance by a small group of persons is enough to block a possible health improvement. Community-based approaches work only when the communities themselves see conditions and practices as problems and undertake communal action to permanently change them.

continued on page 15

FIGURE 1

Common risks in transmitting water and sanitation-related diseases



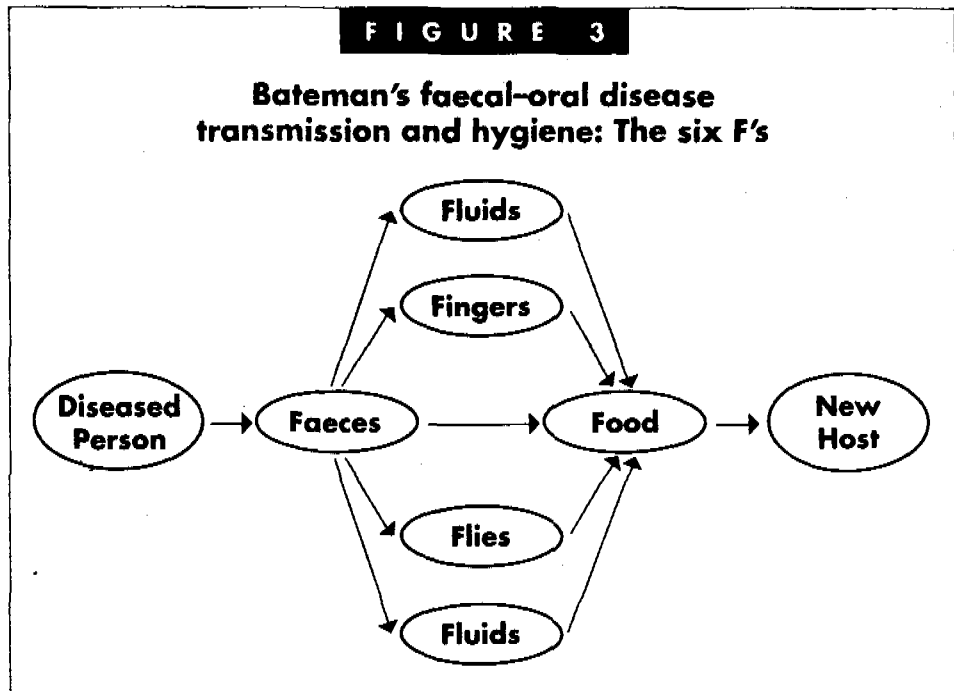
■ **Planning for Hygiene**, from page 14

And, from their own point of view, people have very good reasons if they do not adopt new devices or practices. A different approach to technical projects and the involvement of users (women as well as men) in design and planning for

People tend to adopt or discard practices for which they get the approval or disapproval from "important others" or by which they can make an impression. A further influencing factor consists of positive and negative sanctions.

use and maintenance is needed to determine these reasons. Education alone can never convince people to use facilities which do not bring them clear benefits or which are not sustainable. Before the technology/service is introduced ask if the issue has a high priority. Plan the design, location and control of the facilities through dialogue with women and men. Afterwards, follow up use and hygiene and work with people to reduce any other transmission risks.

Another point from which we can learn is around *how adults learn*. Different educational approaches are needed to meet different educational goals, and quite often a mix of different approaches can be used.



Didactic education tends to equip people as quickly as possible with knowledge and coping skills. The teacher decides which messages are needed and how they will be taught. The didactic mode is best to transfer facts to large groups such as through mass media. Although it is usually not successful in changing behaviour, it can be used to start off discussions among family and peers and contribute to behaviour change.

Growth centered education is concerned with the development of individual capabilities and an increased sense of human dignity. Participants ac-

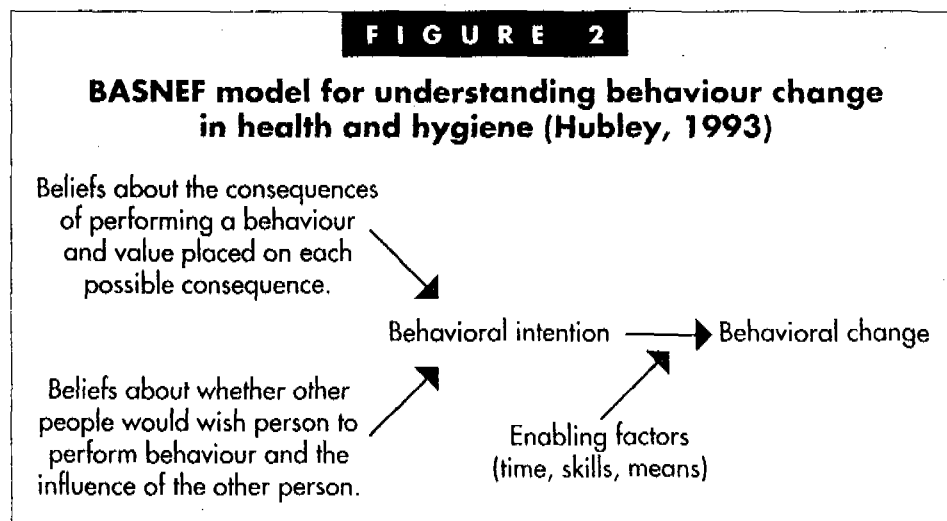
quire additional analytical, planning and problem-solving skills in decentralized decision-making situations.

Education for societal change seeks to create critical consciousness. The animator first discovers what is meaningful to the group, then helps the group to analyse their situation, gain critical insights, organize and take action. Growth centered education and education for societal change use participatory learning methods, stimulating participants to think for themselves, discover underlying principles, draw from their own experiences and think of possible solutions adapted to their beliefs and practices.

A last important insight gained is that *most water and sanitation related diseases can only be prevented by performing a number of hygiene behaviours*. No one intervention can properly stop all risk as can be illustrated by the "Six Fs" (Faeces, Fluids, Fingers, Flies, Fields and Food), the major transmission routes for faecal-oral disease (see Figure 3).

Consequently, three categories of improved hygiene practices have proven to have the greatest impact on people's health:

continued on page 16





■ **Development through Integrated Water Management**, from page 6

efforts were run by the state, with people used only as wage labour. The key lesson of the experience was found to be a need to involve people directly in environmental reconstruction and in the improvement of their own land and water resources. Instead of being "luckily hooked on" to the water agenda in a drought crisis situation, a People's Plan for water management is critical in a sustainable agenda combining poverty-reduction and eco-restoration.

Despite some weaknesses, by the end of 1993 Jhabua had become a posi-

tive argument that investment for development should seek to address environmental rehabilitation. A reverse resource flow into low-income and vulnerable sections of the population was made by improving agricultural production, protecting and increasing safe water sources and increasing livelihood security. Through appropriate organizational structures, a collective energy of people in water-deficit areas could be used for integrated water resource management. The Jhabua District model is a good example for other programmes



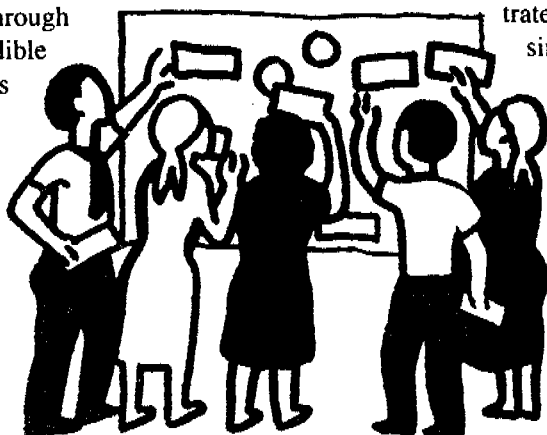
aimed at alleviating environmental degradation in other drought-prone regions of the world. *

■ **Synergism**, from page 10

lized for a behaviour or for a programme such as sanitation, various communities at various levels (grass roots, inter-ministerial, non-government, service, voluntary, professional, art, entertainment, private business, school, community, religious and others) become active partners in advocacy, communication, training and service delivery.

Programme communication is the process of identifying, segmenting and targeting specific groups/audiences with particular strategies, messages or training programmes through various mass media and interpersonal channels, traditional and non-traditional.

Programme communication is a researched and targeted endeavour which, for sustained behavioural change in sanitation and hygiene, must be done right. The message must strike a chord in the receiver through appropriate, credible channels. It takes inter-personal and communication training of field workers, backed up by improved support materials, to make them effective



Participatory Methodologies

Increased participation in planning and training through advocacy, social mobilization and programme communication will help avoid chaotic duplication of efforts and increase ownership in programme goals. In some countries increased participation is being achieved through a method known as "Visualization in Participatory Programmes (VIPP)". The VIPP methodology breaks down hierarchical position-taking and encourages dialogue between all partners, allowing the

voiceless to speak, modifying the usually dominant, encouraging group spirit and devolving planning and decision-making down the hierarchy. VIPP's flexibility allows adaption to many stages of the planning and training processes, from initial problem analysis and goal, objective and strategy setting, to the refinement of ongoing actions. Such participatory methods are essential especially in the area of interpersonal communication training to make field agents into good communicators.

communicators. And dissemination of information and receipt of feedback through mass-, print- and community-based-media should not ignore important non-traditional channels.

Very often, sanitation and hygiene programmes have mistakenly concentrated on using only a single strategy, such as advocacy without researched and targeted communication, communication without advocacy and the mobilization of partners, and mobilization

without advocacy to important political or social leaders. Using a three-pronged strategy for sanitation and hygiene gives clarity and definition of roles. More importantly, the strategies jointly have synergistic energy, that is, together they have a greater impact on programming than the sum of their individual efforts. With such a change, sanitation, hygiene and water programmes can have a tremendous impact on health, sustainable development and the environment. *

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■ **Planning for Better Hygiene**, from page 15

- sanitary disposal of faeces;
- handwashing after defecation and before touching food; and
- maintaining drinking water free from faecal contamination.

Factors promoting behaviour change

Facilitation is the most powerful reason why people adopt new hygiene practices. When facilitating behaviour change, sustainability is a particular concern: an intervention dependant on a highly subsidized distribution of goods is unlikely to be sustainable in a larger programme. Therefore it is best to advocate changes that are sustainable at the local level, or create the necessary skills and capacity for local production/procurement of goods.

Understanding means not that people get external information, but that they understand within their own frame of reasoning why the new behaviour has more benefits than the old one. Creating practical understanding of relations between certain practices and people's health requires insight in and respect for local knowledge, practices and beliefs.

Influence from others is another motivational factor. People tend to adopt or discard practices for which they get the approval or disapproval from "important others" or by which they can make an impression. Health arguments which external promoters use, usually play an insignificant role. Which people are important will vary from cultures to families to individuals. Friends and peers, opinion leaders and informal leaders can play a role. A further influencing factor consists of positive and negative sanctions. But these should not be overestimated: rewards and punishments may also

have adverse impacts and depend for their authority on support from the community at large.

Capacity and control are other factors. Even when people aspire to a new behaviour, they may lack the possibility of doing so because of insufficient time. Issues of autonomy over use are equally important: who in the household or community controls the facilities, equipment or supplies, is equally important.



Influence of socio-economic and cultural circumstances

Introduction of improved hygiene practices only makes sense when they can be adopted and sustained by all. But programmes do not always take the varying capacities of the community members into account. People should preferably be helped to analyse their own problems to find solutions within their own means and skills, or create new skills through which they can better use the means already available to them.

Culture plays a role both regarding the practices and the motivating factors. When the overall benefits of changing a practice (easier life, more status, approval from respected persons) become stronger than the benefits of adherence, change will often follow.

A cultural factor of particular importance is that of gender relationships and gender relations change. For every change, one has to ask if men or women have different needs, priorities and resources. Special strategies may have to

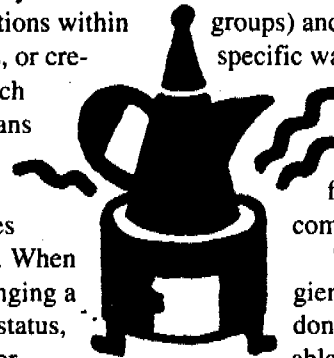
be developed to involve both groups and get generally accepted solutions. Women play a greater role in management decisions on public hygiene than was previously thought, and in the area of domestic hy-



giene, are especially involved. Nevertheless, there is a considerable need to involve men also because some decisions need male cooperation, for example for monetary and labour investments, or to change male health behaviour.

Application in actual programmes

How can the motivational factors described above be used in actual hygiene education programmes? Before starting, find out how the target groups see the problems themselves. Next, find out if all members have the same concerns and priorities and access to the necessary means. Then review actual risky hygiene conditions and practices and ask the people what they would like to change first. Keep in mind the educational approach needed (general meetings, participatory activities, informal interviews, observations and focus groups) and ask questions in a gender-specific way. It is important to include



opinion leaders on environmental health and hygiene, and representatives from each sector of the community.

The joint analysis of hygiene risks, especially when done in a participatory way, enables participants to bring out their knowledge and helps develop analytical and problem-solving skills for both educator and actors. Setting measurable objectives for particular conditions and practices, and monitoring change, help determine if improvements actually occur. *

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HYGIENE EDUCATION IN BANGLADESH

HYGIENE EDUCATION IN BANGLADESH

Marieke Boot

unicef

This case-study presents an overview of hygiene education in Bangladesh. The overview includes both hygiene education activities related to water and sanitation interventions and hygiene education activities in schools and non-formal education settings. In addition, the case-study covers the challenging programme on social mobilization that started a few years ago with the aim of creating mass support for sanitation.

The case-study identifies three main learning points for the development and improvement of hygiene education as part of water supply and sanitation programmes. These learning points are closely related to one another; they concern the effectiveness of the hygiene education, the competence and availability of staff at all levels and the organizational structure for sustainable hygiene education.



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Training review and needs assessment

The training review and needs assessment by Development Planners and Consultants (DPC) (1993) covers both Government of Bangladesh and NGO training programmes. The study indicates that internal training and staff development at DPHE are not yet institutionalized. Of the 5 Government agencies and 13 NGOs covered by the study, only 5 (all NGOs) provided their sanitation training curricula, and these were only course outlines, most of which were still in the draft stage. Training programmes—particularly those associated with the DPHE/UNICEF Integrated Approach—were not always well designed, often failing to allot sufficient time to the courses.

The DPC study found that while NGO instructors receive some training in communication and in the participatory approach, DPHE trainers failed to receive any training of this kind. The study team concluded that the training of trainers should be strengthened, especially with respect to 'software' issues. In addition, the training of field staff in communication, motivation and education methods should be intensified and make greater use of participatory approaches.

The study also found that the pre-service training of engineers requires reconsideration. The Bangladesh University of Engineering and Technology, the four Regional Institutes of Technology, and the 18 Polytechnic Institutes are the main training institutes for engineers working in the water supply and sanitation sector. The curricula of these technical institutes are 'hardware'-oriented, employing a conventional Western approach to sanitation. 'Software' aspects are virtually uncovered, but, the report noted, should be given increasingly greater attention in view of the new tasks of engineers and requirements for successful water and sanitation developments.

6.

In-depth review of a hygiene education activity: The Ramgoti experience

Because of an opportunity to visit the project area in the company of project staff, the Ramgoti experience was selected as an example for a review in greater depth of a hygiene education activity. In addition to discussions and observations in the field, this description of the Ramgoti experience is based on the following documents: Project in Agriculture, Rural Industry and Medicine (PRISM) Bangladesh, 1992; PRISM Bangladesh, 1993a; PRISM Bangladesh, 1993b. One advantage of using Ramgoti as an example of a hygiene education activity is that in addition to its hygiene education component, it also possesses a social mobilization component.

Set-up and organization

The programme

The Ramgoti Intensive Sanitation and Hygiene Promotion Programme ran from July 1992 to September 1993. It was supported by UNICEF with funds from the Australian Government and implemented by PRISM Bangladesh. PRISM is a young NGO with activities in agriculture and rural credit in six thanas of Chittagong Division—Ramgoti in Laxmipur District, among them. Following the 1991 cyclone, PRISM became actively involved in water supply, sanitation and hygiene education.

The Ramgoti programme had three main objectives:

1. Social mobilization and intensive hygiene and sanitation education through interpersonal communication with the entire population of Ramgoti Thana.
2. Better sanitation practices and behavioural changes:
 - increased use of tube-well water for all domestic purposes;
 - proper hand-washing practices with soap/ash before handling food and after defecation;
 - construction of sanitary latrines to be used by all family members;
 - improved personal hygiene practices.
3. Building an effective grass-roots organization and finding allies in the local administration, DPHE, schools, madrashas and mosques.

The population

Ramgoti Thana contains 85 villages and 56,549 households. The Moslem majority observes strict purdah, the traditional system of sequestering women to guard their honour and the honour of their families. In contrast, women of Ramgoti's Hindu minority face no religious obstacles to participating in public life, if they possess the self-confidence to do so.

Organization and staffing

Village sanitation motivators (VSMs) formed the backbone of the programme. Each VSM was responsible for communicating with about 425 individual households.

The 133 VSMs were selected from more than 3,000 applicants. Selection criteria included literacy, status in the community, communication skills and enthusiastic commitment to improved sanitation and hygiene practices. VSMs were required to devote six hours daily, six days a week to motivational work and to travel throughout the village using any available means. Given the cultural context in which VSMs were to function, it was decided to recruit as many female VSMs as possible. Ultimately, the female-to-male ratio among VSMs was 7 to 3.

The VSMs were supervised by one female and six male field sanitation supervisors (FSSs), who were responsible for the day-to-day guidance, on-the-job training and quality control of the motivation and education activities. FSSs' duties also included management, financial control and liaison with government agencies and other NGOs in the area. They were responsible to the thana sanitation coordinator, who carried overall responsibility for the programme activi-

ties, including training of FSSs and VSMs, monitoring of the process and the performance of the programme, and liaison and coordination with government agencies, especially DPHE. Overall coordination was in the hands of the sanitation programme coordinator based at PRISM Headquarters in Dhaka.

Immediately after recruitment, the thana sanitation coordinator and the seven FSSs received 18 days of basic training, covering programme orientation, promotion and use of safe water, sanitation and hygiene practices, techniques of interpersonal communication, community mobilization, planning, supervision and monitoring.

The VSMs received 11 days of pre-service training on the promotion of safe water, sanitation and hygiene, interpersonal communication and community mobilization. Two days of refresher training were given after the first month's fieldwork, followed by one day of refresher training after the third month and again two days after the sixth month.

Baseline survey

A baseline survey was carried out as part of the VSM pre-service training to assess the existing sanitation and hygiene conditions in the area. It was found that 78% of the households use tube-well water for drinking. However, only 1.5% use this source for all their domestic needs. Only 3% of the households had access to a sanitary latrine; 81% used an open latrine and 16% did not have any latrine at all. Nearly 4% of the households indicated that family members washed their hands with soap or ash after defecation and before handling food.

In view of the limited time available, the baseline study consisted of a brief household questionnaire. As it was realized that more in-depth information was required for an effective hygiene promotion programme, the VSMs used their first household visit to also discuss current ideas, beliefs and constraints with regard to water, sanitation and health.

Activities

Household visits

Because the programme was designed to reach every family through house-to-house visits at least four times during the project period, VSMs needed to visit at least six households a day. Some families indicated that they had been visited between 8 and 12 times during the project. The large number of visits probably resulted from the fact that the VSM lived close by.

During the first visit, the VSMs explained the programme and, using flip charts, discussed the benefits of safe water, sanitation and hygiene. This first visit was felt to be the most difficult. The VSMs found people reluctant to interrupt their household chores. Also, the VSMs had not fully grown into their roles as communicators and motivators. Female VSMs, in particular, experienced shyness during the first visits, feeling that their youth—most were younger than 25—made it difficult to establish credibility and gain a rapport with household members. But, as the VSMs gained experience and as their work became more widely known and more accepted by the community, they became more confident and the situation improved.

The VSMs' second visit, three weeks after the first, was intended to reinforce earlier messages and to motivate families to construct a sanitary latrine. (It had been thought important to have this second visit soon after the first in order to maintain and strengthen relationships, but experience revealed that this was not necessary.) The third visit followed after two to four months and the last visit two to three months after that.

A register, in which each visit was recorded, was maintained for each family by the VSM, who carried it when visiting the household in order to note any changes in the household. For its part, each household maintained a monitoring card, which was updated on each visit.

The FSSs organized twice-weekly (once-weekly, during the first month) meetings with the 19 or so VSMs they supervised. The meetings enabled the VSMs to share experiences and to discuss ways of tackling problems faced in the field. In addition, the FSSs accompanied their VSMs on household visits at least once a week in order to provide guidance and support. The VSMs tended to use the visits of the FSS to motivate families to build latrines, suggesting that the FSS would be unfavourably impressed unless action were taken before the FSS's next visit.

Social mobilization

Male 'seminars'

Since men usually work outside the home during the day and were thus unable to meet with the VSM, meetings were held once weekly for male members of the households visited that week. These so-called male seminars took up the

same issues that the VSMs had dealt with during household visits, but female VSMs often found leading these seminars a difficult task and appreciated support from their FSSs.

Involving men in sanitation and hygiene improvements turns out to be very important. Several women reported constructing a hygienic homemade latrine on their own initiative only to find that the men would not use it, claiming that they were only interested in ring/slab latrines, which were far too expensive for the household to purchase. In addition to resisting the use of homemade latrines, male household members, women reported, also tended to leave the hygiene training of children to mothers and older daughters. Thus, many fathers were criticized both for failing to provide good models for hygiene practices and for failing to take an active role in the hygiene training of their children.

Hygiene and sanitation classes in schools and madrasahs

FSSs, together with the family's VSM and local teachers, conducted bimonthly classes on hygiene and sanitation for children in primary and secondary schools and madrasahs. The main aim of the classes was to ensure maximum support for the programme activities. (Because schools were closed for a number of days on account of a national festival, no direct information could be obtained on these classes for this study.)

Involvement of religious leaders

At first, it was difficult to obtain the active support of the imams in the area, who were reluctant to accept women VSMs because it would require women to travel in public. However, through fruitful communications with the programme staff and because the VSMs showed that they did a

good job, the imams changed their minds and became very cooperative. Imams of the mosques included a discussion on hygiene and sanitation in their sermons before the Friday prayer. Also, on several occasions, the imams permitted male FSSs and VSMs to address prayer gatherings on the subject of sanitation and cleanliness.

Mass propaganda

Rallies and meetings were held for the general mobilization of the population in support of the programme during three consecutive days halfway through the programme period. Posters were displayed, leaflets distributed and processions held, followed by meetings with local authorities and Government officials.

Health Committees

Because the aim was to create a grass-roots organization that would survive after PRISM had phased out, the working area of each VSM was divided into four blocks, and each block set up its own Health Committee, consisting of 7 to 11 respected persons from the block area. It remains to be seen whether these committees will continue their activities now that the project is finished.

Progress and achievements

When the programme concluded at the end of September 1993, all households had been visited at least four times. In addition, an impressive number of meetings had been held with various audiences. A detailed overview of the total number of household visits and meetings is presented in Chapter 2.

Latrine construction and use

The main emphasis of the programme was on latrine promotion. The result was an increase in sanitary latrine coverage from 3% to 59%. To what extent this also implies an exclusive use of the latrines installed is not yet clear. A brief visit to two villages resulted in a mixed view. Some very nicely constructed and apparently used ring/slab and homemade latrines were observed, especially in the better-off Hindu village. None of the homemade latrines in the poorer Muslim village had a superstructure, but the women did not indicate that this was a problem, because the latrines were located behind the houses where nobody is supposed to go. Some of the homemade latrines had already collapsed due to heavy rains, adverse soil conditions and construction problems. Some others were not used or only partly used. As indicated above, men used the latrines less than women. All homemade latrines that were in use had a cover.

According to the men and women interviewed, the main reasons for latrine construction were prevention of flies, diarrhoea and bad smells. This contrasts with the usual reasons given for latrine construction, such as convenience, privacy and status, but the contrast is understandable in the circumstances. Most people already used some type of latrine, and thus the major change was from an unhygienic to a hygienic latrine.

Other hygiene practices

Other hygiene practices that were promoted included hand-washing with soap or ash after defecation and before handling food, the use of tube-well water for all domestic purposes and a clean household environment. To facilitate the

use of tube-well water, support was given to the construction of tube-wells in areas with low tube-well coverage and to tube-well repair. Support was also extended to the private sector to induce it to stock spare parts for tube-wells.

The figures in the overview in Chapter 2 show the achievements in hygiene practices. These figures have to be considered with the usual precautions, since judgements about the cleanliness of the household environment were based on the subjective assessment of the VSM, and assessments of water use and hand-washing practices were based on what the women themselves reported. One woman indicated, "We knew that we should wash hands with soap or ash, but now we also do it." Still, researchers can never be sure that people do what they say they are doing. An attempt was made to estimate hand-washing after defecation by looking at the availability of ash or soap in or near the latrine, but this was an unreliable indicator, especially where there was no superstructure. Also, the availability of ash or soap is not always a sign of use: its presence may indicate a desire to please the VSM.

Coordination and collaboration

The programme was coordinated with the thana administration, DPHE (EE and SAE) and the Ministry of Health through meetings and reports. However, this did not result in collaboration and integration of activities. For example, PRISM would hold a meeting and invite the SAE to participate, and vice versa, rather than organizing a combined meeting. There was no cooperation between the TWMs and the VSMs, and the DPHE division health educator was never seen. Clearly, DPHE acknowledged the work by PRISM but

at the same time felt that motivation should be under its own aegis, with motivational staff directly responsible to it.

Also, there was no cooperation between the VSMs and the HAs and FWAs, although the union chairmen instructed the HAs and FWAs to work together with PRISM. A compounding problem was that even though hygiene education is clearly part of PHC, and the HAs are supervised by health instructors who have prime responsibility for hygiene education, HAs and FWAs do not see hygiene education as part of their duties.

Coordination and collaboration with other NGOs in the area were more profitable. They helped each other in tube-well construction and rehabilitation and in the provision and setting of uniform prices for ring/slab latrines.

Financial costs and lessons learned

Costs

The total costs of this one-year programme amounted to US\$100,540. Personnel costs were by far the largest item, as shown below:

Personnel	70%
Transport and travelling	11%
Organization and management	7%
Programme publicity and dissemination of materials	5%
Training FSSs and VSMs	4%
Baseline, reporting, fuel, etc.	2%
Seminars and meetings	1%

The future

The question is now how to go forward. The project is finished, much is achieved, but much remains to be done. Homemade latrines have to be replaced regularly, and sustained hygiene practices take time to develop. PRISM itself indicates that without further Government or NGO support the programme is not yet sustainable. As donor funds are depleted, PRISM will continue on its own with 24 VSMS, 1 FSS and 2 agricultural supervisors, who will mainly work through group discussions and in cooperation with the imams, schoolteachers, SAEs, HAs, FWAs, union chairmen, thana education officers and thana administration. The deputy commissioner of Laxmipur District has targeted the whole district for intensive sanitation promotion, and Ramgoti has been brought under this scheme.

Because the implementation model of the Intensive Sanitation and Health Promotion Programme proved to be quite effective, it will be replicated in a second thana of Laxmipur District, again with UNICEF funds, and again for one year. Some minor changes will be made:

- The programme will start with briefing seminars at thana, union and village levels to solicit the interest and cooperation of local authorities, Government and non-government staff and the population at large. In line with the Integrated Approach, Water, Sanitation and Hygiene Education Committees will be established at each level. The purpose is to get more community participation and to create more interest among Government staff for sanitation and hygiene.
- The total number of visits will be increased from four to six to allow more time for motivation and

demonstration of hygiene improvements. Only the first round will be individual household visits, while subsequent rounds will consist of group discussions. The people are in favour of group discussions because they are more interesting and enjoyable and allow for a better exchange of views. Group discussions will also save a lot of time, thus increasing the cost-effectiveness of the programme. However, the VSMS prefer individual household visits because they find it difficult to manage a group discussion. Thus, the VSMS will need additional skills in interpersonal communication.

- The availability of a sufficient number of ring/slab latrines to meet the rising demand during the motivational campaign will receive more, and more timely, attention.

7.

Learning points

What did we learn from this review of current hygiene education in Bangladesh? Without trying to give a complete overview—the various chapters are full of learning experiences—this chapter will look into three main points that are especially important for the development and improvement of hygiene education as part of water supply and sanitation programmes. Although the learning points are based on the Bangladesh experience, they have been broadened and lifted to a more general level.

1. Effectiveness

Much more is needed for effective hygiene education. Hygiene education effectiveness does not follow automatically from an increased acknowledgement of its importance.

Although there is a general consensus that hygiene education is essential for achieving health and socio-economic benefits from water supply and sanitation programmes, the conceptual framework, factual knowledge and material inputs needed to make hygiene education work are generally lacking.

Maybe we first should specify what is meant by 'general consensus'. In fact, the level of consensus ranges from a deep conviction that hygiene education is essential, to mere lip-service to a current trend. Donor organizations are instrumental in creating more support for the importance of integrating hygiene education into water supply and sanitation programmes. Country organizations respond to the gentle pressure of donor organizations, and whether they do so wholeheartedly or for the sake of good donor relationships is subordinate to the overriding constraint that the country's priorities are elsewhere.

A compounding problem is the generally limited understanding of what hygiene education really is. A common answer to my question concerning the nature of the major constraints on effective hygiene education is the poverty and the low literacy rate of the people. Surprisingly, this answer was common both among engineering/technical staff and among health staff. The answer not only shows that there is little understanding of hygiene education; it also implies that major constraints are beyond their sphere of influence. Thus, there were also few ideas for hygiene education improvements: only requests for more manpower and more audiovisual tools and equipment to increase the capacity for imparting knowledge to an ignorant people.

With low commitment to and little idea about what constitutes effective hygiene education, it is quite understandable

that essential ingredients for effective hygiene education are not always present, and if they are present, they are not always used in the right order or mix. The review showed that there is not much hygiene education planning: clear objectives or a realistic work plan are generally lacking; education activities are usually limited to imparting information; field staff training and supervision are minimal, and monitoring and evaluation are virtually non-existent.

Of course, there are exceptions, and there are some positive examples to build on and learn from. In addition, there seems to be a good deal of room for learning from and making use of developments in non-formal education, especially with regard to education methods and tools.

2. Staff

Hygiene education will stand a chance of being effective only when there is staff that can do a good job. This may be obvious, but it is also a serious constraint, intimately related to the constraints mentioned above. The reality is that at all levels there is a lack of staff that can do a good job.

At the level of development, coordination and management of hygiene education, we need staff that have clear insights into the preconditions and requirements for effective hygiene education. They need to be able to set priorities and make realistic plans. In addition, they need to have the authority and means to translate plans into action. Problems at this level are that sufficient staff that meet these requirements are not available and that the institutional setting is not conducive to giving this staff the authority it needs (see also the next point).

At the field level, we need committed staff with sufficient baggage and backup to create hygiene education and motivation learning opportunities for specific target groups. Staff commitment shows a mixed picture. On the one hand, we find staff whose own motivation leads to their commitment, and we have seen that the success of the Integrated Approach and the Intensive Sanitation Mobilization is very much dependent on these staff. On the other hand—and this seems to be the more general picture—we find staff who do not consider health and hygiene education one of their duties. Pre-service and in-service training—if any is provided—are not sufficient to equip staff with the necessary skills, attitude and knowledge. Working conditions and career structure do not stimulate staff to be more active educators and motivators. Lack of supervision and monitoring paves the way to disregarding hygiene education tasks and activities.

One way of overcoming the field-level staff problem is to turn to NGO staff. This may be the way out, at least in the short run, but only when the right NGOs are selected and realistic demands are made on them. This requires appropriate staff at central level to be in place. In the long run, this will not provide a sustainable solution, unless the involvement of NGOs is institutionalized. But such institutionalization may jeopardize the strengths of NGOs and, ultimately, the reason for their involvement.

3. *Organizational structure*

Institutional weakness is a characteristic of most hygiene education, and this has everything to do with the constraints discussed above. From an outsider's point of view, it may

be self-evident that only the Ministry of Health can be the right home for health and hygiene education, with the ministries responsible for water, sanitation and education having supporting, enabling and contributing roles. However, reality is never simple, and certainly not in this case. The organizational structure of hygiene education—or the lack of it—is a complicated problem that does not stand a chance of being solved in the foreseeable future. It may be that this problem can only be overcome when there is a political and social change in the direction of greater emphasis on preventive health and primary health care. Until then, one must make do, but what is best done may require more consideration based on an open mind, imagination and will.

Social mobilization

The above points are specifically concerned with hygiene education. To a certain extent they are also learning points for social mobilization and require due attention to ensure that the ambitious and important programme of social mobilization for sanitation is more than a balloon that will grow and grow but in the end will burst, leaving behind much less than hoped for. The programme has much potential; the challenge is to make it work, and to do so beyond the level of mere latrine construction, with the goal of safe excreta disposal by all as an enduring practice for the future.

Block 2 : Sustainability Issues

Sunday, September 15, Session C and D

- Subject title** : Operation and Maintenance Systems
- Type of session** : Lecture with discussions and a group exercise
- Objectives** :
- Participants are able to define and explain key issues for a viable operation and maintenance system with involvement of user communities and local private sector.
 - Participants are able to design a basic O&M system.

Increased coverage over the last fifteen years has caused an increasing O&M burden. As a result maintenance is often poor, the investments are not optimally used and benefits not realized. Various agencies are involved in determining issues and principles of importance for the improvement of operation and maintenance. The need to develop viable O&M systems at minimum costs, results in a trend to maximize community roles in O&M, leading to innovative solutions. Community-based maintenance systems need careful assessment before being put into practice, as their success often largely depends on factors outside control of communities. The potential role of private sector agencies is presented. Monitoring functioning of the water supply system is of crucial importance for the development of a maintenance system.

- Hand-out** :
- Summary of principal O&M issues
 - Exercise hand-outs

September 7 - 27, 1996, Kandy, Sri Lanka

MANAGEMENT FOR SUSTAINABILITY IN WATER SUPPLY AND SANITATION PROGRAMMES

OPERATION & MAINTENANCE SYSTEMS

1.0 INTRODUCTION

The effective operation and maintenance is very important in ensuring long term sustainability of water supply and sanitation systems. The neglected systems had always being gradually deteriorated and had given a poor level of service, to the end users.

In many countries always new constructions had been given priority over the O&M of the existing systems. Therefore a considerable portion of national budgets had to be diverted to rehabilitate these deteriorated systems rather than investments on new schemes. Many developing countries have become regular victims of this viscous circle retarding their own national programmes to increase the percentage of water supply coverage. Therefore during the decade more emphasis is placed on consolidating and improving of O&M in existing systems.

2.0 DEFINITION OF O&M

Operation is every day running and handling of a water supply, which involves operations required to convey safe drinking water to the end users. The proper operation procedure always ensures optimum use of the existing resources and also contributes to reductions on breakdowns and maintenance, needs and ensure maximum user convenience. Maintenance is the activity required to sustain the water supply on a proper operational condition. This could be divided into three main categories namely

- a) Preventive maintenance which involves regular inspection and servicing to preserve assets and minimize break downs.
- b) Corrective maintenance which involves minor repairs and replacement of broken and wash out parts to sustain reliable facilities.
- c) Crisis maintenance which involves unplanned responses to emergency breakdowns and user complaints to restore a failed supply.

Rehabilitation is required for a system, When it is necessary to correct major defects and the complete replacement of equipment to bring to the original level of service. On many instances negligence of basic O&M functions had led to early overhaul or rehabilitation of the existing systems.

3.0 ECONOMICS OF MAINTENANCE

It is always necessary to consider the economics of maintenance. When planning a maintenance programme for any existing O&M system. Maintenance will become uneconomic if the long term cost of rehabilitation and subsequent operation is less costly than continued repair and maintenance. However in the case where new equipments for rehabilitation had to be imported in to a country with restrictions for imports, this matter has to be considered very carefully before embarking on rehabilitation of the systems.

4.0 SUSTAINABILITY OF THE WSS

The long term sustainability of the improved water supply and sanitation facilities depend on the following key factors.

- 1) Sustainability of the technology
- 2) Sustainability of the environment
- 3) Effectiveness of the institutional arrangement
- 4) Financial viability of the system

4.1 Sustainability of the Technology

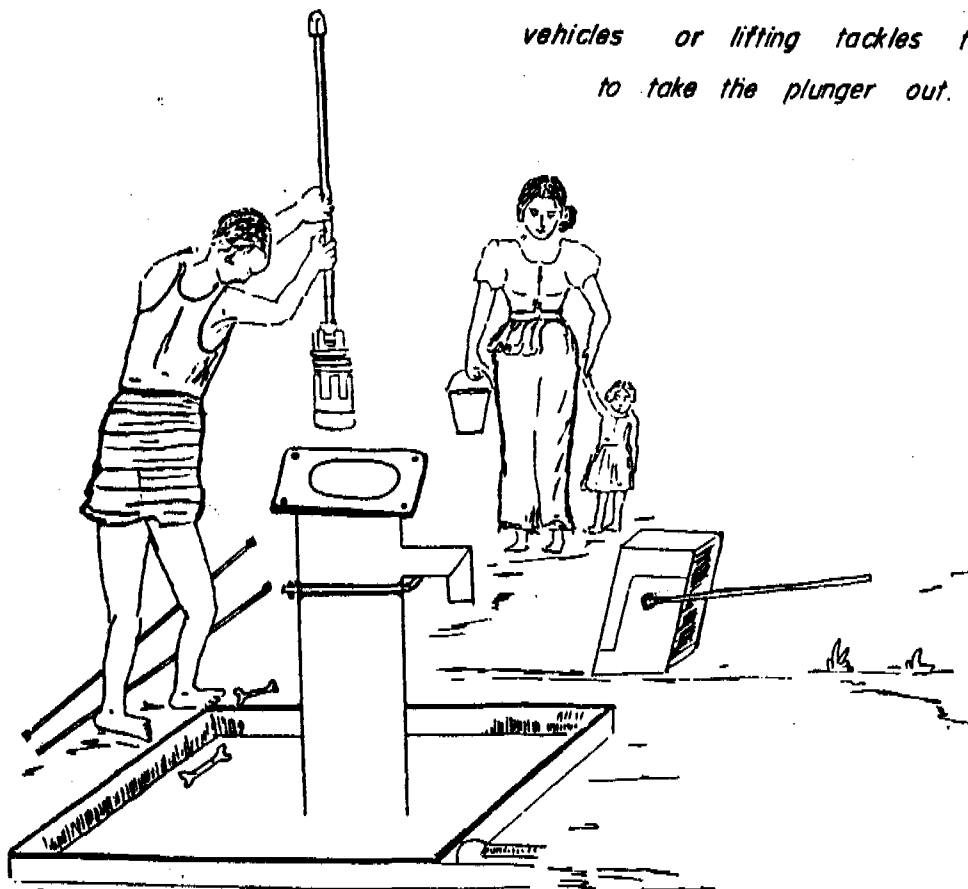
For the technology to be sustainable it is always better that the technology is adapted or evolved within the community system, rather than introducing imported technology from a developed country. Also it has to be simple and affordable to the community and skills for the maintenance of the technology is available within the community. Spares also should be freely available at the locality, which also calls for standardization policy within the country or the region.

The main criteria governing the above consideration are the "down time" and the "cost of maintenance of the facility".

If the beneficiaries have to be dependent on an agency for maintenance and repairs due to the complexity of the technology, then down time of the facility will be longer. The beneficiaries will be compelled to divert to old polluted sources for a considerable period. On the other hand an efficient repair system could be introduced with additional costs in which the beneficiaries could not afford. A locally made system which required maintenance quite frequently may be a better option than importing a superior technology which cannot have local level spare parts supply at an affordable cost.

User convenience on the technology used is the other important criterion in designing the technology. (eg. Facility which cannot be repaired or operated by women might be rejected by the community in long term)

OTC type version of Hand Pumps were used for facilitating easy repairs by the villagers without external support for back up vehicles or lifting tackles to take the plunger out.



The community should acquire technical skills and have tools to maintain and repair the facility independently. Unlike employees of an agency a longer time period will be required for the technological empowerment of the community by the development of the capacity at the local level.

4.2 Sustainability of the Environment

Environment should be given priority in development of any water supply and sanitation systems. It is always required to ensure that water consumed is not over exploited from the source, but naturally replenished. (eg. over exploitation of ground water leads to gradual drying up of nearby areas reducing the ground water level) Secondly, the waste water from the water system might create environmental problems such as erosion of the area and also pollution on down-stream if due consideration are not given when deciding water points for beneficiary use.

The other important environmental factor influencing sustainability of a water system is source protection at the upstream to avoid pollution and deforestation. The polluted sources have always threatened the lives of the beneficiaries and deforestation has gradually created erosion upstream thus gradually reducing the yield of the source. Encouraging beneficiaries to protect their environment on a broader sense will guarantee long term equilibrium of the system.

4.3 Financial Viability

4.3.1 Requirement of Funds

Generally, funds are required to cover all the cost involved in O&M O&M will include the following costs depending on the situation:

- a) Payment for caretakers
- b) Spare parts for repairs
- c) Replacements
- d) Energy (Electricity/Fuel)
- e) Chemicals
- f) Transport
- g) Monitoring
- h) Extension services
- i) Training

In the rural villages requirement of cash contribution is small compared to the case of small towns and major cities as the beneficiaries will contribute free labour and material for the maintenance. Generally at the rural and peri-urban level users are required to bear almost all the direct and local level costs. And the government needs to bear the costs of activities such as monitoring extension services and training.

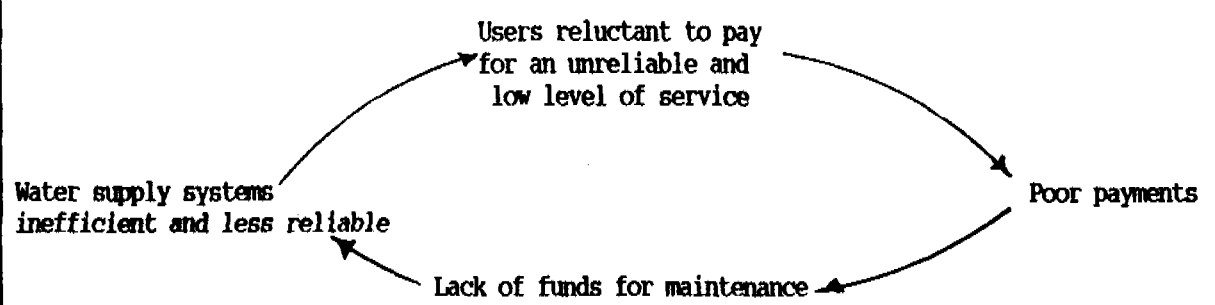
4.3.2 Why should users pay for maintenance?

The conventional free water and free service concept by the governments has deteriorated tendency for users bearing cost of maintenance. The centralized maintenance systems in some countries which cross subsidize the recurrent cost has shown to be less productive and not sustainable. The trend is to pass the operation and maintenance cost to the user than subsidizing that from some other funding sources.

The case for user payments justifies with following interconnected arguments.

- * The capital funds which are currently made available are inadequate to provide safe water supply for everyone due to very low level water supply coverage.
- * Public funds which are currently made available are inadequate to meet the full recurrent costs.
- * Subsidies reduce the decision making power that users might have if they were paying for the service and this might lead to centralized bureaucracy.
- * Subsidies discourage cost-efficiency and the development of low cost solutions. This also might lead to construction of inviable politically motivated water schemes.
- * Many poor people already pay high rate for services and past evidence suggest they would be willing and able to pay for improved services when there is a real need.
- * Properly regulated user charges would allow the provision of better services at a lower cost to the poor.
- * Payments may increase the commitment of users to the sound managements and efficient use of systems with the feeling on ownership.
- * User payments maximize the use of local resources such as cheaper skills, materials and the equipments at the village level.
- * This also will create market dynamism within the water sector catering the real demand for water supply.

THE VICTIOUS CYCLE OF UNDER FUNDED AND POORLY MAINTAINED WATER SUPPLY SYSTEMS



Adapted from IRC publication "Making your water supply work"

4.3.3 Affordability and Willingness to Pay

The level of affordability of a community for paying for operation of a water scheme might change depending on following factors.

- a) Scarcity and need for pure water
- b) Economic level
- c) Specific cultural and social requirement

It is said that in order to balance the other requirement of an ordinary consumer life a user should not pay more than three to five percent of their monthly income for water and sanitation services.

The other important aspect is user's willingness to pay for the cost of O&M. This also will depend on following factors.

- a) Whether it is worth for paying the improved level of service and the improved user convenience.
- b) Stable national and regional level cost recovery policy on O&M.
- c) Comparison of the O&M cost with the neighboring areas.
- d) Acceptability of the existing sources in use.
- e) Confidence on the community organization or the maintenance agency.
- f) Lack of community cohesion.
- g) Policy environment.
- h) Perception of ownership and responsibility.

4.3.4 Pricing Policy

The pricing policy has to be decided to cover whole or part of the O&M costs mentioned in the earlier chapter. In order to decide on the water price the consumer committee or the institution concerned should prepare annual budgets and decide on strategy for O&M cost recovery.

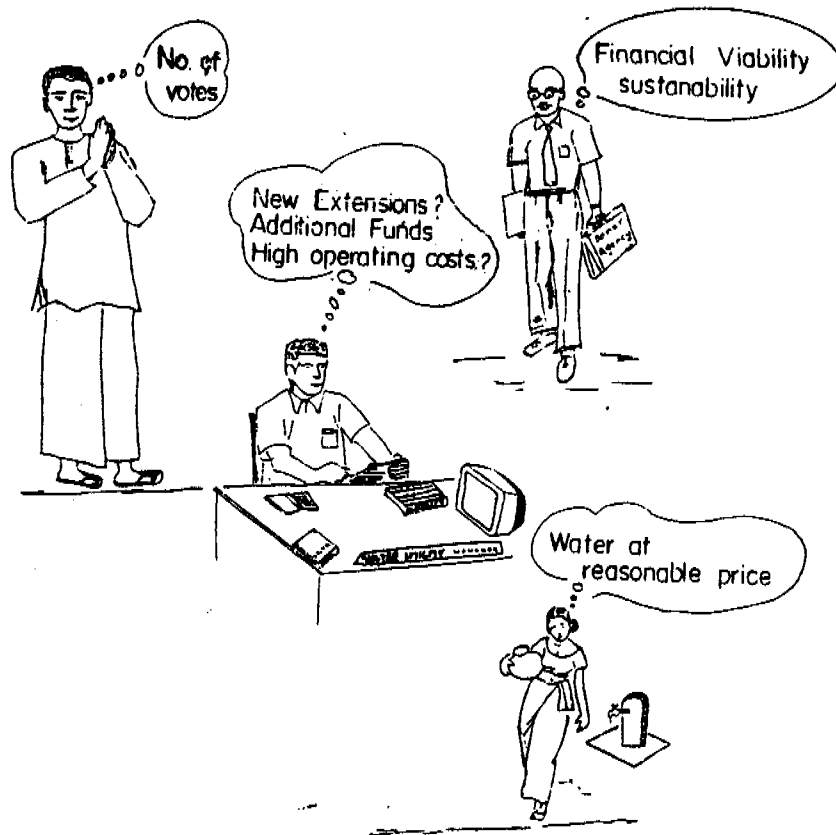
A water rate could be collected in many ways based on the social, geographical and economical considerations.

- a) A flat rate per user household.
- b) A flat rate per adult in each user household.
- c) A graded rate for different households.
- d) A graded rate based on metered consumption.

Adapted from IRC Publication " Making Your Water Supply Work"

Many tariff policies could be worked out based on the total cost which has to be recovered. It is also required to account for non-recoverable percentage when the system becomes larger. However, for the water supply system to be viable the basic philosophy in any pricing policy should be that,

O&M costs \leq Revenue from the users



In many countries increase of an existing maintenance fee might disturb the prevailing social and political situations. Due consideration shall be given for different players such as politicians, users, maintenance institutions and Donor agencies. This will guarantee the success of the implementation of the cost recovery policy.

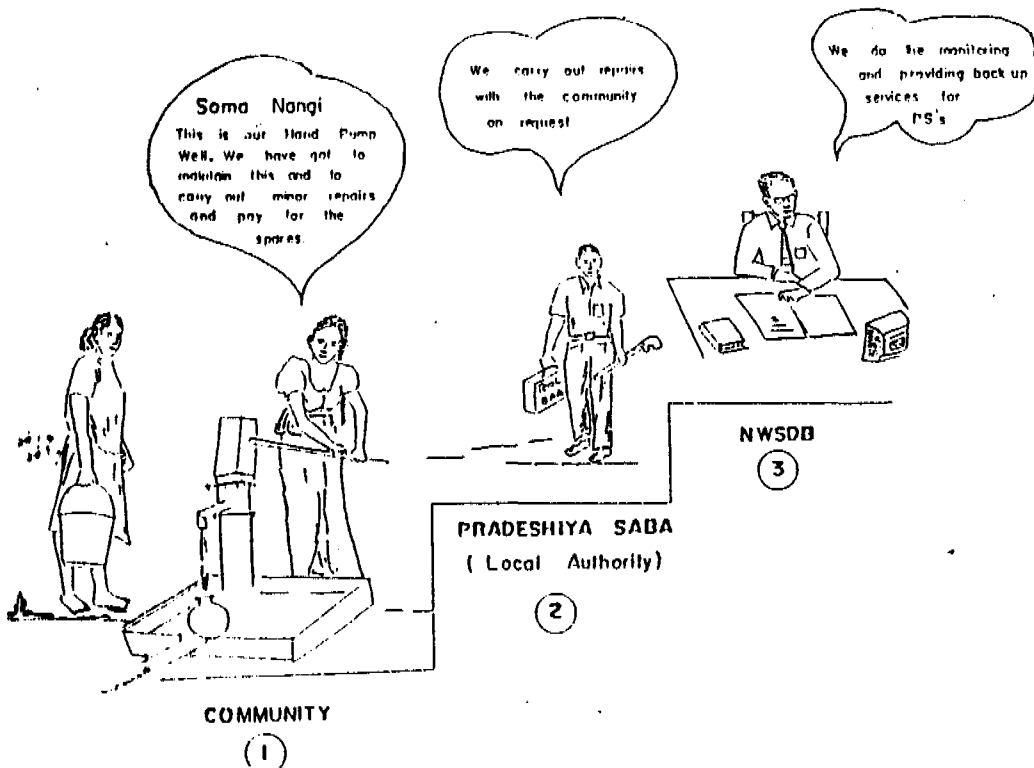
4.4 EFFECTIVENESS OF THE INSTITUTIONAL ARRANGEMENT

For any water supply system to be sustainable the institutions concerned should play an active role in O&M. The institution could be either a national or regional level agency or a well organized water committee or a private operator or Non Governmental Organization.

4.4.1 MANAGEMENT MODELS FOR O&M

Different programmes might adopt their own management model for the O&M based on the situation. The effectiveness of a particular model will depend on active roles played by all the partners. The main tier is the community organization. The second tier will be regional or local bodies while the third tier could be a central government agency. In order to ensure more autonomy at the local level and empowering the beneficiaries in decision making process second and third tiers should be gradually limited to supporting and monitoring roles. The selection of a different management model has to be done very carefully with following considerations.

- a) Type of technology
- b) Geographical distribution of the community
- c) Accessibility
- d) Leadership quality and the self reliance at the community level
- e) Cost of maintenance
- f) Political wish
- g) National or regional level sector policies.



4.4.2 COMMUNITY MANAGEMENT OF WSS

In most of the rural water supply systems the institution responsible for the maintenance could be a water committee appointed by the beneficiaries. The sustainability of these institutions within the community will be an important factor in the long run. The water system should not cover a considerably large geographical area, which does not ensure mutual understanding within the beneficiaries. Rural communities can be either compact villages or scattered settlements. The distribution of people in a community can have an important influence on the choice of technology and O&M management mechanism. The degree of community cohesion can be critical factor in deciding the type of water supply and how it should be executed and managed. Two conflicting communities due to political, social and economical reasons might find it difficult to own and manage one common water system.

Further management of a large scheme supplying several section of a village or several communities may be far more complex than the management of a small system. Although it may be economical to go for a large scheme, to supply water to many communities it may be more suitable to have several pipe net works for different groups from the community management perspective. However, special consideration could be given for some larger communities who can work on better collaboration.

Consideration should be given for traditional leadership in establishing community management structures depending on the requirement. In some countries when existing traditional management systems are by-passed, the functioning of a water supply system had to be completely dependent on government agencies.

In a fairly large piped distribution network an executive committee could take the overall responsibility of the management.

The main water committee should be socially and politically acceptable within the village for the O&M and empowered to collect a fee for establishing a maintenance fund. The ownership of the water supply and the operation of the water committee has to be legalized by the government to ensure due recognition for the operations.

In some cases the community interest and the enthusiasm for up keeping the facility might fade away gradually with time. Some members might ignore their due payments for the maintenance fund. However, with proper internal monitoring and controlling system such problems could be solved at the community level.

In some occasion liveliness of the consumer committee was maintained by carrying out a secondary function such as operating a small scale loan system within the members of the committee. Only the persons who contributed to the maintenance fund enjoyed the privileged of obtaining a loan from the fund during emergencies where by forcing other members to actively participate in contribution to the O&M.

Another issue governing the sustainability of a water committee is whether such a committee has been created by others or introduced externally, than evolving such a organization within the community. Many times the committees established by outsiders for the sake of handing over of the O&M responsibility to the community had been least effective in real operation. With a demand-driven programme it will be very much easier to form a better sustainable and effective consumer committee within the beneficiaries.

4.4.3 Government Agencies

The Government national/regional/local level Agencies are playing to different variety of roles. Presently in many countries the sector agencies are involved on all or part of following activities.

- a) New construction in rural areas.
- b) Construction on urban and peri-urban areas.
- c) Operation and maintenance of Rural WSS
- d) Operation and maintenance of peri-urban WSS
- e) Operation and maintenance of Urban WSS
- f) Rural sanitation and Health education
- g) Urban Sanitation
- h) Monitoring Training and Advisory
- i) Regulatory Activity.

If the same agency has to carry out wide spectrum of activities and play different roles. It might be a larger organization

Generally Larger Government organizations are found to be inefficient and less productive with highly centralized and hierarchy management structures. Also multifunctional systems have always become larger. Such organizations have become inflexible and had become the reason for stagnate water and sanitation sector. It will be always be better that above responsibilities are shared between few other smaller agencies and several non governmental actors, in order to create a more dynamic and productive water sector. However, there should be proper coordination and demarcation of roles and responsibilities for different players to ensure effective operation of such systems, with effective regulatory mechanism.

4.4.4 Private Sector.

The private sector comprises wide range of individuals and companies from village artisan to large companies carrying out different services for the water sector.

The private sector will be efficient in delivering the required services by practicing their own enterpruner skills. On the other hand they will always look for a considerable profit margin for carrying out their activities.

If the private sector is properly guided and regulated their potential in management and technology could be harnessed in a predefined frame work.

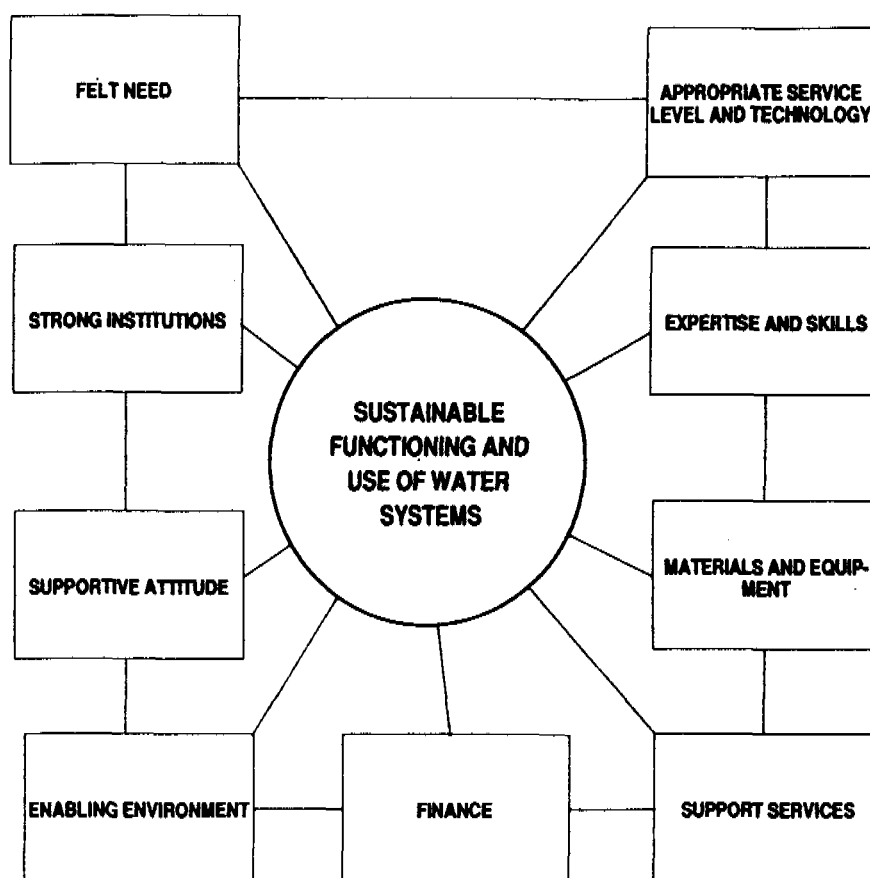
4.4.5 Non Governmental organisations

During last decade use of non-governmental agencies in water and sanitation sector have increase in many countries in development work. The NGO's have better capacities to mobilize communities and identify problems and implement programmes through complete involvement of the beneficiary community. Also they have additional capacity to adapt to new trends and environments.

In few development programmes in Sri Lanka, NGO's are playing the former role played by the Government Agencies as implementor and limiting the role of the Government to the facilitator. NGO's also could be used as one potential partner in supporting operation and maintenance.

II. O&M IN WIDER SETTING OF SUSTAINABILITY

Poor operation and maintenance is often seen as the sole cause of failure of the water facilities. Actually, poor O&M is the result of a series of mistakes and short-comings in the approach and implementation of the programmes and projects. The inter-relationship between the key issues relevant for proper functioning and use of the rural water systems are given below. All key issues have elements for users, community and water agencies.



Felt need

Expressed need for improved water supply; agency has willingness to support the communities in improving their water supplies

Strong institutions

Community with recognized and effective leadership, good organization and all groups represented;
agency has defined responsibility, legal framework for autonomous organization and control

Supportive attitude

Partnership approach to assist villages and acceptance of roles, responsibilities and ownership

Enabling environment

Political will for community managed systems; clear policies; strategies; legal framework for ownership; backstopping role

Appropriate service level and appropriate technology

Financially and technically feasible and sustainable technology and service level; effective demand as decided by community

Expertise and skills

At community level: managerial, financial and technical skills
at agency level: planning, implementation and backstopping skills;
for private sector implementation and technical repair skills

Materials and equipment

Readily and locally available and affordable materials, and spare parts and tools for O&M

Support services

At community, agency and private sector level: back-up for more complicated maintenance and repairs; training; monitoring

Finance

Community level: to manage system including payment for O&M activities; agency level: to finance activities for planning, training and backstopping and monitoring

Addressing only the direct O&M elements (i.e. technical skill training, spare parts availability) will most probably not result in continuing functioning of the water supply systems, and therefore not increase the cost-effectiveness.

III. THE CHALLENGE

The challenge is to aim at sustainable development of the rural water sector using O&M is an entry and not as a goal in itself. Only then the high rates of breakdown and downtime will be diverted and functioning and use of the rural water systems will be sustained. Direct measurable results will be including minimized breakdowns, lower O&M costs and optimal socio-economic and health benefits for the users.

This challenge was clearly expressed during the Delhi Conference in 1990. There a statement was issued, called "**Towards a new philosophy on Operation and Maintenance**". The statement indicated three fundamental changes to take place for the water authorities supplying water in the urban areas and the agencies active in the rural areas.

- ◆ the water agencies should change their orientation and begin to perceive of their primary role, in case of urban water authorities, as provider of a service to people and not the constructor of physical works, and for water agencies in rural areas as facilitators in a process for and not provider of improved water systems
- ◆ the water authorities and committees should become autonomous in efficient and transparent management and financing of the services;
- ◆ the water authorities (urban) and agencies (rural) should provide integrated water and sanitation services only in response to effective demand of the consumer.

IV. ISSUES TO CONSIDER IN IMPROVING O&M SYSTEMS:

a. O&M costs

depend on:

- ◆ definition of O&M costs:
 - direct costs of O&M and repairs
 - labour: staff, contractors
 - equipment, machinery
 - consumables: chemicals, fuel, electricity etc.
 - materials,
 - utilities: office, workshops, laboratory
 - transport: for personnel, materials, chemicals
 - depreciation, replacement costs of parts
 - expansion distribution network,
 - upgrading to higher service levels
 - ◆ age and quality of systems
- > scheme-specific maintenance procedures
(reference: WASH report 48, 1989)

b. O&M financing

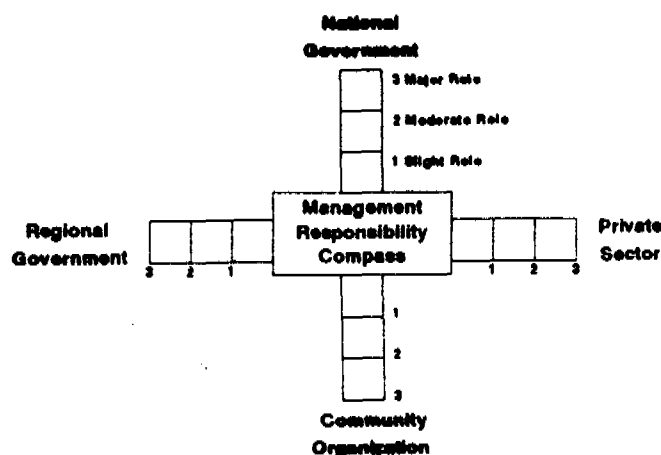
- ◆ who pays for what? cost recovery versus resource coverage and cost-sharing
 - > need for clear agreement between actors
- ◆ ability and willingness to pay (perception of benefits)
- ◆ community-based financial management
 - * Tariff setting
 - * revenue collection; funds; bank accounts
 - * accountability and transparency
- ◆ national and regional economies:
 - * inflation: rise of prices
 - * income-security
 - * unemployment

c. Organizational aspects of O&M

- ◆ Organizational adaptation to change situation that O&M staff is in short and has low status
 - > separate O&M division for water authority
 - > small more training-oriented and assisting O&M team for rural areas
- ◆ decentralization of authority
 - from central to regional/district management
 - from agency-management to community management
 - from community-managed to authority-managed (autonomous)
- ◆ identification of activities: including (not exhaustive)
 - proper operation of tap - handpump - rope pump - etc.
 - proper functioning of intake, drainage etc
 - control functioning of system for leakage etc.
 - minor repairs
 - major repairs

- production spares
 - distribution spares
 - purchase spares
 - financial systems
 - monitoring
 - surveillance e.g. water quality
 - training
- ◆ identification of potential actors for partnership and division of tasks:
 - individual users
 - user group
 - cooperatives
 - private entrepreneurs: mechanics, plumbers, masons, shop-keepers etc.
 - private contractors
 - NGOs
 - district and other government departments
 - others
 - ◆ clear agreement on management responsibilities of roles/tasks: partnership (see figure: management models and tiers of responsibility)

Star Diagram



- ◆ establish clear O&M procedures for equipment
- ◆ development and use of O&M manuals
- ◆ training for O&M:
 - * capacity development at water agency (organization, planning, monitoring, training, technical support)
 - * capacity development on community management (organization, management, finance, monitoring)
 - * capacity development on technical skills required for O&M
- ◆ involvement of the private sector (both in rural and urban situations)
 - * encouragement and support
 - * capacity
 - * interest (profits)
 - * role: construction, drilling, running, maintenance
 - * regulatory control
 - * standardization in design and bills of quantity
 - * construction quality control and commissioning

- ◆ spare parts availability
 - * local manufacturing
 - * quality control and standardization
 - * reliability in supply and distribution
 - * costs of spare parts
- ◆ local manufacturing of spare parts/tools
- ◆ standardization of equipment

d. Community participation in O&M

Community management:

- ◆ tap \ borehole \ well committees
- ◆ caretakers
- ◆ village-based mechanics
- ◆ financial management
- ◆ community-based monitoring on functioning and use
- ◆ leak detection, illegal connections and free supply
- ◆ water quality surveillance (incl. recontamination)
- ◆ water treatment operators
- ◆ water preservation \ conservation
- ◆ pollution control
- ◆ water resource management

e. Policies and legislation

Need for sound and clearly-defined policies and legislation on:

- ◆ responsibilities of communities and the ownership of water systems
- ◆ technology choice procedure
- ◆ role of private sector
- ◆ cost recovery systems
- ◆ role of government including their supporting role

f. Monitoring O&M

at two levels: * community-management level or water authority level
* water agency level

formulate purpose: for what, for whom?

Keep monitoring simple and reduce number of indicators.

some indicators:

- ◆ down time
- ◆ parts needed
- ◆ costs for parts
- ◆ costs per consumer or cubic metre water delivered (example Ghana)
- ◆ availability of replacement skills
- ◆ availability of operational skills

g. Technology selection

- ◆ options of technologies technically (hydro-geological) possible in community
- ◆ options of technologies financially possible in community
- ◆ ability and willingness to pay for service by the users
- ◆ management capacities
- ◆ social/cultural acceptability and preference for technology and service level
- ◆ capacity of the water agency and private sector to render sustainable service
- ◆ village/users decide on technology and management of their water system

V. O&M SYSTEM DEVELOPMENT

Although global problems and solutions could be indicated, each country faces its specific problems and constraints resulting from prevailing conditions. Therefore a process aiming at improvement or optimization of the country-specific O&M system could be considered. At a national or regional/project level workshops constraints and problems will be identified and some solutions will be found, a step will be made in the direction of an improved O&M system.

For the improvement of the O&M system four main phases could be identified:

- * Phase 1: review the existing O&M situation and indicate possible solutions
- * Phase 2: develop a preliminary O&M system including issues related to the wider setting
- * Phase 3: test this O&M system on feasibility
- * Phase 4: expand the application of the field-tested O&M system

Each phases will have a number of activities and outcomes, leading to a flexible and region-adaptable O&M system which needs regular adjustment for improvement. Each phase should also have workshops and seminars to discuss with decision-makers and key-sector staff policy issues and managerial, financial and technical implications etc.

Some key issues in O&M system development

- * Technology selection
- * O&M management models: activities and actors
- * Ownership
- * Finance
- * Information exchange

EXERCISE ON OPERATION AND MAINTENANCE

SUSTAINABILITY RISKS ANALYSIS OF COMMUNITY-MANAGED OPERATION AND MAINTENANCE FOR DIFFERENT RURAL WATER SUPPLY TECHNOLOGIES

setting in rural area:

(several villages);

- rural community with 2500 inhabitants
- subsistence agriculture and some additional income from sale of crops and vegetables, livestock and poultry;
- reasonable developed community organization (cooperatives);
- at present limited technical capacity;
- no hardware shops in community;
- distance from major district town is 150 km;

technology: geo-hydrological and hydrological conditions are suitable for all indicated technologies

community responsibilities:

(this may be not fully the case as yet, but the departments have to work towards that)

1. preventive maintenance
2. minor repairs
3. major repairs
4. replacement of hardware

ASSIGNMENT:

step 1: Mention for each of the (i) preventive maintenance, (ii) minor repairs, and (iii) major repairs, *two major maintenance activities* in community-managed O&M.

step 2: each O&M responsibility will be further tested for sustainability risks on
M= availability of required materials/tools to carry out O&M
S= technical skills required to carry out O&M
C= costs involved in O&M
assign for each risk field one of the following ratings:
high risk : 3
medium risk: 2
low risk : 1

Include in your presentation the arguments for your rating!

step 3: conclude on O&M sustainability of the different rural water supply technologies for the specific location.

OPERATION AND MAINTENANCE EXERCISE**GROUP 1 AND 2**

You get 45 minutes for the groupwork.

Group 1: Gravity-fed piped water system supplying to several communities

Take the situation as given on the "overview" handout.

Group 2: Community water supply using boreholes with VLOM handpump

Take the situation in East Africa.

Assignment:

- step 1: Give the present responsible actors for the O&M tasks versus the indicated water supply system components.
Fill out the table in the "present" column by using the actors' number.
- step 2: Is this distribution of tasks sustainable in the long run, if we look at it from a financial, manpower and organizational/ managerial point of view?
Discuss.
- step 3: Discuss in the group a new division of O&M tasks among actors which is more sustainable than the present situation. Fill out the table in the "improved" column by using the actors' number.
- step 4: What are the implications, i.e. specific requirements for the actors that got new tasks in the "improved" situation? What skills, manpower, financial support might they need to be able to perform well?

Present your table with "present" and "improved" column, indicate the sustainability-risky fields, and give reasons of difference in the two column (present versus improved).

OPERATION AND MAINTENANCE - exercise

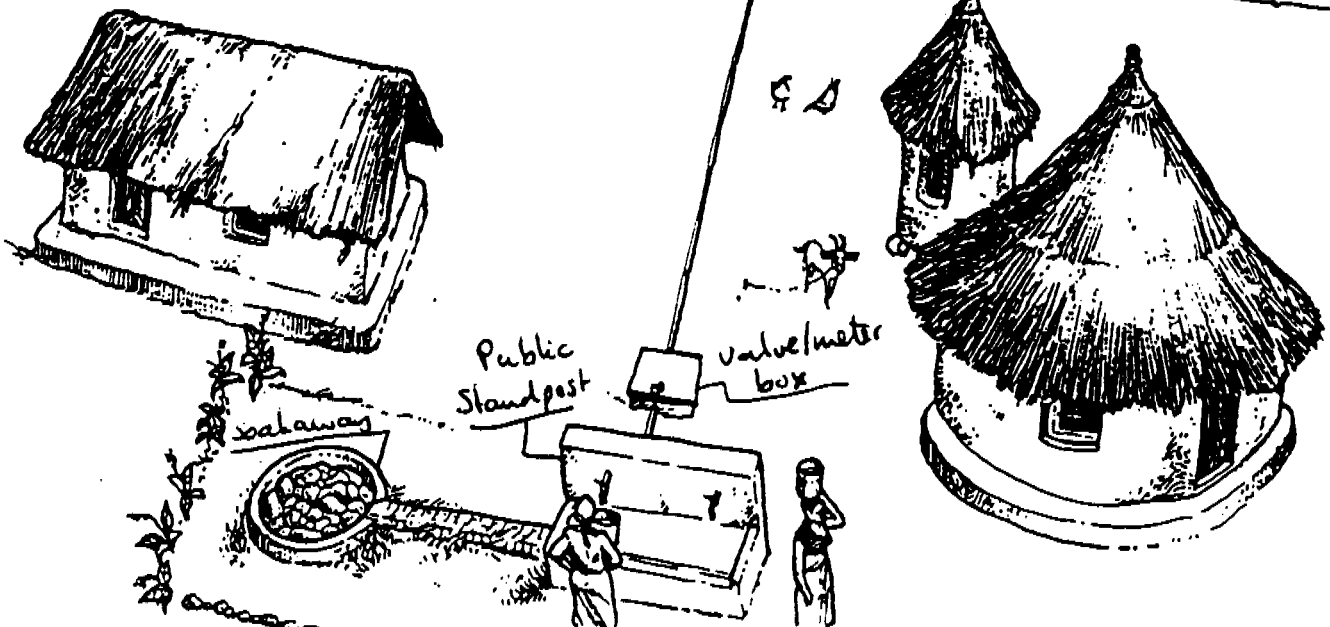
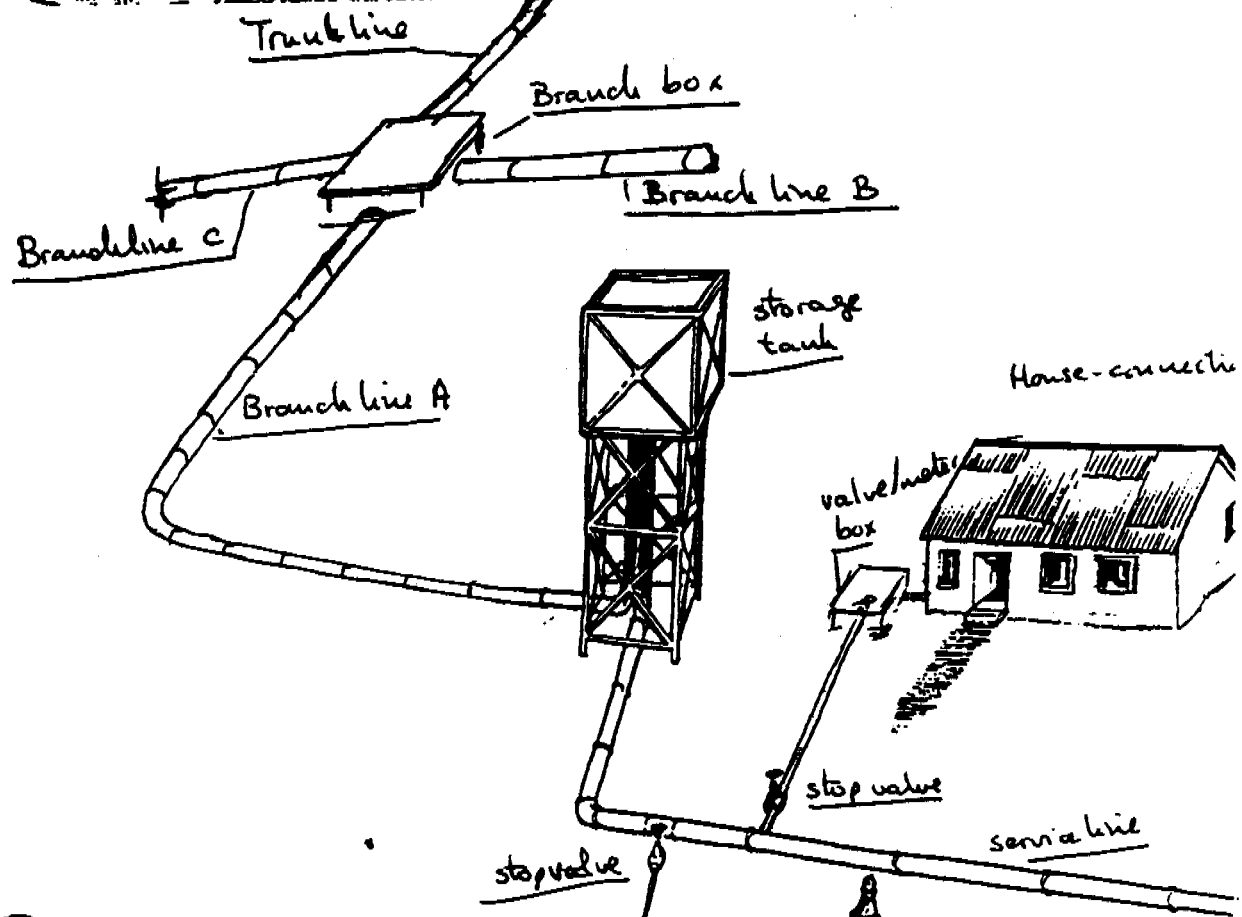
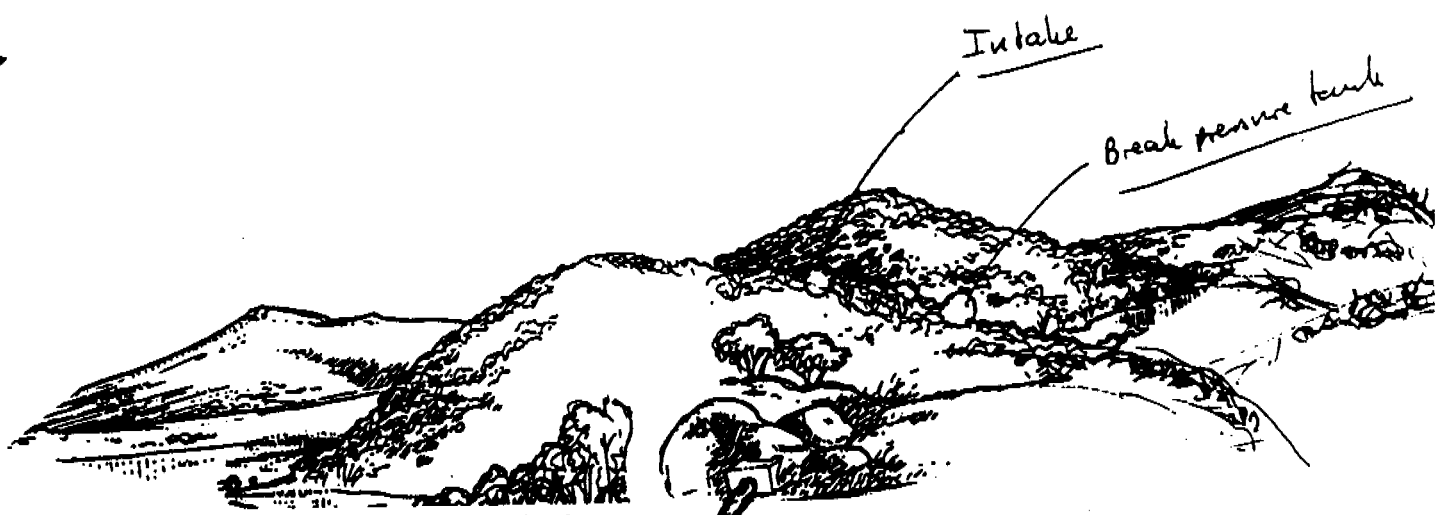
GRAVITY-FED PIPED WATER SYSTEM SUPPLYING TO SEVERAL VILLAGES

IDENTIFICATION OF RESPONSIBLE ACTORS FOR MAINTENANCE TASKS

Possible actors:

- | | | |
|-------------------------------|------------------------------------|--------------------------------------|
| <u>C: Community level</u> | <u>A: Agency /government level</u> | <u>P: Private Sector involvement</u> |
| C1. user/users' group | A1. area mechanic | P1. private area mechanic |
| C2. caretaker | A2. district departments | P2. spares retail-shop |
| C3. community water committee | A3. national departments | P3. private contractors |

O&M tasks Components of systems	Preventive maintenance		Minor repairs		Major repairs		Monitoring	
	present	improved	present	improved	present	improved	present	improved
Catchment	pollution prevention		upkeep (e.g. certain areas not to be used for agriculture etc)		major rehabilitation (e.g. reforestation)			
Intake, break pressure tank and trunk line, branch box								
Branch line, storage tank and service line								
Stop valve and valve/meter box								
Public standpost and soakaway								
House or yard connection								
Monitoring scheme								



OPERATION AND MAINTENANCE - exercise

Community Water Supply using boreholes with VLOM handpump

IDENTIFICATION OF RESPONSIBLE ACTORS FOR MAINTENANCE TASKS

Possible actors:

C: community level Involvement

A: agency/government involvement

P: Private Sector

- C1. user/users' group
- C2. caretaker
- C3. community water committee

- A1. area mechanic (government)
- A2. district departments
- A3. national departments

- P1. private area mechanic
- P2. spares retail-shop
- P3. private contractors

<u>O&M tasks</u> Components of systems	Preventive Maintenance		Minor Repairs		Major Repairs		Monitoring	
	Present	Improved	Present	Improved	Present	Improved	Present	Improved
Borehole with casing and screen								
Pump cylinder, Pump rod and Raising main								
Pump head and pump handle								
Platform and Drainage/soakaway								
Monitoring different maintenance tasks								

1. THE CHALLENGE OF OPERATION AND MAINTENANCE IN AFRICA

1.1 Background

The Water Decade began in Africa in 1981 with the ambitious goal to work towards achieving 100 percent coverage in water supply and sanitation by the end of 1990.

Although more progress in water supply and sanitation occurred in Africa during the Decade than in any comparable period in the past, water and sanitation coverage failed to keep pace with population growth.

Over the period 1981 - 1990, an additional 110 million people were provided with safe drinking water and 80 million with adequate sanitation facilities, but regional population during the period increased by 140 million. It is estimated that 54% of the African Region's population still lacks safe water and 64% is without proper sanitation.

Africa receives less water supply and sanitation investment than any other Region. During the Decade only 10% of global water supply and sanitation investment and only 20% of water supply and sanitation investment from external sources were made in Africa. Despite the significant increase in water supply and sanitation investment in Africa during the Decade, both by donors and national governments, the pace of development has stagnated as old systems break down and go out of service almost as fast as new ones are built.

Unfortunately, too many African countries show little sustainable progress after years of external support mainly because of inadequate resources for operation and maintenance of facilities and insufficient health education of users. As a result, many investment projects have failed to reach their essential objectives of public health improvements and sustainability. The problem has been aggravated by the adverse effects of prolonged drought in 34 countries in Southern Africa and the Sahelian zone, which brought the greatest crisis of the century for water resources in the region, literally leading to the cry "All hands to the pump !" The resurgence of cholera and other water related diseases in the Region are important health effects associated with drought and poor operation and maintenance practices in water supply and sanitation systems.

Conventional water and sanitation projects involve significant hardware components, especially in urban areas. Too often, the search for external financing to cover capital costs deflects attention from consideration of local capacity building through the use of local resources. There is lack of harmony between capital and recurrent budgets. This has led to major weaknesses in operation and maintenance and to overall poor performance of water and sanitation programmes.

In a number of large cities poor operation and maintenance has resulted in more than 50% of water produced, being unaccounted for, resulting in a major financial loss to municipalities and other authorities that pay for collection, treatment and distribution of the lost water. In the rural areas, where supply is frequently provided from boreholes and hand dug wells fitted with pumps, a high percentage of facilities ranging from 30 to 60% have been reported as being out

of order. The deterioration of these valuable physical assets is a major loss to national economies which should be avoided.

Key issues were identified by the Operation and Maintenance Working Group of the Water Supply and Sanitation Collaborative Council in past meetings, which were found to be directly related to the performance of operation and maintenance and with the efficiency and effectiveness of water supply and sanitation services. They include the following :

1. Inadequate data on operation and maintenance
2. Insufficient and inefficient use of funds
3. Poor management of water supply facilities
4. Inappropriate system design
5. Low profile of operation and maintenance
6. Inadequate policies, legal frameworks and overlapping responsibilities
7. Political interference

Data are required for planning and monitoring of O&M, but also to keep managers informed on the causes of breakdowns and the maintenance and costs involved.

A lack of funds restricts the availability of spare parts or repairs, tools and the recruitment and training of competent staff. A lack of accountability in maintenance departments or committees leads to inefficient use of maintenance funds.

Some of the **management constraints**, such as unskilled staff, may be a result of funding limitations, but they are also due to poor management. O&M responsibilities are rarely delegated to individuals, and this can result in a lack of responsibility for the proper use and upkeep of facilities. Management supervision of O&M may be virtually absent in many cases. Management know-how may be not available, especially in cases where staff have mainly been trained as engineers. Furthermore, the management of O&M more and more requires the integration of hardware (technical) and software (social and economical) aspects, which is not a topic being dealt with in conventional training.

If systems are **not technically well designed**, they may be difficult and expensive to operate and maintain efficiently. Initial design must consider long term O&M. Poor design is often compounded by inadequate supervision of construction leading to poorly constructed systems and hence having an impact on future O&M.

The low profile of O&M will mainly cause low priority to be given to O&M, as well as feelings of low status by staff working in O&M. There is a tendency to focus on capital construction, at the expense of maintaining existing supplies.

There is a need for **clear policies**, appropriate legal frameworks and a well defined division of responsibilities to support O&M in the sector. Overlapping responsibilities of staff and departments can divert skills, funds and equipment away from O&M.

Political influences may determine technologies or result in sub-standard systems. The state of national and regional economies can force governments to take decisions which could have an impact.

Effective O&M benefits users, water agencies and countries as a whole. Benefits include improved health and well-being, as well as social, economic and financial advantages.

Users will benefit from improved health through a constant, reliable supply of safe water of sufficient quality for essential hygiene purposes. During periods when a system is broken down, people have to return to their old, often unsafe, sources of water. A nearby improved supply can save water collectors time and energy compared to collecting water from a distant source. A broken down supply means a loss of these important benefits.

Involvement of the users in Operation and Maintenance activities can reduce their dependency on external assistance. Technical and management skills within the community can be enhanced through appropriate training and these can have broad benefits.

Benefits for the water agency include the fact that a reliable water supply encourages users to pay for their supply. This provides the agency with the revenue to fulfill their responsibilities. Involvement of the users in O&M can reduce the day-to-day burden of routine servicing and maintenance often carried out by the water agency.

The Government and country benefit because the existing stock of infrastructure is maintained and preserved. New developments then increase the number of water supply systems rather than merely keep pace with the existing coverage. Functioning water supply schemes contribute to a healthier and more productive population which benefits everyone.

1.2 Overview of major constraints concerning operation and maintenance in the region as reported by the country representatives participating in the Workshop

<p>Zambia</p> <p>Poor statistics of rural areas; overlaps in responsibilities; many actors involved; taking over by communities has been difficult; each one has its own technology; lack of coordination; standardization of Mark II did not succeed; communities do not contribute much apart for labour and materials; lack of skills and capacity of the communities; no standardization or interchangeability between different technologies; lack of clear strategy for water and sanitation; poor training policy; no comprehensive data on rural systems.</p>	<p>Zimbabwe</p> <p>Going through various stages of implementation of new concept of community management and decentralization; no policy on finance; lack of cost recovery system; community-based repairs established but communities are not managing, although they are provided with parts and training; maintenance of piped schemes very expensive, and lack of guidelines.</p>
<p>Tanzania</p> <p>Despite changes of policy introduced since 1990, people still used to old policy of free water and government intervening for all O&M; funding is a problem; some projects have still high technology, with high O&M costs; economic decline; inadequate priority setting of activities by the Government; poor data on O&M; lack of involvement of communities; lack of trained personnel; inadequate health education</p>	<p>Mozambique</p> <p>New approach of decentralized maintenance; AFRIDEV introduced, but failed due to drought; training and participation of communities is alright, but spare parts provision is inadequate, and the organization of collecting funds for maintenance is not working well; the number of pumps installed has increased, but it is difficult to know how many are functioning; because of war, many people went to the cities; lack of accurate information.</p>
<p>Malawi</p> <p>Community participation has declined, mainly due to urban migration; water quality is poor; use of slow sand filters not adequate; vandalism; government owns piped schemes and has problems of cost recovery, since not enough has been budgeted.</p>	<p>Swaziland</p> <p>Inadequate supplies; communities have little trust in their committees; inaccessibility; revenue collection difficult; collapse of pit latrines; lack of data; inadequate training of communities for management.</p>
<p>Nigeria</p> <p>Breakdowns are quite rampant; general unsustainable environment for O&M because of unstable politics and down turn of economy; inflation offsets the system even at rural level; cost sharing concept not yet clear and accepted; investments in the water sector are not looked in a wider perspective of general rural or urban economic development.</p>	<p>Ghana</p> <p>Despite national policy change with intensive educational campaign and a demand driven approach, collection of tariffs is difficult, and recovery insufficient; community management still needs to be pursued and the availability of spare parts is not yet efficient; in general, lack of coordination; overloading of sanitation facilities, because of population growth; priority setting of resource allocations not adequate.</p>
<p>Kenya</p> <p>Law on water use not adapted to real situation; despite a certain subsidization from the Treasury, cost recovery is not enough; high costs of spare parts; difficult to maintain adequate stocks of spare parts; passive community involvement in management of WS; lack of qualified operators; shortage of sufficient funding to finance regular rehabilitation/augmentation of water schemes; many water supplies were designed in the early 1970s; in slums poor access to adequate means of excreta disposal;</p>	<p>Lesotho</p> <p>Problems in implementing cost recovery policy, especially when sanctions have to be applied; question of village water ownership surfaces; Communities ignorant of their roles in community management; communities left to operate and carry small repairs and government has the responsibility of big repairs; lack of commitment on sanitation by Government; regarding urban water supply : lack of land management, inadequate policies and poor enforcement of available legislation, and staff movements resulting in a negative capacity building. Environmental hygiene greatly influenced by lack of hygiene education.</p>
<p>Namibia</p> <p>Country has very recently adopted a new policy aiming to decentralize O&M activities and make people pay for certain services. Cost recovery is not developed properly; difficult to assess new approach because too recent, but O&M was too centralized in the past and costs of maintaining were too high for the government alone to bear; lack of trained personnel; inappropriate technology.</p>	<p>Botswana</p> <p>Less constraints compared to other countries, except : poor data collection; poor management; not a lot of trained staff; insufficient funds for recurrent expenditures; sanitation is a bit neglected and no one is directly involved</p>

Block 2 : Sustainability Issues

Monday, September 16, Session A and B

- Subject title** : Working in a gender sensitive way
- Type of session** : Introduction, lecture, working group exercise, discussion
- Objectives** :
- Participants know the meaning of gender and why a gender approach is important
 - Participants get ideas on how to work gender-specific

If improved facilities and practices in water supply, sanitation and hygiene education programmes are to be sustained by all, they require the participation and support from men and women.

Participation and support by all means taking into account the differences in needs, tasks and areas of influence between men and women and making efforts to bring both categories into the project process sharing decisions, work and benefits equally. In recent years our knowledge has increased on how we can deal with gender despite constraints in budgets, number of staff and time.

- Hand-out** :
- Gender aspects of sanitation : the missing slipper of Cinderella, IRC, 1993
 - List with guide questions for a facilitator

September 7 - 27, 1996, Kandy, Sri Lanka

Not women, but Gender

In the last decade and more there has been a great deal of emphasis on "women's involvement" in W&S projects. In the early years of the Decade (IDWSSD) it was found that the failure of most projects was due to the fact that women were not involved in decisions made about projects that concerned them intimately.

However, as the years passed it became apparent that "women's involvement" could mean that women were being more overburdened than before, that their participation was marginal and that they had not graduated from being fetchers and carriers, from the position they had earlier as cheap labour. That, in fact, their workload had increased.

Due to their disadvantaged position in most countries, such as ours in many South Asian countries, there is a perceived need to uplift them and bring them to the mainstream of development. Programmes which target women usually want to change the conditioning and positions of women, overlooking what men and the relationships between women and men have to do with it. Activities which are geared towards increasing women's involvement may then turn out to be ineffective or may even have a negative impact by increasing their workload.

A W&S project is never a "woman's project". Even if the objective is to provide safe, clean water for the household, it is self evident that the whole community - that is men, women and children will all benefit. Therefore it is very important that the men too must take their share of responsibility. Also focussing only on women can mean that the men become threatened or even jealous.

This is where we talk of "gender". Now, what exactly is gender? Many people have given many definitions to this term trying to explain it simply. The simplest definition I have found is that gender, as opposed to sex which is a biological difference is a difference which society has ordained. Certain roles and responsibilities work and authority are given to men and others to women leading to certain types of behaviour, attitudes, roles and responsibilities to each group. Gender is thus a changeable difference between a man and a woman in a particular situation.

Gender is a dynamic concept as work and position of men and women are not inflexible, but they change over time, within certain cultures and among classes of people. Technology projects and education programmes have impacts on these changes as do other developments.

The gender aspects of drinking water supply and sanitation usually stress the roles of men as the decision makers and emphasize physical work as the role of women. In this role women collect water, dispose of waste and preserve hygiene. This emphasis on physical work sees women as passive beneficiaries of

these projects. The conclusion is that men are responsible for the public water supply and public sanitation while women are responsible for domestic water use and sanitation in the home.

In a gender approach we assume that in a community men and women are the agents of their own development. Women usually in a subordinate role can be denied an active role so that the self determination of the community then becomes the self determination of the men.

In a gender approach attitudes, roles and responsibilities of both men and women are taken into account. It must recognize that both sexes do not have the same access to resources and that work benefits and impacts may be different for both groups. The gender approach requires an open mindedness to aim at the fullest participation of both men and women.

In a gender approach men and women both participate. It is very important that fathers and sons, brothers, village leaders, technicians and the women themselves recognize this. A gender approach is a working together of both women and men and the important issue here is that when men and women work together women must be equitably involved, and not in a subordinate role. Males must see the relevance of women's participation and at every level realise how women and their activities can contribute to the well being of the family and the whole community.

Women's participation is more than a mere contribution of labour. It means that women take part in decision making, management of resources. But it should not mean that there should be further overburdening of women. Traditional roles which reinforce this must not be allowed to perpetuate.

To achieve a gender approach, men must be sensitized on gender issues, their own roles and those of women in W&S. It takes both men and women to change the existing situation into one where there is more justice and equity. It has to take into account existing roles, attitudes and responsibilities of both men and women. A gender approach is an effective way of giving men and women a chance to have men share their burden and recognise women as equal partners.

Gender issues emphasise the roles of both men and women as well as the ways they interact to make decisions and share tasks.

Remember that :

* women's and men's involvement should begin right from the first stage of the project process.

* if the gender sensitive approach is not included at this point, it is very likely that they will not be included during the later stages of the project.

* they must be involved in decision making about technology and other choices rather than trying later to use systems which are not suited to their needs. (Where inappropriate technologies have been installed, it has been found that hygiene education makes little or no difference).

* Training should be equably divided between men and women so that both men and women benefit and human resources are not wasted.

Constraints to a gender approach:

- * lack of knowledge about men's and women's roles in the sector
- * projects designed in an inflexible manner
- * gender planning may have been marginalized, separate from mainstream planning
- * Hardware and software aspects may not have been properly integrated.
- * inadequate number of female staff.
- * Training sessions may not have taken women's considerations of time, duration and location of training into account

Gender issues in handpump selection, maintenance and use

* Men and women must both be involved in evaluation of new handpumps. In testing the views of both men and women should be taken

* In general a handpump should be designed to allow comfortable operation by one woman for the main part of the year

* The physical effort of lifting water should be reduced. Some handpumps (eg. direct action pumps which lift a column of water of more than 50 meters) are heavy and hard on women and children, pregnant women and old women

* Study alternative pumps which are better for women, which do not have to have a stooped position which waste energy. Some societies do not accept foot operated pumps as these are culturally not acceptable and pregnant women and children find it had to operate them

* For women reliability of operation is very important as if the pump does not function properly the women may abandon it and go back to the old unsatisfactory sources which will affect the family's health

Gender issues in piped water supplies

* Many women serve on water committees and have a major role in operation and maintenance. Sometimes the committees are all women this is a risk as this overburdens the women and the men resent the fact that they are not included and oppose the decisions of the committee - maintain a balance of men and women

* Women should have a voice in siting of standposts as places where they can meet with other women and they standpost should also be acceptable in terms of distance, privacy and safety

* Women's views must be listened to as they are the main drawers of water in designing standposts

* Decisions must be taken for sharing domestic water between men and women (men using water for cattle rearing etc.)

Gender issues to consider in spring water

* Women often consider spring water as the best, but the distance can be a problem. Easier transport of water, or other water facilities for laundry and bathing (spring water being reserved for drinking) are topics for discussion with women

* Using water at the spring must be done carefully without contaminating the area. Women can advise on the best ways of organising this

* Men and women usually have good awareness on the presence of water, volume, reliability and access to natural springs in communities

* Protection of spring water involves manual labour to which both men and women can contribute as the system is simple

* In keeping the environment clean and free of pollution men should pay attention just as much as women

* Women must be given the skills to manage the water, according to availability

Definitions

Gender -

The social and therefore changeable difference between a woman and a man in a particular social environment.

Gender Approach -

The approach that seeks to change existing situations into situations where more equality and justice prevail between women and men, taking into account existing attitudes, roles and responsibilities of men and women.

Practical gender needs -

Needs of women that improve their condition.

Strategic gender needs -

Needs of women that improve their position.

IDWSSD -

International Drinking Water Supply and Sanitation Decade.

TEN MEASURES FOR A GENDER-SENSITIVE APPROACH IN DRINKING WATER SUPPLY AND SANITATION PROJECTS

It is recommended that the communities decide on these points after explanation and discussion on the roles of men and women.

- 1. Information.** Make sure, by using suitable communication channels and methods, that project information reaches men and women (Each group may need different channels). In data collection and analysis distinguish between information from men and women.
- 2. Gender division.** Assess with men and women what work and responsibilities they have in land and water use, care of traditional water sources, construction, care and upkeep of households/school latrines, family health and hygiene, communication with other men, women, and household finance.
- 3. Meetings.** Facilitate women's participation in meetings: time and place suitable for women, women informed and encouraged to attend, seating and language is so all can hear and react, speaking out by women is facilitated (sit together, breaks for internal discussion, choose spokeswoman, etc.). Insist that women can react in a mixed or separate meeting as a condition for project continuation.
- 4. Planning.** Give men and a say in and achieve acceptable solutions on: design and location of the facilities, choice of local maintenance and management system, choice of committee members, mechanics, caretakers, health promoters, local financing system.
- 5. Committees.** Determine [by law] that a minimal proportion of committees is female. Enable men and women to choose their own representatives on trust and suitability for tasks. Encourage that women are chosen as treasures (have proved to be most trustworthy). Committees should account for their proper management to male and female users. Higher-committees should include men as well as women.
- 6. Hygiene education.** Involve women as planners and change agents, not as passive audiences. Involve also men, for issues concerning men.
- 7. Training.** Make sure that men and women are trained for technical as well as managerial tasks. Adapt training provisions to the requirements of women (place, methods, literacy level). Train and reward women for new functions: waterpoint repair (they visit daily), latrine masons (they can work in homes), treasures (trustworthy & home collection), monitoring (idem).
- 8. Means.** Ensure that credit, materials and skills are available to men and women to make their own improvements in water supply, sanitation and hygiene. Where feasible and relevant, undertake or link up with income generation projects.
- 9. Gender-sensitiveness.** Make project staff and management aware why gender is important and how a gender-sensitive approach is applied.
- 10. Staffing.** Employ female staff and equip them, as well as male staff, for dealing with gender issues. Work in case of shortage of female staff with gender-sensitive male staff and female intermediaries in the communities.

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CHECKLIST FOR THE PROJECT PROCESS

Planning/Preparation Phase

Policy/Attitudes

- What is the policy and attitude of government, local leaders and project management towards gender sensitive programming?
- 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?
- Will the project systematically promote the sensibilization of local leaders and of its own staff in this respect?
- Will this be reflected in plans for staff training and staff composition?

Baseline

- Have existing water supply and sanitation practices been thoroughly investigated (including which types of technology and which water sources are used when and by whom)?
- Have findings been distinguished for different user categories: men and women, occupational and income groups?
- Have women and men been asked what they like about their current water and sanitation facilities and what they do not like?
- Have poor women been directly approached as informants on their own particular roles, needs, problems and possibilities?
- 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?
- 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, (for domestic and for agricultural use) and what are the 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 role in the preservation of community environmental sanitation;
- 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 other 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; and
- has the baseline uncovered whether men play any of the roles noted above and if so, given a detailed picture of this?

Planning

- Are there legal, economic, social, or cultural barriers to women's participation in the planning or implementation of water and sanitation projects? If so, what plans have been made to reduce or eliminate these barriers?
- What roles do local women play in the community's social and economic infrastructure?
- Do women and men feel a need for the project? What are their respective priorities and expectations?
- Is the community (men and women) willing and able to participate fully in the project, including members of the community who are weaker socially or economically, such as women heads of households?
- Is the design acceptable for all women in terms of:
 - water quality, quantity and reliability;
 - adequate access;
 - appropriate technology and maintenance;
 - cultural acceptability.

Checklists:
The Project Process

- What needs and opportunities exist for increasing women's productivity and/or production?
- What needs and opportunities exist for increasing women's access to and control of resources?
- How do these needs and opportunities relate to the country's other general and sectoral development needs and opportunities?
- Have women been directly consulted in identifying such needs and opportunities?
- Are project objectives explicitly related to women's and men's needs?
- Have women and men participated in setting those objectives?
- Have there been any earlier efforts?
- How has the present proposal built on earlier activity?
- Might the project reduce women's access to or control of resources and benefits?
- Might it adversely affect women's situation in some other way?
- What will be the effects on women and men in the short and long run?

Design Phase

Project Impact on Women's and Men's Activities

- Which types of women's and men's activities (production, reproduction & maintenance, and socio-political) does the project affect?
- Is the planned component consistent with current gender roles in the sector?
- If it plans to change women's and men's performance of that activity, (i.e. locus of activity, remunerative mode, technology, mode of activity) is this feasible, and what positive or negative effects would it have?
- If it does not change it, is this a missed opportunity for changing men's and women's roles in the development process?
- How can the project design be adjusted to increase the above-mentioned positive effects, and reduce or eliminate the negative ones?

Project Impact on Women's and Men's Access and Control

- How will each of the project components affect women's and men's access to and control of the resources and benefits stemming from the production of goods and services? Will their relative amounts of access and control change? If so, how?
- How will each of the project components affect women's access to and control of the resources and benefits stemming from the reproduction and maintenance of human resources?

Further Preparation

- To what extent do the project objectives address the issues discovered during the baseline?
- Have women's desires for changes concerning these issues been identified?
- Has a system been developed to monitor project-induced changes in these issues? And does this system rest on continuous consultation of women and men?
- Are project targets sufficiently flexible to allow the development of systematic procedures for women's involvement?

Participation and Workload

- 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?
- Is there sufficient insight into the benefits that do or might accrue from this, to women directly and to households and the community as a result?
- Does the project sufficiently appeal to the community as a whole, taking care that women are not inordinately burdened?
- 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.
- Will women be able to participate on the basis of all of their interests and key roles?

Checklists:
The Project Process

- Is women's local expertise being utilized to identify suitable locations for and to ensure convenient design of facilities?
- Is this done with sufficient attention to social factors, such as ease of access for all, and respect for privacy?
- Are women consulted to find suitable training candidates for local maintenance and management: people with sufficient time, commitment, trustworthiness and skill?
- Is women's familiarity with traditional learning systems used as a basis for effective health education and project communication as a whole?
- Are the potential users (women and men) participating in decisions on siting of facilities; additional provisions for washing and bathing; community contributions in cash, labor, time, or materials; operating hours?
- Have target categories been identified on the basis of felt needs, with special alertness to the needs of poor women?
- Does the project provide enough information on the technical, managerial, health and workload implications of various options to enable users to make responsible choices?

Construction, Maintenance, Management and Use

- Can women assist in low-cost construction of facilities without being disproportionately burdened?
- What specific skills and insights can they contribute, what voluntary labor can they do, what can they contribute financially themselves and what community funds can they raise? What contributions can men make?
- How can women's and men's traditional maintenance tasks be extended to the project situation?
- 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? What should men's role be?
- Is the project designed to keep close track of actual and adequate use of new facilities?
- Will users have reasonable alternatives for safe water supply and excreta disposal when facilities are out of order?

Training

- Will women be trained in the actual construction, operation and long-term maintenance of the system? What will men's role in training be?
- Will a system for potable water be complemented with training for men and women on health education, so as to maximize the benefits of clean water?
- Will women and men be informed of the supplies required and the names of suppliers of parts and equipment?
- Will women receive instruction on legal matters such as water use rights or land rights related to water, if applicable?

Implementation Phase

Personnel

- Are project personnel sufficiently aware of and sympathetic toward women's needs?
- Are there female staff to deliver the goods or services to women beneficiaries?
- Do personnel have the necessary skills to provide any special inputs required by women?
- What training techniques will be used to develop delivery systems?
- Are there appropriate opportunities for women to participate in project management positions?

Organizational Structures

- Do organizational structures enhance women's access to resources?
- Does the implementing agency have adequate power to obtain resources needed by women from other organizations?
- Does the agency have the institutional capability to support and protect women during the change process?

Operations and Logistics

- Are the agency's delivery channels accessible to women in terms of personnel, location and timing?

Checklists:
The Project Process

- Do control procedures exist to ensure dependable delivery of the goods and services?
- Are there mechanisms to ensure that the project resources or benefits are not usurped by males?

Finances

- Do funding mechanisms exist to ensure program continuity?
- Are funding levels adequate for proposed tasks?
- Is it preferential access to resources by males avoided?
- Is it possible to trace funds for women from allocation to delivery with a fair degree of accuracy?

Flexibility

- Does the project have a management information system which will allow it to detect any differential impacts on women and men?
- Does the agency have enough flexibility to adapt its structures and operations to meet the changing situation of women?

Information Network

- Have women's groups been approached to assist with information, motivation, reinforcement, and/or maintenance activities?
- Is women's and men's access to project information sufficient? Does the choice of channels through which information is disseminated inadvertently exclude or bypass women?

Monitoring and Evaluation Phases

Data Requirements

- Does the project's monitoring and evaluation system explicitly measure the project's separate effects on women and men?
- Is data collected to assess changes in women and men's involvement in the project and their access and control over management and resources?
- Are women and men involved in designating the data requirements?

Data Collection and Analysis

- Are the data collected with sufficient frequency so that necessary project adjustments can be made during the project?
- Are the data fed back to project personnel and beneficiaries in an understandable form and on a timely basis to allow project adjustments?
- Are women and men involved in the collection and interpretation of data?
- Are data analyzed so as to provide guidance to the design of other projects?
- Are key areas for gender research identified?

Monitoring and Evaluation

- Are there women on existing village water committees? If so, what is the percentage of women and what role do they play?
- Are women consulted on the choice of technology, the selection of well sites or pump sites? Are they consulted on additional facilities such as washing, or bathing facilities? Are men consulted?
- Are women given training in maintenance of water supply schemes? If so, what is the percentage of women trained as preventive maintenance workers/caretakers/managers of the facilities? What is the percentage of men trained in these roles?
- Are women trained as health/hygiene educators? If so, what is the percentage of women trained? What is the performance of male versus female educators? What are the turn-over rates for men and women?
- Do women derive economic benefits from saved time? Do women use the saved time for income-generating activities such as: sewing, handicrafts, vegetable growing, for greater involvement in the local market system, for education and training, or learning new skills?
- Do they use saved time for other activities? If so, what activities and why?
- Have women, and in particular, poor women, participated in the design and execution of project activities?
- Do they have easy access to relevant health education?
- Can women participate in line with their own wishes and potential, without harm to present tasks and new opportunities?

Block 2 : Sustainability Issues

Monday, September 16, Session C and D

Subject title : Water resources management

Type of session : Lecture with panel discussion

Objectives :

- Participants get familiar with the concept "Water Resources Management".
- Participants gain insight into institutional, political, legal and strategic aspects of water resources management.
- Participants get insight in the various interests and possible interest collisions (international, national, community and gender).
- Participants get familiar to the demand of sustainability in the use of water resources (financial, political and environmental aspects).

The lecture will try to evoke discussion on the subject matter and through it enhance the idea of lowest competent level of management with support from the competent line-agencies to protect the resources and rights of all concerned parties.

Hand-out : relevant section of WB-policy document on water resources management, summary of Nordic Freshwater Initiative

September 7 - 27, 1996, Kandy, Sri Lanka



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WATER RESOURCES MANAGEMENT

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Glossary

Aquifer	An underground stratum that is saturated with water and transmits water readily
Command and control	A system of water management based on administrative allocations
Comprehensive framework	An analytic framework for water resources that views water as a single resource with many uses and interlinkages with the ecological and socioeconomic system
Cost recovery	Fee structures that cover the cost of providing the service
Decentralization	The distribution of responsibilities for decisionmaking and operations to lower levels of government, community organizations, the private sector, and non-governmental organizations
Demand management	The use of price, quantitative restrictions, and other devices to limit the demand for water
Drip irrigation	A localized drop-by-drop application of water that uses pipes, tubes, filters, emitters, and ancillary devices to deliver water to specific sites at a point or grid on the soil surface

Ecosystem A complex system formed by the interaction of a community of organisms with its environment

Externality The unintended real (nonmonetary) side effect of one party's actions on another party that is ignored in decisions made by the party causing the effects

Financial autonomy The ability of an entity to operate and sustain its activities for a long period based on the revenue it collects from the users of its services

Gravity irrigation A system that depends on sloping canals and fields to transport water to an irrigated site

Market failure A divergence between the market outcome (without intervention) and the economically efficient solution

Opportunity cost The value of goods or services forgone, including environmental goods and services, when a scarce resource is used for one purpose instead of for its next best alternative use

Riparian state A state through or along which a portion of a river flows or a lake lies

River basin A geographical area determined by the watershed limits of a system of water, including surface and underground water, flowing into a common terminus

Sewage Liquid refuse or waste matter carried off by sewers

Sewerage The removal and disposal of sewage and surface water by sewer systems

Tubewells Circular wells consisting of tubes or pipes placed in holes bored into the ground to tap groundwater supplies from one or more aquifers

Unaccounted-for water The difference between the volume of water delivered to a supply system and the volume of water accounted for by legitimate consumption, whether metered or not (or the measured volume of supplied water that is produced or treated less the water that is consumed legitimately, the difference being what is stolen or lost)

Watercourse A system of surface and underground waters that constitute, by virtue of their physical relationship, a unitary whole and flow into a common terminus

Watershed An area drained by a river or stream system

Watershed management A process of formulating and implementing a course of action that involves a region's natural and human resources taking into account social, political, economic, environmental, and institutional factors operating within the watershed, the surrounding river basin, and other relevant regions to achieve desired social objectives

Wetlands Areas of marsh, fen, peat land, or water that include natural, artificial, permanent, and temporary areas with static or flowing water that is fresh, brackish, or marine

Executive Summary



Water resources have been one of the most important areas of World Bank lending during the past three decades. Through its support for sector work and investments in irrigation, water supply, sanitation, flood control, and hydropower, the Bank has contributed to the development of many countries and helped provide essential services to many communities. Yet, as pointed out in reports of the Operations Evaluations Department, the investments supported by the Bank in the areas have often encountered implementation, operational, and social problems. Underlying these problems is a vicious cycle of poor-quality and unreliable services that result in consumers' unwillingness to pay, which, in turn, generates inadequate operating funds and a further deterioration in services. Moreover, the Bank and governments have not taken sufficient account of environmental concerns in the management of water resources.

The difficulties encountered by Bank-supported projects reflect a larger set of problems faced in water resource management, which are highlighted in the *World Development Report 1992: Development and the Environment* (1992d). Water is an increasingly scarce resource requiring careful economic and environmental management. The situation is exacerbated by rapid population growth and urbanization in developing countries. As the demand for water for human and industrial use has escalated, so has the competition for water used for irrigated agriculture. At the same time, the engineering and environmental costs are much higher for new water supplies than for sources already tapped. New challenges call for a new approach. Governments have often misallocated and wasted water, as well as permitted damage to the

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environment, as a result of institutional weaknesses, market failures, distorted policies, and misguided investments. Three problems in particular need to be addressed:

- Fragmented public investment programming and sector management, that have failed to take account of the interdependencies among agencies, jurisdictions, and sectors
- Excessive reliance on overextended government agencies that have neglected the need for economic pricing, financial accountability, and user participation and have not provided services effectively to the poor
- Public investments and regulations that have neglected water quality, health, and environmental concerns.

To manage water resources more effectively, a balanced set of policies and institutional reforms should be sought that will both harness the efficiency of market forces and strengthen the capacity of governments to carry out their essential roles.

A Framework for Improving Water Resource Management

The proposed new approach to managing water resources builds on the lessons of experience. At its core is the adoption of a comprehensive policy framework and the treatment of water as an economic good, combined with decentralized management and delivery structures, greater reliance on pricing, and fuller participation by stakeholders. The proposed approach is consistent with the Dublin Statement (1992) from the International Conference on Water and the Environment as well as with Agenda 21 from the 1992 United Nations Conference on Environment and Development.

Need for a comprehensive framework

The adoption of a comprehensive framework for analyzing policies and options would help guide decisions about managing water resources in countries where significant problems exist, or are emerging, concerning the scarcity of water, the efficiency of service, the allocation of water, or environmental damage. The complexity of the analysis would vary according to the country's capacity and circumstances, but relatively simple frameworks can often clarify priority issues. The framework would facilitate the consideration of relationships between the ecosystem and socioeconomic activities in river basins. The analysis should take account of social, environmental, and economic objectives; evaluate the status of water resources within each basin; and assess the level and

composition of projected demand. Special attention should be given to the views of all stakeholders.

The results of the analyses at a river basin level would become part of the national strategy for water resource management. The analytical framework would provide the underpinnings for formulating public policies on regulations, incentives, public investment plans, and environmental protection and on the interlinkages among them. It would establish the parameters, ground rules, and price signals for decentralized implementation by government agencies and the private sector. Decentralizing the delivery of water services and adopting pricing that induces efficient use of water are key elements of sound water resource management. But, for decentralized management to be effective, a supportive legal framework and adequate regulatory capacity are required, as well as a system of water charges to endow water entities with operational and financial autonomy for efficient and sustainable delivery of services.

Country focus of the policy

The comprehensive analytical framework outlined above will need to be tailored to the situations and constraints facing individual countries. Many of the countries with limited renewable water resources are in the Middle East, North Africa, Central Asia, and Sub-Saharan Africa, where populations are growing fastest. Elsewhere, water scarcity may be less of a problem at the national level but is nevertheless severe in many areas such as in northern China, western and southern India, western South America, and large parts of Pakistan and Mexico. For some countries, such as those in Eastern Europe, pollution is the largest problem affecting water resources. In much of Africa, implementation capacity is a critical issue exacerbated by the frequency of prolonged droughts. In some countries, water resource management is not yet a significant problem. These differences among regions and countries will shape the design of strategies and programs for a given country.

Water policy objectives

Differences among countries notwithstanding, water resource management that follows the principles of comprehensive analysis, opportunity cost pricing, decentralization, stakeholder participation, and environmental protection outlined in this volume will yield more coherent policies and investments across sectors, promote conservation, and improve the efficiency of water allocation. The objective is to achieve, over time, the following improvements:

- *For industry*, extensive water conservation and protection of groundwater sources. Experience in industrial countries suggests that controlling pollution will also substantially reduce the quantity of water used per unit of industrial output.
- *For water supply and sanitation*, more efficient and accessible delivery of water services and sewage collection, treatment, and disposal, with the ultimate goal of providing universal coverage. This will be achieved by extending existing supplies through water conservation and reuse and by using other sustainable methods. Greater involvement of the private sector, nongovernmental organizations, and user groups will be required, as will cost recovery to ensure financial viability while applying graduated fees to assist the poor.
- *For irrigation and hydropower*, modernized irrigation practices, greater attention to cost recovery, drainage and salinity control, measures to reduce pollution from agricultural activities, improvements in operation and maintenance of existing systems, and investments in small-scale irrigation and various water-harvesting methods. This calls for the development of institutions and technologies that respond to the needs of farmers for higher-quality services, including greater participation of community groups and user associations, while reinforcing the efficient management of demand. Particular attention will be given to the needs of small-scale farmers, who comprise most of the agricultural community. Greater priority should be given to managing the demand for energy, identifying small-scale and renewable energy alternatives, promoting watershed conservation practices, and retrofitting and enhancing dam facilities.
- *For the environment and poverty alleviation*, more rigorous attention to minimizing resettlement, maintaining biodiversity, and protecting ecosystems in the design and implementation of water projects. Water and energy supplies gained through conservation and improved efficiency can be used instead of developing new supplies to extend service to the poor and maintain water-dependent ecosystems. Low-cost and environmentally benign methods of developing new water supplies for agriculture, rural drinking water, and industry will be pursued. The water supply needs of rivers, wetlands, and fisheries will be considered in decisions concerning the operation of reservoirs and the allocation of water.

The World Bank Policy

The Bank's overarching objective is to reduce poverty by supporting the efforts of countries to promote equitable, efficient, and sustainable de-

velopment. This entails support for the provision of potable water and sanitation facilities, flood control, and water for productive activities in an economically viable, environmentally sustainable, and socially equitable manner. The new approach is designed to help countries achieve these objectives more effectively while sustaining the water environment, and the Bank will support member governments to that end. The Bank will give priority to countries where water is scarce or where the problems of water allocation, service efficiency, or environmental degradation are serious. In these countries, through its economic and sector work, lending, and participation in international initiatives, the Bank will promote policy reforms, institutional adaptation and capacity building, environmental protection and restoration, and, when requested, cooperation in the management of international watercourses. Because of the crucial interdependencies between water and other sectors, the Bank will incorporate water resource policy and management issues in its country policy dialogues and in the formulation of country assistance strategies where water issues are considered to be significant.

A comprehensive analytical framework

The Bank will encourage and, when requested, selectively help countries develop a systematic analytical framework for managing water resources that is suitable for a country's needs, resources, and capacities. The framework will be designed so that options for public water management can be evaluated and compared in the context of a national water strategy that incorporates the interdependencies between water and land use. It will enable coherent, consistent policies and regulations to be adopted across sectors. To facilitate the introduction of such a framework, the Bank is ready to support capacity building through training, demonstrating participatory techniques, and helping in water resource assessments. The Bank will also promote the creation, enhancement, and use of hydrologic, hydrogeologic, socioeconomic, water quality, and environmental data bases for both groundwater and surface water, as well as help governments effectively use this information in decisionmaking.

Institutional and regulatory systems

The reform of water resource management policies will have implications for the institutions dealing with water resources. The Bank will assist governments in establishing a strong legal and regulatory framework for dealing with the pricing, monopoly organizations, environmental protection, and other aspects of water management. Simi-

larly, the Bank will support the adaptation of institutional structures at the national and regional levels to coordinate the formulation and implementation of policies for improved water management, public investment programs, and drought planning. In many countries, institutional reform will focus on river basins as the appropriate unit for analysis and coordinated management. Such coordinating arrangements are particularly important in countries with federal structures, in which provincial or state governments have primary authority over the management of water resources in their jurisdictions. In such countries, before committing funds to support operations that have important interstate effects, the Bank will require legislation or other appropriate arrangements to establish effective coordination and agreed procedures for allocating water. The Bank will also use water resources sector loans to coordinate water resource activities across sectors.

Incentives

Many of the problems encountered in providing water services are due to the lack of incentives both for performance by providers and for efficiency by users. A key component of the reforms to be supported by the Bank will thus be greater reliance on incentives for efficiency and financial discipline. The Bank will highlight the importance of pricing and financial accountability by using estimated opportunity costs as a guide in setting water charges. In practice, immediate adoption of opportunity cost pricing may be politically difficult. Thus, given the low level of current cost recovery and the importance of finances in the sustainability of operations, pricing to ensure financial autonomy will be a good starting point.

Water-conserving technology

An important element in any strategy to conserve water will be incentives for adopting technologies and management approaches that increase the efficient use, allocation, and distribution of water. Such technologies and management approaches will make it easier to conserve water, to increase the efficiency of water use and conveyance, and to reuse wastewater. As water scarcity and waste disposal problems become more acute, adopting and improving water conservation practices, wastewater reuse systems, and overall approaches to reduce pollution will become increasingly important.

Poverty alleviation

Inadequate water services have a particularly adverse impact on the poor, facilitating the spread of disease, especially in crowded low-income areas. Thus, special efforts will be directed to meeting the water needs of the poor. Moreover, the health benefits of better hygiene and clean water should be emphasized so that the advantages of having an improved water supply can be fully realized. Where public finance is scarce, significant additional resources can often be mobilized within local communities. Efforts should be made to determine the level of services actually wanted by the poor. Research and experience suggest that the poor are willing to pay for reliable service. Indeed, in the face of unreliable service, the poor often pay more for less water, which they typically receive from street vendors. Water entities that have a financial stake in serving the poor are more likely to provide them with better, more sustainable services. "Social fees," whereby the better-off cross-subsidize the poor, as well as budgetary transfers to subsidize connections can be used. However, caution is required. Assigning noncommercial objectives to a public enterprise may undermine the achievement of its service objectives, possibly initiating a new round of the vicious cycle of unsatisfactory service and low collections. Policies that affect or change water rights should be carefully evaluated to ensure that they do not harm the poor, since water rights are often crucial for generating income. Where necessary, adjustments should be accompanied by compensatory measures.

Decentralization

Because of their limited financial and administrative resources, governments need to be selective in the responsibilities they assume for water resources. The principle is that nothing should be done at a higher level of government that can be done satisfactorily at a lower level. Thus, where local or private capabilities exist and where an appropriate regulatory system can be established, the Bank will support central government efforts to decentralize responsibilities to local governments and to transfer service delivery functions to the private sector, to financially autonomous public corporations, and to community organizations such as water user associations. The privatization of public water service agencies, or their transformation into financially autonomous entities, and the use of management contracts for service delivery will be encour-

aged. Arrangements for ensuring performance accountability and for putting in place an appropriate regulatory framework to set and enforce environmental protection standards and to prevent inefficient monopoly pricing will be incorporated into Bank-supported activities. These steps should improve incentives for cost recovery and service provision and give users a sense of ownership and participation. In countries where provincial or municipal capabilities are inadequate to manage a complex system of water resources, the Bank will support training and capacity building to improve local management so that decentralization can eventually be achieved.

Participation

Participation is a process in which stakeholders influence policy formulation, alternative designs, investment choices, and management decisions affecting their communities and establish the necessary sense of ownership. As communities increase their participation in managing water resources, project selection, service delivery, and cost recovery will likely improve. Therefore, the Bank will encourage the participation of beneficiaries and affected parties in planning, designing, implementing, and managing the projects it supports. In environmental assessments, the Bank requires consultation with affected people and local nongovernmental organizations, and will additionally promote the participation of concerned people—including the poor, indigenous people, and disadvantaged groups—in the water-related operations it supports. Special attention will be given to the participation of women because they are essentially the managers of domestic water. The Bank will encourage governments to follow these principles more broadly in their investment programs and other activities related to water resources.

Environmental protection

Preservation of the environment and the resource base are essential for sustainable development. The protection, enhancement, and restoration of water quality and the abatement of water pollution will therefore be a focus of Bank-supported operations, particularly since providing safe drinking water is so critical to maintaining and improving human health. Accordingly, the Bank will increase its support of government efforts to improve and expand sanitation and the collection and treatment of wastewater. Similarly, the Bank will promote the use of efficiency pricing and "the-polluter-pays" principle through the imposition of pollution charges to encourage water conservation and reduce pollution. For industrial waste, mining runoff, and wastewater discharges, a

balanced strategy involving economic incentives, effective legislation and regulatory systems, and guidelines for levels of pollution control will be used to reduce effluents at the source—especially toxic substances—and to stimulate reuse. For pollution originating from agricultural activities, the Bank will support initiatives that restore and protect surface and subsurface waters degraded by agricultural pollutants and that minimize soil erosion. The Bank will assist governments in developing strategies and cost-effective mechanisms for the ecologically sustainable management, protection, and restoration of recharge areas and water-dependent ecosystems, such as wetlands, riverine floodplain areas, estuaries, and coastal zones. Investments that involve resettlement should be avoided or minimized, and, where resettlement is necessary, former incomes and living standards should be restored or improved. Given the increasing importance of groundwater, especially in arid and semiarid areas, the Bank will pay attention to the linkages between ground and surface water in managing river basins and will support the establishment of government programs and policies, including land use policies, that restore and protect the quality of groundwater and preserve groundwater recharge areas.

Upgrading skills

In tandem with the promotion of a comprehensive framework and with institutional and policy reforms, country policy analysts, planners, managers, and technicians will need to upgrade their skills. Accordingly, where water resource management issues are significant, the Bank will support the training needed to deal with cross-sectoral analysis; with legal, regulatory, and privatization issues; and with river basin management, flood and drought planning, environmental protection, project formulation and evaluation, demand forecasting, and participatory management. The Economic Development Institute of the World Bank will be an important element in this training effort, through a special initiative to support the implementation of the new policy.

Designing country programs

Countries differ in their water requirements and endowments, their poverty profiles, their institutional capacities, and the problems they face from environmental degradation. Thus, the design of relevant reforms, and the time frame for implementation, will need to be developed and evaluated case by case. Nonetheless, introducing the recommended reforms will typically entail difficult political choices, and commitments by governments will therefore be essential. Given the present status of

water resource management and institutions in many countries, implementing the necessary changes will take time. Accordingly,

- In countries with significant water management problems, the Bank will, in collaboration with other international and national agencies, assist governments through sector work, technical assistance, and environmental action plans in identifying and formulating priority policy and institutional reforms and investments and in determining their appropriate sequencing. These priorities—and the degree of government commitment to them—will be highlighted in the country assistance strategy and will guide the sectoral lending program.
- The priority reforms and activities to be addressed in analytic work and referred to in the country assistance strategy will deal with issues such as the appropriate (a) incentive framework and pricing, (b) service delivery to the poor, (c) public investment priorities, (d) environmental restoration and protection, (e) water resource assessment and data requirements, (f) comprehensive analytical framework, and (g) legislation, institutional structures, and capacities. Assessing the degree of government commitment to implementing the requisite reforms will be an important part of the analysis.
- Progress in implementing the identified priorities will be monitored through normal Bank interactions with the country. When inadequate progress on priority actions is judged to cause serious misuse of resources and to hamper the viability of water-related investments, Bank lending in this area will be limited to providing potable water to poor households and to operations designed to conserve water and protect its quality without additionally drawing on a country's water resources. Such operations include sanitation, waste treatment, water reuse and recycling, abatement of water pollution, drainage, and rehabilitation of the distribution systems. These investments will be assessed on their individual merits.
- Individual water lending operations should discuss the linkage to priorities for reform, investment, and Bank support as well as the likely impact of the overall water-related program. The analysis of operations will include an assessment of the implications for other water-using subsectors within the relevant regional setting, most likely a river basin. Relevant pricing issues, cost recovery, and financial autonomy and sustainability will receive particular attention. The rationale for institutional arrangements for implementation, particularly the division of responsibilities between

government and nongovernmental or financially autonomous entities, will be provided. The Bank requires the assessment of the environmental impact of projects, as well as environmental assessments of the entire river system for significant water-related projects, and full consultation with affected people and local organizations.

International watercourses

Existing guidelines describe Bank policy on the financing of projects dealing with international waterways. The Bank, together with other international organizations, will help countries improve the management of shared international water resources by, for example, supporting the analysis of development opportunities forgone because of international water disputes. Through technical, financial, and legal assistance, the Bank, if requested, will help governments establish or strengthen institutions, such as river basin organizations, to address transnational water management activities. Furthermore, the Bank will support studies and consultations to review available organizational arrangements and help countries develop alternative solutions. In initial contacts with riparians, the Bank will avoid setting preconditions, exploring instead the most appropriate form of assistance. The Bank will be sensitive at all times to the interests of other riparian parties, since all parties must be treated in an even-handed manner. The focus will be on international watercourses in which the Bank's assistance is likely to have a substantial effect. In addition, the incremental cost of actions taken by riparian states to protect international water resources and river basins will continue to be financed within the framework of the Global Environment Facility. The Bank will promote the acquisition of knowledge concerning internationally shared groundwater to provide a basis for establishing guidelines governing the Bank's activities in this area.

Implementation

To help implement its water resource management policy, the Bank will undertake a range of activities, including the preparation of guidelines and best-practices papers, staff and country training programs, capacity building, and the development of coordination mechanisms to improve the management of water resources. More specifically, in collaboration with the United Nations Development Programme, a guide on capacity building is being prepared for countries interested in formulating strategies for managing water resources. Guides are also being prepared on establishing water resource information systems, on best practices for

Agenda 21 and the Dublin Principles

The Dublin principles, which are also integrated in Agenda 21, namely

- to manage water at the lowest appropriate levels,
- to treat water as a social and an economic good,
- to involve women in water resources management, and
- to promote a holistic approach to water resources management

are basic to water resources management approaches. At the same, however, guidelines are lacking for the application of these principles.

Operationalisation of the Dublin Principles

The guiding principles of Dublin are valid as the basis for future integrated water resources management, but interpretation, elaboration and added specificity is required.

- **Water as a Finite and Vulnerable Resource**

The holistic and integrated approach to water resources management seems obvious, but experience shows that it is very difficult to achieve in practice. The importance of distinguishing between consumptive and non-consumptive use of water was stressed, as was the application of economic and regulatory instruments in improving efficiency in water use.

- **Participatory management, including management at the lowest appropriate levels**

This principle is considered vital for the prevention of serious conflicts, and properly implemented it will lead to increased efficiency and reduced costs. It is important that beneficiaries be involved in decision-making, but the very concept of "participation" need to be better defined, not least with the increasing privatization, markets for water etc. The principle of management at the "lowest appropriate level" is often misunderstood and needs to be elaborated. Lowest appropriate level range from the local community for some issues, to national and even international fora for others.

- **Water as an economic good**

The recognition of water as an economic good is considered essential and one of the cornerstones of the Dublin and Rio statements. It is, however, extremely difficult to translate this concept into specific guidelines for water resources management, and different sub-sectors view its interpretation and implications differently. There is a need to define the concept vis-a-vis water as a "public good", or "social good", and also in relation to the equity and health aspects of water management. The various elements of the economic cost of water - direct cost, environmental cost and opportunity cost - need to be better described and defined.

Box 2***Definition of water resources management***

'Water resources' means fresh water in the broad sense as available for use and susceptible to human interventions. 'Water' can be surface or groundwater, and is characterized by both quantity and quality.

'Management' means integrated management, covering all phases of resources planning, development, use and protection, i.e. assessment, planning, implementation, operation and maintenance and monitoring and control. It includes both 'demand management' and 'combined resources and supply management'.

'Integrated' means management of water resources as regards their development, use and protection, and considering all sectors and institutions which use and affect water resources (cross-sectoral integration). 'Integrated water management' may be interpreted as integrated 'land and water management' to the extent that land management measures affect the supply and quality of water resources.

(Adapted from Nordic Freshwater Initiative, 1992)

Southern Africa

In Southern Africa, i.e. Angola, Botswana, Malawi, Mozambique, Lesotho, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe several countries experience water shortage as an impediment to their development.

South Africa is regarded as the region's economic motor. Indeed, it is generally hoped that the country will take a lead in the accelerated development of the whole region. At the same time, South Africa is experiencing severe water scarcity and has already resorted to importing water from Lesotho.

Discussed as a future option is the importation of water to South Africa from the Zambezi river, which is bordered by other southern African countries. These countries are also looking to the Zambezi to meet their own water needs. Namibia wants to utilize the Caprivi strip and with peace Angola is also looking for a better use of the Zambezi water. Zimbabwe and Zambia are already using the Zambezi for electricity generation. These are just a few examples. The list of countries that have cast an eye on further utilization of the Zambezi could be expanded.

There are consequently a number of international issues in southern Africa which have to be tackled in order to avoid increasing competition and a future crisis. Since most projects are still in the planning stage, this is a region where prudent planning and coordination of

activities can have an important impact to secure sustainable development, including peace as one of the fundamental conditions for sustainability.

Then there are issues in the region related to water scarcity within countries. A number of water resources management strategies are currently being drawn up, notably in Zimbabwe, Tanzania and South Africa. Pertinent issues concern for instance the future of irrigated agriculture, rural-urban competition for water and interbasin water transfers.

The region presents a number of problems and challenges of which all parties are aware. At the same time, the multitude of national and regional initiatives renders a coordinated approach to the situation quite difficult.

Water Resource Legislation

It is now generally recognized that for water users to manage their resource effectively and sustainably, user rights are a primary condition. A functioning user right system implies functioning mechanisms for monitoring, enforcement and sanctions. In addition, appropriate fora are needed for the various stakeholders to express their needs and demands.

In view of increasing water scarcity, both due to pollution and increasing demand, a number of countries have in recent years abandoned the administrative top-down approach to water resources management and are attempting to build up stakeholder based systems. They also recognize that, in addition to user rights, economic incentives play an important role in encouraging users to use water more efficiently. In most countries this re-thinking implies that water resources legislation has to be introduced or reformed, in accordance with the requirements imposed by local circumstances.

Examples of countries that have implemented new approaches to water resources management, are for example Chile (water markets), Brazil and Indonesia (variations of the French approach to water resources management), and several African countries (water resources management strategies).

A number of countries are now in a stage where conclusions can be drawn as to the impact, success and failures of their new approaches. While hitherto much of the information disseminated on water resources development and management has come from developed countries, notably the United States and France, the recent experience in developing countries can be used to illustrate their approaches to the emerging problems regarding water resources. For example, Latin America has a wide range of countries at different stages of development and with different problems related to hydro-climatological and socio-economic conditions. The experiences of this continent may, with appropriate modifications, be applicable for both African and Asian countries.

Water from Mountain Streams

A Case Study with Focus on Management at Local Level in Tanzania

Ismani is defined as the area served by the Ismani Water Supply Scheme, which is a piped gravity scheme with 2 small river intakes. It coincides with Mbunga river catchment, and in the dry season only additional sources are a few springs. Low flows are presently sufficient, but allows no further economic development e.g. based on expanded irrigation. Costs of dams or reservoirs for seasonal storage or deep boreholes are probably prohibitively high.

Institutional Aspects

According to Tanzanian law a permission to extract water is required for most purposes. In practice, the authorities rarely use permissions as a tool of resource management.

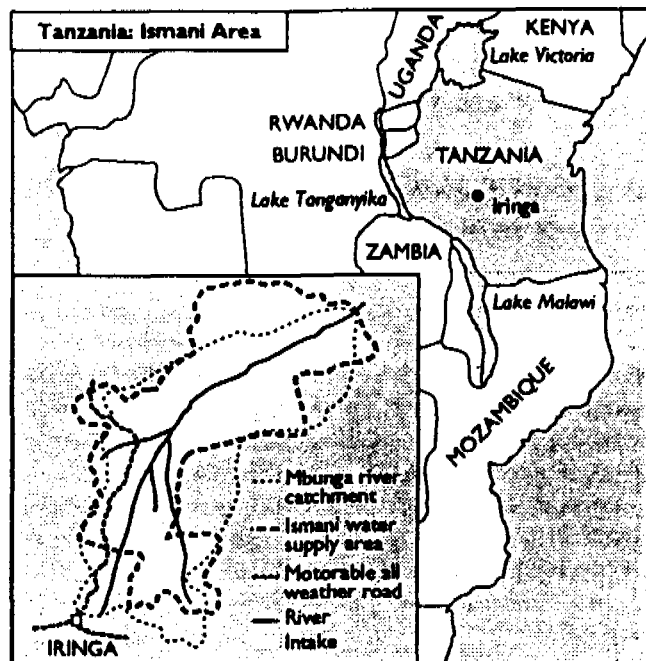
Locally, each village has the ownership and responsibility for operation and maintenance of the village scheme through a Village Water Committee. Management of the entire scheme is supported by a Group Scheme Committee comprising two representatives from each village.

Possible Reasons for Conflicts Between User Groups

- Competition over water mainly between domestic and different commercial use (irrigation, livestock).
- Settlers in intake areas responsible for degradation of water quality.
- Government institutions (oil pumping station and police station) fail to pay the fees to the village water funds.

Suggested Improvements of the Management System

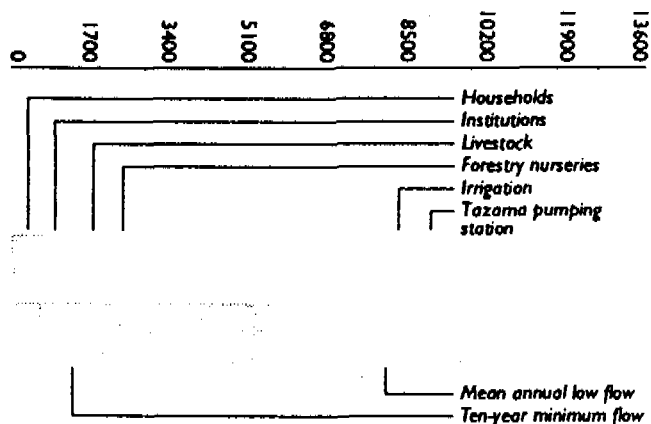
- Decentralisation of the water management hierarchy with the aim of decisions being taken at the lowest appropriate level, also in relation to the physical hierarchy. According to this the individual households and user groups will be the first level. Another level will be the villages which extract water from the same source. Only major sources serving bigger areas with conflicting interests should be managed at higher levels.
- Assistance of community workers to try to achieve better cooperation with settlers in the intake areas.
- Introduction of a m³ pricing system with water meters for house connections as well as for farmers with livestock and irrigation.



Ismani Area

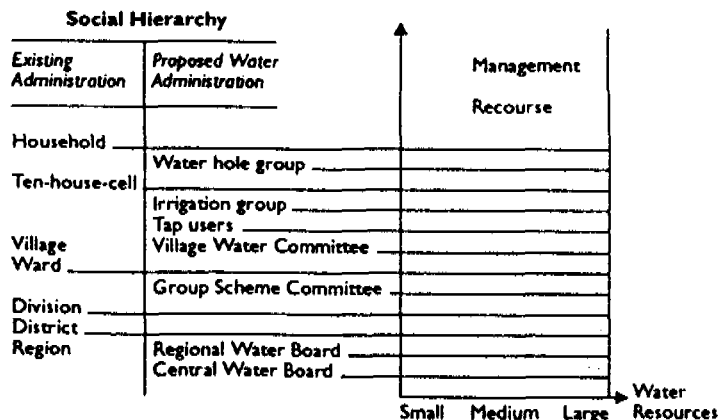
Area, km ² :	1800
Villages, no:	21
Population:	31,100
Climate:	Warm and wet Nov.-April. Dry and cool June-Sept.
Precipitation, mm/year:	500-750
Potential evapotranspiration, mm/year:	1400-2000
Runoff, mm/year:	100-200

Present Water Demands From the Intakes of Mgera and Kigasi and their Total Flows (m³/day)



Future water demands are uncertain, especially those related to agricultural water use.

Suggested Water Resource Management Hierarchy



Augmentation of a Water Resource

A Case Study with Focus on Management at Watershed Level in India

For management on a watershed basis it is important to consider how land use will effect the various components of the hydrological cycle. An important objective in an area as Allikuli catchment, where lack of water is a constraint to the agricultural activity, is to augment the available water by increasing the infiltration and reducing unproductive losses (e.g. overland flow), and this is one of the aims of the afforestation and water conservation measures of the Interface Forestry Programme (IFP). Increased ground water withdrawal since the start of the IFP has resulted in larger agricultural production with a value equivalent to 1 Rupee/m³ of irrigation water.

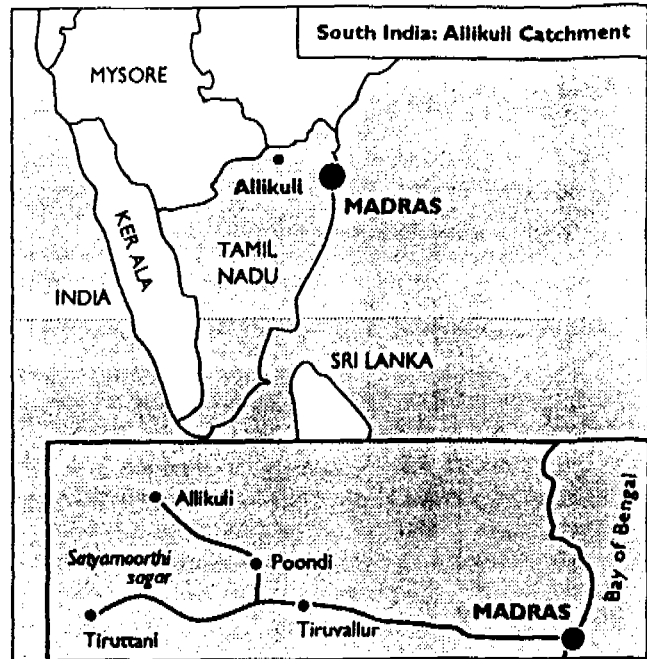
Possible Reasons for Conflicts

There seems to be no local reason for the government decision on restricting loans to well digging, since aquifers according to the best estimates are not being depleted. However, the watershed drains into the water reservoir used by Madras Water Supply, which is currently being extended, and thus there is a clear possibility of conflict between the national level and the local level.

Conflicts may arise between the Reserve Forest and farmers if evidence is given that afforestation at a later stage of the IFP causes reduced water amounts in farmland.

Suggested Improvements of the Management System

- Strengthening of local administration (Village IFP Committee) and inclusion of technical expertise at local level.
- Introduction of incentives, disincentives, and training to farmers in optimization of water use efficiency (crop selection, irrigation efficiency etc.)
- Monitoring of surface water and ground water resources in the watershed to assess the effects of the IFP.



Allikuli Catchment

Climate:	Early summer hot and dry
	Sep.-Nov. heavy rain from North-East Monsoon
Estimated precipitation, mm year:	1100
Annual actual withdrawal from wells	
Prior to IFP, mill. m ³ est.	3.25
Post to IFP, mill. m ³ est.	4.6
Population:	4,400
Villages:	4

Allikuli Catchment

Variations in Rainfall Recorded in nearby town of Poondi

Year	Rainfall	1990	Rainfall
1981	1047	Jan	0
1982	701	Feb	0
1983	1931	Mar	0
1984	1118	Apr	40
1985	1040	May	374
1986	720	Jun	50
1987	1236	July	87
1988	1150	Aug	58
1989	999	Sept	161
1990	1347	Oct	289
		Nov	275
		Dec	13

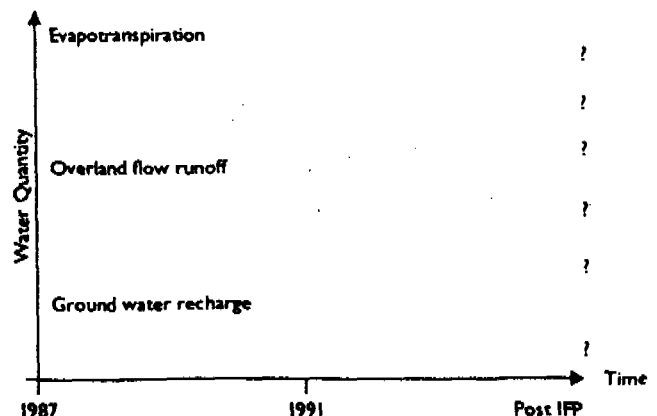
Government land 3,000
 Reserved Forest 2650
 Arable Land 350

Private land 750
 Tank Irrigation 230
 Drylands 170
 Well Irrigation 350

Total area: 3,750 ha

The erratic character of the rainfall and the seasonal and inter-annual variations pose serious problems.

Effects of Interface Forestry Programme (IFP)



The IFP activities (check dams, percolation ponds, gully plugging, afforestation) is expected to increase both infiltration and evapotranspiration. The net effect on water availability is not known.

Where Water is in Abundance

A Case Study with Focus on Users' Participation in Kenya

North of Lake Victoria in Kenya are hundreds of small streams, thousands of springs, and good water resources. People have never felt a big need for water development or been aware of water hygiene problems, the cause of much disease. Here, the Western Water Supply Program (WWSP) was initiated with a supply-driven approach with the aim of effective increase of safe water supply.

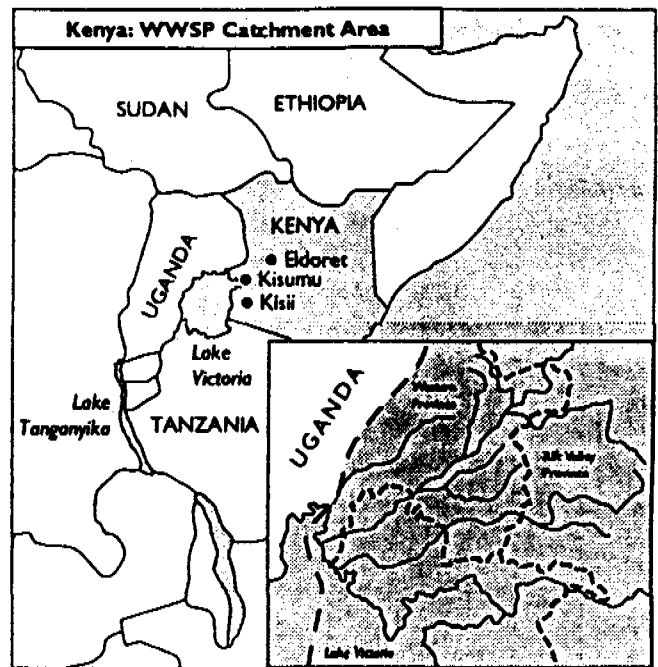
Problems

Because of the supply-driven approach:

- The population has been regarded as passive beneficiaries which has inhibited their own initiative and responsibility. This has weakened the program's economic and operational sustainability and even caused contamination of water sources.
- The program has not considered productive water usage such as cattle watering. This limitation to drinking water only has affected the program's economic sustainability and even reduced the health benefits through neglecting the problem of water washed diseases.

Suggested Improvements of the Management System

- Diversion to a demand-driven approach, where the basis for improvements will be the beneficiaries' own needs, affordability and environmental circumstances.
- Reducing the authorities' and project's role to that of a promoter's, controller's and supporter's one. Management should be taken care of by the users.

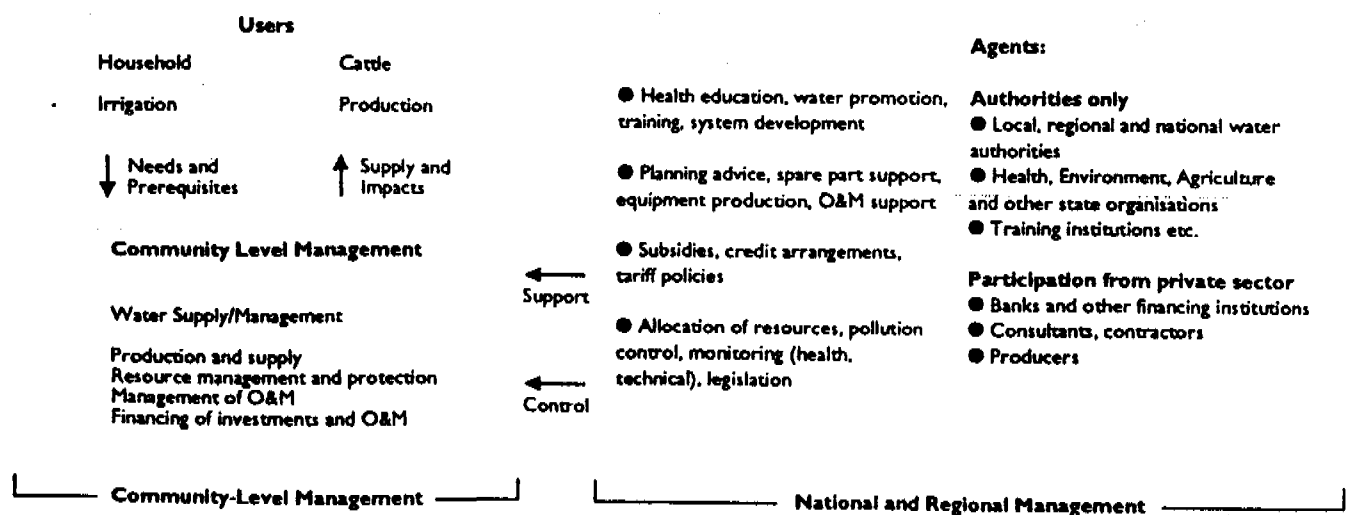


WWSP Area

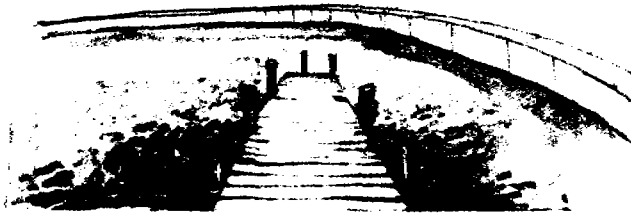
Western Province and Siaya District in Nyanza Province

Climate:.....Tropical, mean daily temperature 20-25 C. Rather even rains
 Precipitation, mm year:.....1000-2000
 Water resources:.....Abundant
 Project Achievements:..Over 2500 point sources, serving over 750.000 users
 Piped scheme rehabilitation

Suggested Improvements of the Management System



Water Law Principles



Preface

South Africa has a unique opportunity at present to take a new look at many different aspects of our society. Few aspects of our common life in South Africa can be more important than water. Water is critical to our growth and prosperity as a nation. We have been reminded of this in recent months as we moved from a drought which threatened our whole economy to unprecedented floods.

Many experts and ordinary people have been saying for a number of years that our water law needs to be thoroughly revised. The law should always be changing as we gain greater scientific understanding of our surroundings, as our economy and technology develops, and as our society changes. Changing the law, especially the law about something as important as water, must be done very carefully; however, otherwise we may find that we end up with more problems than when we started out! It is for this reason that we are moving very cautiously, one step at a time.

The first step was the publication of a short document called "You and Your Water Rights" which we sent all around the country (and to some international experts) in mid 1995. The document set out some of the problems with the existing water law and asked people for their ideas on how the law should be changed. There was a good response and many interesting ideas came forward. Next, a panel of experts and ordinary people was set up to draft a set of principles on which a new law could be based. This took a few months and involved long hours of detailed discussions. The Panel reported to me and the process was taken further by a Water Law Steering Committee, comprising of three members of the Panel and four members of my Department, which has finalised a set of principles for discussion.

It is now time go to the public again. This time, we need your comments on the Draft Principles. If they are acceptable - and most of them should be to any reasonable person - we want your suggestions as to how they could be implemented. You may think that your voice will not be heard but this is not the case. I know that a new water law will only be effective if it reflects the wisdom and enjoys the support of the majority of South Africans and is well understood by them.

This document will form the basis for the efforts now underway to engage all interested and affected parties in drafting of law and I look forward to your collaboration in the process.

A handwritten signature in black ink.

Prof. Kader Asmal, MP
Minister of Water Affairs and Forestry



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Introduction to the Principles

The principles attempt to find what is best for South Africa as a whole: what will meet the requirements of our new constitution (to which all law in the country must be subject); what makes most sense in terms of our present understanding of the environment around us on which we all depend; and how we should manage a scarce resource for development and prosperity. Most of the principles are “common sense”. Some call for a break with the past and have far reaching implications. The results of this whole exercise must be more equitable, cost effective and easier to implement than the current water law or we stand to gain very little in practice.

Water law is one of the most complicated fields of law. However, this document is deliberately written in a simple and straight-forward style, without legal or technical jargon, to make it as accessible as possible. Brief discussion points and explanations are provided after most of the Principles to give them added clarity.

The Principles are divided into 7 Sections, dealing with the following topics:

- A. The Water Cycle
- B. Legal Aspects of Water
- C. Water Resource Management Priorities
- D. Water Resource Management Approaches
- E. Water Institutions
- F. Existing Rights
- G. Water Services

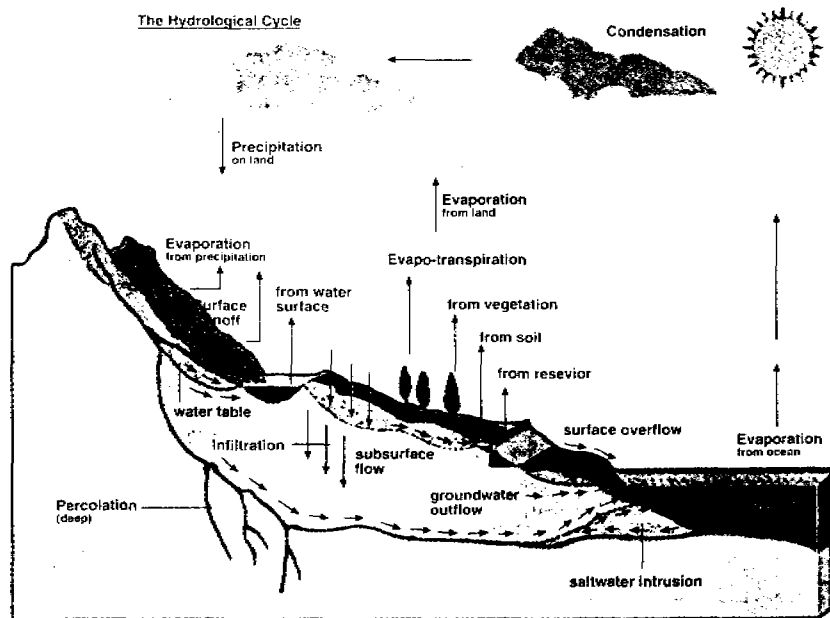
Principle A. The Water Cycle

Principle A. 1.

In a relatively arid country such as South Africa, it is necessary to recognise the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to underground water, rivers, lakes, wetlands, estuaries and the sea.

The water law Principles reflect the natural laws of the world we find ourselves in. Water in nature is continuously moving, even though in some cases it may move very slowly over millions of years, trapped in rocks deep below the earth's surface. Not only is water continuously moving, it is also continuously changing its state between a liquid, a gas and a solid. This continual movement and changing of water is known as the water cycle and is illustrated in the diagram overleaf. The water cycle is indivisible and all parts of it are inter-related. Water is (generally speaking) neither made nor destroyed. Different parts of

the cycle influence each other - rainfall affects the amount of water which is available to plants; the amount of water which plants use affects how much water seeps deep into the ground to form ground water; when ground water is pumped out of the ground, the level of underground water, or the 'water table' level, is affected; water table levels have an important influence on river flows.



Human activities also have an impact on the water cycle and, as development occurs, that impact increases. We are now better able to control the quantity of water available to us, using modern engineering methods, and we have a greater impact on the quality of water. Before the introduction of high yielding, deep level ground water pumps, for example, we did not have much impact on ground water. Now, with modern technology, we are virtually able to destroy our resources and cause damage which will take thousands of years to repair. Therefore, as technology advances, so does our need for protection and regulation.

Different land uses also impact on the water cycle. When a crop such as sugar cane or timber is planted, the runoff to rivers and streams will decrease and so will the rate of ground water recharge. This in turn will reduce the amount of water which is available for other uses. The development of an urban area can increase the runoff and the risk of flooding. It is not possible, therefore, to manage water resources without having some influence and control over land-use practices. (Refer to Principle D.7)

Underground water needs special consideration. Because it is slow moving and invisible, it is difficult to understand and to predict. Most of the aquifers (underground formations

in which water is stored) in South Africa have low storage capacity but, in the drier two thirds of the country, ground water is the only accessible source of water.

The idea of the "catchment" is important. It is a natural drainage area made up of an inter-linking systems of streams and tributaries flowing under the influence of gravity. All naturally occurring water in a catchment can, for practical management purposes, be treated as inter-related in terms of both quantity and quality. With the use of storage facilities such as dams and reservoirs, water can be regulated and controlled in a catchment to meet different demands. In most instances surface water catchment boundaries or watersheds coincide with ground water "catchment" boundaries. In South Africa, management of catchments is complicated by the need to transfer water between catchments.

As our understanding of the water cycle increases, so the law relating to water needs to be progressively amended to reflect what we know to be the physical reality. We know a great deal more now than we did when the present law was drawn up and so changes are needed.

Principle A. 2.

The variable, uneven and unpredictable distribution of water in the water cycle should be acknowledged.

South Africa is a semi-arid country. Our climate is characterised by its variability and unpredictability. (In South Africa 43% of the rain falls on 13% of the land; and of the rain which falls, only 9% reaches our rivers.) Droughts are followed by floods, rainfall fluctuates from year to year and from region to region. The storage of water to help balance the extremes becomes very important. The law needs to take account of these circumstances. The water law in a temperate climate with plenty of water will be different from the law in a semi-arid climate. Some of our present water law is based on laws from European countries with very different climates from our own. South African laws need to reflect South African conditions if they are to be fair and practical.

Principle B. Legal Aspects of Water

Principle B. 1.

All water, wherever it occurs in the water cycle, is a resource common to all, the use of which should be subject to national control. All water should have a consistent status in law, irrespective of where it occurs.

This principle is central to the water law review. It is based on hundreds of years of legal practice established in Roman times which defines a category of "things" which belong to nobody, but which everybody can make use of, subject to some form of state control.

The present Water Act recognises many different legal categories of water including the distinction between private and public water. It is clear from the 191 government water, subterranean, and drainage control areas proclaimed throughout the country that, over the years, it has become increasingly necessary for the government to control public water, underground water and the storage of private water in dams. On land not falling within any of these areas, ground water and water originating on a person's property is considered in most cases as private water and there are very limited controls on its use. These different categories of water deny the physical reality that all water is inter-related and, if maintained, would greatly hinder effective management.

One of the most important results of adopting this Principle will be to enhance Government's ability to control the abuse of ground water, where resources are over-exploited on the basis of the water being "private".

A further consequence of the principle is to place in context the distinction between the concepts of normal and surplus water as it exists in the present Water Act. Whilst the distinction between "public" and "private" water, and "normal" and "surplus" flow may retain some use when it becomes necessary to calculate and define the quantity of water that can be allocated in practice to a water user, terminology and definitions will have to change to avoid outdated and misleading connotations.

Principle B. 2.

There shall be no ownership of water but only a right to its use.

Although this may sound new, it is not actually a change from the present law. There is a widespread public misconception that "private" water is actually the property of the land owner but this is not true. People may have an exclusive right to the use of water, but it can never be "owned" as it passes through a particular point on its continuous journey through the water cycle.

Principle B. 3.

The location of the water resource in relation to land should not in itself confer preferential rights to usage.

This Principle is closely related to Principle D.2 Its effect is that owners of land adjacent to a natural stream will in future not automatically be entitled to priority use of the water flowing past their land simply because of their ownership of the land. (Such land is known as riparian land and its owners are called riparian owners). There are many thousands of farmers and other people in the country who do not own riparian land and a fairer way of allocating water needs to be found. This issue is addressed in more detail below.

Principle C. Water Resource Management Priorities

Principle C. 1.

The objective of managing the quantity, quality and reliability of the nation's water resources is to achieve optimum long term social and economic benefit for society from their use, recognising that water allocations may have to change over time.

The State has a responsibility to provide a framework within which individual activity and enterprise can flourish. The effective control and management of water is of interest to all and can only be achieved through public co-operation and intervention.

This principle is perhaps the most important of all because it unambiguously guides the actions of the State in the fulfilment of its functions. It highlights the need, when rights to use water are being defined, to ensure that they are flexible enough to accommodate changes in social priorities and economic circumstances over time.

Principle C. 2.

The water required to meet peoples' basic domestic needs should be reserved.

"Water required for basic domestic needs" means widely different things to different people and definitions may change over time. Very few people would argue, however, that there should not be a basic minimum amount of water available to everyone, sufficient to ensure a basic level of health and quality of life.

Principle C. 3.

The quantity, quality and reliability of water required to maintain the ecological functions on which humans depend should be reserved so that the human use of water does not individually or cumulatively compromise the long term sustainability of aquatic and associated ecosystems.

Ecosystems include living organisms and their interactions with each other and their external environments. They are sensitive and we depend on them for our existence. In aquatic ecosystems we make use both of the water itself, and of many natural processes (for example, the ability of rivers to break down sewage). In order for us to have the long term use of both the water and natural processes, we have to look after them. They need the right quantity of water at the right times and of the right quality, consistent with natural cycles and seasons. The actual quality and amounts of water we reserve for the environment depend on how healthy we want the ecosystem to be, because ecosystems may be sustained at different levels of ecological health, depending on our decisions. The closer the patterns of quality and quantity are to natural patterns, the healthier the system will be. The physical structure of ecosystems (for example the shape and course of a river bed), also affects processes and needs to be protected. The objective is to achieve a balance

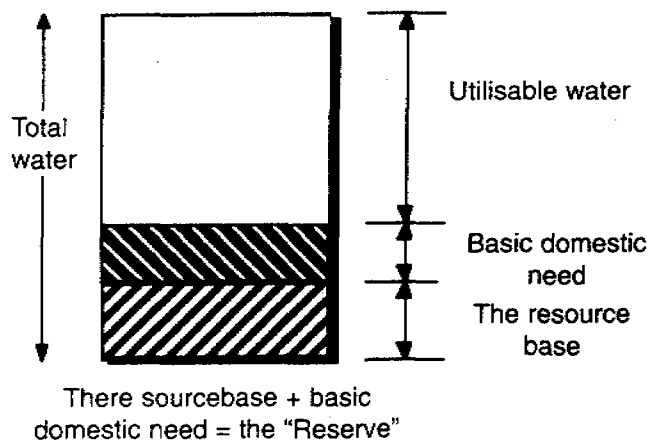
between the effects of human development and ecosystem health. There are water quantity, quality and structural stresses which impair ecosystem function, possibly beyond recovery.

Although human needs and activities will modify natural ecosystems, these modifications should be restricted to the capacity of the systems to recover or keep functioning. If we exceed the capacity of the system to recover, we are "shooting ourselves in the foot" because we and the rest of the environment will jointly suffer the consequences. This reserve therefore forms the resource base - it should not be regarded as an "allocation" but recognised as the base on which all other allocations depend.

Principle C. 4.

The water required to meet peoples' basic domestic needs and the needs of the environment should be identified as "the Reserve" and should enjoy priority of use.

The Reserve is illustrated by the following diagram. (The diagram is merely an illustration - the actual proportions will vary with location and time.)



Principle C. 5.

International water resources, specifically shared river systems, should be managed in a manner that will optimise the benefits for all parties in a spirit of mutual cooperation. Allocations agreed for downstream countries should be respected.

Many of South Africa's rivers are shared with neighbouring countries. The use of water from these rivers in South Africa may have negative impacts upon ecosystems and water users in these countries. This has in the past become a source of conflict which should be avoided in the future by ensuring that there are mechanisms for cooperative management in place. South Africa is also interested in promoting joint projects with our neighbours to develop their water resources for mutual benefit and a framework is required to guide such cooperation.

Principle D. Water Resource Management Approaches

Principle D. 1.

The national government is the custodian of the nation's water resources, as an indivisible national asset, and has ultimate responsibility for, and authority over, water resource management, the equitable allocation and usage of water, the transfer of water between catchments and international water matters.

This Principle formalises the approach whereby the 'public interest' is represented by the government. It recognises that, where resources are limited and the competition is increasing, some party has to have oversight and custodianship over water. This does not mean that the government is the legal owner of water - it is the overall manager of water.

Principle D. 2.

The development, apportionment and management of water resources should be carried out using the criteria of public interest, sustainability, equity and efficiency of use in a manner which reflects the value of water to society while ensuring that basic domestic needs, the requirements of the environment and international obligations are met.

Water is a social and economic good. It is essential for life and economic development is not possible without it. Its value to its users reflects, in part, the costs incurred when it is transported, treated or stored. Because water is a scarce commodity, its value also reflects the benefits it can bring to its users; this economic value may be greater than the direct costs of its production. The management of our water resources should reflect the value placed on them by the users while keeping a balance between what is fair (social equity) and what is economically efficient.

The price of water should thus reflect the fact that it is a scarce national resource. Using water for one purpose and not for another means that there is a trade-off. The cost of the trade-off has to be considered. The price of water should therefore be guided by what is economically most efficient, balanced by social equity considerations such as the needs of

the poor. National economic interests would also have to be taken into account, as would the different needs of groups such as farmers, industry, mining and others.

In order that water may be allocated to its most economic use, it may be necessary to be able to transfer water allocations between users. The water law should provide a framework which makes this possible.

Principle D. 3.

In as far as it is physically possible, water resources should be developed, apportioned and managed in such a manner as to enable all user sectors to gain equitable access to the desired quantity, quality and reliability of water, using conservation and other measures to manage demand where this is required.

Principles D.2 and D.3 establish the basis for the methods by which water should be managed, apportioned (or shared) and developed in South Africa if we are to get the most beneficial use from water while ensuring fairness, equity and long-term sustainability.

The application of the principles would ensure that everybody has access to their minimum domestic requirements and that other social priorities are met. Economic objectives are then addressed by requiring water to be managed in a way which reflects its value to society. This approach will help to encourage the conservation of water because its price will more closely reflect its value. It will also enable a market-guided approach to allocation to be put in place whereby low value users could cede their right to use water to higher value users. In general, it will focus more attention than in the past on managing demand rather than meeting needs by developing new supplies.

The principles also highlight the reason for moving away from the present riparian rights system. This system restricts the rights to use water to a particular parcel of land and may mean that it cannot be used in the most economically efficient manner or in a way that could be considered to be fair. Obviously riparian owners will still have the advantage of being closer to the water since more distant users will have to bear higher costs of access. The current inequities in the ownership of riparian land would have to be resolved through changes in the pattern of land ownership although provision to ensure controlled physical access to water in rivers for non-riparian users would help to achieve more equitable arrangements.

Principle D. 4.

Water quality and quantity are interdependent and should be managed in an integrated manner, which is consistent with broader environmental management approaches.

There have been proposals to separate water quality management from the management of water quantity. This would create major difficulties since, for instance, the impact of pollution on a water course depends on how much water is present to dilute the pollutant. Similarly, the quantity of water used can affect its quality. This effect is often seen when over-pumping of ground water causes the intrusion of unusably salty water from other formations.

South Africa is comparatively fortunate to have a single water administration which is responsible for the management of both water quantity and water quality and the principle suggests that this should be maintained. The danger, though, is that this creates a strong national organisation which may resist co-operation with broader environmental management activities. This Principle directs the water sector to co-operate with all the other parties concerned with the protection of the environment. It also promotes the use of such tools as Integrated Environmental Management (IEM) and Integrated Pollution Control (IPC).

Principle D. 5.

Water quality management options should include the use of economic incentives and penalties to reduce pollution; and the possibility of irretrievable environmental degradation as a result of pollution should be prevented.

All water has a value to society and therefore the ecosystems which provide us with water also have a value. Water is used in a variety of ways, some of which are not obvious. For example water is used for transport and the dilution of waste. Water borne sewerage systems, for example, use expensive, treated water to transport waste from the toilet to the sewerage treatment plant. Water in rivers and streams is used to dilute and carry away waste from industry and agriculture. The flow of water is also used for cooling or to pass through turbines to generate electricity. When water is used in these ways, a cost should be borne by the user which reflects the value of the water used. In the case of waste disposal, this may be achieved through the "polluter pays" policy.

Principle D. 6.

Water resource development and supply activities should be managed in a manner which is consistent with broader environmental management approaches.

Any development of water resources has an impact on the broader social and natural environment. The water administration should not be exempted from the requirements to evaluate environmental impact and to take appropriate action to keep them to acceptable limits. This would require the use of well-established methods such as Integrated Environmental Management (IEM) and Environmental Impact Assessments (EIAs).

Principle D. 7.

Since many land uses have a significant impact upon the water cycle, the regulation of land use should, where appropriate, be used as an instrument to manage water resources.

The same approach to cooperation with other agencies around environmental issues is needed with respect to land use. This Principle could also provide some redress for the forest industry which claims that it is penalised (or regulated) unfairly because it is not allowed to plant forests wherever it pleases. Fairness may require that the regulation of land use be extended to other crops, such as sugar cane planting in some vulnerable catchments. Land management also affects water quality. Where poor practices are followed, topsoil is washed into rivers which silts up dams and increases the turbidity of the water. These are but two examples of how a certain use of land may affect the water cycle and therefore the interests of other water users in a catchment area.

Principle D. 8.

Rights to the use of water should be allocated in good time and in a manner which is clear, secure and predictable in respect of the assurance of availability, extent and duration of use. The purpose for which the water may be used should not be arbitrarily restricted.

It is important to note that current water "rights" often have substantial deficiencies. They may reflect, at best, the occasional right to use water when it happens to be present. Existing allocations may be challenged and altered as new hydrological information becomes available. In addition, riparian rights are normally limited to the use of water for specific purposes on the parcel of land concerned and are not automatically transferable for use on other land or even for other purposes on the same parcel of land.

The objective of the water law review is not to penalise the people who already have rights - it is to develop a better, fairer and more efficient system for everybody. The objective is to improve the quality of water rights by addressing some of the deficiencies described above.

The improvement in the quality of water rights should be achieved by ensuring that new water rights are more substantial and carry stronger guarantees than existing rights. This will improve the value of water rights. There may be reason to place restrictions on the time for which a right may be exercised, in other words, rights may not necessarily be in perpetuity although there is obviously need for security, clarity and predictability.

Principle D. 9.

The conditions subject to which water rights are allocated should take into consideration the investment made by the user in developing infrastructure to be able to use the water.

When people invest a large amount of money in a development like a dam, an irrigation system or a factory which depends on having access to water, they need to know that their investment will be worthwhile. To this end, they must be able to ensure that the water they need is available for a reasonable period. A forestry permit might thus reasonably cover a number of cycles of afforestation while a permit to build a dam and abstract cooling water for a power station should cover the economic life of that power station.

Principle D. 10.

The development and management of water resources should be carried out in a manner which limits to an acceptable level the danger to life and property due to natural or man-made disasters.

If optimal social and economic benefit is to be achieved, this must apply to all aspects of water management. The variable nature of our climate means that many parts of South Africa are occasionally subject to devastating floods. To the extent that it is possible to do so, water resource management must aim at reducing the resulting damage to life and property.

Disasters of this kind can also be man-made since the impoundment of large quantities of water always represents a potential hazard to downstream development and communities. For this reason, water resources must be developed in a way which minimises the hazard potential due to dam failures or other events to an acceptable level.

At the other extreme, drought is a normal condition in South Africa. Water resource planning must aim to ensure that the possible impacts of drought are identified and appropriate measures taken to minimise them.

Principle E. Water Institutions

Principle E. 1.

The institutional framework for water management should, as far as possible, be simple, pragmatic and understandable. It should be self-driven, minimise the necessity for state intervention, and should provide for a right of appeal to or review by an independent tribunal in respect of any disputed decision made under the water law.

A principle was proposed relating to enforcement and the quantification of water rights which is quoted immediately below. There have been a number of adverse comments on this proposed principle and it has been excluded from the final draft. The objection raised in some quarters was that it assumes a specific approach to the future administration of water rights that may not in fact be chosen, and that it would be an enormous task which would be very expensive.

Efficient enforcement is dependent on the speedy quantification of as yet undetermined water rights and the proper registration of all water rights, including existing rights, particularly in those areas of the country where water rights are most contested. This should take place systematically over as short period as available finances will allow.

It is the opinion of others that a beginning must now be made to expedite this process, despite the time and cost, and that no alternative exists to the registration and quantification of at least all contentious water rights.

Principle E. 2.

Responsibility for the development, apportionment and management of available water resources should, where possible, be delegated to a catchment or regional level in such a manner as to enable interested parties to participate and reach consensus.

The above two principles are largely self-explanatory but their impact on the administration and management of water resources in South Africa could be substantial.

The principles first highlight the need to avoid unnecessarily complicated, expensive and cumbersome methods of management. Because the water cycle is so variable and unpredictable, it is difficult to determine the amount of water available for allocation to a user at any one time. For this reason, it is vital that use is only regulated when it is necessary in the public interest to do so and that it is then regulated in the most efficient and non-bureaucratic manner possible.

Thus, although rainfall on a building's roof could theoretically be subject to management, it would serve no purpose to require that all rain water tanks be authorised. Similarly, where underground water is plentiful, little purpose would be served by requiring all boreholes drilled for domestic purposes to be licensed.

A separate but related issue is the desirability of promoting approaches of local consensus-building regarding water apportionment and management between actual and potential users. If all interested parties in a catchment can reach agreement about the sharing of available resources (subject to the requirements of the reserve and to over-riding national interests), there may be no reason for the State to intervene.

It may also be appropriate to delegate certain functional responsibilities to provincial or local government agencies. While this may be done to achieve greater efficiency in administration, the more important objective will be to promote democratic governance at all levels of society.

Principle E. 3.

Beneficiaries of the water management system should contribute to the cost of its establishment and maintenance.

The establishment and running of an administrative system to manage water allocations can be a costly exercise. It will however bring clear benefits to water users. It is therefore reasonable for the potential beneficiaries of the allocation and management process to contribute to the costs of its establishment and maintenance.

Principle F. Existing Water Rights

Principle F. 1.

Lawful existing water rights should be protected, subject to the public interest requirement to provide for the Reserve. Where existing rights are reduced or taken away, compensation should be paid wherever such compensation is necessary to strike an equitable balance between the interests of the affected person and the public interest. An existing right should not include a right which remains unquantified and unexercised at the time of the first publication of these principles.

In introducing any new system, clear principles guiding the transition from what is currently in place to new arrangements have to be in place and the transition process must be carefully managed. This principle addresses the issue of compensation which may arise should existing rights have to be curtailed.

An existing right means any right of use which is provided for by common law or legislation. The exclusion of rights which have not been allocated or exercised at the time of the first publication of these principles is to prevent a rash of speculative development in order to entrench or establish new rights or to attract compensation.

Principle G. Water Services

Principle G. 1.

The right of all citizens to have access to basic water services (the provision of portable water supply and the removal and disposal of human excreta and waste water) necessary to afford them a healthy environment on an equitable and economically and environmentally sustainable basis should be supported.

The Constitution sets out the rights of all people in the country to a healthy environment. Water rights and the right to a basic water supply are not the same thing since even if a community has full rights to take water from a river, they will not necessarily have the money or expertise to treat the water and pipe it to their homes.

This suggests that the question of rights to water supply is not the same as the right to the use of water. Whilst it is not the direct responsibility of the national government to supply water directly to each citizen in the country, it is the responsibility of national government to ensure that water is supplied. Similarly, if the objective is to achieve a healthy environment, action must be taken to ensure that adequate sanitation provision is available. Because water supply and wastewater removal are often very closely linked, it is traditional to consider them as part of the same service.

Principle G. 2.

While the provision of water services is an activity distinct from the development and management of water resources, water services should be provided in a manner consistent with the goals of water resource management.

The objectives of water services provision may be met by a water administration, by an agency of local government or by private endeavour. Water services provision may impact heavily upon water resources, be it due to rapidly growing urban demand or the effect on water quality of run-off from poorly planned peri-urban areas. It is thus necessary to link water service provision to water resource management administration if water services goals are to be achieved in a sustainable way. This principle provides the basis for that linkage.

Principle G. 3.

Where water services are provided in a monopoly situation, the interests of the individual consumer and the wider public must be protected and the broad goals of public policy promoted.

The distinguishing feature of water services is that, more than most infrastructural services, they are natural monopolies. This creates certain dangers and problems which need to be guarded against, particularly in order to protect the poor. We must ensure that broad public policies, such as the Reconstruction and Development Programme are not thwarted by monopolistic arrangements which are not equitable.

In the case of a public monopoly the rules of local government accountability could, theoretically, achieve the desired level of equity. Where services are provided by private sector "for profit" organisations, the mechanisms of regulation need to be more formalised. Where there is a mixture of public and private provision (as in the case of the delegated management contracts currently being promoted in certain local governments), the need for sensitive and systematic regulation becomes critical. This principle provides the basis for such regulation.

Public Response

This document has been produced as part of a broad process of consultation. If you want to participate in the ongoing process of water law review or have specific comments which you would like to have considered, please contact :

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Ready to fight to the last drop

Next century's wars will be fought over water, warns the World Bank.

John Vidal reports

THE WORLD BANK has seen the future, and it's very, very dry. This month, as the US counted the rising death toll of a searing summer, as Spanish regions clashed over what to do in a few weeks' time when their drinking water may run out after a two-year drought, and as tinder-dry Britain found it was leaking a third of its supplies, the world's most cautious economists helpfully chimed in. "Earth faces H₂O crisis," the Bank yelled.

"The wars of the next century will be over water" — not oil or politics — says Ismail Serageldin, the Bank's vice-president, echoing UN Secretary-General Boutros Boutros-Ghali's 1988 assertion that the next war in the Middle East would be over the Nile. Within hours, Israeli and Palestine diplomats had reached more deadlock on water in their peace talks.

Unlike Boutros-Ghali, Serageldin wields facts: 80 countries, he says, now have shortages that threaten health and economies; 40 per cent of the world (more than 2 billion people) has no access to clean water or sanitation. And as industrial, agricultural and individual demands everywhere escalate (see diagram), the situation is deteriorating.

Serageldin's analysis is devastating but his conclusions will be hotly debated. When set alongside new statistics from the FAO (the UN's Food and Agricultural organisation)

multiple factors are compounding each other's impacts.

Parts of Africa could shortly experience a "drying out", and as demand soars, so supplies may decline faster than ever. Result everywhere: communities less able to feed themselves, political tension and an escalation towards conflict. "It's no longer an economic struggle, but a fight for survival," said one regional politician grappling with the Spanish water crisis.

Peter Gleick, of the Pacific Institute for Studies in Development, Environment and Security in California, agrees with Serageldin. He sees water becoming increasingly important in inter-state politics and the "probability" of violent conflict over Earth's fundamental resource. Water, he says, is fast evolving into an issue of high geopolitical strategy: "It's dynamite."

Because water is no respecter of national boundaries, the potential for insecurity is great. Botswana, Bulgaria, Cambodia, the Congo, Gambia, the Sudan, Syria and many other countries receive 75 per cent or more of their fresh water from the river flows of (often hostile) upstream neighbours. Some 40 per cent of the world, Gleick says, lives in the 250 river basins whose water is competed for by more than one nation. Great rivers like the Nile, Niger, Tigris, Mekong, Brahmaputra and Indus flow through many countries, all of whom want to extract as much water as possible. All have been the subject of recent international disputes. Tensions appear "especially likely" in parts of southern and central Asia and the Middle East, where water conflicts



Splashing out . . . A Sri Lankan girl washes from a full bucket, but how long will this plentiful supply last?

PHOTOGRAPH: MARK EDWARDS

The dry and the mighty

Rivers where the international tension flows . . .

NILE: Flows through 10 volatile countries; provides 97 per cent of Egypt's water. Water developments upstream in Sudan, Kenya, Rwanda, Burundi, Uganda, Tanzania or Zaire would add to existing tensions. Only Sudan and Egypt have signed a water-use treaty.

INDUS: Pakistan is greatly dependent on the river but two of its tributaries rise in India — which wants water for the Punjab grain basket.

BRAHMAPUTRA: Vast amounts of silt are flowing down the river following deforestation in Bangladesh and Nepal. An Isle of Wight-size island is building up in the Bay of Bengal and will shortly surface.

JORDAN: River basin shared by Jordan, Syria, Israel and Lebanon. Forty per cent of Israel's water originates in territories occupied after the 1967 war. Water use is currently part of the deadlocked peace talks.

TIGRIS/EUPHRATES: Turkey controls the headwaters of both rivers via 33 dams in the giant GAP project. Downstream countries like Syria and Iraq depend completely on the Euphrates. Syria has ambitious irrigation plans which would further hit Iraq.

MEKONG: Laos, Vietnam and Thailand are rapidly industrialising and disputing how to manage the river. Thailand wants dams built in Laos that would change agriculture patterns in other countries.

GANGES: 300 million Indian farmers depend on the river but deforestation in Himalayan foothills is said to be disrupting the flow.

and a rain of recent independent scientific and academic hydro-political studies, the size of the global water bomb emerges.

Worldwide demand for water is doubling every 21 years, more in some regions. Supply can't keep pace with demand growth as populations soar and cities explode, the Bank says. Cape Verde and Barbados are running out now. The situation in the Middle East and North Africa is "precarious". Northern China, western and southern India, parts of Pakistan, South America and much of Mexico all face water scarcity.

Much of sub-Saharan Africa is in semi-permanent crisis. Fifty Chinese cities face acute shortages as the water table drops one or two metres a year. Meanwhile, many countries are accelerating the process of desertification and water quality is falling rapidly in the developing world as pollution and salinity, caused by industrial farming and over-extraction, rises.

"With water there is survival, without it there is no food nor sustenance of any sort," says Dr Norman Myers, a fellow of Green College, Oxford, and consultant to the Bank. His recent book, *Ultimate Security*, is harrowing. It says Egypt's water supply per person is expected to shrink by 30 per cent, Nigeria's by 40 per cent, Kenya's by 50 per cent in under a decade. By 2025, Serageldin adds, the amount of water available to each person in the Middle East and North Africa will have dropped by 80 per cent in a single lifetime.

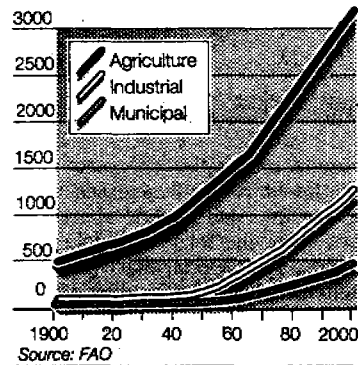
Myers identifies an ecological "risk spiral". As population grows (it's expected to double worldwide in 40 years), so drier areas are being farmed. This justifies the loss of forests and other water-conserving vegetation but the result is less rainfall and a "dessicatory effect" —

go back more than 5,000 years.

The problem, the FAO says, is not "climatic drought". Rainfall stays roughly the same, even if the last decade has seen eight of the hottest years on record. Rainfall varies widely from year to year but good and bad years tend to be

Supply and demand

World water use: (cubic kilometres p.a.)



grouped. Today's problem is self-induced. What we are seeing, the FAO says, is mostly "agricultural drought" — where water supply is insufficient to cover crop or livestock needs.

It comes in two forms. Growing populations need more food, which demands more water to grow it. But less remarked (and ignored in the Bank's analysis) is the fact that new, high-yielding crop varieties — subsidised and pushed vigorously by governments, industry and world bodies as the most efficient way to feed people — demand much more water.

Moreover, agricultural drought is being worsened as tensions grow everywhere between the three sectors of society that traditionally compete for water — farming, in-

dustry and individuals. The FAO and the Bank agree that, as wealth increases, agriculture is being denied water by emerging industrial and urban areas.

"Where's the food going to come from?" Gleick asks. "How can we possibly meet the needs of 10 billion people when we can barely meet the needs of 5 billion and are actually taking water away from agriculture?"

"Food production capacity is being lowered," Serageldin says. "Water scarcity, not shortage of land, will be the main future constraint of agriculture in developing countries."

The solutions are hotly debated. The Bank wants \$600 billion to be invested in sanitation and water schemes in the next decade, and says it will up its lending in this area to about 25 per cent of its loans. It makes economic sense: the price of not investing in health and sanitation is huge. Ten weeks of cholera caused by contaminated water in Peru recently cost about \$1 billion — three times the amount invested in the country's water supply in the whole of the 1980s.

Because it could not afford to clean up the pollution of its water supplies, Shanghai spent \$300 million recently moving its intake 25 miles upstream. Here British water companies say it will cost \$60 billion to meet EU water quality standards — the price of not investing in pollution prevention earlier.

"It's good to see the Bank taking water seriously," says Mark Robinson of WaterAid, the British charity which claims that 80 per cent of all deaths in the developing world are now water-related and warns that cities in the developing world are becoming mega-slums increasingly

prone to disease. "The implications for the IMF and the world community are great. Scars like the recent Indian plague outbreak will be repeated month after month unless we get to grips with water."

"But money is not enough — the approach is vital. Time and again the poorest are bypassed by inappropriate water and sanitation investments. The developing world is littered with failed water projects. Soon the majority will be living in little more than urban slums. Without safe water there can be no good health and without health you can't fight poverty. Everything starts with water."

HE IS supported by a Malaysian development academic who asks not to be named. "Unless the World Bank and governments really attack the roots of the crisis, start thinking in the long-term and work from the bottom-up, the problem will not be solved," he says.

He warns of another risk spiral: "The core thinking of the Bank and others is to push western efficiency, technology and modernisation — most of which have ignored social costs. Yet the poor have ended up poorer in cities, where they need more water than before and the pollution of water is greatest."

"Without clean water and good sanitation, urban poverty, slums and diseases have flourished and countries have slipped even further into the poverty trap. But countries are still told by the World Bank and western-trained economists to develop, at the expense of their traditional water-sparse agriculture, foreign exchange-earning crops like flowers or lettuces — which need even more water." It's all underpinned by global free trade

and the Gatt — pushed by the Bank, he says. "Now everyone says 'develop tourism', which, per capita, is the most water-intensive of all industries!"

The figures are startling: according to the FAO, the average 15,000 cubic metres of water needed to irrigate one hectare of high-yielding modern rice is enough for 100 nomads and 450 cattle for three years, or 100 rural families for two years, or 100 urban families for two years. The same amount can supply 100 luxury hotel guests for just 55 days.

Meanwhile cities, Gleick says, can pay 10 times more for water as farmers; African safari hotels are paying to usurp wells that have traditionally watered whole tribes, and everywhere farming and industry is excused paying for the pollution it causes. In-city after city in the developing world the poor must rely on private water vendors paying 10 times or more what those with government-provided tap water pay.

Most contentiously, the Bank wants to see water valued as an economic good. Ignoring all arguments about water being a human right, or cultural or religious factors that celebrate the sacredness of water, it says private enterprise and the privatisation of water supplies are the way to provide the most services at the lowest price for the poor. It will be as hotly debated as Britain's venture into privatising water.

"Privatisation misses the mark," WaterAid says. "The poor already pay very heavily for water. In effect it's privatised already but going down the route of private facilities may not be appropriate. There are other ways. Otherwise water has a funny way of ending up only in the rich man's bucket these days."

Watershed development through peoples participation:

The Story of Pimpalgaon Wagha



Children no longer had to look after the goats and could go to school. Now eighty percent of the people of Pimpalgaon Wagha can read and write.

Watershed development is getting increased attention in the semi-arid regions of India. However, the approaches applied are often rather technology oriented and controlled by NGOs and the Government. The participatory approach as developed by Social Centre and experimented with in Pimpalgaon Wagha holds many important lessons.

Crispino Lobo

Pimpalgaon Wagha is a small village covering an area of 840 ha in the Ahmednagar district of the state of Maharashtra. It is located at the foot of barren and rocky hills in the rain shadow area of the Western Ghats. The village experiences two major seasons: summer (March-June) and winter (October-February). The temperature varies between 28°C and 12°C in winter to 39°C and 23°C in summer. With an average annual rainfall of 511 mm, most of which falls within a span of a few days, Pimpalgaon Wagha has been experiencing severe droughts for many years.

The landscape is marked by heavy soil erosion. The highly eroded stony soil is largely unfit for cultivation, but for the lack of alternatives, the people of Pimpalgaon Wagha continue to grow crops. The main crops grown in summer and monsoons are millet, pigeon pea, lentils, gram and kidney beans, while sunflower, safflower and sorghum are grown in winter. Where seasonal irrigation is still possible, vegetables, onions and groundnuts are grown.

Pimpalgaon Wagha has 879 inhabitants, 27% of the families belong to backward caste, they live at the border of the village. A socio-economic study conduct-

ed in early 1988 revealed a very grim picture. Because of recurrent drought and the resulting poor economic condition, the 879 inhabitants often experienced hunger and were prone to many diseases. Sixty percent of the people depended on agriculture for their subsistence and the 11 landless families had other occupations, like hair-cutting, cobblery, carpentry. Most people from the village had to go out as agricultural labourers, but this income was barely enough for subsistence and that too not on a regular basis. People either migrated to urban areas in search of jobs or took debts from moneylenders and landlords and to pay them back often worked as bonded labourers. The women were the worst affected. Drinking water was not available within the village and they had to walk for miles to get water and fuelwood. More often than not, this task was given to young girls, who had to leave school to help in household chores and were, as a result, deprived of education.

In 1988 Social Centre, a voluntary agency which has been working in the district for two decades, decided to work in the village because of its poor condition. When Social Centre approached the village, the people expressed a desire to start a dairy co-operative as they had seen one in a neighbouring village. Social Centre helped them in this endeavour and also helped them

obtain loans to buy better cattle. Thus a relationship of trust was established.

Watershed management

In 1989 Social Centre decided to introduce watershed development in Pimpalgaon Wagha. Some villagers were taken on an exposure visit to Adgaon and Ralegan Siddhi, where experiments of participatory watershed development had been successful. The villagers were very impressed and enthused. They saw the benefits of watershed development and decided to try out the same in their village.

The conditions laid down for successful implementation of watershed development were quite rigid and demanded a change in the prevailing lifestyle of village community. But the now-motivated people readily accepted the conditions.

Watershed development involves the complete participation of the affected people, where they are responsible for the planning, implementation and monitoring of the project. This was a new experience for the people, because hitherto developmental projects were implemented by the Government and the opinions of the affected people was hardly solicited.

The people of Pimpalgaon Wagha formed a Village Watershed Committee (VWC) to oversee the activities involved developing their watershed. This body was nominated from among the villagers and was representative of all communities and geographical regions within the village. This was again a novel experience as the backward communities who had never really been part of the village affairs now had fair representation on this decision-making body. As the VWC had been unanimously nominated by the villagers, the better-off farmers lobby could not dominate it.

A ban was imposed on free grazing and free felling. The villagers decided to levy a fine on defaulters. The villagers also sold off their scrub cattle and replaced them by good quality hybrid cattle. Goats were sold off, as a result of which children who otherwise had to tend them could go to school. The villagers then decided to take up measures to conserve soil and water. Social Centre gave them support for technical surveys and other managerial assistance. A nursery was set up by a small farmer. Treatment measures like contour trenching, contour bunding, gully plugging,

construction of check dams and percolation tanks were taken up. The villagers contributed free labour on the basis of two man-days per month per family or two days wages in lieu of labour. Women also contributed free labour for tree plantation activities.

The villagers were trained to carry out tasks like surveying and levelling. The activities were monitored by a supervisor who was also from the village. The result was that the people began to feel responsible for the project and so worked hard to make it a success.

Post-watershed impacts

Social. The backward communities were previously isolated from the village. They were not consulted on any matters pertaining to the village. They were considered as social outcasts. The watershed movement brought about a change in this attitude of the people of Pimpalgaon Wagha. Social taboos have been lifted and these people are now allowed freely in the village. The backward communities have fair representation on the VWC and participate actively in the decision-making process. Once the financial condition improved, the people from these communities also began to get respect from the other villagers. Injustice by landlords and moneylenders also greatly reduced. People became less dependent on them as they became aware of government schemes and loans. The income earned from the work on watershed sites helped them pay off their loans. As more children could go to school, literacy in the village improved and today the literacy rate is about 80%. Biogas plants were set up in some households in the village and their fuelwood consumption declined. As drinking water had become available within the village, the women did not have to go far for water and so could contribute more positively to the development of the village. They set up a revolving credit and made loans available to the needy at the low interest rate of 2%.

Economic. The soil and water conservation measures increased the water levels in the village wells and water was available for about 11 months in the year. Before watershed development was introduced in Pimpalgaon Wagha, only 40 of the 75 wells had water and that too for just 8 months. As a result, the farmers could irrigate their fields and agricultural productivity increased by nearly 50%. Horticulture was introduced in the village on wastelands and private farmlands bringing more land (33 ha) under productive use. Eleven ha is under dryland horticulture, while the remaining 22 ha under mango, chickoo, orange and tangerine cultivation is irrigated. The dairy co-operative is running successfully and milk production has also gone up to 1200 litres per day. As more opportunities for employment have become available within the village, the

migration to urban areas and other agricultural wage labours has stopped. In fact, some families who had earlier left the village have now returned.

Natural resources. Positive impacts on natural resources are also observed. The once rocky hillsides around Pimpalgaon Wagha are now covered with grasses and shrubs, as a result of the ban on free grazing and free felling. In spite of the drought situation, nearly 80% survival rate is seen in the 200,000 saplings planted by the people. Soil erosion had declined considerably and grasses are growing along the waterways. Streams which would flow only up to November now flow up to January even in a dry year. Drinking water is available even in the dry years. This year, for example, the monsoons did not arrive in Pimpalgaon Wagha till September, but the people had drinking water, and could also irrigate their horticulture plots.

Lessons learnt

The experiment of Pimpalgaon Wagha shows that it is possible for people to unite and work together to develop themselves, at the same time expressing their creative potential and wisdom. About the way how to enhance such a process many important lessons have been learned, for example:

- Watershed development is possible only when the creative potential of the people is awakened, mobilised and organised in such a way that they constitute themselves into a self-help group oriented towards rejuvenating and managing their "space of survival" to the long-term benefit of all.
- The role of an NGO is only one of catalyst and advocate. It's job is to mobilise the latent power of the people, to accompany them and to empower them by putting them in contact with existing development institutions and by also upgrading their skills in the various aspects of project management, maintenance of works and enhancing of the productive potential of created assets. The NGO should not substitute the people's own initiative and responsibility.
- The imposition of "outside" ideas of equity may well prove counter productive in terms of good will of people who do not perceive it as just and fair within their particular socio-eco-cultural situation, thus leading to group resentment.
- All work plans, implementation and decisions concerning the same should be made by the people and the NGO together, with weight being given to the former. Moreover the project should be implemented in such a manner that the beneficial traditional, cultural and institutional mechanisms are not only eroded by the introduction of exogenous management systems into the village but are in the process to be strengthened and made effective.

- Whenever possible, all relevant major GO and NGO development institutions should be involved in such a project. This might well provide the possibility to reorient such actors in a way that people's priorities and demands set the agenda rather than institutional and administrative compulsions.
- Selection of the village has to be done very carefully. Those villages in which people have a tradition of intra village conflict management and decision making based on consensus in matters that affect the village as a whole offer a promising basis for success.
- Participatory development is largely a question of people management and personal relationships. Therefore having the right kind of staff is crucial to the success of such projects. Only s/he will succeed who is perceived by the people as sincere, committed and having their best interest at heart.
- Furthermore, if one is to empower the people and evolve a people's programme, it is important that these same people also have access to project finance - how much and how it is spent. The people cannot be mere beneficiaries of largesse or mere wage labour with the NGO being contractor or master. Mechanisms should be evolved wherein people are not only enabled to make their own active contribution but also have a say in the disbursement of project funds. The project must be accountable to the people!

Today, Pimpalgaon Wagha acts as a role model for other village communities that wish to help themselves and better their conditions. The people of Pimpalgaon Wagha have even decided to adopt another village community in their vicinity and introduce it to watershed development, thus giving an impetus to a watershed movement.

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Further reading

- Lobo C. & Kochendorfer-Lucius G, 1992. *The rain decided to help us. Pimpalgaon Wagha: an experience in participatory watershed development in Maharashtra State, India.* GTZ, Bonn.
- Pangara G. & Pangara V, 1992. *From poverty to plenty: The story of Ralegan Siddhi.* Studies in ecology and sustainable development - 5. INTACH, 71, Lodi Estate, New Delhi - 110 003, India.

Block 2 : Sustainability Issues

Tuesday, September 17, Session A

- Subject title** : Sanitation technology options
- Type of session** : Lecture and discussion
- Objectives** : - Participants gain an overview of considerations and steps needed to come to proper technology selection and service levels.

The right selection of sanitation technology is crucial to the proper use of sanitary facilities. Drainage, solid waste management and vector control are an essential part of a community level sanitation programme. Socio-cultural, technical, environmental and community criteria should be taken into consideration when selecting options for human waste disposal and sanitation improvements. Planning steps to be taken are to be determined and the possible communities input defined.

- Hand-out** : - Summary of criteria, planning steps, technology and service level options.

September 7 27, 1996, Kandy, Sri Lanka

SAN

Promotion of Sanitation

**Working Group of the Water Supply and Sanitation
Collaborative Council**

Report for consideration at the Barbados Meeting
30 October - 3 November 1995

Volume 2: Main Report

Working Group Coordinator
Dr Mayling Simpson-Hebert, World Health Organization

1. THE BURDEN OF POOR SANITATION

- 1.1 Every year, 2.5 million children die from diarrhoea that could have been prevented by good sanitation. Millions more suffer the nutritional, educational and economic loss because of diseases which improved sanitation can prevent. Poor sanitation has led to the infestation of nearly a billion people, largely children, with a variety of worm infections, with corresponding costs in health and energy. Human excreta are also responsible for the transmission of schistosomiasis, cholera, typhoid, and many other infectious diseases affecting hundreds of millions. **Overall, WHO estimates that about 3.6 thousand million people die annually and about 1.5 thousand million suffer at any one time from infections stemming from human excreta, waste water and solid waste in the environment (WHO 1995).** Heavy investments have been made in water supply since 1980, but the resulting health benefits have been severely limited by the poor progress in sanitation. Besides this toll of sickness and disease, lack of sanitation is a major environmental threat to water resource systems and a fundamental denial of human dignity.
- 1.2 Today about 1.7 thousand million people, by conservative estimates, lack access to latrines and other forms of good sanitation. However, even among those having some sanitation coverage, the "latrine mortality rate" is very high, with latrines not being used as intended or closed to use altogether. Hygiene behaviours have not been stressed in programmes leading to an extreme hardware bias without accompanying hygiene education. This results in the continued spread of disease even where infrastructure exists. This situation affects all of mankind, rich and poor alike, because it puts everyone at risk of disease, and curing and controlling these diseases, including the increasing cost of cleaning polluted water, is a financial burden for all.
- 1.3 The gap between population growth and provision of sanitation is holding steady (see Figure 1). Projections of human population growth rates predict that, with "business as usual" in promoting and providing sanitation, about two thousand million people will be unserved in the year 2025. The sector clearly needs new approaches and increased emphasis.
- 1.4 During the International Drinking Water Supply and Sanitation Decade it was thought that sanitation could be combined with water supply projects and that the more attractive water would pull along sanitation. Some projects required that communities first build latrines before the water supply project would begin. Others believed that the communities higher priority for water should be met first before discussing with them sanitation. Little attention has been given to hygiene behaviours within projects. Despite a heightened awareness and greater efforts during the Decade, sanitation lagged behind water supply. Could it be that sanitation requires a special approach?

2. PROBLEMS AND PROMISE OF THE SECTOR

- 2.1 Among the main problems in the sector are a **lack of political will** at all levels, **low prestige** of the sector, **poor policy** at all levels, **poor institutional frameworks** for implementing sanitation, **inappropriate approaches** which focus on single solutions and ignore the diversity of needs and contexts, **neglect of consumer preferences**, **lack of enough good technical solutions**, and **lack of a gender focus**. Many of those most in need of sanitation, the rural and urban poor, have the least voice and power in society so that their demand for services, where it exists, is often not effectively expressed. A concise paper entitled "The Problem of Sanitation" was produced by the Working Group which discusses problems of the sector in greater detail (see Annex D).
- 2.2 *In order to promote sanitation, we must do better programmes which demonstrate success and sustainability.* There has not been a great deal of analysis of the sector and one conclusion of the Working Group is that there is still much to be learned about how to do better programmes.

- 2.3 The Working Group identified what seem to be the features of better sanitation programmes, i.e. those in which the community has become fully involved and which are leading to or have led to change (see Box 1 page 4).
- 2.4 From these features and other literature (Cairncross 1992, La Fond 1995, WHO 1993), the Working Group observed a growing consensus around a set of guiding principles for better programmes (see Box 2 page 5).
- 2.5 Following this exercise, the Working Group agreed that sanitation programmes are often based upon numerous **wrong assumptions** which lead to failure (see Box 3 page 6). This could be avoided if the sector as a whole had its own set of principles based upon experience and agreed upon by professional consensus.
- 2.6 The Working Group found the exercise of searching for such principles to be extremely useful and believes that existing programmes of any size can be improved by examining their own underlying assumptions and by considering what appear to be the principles behind more successful programmes. The search for principles is important because principles should govern sanitation policy, how a programme is designed and eventually run, what mechanisms a programme uses to reach communities and households, and how it does planning, design, implementation, monitoring and evaluation.
- 2.7 *Institutions are encouraged to go through a process of reflection about:*
- the underlying assumptions and principles of their current programmes
 - principles which may result in better programmes in their own local context.
- 2.8 Some of the most important principles to be respected are:
- a) sanitation programmes should be based upon demand,
 - b) sanitation improvements should be approached incrementally, starting from where people are and helping them to improve according to what they can afford and sustain,
 - c) sanitation programmes should take a gender-sensitive approach at all stages and all levels,
 - d) good sanitation is a well-functioning "bio-cultural" system.
- 2.9 Users of the principles should be national institutions implementing sanitation programmes, external support agencies, sector professionals (extension workers, consultants, evaluators, commercial sector), NGOs, local councils and organizations, village committees, and the public at large.

Box 1: Features of better sanitation programmes identified by the Working Group

- ▲ They take a learning approach. They flex, change and innovate until they get it right.
- ▲ They are focussed on demand creation.
- ▲ They use social marketing and participatory approaches together.
- ▲ They create an environment whereby private producers can thrive.
- ▲ They have relaxed the definition of what constitutes "acceptable" latrines and obtained the highest political support for a less rigid range of good technologies.
- ▲ They consider what people are already doing and help them to do it better. This includes building upon existing good technologies.
- ▲ They offer a range of technical options that can be afforded by most people without subsidy.
- ▲ They introduce new latrine options through slightly wealthier, higher status people in the community. This is because community members in most places expect wealthier and higher status people to take risks and to be the first to try new things.
- ▲ They let the community know that the sanitation programmes has political support from the very top. This is because community members want to follow programmes that are endorsed from the top.
- ▲ They involve schools, school children or community children. Many use schools as the entry point to the community.
- ▲ They combine facilities with behaviour change strategies.
- ▲ They build upon existing community organizations rather than creating new ones.
- ▲ They encourage community groups to formulate their own hygiene education programme, their own messages and their own methods.
- ▲ They use both female and male extension workers.
- ▲ They build capacity for community management of the project.
- ▲ They involve a strong training and human resources development component at all levels.

Box 2: Guiding principles to better sanitation programmes identified by the Working Group

- ▲ From an epidemiological point of view, sanitation is the first barrier to many faecally transmitted diseases, and its effectiveness improves when integrated with improved water supply and behaviour change. However, improvements in hygiene behaviours alone can result in disease reduction and can serve as a valid programme objective.
- ▲ Sanitation comprises both behaviours and facilities, which should be promoted together to maximize health and socio-economic benefits.
- ▲ From an implementation point of view, sanitation should be treated as a priority issue in its own right and not simply as an add-on to more attractive water supply programmes. Sanitation requires its own resources and its own time-frame to achieve optimal results.
- ▲ Political will at all levels is necessary for sanitation programmes to be effective. Communities are more motivated to change when they know political will exists.
- ▲ Communities are bio-cultural systems. A sanitary environment is a successful interaction of the key parts of that system: the waste, the natural environment with its unique physical, chemical and biological processes, local cultural beliefs and practices, a sanitation technology and the management practices applied to the technology.
- ▲ Sanitation programmes should be based upon generating demand, with all of its implications for education and participation, rather than provision of free or subsidized infrastructure. Governments should be responsible for the protection of public health. Government sanitation policy should be one of creating demand for services, facilitating and enhancing partnership among the private sector, NGOs, based organizations, local authorities and removing obstacles in the paths of each of these and households in the achievement of improved sanitation.
- ▲ Sanitation programmes should equally address the needs, preferences and behaviours of children, women and men. Programmes should take a gender-sensitive approach but, learning from the mistakes of other sectors, should guard against directing messages only to women or placing the burden of improved sanitation primarily upon women.
- ▲ Sanitation improvements should be approached incrementally, based on local beliefs and practices and working toward small lasting improvements that are sustainable at each step, rather than wholesale introduction of new systems.
- ▲ User ownership of sanitation decisions is vital to sustainability. Empowerment is often a necessary step to achieving a sense of ownership and responsibility for sanitation improvements.
- ▲ Good methods of public health education and participation, especially social marketing, social mobilization, promotion through schools and children, exist to promote and sustain sanitation improvements.
- ▲ Sanitation services should be prioritized for high risk under-served groups in countries where universal coverage seems unlikely in the foreseeable future. Hygiene promotion should be targeted to all.
- ▲ Latrines are consumer products and their design and promotion should follow good marketing principles, including a range of options, designs attractive to consumers and therefore based upon consumer preferences, affordable, and appropriate to local environmental conditions. Basic marketing research and participation in design will likely be necessary to good programmes. Market forces are best understood by the private sector.
- ▲ As in all other public health programmes aimed at preventing disease, the promotion of sanitation should be a continuous activity. This continuous promotion is necessary to sustain past achievements and to ensure that future generations do not become complacent as diseases decrease

4.7 Examples of better mechanisms for working with communities were collected by the Working Group and follow:

4.7.1 Sulabh International Sanitation Programme, India

Sulabh International Social Service Organisation is the largest non-profit voluntary social organisation in India with more than 35,000 people from different disciplines working all over the country. It is dedicated to the promotion of sanitation, environmental improvement and social reforms. Sulabh has developed an efficient marketing and delivery system with back up support in training, motivation, sanitation education and community participation. Sulabh has so far constructed over seven hundred thousand toilets used by over 10 million people daily. The system works because the toilets and bathing facilities are not free - users pay. Some toilet facilities have been expanded into social centers providing other services such as primary health care, health education, telephones, and drinking water, and some community toilets produce biogas for cooking, lighting, warm water and heat for winter. An important focus of Sulabh efforts is the liberation of scavengers from the manual handling of human excreta and training them for new professions.

4.7.2 SARAR Participatory Hygiene and Sanitation Transformation (PHAST) methodology, Eastern and Southern Africa

The UNDP/World Bank Water and Sanitation Program and WHO joined forces in 1993 to try and develop a new approach for hygiene education which was participatory and built upon existing beliefs and practices. Under the Program, PROWESS¹ had already developed a network of sector specialists and core trainers in Eastern and Southern Africa with experience in the SARAR methodology under the PROWESS programme. Building upon those accomplishments, two workshops in 1993 developed a prototype set of participatory tools, drawing upon existing techniques and materials and creating new ones. The approach was tested by governments and NGO programmes in 16 sites in Kenya, Uganda, Zimbabwe and Botswana and all sites were extremely successful in the short term. Follow-up is required to see how sustainable the changes will be and whether the methodology can be used at the national scale. WHO is currently preparing a tool kit on the methodology for wide dissemination. A Manager's Guide and video are planned for completion in early 1996. (Sawyer, Simpson-Hebert and Clarke, 1995; Chatterjee, Clarke and Sawyer, 1995)

4.7.3 HESAWA School Health & Sanitation Package, Tanzania

The objective of this programme is to reach households and communities through schools. Projects begin with a health screening of school children for sanitation-related diseases. A health report card is sent home to parents and a parents' meeting is called to discuss the collective results. Parents are surprised to learn the severity and extent of the health problems in the community as a whole. Projects take a "problem-based learning" approach with parents. The problem is the school and community environment being contaminated with human excreta and the parents are encouraged to take responsibility for resolving this situation. HESAWA staff are trained in adult education techniques and help guide the community in action planning. They provide technical advice and training to a Village Health Committee and Village Health Workers. They also assist in improving the health education curriculum at school and the establishment of a School Health Club. An external evaluation of the programme states that it has made "remarkable progress in promotion of the use of available materials and in increasing sanitary facilities." (Mwasha 1994)

4.7.4 Lombok Indonesia Sanitation Programme

The sanitation programme on Lombok Island has shown remarkable success by moving from a supply-driven to a demand-driven programme and focussing on provision from the private sector.

¹ PROWESS is a project of the UNDP/World Bank. It stands for the Promotion of Women in Water and Environmental Sanitation Services.

The programme looked at market principles including design of the facilities, color of the facilities (consumers prefer blue latrines), the design of moulds so that producers can increase their daily output of slabs, and the cost per unit. In less than three years, some 46 private entrepreneurs are producing latrine components. A healthy competition among producers has helped to lower the cost of latrines from US\$5 to \$2 with significant improvement in the quality of the product. *Import of latrines from the Java Island has stopped. Communities now have easy access to components in the neighborhood.* Coverage has increased from 8 percent three years ago to about 60 percent today, with 20 000 latrines being built each year. The main channel for demand creation is through hygiene education transmitted by Muslim religious leaders. The leaders use the book "Water, Sanitation and Islam" compiled by Indonesian religious scholars to deliver sermons at mosques and informal Koran reading groups. Encouraged by the Lombok success, on World Health Day 1994, President Soeharto launched the "Clean Friday" movement as a national movement. The West Lombok water and sanitation programme was managed by the Women's Welfare Movement (PKK) with technical support from the Ministries of Health and Public Works and UNICEF. (Mathur 1995)

4.7.5 Mvulamanzi Trust Sanitation Programme, Zimbabwe

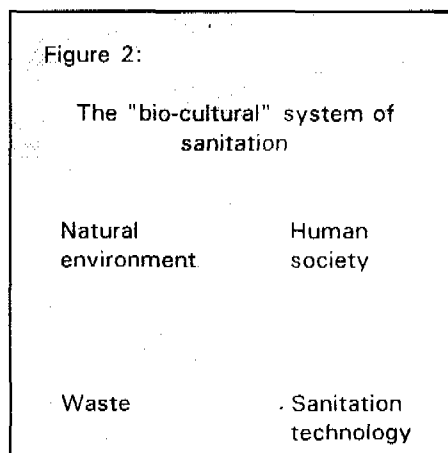
The Mvulamanzi Trust Sanitation Programme focusses on improving sanitation in rural households by promoting the Ventilated Improved Pit Latrine, developed originally at the Blair Research Institute in Harare. The Trust combines what they consider to be elements of a successful rural sanitation programme: training to local artisans in construction and hygiene education so they can sell their services and a minimum materials subsidy to households. The programme believes in starting where people are and helping them to improve upon what they have. They continually carry out research on consumer preferences and design features to improve upon the technologies they promote. Their current latrine design includes a hand-washing facility.

Recognize the "bio-cultural" system

4.10 Better sanitation programmes recognize the principle that communities are bio-cultural systems. A sanitary environment is a successful interaction of the key parts of that system:

- the local human society with its unique cultural beliefs and practices;
- the waste of that society;
- the natural environment with its unique physical, chemical and biological processes;
- a sanitation technology.

4.11 Adoption of this systems approach involves understanding fully, in each context, the bio-cultural environment. The purpose of external support should be to assist households and communities to achieve the optimal sanitation system within their bio-cultural context. This implies application of some of the principles identified by the Working Group, such as the need for a variety of technical options, an appropriate time-frame for incremental change, and a gender-sensitive understanding of the respective roles of men and women in the society.



4.12 This systems model implies that the sector may be resource poor with regard to latrine designs and that much more research and innovation could take place. With increasing pressure on water resources, dry latrine systems need to be given more attention. Most "low-cost" latrine designs promoted today are far too expensive for the urban and rural poor, and often require subsidies to make them affordable. More attention should be given to promoting designs that are completely affordable to most consumers, as has been done in Bangladesh with the promotion of the "do-it-yourself" home-made latrines.

Block 2 : Sustainability Issues

Tuesday, September 17, Session B

- Subject title** : Field Trip to Nagas Tenna.
- Type of session** : Visit of Nagas Tenna Urban Area and discussion with water committee
- Objectives** : - Participants learn about actual conditions in peri-urban settlements with respect to water supply and sanitation

Participants get a short description of the community which will be visited. In several small groups participants traverse the area and pay attention to important aspects such as; sanitation, water supply, gender and operation and maintenance. After the traverse a discussion with the water committee will take place.

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Block 2 : Sustainability Issues

Tuesday, September 17, Session C and D

- Subject title** : Peri-urban Water Supply and Sanitation
- Type of session** : Lecture and discussion
- Objectives** :
- Definition of peri-urban water supply and sanitation
 - Participants learn about the particular situation of communities and households in marginal urban areas.
 - Participants discuss options for the delivery of water supply and sanitation facilities to the under-served urban population.

Many municipalities face the challenge to provide water and sanitation services to their under-served population in inner-city slums or unplanned growth-areas at the edge of town.

Mobilization and organization of beneficiaries to act as initiators and partners in the WSS development process is an important step in overcoming many of the legal, financial and environmental hurdles in the urban setting.

- Hand-out** :
- WASSANGO - WG/U (1993)
 - Policy Paper SDC (1995)

September 7 - 27, 1996, Kandy, Sri Lanka

PERI URBAN WATER SUPPLY AND SANITATION.

GENERAL OVERVIEW

A rapidly increasing share of the population of developing countries lives in cities. Each year nearly 40 - 50 million new urban inhabitants join the struggle for live hood, service access and a secure community life.

The urban population living in developing countries has been estimated at 37% at present and by the end of this century more than half of the poor in developing countries will be living in cities making the peri urban sector enormously enlarged.

The peri urban sector is the term adopted to describe the following environments.

- Squatter settlements
- Overcrowded tenements
- Illeged subdivisions

Municipal authorities are pressed to provide infrastructure services to these populations. According to WHO estimates more than 25% of the urban population living in the developing countries lacks access to safe drinking water and more than 40% lives without adequate sanitation. Only 1/3 of the urban population is connected to a sewer system and 90% of the collected waste water is discharged without treatment.

The inadequate sanitary facilities have caused illness and child deaths.

WHO estimates that 75% of all illness and 80% of all child deaths in cities of developing countries are associated with unsafe excreta disposal, poor hygiene and inadequate drinking water supply.

In order to select the best delivery mechanism for water supply and sanitation for the peri urban sector the following are to be considered.

- Capacity of the beneficiary communities to participate in the process of planning, execution and operation and maintenance of the system.
- Support services that can be expected from the Local Authorities and the service agencies especially in maintenance.
- Affordability of beneficiaries to make financial contributions.
- Availability of technology options
- Land ownership

SRI LANKAN EXPERIENCE

Many developing countries would have tried several options for delivering water and sanitation to the peri urban sector and following describes briefly the attempts made by Sri Lanka, the success and the failures.

In Sri Lanka peri urban sector was neglected for many years and they were never considered as part of the city until mid eighties. In 1984 Sri Lankan government launched million houses programme aiming at providing better housing conditions for the nation and the housing and related infrastructure for urban poor was one of the main sub programmes under the million houses programme.

Urban poor who were living in canal reservations railway reservations, government lands were either relocated or upgraded under the programme and they were provided with a plot of buildable land, financial and technical assistance for housing and basic infrastructure facilities.

Figure I shows a typical layout of an urban low income settlement.

Following briefly describe how the water and sanitation were delivered and the observations made in an evaluation exercise carried out in some settlements.

Delivery Mechanism

Initiator	-	Government
Selection of technology option	-	Government
Planning and designs	-	Government
Cost sharing	-	Total cost borne by government
Cost recovery	-	Nil

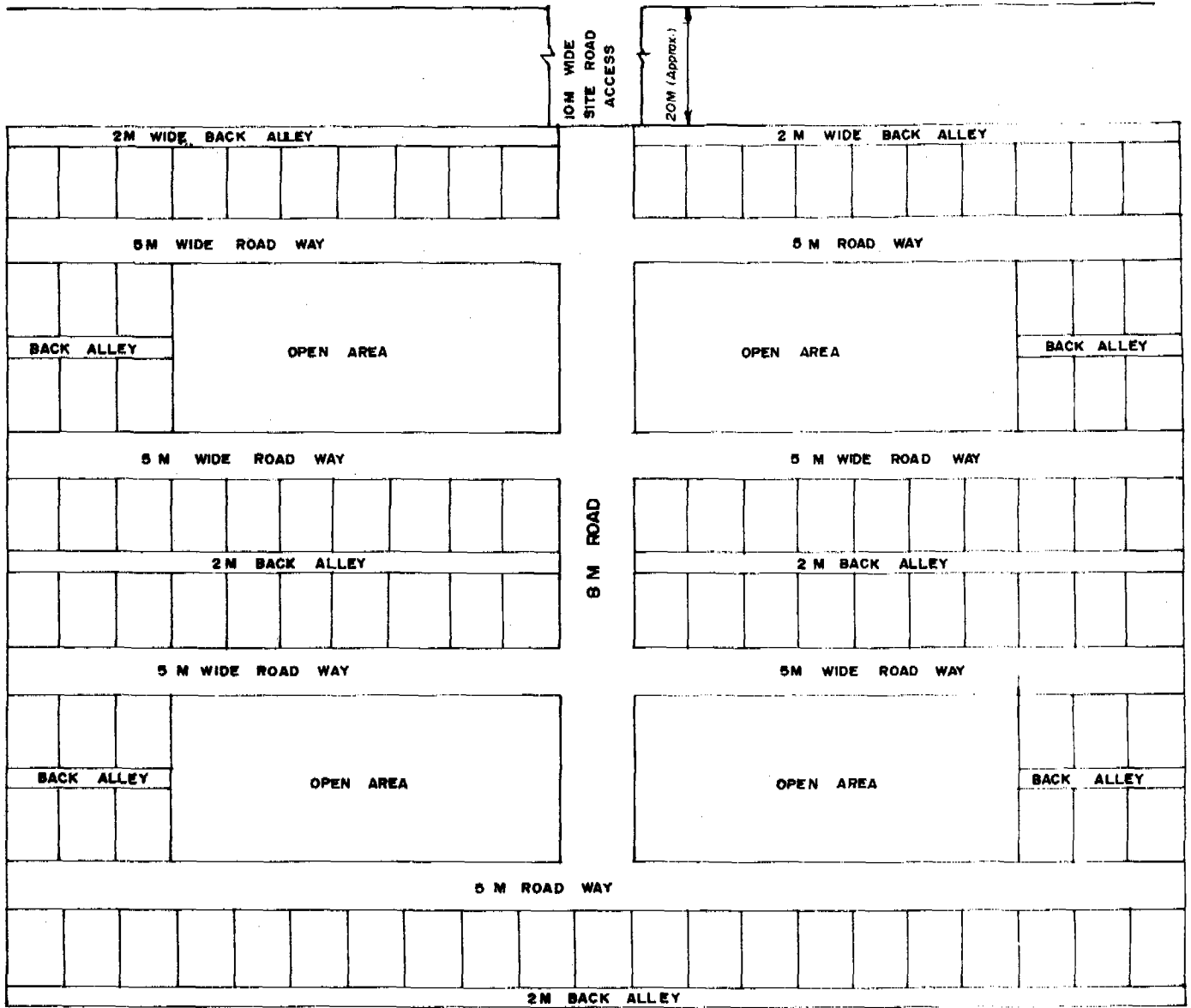
Observations made at the evaluation

Water Supply

- Systems provided can be broadly categorized in to two as follows.
- Communal water points - stand posts
- Household connections

In both cases water has been drawn from the city mains through distribution networks.

CITY ROAD



NO OF PLOTS - 105
PLOT SIZE - 66M x 6M

TYPICAL LAY-OUT OF AN URBAN LOW INCOME SETTLEMENT

SCALE - 1:500

- Cost of laying the distribution network in both cases has been borne by the government and in the case of standposts as the consumption is not metered and as no revenue collection is involved the connection of standpost to the distribution network has also been done by the government leaving the responsibility of individual house connections to the house holds.
- The stand posts have become unattractive to the beneficiaries due to long waiting hours for service, lack of privacy, inadequate supply, no proper mechanism for maintenance etc. On the other hand the municipalities are also not promoting the stand posts as the consumption is un metered and no revenue can be collected.
- Families prefer household connections but it was observed that majority of them have been unable to obtain the connections as the connection fee is unaffordable (App-US\$ 80). As a result many distribution networks laid in the settlements are either under utilized or not utilized at all. Where ever possible people have obtained illegal connections.
- The low velocity of flow due to low head at the source has resulted dissatisfaction among the users. When investigated it was revealed that there has not been any co-ordination among the agency who designed the distribution network and the agency who owned the water source.
- Beneficiary families are not educated/trained on O&M aspects related to the systems. They have become dependents of government organizations.
- According to water authorities the revenue collection is very low in the peri urban areas.

- **Sewage Disposal Systems.**

- Systems provided can be broadly categorized as follows.
 - On plot disposal (single pit latrines, double pit latrines, house hold septic tanks)
 - On site disposal (common toilets, shallow sewer systems connected to common septic tanks)
 - Off site disposal (Shallow sewer systems connected to city sewers)
- Beneficiaries were dissatisfied with the common latrines which were not maintained and because of their perception that the systems will be maintained by the provider (government)

- some systems (especially the double pit latrines) have been abandoned as the users do not prefer that option due to cultural practices.
- The implementing agency has expected the local authority to maintain the common latrines and other sewer systems but the local authorities have not considered maintenance as their responsibility. Most of the local authorities do not have the sufficient resources for satisfactory maintenance.
- As most of the systems have been provided without the involvement of beneficiaries they are unaware of
 - How the system functions
 - How it has been constructed
 - What are the Operation & Maintenance procedures involved, and who are the agencies connected.
- Satisfactory maintenance practices was observed where the Community Based Organizations are effectively involved.
- Beneficiaries are unaware of how water and sanitation is related to illness, family health.

Issues

The evaluation exercise reveals that most of the water supply & sanitation systems provided have become deteriorated/under utilized/non sustainable due to

- Poor linkages and lack of co-ordination between the programme partners.
- Inadequate active community participation in the process
- Limited institutional capacity of the programme partners.
- Lack of focus on community development/community mobilization programmes.
- Supply driven mechanisms.

The lessons learned from previous programmes have led the implementing agencies to think of

- For whom are the water supply and sanitation
- Who should be involved in planning, executing and managing water supply & sanitation programmes.

ALTERNATIVE ATTEMPTS.

The Clean Settlement Programme has been introduced by Government of Sri Lanka as an attempt to prepare and implement a five year demonstration programme aiming at

Improving the quality of life of the
people living in Low Income Urban Settlements

By Providing

- Sustainable infrastructural facilities
- Income Generation opportunities
- Socio Educational Services
- Better co-ordination among relevant agencies
- Awareness and commitment to reduce waste/minimize pollution

Through a process of

Community Development & Empowerment and
Institutional strengthening

Adopting

Community Centered Participatory and
Integrator Planning Approach

Ensuring

- Development focus on areas of great need
- Implementation on equitable basis, &
- Economic & Institutional sustainability

Social prepration. Community Mobilization and Participatory Planning Phase

Implementation / Construction Phase

Post implementation / consolidation Phase

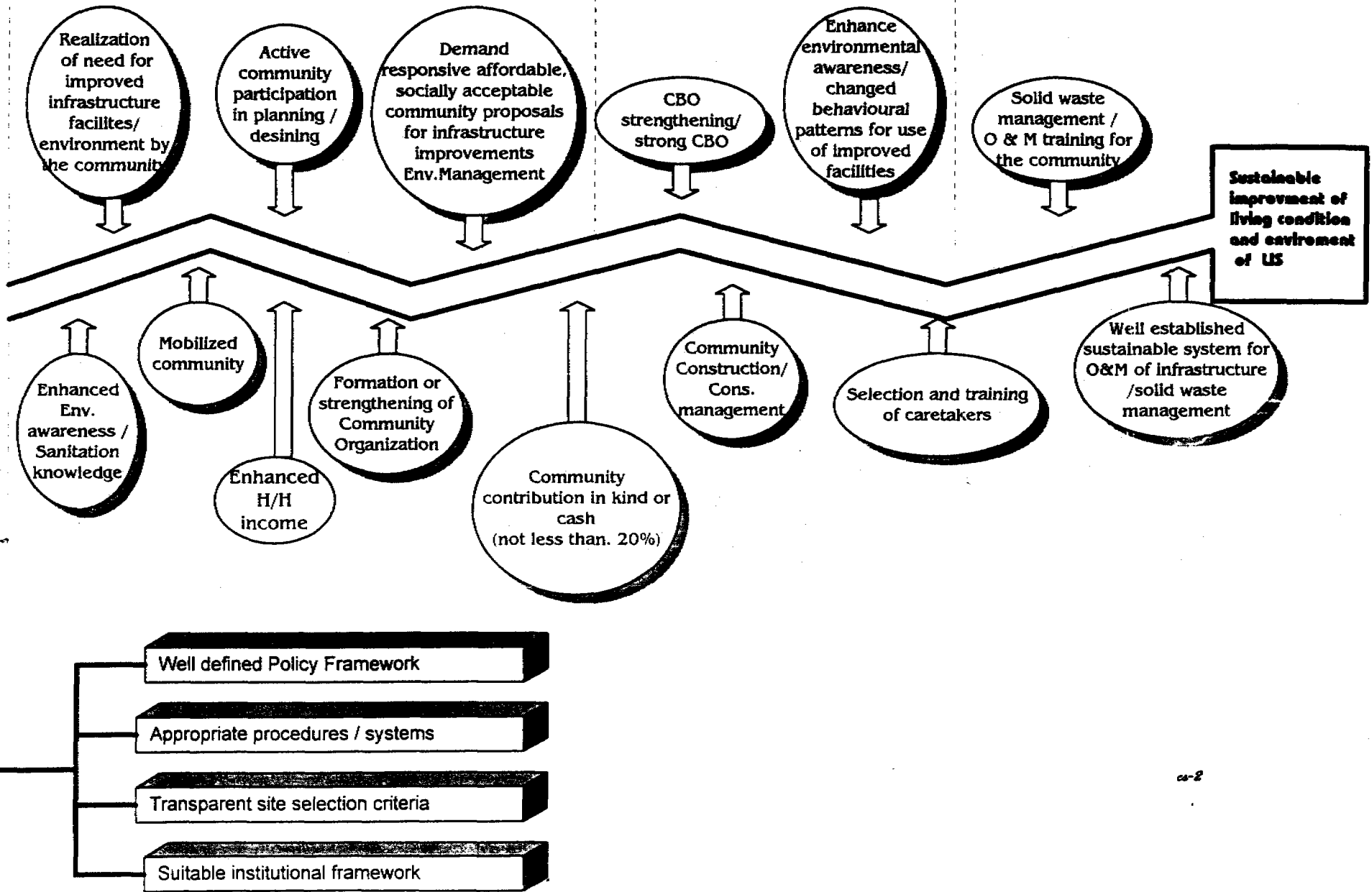
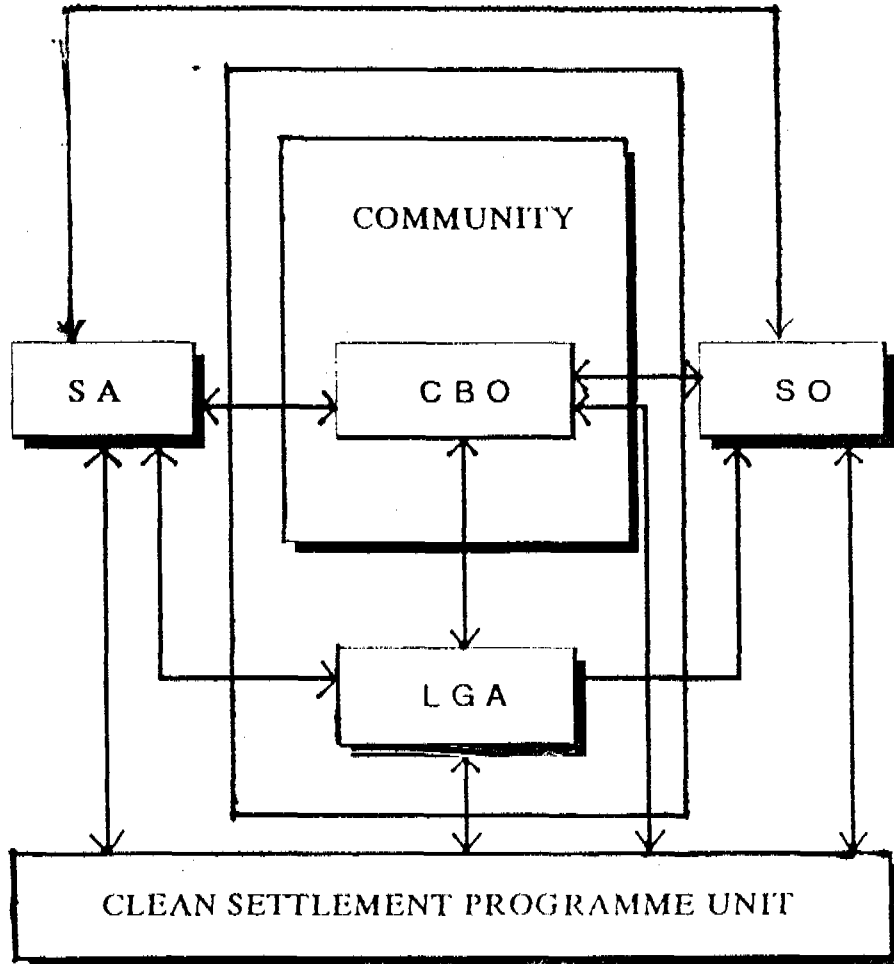


FIG II

Functional Relationship among CSP Partners



- CBO - Community Based Organization
- LGA - Local Government Agency
- SO - Support Organization
- SA - Service Agencies

FIG. III

The milestones along the path towards sustainable environmental improvement in Low Income Settlements are shown in figure II and the functional relationship among CSP partners is shown in figure III.

The programme is still in the initial stages and therefore, can not be evaluated yet.

But, similar attempts made in the rural sector in Sri Lanka have achieved the goals and objectives.

Share/dg

1.3 Challenge of Urban Sanitation

1.3.1 Conditions

An increasing share of the population of developing countries lives in cities. Presently estimated at about 37%, the urban population is expected to account for nearly one half (46%) of the total population of developing countries by 2010. Each year, some 40 to 50 million new urban inhabitants join the struggle for livelihood, shelter, access to basic services and the security of a stable and functional community. This growth is characterised by mounting economic and social disparity. In 1988, some 28% of the urban population in developing countries were considered to be poor: 23% in Asia, 27% in Latin America and 42% in Africa. Furthermore, urban poverty is growing much faster than rural poverty. By the end of the century, more than half of the poor in developing countries will be living in cities.

In the face of rapid urban growth and widespread poverty in developing countries, the authorities of most cities of developing countries are unable to provide urgently needed infrastructure services. Sanitary facilities, in particular, are highly unsatisfactory. While more than 25% of the urban population in developing countries lacks access to safe drinking water, according to estimates of the World Health Organisation, more than 40% of the urban population lives without adequate sanitation. Only about one-third of the urban population is connected to a sewer system and 90% of the collected wastewater is discharged without treatment. Overall, municipal services collect only about one-third of the total generated solid waste, and only about 5% of the collected waste is disposed in an environmentally sound manner.

Inadequacy of sanitary facilities and services exposes the urban population—in particular the poor—to daily hardships, unacceptable living conditions and critical health risks. WHO estimates that 75% of all illnesses and 80% of all child deaths in cities of developing countries are associated with unsafe excreta disposal, poor hygiene and inadequate drinking water supply.

1.3.2 Provision of Sanitation Services

How do urban residents and other users in the cities of developing countries gain access to sanitation services? To answer to this question comprehensively, three existing approaches should be considered: i) conventional urban sanitation, ii) informal housing development and iii) low-cost sanitation approaches. These are described briefly, below:

Conventional Urban Sanitation

The conventional approach to urban sanitation normally employs a long-term (e.g. 20-year) sectoral master plan, which specifies the phased implementation of the overall infrastructure network—a water-borne sewerage system, for example—according to generally accepted standards of service level and design. In principle, this approach enables the formulation of a technically coherent system for the entire urban region, taking due account of natural parameters and anticipated patterns of urban growth.

In the context of developing countries, the conventional approach has serious shortcomings, however. Long-term plans often incorporate unrealistic assumptions regarding population

growth, economic potential and the final cost of proposed systems. As a technical response to anticipated sanitation needs, conventional sanitation frequently comprise a supply-driven, "blue-print" approach, which takes little account of actual priorities, specific needs or varying ability to pay in different localities of the city.

In many cases, the conventional approach has produced unaffordable proposals which are not implemented as planned. Implemented systems commonly serve only a limited portion of the population while severely taxing the municipality's technical and financial capacity to operate and maintain them. The effectiveness of conventional facilities is often quite low. Furthermore, when conventional facilities are realised in low- and middle-income areas —with donor financing, for example— they are likely to exceed the economic demand for service. Few private connections are implemented and the public investment remains under-utilised and financially unsustainable.

In summary, the main weaknesses of the conventional approach are:

- high-cost solutions which are unaffordable to most low-income households
- lack demand-orientation, unresponsiveness to real priorities and needs
- poor cost recovery
- low operating effectiveness; inadequate operation and maintenance
- lack of incentives, competition and accountability.

Informal Shelter and Service Provision

In most cities of developing countries, neither the public sector nor the formal private sector is capable of providing housing which meets the needs of low-income households at prices which they can afford. In consequence, about 30% to 50% of the housing in most cities of developing countries is produced informally by low-income households through an incremental process of owner-managed development.

Informal housing production is not limited to the dwelling unit alone, but encompasses a wide range of infrastructure and service needs as well. Roads, footpaths, drains, water supply, sanitary facilities and transport services are often provided, extended and/or improved through the combined efforts of residents, community-based organisations (CBO) and informal private sector actors. While the popular image is one of a "self-help" endeavour, the terms "owner-managed" and "community-based" development are more accurate. Beyond the self-help contributions of individuals and community groups, informal housing and service provision depend private sector enterprises and workers for technical skills, organisational capacity, labour, materials and even credit.

Although informal sanitation, drainage, and waste disposal systems constitute the only available service for large numbers of low-income urban households, the solutions which they provide are hardly satisfactory. In densely settled informal settlements, on-site disposal of human waste is highly problematic from the ecological and public health perspectives. Channelling waste water to the open street drains and dumping solid wastes on open plots are widespread but environmentally unacceptable informal practices. In most cases, informal sanitation facili-

ties constitute poorly executed, fragmentary solutions to pressing sanitation problems. They are implemented without a coherent plan and their linkage to the municipal network is poor or non-existent.

The main weaknesses of informal approaches, in summary, are:

- poor technical quality
- uncoordinated, locally isolated solutions with no effective links to municipal systems
- low-level of activities, ineffective protection of environmental and public health conditions.

Low-Cost Sanitation Approaches

Governments in developing countries have not always responded positively to their own incapacity—and that of the formal private sector—to provide adequate housing and services for the low-income urban population, nor have they looked kindly upon the explosive growth of informally built facilities. Up to the 1970's, many governments actively combated informal housing formation while attempting to provide low-cost housing solutions of their own. By the mid-1970s, however, it had become apparent to most authorities in developing countries that low-income residents do, in fact, make important contributions to housing and service provision. Government-based development efforts—often supported and financed by external support agencies (ESA)—have sought increasingly to mobilise self-help potentials through site and service schemes and up-grading programmes.

The outcome of low-cost sanitation strategies has been generally positive. Technical solutions have been implemented which meet the needs and ability to pay of low-income households. User communities have been involved to some degree in the planning and implementation of sanitation improvements and the subsequent operation and maintenance of facilities. A major advantage of low-cost approaches lies not just in the mobilisation of users' contributions, but in the more effective use of public resources through a better targeting of investments to the people's real demands.

On the other hand, the application of user participation within government directed projects has often proven problematic. Community mobilisation is a time-consuming activity which calls for specific skills and methods. Wary of rising expectations and time-consuming decision-making processes, authorities tend to limit beneficiary involvement to a brief planning consultation. The pressure to implement the projects on schedule—particularly strong when foreign donors are involved—often gives a "supply-driven" character to the approach. Conditions for effective participation are thus inadequate and the potentials of informal development are not engaged. Finally, when the community's "ownership" of the project is not achieved, cost recovery tends to be quite poor.

Aside from some notable exceptions such as Indonesia's Kampung Improvement Programme (KIP), most low-cost sanitation approaches remained isolated local efforts with little linkage to municipal sanitation systems. Only a limited portion of the target population has been reached.

The main weaknesses of low-cost approaches, in summary, are:

- failure to engender effective participation or project "ownership" by beneficiaries
- poor cost recovery
- failure to mobilise the potential of informal private sector development
- isolated local solutions with little linkage to the municipal sanitation systems
- failure to reach the most poorly-served low-income households.

1.3.3 Defining the Challenge

In spite of the particular strengths of each approach, neither conventional urban sanitation, nor informal user-managed development, nor the low-cost sanitation approach has proven capable of meeting the needs of a large majority of low-income urban residents. In this light, the challenge of urban sanitation may be framed as follows:

1. How can the positive aspects of existing processes of urban sanitation be preserved while overcoming the weaknesses and limitations of each?
2. How may the activities and contributions of various stakeholders—including users, informal and formal private sector enterprises, government authorities and external support agencies—be mobilised and linked for a more effective and equitable delivery of sanitation services?
3. What approach would be capable of addressing the sanitation needs of the entire urban population, including low-income groups?

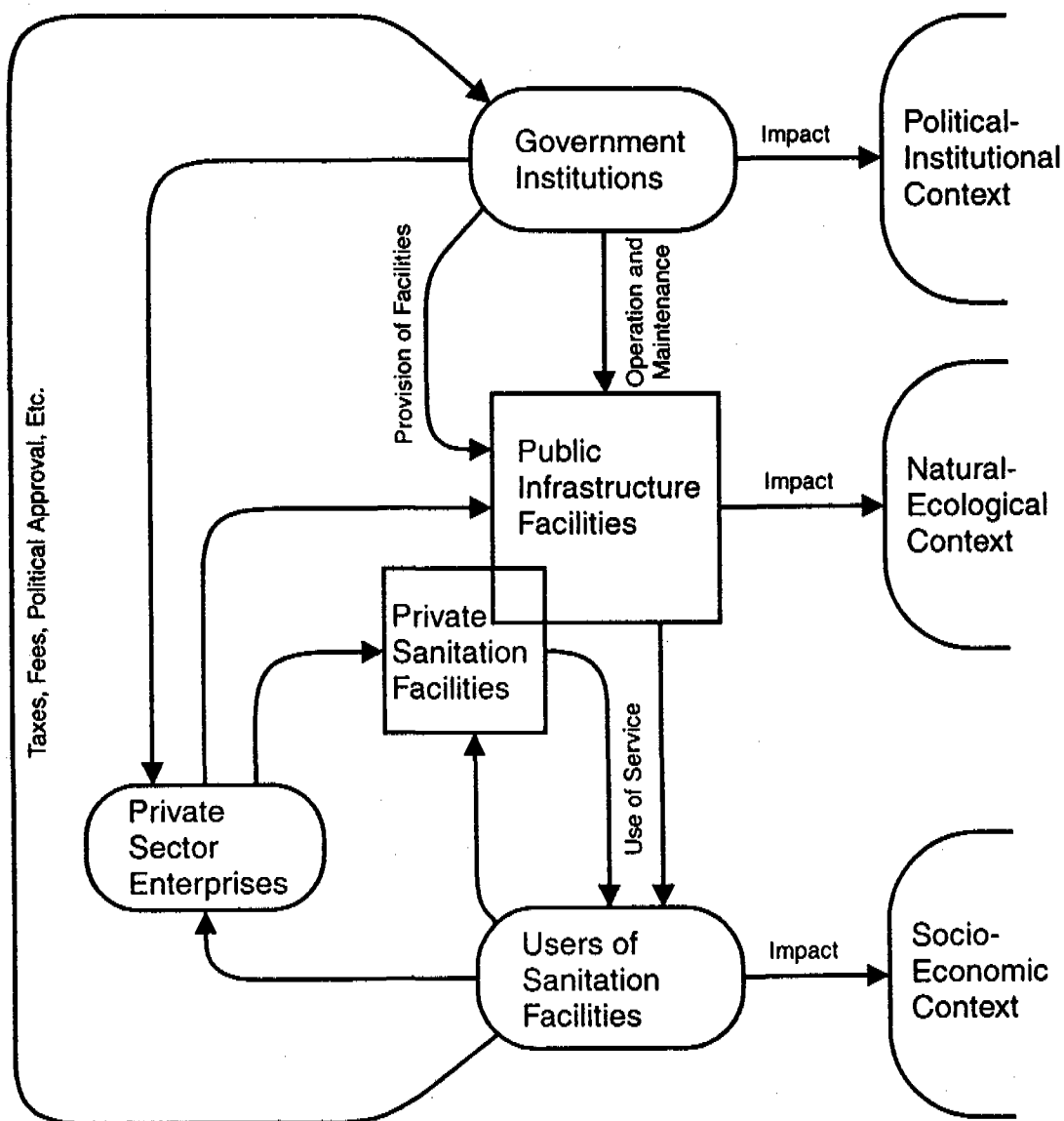
The four cases presented at the Workshop provide the material for tentative answers to these questions. Before turning to the cases, though, this introductory chapter closes with a brief definition of urban sanitation and consideration of its socio-cultural dimensions.

1.4 Components and Processes of Urban Sanitation

Urban sanitation includes the sectors of surface water, waste water, human waste and solid waste. Solid waste is included even though it is often treated as a separate sector; from the user's perspective, though, it is important to deal in a co-ordinated manner with both "wet" and "dry" forms of waste.

Urban sanitation is much more than the "hardware" of facilities and equipment, of course. It is comprised, above all, of service delivery processes, which encompass the functions of waste collection, treatment, recycling and disposal. A sanitation system may thus be defined to include all components (institutions, facilities, users, etc.), processes (operation and maintenance, fee payment, etc.) and factors (organisations, skills, etc.) which are required for a sustained flow of services in the above mentioned sectors. The main components and processes are illustrated in Figure 2. In the following sections, this schema will be employed to describe the features of case examples.

Figure 2: Components and Processes of Urban Sanitation



1.5 Socio-Cultural Dimensions

Technical approaches to urban sanitation deal in quite neutral terms with experiences which can, in fact, be symbolically and emotionally charged. Personal hygiene is an intimate affair, and every society evolves acceptable forms for dealing with questions of sanitation in the public realm. In many cultural traditions, cleanliness and filth delimit a scale of values which may apply to things, activities and people. (See Annex 4, for an identification of value as a "logical level" of experience). Association with filth very often has negative social connotations.

The absence of adequate sanitary facilities usually obliges people to act in ways which they feel to be embarrassing or even anti-social. Personal and social costs arise which hardly figure in the calculations of sanitation planners. When people channel excreta directly into the street or dump garbage into a nearby stream, for example, they are not necessarily indifferent to the consequences. While they may have no practical alternative, they are not likely to feel good about such practices. To preserve self-esteem, people may become indifferent or even defensive regarding environmental sanitation, and the social cohesion of a community may suffer in consequence. Be this as it may, sanitation development is a complex process which implies significant socio-cultural dimensions along with the technical and public health considerations.

In a brief but very pertinent contribution, Mary Boesveld, ethnologist, illustrated some limits of our "modern" Western (and usually masculine) understanding of sanitation. The central message was that we need to become conscious of our own culturally-based attitudes towards sanitation if we want to contribute effectively to improved sanitation in other cultural settings. It was noted, for example, that male and female experiences and needs regarding sanitation are different, and that the differences may vary from culture to culture. It is indicative that sanitation technology almost universally ignores the requirements of menstruation.

The idea that faeces may be dangerous is, in fact, quite recent. In Amsterdam, for example, the bucket system of human waste removal was common until the end of the last century; sewers were only extended after a serious cholera outbreak in 1894. In many parts of the world, children's' faeces are not even considered to be dirty. While there is thus much need for information regarding hygiene and public health, westerners should avoid the moralising tone which often characterises their contributions. Different sanitation practices are not necessarily an sign of ignorance. Human waste can be valuable as fertiliser, for example, and many traditional systems make better use of waste from an ecological viewpoint than modern sanitation systems.

It is above all important that sanitation problems be treated in an integrated manner which considers the particular socio-cultural context in which they arise, and the closely related functions of water supply, drainage and solid waste management. (See *SDC Sector Policy on Water Supply and Sanitation*, Swiss Development Cooperation, May 1994).

2. Four Approaches to Urban Sanitation

This chapter introduces the four cases of urban sanitation development, summarising presentations of the resource persons and the first work group sessions. The case studies themselves may be obtained from SKAT (see References, Annex 6).

2.1 Orangi Pilot Project

2.1.1 Project Description

Orangi is one of the largest "katchi abadi" or squatter areas of Karachi. The Orangi Pilot Project (OPP) was started in 1980 by an eminent social scientist, Dr. Akhtar Hameed Khan, with financial support from a local foundation. Rather than conducting surveys, the OPP initiated extensive discussions with the people of Orangi and their leaders. Sanitation emerged as the priority problem.

Noting that the construction of most houses in Orangi was owner-managed, the OPP became convinced that the people would also be capable of constructing a local sewer system. Some households had, indeed, attempted to construct sanitary improvements but lacked the technical know-how, organisation and co-ordination required to build an effective system. The OPP thus undertook research aimed at developing low-cost sanitation solutions and devising an appropriate organisational form for community-managed implementation. Through technical simplification and, above all, efficient management of contractors, the cost of sewer construction could be markedly reduced. With the support of local activists, the people were then encouraged to establish lane-level organisations for financing and implementing the local sewer lines. The success of the early lane sewers created a "snow-ball" effect as neighbouring areas followed suit. Related programmes were initiated for low-cost housing improvement, small-scale enterprise credit, health education and schools.

An important feature of the approach was the distinction between the "internal" and "external" components of sanitation infrastructure. The former comprises private sanitary facilities, local or tertiary sewer pipes and, in some cases, secondary sewers. The latter includes trunk sewers and treatment facilities. While the lane-organisations (CBO) assumed responsibility for financing and managing "internal" components of the system, the municipality was expected to assume responsibility for the "external" components.

The low-cost sanitation scheme is being replicated in several other areas of Karachi and other cities of Sindh and Punjab. Besides the Orangi Project itself, discussion also touched upon the "Collaborative Katchi Abadi Improvement Project" (CKAIP) in Hyderabad, which is undertaken in collaboration with the municipal government with overhead support from the SDC. Finally, a more recent programme in Karachi was described, which is being implemented by the Sindh Katchi Adadi Authority (SKAA) together with the OPP.

The main results of these different projects are:

- In Orangi, since 1980, a total of 80'503 houses encompassing about 85% of the population of about 900'000 people have been provided with sewer connections and in-house toilets through self-financed, self-managed efforts.
- In Hyderabad, after two years of collaboration with the local government, the "external" trunk sewer (966 m. long) is finally nearing completion; due to this inordinate delay in "external" works it is not yet possible to begin "internal" development and the people have begun to lose faith in the project.
- In Karachi, after one year's work with SKAA, an energetically directed Provincial agency, external sewers have been completed in six katchi abadi. Internal sewer connections reached 12'789 houses, about 53% of the total, by December 1994.

2.1.2 Actors and Challenges

While the OPP was an essential initiator and facilitator the community-based sanitation project, success has depended upon a self-imposed restriction of the *NGO* role. In the OPP's view, its main functions are research and extension work, including various forms of training. Key contributions are appropriate technical solutions and workable models of community-based management. In providing these inputs, the *NGO*'s relationship to the people is essentially that of consultant. The OPP is very careful not to take the lead in organising lane associations or in managing project financing or implementation. These responsibilities lie clearly with the people, even if it means waiting for some time until the people are willing to assume them.

The central *challenge* of the project was to overcome the "psychological barrier" which prevented the people from attempting to construct a local sanitation system — a responsibility which, in their view, belonged to the government. To overcome this barrier, the people had to be convinced, firstly, that they were capable of the task and, secondly, that the government would not go to do it for them. To enable people to self-finance and manage sewer construction a suitably low-cost technical solution was required. Once developed, the solution had to be demonstrated and "demystified" for the people.

As might be expected, *local politicians* resisted self-help efforts which made the people independent of prevailing patronage relationships. Politicians redoubled their promises to obtain service from the government, arguing that the people should not pay for facilities themselves. Overcoming this resistance was a major *challenge* which was met by extensive interaction, information and persuasion. A turning point occurred when a local councillor became convinced of the approach's potential and began to support it.

According to the organisational concept mentioned above, the sanitation system is divided into "internal" and "external" portions. Through *lane-level organisations* of 20 to 30 households the people took full responsibility for managing "internal" works. The task of forming and leading the lane CBO was assumed by local "*activists*". Supported and trained by the OPP, activists became the main "transmission line" between the *NGO* and the people.

Informal construction companies and workers implemented the physical works under the management of the lane organisations, often with labour inputs from the residents. The technical and organisational skills of these informal private sector actors were vital to the programme success, and the NGO also invested considerable time in small-scale entrepreneurs, helping them to up-grade their products and improving their technical and organisational skills.

The OPP has had limited success in mobilising the *local government* to complete “external” sewers. Only after more than 13 years’ work in Orangi did the municipal government, with Asian Development Bank financing, finally initiate a project to build trunk sewer lines to receive effluent from the community-built “internal” sewers. The *challenge* in this situation was to ensure that the municipality’s contractors did not install shoddy construction, which would soon become non-functional, as commonly happens in low-income areas. To address this challenge, the government was petitioned to grant the lane organisations some responsibility for construction supervision. The arrangement contributed significantly to the efficiency and quality of the construction; lane organisations managed to force contractors to tear out and reconstruct a considerable number of badly executed manholes.

In contrast to the Orangi setting, the Hyderabad project area is quite flat. “External” trunk sewers are thus a technical precondition for the construction of “internal” lane sewers. The *challenge*, in this case, was to arrange for timely construction of the “external” trunk sewers by the municipal government. In spite of active participation and support of local government officials, it has taken more than two years to implement about 970 m. of sewer line. The reasons for this excessive delay include i) very frequent transfer of government officials, ii) lack of inter-departmental coordination, iii) ineffective contract management, iv) lack of accountability, v) poor technical capacity, and vi) failure to integrate monitoring into project management in a way that promotes the development process. This discouraging experience contrasts with the successful katchi abadi upgrading programme which SKAA is implementing in Karachi with OPP support. The crucial distinction is that these external sewer works are financed directly by SKAA out of residents’ lease payments and constructed by SKAA; municipal government participation was not required.

This experience suggests that municipal governments in Sindh are presently not able to promote or collaborate with community-based sanitation development. In these circumstances, an alternative strategy would shift the *challenge* to the technical level. Indeed, the OPP is seeking to develop decentralised technical solutions for the “external” functions of sewage collection and treatment. In this way, the scope of community-based sanitation development may be expanded in spite of ineffective public sector collaboration.

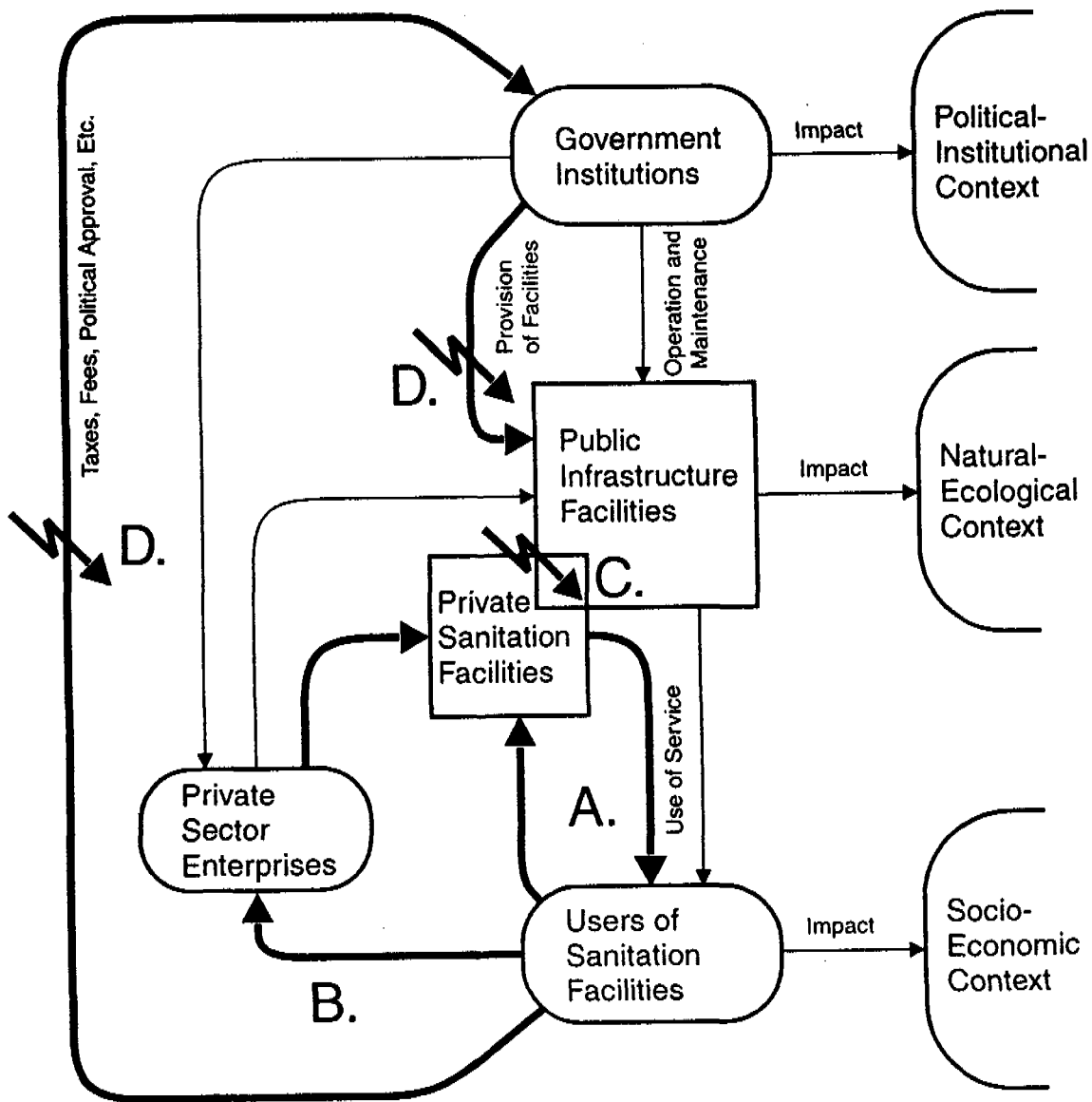
The final *challenge* which was highlighted by the work group concerned replication of the approach in other areas. Instead of attempting to expand its own operations to meet the potential demand, the OPP has established a Research and Training Institute (OPP-RTI) for the purpose of training members of other NGO, CBO leaders, community “activists” and government staff.

2.1.3 Organisational Setting and Limits

Figure 3 illustrates the organisational setting of the OPP model. Activities begin with the existing private circuit by which residents and informal construction enterprises provide sanitation facilities and services (A). Improvement of the technical quality and organisation of the community-based solution is sought through improved collaboration with strengthened private enterprises (B).

The logic of the approach calls for better integration between the private ("internal") and public ("external") segments of the system (C). To accomplish coordinated development, an organisational link is required between user communities and municipal authorities (D). After more than a decade of successful community-based development, municipal governments have, in principle, accepted the approach. In practice, though, government agencies—with the important exception of SKAA—have not managed to significantly alter the prevailing, ineffective procedures of service provision, or to promote and complement the potential of the community-based approach.

**Figure 3: Components and Processes of Urban Sanitation:
Orangi Pilot Project, Karachi**



2.2 Self-Help Provision of Family Toilets in Yogyakarta

2.2.1 Project Description

The Yayasan Dian Desa (YDD) is an NGO based in Yogyakarta, Indonesia, with many years of experience in rural and urban development projects in the Yogyakarta area and elsewhere in Indonesia. In the framework of the Yogyakarta Urban Development Project (YUDP) —an SDC supported project for municipal management support— the YDD has assumed responsibility for specific tasks of community-based and community-oriented development. As a first step, the YDD completed an extensive survey of urban households, the “Real Demand Study” (RDS), in 1991. The objective of the RDS was to provide detailed data on the people’s needs and economic demands for infrastructure services in different parts of the city, including information on their attitudes and aspiration with regard to infrastructure services. The RDS was expected to enable more effective programming of infrastructure development, leading to activities, strategies or “social packages” for increased community involvement in service provision.

The case presented at the Workshop —a relatively modest project for “Self-Help Provision of Family Toilets”— was an initial step towards operationalisation of RDS findings. Besides the immediate aim of improving sanitation conditions of poorly served households, the project’s objective —within the YUDP— was to introduce municipal authorities to community-based infrastructure development approaches.

The Pilot Scheme, which began January 1993, provided technical support and credit facilities for the construction of private toilets and privately managed public toilets in areas where the space for private toilets was lacking. Two types of approaches were implemented: Type I, implemented with government collaboration and Type II, implemented by the NGO alone. Different conditions and features were applied in each type:

Type I

- Administered by YDD under the YUDP umbrella with direct government involvement
- No collateral required of borrowers
- Borrowers were selected by local government officials
- Interest-free loan were provided
- Credit limit of SFr. 160.

Type II

- Administered directly by YDD with no government involvement
- Private or social collateral were required
- Borrowers were selected by borrower groups; local officials were informed
- Interest rate of 12%, compared with commercial rate of 15.5%
- Credit limit of SFr. 200. (

While both Programme types have produced functional on-site sanitary solutions, a comparison between them is quite instructive. Type I has distributed 123 loans since December 1992. The recovery rate is 65%, meaning that 35% of the loans are “bad”. Type II, the private

(NGO) version, has distributed 153 loans since August 1993. It has avoided the "Santa Claus syndrome" which plagues the public sector version and the loan recovery rate is 100%.

2.2.2 Actors and Challenges

The pilot project was planned and implemented by an *NGO*,¹ as in the previous case. Here, however, the role of the NGO was not only that of technical and organisational consultant to user communities, but also that of development agent with responsibilities for planning, providing and servicing the credit programme.

Standard on-site sanitation technology was employed and no technical research or development work was required. The *challenge* at the technical level was merely to ensure satisfactory design and quality of the underground construction—which is too often compromised by uninformed users and cost-cutting contractors—while leaving the user households free to elaborate above-ground construction according to their budget, taste and desired level of comfort.

The general YUDP aim of improving the municipal government's capacity to support community-based development meant that the *municipal government* was also a central actor. The main *challenges* in this regard were to i) win the government's political cooperation, ii) demonstrate the superiority of the community-based approach and iii) build government capacity to implement community-based development schemes.

The municipal government had a somewhat ambiguous role, figuring as implementing agent as well as "beneficiary" of the institutional development programme. For YDD association with the government in a community-based project complicated the task considerably. As project planner, the NGO had a "high profile"; if the programme failed for some reason, YDD and not the government would be blamed. Difficulties arose because the interests of government officials—and their way of relating to the people—were quite different from those of the NGO. While the NGO was primarily interested in empowering *people* by assisting them to gain independence and self-sufficiency, government officials were also interested in winning public support. As politicians, officials sometimes consider *dependence* to be a more reliable guarantee of support than *independence*.

Government cooperation could be harnessed through the methodology of the scheme itself. Through the detailed analytical mapping of physical and socio-economic conditions (RDS), the community-based approach acquired logical status in a city-wide development strategy, avoiding the "one-off" character of many NGO efforts. At the same time, division of the project into two different types—with and without government participation—made it possible for the YDD to collaborate with the government while maintaining its identity as a representative of community interests.

Splitting the project into two types made it possible to test different approaches under similar conditions. Judging by the initial results, the greater effectiveness of the NGO's community-based approach—which relates to people as partners rather than beneficiaries—has been amply demonstrated.

The third *challenge* —building government capacity to implement community-based approaches—involves policy changes as well as training and institutional development. While it may be too early to reach a conclusion, the challenge does not appear to have been met. However, the NGO does envision several steps which would promote the replicability and sustainability of the approach. The first would increase *private sector* provision of technical and financial inputs. This implies that government involvement may be limited to facilitating, enabling and/or controlling private sector actors rather than implementing the scheme itself.

A second step would involve human resource development and training of community workers and staff in the approach and methods of community-based development. The main *challenge* in this regard is to attract qualified people to engage in a rather “non-glamorous” undertaking. Finally, replication of the scheme would be promoted through adequate documentation of the pilot experience, clear measurement of its effectiveness and widespread dissemination of the results. For this, simple but significant indicators need to be devised.

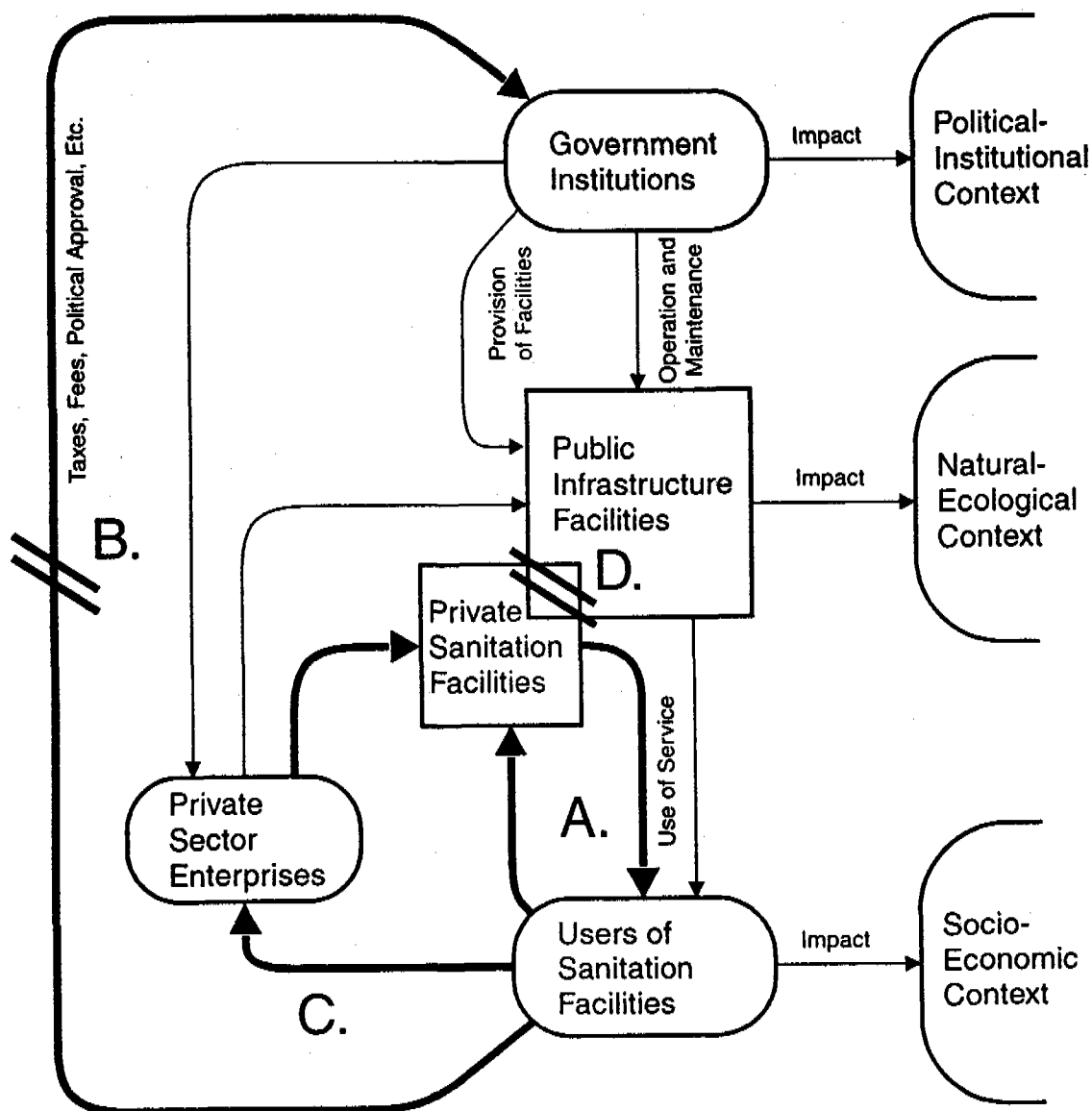
2.2.3 Organisational Setting and Limits

The organisational setting of the project is illustrated in Figure 4. As in the case of the OPP, the management circuit is quite local, involving only individual users, user-groups and private enterprises in the construction of private sanitation facilities (A). It is not apparent what role the government could or should play at this level. An important part of government interest is directed towards winning political approval (B).

The NGO does not feature in the diagram; its intermediary role is temporary, flexible and difficult to localise. In this case, though, the NGO assumed the characteristics of a private sector enterprise which managed credit facilities on a near-commercial basis (C). There is a limit to the potential expansion of the NGO in this role, however. Project up-scaling would call for increased private sector involvement.

Finally, the absence of functional interface between private and public infrastructure facilities (D) is an important limit. Dealing only with on-site facilities, the scheme manages to avoid this issue. However, it does not provide any solution for densely settled residential areas where off-site solutions (e.g. sewers) would be required.

**Figure 4: Components and Processes of Urban Sanitation:
Self-help Provision of Family Toilets, Yogyakarta**



The Solutions

A Workable Paradigm for Prevention

The Network on Services for the Urban Poor of the Water and Sanitation Collaborative Council has developed a program for successful water and sanitation provision in urban poor areas: recognition of *de facto* land holding, user-pay cost-recovery systems, appropriate technology, consumer involvement, and institutional reform. This program can be adopted for broader environmental health efforts in urban poor areas through the addition of four more elements: risk assessment, private sector involvement, intersectoral planning, and integration of service delivery.

The "Official City" and the "Unofficial City"

The urban poor live in the shadow of the city. Often the slums and shantytowns are physically dominated by the prestigious tower blocks of the city's central commercial areas. This 'official' city is the one known to business people and tourists. The residents of the slums and shantytowns are also in the shadow of the rest of the city in terms of quality of life and services.

—Trudy Harpham, Tim Lusty, and Patrick Vaughan, eds., *In the Shadow of the City* (Oxford: Oxford University Press, 1988), 1.

■ **Recognition of *de facto* land holding.** Granting some measure of legal recognition to urban settlements gives municipalities a basis for extending services or activities to peri-

urban communities. Without the security legal recognition provides, the inhabitants themselves are unwilling to make permanent investments in water, sanitation, housing, and so on.

- **Cost recovery.** Through user fees and credit, the poor can and should help shoulder the costs. Full cost recovery promotes conservation and makes it possible to extend service to the unserved. This approach would be welcomed by the poor people without piped water in or near their homes who often pay vendors far more for water than if they were connected to a municipal system. Some are currently paying as much as 10 times more for a cubic meter of water than residents of New York or Washington.
- **Appropriate technology.** Technologies that work in formal urban areas often fail to work in peri-urban areas because they are not appropriate to the socioeconomic, cultural, and physical setting. Increasingly, technologies such as small-bore condominium sewers are being successfully used in informal settlements.

■ **Involving consumers.** The poor should be involved in diagnosing and resolving their local environmental health problems. Consumers should be educated to demand quality services and to pressure municipal leaders and the services they control to respond to community demands.

Local Capacity Building

There is an alternative urban future, within each city, where government policies become rooted in making the best use of local skills, knowledge, culture, and resources. This requires that governments turn to the capacities of the people who are already the most active city builders—individual citizens and the community organizations they form. The failure of government to support and help coordinate the actions of these people represents an enormous loss in what both government and these people can achieve.

—Jorge E. Hardoy, Sandy Cairncross, and David Satterthwaite, *The Poor Die Young: Housing and Health in Third World Cities* (London: Earthscan Publications Limited, 1990), 236.

■ **Institutional reform.** Capacity building, or strengthening the institutions responsible for health, population, and the environment, coupled with development of human resources, is essential if the health problems of the urban poor are to be solved. Institutional reform must take place at all levels.

□ National, provincial, and municipal agencies should all share the burden of health, population, and environmental services. This includes making resources available. Unless a clear, definitive division of authority, responsibility, and resource allocation is made, problems will be deferred and sustainable solutions will not be implemented.

□ Municipal governmental services should be run more efficiently. At present even fairly large municipalities seldom have adequate health staff, and smaller towns and midsize municipalities may have no trained health professionals except those providing clinical services at provincial or district levels. Local governments should organize public and environmental health departments and hire staff to collect and use available data on health, population, and the environment to advise municipal decision makers. In turn, municipal authorities should be trained in the use of innovative planning and management methods that can be used in complex urban environments.

□ Urban public health and environmental managers and providers should acquire new skills in communications and marketing. This kind of skill-building is necessary to expand the role of prevention and integrate it whenever possible with essential health services, especially in models which focus on activities outside of clinics and hospitals. Social marketing, including new principles of market segmentation, has particular relevance for heterogeneous urban settings and can be used to tailor messages to specific subpopulations. Ethnographic studies can help determine barriers to utilization of services or objections to preventive measures. Public health and environmental managers should also be able to perform and/or understand health care interventions, as well as financial administration and quality assurance monitoring. Although the field of public health will continue to include the control of infectious diseases, professionals must be equipped to deal with emerging chronic diseases and environmental, mental, and lifestyle disorders, including sociological ills such as the current epidemic of violence.

■ **Risk assessment and communication.** Plans and choices about urban health should be made on the basis of solid information and on an analysis and prioritization of the environmental health risks a community faces. Critical policymakers—both national and local—must be fully informed regarding urban health and environmental issues. They need urban and intraurban data to make responsible decisions about resource allocations. Many leaders are unaware of the vast differentials in health status, population rates, and environmental conditions among urban groups.

■ **Private sector involvement.** New relationships should be formed between the public and private sectors. The role of national and municipal governments is to pro-

Creative Methods for Collecting and Presenting Data

Many tools for data collection, decision making, and planning can be found in user-friendly computer software programs. Interesting and easily understandable data presentations can also be produced using inexpensive software, or by following published guidelines for effective communications. Mapping and the use of geographic information systems can simplify and improve health services planning and disease control. Visualization techniques and participatory methods of information collection help build community capacity and responsibility for health and the environment.

The Intersectoral Nature of Environment-Related Diseases

Nine environmental determinants are associated with ingested health problems:

- domestic water supply
- sanitation (excreta disposal)
- hygienic facilities (soap, privacy, etc.)
- food storage and handling
- markets
- slaughterhouses
- cooking facilities
- fuel
- industrial pollutants

mote policies that encourage the private sector to participate in efforts to alleviate the environmental health problems of the urban poor. It is important, however, that private sector participants be involved in ways that use their strengths. For example, private non-profit organizations may be extremely successful at community organization and promoting household preventive behaviors, while for-profit enterprises may be most efficient at developing products or providing large-scale facility services.

How Many Urban Poor?

By the year 2000, 1 billion people will live in urban poverty: 56% in Asia, 24% in Latin America, and 20% in Africa. Assuming that 20% are children under five, an estimated 200 million children will be living in urban poverty.

—World Population Prospects, 1992: WHO Commission on Health and Environment, 1992.

- **Intersectoral planning.** Because many health problems are rooted in environmental conditions, different agencies will need to collaborate to successfully address them. Until recently, the norm has been to deliver selected primary health care interventions vertically, that is, through programs (such as diarrhea control, immunization, family planning, health education, income generation, etc.) that are planned and implemented separately. These programs often compete for resources. Urban settings are an ideal testing ground for new, multipronged strategies that can simultaneously attack the various environmental causes of ill health.
- **Integration of service delivery.** Municipal and local authorities should seriously consider integrating services that provide primary health care and primary environmental care, especially at the community and household levels. Both types of services promote basic preventive behaviors that have a synergistic effect on individual health and the environment.
- **Shift to community-based care.** To improve environment-related health conditions for the increasing number of people living in urban poverty, public health must be reinvented, beginning with the development of new institutional roles and responsibilities. Urban demographics and transitional epidemiology require a shift of emphasis from hospital-based care to less expensive community-based care that stresses prevention and health promotion. Without this shift, no city will be able to bear the costs of developing equitable health delivery systems.

A Sense of Urgency

The time has come to pay heed to warnings from the 1990 UNICEF Summit for Children and the June 1992 United Nations Conference on the Environment and Development in Rio de Janeiro, which placed environmental health interventions among the highest priorities for improving the health of the poor in developing countries. Plans for Habitat II: The Second United Nations Conference for Human Settlements (1996) similarly call on the nations of the world "to confront the emerging urban crisis and initiate urgent worldwide action to improve shelter and living environments." The challenge is to convey a sense of urgency to national and municipal governments, to let them see that their national well-being depends on improving their urban environments.



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WATER SUPPLY AND SANITATION IN LOW-INCOME URBAN AREAS: PARTNERSHIPS AND STAKEHOLDER PARTICIPATION

by W.J. Kakebeke¹ and C.A. van Wijk²

Introduction

The problems of providing effective and sustainable water supply and sanitation services in low income urban areas are well-known. By 2000, 18 of the 22 megacities of more than 10 million people will be in developing countries. By 2050, 60% of the world population will live in cities. Poor households will constitute over half of the population in most of these cities (Kassam, 1994).

During the International Drinking Water and Sanitation Decade (1981-1990) improved water supply systems were built for some 1,348 million people, of which 27% lived in urban areas. An estimated 748 million people received improved sanitation, 42% of them in urban areas. However, in 2000, there will likely be 200-250 million more people in cities without good water and sanitation than there are today. Reasons include the ongoing population growth, the decline of readily available water resources which increases development costs and the inefficient and effective management of existing services (UN, 1990).

To address these problems changes in direction are required. The Ministerial Conference on implementing Agenda 21 with regard to drinking water and sanitation, which was held in Noordwijk in March 1994, stressed that business as usual is not enough. To provide adequate services for un(der)served households urban and rural water and environmental sanitation programmes "need to be based on partnerships that involve all stakeholders: users -especially women-, community associations, local, regional and central government, public and private sector organizations, non-governmental organizations". (Political statement, p. 2). Priority actions adopted in the action plan included that:

- decision makers and implementors of programmes ... involve local communities, user organizations, women and NGOs in decisions about water and sanitation systems, so that local knowledge, special skills and different viewpoints are used;
- establish the legal and institutional framework to support such participation and partnership and recognize the rights and responsibilities of citizens and communities;
- develop plans to build up the capacities of stakeholders;
- provide access to information on projects, programmes and policies; and
- provide for accountable, transparent decision-making processes and water quality standards with opportunities for appeal and independent review (Action plan, p.2)

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Partners in public-private partnerships

Under the broad concept of public-private partnership, public authorities, i.e. municipalities and other government agencies, create the opportunities for private organizations to establish, operate and manage local water supplies and/or sanitation services. The aim is to create efficient, effective and equitable services for low income urban areas, which operate well and are generally affordable and used.

In general five groups may play a role in public-private partnerships: public (governmental) agencies, the formal private sector, the informal private sector, non-governmental organizations and community organizations.

The provision, operation and maintenance of urban infrastructure services is usually the responsibility of the municipal authorities. Wegelin (1995) makes a distinction between technical agencies/departments/utilities and local political authorities responsible for overall urban management and development and politically accountable to the public.

The main interest of the technical agencies is to keep the service functioning in the key parts of the city. As such they are less concerned with provision of services to low-income areas, as the revenues for these services often do not cover operational costs and the tax base in these areas is low. Moreover, in many cities municipal regulations do not allow the agencies to extend services to areas considered illegal. In general, such agencies are not very consumer oriented and do not have the interest and capacities to work directly with community organizations and try non-conventional solutions.

The responsibility of municipal authorities is broader than that of technical agencies, encompassing all infrastructure sectors, social services and general urban-economic and spatial development. Their powers may range very widely from being directly controlled by central government to relatively autonomous bodies which control their budgets and have full political autonomy (Dillinger, 1994).

Within the private sector a distinction can be made between formal and informal private sector enterprises. Formal private sector enterprises include large and small registered businesses that can be contracted by the municipal authorities, user communities or commercial/industrial establishments to provide certain services in a designated area. This includes for instance the contracting out of solid waste collection services, desludging services and the construction of infrastructure works or components for infrastructure services. The main interest of these enterprises is to earn a profit (Wegelin, *op. cit.*) Through the introduction of competitive, commercially oriented behaviour, private enterprises may increase the efficiency of service delivery (Shübeler, 1995).

The informal private sector consists of unregistered single entrepreneurs or small (family) businesses, which are engaged in similar activities as the formal private enterprises, but on a more limited scale and usually located in low-income settlements. The main interest of these enterprises is self organized income generation. Because of its magnitude the informal private sector may constitute a considerable share of the total municipal economy and form an important supplement to the formal private sector (Arrais, 1996).

Non-governmental organizations (NGOs) are organizations which normally originate outside the communities with which they work. They are usually non-profit organizations and not politically aligned. At local level, NGOs may focus on community mobilization and organization, facilitate access to credit and develop local capacity to participate in planning and implementation of infrastructure services. In many cities NGOs have developed a function as an actor/mediator between the communities and the municipal authorities, even to the extent of taking over responsibilities to provide services to all residents in low-income urban areas from the municipal authorities (Wegelin, op. cit.).

Community organizations, also known as CBOs (Community Based Organizations) are organizations of local residents who share common problems and aspirations. To solve these problems and fulfil their aspirations they may negotiate for services with municipal authorities, either directly or through NGOs, establish such services with NGO support or find autonomous solutions, if necessary in cooperation with the (informal) private sector.

Factors affecting solutions

Partnerships between the public sector on the one hand and the formal or informal private sector, NGOs and CBOs on the other hand may take many forms. Review and analysis of partnership cases that have been successful in establishing water and sanitation services in low income urban areas show that such successes occur when the chosen solution has been related to a range of local conditions. Differences in legal, socio-cultural, economic, financial, environmental and technical conditions will all play a role in whether a particular solution will be suitable or not in a particular area.

Security of tenure and legal (de jure or de facto) recognition of tenure have proven to be crucial elements in the improvement of living conditions in low income urban neighbourhoods. When people know they are not in danger of being evicted and seeing their houses bulldozed away, their interest to invest in basic services, such as water supply and sanitation is high. Conversely, the interest of illegal settlers in establishment a water supply or a similarly essential infrastructure is also high, because the establishment of such a service can imply a de facto recognition of the settlement (van Wijk, 1985).

Variations in socio-economic, cultural and physical conditions also play an important role. The kind of community makes quite a difference for what kind of water supply or sanitation service is most feasible. In communities that are stable, with a low migration, are homogenous in socio-cultural characteristics and have a strong leadership another type of service is possible than in communities where such conditions are different. Financing feasibilities depend not only on the match of service levels with willingness and capacity to pay, but also with the reliability and spread of income over the year.

Physical and technical conditions also have an impact. In communities where space is lacking, or no nearby and reliable water supply is available, the feasibility of water borne sewerage or even pour-flush latrines becomes questionable. It occurs that the households are more aware of these limitations than the technical agencies. In Kumasi in Ghana for example, an assessment of popular demand for improved environmental sanitation revealed that over half of the households preferred an on-site dry latrine with ventilation

over a water-flushed toilet, because the former does not depend on water, is simple and doesn't break (Whittington et al, 1992).

The high density and physical location of many low income urban neighbourhoods on steep slopes or in flood plains or swamps tend to have large consequences for the choice of technology and environmental protection. Where low income neighbourhoods are sited on high rises above the valley in which the centre of the city is located, the expansion of the municipal water supply, if at all possible with the existing water resources, often requires high costs for pumping. Moreover, local conditions often necessitate integration of services: improvement of water supply leads to the need to improve waste water disposal, improvement of drainage requires improvement of solid waste collection and off-site sanitation or pour-flush latrines require sufficiency of water supply, while also the presence and condition of roads will play a role in the type of services needed and possible (Wegelin, op. cit).

Towards a typology of solutions?

Taking the above into account the challenge is to determine which types of partnerships and services work in which type of circumstances. In a brief presentation such as this it is not possible to present a comprehensive and representative range of problem situations and cases that provide well-fitting answers to such situations. The choice has therefore been limited to eight cases, which each stand for a fairly typical combination of the above mentioned factors. The first three cases concern drinking water supply and illustrate partnerships between an NGO and CBOs, or between CBOs and a municipal water agency with a social specialist or special wing for low-income urban areas; they originate from Southern Africa and Central America. The second series concerns partnerships for a combination of personal hygiene and excreta disposal facilities in India and Indonesia. The third series consists of two cases of partnerships for solid waste collection and disposal, from West Africa and Brazil.

1. Piped water supply
 - a. Community-managed vending, South Africa

Embo-Nqcolosi and Emolwezi are low income townships on the outskirts of Capetown, South Africa. They are unstructured densely settled communities with informal housing. The population comes from different rural areas and belongs to different ethnic groups. Social cohesion and organization are limited. Most people have an income as labourers in the formal sector. At the time of the project drinking water sources were few, far between and polluted. A development policy for the area was lacking. A four year drought and typhoid epidemic acerbated the crisis. An NGO of concerned residents from the better-off parts of the city financed a study for an improved water supply. The results were discussed with local water committees the NGO helped set up in both settlements. The low social cohesion and need for cost recovery made the committees and NGO choose for metered water kiosks run by committee-paid operators. Households purchase plastic tokens, one for each bucket of 25 litres. The price is three times the bulk price paid by the committee to the city authorities delivering the water. The difference goes to pay for administrative costs, maintenance of pipes, taps and kiosk buildings, repayment of

the construction loan and expansion of the network of kiosks. At the time of the review the supply had functioned almost 100% of the time for over three years, at a price for water 3 to 7 times lower than that charged by private water vendors. It had given regular employment to 20 community members and strengthened community organization for self-reliant problem solving. However, half of the population was not yet served, the people served still paid three times more for one litre of water than people with a private connection and there was no change in policy on basic services for people who with their cheap labour greatly support the city's economy.

b. Community-managed neighbourhood connections, Malawi

Common problems of the municipal water supply for low income urban neighbourhoods in the periphery of towns in Malawi were the limited amount of available water, the high cost of new developments, the high costs of free water through public standpipes and the high cost and limited service levels of water supply through kiosks with municipally paid operators. An alternative tried was that the urban water authorities asked inhabitants to form consumer groups of 20-30 families and take a metered group connection. The monthly bill was submitted to a tap committee elected by the group. The groups chose their own tap locations with technical advice of the city engineer. Initial experiences were good until payments began to fall off and the municipality decided to close down taps with heavy arrears, "because people would or could not pay". A one year action research revealed that these were not the true reasons. Rather, the groups stopped paying because of internal management problems. Having never managed a communal water point through elected committees, problems arose about opening hours, division of the bill among smaller and larger user families and the reelection of committees that did not function well or fell apart. When a Malawian sociologist identified and solved these problems through action research, he was given a permanent job with the urban water agency. The communal water points strategy, with community capacity building courses and monitoring system developed by the sociologist were replicated in many other low income urban neighbourhoods in Malawian towns.

c. Community managed neighbourhood systems, Honduras

In Tegucigalpa, the capital of Honduras, a CBO took the initiative to improve the local infrastructure. Women in the low income neighbourhood of Villa de los Laureles formed a water cooperative to tackle the shortage of water and high prices of water vendors. The cooperative got permission from the urban water authority to establish two kiosks, one in the lower part of the area, one in the higher. The cooperative paid the water bill of the metered kiosk to the municipality and resold the water at a price per bucket which was 1/5th of the price charged by the private vendors. From the difference they paid the costs of running the kiosk and administering the service. The work of kiosk operator the cooperative divided between poor women from women-headed households in the neighbourhood, who needed the job to earn a living and had a high commitment to the work. The lower lying kiosk operated at hours when pressure in the city net was low, the higher one when the pressure was higher.

As half of the population of Tegucigalpa belong to the lower income groups, the city's water agency decided to establish a special wing, UEBM, to support the development of

innovative approaches to water supply in areas like Villa de los Laureles. With financial assistance from Unicef, UEBM constructs community water reservoirs in the respective neighbourhoods. These are filled from the municipal net, from boreholes or by tanker. The water is pumped into an overhead reservoir and then flows by gravity to standpipes or yard connections. The communities finance 20-50% of the capital costs through a revolving fund and voluntary labour. The community service is administered by elected water committees. The users pay all recurrent costs through a flat water tariff calculated by UEBM. In five years, 52,000 people, or 10% of the low income population thus received an improved water supply. A participatory evaluation in 6 communities showed an average service coverage of 85% of the households. All supplies function, be it on alternate days, because of shortfalls in water resources and scheduled electricity supply, which affects pumping. Maintenance and quality control can be improved. Nevertheless the systems are a great improvement because more water is available more regularly than before at much lower costs and efforts. Earlier, 80% of the households spent 12% of their monthly income on buying the minimum amount of water for their domestic needs.

2. Environmental sanitation and personal hygiene

a. NGO managed public latrine, bathing and washing facility

In 1970 a sanitation NGO, Sulabh Shauchalaya Sansthan, was initiated in Patna, India. Having successfully converted a bucket latrine to a sanitary latrine in the house of a city councillor, the NGO managed to convince the Municipal Corporation to authorize it to build and operate a public latrine. The site chosen was the Ghandi Maidan, an open space used as public defecation area by hundreds of poor city households. The Municipal Corporation gave the site, a 100% construction grant and a water connection.

The NGO built a unit with sanitary latrines, showers and facilities to wash hands and clothes and employed operators and sweepers (cleaners). Within 5 years SSS had built and was maintaining 34 units with over 2000 latrines at a total costs of Rs. 2,2 million in 1975 prices. Designs were taken "straight out of Wagner and Lanoix". Units are located especially at crowded places where people have a need for facilities, such as railway and bus stations, markets, hospitals and tourist places and cater especially for those with ready cash, such as travellers, rickshaw drivers and other workers in the informal sector. Many are not legally settled, but work as migrant labour, leaving their families in the rural areas. Hence one study showed women and children to be in the minority among the users. Each visitor pays a flat entry fee and gets a handful of blue soap powder for washing and laundry. The units are run on a cost-covering basis. Accounts are checked by a committee of eminent citizens. Good maintenance and giving out management to concession holders, who can keep the profits, are essential for sustainability. When the Municipal Corporation of Patna took over the operation because of a problem with the trade unions, the latrines were unusable within two weeks and SSS was requested to take over again.

b. CBO managed public latrines, bathing and washing facility

In contrast to the SSS facilities, which cater largely for mobile populations, the public facility in Vakko-Ajengo in Kerala, India is run by a women's group and caters for

women and girls from legally settled households. The establishment of such women's latrines is part of the new national sanitation policy of India. Vakko Ajengo is a crowded and poor fishing community on the outskirts of the state's capital. Many of its households have no space to build their own latrine. Men and children use the beach. Women and older girls can do so only at night with high risks to their safety. During the day they adjust their drinking and feeding habits, with negative impacts for health. Hence the local women's group organized the building of a women's toilet, shower and handwashing facility on council donated land and with the help of an NGO and external financing.

The group has managed the completed facility since one year. It employs three operators who work in shifts and clean the facility twice a day. The ward where it is located has some 400 households; about 100 of these have a private latrine. Daily the facility gets some 200 women and girl users, so the percentage served is substantial. (A study will assess these and other aspects in detail). Users can take a life membership of Rs. 10 and then pay half price (Rs.0,25) to use a latrine; showers cost Rs.1 for all. The facility has worked daily for one year and is well maintained; it has its own water supply (well and electric pump); a (paid) connection to the municipal piped water supply is planned, as high use leads to a seasonal water shortage in the well. The women's group uses about half of the income from user payments for operating and maintaining the facility; the other half is reserved for repairs and for socio-economic activities of the group. Other municipalities have shown an interest to replicate a similar service.

c. CBO managed private latrine, bathing and washing facility

In the town of Semarang in Central Java, Indonesia, the latrine, bathing and washing facility is not public, but used and run by a users' association. All 650 households, also those who had their own facility, contributed towards the establishment of the facility. Together they raised Rp 2,5 million (= US \$ 1,500 in 1987) and constructed 15 toilets for women and 13 for men. After the construction, 125 households registered as members of the user association. Each paid a monthly fee of Rp. 300 (US\$0,20). Another 80 families from an adjacent low income urban community registered and paid Rp. 500. The monthly income of Rp. 77,500 is used to pay the cleaner (Rp. 10,000 a month) and the fee collector (Rp. 15,000 a month). The balance, ad Rp. 52,000 is used for maintenance and repairs and to finance solid waste collection, street paving and drainage. A local committee, in which women are prominently present, manages the accounts and supervises the operation and maintenance of the facility.

Cooperation between PKK (=the national women's programme) and the local communities resulted in the construction of 10 similar blocks in five other 'kampungs', with the communities financing 15% of the capital costs and the government the remainder. Supply of water is through a handpump or a connection to the piped water supply system. PKK's women's workers organize the local planning meetings and user associations; an NGO gave training and did action research. The user households formed local user associations and elected committees to manage and maintain the facilities from the monthly subscriptions. Eight kampungs later expanded the blocks and two kampungs built a second block in their neighbourhoods.

3. Solid waste collection and recycling

a. Collection by CBOs and private enterprise

Success of informal waste collection in low-income neighbourhoods in Abidjan, the capital of Ivory Coast, varies with the type of public-private partnership. In one neighbourhood, the local authorities have given a concession to two entrepreneurs, a local cooperative and a local businessman, to collect solid waste. The collectors of the cooperative and business man use one-axle handcarts financed by the EC. Waste is collected daily from households who pay a collection fee and brought to communal collection points and mobile container skips. The municipal collection service then comes to collect the skips. The scheme has run well for two years and is being copied in other areas. It serves some 30% of the households.

In two other neighbourhoods, local committees organized solid waste collection. In the first community, it placed waste collection bins at distances of 60 metres, covering 100% of the community. It also hired unemployed youths to empty the bins and bring the contents to central collection places. The youths were paid from voluntary contributions raised in the community to keep the area clean.

In the second community, the local committee engaged two teams with push barrel carts to collect solid waste from subscribing households. Collection was daily. Once a week the collectors would call to collect the flat fee, of which they could keep 80%, so their motivation to enforce payment discipline was high. The service covered 70% of the households.

In these communities, community managed solid waste collection came to an end because it was not supported by a partnership with the authorities. Large trucks from a private company which began to call for (initially) free waste collection took away the business for the community organized teams. Then people's willingness to carry waste to the collection truck began to dwindle and indiscriminate dumping of solid waste was back.

b. Collection and recycling through partnerships

An example of close cooperation between the municipality, CBOs and the formal and informal private sector is the case of Recife in Brazil. Recife, the capital of Pernambuco, has 1,3 million people. Unemployment is the highest of the 6 main cities of Brazil and 53.2% of the working population works in the informal sector. The proportion of women headed households is 9% above that of other Brazilian cities. The city has a serious problem with drainage, as sewerage infrastructure is poor and natural drains get blocked with solid waste. Because of limited own finances, the municipality chose for partnerships as official strategy. Partnerships encompass drainage, removal of sewage, urban cleaning and health promotion and is administered by a decentralized administration of 6 sectors and 18 micro-regions, which include representatives from the concerned communities.

The Programme of Selective Collection and Recycling of Solid Waste began in June 1993. Consultation with CBOs, NGOs and the Municipal Councils resulted in a programme promoting that households separate recyclable materials at the source and

donate them to groups which collect, sort and sell them for a living. In high income communities

special containers for the segregated collection of recyclables are placed. In middle-low and low income neighbourhoods, women are stimulated to separate materials into recyclable goods in exchange for food or mealtickets or for construction material for a groupbuilding. For the first three months the Urban Cleaning Municipal Company (EMLURB) receives and sells the recyclables to the private sector. Then the project is gradually handed to over community based organizations, which EMLURB helps to register as association, micro-enterprise or cooperative. Only equipment maintenance and social monitoring remain public sector tasks. The programme currently has 34 groups, of which 57% led by women, involving 13,200 families.

With local industries the programme has developed a partnership to buy recyclable materials. Community pickers and cart pullers collect the separated recyclables. In Recife almost 2,000 families lived on waste picking, unqualified and mostly illiterate labourers without permits, exploited by middlemen and exposed to serious health threats. With the help of NGOs the municipal programme offers street pickers and cart-pullers the opportunity to organize in pickers/pullers cooperatives. Four now exist with on average 16 members each. They got equipment and training on hygienic collection and sorting methods and learn how to strengthening the association, avoid middlemen and negotiate with recycling industries. As a result of the programme the number of illegal dump sites in the city has dropped from 285 to 124, a decrease of 44%.

Other activities of the programme are a workshop which recycles the municipality's own waste paper and gives training to those interested to learn the trade; a production unit for compost for municipal parks, used also to study waste recycling and demonstrate composting to primary school pupils gardens, and a programme to upgrade the main solid waste dump of the city, reduce the number of rag pickers on the site and improve their living conditions. Some 5,000,000 ton of garbage deposited in the site has already been treated. Biological processing was initiated in March 1994 and will increase the lifetime of the dump by approximately 5 to 20 years. The dump's rag pickers and rag vendors have organized themselves in cooperatives and received help in vaccination, hygiene guidance and access to legal documents to improve their status and working conditions. They started a screening/sorting Centre in September 1994. All 52 children and youths who worked in the site have been given work in communal vegetable gardens with sharing of profits as from April 1994. Recreative-educational activities started in April 1995, including learning to read and handicrafts and involving already 30% of the children. Those interested to work in urban cleaning are assisted to join a cart-pullers cooperative and help expand the informal urban garbage collection system.

Some concrete results of the partnership include:

- a 73% increase in recycled materials in two years
- a 62% annual increase in volume of material for recycling
- a 5,796 tons/month reduction in garbage collected
- a 56,5% reduction in special operations for waste collection
- food supply for approximately 2,040 recycling families

Conclusion

Experiences with effective partnerships confirm the political statement of the ministerial conference in Noordwijk that for progress in low-income urban areas the political will to improve services and try out non-conventional approaches is crucial. They also show that in effective public-private partnerships the activities of user communities, NGOs and the informal private sector are matched with support from government, especially at the local level.

In addition, they show the importance of seeking answers which are appropriate for the particular local conditions and opportunities with regard to the legal, social, economic, political and environmental context. In low income urban areas each situation is unique and requires a local identification of problems and finding of solutions. Nevertheless a number of common factors can be identified, which together determine to a large extent the type of problems and the kind of solutions that might work in a given situation. It is these communalities in ecological, cultural and socio-economic and administrative circumstances that make it possible to draw more general lessons concerning the type of partnerships that are viable under various circumstances and to stimulate organizations working under similar conditions and developments to make their own local application of a particular proven strategy.

Continuation with and improving the analysis and classification of cases that have been wholly or partially successful can in time give access to a complete typology of partnerships pertaining to equitable, efficient and effective water and sanitation services for not only the better off but in all urban areas.

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Vakko Anjengo Pay and Use Latrine for Women
Some additional information to the note of SEU
C. van Wijk, IRC

The latrine is located in a low income and densely settled fishing village on the outskirts of the state's capital of Trivandrum. At the time of visit the latrine had been operational for 11 months. It is managed by "Deepti", the local women's club whose name means "light". The facility is open 7 days a week. It has an office, storeroom, 10 latrines with a watertap for flushing and personal hygiene and 2 showers. The latrines and bathrooms are build in a square around a central handwashing facility. The latrines are of the pour-flush type with white ceramic pans. All cubicles are tiled in light blue tiles. The cement passage around the square is covered, the centre of the square is open to sunlight. The facility is located in a walled yard planted with flowers. It has its own water supply (shallow well, electric pump and overhead reservoir, electric light and a fan in the office.

Every day the facility gets some 200 women users. The direct 'catchment area' consists of women in the nearest ward who have no space for a latrine. The number of such families is about 300 (Total number of households with no latrine in the Panchayat is 900). Assuming that each family has 2-3 adult women, some 25% of the target population uses the facility. The costs are 50 paise for latrine use by registered members (a life membership costs Rs. 10), and Rs. 1 for non-members. Use of showers costs Rs. 1 for all. Users pay at the office and get a small receipt slip. The operator keeps the account and maintain cleanliness.

The facility has 3 operators, all poor members of Deepti. They work in shifts. Those working on weekdays earn Rs. 350/month, the operator for the weekend earns Rs. 150. They clean the facilities twice a day, mornings and evenings. Each latrine also has its own cleaning broom for users. Users can also wash their feet at the entrance. The operators have stopped to provide soap for handwashing as it gets pinched. A suggestion to give a handful of soapflakes or powder to each user to promote handwashing after latrine use was received favourable and the option will be considered.

During the unannounced visit the facility was seen to be very clean. Two taps were however found leaking. Their washers probably need to be replaced, but the operators do not know how to do this and would like to learn and are ready to buy the tool and spare washers. Advice to users to properly close taps in latrines can improve, especially since in the dry season the water supply diminishes with the falling water table in the well. Lack of water also limits the use of the showers. Deepti is trying to get a connection to the piped water supply to increase the amount of water.

The operation is financially self-sustaining. Monthly running costs are:

salaries operators	Rs. 850
electricity	Rs. 100
cleaning mats	Rs. 32
small repairs	Rs. 100
Total	Rs.1082

Block 2 : Sustainability Issues

Wednesday, September 18, Session A and B

- Subject title** : Field Trip to Hantenna, Yatinuwara
- Type of session** : Visit of existing water supply facilities and laboratory of the National Water Supply and Drainage Board.
- Objectives** : - Participants relate what they learned in theory during the course with the field situation.

The NWSDB operates several schemes in the vicinity of Kandy, equipped with a variety of treatment systems. Participants will see details of dynamic roughing filtration, slow sand filters, iron removal plant and defluoridation unit, in working condition. Water quality covering biological, chemical and physical aspects, will be discussed.

- Hand-out** : - description of field visit
- notes/papers on water quality

September 7 - 27, 1996, Kandy, Sri Lanka

Reduction of iron in ground water using a low-cost filter unit

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Abstract: Occurrence of iron in ground water has become one of the constraints in gaining acceptance to the hand-pump well programme within the community, as consumers are very sensitive to any taste that occurs in the drinking water. Therefore, different types of filter units have been used for the reduction of iron to desirable levels. Although the FINNIDA circular type filter unit has been tested with the UNICEF type filter for iron and manganese reduction and found comparatively effective, certain limitations were observed in utilizing the FINNIDA circular type.

The limitations encountered in the FINNIDA circular type were in the manual transportation of the pre-cast filter unit to remote locations and in handling the cover slab during maintenance. The other disadvantages were the high costs involved in production and the need to have a pre-casting yard for production. The new FINNIDA square type filter unit has been designed to avoid these problems. The special features are simplicity of design and possibility of in situ construction. The handling for maintenance is easy, hence achieving village level operational and maintenance (VLOM) status. In addition, the construction cost was low. With these advantages, the desired iron concentration required by Sri Lankan Standards 614:1983 based on WHO guide lines (1983) for drinking water has been achieved in the FINNIDA square type.

The identification of suitable locally available filter media, such as wood charcoal/sieved sand, metal chips/sieved sand was made in this study.

INTRODUCTION

After the declaration of the International Drinking Water Supply and Sanitation Decade 1981-1990, Sri Lanka was able to launch out on several water supply and sanitation projects. The donor of one such project is the Finnish International Development Agency (FINNIDA) with the object of providing safe drinking water and proper sanitation in Kandy District (Fig. 1). This project was started in Udunuwara electorate in Kandy District in 1986 and 70 community hand-pump wells were installed by the end of 1987 under the Harispattuwa Water Supply and Sanitation Project (HWSSP). With the commencement of Kandy District Water Supply and Sanitation Project (KDWSSP) a further 230 hand-pump wells have been completed in Udunuwara area in 1989. Of these hand-pump wells, 20 were not able to be utilized directly due to the presence of excessive amount of iron with respect to Sri Lankan Standards based on WHO guide lines of drinking water. Another salient feature of these hand-pump wells was consumer reluctance to utilize this water for drinking purposes, which leads the consumers back towards their traditional, bacteriologically polluted, but low iron content sources. The facility was further extended to Kundasale area in Kandy District and another

275 hand-pump wells constructed in this area, but 10 per cent of these wells had high iron contents of more than 1.0 mg/l Fe.

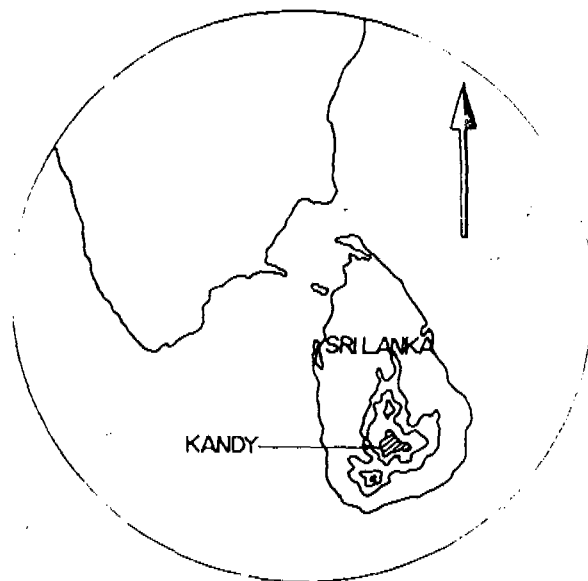


Fig. 1. Map showing location of Kandy District, Sri Lanka.

A strategy followed in installing these hand-pump wells was the involvement of the beneficiaries in planning, construction and the maintenance activities. The importance of each hand-pump well to the beneficiaries need not be highlighted, but it was necessary to reduce the iron content to acceptable levels so that water could be used with consumer acceptance.

At the beginning, there were two types of filter units in operation, namely UNICEF, 1987 fibre glass (Fig. 2) and FINNIDA circular type (Fig. 3). Although both these types were tested for iron and manganese removal (Padmasiri 1989) and found comparatively effective, certain limitations were observed in these types of filter.

In the UNICEF rectangular fibre glass unit the main limitation was the cost involved, i.e. about Rs. 5,000/- (US\$ 125), and its maintenance. Since it has four chambers to clean, it has become a cumbersome job at the village level. The limitations encountered in the FINNIDA circular type were the difficulty of manual transportation of the

pre-cast filter unit to remote locations and of handling the cover slab during maintenance. Other disadvantages were the high costs of production (Rs. 2,400/- US\$ 60), and the necessity for having a pre-casting yard for production (Table 1).

The new FINNIDA square type filter unit (Fig. 4) has been designed to avoid these problems. The special features are simplicity of design and possibility of construction *in situ*. Handling during maintenance is easy, thus achieving village level operational and maintenance (VLOM) status. In addition the construction cost was low (Rs. 1,600/- US\$ 40). FINNIDA square type (Fig. 4) low cost filter units were constructed at some of hand-pump well locations. Frequent maintenance of these filter units is essential. It is also necessary to train the beneficiaries to maintain the filter units. The beneficiaries themselves are able to identify when to clean and maintain the filter unit because high iron content gives a yellowish brown colour and bad taste to the water. In addition, the filtering

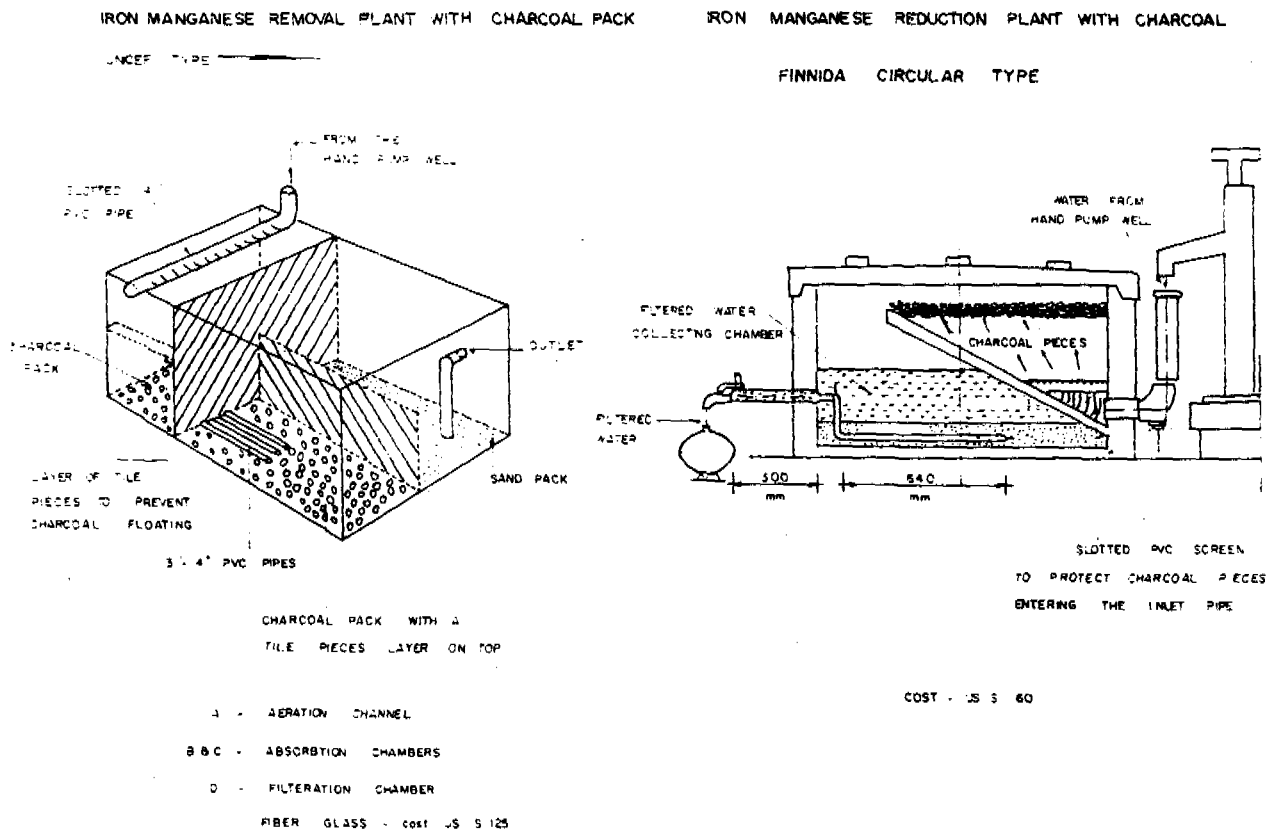


Fig. 2. Iron/Manganese removal plant with charcoal pack - UNICEF type.

Fig. 3. Iron/Manganese reduction plant with charcoal - FINNIDA circular type.

Table 1. Comparison of Iron Reduction Filter Units.

	FINNIDA Circular Type	FINNIDA Square Type
Easiness in transportation	Needs to be transported as the pre-cast unit which is very difficult in handling. Weighs about 900kg.	Can be transported to the site as materials and could be in situ constructed
Requirements of space for installation	1.1 m ²	1.2 m ²
Effective filter area	0.80 m ²	1.2 m ²
Moulds and special facilities for production	Requires a mould and pre-cast yard for production	Only a simple shuttering is required and could be in situ cast
Initial cost	Rs. 2,400/-	Rs. 1,600/-
Easiness in cover slabs for maintenance	Very heavy as the cover slab weighs 350kg and needs about 04 people for handling	Each segment of cover slab weighs about 50kg. 02 persons can handle
Percentage iron reduction	In the range of 75%	In the range of 92%
Easiness in maintenance at village level	Easy	Very easy
Maintenance cost excluding labour per annum	Rs. 100/-	Rs. 100/-

rate is very slow when the porosity of the charcoal is reduced. Once the filter unit is blocked, water splashes out from the inlet of the hand pump.

The maximum desirable level of total iron is 0.30mg/l and the maximum permissible level of iron is 1.00mg/l according to Sri Lankan Standards of Drinking Water (SLS 614 Part I, 1983). Above these levels the quality of water is poor due to unpleasant tastes and yellowish brown colour. The iron compounds usually found dissolved in ground water are in the form of ferrous bicarbonate (World Water 1988). This is stable only in the absence of oxygen. The iron gets oxidized to higher state due to the aeration taking place in the filter systems, thus producing insoluble oxyhydroxides. These are easily removed by filtration through sand. Aeration also reduces the dissolved carbon dioxide, thereby increasing the pH value (Ahmed and Smith 1987).

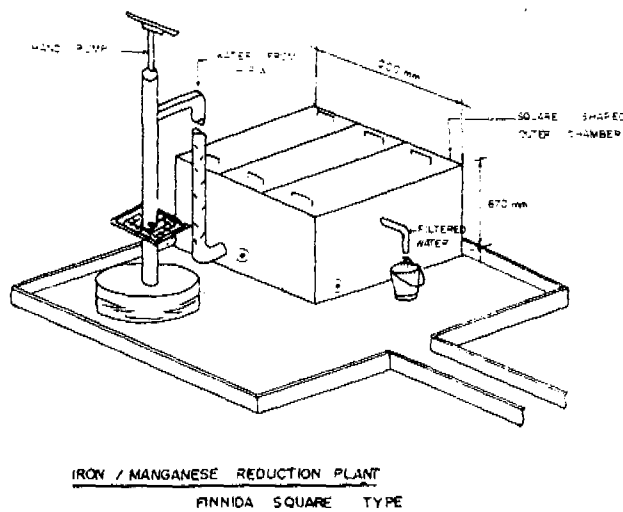


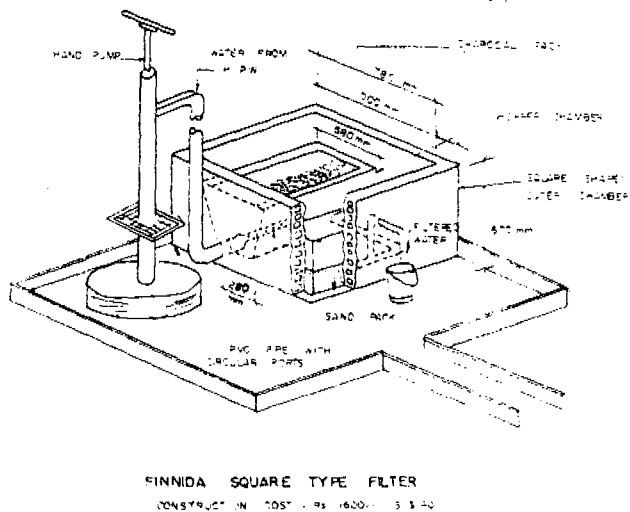
Fig. 4. Iron/Manganese reduction plant - FINNIDA square type.

Microbiological oxidation of Fe² to Fe³ forms insoluble oxyhydroxides. The pH range is 4.6 to 8.0. Iron bacteria frequently encountered in ground water include Gallionella and filaments of the Sphaerotilus-Heptothrix group. It is believed that the iron bacteria thrive here and live on these energy conversions of Fe² to Fe³ (Mara 1974, Cullimore and McCann 1977).

PLANT DESIGN

Special emphasis has been given to make the construction and maintenance of the Finnida Square unit very simple and cost effective. Simplicity was achieved by changing the shape to a square, and the structure was made out of locally available, fired bricks of size 18x9x6 cm³. The filter unit consists of two chambers, as in the FINNIDA circular type (Fig. 3). The lid is made of reinforced concrete with handles in three segments, facilitating easy handling. The square unit is separated into two chambers by constructing a concrete slab on three sides, which starts from (30cm) at the bottom and increases up to (60cm) at the top level in order to provide more spillage perimeter length. This chamber is packed with filter media of 1-3cm range in size.

Incoming water from the hand-pump outlet fills the inlet pipe of 7.5 cm diameter first and then enters the chamber through a pipe of 5 cm diameter, which has ports for discharging the inflow. The advantage of having three side separation slabs is to increase the spilling length. The inlet pipe of 7.5 cm diameter was selected as in the FINNIDA circular type and slots were made in this pipe. To facilitate turbulence in the incoming water, aeration vanes had been provided in the pipe. The design has an increased capacity for effective aeration due to the special



advantage of change of water column in the inlet pipe, which is used as the aeration chamber at each discharge. Five-centimeter diameter pipe was selected to discharge the incoming water into the hopper chamber. The special feature in this pipe outlet is that ports are spaced and staggered to create effective upward flowing plumes in the filter unit. The dimensions of the hopper chamber was designed to utilize the effective plume volume created by the discharge pipe with ports. The edges of the hopper unit were sharpened to make the flow spill over the cutting edge. A wash-out was introduced at the hopper chamber, for easy operation and maintenance purposes, which will utilize the available head for back-washing purpose. This helps in the frequent cleaning process.

Water from the first chamber spills over to the second chamber where the surface area of the sand filter will be almost same as that in the FINNIDA circular type. The precipitates of iron oxide are filtered in this chamber, using washed and sieved river sand of size range 1-3mm.

To improve the outflow from the unit, the collection length of the perforated pipe was increased, and two washouts were introduced to ease frequent cleaning process. In addition a synthetic net is provided to accumulate the precipitated materials.

By opening the plugs provided in the two chambers, water can be drained out easily. This should be done two to three times by pumping fresh water to the filter unit, thereby washing the media in the two chambers. The major cleaning process and the up-grading of the filter media are quite easy.

The removal of the lid is very easy in the FINNIDA square type because it is made in three pieces, of reinforced concrete with handles. Maintenance of the filter unit is done by the beneficiaries when the outflow from the unit is reduced. At this time it is necessary to open washouts in the first and second chambers, and necessary to take out the charcoal or metal chips and repack it as it was earlier. This operation can be repeated whenever it is found that the outflow rate is reduced. However, if the time duration needed from one cleaning operation to the next gets less, this indicates that the porous voids in the charcoal grains have been filled and it is necessary to replace it.

After initial installation of the filter unit, the first two cycles of cleaning were handled with consumer participation. Thereby beneficiaries were trained to clean the filters by themselves.

FILTER MEDIA

The wood charcoal pack is the only material which needs replacement with time, but this material is not available in every household as most consumer families

Table 2. Hand Pump Wells Installed with Filter Units.

Well Number	G.S. Division	Shape of Filter Unit
1100-UN	Bambaradeniya	Square
3001-UN	Kamburadeniya	Square
3004-UN	Palkumbura	Square
4020-UN	Uda Aluoeniya	Square
1049-UN	Wegiriya	Circular
1096-UN	Wegiriya	Circular
4025-UN	Mathgamuwa	Circular
4029-UN	Rangoda	Circular

are utilizing firewood burnt completely to ash. However, this material is available as a waste in bakeries, lime kilns, brick kilns and tea factories in the area, and can be bought at a low price. The beneficiaries require about 15kg of charcoal for replacement, which will cost about Rs. 1.25 per kg.

It is also necessary to remove the top layer of sieved sand from time to time. When the sand layer becomes too thin, fresh washed and sieved sand can be added to the filter unit. The thickness of sieved sand layer is 6 cm, and its grain in the range of 1-3 mm.

SAMPLING

Hand-pump wells installed with FINNIDA filter units, both circular and square, have been monitored to determine the effectiveness and efficiency in reducing iron concentration using wood charcoal/sieved sand as media (Table 2). This study was extended to filters installed in Kundasale area, but with different locally available filter media. The drawback observed was the unavailability of hard-wood charcoal at the village level. This was a hindrance to the sustenance of the filter unit. As an alternative measure, stone chips of size 3-25mm were used in the first chamber. This material can be easily found in villages in Kandy District. In addition, stone chips of sizes 3-25mm can be re-used after washing. The re-usage of charcoal was not satisfactory because of reduced porosity after a single use (Padmasiri 1989).

The water samples were collected in clean, acid-washed plastic bottles and transported to the laboratory in a cool box. The sampling bottles were rinsed with the water to be sampled before the final collection for analysis. The samples were collected from each filter unit at both inlet and the outlet, and were analyzed within 24 hours. The parameters measured were colour, turbidity, conductivity, pH, total hardness, total iron and manganese in both inlet and outlet samples.

Conductivity measurements were carried out using a WTW-Digital LF91 conductivity meter. Colour, turbidity, nitrate, iron and manganese determinations were carried

out in a DR/2000 HACH programmable spectrophotometer. Total hardness was measured using the EDTA method with the HACH test kit. The pH measurements were done using a WIW-Digital pH 91 meter.

For bacteriological analysis all the samples were collected after sterilization of the mouth of the outlet by flame. The water was collected in sterile glass bottles and transported in cool boxes. The samples were then subjected to culturing within two hours of sampling. All the samples were tested for total coliforms and faecal coliforms by membrane filter (MF) method. MIL-LIPORE materials and media were used (WHO 1985).

RESULTS AND DISCUSSION

The geological conditions of the wells considered were similar—hornblende-biotite gneiss with layers of greenish, yellowish brown clay at the top. In this study two types of wells, viz. hand-dug shallow wells and drilled borehole wells were taken into consideration. In the case of hand-dug shallow wells, the iron contribution is from

overburden soil, identified as greenish, yellowish and reddish brown clay. In comparison, in drilled borehole wells the iron contribution is from the hornblende-biotite gneiss. This has been contributed to the unfavourable iron content in the drinking water (Table 3).

The use of high density polyethylene pipes for hand-pump wells prevented secondary contamination of iron through pipes. The pumps installed were NIRA 85 (FINLAND) and INDIAN Mark II.

The varying concentrations of total iron, turbidity and colour are shown in Table 4 of the inlet water samples before the filtration. The physical appearance of the water is bad, hence unacceptable for drinking purpose. The maximum recorded levels of these parameters in these wells are shown in this table.

Iron and manganese are most commonly removed by oxidation to an insoluble form followed by filtration. Removal of iron and manganese in the presence of microbial activity has been reported for rapid and slow sand filters, granular activated carbon filters (Knocke *et al.* 1988). Iron bacteria are common in aerobic environ-

Table 3a. Lithological and Physical Data - FINNIDA Circular Type Filter Units.

Well Number G.S. Division	Location	Lithological Data	Depth m	Aquifer Depth m	Yield l/min	Diameter of Casing mm	Average Iron mg/l
1049 -UN Wegiriya	NS f. valley	Brown to whitish brown quartzite sand Greenish brown sand Hornblende biotite gneiss boulder Greenish brown sand Hornblende biotite gneiss	0-5 5-10 10-11 11-17 17-82	Aquifer 69-82 Main Aquifer 76-82	46	160	0.74
1096-UN Wegiriya	NE wide f.valley/NW wide s. valley	Greenish brown micaceous clay Reddish brown clay Greenish brown sand Hornblende biotite gneiss	0-1 1-4 4-6 6-64	Aquifer 14-64 Main Aquifer 49-64	74	160	0.94
4025-UN Mathgamuwa	NE wide f.valley	Reddish brown clay Brown clay Whitish brown micaceous clay Underlain rock is biotite gneiss	0-2.5 2.5-3.5 3.5-6.5	-	-	1000	1.07
4029-UN Rangoda	NW wide f.valley	Brown micaceous clay Light brown clay Yellowish brown clay Whitish brown micaceous clay Underlain rock is hornblende biotite gneiss	0-3.5 3.5-6.5 6.5-7.5 7.5-9.0	-	-	1000	0.90

Table 3b. Lithological and Physical Data - FINNIDA Square Type Filter Unit.

Well Number & G.S. Division	Location	Lithological Data	Depth m	Aquifer Depth m	Yield l/mir	Diameter of Casing mm	Average Iron mg/l
1105-UN Bambaradeniya	Wide NW s.valley	Brown clay Hornblende Biotite gneiss	0-5 5-70	Aquifer 22-70 Main aquifer 61-70	108	115	1.94
3001-UN Kamburadeniya	NE wider /NW narrow f.valley	Biotite gneiss		13-42	08	130	2.37
3004-UN Pelkumbura	NW f.valley NE s.valley	Greenish brown clay Reddish brown clay Greenish brown sandy clay Hornblende biotite gneiss	0-1.5 1.5-4.5 4.5-6.0 6-40	Aquifer 21-40 Main Aquifer 28-40	151	160	0.62
4020-UN ude-Aludeniya	NNW wide f.valley NE narrow f.valley	Greenish brown clay Greenish brown sand Yellowish brown clay under rock is migmatitic gneiss	0.2 2-2.5 2.5-4.5	-	-	1000	2.13

f. Fractured s. Strike

ments, such as wells where soluble iron exceeds 0.2 mg/l. Microbial oxidation of ferrous to ferric iron forms insoluble oxyhydroxides. Manganese oxidizing bacteria transform manganese² to manganese⁴. Oxidation of manganese² to manganese⁴ is a less frequent and slow reaction. Manganese oxidizing bacteria develop in ground water where the pH is between 5.5 and 9.9. The oxidation expected in the process had been successfully achieved by introducing an aeration pipe into the inlet pipe of the filter unit. The effect can be clearly seen by the increase of the pH and dissolved oxygen in the hopper chamber. This aeration is sufficient for oxidation to take place (Table 5). The hopper chamber was packed with

materials such as hard-wood charcoal and stone chips of 2-25mm. In this chamber the conversion of Fe^{2+} to Fe^{3+} takes place with the oxygen provided in the aeration pipe. The iron oxyhydroxides formed get adsorbed on the particles of the filter media.

In both the FINNIDA circular and square type units, filtration of iron is effective (Table 6). In these units, water is forced through the charcoal pack, thereby better adsorption takes place due to forced flushing. At the inlet to the filter unit the aeration takes place, thereby reducing the carbon dioxide content of the incoming water. The pH condition is ideal for microbial oxidation as well as conversion of ferrous bicarbonate to ferric hydroxides. The iron bacteria starts growing in the top layer of the metal pieces. Subsequently, water is allowed to spill over to second chamber, which has 15 cm thick layer of washed and sieved sand. The sand filter bed acts as a strainer since

Table 4. Total Iron, Turbidity and Colour of the Inlet samples before filtration.

Well Number	Filter Unit	Maximum Recorded Levels of		
		Total Iron mg/l Fe	Turbidity FTU	Colour mg/l Pt
1049 UN	Circular	1.30	20	125
1096 UN	Circular	1.61	25	160
4025 UN	Circular	2.20	50	285
4029 UN	Circular	2.30	50	140
1100 UN	Square	8.80	120	450
3000 UN	Square	12.50	230	600
3004 UN	Square	2.07	20	110
4020 UN	Square	12.0	130	530

Table 5. pH and Oxygen Variations in Filter Unit.

	Inlet to Filter	Hopper Chamber in the Filter
pH	6.46	6.57
	6.10	6.57
	6.05	6.54
	6.08	6.53
O ₂ mg/l	1.3	2.0
	1.3	2.4
	1.3	2.0
	1.8	2.4

the small suspended solids are retained at the top of the layer in the pore system of the 1-3 mm sieved sand. For easy cleaning purposes, a net was laid on the sand bed. The biological and chemical actions that took place in the charcoal chamber forms a layer on top of sand layer called 'Schmutzdecke'. The slow sand filtration will produce hygienically safe water once this layer is fully developed (Graham 1988). Finally the water is collected from the outlet, and conforms to the Sri Lankan Standards of Drinking Water 614 (1983). The reduction of iron in the outlet water sample is accompanied by a reduction of colour and turbidity values as shown in Figures 5 and 6. The pH increase of the outlet samples is also shown.

It was noted in the study that the life span of the hard-wood charcoal depended on the iron content of the well as well as sizes of the charcoal. Hard-wood charcoal was obtained by burning trees like Weera, Palu, Mora, etc. (courtesy of Ayrvedic Pharmacy Ltd., Kandy). It was noted that the life span of the hard wood charcoal shortens when the iron content of water exceeds 3 mg/l Fe.

Table 6 shows the percentage reduction of total iron of the hand-pump wells studied. It can be seen that the iron removal efficiency of the newly constructed FINNIDA square type is above 90% level, whereas the FINNIDA circular type show less efficiency, with one unit going down as low as 54%, while another filter unit has exceeded 90% iron removal efficiency.

Table 6. Efficiency of Iron Reduction And Life Span - with charcoal /sand.

FINNIDA CIRCULAR TYPE FILTER UNIT

Well No.	Average Total Iron mg/l		Percentage Reduction of Total Iron	Life Span of Wood Charcoal Packs Used in Weeks			
	Inlet	Outlet		1st pack	1st Wash	2nd pack	1st Wash
1049-UN Wegiriya	0.74	0.34	54.0	11	07	8	-
1096-UN Wegiriya	0.94	0.28	70.5	20	12	-	-
4025-UN Mathgamuwa	1.07	0.15	86.0	20	10	15	-
4029-UN Rangoda	0.90	0.04	95.8	13	-	16	-

FINNIDA SQUARE TYPE FILTER UNIT

Well No.	Average Total Iron in mg/l		Percentage Reduction of Total Iron	Life Span of Wood Charcoal packs Used in Weeks					
	Inlet	Outlet		1st Pack	1st Wash	2nd Wash	2nd Pack	1st Wash	2nd Wash
1100-UN Bambaradeniya	1.94	0.03	98.5	11	04	02	07	-	-
3001-UN Kamburadeniya	2.37	0.04	98.3	10	08	05	-	-	-
3004-UN Pakumbura	0.62	0.05	91.9	04	06	04	03	04	03
4020-UN Uda Aludeniya	2.13	0.06	97.2	06 Activated charcoal	01	-	05	05	05

Table 7. Efficiency of Iron Reduction in FINNIDA Square Type Filter Units with Stone Chips /Sieved Sand as Media.

Well Number	Average T. Iron mg/l Fe		Percentage Reduction of Total Iron
	Inlet	Outlet	
1128-KU	3.52	0.08	97.7
2002-KU	2.65	0.30	88.7
2033-KU	1.38	0.08	94.2
2151-KU	1.32	0.14	89.4
3047-KU	4.08	0.09	97.8
3085-KU	4.52	0.22	95.1
8001-KU	1.32	0.08	94.0
8510-KU	4.45	0.10	97.8
9004-KU	1.82	0.12	93.4
9018-KU	1.62	0.15	90.7
9021-KU	1.22	0.12	90.2
9024-KU	1.21	0.06	95.0

Table 7 shows the efficiency of iron removal using stone chips in the FINNIDA square type filters. The high iron content variation in the wells are in the range 1.21 - 4.52 mg/l Fe and the efficiency of iron removal in all the wells was above 88%, which is very satisfactory. However, stone chips of sizes 3-25mm can be re-used after washing. The re-usage of charcoal is not satisfactory because of lowered porosity after a single use.

Table 8. Bacteriological Quality of Water in the Filters.

Well Number	TC/FC	TC/FC	TC/FC	TC/FC	TC/FC	TC/FC
1100-UN	11.07.89 20/06	24.07.89 14/00	08.08.89 Nil	25.09.89 80/20	10.10.89 86/18	31.10.89 24/00
4025-UN	23.11.89 44/04	11.12.89 Nil	08.01.90 Nil	21.06.90 04/Nil	29.08.90 20/Nil	24.04.91 12/Nil
3004-UN	05.12.89 Nil	03.01.90 02/00	15.02.90 4/Nil	12.03.90 06/00	13.08.90 Nil	21.01.91 Nil
4020-UN	03.01.90 Nil	30.10.90 Nil	06.02.90 02/Nil	18.06.90 Nil	16.07.90 12/Nil	09.08.90 Nil
1049-UN	17.07.89 48/4	08.08.89 34/4	22.08.89 04/00	15.11.89 06/02	05.12.89 Nil	03.01.90 Nil
3001-UN	09.10.89 72/6	24.10.89 18/00	16.11.89 04/00	05.12.89 18/00	08.02.90 30/00	12.03.90 Nil
1128-KU	29.05.90 Nil	24.06.90 30/Nil	14.06.90 20/Nil	05.07.90 18/Nil	17.07.90 20/Nil	30.07.90 06/Nil
2151-KU	12.08.91 32/Nil	20.09.91 20/Nil	24.10.91 28/Nil	14.11.91 06/Nil		
3047-KU	27.06.90 4/Nil	10.07.90 Nil	30.07.90 Nil	12.06.91 50/06	25.07.91 28/Nil	22.11.91 Nil
3085-KU	24.09.90 Nil	12.10.90 06/Nil	12.11.90 04/Nil	12.08.91 24/Nil	01.10.91 8/Nil	22.11.91 14/Nil

TC - Total coliforms at 35°C per 100ml sample
FC - Faecal coliforms at 44°C per 100ml sample

The consumers were trained to do the cleaning of the filter units from time to time. Cleaning required in the filter units depending on the iron content of hand-pump wells. The cleaning interval was varied between 3 weeks and 3 months, and the time required for cleaning the unit is 30-45 minutes. The community participation approach was very productive in these wells, and the filter units have been in operation for the last 3-4 years.

Table 8 shows the bacteriological quality of water in the filter units, achieved by washing the sieved sand properly and by chlorination of the sand layer. But the chlorination became a hindrance to the bacterial growth formation on the top of the sand layer, so this procedure was therefore omitted, and only washing retained. Hence, at the start of the cycle of the filter unit, the bacteriological quality of water was not satisfactory, but once the filter system was developing on its own, with the formation of 'Schmutzdecke', water quality conformed to the required SLS 614 (1983).

CONCLUSION

1. The low cost square type filter unit is very simple in design and cheap to build in remote areas.
2. This unit can be constructed *in situ*, thus avoiding need for a pre-casting yard.

3. The desired iron concentration required by SL Standards of Drinking Water has been achieved.
4. Stone chips and sieved sand found locally provided a very appropriate, cost-effective medium to remove iron from ground water, so achieving VLOM status.

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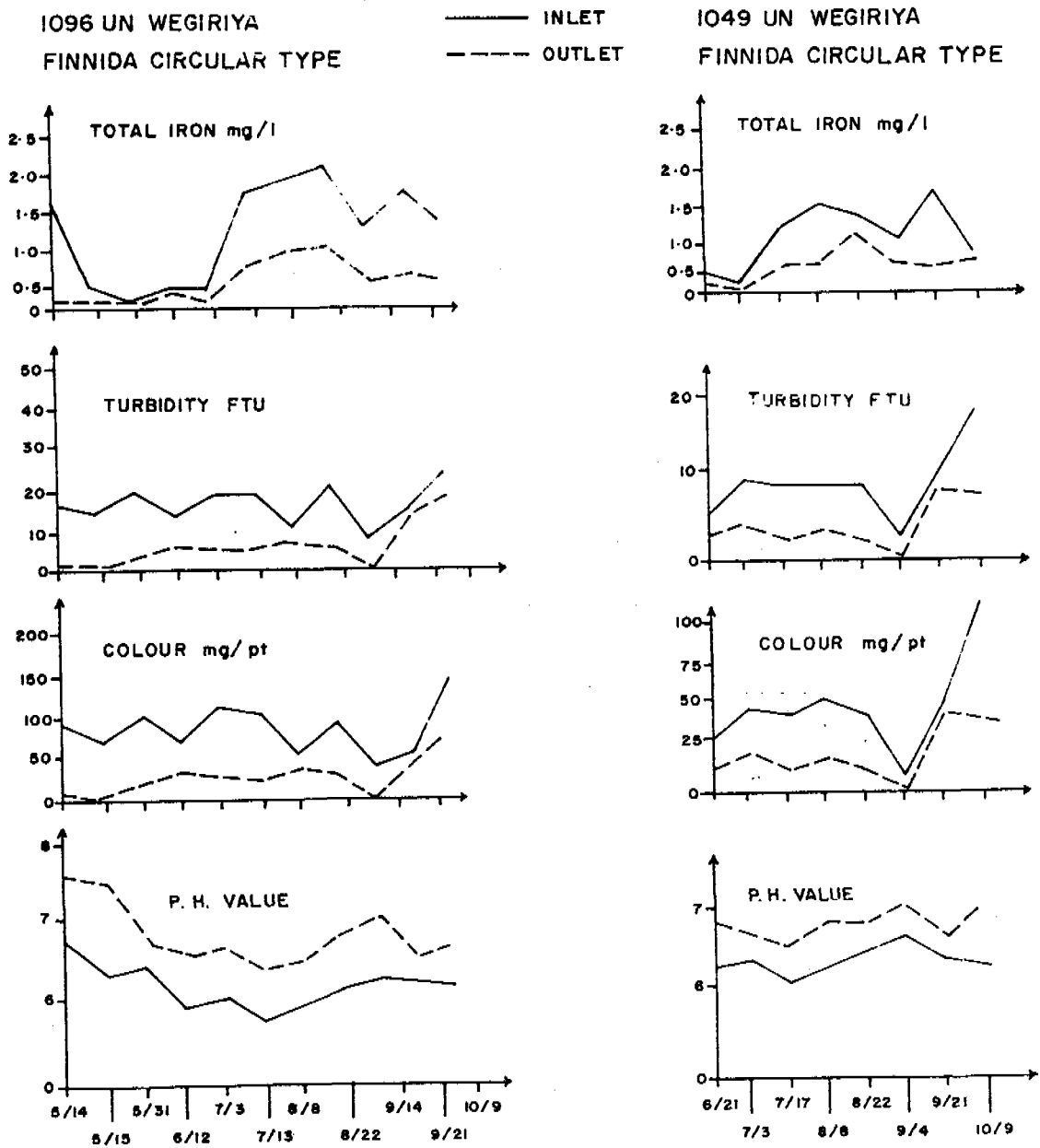


Fig. 5. Total iron, turbidity, colour, pH of FINNIDA circular type.

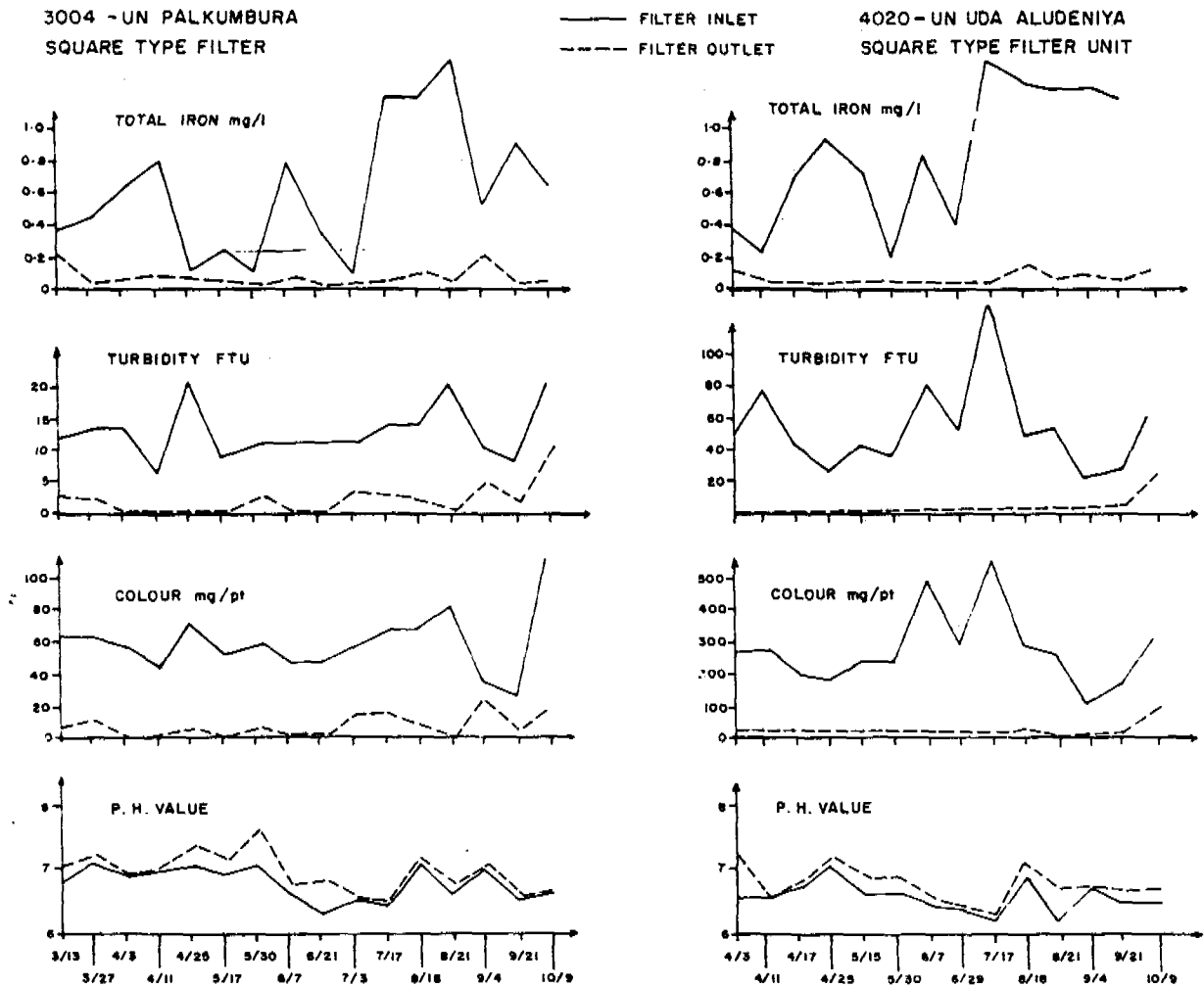


Fig. 6. Total iron, turbidity, colour, pH of FINNIDA square type

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A simple defluoridator for removing excess fluorides from fluoride-rich drinking water

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Dental and skeletal fluorosis caused by ingestion of fluoride-rich waters has affected millions of people, particularly in the developing countries. In view of the lack of awareness of the cause of the problem among the inhabitants in such areas, and also on account of economic constraints, a simple, easy to operate household defluoridator is most essential to alleviate the problem. Such a low cost household defluoridator using burnt bricks was developed and tested in fluoride-rich regions of Sri Lanka. The results were promising and if distributed properly, the problem of dental and skeletal fluorosis in Sri Lanka could be alleviated.

Keywords: fluoride; defluoridation; dental fluorosis; burnt bricks.

Introduction

Excess fluoride in drinking water causes dental fluorosis, and in cases of higher ingestion, skeletal fluorosis sets in. The WHO has set a danger limit of $1.5 \text{ mg l}^{-1} \text{ F}^{-}$ for drinking water. Many parts of China, India and Sri Lanka are affected by these diseases and techniques for the defluoridation of fluoride-rich waters have, therefore, become indispensable. In India alone, 20 million people are affected by fluorosis (Mangala 1988). In China, the population so estimated is 50 million (Zeng and Hong 1988). In Sri Lanka too, there is a marked increase in the incidence of dental fluorosis, notably in the dry zone (Dissanayake 1991).

While techniques for the defluoridation of fluoride-rich waters are indeed available, the application of such techniques in remote parts of the developing countries, where dental fluorosis is most common, has inherent problems. As noted by Phantumvanit *et al.* (1988), the shortcomings of most defluoridation methods are:

- high cost of plant;
- high operational and maintenance costs;
- low capacity for removing fluoride;
- lack of selectivity for fluoride;
- undesirable effects on water quality;
- generation of sludge that is difficult to handle;
- complicated procedures.

This paper discusses the application of a simple technique of defluoridation of water, well in excess of the WHO danger limits, in a village in the North Central Province of Sri Lanka.

Methodology

Prevalence of dental fluorosis

The few primary and secondary schools in the area surveyed revealed that more than 20–40% of the children of the age group 8–16 years suffered from dental fluorosis. In a particular school, 90% of the children of this age group were affected.

A defluoridator for households

The filter is simple in design (Fig. 2) and is fabricated using a 225 mm dia., 1 m PVC pipe length, 20 mm dia. 1 m PVC pipe length and an elbow bend. In order to get a longer retention time for water to pass through the defluoridating material, i.e. burnt bricks, the upward flow technology was used. In using this filter, at the beginning, the high-fluoride water should be retained for a minimum period of 12 h in the defluoridator. Thereafter the high fluoride water is fed and the defluoridated water comes out from the outlet. This exercise needs to be carried out at minimum 4 h intervals. The beneficiaries were instructed to collect water samples from the inlet and outlet on a weekly basis and which were analyzed in the laboratory. The fluoride analysis was carried out using a HACH DR 2000 programmable spectrophotometer using the Spands reagent (Hach 1992).

Results and discussion

A map showing the distribution of fluoride in water was utilized in identifying the fluoride affected villages in the dry zone area in Anuradhapura. Several secondary schools of the children of the age group 10–18 years in the Kekirawa area were visited and the present status of fluorosis affected children investigated (Table 1). The data in Table 1 indicates that in these schools more than 12% of the children had fluorosis while in some schools, the percentage was above 40.

It is worthy of mention that during the drought, the fluoride levels in the well increase from March–October and then drop during November–February (Fig. 1). The uptake of water during the hot season (drought) is more specially in the age group 1–10 years. Thus the body intake of fluoride in the dry zone is much higher.

The pilot scale defluoridator tested in the laboratory using freshly burnt broken pieces of bricks as the filter medium showed good removal of fluoride from water. When high fluoride water is fed through the inlet pipe, an equal volume of low fluoride water comes

Table 1. Fluorosis in secondary schools in Kekirawa

<i>School name</i>	<i>% Fluorosis (mild/moderate)</i>
Olukarada	42.4
Madatugama	44.2
Tibbatuwewa	40.1
Lenadora	27.0
Pannampitiya	12.1
Pallegama	12.5
Maminiyawa	90.0
Maradankadawala	70.0

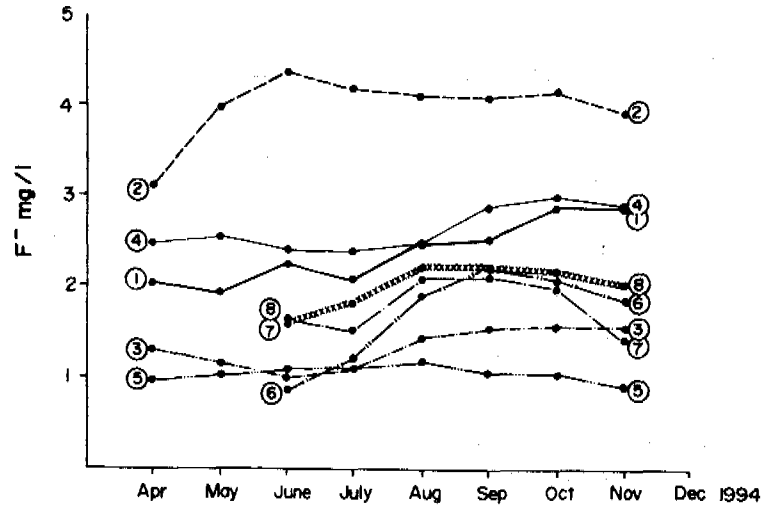


Fig. 1. Fluoride content of drinking water wells.

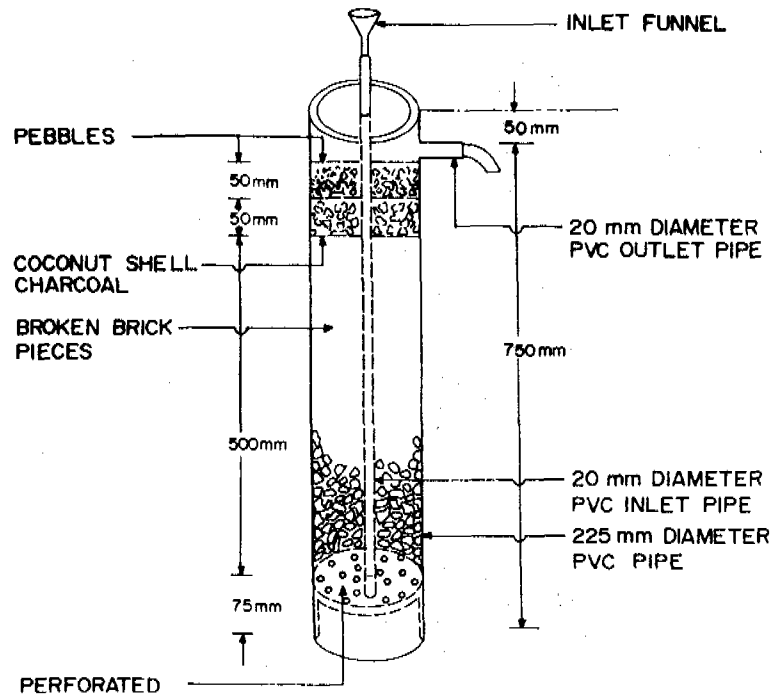


Fig. 2. Low cost defluoridator.

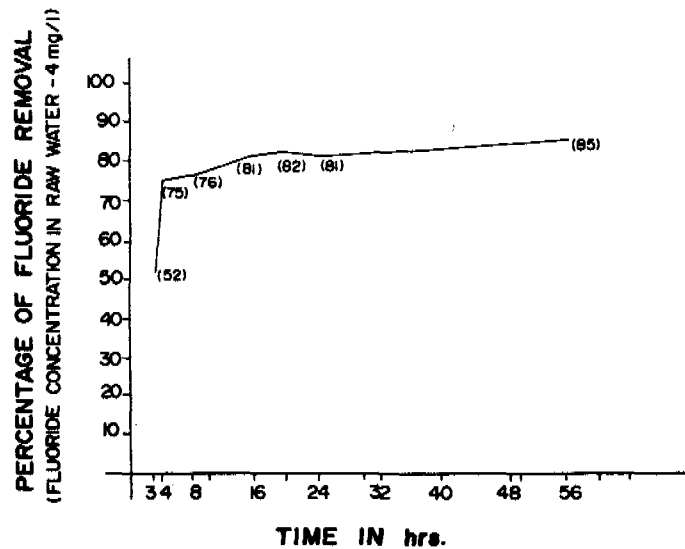


Fig. 3. Percentage of fluoride removal at different time intervals.

out automatically through the outlet pipe. In order to discern the optimum time required for the reduction of fluoride levels, 5 l of water of 4 mg l^{-1} of fluoride were fed and withdrawn at various time intervals. The data for fluoride removal is shown in Fig. 3.

Another trial was run to observe the lifetime of the broken pieces of bricks using water from a well where the fluoride content is 4 mg l^{-1} . The filter was in operation continuously for a period of 75 days. Ten liters of high-fluoride water was fed and withdrawn in the mornings after a retention period of 16 h as shown in Fig. 4.

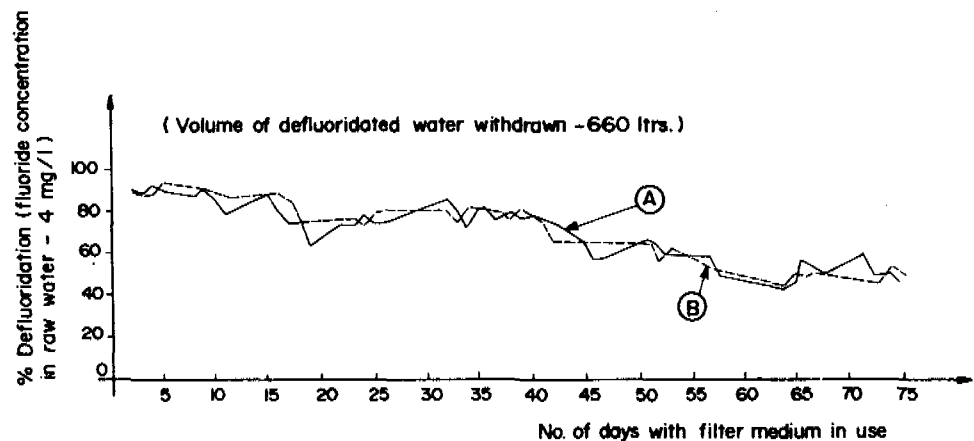


Fig. 4. Defluoridation vs time for low temperature burnt clay (bricks). Retention time 8 h and 16 h.

Table 2. Life time of broken pieces of bricks

Fluoride content in the well (mg l^{-1})	Life span of broken bricks in months
1-2	3-4
2-3	3
3-4	2.5
4-5	1

Similarly 5 l of high fluoride water were fed and withdrawn in the evenings after a retention period of 8 h. The pattern of the percentage removal of fluoride is nearly the same (Fig. 4).

Subsequently, 50 filters were put in to operation in the Kekirawa area and some are already 6 months old. During this period the beneficiaries themselves changed the filter media and some filters are now running its 3rd cycle. Data pertaining to the life span of the filter media for different fluoride levels is shown in Table 2.

The filter media used for the removal of fluoride is low temperature burnt brick clay pieces. The burnt brick (clay) has silicates, aluminates and hematite. When this is soaked in water for several hours, these oxides get converted into oxyhydroxides of iron, aluminium and silica. The Si-O, Al-O bonds are much stronger than Fe-O bonds (Cotton and Wilkinson 1988). The geochemistry of the fluoride ion (ionic radius 1.36Å) is similar to that of the hydroxyl ion (ionic radius 1.40Å) and these can be easily exchanged between them (Fig. 5). The other possible formation is $\text{Al}^{3+} + 6\text{F}^- > \text{AlF}_6^{3-}$.

These filters were distributed among the beneficiaries to ascertain the acceptability at village level, and whether or not they are capable of maintaining the filter unit. Another aspect was to give these filters to families where:

1. The first child is 5-9 years old (fluorosis visible).
2. The second child is 2-5 years old (fluorosis may not be visible).
3. The third child is less than 2 years old (or expecting mother).
4. The well water contains 1-5 mg l^{-1} fluoride.

This work will be continued for the next 4-5 years in order to check the effectiveness of the filter for the age group 1-4 years. At the end of 4-5 years, one needs to make sure that by this method, fluorosis in the zone is completely eliminated. The enthusiasm shown by the beneficiaries was most encouraging. In addition, the information of logging data with regard to submitting samples to the laboratory is done methodically, the monitoring of filters thus being made easy.

A few case studies are elaborated to show the efficiency of fluoride removal in these filters. Figure 6 shows the efficiency of fluoride removal by one of the beneficiaries. In graph A, the amount of water used for consumption was 24 l day^{-1} and the fluoride level in this well was 4 mg l^{-1} . Because of the high fluoride level and high consumption rate, the efficiency dropped sharply. The consumer was advised to use less water, i.e. 16 l day^{-1} , and the efficiency of fluoride removal then increased to more than 80% (graph B). The efficiency of fluoride removal shown in graph C had dropped due to the under-burnt brick pieces used. Hence the quality of the broken bricks is also of extreme importance, a reddish colour indicating its suitability for fluoride removal.

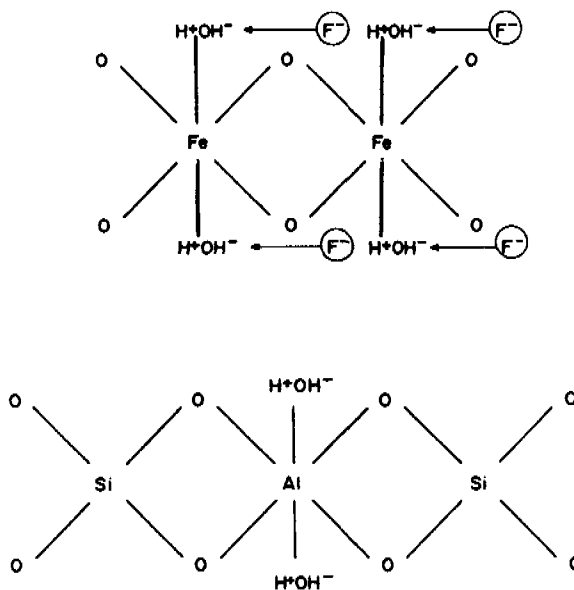


Fig. 5. Mechanism of exchange of fluoride ions.

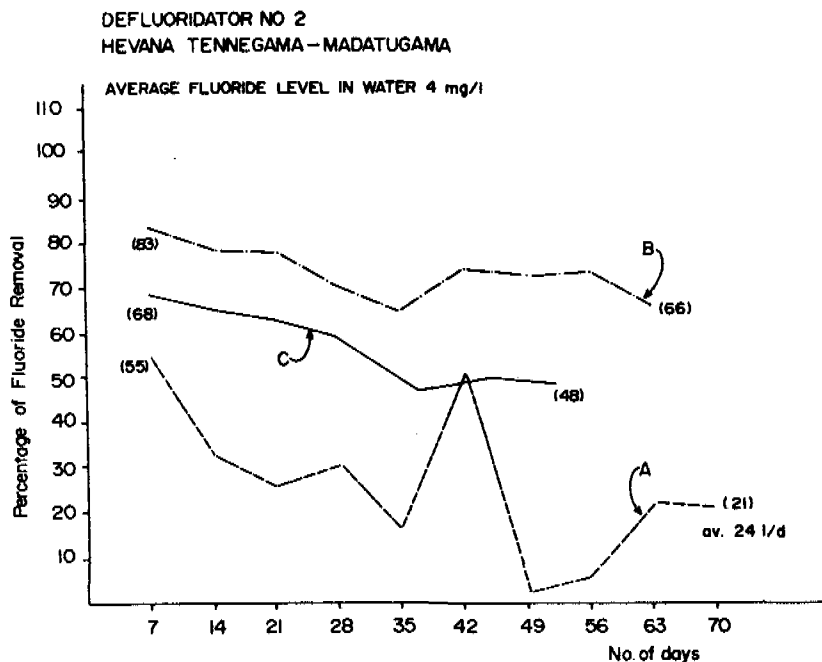


Fig. 6. Performance of a defluoridator with well water containing fluoride of 4 mg l⁻¹. (A) Average withdrawal 24 l day⁻¹ total 1650 l; fluoride content at the start 1.42 mg l⁻¹; fluoride content at the end 3.82 mg l⁻¹. (B) Average withdrawal 16 l day⁻¹ total 1008 l; F⁻ content at the start 0.73 mg l⁻¹; F⁻ content at the end 1.40 mg l⁻¹. (C) Average withdrawal 16 l day⁻¹ total 448 l; F⁻ at the start 1.06 mg l⁻¹; F⁻ at the end of 28th day 1.66 mg l⁻¹.

Another case that was considered is a well with a fluoride concentration of 5 mg l^{-1} . The outer body of the filter is fabricated using a 225 mm dia. PVC pipe length. This unit has a 16 l water capacity. The first graph (Fig. 7) shows the water withdrawn limited 4 l day^{-1} . In spite of a low consumption rate, the fluoride removal efficiency was low. The filter capacity was increased to 24 l by using a 280 mm dia. pipe. The consumption rate increased to 8 l day^{-1} and the fluoride removal efficiency was very good, as shown in Fig. 7. Hence for higher levels of fluoride in well water a bigger capacity defluoridator is recommended, thereby increasing the surface area for fluoride absorption.

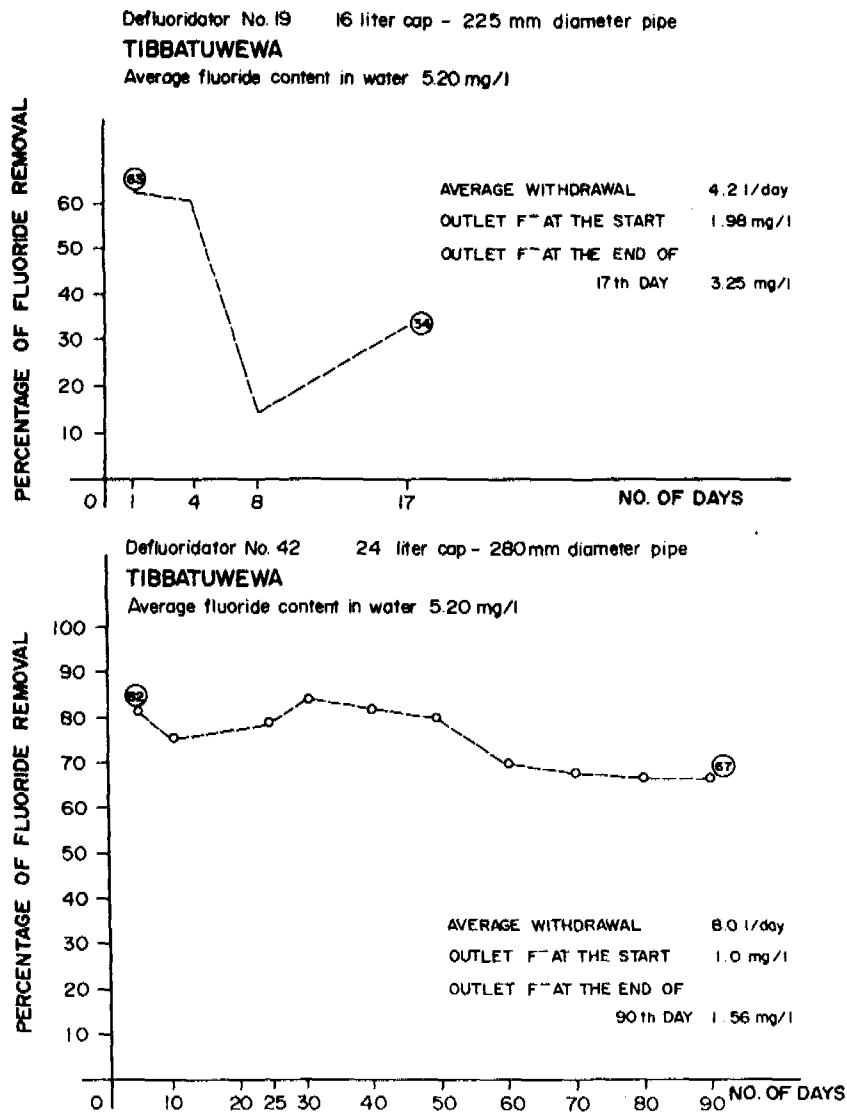


Fig. 7. Performance of a defluoridator with well water containing fluoride of 5 mg l^{-1} .

Conclusion

A simple household defluoridator using burnt bricks can be used effectively to remove excess fluoride from fluoride-rich drinking water. This defluoridator is suitable for developing countries and is especially suited on account of its easy installation, maintenance, ready availability of the defluoridating raw material used, i.e. burnt bricks and low cost, thus achieving Village Level Operation and Maintenance status (VLOM).

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Block 2 : Sustainability Issues

Wednesday, September 18, Session C and D

- Subject title** : Community-based financing
- Type of session** : Lecture and groupwork
- Objectives** :
- Participants know about O&M costs, cost estimation, financial management for O&M and the "willingness to pay" concept.
 - Participants know how accountability and transparency can be enhanced at community level.

The wish to increase water supply and sanitation coverage and to sustain facilities already implemented asks for sound financing. Communities play a role in covering costs of implementation as well as of operation and maintenance.

Extension and improvement of facilities further require financing and community level arrangements to organize, collect and pay. Accountability and transparency are essential for community level financing.

Hand-out : - Paying the piper (1992)

September 7 - 27, 1996, Kandy, Sri Lanka

COMMUNITY FINANCING

WHY ?

- . Why should users pay ?
 - . Trends
- . Financial sustainability
- . . . Willingness to pay
- . Examples from 7 countries

WHAT ?

- . Designing for cost recovery
- . Community financing options
- . Local management organizations
 - . Rate collection
 - . Financial control
- . Other management tasks

HOW ?

- . The making of a training guide for community development assistants on financial management

WHY USERS SHOULD PAY FOR WATER AND SANITATION SERVICES

- * 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 too 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 maximize the use of available resources
- * User payments improve quality and standards of service

(Adapted from Briscoe and de Ferranti, 1988; Katko, 1990).

from: "Paying the Pipe"
IRC Occasional Paper Series n° 18
April 1992
by Philip Evans.

ISSUES IN COMMUNITY FINANCIAL MANAGEMENT :

- a. the context of community financial management :**
Partnership; negotiations; full or partial recovery of costs; why good payment arrangements are necessary; water committee and roles and tasks of main actors; gender specific roles; why should the users pay; affordability and willingness to pay;
- b. budgeting for costs :**
Before, during and after construction; cost sharing; Creating a budget; Estimation of O&M costs & replacement costs
- c. choosing the type of financing system :**
Tariff setting; vending; community fund raising; credit schemes and revolving funds; periodicity; revenue collection system and flow of collected funds; establishing a payment system with the village;
- d. administration and use of funds :**
Registration of collected funds and payments; bookkeeping; opening and using an account; use of funds for other sector activities; money plan; control and reporting to the community; sanctions for non payments; remuneration of water committee staff;
- e. management capacity :**
Decision-making process; problem solving capacity (in case for ex. of unexpected expenses or high inflation); information needed in order to make financial decisions; self monitoring; learning from experience; training needs; relationship with other actors

Table 1: Summary of Community Contributions to Capital and Recurrent Costs in Workshop Case Studies

LOCATION AND TYPE OF SCHEME	CAPITAL COSTS	RECURRENT COSTS
CAMEROUN Gravity-fed piped scheme from protected spring	Capital and labour contribution equal to 20% of total capital cost Trench and pit digging Carrying local materials (sand and stones) Cash contributions: CFA 500 per man and CFA 200 per woman	All recurrent costs paid by community, in accordance with service level: CFA 500 per taxpayer per year for standpost; CFA 5000 per year per house connection; 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 downpayment Repayment of community loan supplemented by agency donation Trench and pit digging Carrying local materials (sand and stones)	Users make monthly payments which cover all operation and maintenance costs, including employment of a local plumber. Community water boards form local associations to provide mutual assistance in solving problems of operation and maintenance, and local management.
HONDURAS Borehole wells, communal tank networks, independent communal tanks served by tankers	Payment of a cash contribution (30% of development costs) Repayment of a loan into a revolving fund for remainder (70%) 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	Payment of a monthly fee in accordance with service level: US\$1.75 for use of a standpost; US\$3.00 for a yardtap. Monthly payments include costs of water board staff and hiring of a plumber.
INDONESIA Piped schemes and rainwater harvesting, public bathing facilities	Full cost met by most communities in most cases Combination of cash and in-kind payments + loans and credit Individuals contribute according to socio-economic status Poorest members often exempt from payments Grant assistance may be arranged if communities have difficulties Provision of local materials + skilled and unskilled labour	Full costs met through user fees, depending on service level and system costs: range from US\$5.00 to US\$50.00 per household per year. Funds also raised through local revolving funds, lotteries, credit systems, entertainments, etc.
PAKISTAN Gravity-fed piped scheme from protected spring, with yardtaps	Villagers contribute to a common fund to support the work of the Village Organization (VO) as a precondition for support Aga Khan Rural Support Programme secures loans or grants Provision of local materials and labour Additional funds raised by fining those who don't meet communal labour obligations Village funds hire local plumbers to help 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 for repairs as necessary 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 Cash contributions usually cover only a small part of costs Provision of local materials and labour Funds may come from cash collections, donations from prominent individuals, auctions, lotteries, raffles, or 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 about 30% of scheme development costs 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 the repairs.

from: "Community management today"¹⁵
 IRC Occasional Paper Series N° 20, June 1993
 by P. P. F. Wilson and Brian Appleton.

Financial sustainability indicators

COMMUNITY LEVEL

- a. Users can afford to pay :
- . what is the type, level and time (season) of income ?
 - . who is paying for water, man or woman ?
 - . what is the level of basic expenses (price of flour, milk, sugar, oil, basic housing material, bus transport, a liter of petrol, wood or charcoal for cooking) ?
 - . how much is the population required to pay and when ?
 - . economic growth potential of the village or the district
- b. Users are willing to pay : (adapted from Katko, 1991)
- *encouraging factors
 - . reliable water supply
 - . users have a clear perception of benefits (health & economic)
 - . household characteristics
 - . convenient service level
 - . women are paying
 - . availability of water for productive use
 - . reliable fund collection and management
 - . involvement of consumers
 - . sense of ownership regarding water point
 - . strong community leadership
 - . women as fee collectors
 - . formal educational level
 - . water system corresponds to the needs / demand
 - . new water supply is superior to traditional one, in terms of quality, quantity, walking distance
 - . users understand the reasons of why they have to pay
 - . there has been some motivation campaign on reasons for paying
 - . additional facilities such as laundry & bathing facilities can enhance willingness to pay
 - *discouraging factors
 - . earlier bad experience with the project or other project
 - . earlier or present "free water policy"
 - . intermittent, unreliable supply
 - . unreliable fund management
 - . time delays between fee collection and working service
 - . non involvement of users
 - . long delays for repairs
 - *other factors
 - . importance of water vending and level of price that users are ready to pay through re-vending
 - . willingness to pay assessment in other project of the village

***direct assessment**

- . are people paying ? regularly ?
- . amount / percentage of non paying ?
- . what are users ready to pay ? for how much ?

c. Local financing can meet the O&M costs

- . level and type of costs to be met by the community ?
(materials, tools, parts, remuneration of caretaker or mechanics, price of intervention, price of replacement of some parts)
- . characteristics of the cost recovery financing ?
(flat/graded rate ? how much? water selling, reselling? how much? seasonal collection ? has an initial contribution been made before the construction of the new scheme ? village taxes ? levy on harvest ? regular or incidental household rates)
- . level of revenues for water and for sanitation
(monthly, yearly) ?
- . capacity to solve a crisis ? What happens if costs cannot be met ? (community raising of funds ? access to small credit schemes ?)

d. Communities are backed up by some financial contributions

- . contributions by the project or Government, direct or indirect ? for what ? how much ?
- . who will take over the project contributions after project ends ?
- . are prices of parts subsidized ? for how long ?

e. Revenue collection system is functioning well

- . characteristics of revenue collection system ? who collects ? man, woman? what happens to the money collected ?
is there a system of control ?
- . how are rates or contributions set up ?
- . what is the amount of no - payments ?
- . are there any receipts given ?
- . are there any sanctions ?
- . degree of satisfaction by users, committee and panchayat of such arrangements?
- . what are the problems and constraints ?

f. Water Committee has financial & accounting skills

- . how is payment for repairs arranged ?
- . bookkeeping system ?
- . any fund for repairs ? or how is the bank account used?
- . account statements are made public ?
- . profile of treasurer is appropriate
- . members of Committee have been trained on financial management
- . who decides on rates/contributions and expenditures ?
- . women participate in the financial management
- . remuneration of different cadres is motivating ?
- . possible support by the district or the project
- . financial monitoring ?
- . type of relationship between water point committee, village panchayat and district panchayat ?
- . what is suggested to improve the situation ?

- g. The users have a good perception of the economic benefits
- . awareness raising campaign have been done
 - . perception of time gain by users
 - . perception of labour gain by users
 - . type of activity done when using these gains
 - . type of activities introduced in the village as a result of the introduction of new or rehabilitated water scheme
 - . money collected is not staying idle in an account or in the pocket of the treasurer, it is partly used for other economic purposes
- h. The installation is simple and cheap to operate and maintain
- . type and complexity of technology chosen
 - . availability of spare parts
 - . price of spare parts (variations due to exchange rate fluctuations, and to inflation)
 - . use of locally made parts
 - . use of local resources

Other :

- . What kind of monetary or non monetary contributions has the community made for the project ?

DISTRICT LEVEL

- . What type of capital or recurrent costs are met by the District, concerning the project ?
- . What type of revenues does the District have ? (development levy, business and liquor licences, taxes on livestock, market dues and other fees and revenues on properties,...)
- . Are revenues successfully collected ?
- . How much "project funds" go to the Districts ? What for? Is there any control & monitoring ? Who will take over the funding once the project has ended ?
- . Are District Treasurers informed about the project ?
- . Is remuneration of district staff motivating ?
- . What is the financial relationship between the district and the community ?

Block 2 : Sustainability Issues

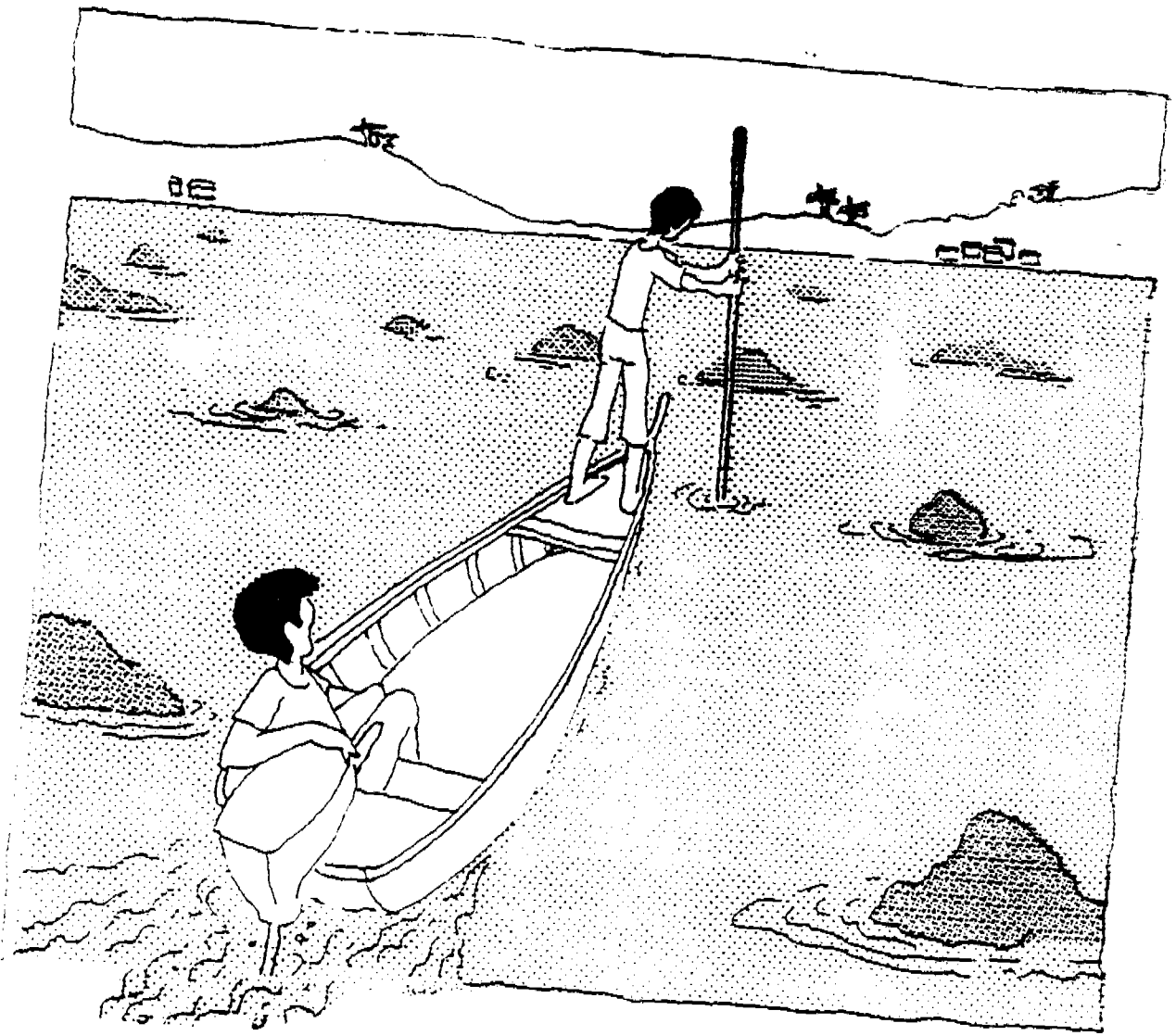
Thursday, September 19, Session A, B and C

- Subject title** : Monitoring and Evaluation, and Information Management
- Type of session** : Presentation, informal discussion, groupwork
- Objectives** :
- Participants appreciate the need to monitor different aspects of WSS planning, execution and impact.
 - Participants review the needs in monitoring and management information at various operational levels.
 - Participants are able to design a basic monitoring system.
 - Participants get familiar with the concepts, principles and practices of information management as applied to the information characteristics and needs of the water and sanitation sector.
 - Participants review their experiences in relation to information management in their own institutions, projects and programmes.
 - Participants examine the ways in which effective information management can provide support to efforts to achieve sustainability in water and sanitation programmes.

Monitoring is an essential day-to-day activity affecting performance. Ways and means of monitoring are presented. Information and information management are more and more considered crucial for the water sector. Managing information requires commitment and special skills and this session is meant to give it a start to develop these.

Hand-out : Participatory Evaluation : Tools for Managing Change in Water and Sanitation, Deepa Narayan (1993).

September 7 - 27, 1996, Kandy, Sri Lanka



Monitoring

Observation

Data - recording

Evaluation

Assessment

Discussion

Action



without losing too much of its information content, meaning or accuracy.

The introduction of the monitoring system made it necessary to convey a great deal of abstract and relatively new information. For this reason it seemed a good idea to use pictures as a medium in addition to language.

We did our best to avoid professional jargon, to translate complicated expressions and to illustrate abstract concepts by means of examples from the realm of experience of the people on the spot. The national language was used as far as possible. We tried to complement the oral information with pictures. In this way our own style of communication was adapted better to that of our communication partners.

Picture stories

To explain „monitoring” to the farmers, we made use of examples from their own environment: in two picture stories, we showed on the one hand how a farmer can observe the growth of the plants in his fields at regular intervals and thus respond in good time to attack by pests. His harvest is good and he is satisfied. The other story shows a farmer who does not do this. His harvest is bad (Example A). In this way we explained to the farmers that, in fact, they had already known for a long time what „monitoring” is — and also practiced it with success. Now it was a question of extending this method to other areas and refining the instruments used.

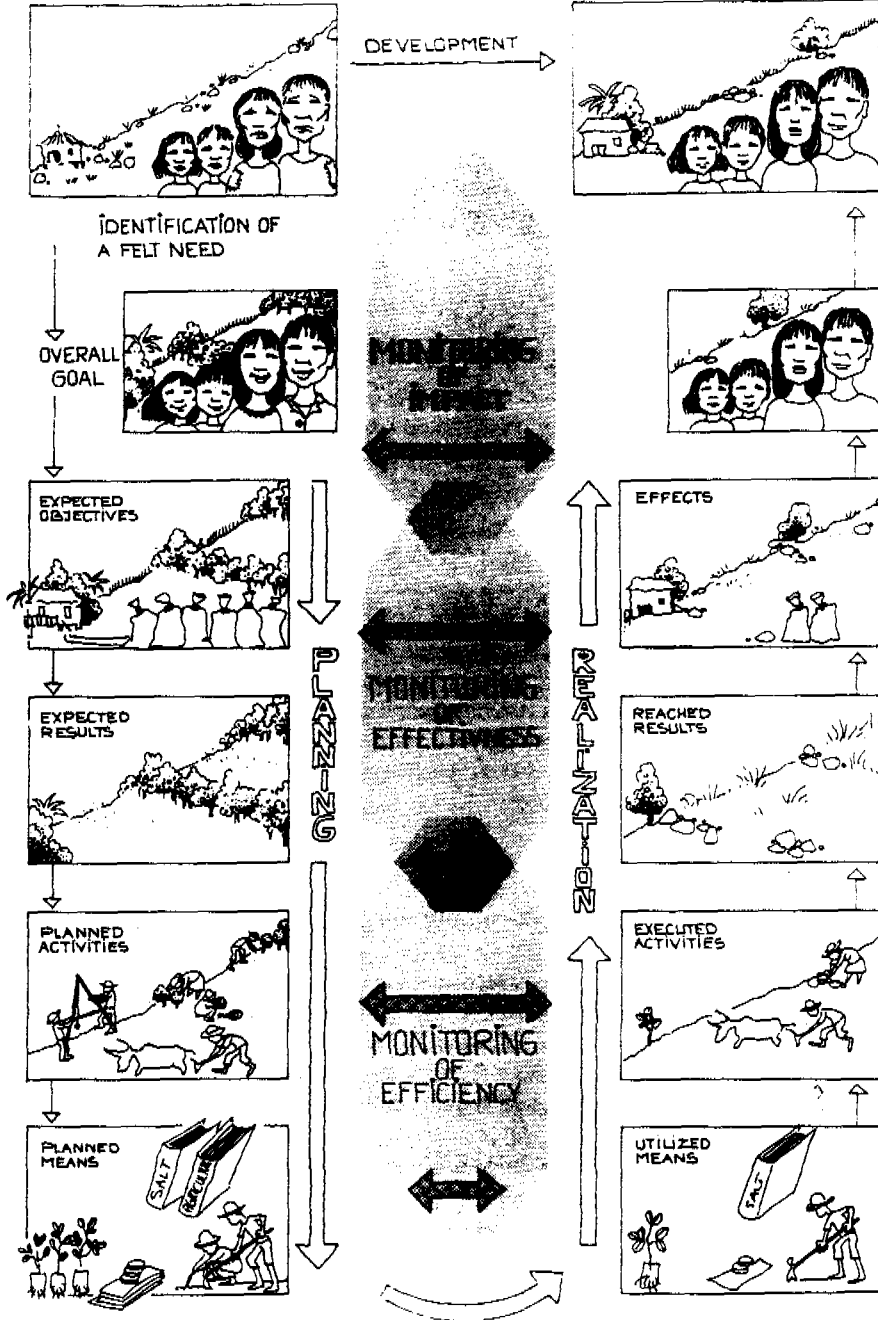
We had adopted the farmers' modes of behaviour and approved of them. They were reassured, motivated and eager to find out more.

The „learning situation” itself also plays a major role: if it is perceived negatively it is associated with stress, pain and fear. Mental blocks are an obstacle to learning and assimilation. New, unknown information can also lead to stress and mental blocks if

it is conveyed incomprehensibly and in too abstract a way. Positive learning situations have a reinforcing effect: people recollect the situation and the knowledge imparted in it better and more willingly. For this reason we tried to keep pressure to a minimum in

Example B:
Demonstration
 „output”, „effect”, and „impact”.

Drawing:
 Dorsi Germann



Participatory Evaluation

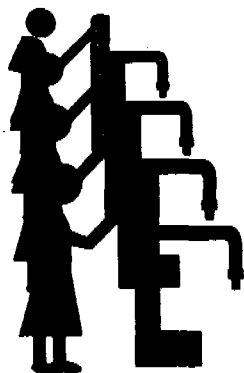
Tools for Managing Change in Water and Sanitation

Deepa Narayan

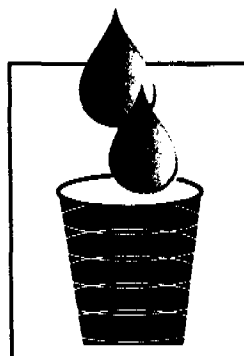


Indicators of Progress in Water and Sanitation Programs

SUSTAINABILITY

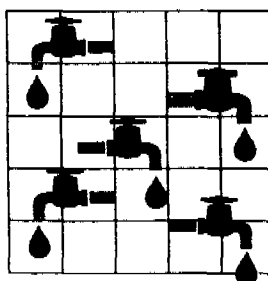


- S.1 Reliability of systems**
 - S.1.a Quality of water at source
 - S.1.b Number of facilities in working order
 - S.1.c Maintenance
- S.2 Human capacity development**
 - S.2.a Management abilities
 - S.2.b Knowledge and skills
 - S.2.c Confidence/self-concept
- S.3 Local institutional capacity**
 - S.3.a Autonomy
 - S.3.b Supportive leadership
 - S.3.c Systems for learning and problem-solving
- S.4 Cost-sharing and unit costs**
 - S.4.a Community contribution
 - S.4.b Agency contribution
 - S.4.c Unit costs
- S.5 Collaboration among organizations**
 - S.5.a Planning
 - S.5.b Activities



EFFECTIVE USE

- E.1 Optimal use**
 - E.1.a Number and characteristics of users
 - E.1.b Quantity of water used (all purposes)
 - E.1.c Time taken to use facilities
 - E.1.d Management of water resources
- E.2 Hygienic use**
 - E.2.a Water quality at home
 - E.2.b Water transport and storage practices
 - E.2.c Home practices to improve water quality
 - E.2.d Site and home cleanliness
 - E.2.d Personal hygienic practices
- E.3 Consistent use**
 - E.3.a Pattern of daily use
 - E.3.b Pattern of seasonal use



REPLICABILITY

- R.1 Community ability to expand services**
 - R.1.a Additional water/latrines facilities built
 - R.1.b Upgraded facilities
 - R.1.c New development activities initiated
- R.2 Transferability of agency strategies**
 - R.2.a Proportion and role of specialized personnel
 - R.2.b Established institutional framework
 - R.2.c Budget size and sheltering
 - R.2.d Documented administrative/implementation procedures
 - R.2.e Other special/unique conditions

Field Insight—Honduras







PROPAR (Proyecto de Pozos y Acueductos Rurales) is a community water supply and sanitation program in northern Honduras, supported by the Honduran and Swiss governments. PROPAR has developed a simple monitoring system managed by field staff to track project effectiveness and impact on health. Through a series of staff workshops that focused on defining objectives and identifying indicators, the project developed the following chart to track progress on well construction.

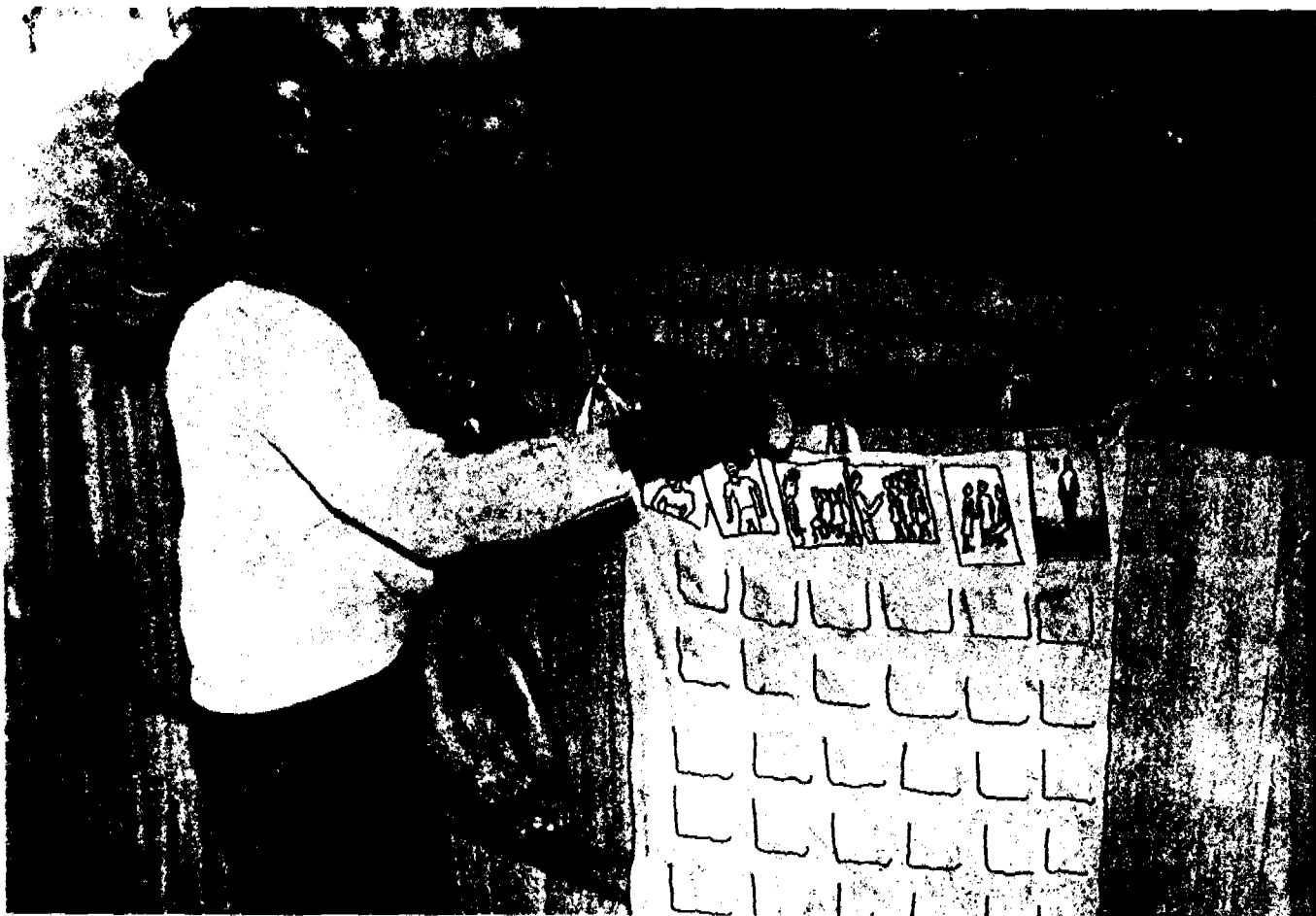
OBJECTIVE	CRITERION	INDICATOR	MAGNITUDE	1988 RESULTS	1989 RESULTS	
Program of wells equipped and pumps supported	Capacity to promote and direct well projects	% of promoters located in proper zones capable of promoting and directing well projects	90% of promoters promote and direct well projects	68.1%	50%	
	Well construction quality	% of wells built properly	100% fulfill quality standards	91.6%	83.3%	
	Pump installation quality	% of pumps installed well	100% fulfill quality standards	90%	76%	
	Use of constructed wells	% of constructed wells in use	100% in use	100%	95%	
Effective operation and maintenance achieved	Initial interest in operation of wells by water committees	Ability to attain funding	Minimum initial budget of \$130 for buying tools	\$57	\$5	
	Training of water committees	Water committees trained	A committee per W/GFS & a committee coordinator	87.5%	26.8%	
	Fluctuation of committee members	% of members fluctuated/yr	Max 10% of members fluctuated	4%	2%	
	Quality of well maintenance	% of wells functioning	80% of pumps fulfill quality standards of functioning	63.3%	65%	
	GFS maintenance quality	No. of taps in poor condition	Less than 20% of taps in poor condition		15.5%	17%
		Availability of water at tap level	Water reaches 100%		99%	92.5%
	Spring catchment and water tank maintenance level	90% fulfill quality standards		85.7%	84%	

Field Insight—Indonesia











In a project in Indonesia, participation of women in decisionmaking was measured using a cloth pocket chart hung on a fence or a wall. Consisting of six columns and eight rows of cloth pockets, the chart had a picture attached above each of the six columns. The pictures depicted different potential decisionmakers, such as an "ordinary" woman and man, a female and a male leader, the water users group and a field worker from the external agency.

Each person in the group was given seven small paper discs to select the most important decisionmaker for six different issues. Group members turned their backs during the process so that each could vote in private. Everyone participated enthusiastically, even older women who, at the beginning, wanted to leave because they were illiterate. At the end of the process, the votes were counted and discussed. The results are given here.

Who Decides What?	 Ordinary Woman	 Ordinary Man	 Female Leader	 Male Leader	 Water Group	 Field Worker
1. Decisions within groups	7%	5%	19%	12%	28%	29%
2. Group Leaders	3%	11%	30%	20%	10%	26%
3. Group Activities	9%	13%	16%	23%	27%	12%
4. Size of Monthly Contributions	8%	13%	32%	10%	17%	20%
5. Need for Sanctions	5%	6%	22%	39%	13%	15%
6. Location of Pumps, Taps, Tanks, etc.	1%	13%	16%	16%	14%	40%
7. Repairs	4%	5%	9%	18%	21%	43%
OVERALL SCORES	6%	9%	21%	21%	19%	24%



Personal Habits in Relationship to Using Water

										
Always ▲										
Sometimes ●										
Never ■										



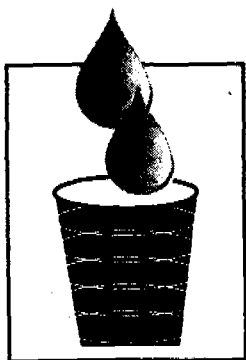
- Is the language of the message understood?
- Is the content understood?
- Is the content relevant to the cultural context?
- Did the target group receive the messages through media or personal contact?
- Was there a change in behavior?

In Bangladesh, for example, observational studies established that wiping the bottoms of infants with the ends of saris was a major contamination route associated with increased diarrhea episodes. A study in Indonesia, found that samples of drinking water kept on raised platforms were less contaminated than those within easy reach of young children. As these examples indicate, it is more useful to focus on sequences of specific behavioral practices and their observed consequences (increased cleanliness, presence of soap in kitchens, and so forth) than simply conducting knowledge and attitude surveys.

There are five main sub-indicators of hygienic use:

- E.2.a Water quality at home
- E.2.b Water transport and storage practices
- E.2.c Home practices to improve water quality
- E.2.d Site and home cleanliness
- E.2.e Personal hygienic practices

All five of these sub-indicators are relevant to the hygienic use of water; the two measures for use of toilets are site and home cleanliness and personal hygiene practices (E.2.d and E.2.e). The sub-indicators of hygienic use are elaborated upon in the following chart.



Box 5-2. Measuring Hygienic Use

— Sub-Indicators —

- E.2.a Water quality at home***
Maintaining water quality at home from source to mouth during the stages of:
- drawing
 - carrying
 - storage
 - drinking
- E.2.b Water transport and storage practices**
- Condition of containers and ladles
 - Presence of covers and degree of exposure
 - Place of storage, including child/animal access
 - Contact with hands and other objects
- E.2.c Home practices to improve water quality**
- Sedimentation/filtration
 - Chemical treatment
 - Heating/boiling
- E.2.d Site and home cleanliness**
- Proper excreta disposal
 - Household waste disposal (waste water solid waste)
 - Presence of animals and fences
 - Presence of vectors and rodents (flies, ascaris eggs, and so on)
- E.2.e Personal hygiene practices**
- Hand cleansing practices
 - Handling of infant faeces
 - Body cleansing practices

* As measured by faecal coliform count, smell, taste, turbidity and chemical quality

Block 2 : Sustainability Issues

Thursday, September 19, Session D

- Subject title** : Evaluation of second week
- Type of session** : Plenary group discussion
- Objectives** : - Participants and course staff get insight in how the second week has been valued and how improvements could be made.

The second week will be evaluated by asking participants to note down some positive and negative aspects and to discuss these.

Hand-out : none

September 7 - 27, 1996, Kandy, Sri Lanka

Block 2 : Sustainability Issues

Friday, September 20, Session A, B, C and D

- Subject title** : Field-trip to Badulla and Nuwara Eliya
- Type of session** : Visit of existing water supply and sanitation projects
- Objectives** : - Participants relate that they learned in theory during the course with the field situation

Several projects will be visited in the Badulla and Nuwara Eliya districts. Projects will show a variety of technical solutions (gravity water supply, hand dug wells, rain water harvesting) in different settings (village, plantation area). Adequate importance is given to treatment and sanitation.

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**Management for Sustainability
in Water Supply and Sanitation Programmes**

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Kandy, Sri Lanka.**

SUSTAINABILITY ISSUES