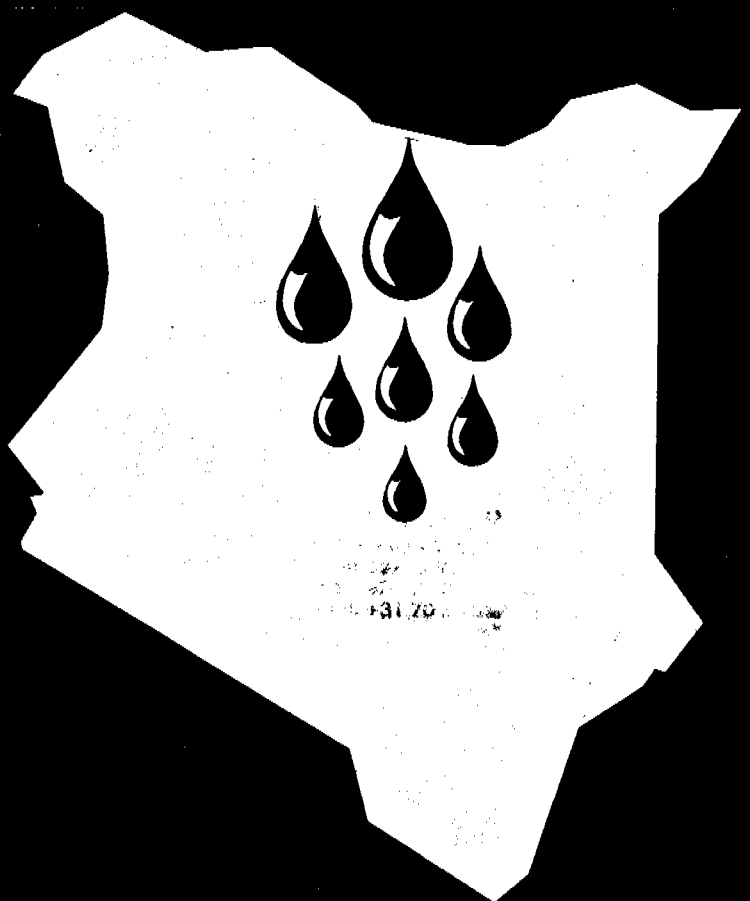
An Annotated Bibliography on

Water Supply and Sanitation, Kenya



NETWAS International

ITN Africa Centre

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An annotated bibliography on

Water Supply & Sanitation, Kenya

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NETWAS International hopes to continuously update this bibliography in future in order to keep in pace with the developments in the sector. We welcome suggestions and proposal from all sectors.

Wilfred N. Ndegwa, Programme Manager
Networking and Information Services.

FOREWORD

There are various reasons for the production of this bibliography on water and sanitation sector. First there is a realisation that there is a general out cry in the sector for a resourceful source of information that provides the reader with relevant literature. Secondly, several fronts have recommended that a process of collection, analysis and dissemination of useful information in the sector be started. Thirdly and most important, is the need to bring to the attention of those concerned with familiar problems/situations in the Eastern African region and the rest of Africa the experiences, lessons learnt and the best practices from Kenya. This bibliography contains information on several research topics, project/ programmes implementation; lessons learnt, and best practices.

NETWAS International takes great pride in facilitating the formulation process of this document out of a realisation that programme implementors, researchers, donors and policy makers will benefit from its use.

The mission of NETWAS is to improve the living conditions of the people of East African region particularly the poor. With its operations dating back ten years, in 1986, the organisation has been able to address the water supply and sanitation issues with a considerable degree of success through specialised programmes in training, consultancy, advocacy, networking and information dissemination services.

NETWAS International realises the important role information dissemination plays in the sector. Over the years, we have responded to the needs of the sector institutions by supporting information management in the East African region. The aim has been to disseminate valuable experiences and lessons learnt from development projects and researches undertaken in the region.

There were several problems that we encountered during the production of this document. The selection of the documents for abstracting from various institutions , projects/ programmes posed the greatest challenge. We believe that the bibliography has room for improvement.

Finally it is our hope that this publication will prove useful in forging close links of collaboration amongst those involved in the water supply and sanitation sector.

Matthew N. Kariuki, Executive Director
Network for Water and Sanitation International, July 1997

ACRONYMS/ABBREVIATIONS

ADB	African Development Fund
AMREF	African Medical and Research Foundation
ASAL	Arid and Semi-Arid Lands
BER	Business Economic Research
BOD	Biochemical Oxygen Demand
CARE	Community of American Relief Everywhere
CDD	Diarrhoeal Disease Control
CIDA	Canadian International Development Agency
CSD	Child Survival Programme
CWP	Communal Water Points
DANIDA	Danish Development Assistance
DDC	District Development Committee
EEC	European Economic Community
ESA	External Support Agency
FINNIDA	Finnish International Development Agency
GAD	Gender and Development
GoK	Government of Kenya
GTZ	Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HABITAT	United Nations Centre for Human Settlements
IDRC	International Development Research Centre
IDWSSD	The International Drinking Water Supply and Sanitation Decade
IFAD	International Fund for Agricultural Development
INSTRAW	International Research and Training Institute for the Advancement of Women
ITN	International Training Network
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KEFINCO	Kenya Finland Cooperation
KWAHO	Kenya Water for Health Organisation
LBDA	Lake Basin Development Authority
MAPET	Manual for Pit Emptying Technology
MoH	Ministry of Health
MOWD	Ministry of Water Development
MSWM	Municipal Solid Waste Management
NCC	Nairobi City Commission

NCC	Nairobi City Council
NCPB	National Cereals and Produce Board
NETWAS	Network for Water and Sanitation
NGO	Non Governmental Organisation
NORAD	Norwegian Agency for International Development
O&M	Operation and Maintenance
OXFAM	Oxford Committee for Famine Relief
PLANASA	National Sanitation Plan
PRA	Participatory Rapid Appraisal
PROWWESS	Promotion of the Role of Women in Water and Sanitation Services
RDF	Rural Development Fund
RDWSSP	Rural DomesticWater Supply and Sanitation Programme
RWS	Rural Water Supply
SAP	Structural Adjustment Programme
SDC	Swiss Development Cooperation
Sida	Swedish International Development Cooperation Agency
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNCHS	United Nations Centre for Human Settlement
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations International Children Educations Fund
UoN	University of Nairobi
USAID	United States Agency for International Development
UWASAM	Urban Water and Sanitation Management Project
VIP	Ventilated Improved Pit Latrines
WASH	Water and Sanitation for Health Project
WECO	Western College of Arts and Applied Sciences
WEDC	Water, Engineering and Development Centre
WHO	World Health Organisation
WMO	World Meteorological Union
WRAP	Water Resources Assessment Project
WSS	Water Supply and Sanitation
WUP	Water User Group

HOW TO USE THIS BIBLIOGRAPHY

This bibliography is a record of documents published or unpublished in the water and sanitation sector on Kenya. Other documents from elsewhere relevant to the country's water development have also been included. Their subject scope is diverse reflecting the various aspects that have been tackled in the sector. These include environmental concerns, hygiene and sanitation interventions in water supply and and sanitation, technology choice in the delivery of services, role of communities, the NGOs and the Government, policy issues and legal considerations, among others.

Some of the documents cover several useful subjects, hence no attempt has been made to cluster and confine them under one subject heading. However, a general **subject guide** is provided at the back touching on some of the subjects including the geographical coverage. The guide however, is just a pointer to some and not all of the subjects contained in the bibliography.

ANNOTATED BIBLIOGRAPHY

Economic benefits from improved rural water supply: a review with focus on women/Eveilne M. Karinga.-IRC occasional paper No.17, 1991; 30p.

The paper contributes to better understanding of the phenomenon of economic benefits derived from water supply interventions, The study shows that most water supply projects focus on drinking water supply for the improvement of health conditions and pay little attention to economic benefits.

The kind and amount of economic benefits derived from water interventions varies from one community to another. Water supply improvements in areas with distant, limited unreliable water sources have more potential for having an economic impact than areas with plentiful water close at hand.

The publication supports the assumption that reducing the daily burden of water collection and improving access to water for productive use makes women more efficient in both their domestic and productive roles.

Economic benefits from water supply can fulfil practical needs of women especially the poor ones, through improved working conditions, released time, access to water for production, and sometimes increased income.

The literature supports the assumption that if the goals of the users and the project match, there is a greater chance that the users will give fuller support.

Suggested research areas are provided which could enhance understanding of the meaning and potential role of economic benefits for sustainable water supply improvements, and assist i developing guidelines.

An explicit strategy should be developed to support income generating activities, to be implemented either inside or outside the framework of the water project. An assessment of economic benefits is provided in an annex.

Community management of rural water supply and sanitation services/ by Carolyn Mc Common; Dennis Warner; David Yohalern. - WASH/UNDP/ World Bank, 1990; 44p. - WASH technical report No. 67.

This discussion paper derives from a symposium held at the the world Bank in 1988. The paper develops a definition of community management and describes the 'enabling environment' necessary for meaningful community management of water resources and waste disposal.

The paper analyses the roles of and identifies salient issues between, communities and external agencies. It describes growth towards full community management as a five level process and outlines the types and degree of external support and interaction appropriate to each level.

The paper examines seven projects or identify important features of community management, underscoring the importance of enhancing the capacities of local communities to assume a leading role in the planning, construction, financing and management of new water supplies . By doing this, communities can best obtain the system they want and will support.

Finally the paper reviews community management functions, resources, benefits and constraints and proposes priorities for further research.

A guide to health education in water and sanitation programmes/ by David Nyamwaya; Peter Akuma. - AMREF;UNICEF, 1986. - 63p.

This guide is for use by those involved in helping rural and semi-urban communities to improve their health, with water and sanitation as an entry point.

The provision of an improved water supply alone is not sufficient for the elimination or reduction of water and excreta disposal-related diseases. This situation is obtained because people lack appropriate knowledge on proper use of water and lack properly developed human waste disposal methods. Health education is therefore an integral part of Primary Health Care (PHC).

A PHC based health education programme must take into account the various social aspects of a community such as the customs and farming practices. The aim of the health education programme should be behaviour change and not just knowledge.

The health educator must be an informal person who can translate to the community why water borne diseases are prevalent when water is misused. The community will need firm explanations for changing their behaviour. People must be made to understand that diseases such as typhoid, diarrhoea and intestinal parasites usually result from poor sanitation.

The community should be helped to understand that diseases can be prevented only if all of them practise proper sanitation and use water well.

Several methods are identified as useful in translating the message to the community. They include discussions, demonstrations, interviews, visits, drama, songs and dances, proverbs, poems and narratives.

Part 2 of the guide gives detailed information on the causes, spread and prevention of many water and excreta disposal-related diseases.

Facing the challenges of water supply and sanitation goals for Africa, 1992, 38p. Report.

At the 1990 world summit for children, national leaders and governments pledged their commitment to reach the goals for children and women in the 1990s. Among these goals was that of "universal access to safe water supplies and sanitation by the year 2000."

Of the 640 million people in Africa today, 310 million still lack a supply of safe drinking water and 385 million lack sanitation facilities. Service shortages are most acute in rural areas.

The poverty affecting many African countries is currently compounded by the exigencies of Structural Adjustment programmes (SAPs) designed to establish economic equilibrium.

The intention of this paper is to assist African countries facing severe resource restraint to rebuild momentum behind the goal of "water and sanitation for all". The paper reviews strengths and weaknesses in the growth of the water and sanitation sector and advocates the development of new strategies and action plans. The primary purpose is to enable countries to achieve rapid progress in extending water and sanitation coverage during the 1990s.

Taking a decade of hard-won experience into account, the strategy outlined for Africa in this paper for universal coverage of water supply and sanitation consists of several elements that include use of low cost and appropriate technologies in peri-urban areas; health education, cost recovery, rural banks and credit unions, women's role and environmental impacts.

Management of solid and liquid wastes: a manual for environmental health workers/ by George N. Nyang'echi. - AMREF, 1992. - 104p.

This manual is intended to provide the reader with adequate knowledge with the diseases and other nuisances which arise from poor management of solid and liquid wastes.

There are many health problems originating from poorly managed solid and liquid wastes - diarrhoeal diseases and others from contamination of food and water and also diseases transmitted by flies and rats.

Techniques of advising the community about preventive programmes are presented. The manual is intended for use by Environmental Health Officers and Public Health Technicians.

Part 1 of the manual focuses on management of solid wastes and the main reasons for controlling refuse, which are the prevention of providing shelter and food to rodents, flies and other vermin by proper storage, collection and disposal; andthe suppression of the spread of communicable diseases associated with multiplication of flies, rodents, mosquitoes and other vermin through proper management at all stages.

Part 2 of the manual focuses on management of liquid wastes. The main topics covered are excreta treatment and disposal by conservancy - especially in rural areas; sewage treatment and disposal mainly in urban areas; and treatment of liquid wastes by oxidation ponds - a system especially suitable for Africa

A bibliography is provided to identify further reading materials and a glossary provides the meaning of new or difficult words.

Birongo water project committee - a survey of community organization and water needs on Birongo, Kisii.- BIP Consultants, 1992; 23p., paper.

Birongo Domestic Water Supply Project covers Nyaribari Chache and parts of Kitutu East divisions in Kisii district. It is a community project under joint sponsorship of the Kenya Freedom From Hunger Council and its German counterpart, Deutsche Welthugerhilfe.

The project covers an area measuring 121 Km^2 with a population of more than 110,000 people. 50% of these people could at full development of the programme be provided with water from the project. A community diagnosis was designed on water related issues to assess the level of preparedness and ability of the community to sustain the project after its completion. The project area has a population density estimated at 750 inhabitants per Km^2.

Birongo water project intends to supply fully treated water from the Chiri Chiro

river to the consumers. The water will be pumped from the treatment plant at Chiri Chiro intake (at 30 litres or 108 m^3) over a total head of 170 m to the storage tank from where it is gravitated to the consumers. The costs are expected to be considerable as well as costs for water treatment. These are to be borne by the community at around 13 Kshs/m^3 at 1992 prices. The monthly tariff for a family consuming about 8m^3 per month will be about Kshs. 100.

Metered services will be put in operation and tariffs will be quantity oriented. Consumers who cannot meet the connection costs initially will be provided water through communal water points (kiosks) at a rate of about 0.50 - 1 ksh. per 20 litre jerry can.

A survey methodology was used to obtain the actual community diagnosis. The findings reveal that the level of acceptability and willingness to pay for the water is high.

Conclusions and recommendations based on the survey are made. An appendix on ground water resources , the ground water component of the project, drilling, pumping system and the economic organization of domestic water supply is included.

Development in sanitation. Consultative meeting - Lake Basin Development Authority, UNDP-World Bank Regional Water and Sanitation Group and BKH Consulting Engineers - Report 25p.

This paper examines the Rural Domestic Water Supply and Sanitation Programme (RDWSSP) that is implemented in Nyanza Province of Western Kenya. A pilot project on the use of hand pumps was carried out in 1982 and resulted in a full scale programme (RDWSSP) which was implemented from 1985 till 1989. The paper gives a summary of the RDWSSP II objectives which are:

- to provide safe and accessible water ensuring user responsibility for facilities that are easily operated and maintained and reduction of the burden of women and children carrying water.
- to provide for safe and low cost disposal of human waste
- to decentralize the programme to independent district based operation with an implementation methodology designed to enhance the organization capacity of the beneficiary communities.

A description of the programme organization is made. The programme used participatory techniques for project identification, implementation and monitoring. The paper documents the sanitation experiences of the RDWSSP I which include:

- construction of a standard design demonstration VIP latrine,
- Construction of cluster VIP latrines with super structures built of different materials available locally and of different costs.

Experiences in sanitation during this period are also documented and reveal that:

- whereas the VIP was popular it's construction costs were beyond the reach of many communities;
- the complexity of the design and construction of the VIP latrine, either in clusters or elsewhere, made it's implementation impossible;

- hygiene education created the necessary awareness. However, it was not possible to asses the resultant behavioural change nor the improvement in the health of the communities;
- some of the nearly 300 constructed VIP latrines failed to work because of poor construction and/or lack of proper use and care;
- some VIPs were used by few individuals and were not accessible to the general public.

Other experiences noted include:

- increase in participation of beneficiaries due to community mobilization through PRA;
- the sharing of responsibilities which has strengthened their feeling of project ownership;-
- development of a standard design (simple, affordable, sustainable, replicable) which has promoted participation in construction.

KWAHO experiences in water and sanitation 1980-1990 - KWAHO (Kenya Water for Health Organization). Report, 65p.

This report is an account of Kenya Water for Health Organization (KWAHO), a non governmental organization operating in Kenya. It was established in 1976 as a project of women of Kenya, with the assistance of UNICEF/NGO Committee in New York.

KWAHO was a pilot project from 1976-1980. By 1979, the goals on what the pilot project had been founded begun to be realized.

Objectives of KWAHO are outlined. KWAHO's capacity to implement community based projects is examined through its staffing structure.

The report reveals KWAHO's success in the implementation of community based water and sanitation projects due to its commitment to the integrated approach. KWAHO involves relevant government ministries in its programmes in a partnership that goes to support the District Focus for Rural Development. Also revealed is the organization's grassroot level approach in implementing community based programmes.

The report states that the integrated approach has given KWAHO unique experience in playing an important liaison between the communities, the government ministries and other Non-Governmental Organizations.

KWAHO's experiences in peri-urban projects with case study reports, experiences in flood prone areas, in island communities, in nomadic communities and other Arid and Semi-Arid lands (ASAL) are also examined.

Kitui integrated rural development and water supply project._ BRGM, GERSAR, CIRAD, et al..., Republic of Kenya, 1986; 88p. paper.

The project concerns one of the regions of Kenya which has suffered severely from the drought of 1983-1984. Located within the limits of Kitui district the project area covers about 20,000 km^2 of semi-arid and arid lands where in normal years precipitation ranges between 300 mm in the east to 700 mm in the west.

The underlying rocks mainly belong to the metamorphic basement complex and soils are vastly sandy loams. Water is a dominant constraint in the area. The only two permanent water sources, the Tana and Athi rivers bind the project area to the north and south respectively. Water sources are far too few and limited essentially to the main valleys, which provide surface water when dammed or ground water from wells and pits dug into the alluvium. As a result, it is necessary to walk long distances to collect water and more than half the population lives on less than 5 litres per day.

The water supply project involves the drilling of 1,200 boreholes at selected locations with the basic purpose of providing safe domestic water where the people live.

Both surface and ground water resources are noted to be available in the project area. As the project objective is the development of ground water, this resource is assessed. The mineral quality of the ground water is found to be good, with slight moderate salinity.

A number of government and non-governmental agencies are engaged in water development in this area. These are identified. Inspite of their activity, water supplies are still inadequate. The distribution of water sources reveals that 83% have less than 10 litres per day, 47% have less than 5 litres per day, 72% of people fetching water spend more than 2 hours per day on this activity.

The study reveals that the water fetcher is generally a 30 year old woman going twice to the water source walking one hour on each occasion. She carries with the help of a teenage daughter 65 litres per day but waiting time at the source is over an hour.

For livestock watering, the document reveals that the water is limited in terms of quantity. The document concludes that it is necessary to improve domestic and livestock water supply, to increase the quality of water and distribute the sources of water more rationally.

Education for action: Siaya Health Education, Water and Sanitation project (SHEWAS) - CARE International, 1989, 21p. paper.

SHEWAS is a proposed 5 year programme of the CARE International in the Boro division of Siaya district, Western Kenya. The project aims at improving health of the people in the target area through assistance in the provision of clean water, improved sanitation and expanded primary health care education. CARE intends to work with three groups namely women groups, institutions such as schools and youth polytechnics and water management groups.

The project is in two phases. Phase one of three years will establish implementation strategies: 40 communities with an estimated population of 60,000 are targeted.

Boro division comprises six locations and 42 sub-locations. It has a population of 160,000. A project overview is presented in which the area profile is examined. It is noted that poverty is widespread and female illiteracy at over 10%. Adult male out-migration is in the order of 50% leaving the resident population predominantly female (65%).

The paper notes that according to government statistics Siaya has one of the lowest levels of per capita income in the country. In line with this, the district has one of the highest infant mortality rates (211/1,000 live births). The district has also the second highest rate of reported cases of diarrhoea in Kenya.

Water borne diseases account for over 50% of all recorded diseases in the district. The paper further notes that there are only 18 improved communal water points in Boro division.

A project proposal summary is presented identifying the final goal of the project, the intermediary goals, indicators and the project strategy.

A detailed project description is made which includes all the project components such as the start up phase, implementation and finally termination phase. An evaluation plan is proposed and the first phase budget provided.

Water users management of watershed and silt load for the Arid and Semi-Arid Lands. Draft._ Water Users Association support._ Ministry of Land Reclamation Regional and Water Development - Kenya; 1995; Report 52p.

The Arid and Semi-Arid Lands (ASAL) of Kenya are described as those whose rainfall ranges from 800 mm to as low 200 mm per year. They comprise about 82% of Kenya's surface area. Due to the harsh climatic conditions and overstocking by pastoralists, the ground cover by vegetation has been nearly exterminated in most of the areas. In the ASAL, rain falls in short durations and heavy storms creating violent run off. The consequence of such run off on bare soils is severe soil erosion. Soil erosion by water contributes silt load to water reservoirs such as pans and dams.

The report is a collection of ideas that can assist water users in ASAL to reduce the silt load that fills up the water reservoirs. These guidelines on water shed and silt load management for the ASAL were found necessary after a baseline study was carried out in 1994 for communities in Samburu district together with experiences acquired in Laikipia, Kajiado and Embu districts by the Dam Rehabilitation Unit (part of the Kenya Belgium Water Development Programme).

The guidelines mainly focus on pan premises since they are the most viable water structures for the ASAL. Areas in need of water harvesting are identified.

Siltation of reservoirs is noted as a key problem of water harvesting and storage. To avoid siltation of water points silt trapping systems are suggested including the concerted commitment of the water users. Water users are advised to focus their attention on silt load management. A silt trap intake channel is also suggested as an alternative to silt trapping system.

The report identifies soil erosion types and the resultant consequences. Solutions using physical silt management structures are identified. The typical pan is one such system which is noted as being an appropriate surface water catchment reservoir system on low gradient lands. A diagrammatic presentation of a modified water pan and its construction is shown.

Technical diagrams for modified pan system design are prevented. Check dams for the rehabilitation of gullies are suggested. The report advises that severe hydraulic drops should be avoided by making low check dams (< 1 m).

Gullies are seen to be common in ASAL areas. They should be rehabilitated to become safe waterways. Revegetation is suggested for silt management. Components of a proper establishment of vegetation cover are identified

An assessment of the water shed condition is noted as essential. This includes both the field work and desktop study results. Finally a checklist and recommendation table is provided for the water users.

Water resource identification, with emphasis on ground water/ P.N. Gathuru.- Paper presented at seminar on water, sanitation and the environment, 25-29th November, 1991, Nairobi. p 35

Water resource identification is usually done after water resource surveys. The latter address the questions of where water is, and how much for how long and what quality. The surveys, thus, can be viewed as the study of all parts of a hydrogeological regime, which constitutes a recharge area, a circulation area and a discharge area . For a hydrogeological survey to be complete it must address all the three constituent parts, and not one or two parts , if fairly good knowledge of the regime is to be obtained.

The procedure in carrying out a water resource survey study depends on the level of the investigation. Generally, a distinction can be made between *inventory or existing information/preparatory study, *reconnaissance study and *an investigation study

This paper looks at the general activities in each of the three studies and how they lead to the development of a conceptual model of a given hydrogeological regime and ultimately to a mathematical model which can make the management of such a regime feasible.

Private participation in the delivery of Guinea's water supply services/ Thelma A. Triche. - Washington D.C: World Bank, 1990. 30p.

This study represents an initial effort in what is hoped to become a significant research project on privatisation and introduction of commercial principles and mechanisms into the water supply and sanitation sector. The Government of Guinea began to restructure the water supply sector with assistance provided through IDA's project preparation facility. Eventually, the Directorate for Energy Services and the National Water Company were replaced with two new companies, a State owned National Water Authority (SONEG) and a Water Management Company (SEEG). SONEG owns the urban water supply facilities in Conakry and secondary centres. It is fully responsible for sector development including identification, preparation, financing and implementation of new projects. SEEG is jointly owned by the state and a professional private partner, the Foreign Investor-Manager (FIM). It is responsible for opening and maintaining urban water supply facilities, billing customers and collecting charges, within the framework of a ten-year lease contract with SONEG. Through bidding process for a lease contract to operate the water supply system, competition has been introduced into a public service. With cost control and the effective collection, incentives for efficiency have been created. The initial performance has been encouraging. The arrange-

ment of the Foreign Investor-Manager as a shareholder in SEEG and as a management consultant whose fees are linked to SEEG's revenues, establishes a framework that encourages effective training and transfer of skills and responsibility to local staff. Moreover, the timeframe of the lease/contract i.e ten years, is more realistic for achieving technical assistance objectives than the usual two or three year technical assistance contract. The paper outlines the theoretical arguments that are relevant to project design and describes the institutional arrangements that were adopted. It also examines the key provisions of legal documents and explains how the major issues that arose during project preparation were addressed.

Assessment of water supply installations in Marsabit District. - Norconsult/ UNICEF, 1992. - 45p. Report.

UNICEF is coordinating donor agency assistance for improving water supply services to drought stricken areas. Marsabit district which is categorized in the eco-zone of lowland potential is one of the affected areas. In order to be able to respond to the donor assistance, UNICEF commissioned Norconsult to carry out a rapid water supply situation survey in Marsabit district. This report aims at forming a base on which future decisions and actions can be made. The baseline information presented in the report was acquired from documentation, discussions with the Marsabit district Water Engineer, and staff and from actual spot checks of some of the water supply systems. The water supply situation survey, as part of the pre-investment planning stage was conducted in order to present information necessary for project priorities within the water sector of the district. The document begins by examining the topographic and climatic characteristics of the region including the demographic ones. An examination is then made of the existing water supply systems. Documentation of each system is made and these include location, source (of system), yield, supply area, population, water demand, production, equipment maintenance and storage and finally recommendations made. The report only presents a situation survey baseline information of pre-investment planning necessary for water supplies in Marsabit district.

Kwale GoK/SIDA case studies. Kwale water and sanitation project: sanitation pilot project - Diani location, SIDA, 1988; 10p. paper.

The paper reports on a pilot study that was launched to determine whether the proper use of latrines would have any impact on health through the reduction of faecal and water borne diseases such as diarrhoea and intestinal worm infestation. The study also aimed at improving latrine coverage, cultural beliefs on the use of latrines and development costs of latrine technology. An investigation of outpatient data on diarrhoea and intestinal worm infestation cases collected both before and after launching the pilot study for Diani location show a remarkable reduction on the number of cases reported for a period of four years from 1983 to 1987. This study is a joint initiative of the Kenyan and Swedish governments.

Diani location has six villages with a total population of 39,000 people (1979

census). The inhabitants are predominantly the Digo who practise Islamic religion and culture. The community depends on subsistence farming, fishing and working in hotels on Diani beach. The crops grown include cash crops such as cashew nuts, and coconuts and maize, rice, and cassava for subsistence.

Earlier sanitation programmes were aimed at reducing the incidence of Schistosomiasis by encouraging the community to dig and use latrines. In the current programme the following specific objectives have been considered:

- The study's replicability elsewhere
- Experiment on locally available, acceptable and affordable low cost sanitation technology
- Arouse community awareness on construction and use of latrines and encourage community involvement and full participation in casting slabs and pit digging
- Step up pit latrine coverage in the area.

The study revealed the following:-

- The status of latrine coverage and usage was low. Most homesteads had no latrine and faeces were disposed off indiscriminately
- High incidence of diarrhoea diseases
- Nature of soil was poor (black cotton, or loose sandy soil which made it impossible for pits to last long. Also use of water for anal cleansing which weakened the floors of muddied latrines
- Use of latrine was regarded as convenience rather than a measure for faecal borne diseases control.

The pilot study mobilized the communities and conducted health education meetings. The paper concludes that the project met its objectives although it was faced with some problems during it's implementation.

Sustainable water supply and sanitation coverage in rural areas. - Julia Kunguru; KEFINCO, paper, 10p.

The paper documents experiences gained by both the governments of Kenya and Finland through their development cooperation in the field of rural water development, health and sanitation. It examines the western water supply programme, implemented by KEFINCO, a Finnish consulting agency in collaboration with the Ministry of Water Development.

The paper notes that the rural population in Kenya have limited access to improved water supplies despite the government effort to improve the situation. It is noted that water usage in these areas range from 50 lites per day (50l/d) for individuals connections to about 10 litres per day (10l/d) for wells and protected springs.

Scarcity of resources and increase in population are noted as key inhibitants to the success of rural water supply.

The Western Water Supply Development Programme covers an area of 4,850 sq. Km whose average rainfall is 1,100 mm. The programme aims at availing water from ground and point sources such as dug wells, boreholes and protected springs.

The objectives of the programme are to improve the health of the people through increased provision of safe water supply for both domestic and livestock requirements and to consolidate existing water facilities and provide more sustainable water systems.

The paper notes that an established community development and training component is necessary for sustainability. However, it is observed that the programme started without the support from the community (1981-1983). This component was later adopted in 1984 and this meant working backwards to set up structures which could deal with specific issues that were important to the beneficiaries. These structures have included mobilization, well siting, committee formation and registration, contribution to construction by the communities, maintenance structure and extension services.

Women were integrated in all the stages of the programme to ensure sustainability. They have been taught simple techniques of operations and maintenance and have been encouraged to form groups to undertake health education and economic activities. Public information and training needs at all levels of the programme are emphasized. This include the training of repairmen/women, community leaders, extension staff and in health education.

The project collaborates with non-governmental and donor agencies especially in training staff from these organisations in well construction. Issues related to fund raising and management of funds are addressed through seminars and barazas.

The paper ends with a brief account of lessons learned from the programme and makes recommendations.

It is proposed in the paper that community participation and hygiene education be a priority in all water and sanitation programmes in rural areas.

Summary of recent recommendations on the rural water sector in Kenya, Business Economic Research: SIDA, 1985; 40p. paper.

This paper is a condensed summary of the three major studies commissioned between 1982-1984 in MOWD's effort to identify policy options regarding water use in Kenya's rural and minor urban centres. The three studies are:

- water use study - the Cookson Report
- socioeconomic addendum to water use study - BER Report and
- water use and tariff study - policy options - Valdelin Report

The summary aims at allowing policy makers to focus on the crucial issues facing the water sector. The summary is reported in two parts. Part I states the problems facing the water sector. Part II summarizes the policy recommendations made in the reports in answer to the problem.

The paper identifies two basic problems in the development of rural water supply. These are the continuing task of providing healthy and easily accessible water to the unreached majority of Kenyans, and, the performance of existing schemes and their possible contribution towards further development of the country's water sector.

The paper notes that whereas the government's objective is to provide clean

water to all Kenyans by the year 2000, three quarters of the 1981 rural population had not been catered for by the existing design capacities. A table is drawn to illustrate the projected domestic water demand for the rural population and in minor urban centres.

The paper also notes that the existing MOWD operated schemes have a severely limited social reach, operate inefficiently, poorly and distribute water inequitably among different types of consumers. Existing schemes, further, fail to raise adequate resources for their operations and maintenance thus becoming a drain on the treasury. The paper outlines a detailed analysis of the performance of existing MOWD schemes.

Conclusions are drawn which reveal that the cost of piped water in Kenya is very high and that due to the poor performance of MOWD schemes the following reforms need to be adopted:

- provision of adequate operation and maintenance resources
- drastic reduction of water losses to a minimum of less than 1/3 of total population
- improvement in the social coverage of schemes
- strengthening of MOWD's capacity to collect revenue
- revision and restructuring of price and tariff structures to ensure that operation and maintenance costs in rural areas are recovered while in urban centres the full cost of water production are recovered.

Finally, the paper outlines policy recommendations with a detailed analysis of their implications.

GoK/SIDA case studies: case study on the protection of springs in Kwale district - Kenya, Mr. M Mwadiga, SIDA; 11p. paper.

The period covered during this study dated from 9th February 1988 to 20th March 1989. A total of 25 springs have been protected to date. Out of this only 2 are not functioning. The first spring has failed to function because the water is flowing out of the catchment area instead of the pipes. The second spring does not have enough water to reach the spring box where it is stored before flowing through the pipes.

The community was mobilized to provide labour while the project provided the resources such as cement, sand, transport expenses and wire mesh.

The springs serve six to eight households depending on the population of the area in which they are located.

Adequate water supply is provided by the springs throughout the year although the flow rate decreases during the dry season. The water is used for both domestic, livestock and agriculture (growing vegetables).

The roles played by the various ministries and organizations which make up the Kwale Water and Sanitation Project are outlined.

The indicators for a successful spring are provided. These include the flow rate, good utilization, regular cleaning of water point, adequate water quantity, reliability and time saving.

Finally the paper makes recommendations for future improvement. These include

use of local materials and techniques in construction to minimize costs and the community to fully participate during and after construction. Adequate education, earlier mobilization of the community, functioning and utilization of facilities are also stressed.

Rural water supplies in Kenya: cost aspects and pricing. - Anika Idemalm, SIDA. _ 1980; 41p. paper.

The paper through it's research and analysis attempts to answer a number of questions regarding access to water, costs of improved water supplies and whether Kenya can afford it.

The study has used a number of papers and reports on rural water supply as background material including interviews with GoK and donor agencies.

The paper describes how discussions on water pricing proceeded until may 1979 when the final tariffs were agreed. Since July 1979 the tariffs have been implemented in Kenya.

The first part of the paper concerns the water supply situation in Kenya. The development of the water sector since the late 1960s is traced.

Water supply programmes have to cover population in rural areas that live in small scattered individual farms.

It is noted that development assistance in the water sector has been given to Kenya by countries such Sweden, Great Britain, Norway, Denmark, the Netherlands, Belgium, West Germany, Switzerland, Canada and Japan. These have also included multilateral donors such as World Bank and the EEC.

The paper examines the planning of water installations as an activity of MOWD through District Development Committees. These committees formulate projects which are approved by MOWD.

Both ground water and surface water sources are used in the RWS Programme. Surface water makes up 63% of the total potential while ground water is the rest.

Water is brought to the surface by pumps either diesel driven or electric with a diesel generator. Since purchasing routines of MOWD are centralized in Nairobi even minor repairs take a long time. The paper notes that only 20% of the pumps installed have continuously supplied water since installation. The cause of this is lack or inadequate maintenance.

Many communal water points (CWP) have been closed due to lack of capacity to collect revenue. The paper examines the failure of Water User Groups (WUG), the unreliability of installations and cites cases of vandalism. It examines the implications of individual connections, group connections, kiosks and licensed retailers.

Different approaches to the tariff problem are analyzed including the tariff system of 1978 vis a vis principles applied by the World Bank tariff proposal. The MOWD proposal for water tariffs is exhaustively analyzed. The author also examines the Swedish policy for tariffs (1978).

Part two of the paper examines the rural water supply situation in Kenya in the period August 1978 - May 1979.

GoK/SIDA case studies. Possible causes contributing to the high incidence of Bilharzia in Kwale District, Tsuma, SIDA, paper.

Bilharzia is noted to be on the increase in Kwale District, although the provision of safe and adequate water supply in the district has seen the decrease of diarrhoea diseases. The paper provides several reasons for this increase:

Traditionally, the local communities do not relate bilharzia to water. Bilharzia has always been known as a sexually transmitted disease. The local name for bilharzia is 'kisonono' which is also the name for gonorrhoea in Swahili. The appropriate Swahili/Digo name for bilharzia should have been Kichocho.

Transmission of this disease according to cultural belief partly explains why some members of the communities don't avoid the use of swamp water for washing clothes and bathing even where hand pumps have been installed and are operational.

An economic reason why communities use swamp water is that it saves soap. When washing clothes and bathing in the swamp water little soap is needed whereas the borehole water which is slightly saline consumes a lot of soap.

The community also finds swamp water more palatable and cool than the borehole water for drinking and they argue that they have used this water since time immemorial without any problem.

Agricultural practices, particularly during the rainy season are also contributory. During the rains the community plants rice, a staple crop for many. Due to the low latrine coverage urinating in the rice fields is common. With the assistance of snails this spreads bilharzia to those working in or near rice fields.

School age children are prone to infection due to their habit of swimming in swamps. Children also urinate and defecate in the water while swimming which greatly spreads the disease.

Possible solutions suggested in the paper include intensified health education, seminars for primary school teachers, an investigation of molluscicides (bellucide) to control snails and mass screening should be routine.

Low cost rural water supplies development and community participation in Kenya. - Musyoka, Lawrence: Tampere University of Technology, 1986, 87p. Thesis.

This thesis paper discusses community participation strategies used in low-cost rural water supply development. The paper also discusses the advantages as well as constraints and limitations of community participation. The paper looked into the implementation strategies used in three projects located in different provinces of Kenya. These projects are:

- the Rural Water Supply and Development Project in Western Province
- the Machakos Integrated Development Programme in Eastern Province
- Kwale District Community Water Supply Project in Coast Province

Mutual respect between the intervenor and the community being helped to develop it's own water supply is a very important parameter to the success of the project. During the study the author found that the community preferred officers with open mind.

Communication media between the intervenor and the community was found to be important in mobilizing the community. The community members were not interested in lectures from the field officers, but audiovisual aids such as films on water and diseases or slides shows commanded large audiences. Music which was used by most African communities for relaying messages was being used in the Western project to mobilize the community with good results.

In the Kwale project women were trained to maintain hand pumps. The author noticed that the women were interested in the maintenance work. Besides the water supply projects, the communities were involved in other development activities. The author found that some individuals were members of more than five development projects. In Machakos district departments involved in the Machakos programme worked in close cooperation holding regular meetings. This enabled the different departments to work harmoniously with the community.

The paper concludes by observing that:-

- water supplies that are imposed to unprepared communities are bound to fail
- if a community is forced to participate in water supply activities, eventually the water supplies will be neglected.
- communities need proper technical guidance in water supply development.
- it is necessary to develop a strategy like the one used in the Community Based Rural Water Supply Development Project in Western Kenya. A bibliography of references is included in the paper.

Water in a developing world / A.E. Utton and L. Teclatt.- Westview, 1978. 282p.

Water development now comprises the whole range of activities which might contribute to suitable development of water and related land resources for the public welfare. The problems of water supply are; unsuitable water supply for 1/5 of the urban population and 3/4 of the rural population, increasing degradation of water quality due to waste disposal and non-point pollution, rapid increase in complexity and volume of industrial waste discharge, including enlarged mutagenic and carcinogenic effects of new substances, continued destruction of soil fertility through water logging, salination, alkalination and erosion in agricultural areas; accelerated exhaustion of ground water supplies, high cost of water used and rising conflicts about water rights and priorities.

Legislations aimed at conservation of water resources and against the detrimental effects of water development and use were enacted long before the era of projects. Among the earliest efforts on protection of water resources were pollution control laws.

There are two basic means of pollution control: to reduce the amount of wastes discharged, either by preventing them from entering the water or treating them to make them harmless, or to increase and make more effective use of water's assimilative capacity. In modern water quality control, the reduction of the input of water is achieved by means of economic incentives and economic disincentives and standards. Standards may be either water quality standards or effluent standards.

As the menace of water pollution increased, the rules for water distribution had to be supplemented by rules concerning pollution. The realization that existing law was inadequate to deal with the great lakes (US) pollution led to the forging of more effective measures. Many of the developing countries need to be endowed with adequate and reliable hydrological networks since this is not adequate. Investigations of ground water sources are often spotty and data recording and retrieval systems are inadequate.

For the improvement of community water supply, targets and desirable quantitative and qualitative standards should be established.

Since agriculture is the largest user of water, strategies for efficient use and reuse of water in agriculture should be set. Improved water application efficiencies, better overall water management and the rehabilitation of out dated schemes may yield saving of water sufficient to meet expected new demands for many years. Management strategies which would permit more intensive use of flood plains and drought prone areas while minimizing the associated losses should be practised.

Neglect of environmental and ecological limits in the selection of water related technologies leads to losses in human life and property due to floods and drought, spread of water related diseases, eroded or water logged soils, river and ground water pollution.

Rural water supply in Kenya: a case study of Giathieko Self Help Water Project in Giathieko location, Kiambu district/ A. W. Muhia.- Nairobi:UoN, 1989.- 71p.

Water forms the largest part of the earth which is in form of oceans, seas, lakes and river. Despite all this, man still suffers due to lack of water.

In the arid and semi-arid areas, the problem of lack of water is very severe. People walk long distances in search of water. Even when water is available, it is sometimes, unsuitable for human consumption because, it is either polluted or it has high levels of salt and other minerals. Sea water for instance, is too salty and people living right at the shores may find themselves with no water for consumption.

According to a survey carried out by the World Health Organization in 1975, 24% of the urban population in developing countries neither had house water connections nor stand pipes and 25% were without excreta disposal systems.

The natural sources of water supply for domestic use are subjected to pollution by animal and human faeces. This occurs especially in places where there is rapid increase in population without a basic increase in hygienic facilities. Disease organisms are transmitted first into the water and then to the human beings drinking this water.

In Kenya, traditional water resources are used which are not safe from water borne diseases. In Giathieko, the distribution of treated piped water is by pumping water from the man made dam to the sedimentation tank at Kianjogu village where the water is filtered by rapid sand filters, chlorinated and gravitated to Gatina and Gakoe village tanks. The distribution of water is by gravity.

During the field survey in Giathieko, there was evident wastage of water through burst pipes, leakage and water left running by consumers. The scheme has tremendous socioeconomic benefits to the rural community with the absence of close traditional sources of water. There is improvement of animal health since the farmers can spend more time caring for their cattle. Animals are not exposed to tick hazards due to the construction of three cattle dips which use the project's water. Improved community health is an indirect benefit which has been enhanced by the water supply. Provision of treated water has reduced the incidence of water borne diseases resulting to improved health standards of the rural community and has enhanced their productivity. Giathieko location does not have a water quantity problem. The location's surface and rain water quality is excellent for all purposes. The main water supply systems are provided by the government and the local people on self help basis.

Conference on rural water supply/ G. Tschannerl.- Dar-es-salaam: Bureau of Resource Assessment and Land Use Planning, 1971.- 274p.

The conference and the 1969 workshop had a rather unique character being focused on the very specific topic of rural water supply in East Africa and bringing together people from all kinds of institutions. The 1971 conference dealt with some of the key issues in water development in East Africa.

In this paper planning and policy matters are discussed. Here flexibility, coordination and choice in water resource planning, the utility of recent planning innovations for water development in Tanzania are also tackled in the topic of planning and policy. Rural water supply has been a priority of the Tanzanian development programme since independence and in some areas even before that. In his paper some suggestions for the format of a standard master plan as a basis for discussion has been put forward.

There is still inadequate understanding of the relationship between water supply and health. It seams that in large cities, where the dangers of typhoid, cholera and other epidemic diseases are present, the key factor is water quality.

In Tanzania the view is taken that rural water supply is basically a social service although with some economic benefits. Large sums of money are at present being invested in rural water supplies on the basis of inadequate information on impact benefits. Genuine impact studies are difficult and costly to plan and implement, but in view of the size and long term nature of the rural water development programme, the rate of return on such studies will be high.

The problems confronting the economist and professional planner in planning investment in rural water provision for domestic use have also been discussed in this paper. Where the existing water supplies are polluted or simply unreliable, provision of extra water will have important implications with respect to the number of man days lost through illness, the incidence of disease.

Water development planning in Tanzania is now at a crucial stage. Projects have largely been conceived and designed in the regional offices, where the selection of projects for implementation also took place. Mathematical models in water supply planning were discussed and used.

The health of the community depends in large measure on the ample supply of a wholesome water supply. Diseases of varied character and nature can be and are transmitted to man by water. Deficiency or over abundance of certain chemical substances in the water supply are also ascribed to cause certain diseases. By improving domestic water supply, many diseases can be reduced.

Guidelines for the design, construction and rehabilitation of small dams and pans in Kenya-GoK (Ministry of Water Development), 1992. Report.

The guidelines are intended to provide a methodology and general reference of the design, construction, rehabilitation and maintenance of small water conservation structures in Kenya. Special emphasis is put on the specific problems encountered in constructing and rehabilitating small dams and pans for domestic and livestock water supply in the arid and semi-arid areas of the country.

This document is a result of a draft manuscript that was discussed at a workshop held in Nyeri. During the workshop, participants drawn from the Ministry of Water Development and other ministries and Government institutions handling water conservation activities and representatives from Non Governmental Organizations involved in water development in Kenya formulated a number of recommendations which were taken into account during the preparation of the final manuscript.

The guidelines are particularly intended for use by the staff of the Ministry of Water Development and other interested organizations at the level of district headquarters, thus reinforcing the capacity of district level to study agro-ecological condition and to design environmentally appropriate small dams and pans.

References of design manuals and internationally recognized textbooks providing in depth covering of various scientific and technical disciplines related to design and construction of dams form part of the bibliography attached to the document.

The document outlines domestic water supply, livestock supply, irrigation, wildlife supply and fish breeding as what to be considered regarding the various possible uses of the stored water which should be taken into account when planning the construction and or rehabilitation of small earth-fill dams and pans:-

Location of additional depots of Nairobi City Council/J. M. Wagura.-Nairobi: UoN, 1981.-94p.

Nairobi was established in 1899 as a railway depot and grew to its present size and importance as a centre of commerce and industry for the entire nation. About 17% of the water supplies in the city is lost through leakage and expressed in monetary terms, it means that the city council is losing revenue to the tune of 23 million shillings per annum. This loss can be reduced by building additional water repair depots so as to attend to leakages with minimum delay. Less loss of water will result in an improved supply of water to the industries and other businesses and private households in the city thus benefiting the country's economy in general and city dwellers in particular.

There are four main sources of water supply for the city council's distribution system. These are Sasamua Dam, Mid Chania Stage I, Ruiru Dam and Kikuyu springs. Sasamua water is treated at Sasamua water treatment plant. That from Kikuyu springs and Ruiru dam is treated at the Kabete treatment plant. These track mains operate by gravity. Water was a major reason for the siting of Nairobi city. It's subsequent growth would have been impossible without a well regulated and maintained water supply.

It is the duty of the water and sewerage department to provide and distribute water and to collect and treat sewage for the city. The section is also responsible for maintenance of the storm water drainage system.

The distribution coordination section is in charge of water distribution from the various reservoirs and tanks to the consumers. It regulates the pressure and flow of water within the city's water system. This section also cleans and repairs metres. The function of the water laboratories is to test water in order to determine whether it is suitable for human consumption before it can be distributed to consumers.

During this study, a brief analysis of the existing system of operation was carried out, where one of the most important findings was that on average 33% of the official working hours was spent on travelling due to a non-central location of the depots. A prediction model was developed which was to be used for predicting the number of leaks expected to occur in the various regions. The occurrence of leaks was found to depend on three variables - length of piping, age of the pipes and the type of soil. Two prediction equations were developed one for red soil and the other for black cotton soil areas, due to soil effect in the prediction model.

The prediction equations developed were later on applied to forecast the number of leaks and the forecasted number of leaks were later used to investigate where the additional depots were to be located.

Sanitation in developing countries/ IDRC.- Lobster: IDRC, 1981.- 171p.

Provision of sanitary excreta disposal systems is listed by the World Health Organization Expert Committee on Environmental Sanitation as among the first basic steps that should be taken towards ensuring a sage environment in rural areas and small communities. In Ethiopia, faecal borne illnesses are the most formidable public health problems. Recent surveys carried out within the country have shown that all elements of rural sanitation are more or less lacking and indiscriminate fouling of the soil with human excrement is common and as a result gastrointestinal diseases rank high among the most important communicable diseases. This problem can be alleviated by using water borne excreta disposal systems for excreta disposal. For the Ethiopians, a pit latrine for excreta disposal was found to be an appropriate system because it is effective as other methods in controlling faecal borne diseases. It is cheap to build, easy to maintain and within the reach of the community.

In Malawi, Health Assistants and Disease Surveillance Aides concentrate on among other things, sanitation. They are primarily concerned with the safety of rural water supplies and latrine construction. Rural water supply protection re-

ceives the attention and aid of various departments including the health department. Due to the Cholera outbreak of 1973 , District Health Inspectors were requested to analyze the use of pit latrines in their areas.
In Mozambique, sanitation was seen to have three aspects i.e. the safety, ecological and comfort aspects.

Liquid waste collection and disposal refers to the collection of liquid wastes that are accumulated in private or public cess pools and septic tanks. Due to the inadequate provision of vacuum trucks, the method is very difficult to cope with the high number of cess pools and septic tanks that become full and overflow particularly during the three month rainy season. The liquid wastes carried by these vacuum trucks are poured in open fields at a public garbage dumping site far from the city itself.

The quality of the water is controlled in urban water supplies by chlorinating the water before it's distribution. Bacteriological investigations carried out in July 1978 on water from boreholes, well points and stand pipes showed that the water contained unacceptably high levels of faecal bacteria contamination. Salmonella and some other possible pathogens were reported.

Water can be given to people in both rural and urban areas but this alone will not improve their health. Water is the main vehicle for disease transmission when contaminated with excreta. Sanitation is also necessary to improve the health to the people. Sanitation includes the proper use of water and protection from contamination in the home. Sanitation improvements need to be implemented in conjunction with water supply delivery.

Drawers of water: domestic water use in East Africa/G.F. White, D. J. Bradley, A.U. White.- London: University of Chicago, 1972. 306p.

Most industrialized cities take it for granted that abundant flow of water supply, free from harmful organisms, will be available to those who can afford to pay and they assume that the price will be within reach of all. Two thirds of the human family draw their water daily from sources outside the household and carry it in containers to their homes. In East Africa, the sources of water range in quality from continuously polluted pools to systems offering supplies as pure as the most sophisticated in Europe or America. In quantity, they run from intermittent and fable streams to completely reliable and unlimited flows through pipes.

Improvements of natural sources for water supply range in complexity from the simple individual action of cleaning a spring or setting out a pot to catch rain dripping from a roof as in Iganga, to the intricate organization of a city water system as in Nairobi. There are six classes of improvement of water supplies. These are individual management for individual families, community management for individual use, community development for pipeline distribution, community stand pipes single tap household service and comprehensive city systems.

There are several factors affecting water use. These are the size of the family, income level, education, cultural heritage, character of water supply, cost of obtaining water as measured by energy or cash expenditure, and climate and terrain.

Lack of water can lead to death of man. Also if man obtains abundant water

containing the vibrio of cholera he can also die. Poor water supplies in quality and quantity are communally believed to be associated with a high incidence of infective disease. Conditions considered ineffective such as carrier and atherosclerotic heart disease are believed to vary with water quality.

The most dramatic falls in disease incidence associated with improved microbiological quality of urban water supplies have been seen in typhoid and cholera. The infective diseases associated with water supply are usually listed as cholera, diarrhoeal diseases including bacillary and amoebic dysentery, leptospirosis, typhoid and paratyphoid fevers, guinea worm and schistosomiasis, infectious hepatitis, tularaemia and some enterovirus infections.

Any water that is polluted should be boiled before being drunk. Equal degrees of pollution are not necessarily comparable epidemiologically in different communities, quite apart from the fact that animal pollution with faecal coliform has different implications from human pollution.

The effects of local environmental changes aimed at improving water supplies may go beyond improving the quality of water consumed. Many people dislike borehole water for drinking and in some areas as it's bacteriological safety is largely dissipated in merely washing clothes.

The problems of water supply in Eldoret, Kenya/ M.O. Otieno.- Nairobi:UoN department of Geography, 1989.- 95p.

It is obvious that there is need for scientists to work together in the study of water resources. There is scarcity of reliable data to researchers, planners and extension workers in usable form on the development of water resources.

Attempts have been made to pool together the available data on the basic environmental and socioeconomic factors including land use types in the hope of understanding the problems and prospects of development of Eldoret's water resources. In evaluating water resources, a comparison between industrial and domestic water usage was made and reason as to why they are still problematic highlighted.

Physical and chemical qualities of water have been discussed, pollution of water by basic industries constrain the use of the stream and river water, backed by domestic human interference upstream.

This paper provides a framework for discussion and generates a set of questions and options for more intensive research in the future. Concluding observations for policy implementation are provided . For the benefit of those who may find some of the bare facts useful, a number of appendices have been included containing some statistics not readily available elsewhere in the main text.

The water quantity in Eldoret is plenty, looked at against demand with most people getting their supplies from the municipal council. A few of the people use untreated water from rivers and wells which are normally within a walking distance.

Rainwater is very unpopular amongst the majority of consumers living in the middle income level residential areas but common in the high income residential areas where facilities for roof harvesting do exist.

In terms of water quality, rainwater is excellent for virtually all purposes. From the laboratory tests, streams and river water were found to have some undesirable colour turbidity and slightly higher amounts of iron and ammonia. This shows some considerable degree of organic pollution that needs treatment to render it usable.

Despite the lack of data on burst pipes, the research revealed that pipe leakage and bursts have contributed to water shortages. It appears far more economical to save water from leakage than to invest in augmentation projects given the large quantity of water that is lost through leakage. It also revealed that in most cases, where piped water without metres was available in the homes, very little conservation measures were taken.

Industrial plants do not use any method to conserve the little amount of water available. Basic hygienic principles are flouted by those who release effluent into the river. Jua Kali garages release oil and diesel into the Sosiani river.

Water resources and water management in South Western Marsabit District/ G. Bake.-Nairobi:UNESCO, 1984.-116p.

Water is the basis of human land use for agriculture and for livestock husbandry. While there is an abundance of water in the humid areas, water resources in an arid or semi-arid environment are very limited. The aim of this study is to give a scientific base to the proper exploration and use of the existing water resources in the IPAL study area. It incorporates subsurface and surface hydrology.

Ground water resources can only be detected using geophysical methods unless the ground water is so close to the surface that the vegetation shows its presence. Ground water is the most important water resource in arid areas as surface water only occurs for a few days during the wet season.

In this study, the age of ground water was determined. The actual age determination was carried out for five boreholes and one spring mainly to check on the accuracy of the estimates of age structure. The age determination was carried out by the ^{14}C. and ^{3}H. laboratory of the Niedersäch sisches landersamt für Bodenforschung in Hannover, Germany. The principal objectives for the management of water resources are for the provision of adequate water points for domestic use and the provision of water for livestock which is well distributed to facilitate even grazing and to reduce walking stress suffered by livestock.

Droughts are a common feature in the arid and semi-arid lands. Traditional nomadism was able to face the challenges and give the people a fair chance of survival. Increasing population of people and livestock has made the pastoralists more vulnerable to these natural phenomena. During recent droughts, livestock died and the people had to be fed from external sources. Drought as a climatological feature also affects hydrology of the area. With decreasing rainfall the surface run off also becomes sparse so that there is no reliable water source of the nomads.

Exploration has determined that there is enough water to supply the entire area at the present stocking rate but these water resources are not distributed equally. Research is constrained by the enormous cost of drilling deep boreholes.

This limits the possibility of finding rich water tables, but it does not give the local people the opportunity to contribute their labour to the development of the identified well sites. The people using the water sources should learn to understand that proper handling of materials is to their own benefit and is essentially for their welfare.

The description of current urban storm sewer system design methods in East Africa/R. Keenan.

This paper deals with the existing storm water drainage systems employed in urban centres throughout East Africa. It briefly examines their development and takes a critical look at the present design criteria and formulae which have been adapted for computing run off from these areas.

Storm water drainage is concerned with the measures taken to control the flow of surface water by collecting and transporting it through suitably designed conduits, away from developed areas where it would otherwise cause flooding, thereby impairing the safety, health and well being of the public and disrupting essential public and commercial services. Drainage is also employed in an effort to improve public health by preventing the spread of Malaria.

It is generally appreciated by drainage engineers that the separation of foul and storm water flows in 'separate' drainage systems has distinct advantages over 'combined' systems. In East Africa, the separate system has now been adopted extensively.

The following are the basic types of drainage conduits: earth channels, lined open channel pipes, culverts. Great variations in drainage lay outs exist. Open systems are used in high density low cost housing areas where economy is a prerequisite to design.

In heavy industrial areas and high cost, high density housing areas where land costs are more significant the tendency is to utilize all available land as effectively as possible and drainage in these areas also takes the form of partly piped system. Although this systems employ piped sewers and gully connections, the discharge from adjacent plots, in the majority of cases is still disposed off "overland", before entering the system via the gully connections.

Drainage design in East Africa offers considerable challenge to the designer. Many alternative lay outs coupled with a wide choice of conduit types demand considerable expertise on the part of the engineer to arrive at the optimum design solution.

The reports obtained from city and municipal authorities indicate that the drainage systems are functioning adequately. The truth of these reports has been confirmed in Nairobi and Mombasa through studies recently carried out for the authorities by specialist consulting Engineers.

Extensive surface flooding has been experienced, but only due to the lack of sufficient surface inlets. This points to the over adequacy of the sewer systems and suggest that substantial safeguards against flooding have been built into the system in the past but the extent to which these safeguards extend is still not known.

The rural water fluorides project, Kenya/J. N. Gitonga.-Nairobi:UoN, 1982.-181p.

The report first gives some general background information about Kenya. Information on location, population, climate and geology is given in an outline. The report then discusses the findings of previous research carried out in the field of defluorination that no universally accepted method of fluoridation has yet been found since all methods that have been tested have one or another disadvantage. It also becomes clear that very little work has been previously done in Kenya in this field.

A discussion of the work previously done in the survey of the distribution of fluorides and the prevalence of dental fluorosis shows that no comprehensive research has been done in this field on a nation wide scale.

The main part of the report describes how the authors collected their information during experimentation and also during the survey on the distribution of fluorides and the prevalence of endemic dental fluorosis. After analyzing data collected from slightly over 29,000 people, it is shown that endemic fluorosis is widespread in Kenya and is a serious public health problem in this country. Results obtained from analysis of slightly over 1,200 samples of water collected from boreholes and about 150 samples taken from rivers all over the country confirm that excessive fluoride concentration occur in many parts of the country.

After experimenting extensively, it is established that for raw water with less than about 7 parts per million, it is possible to reduce the fluoride content to about 1 part per million. For raw water with high fluoride content excessively large doses of alum and lime are required and the addition of these large doses of chemicals make the water quality deteriorate. Other chemicals like clay, charcoal, kaolin and diatomaceous earth were also tested and the finding also given.

Ockerse (1953) reported that the incidence of dental carries was low amongst children with mottled teeth Schwartz; (1952) was of the opinion that carries caused by fluorosis in age groups under 20 disappears in adults. The present study reveals that the incidence of carries is very high among those affected by 3rd and 4th degree mottling, an observation quite contrary to that of Ockerse.

Water pollution bacteria in Kenya/S.I. Muhammed.-Colorado: Colorado State University, 1971.-134p.

Provision of portable water in rural areas of many developing countries is one of the main problems facing the public health worker. Majority of people living outside city centres obtain their water supplies either from wells or rivers. The sanitary quality of these supplies is highly variable because of the case of pollution from both animal and human faeces.

Many countries use the coliform organisms as the index of pollution in the main water supply but the suitability of these gram negative, non-spore forming, lactose fermenters in the tropics has been questioned. Many well waters in the tropics, believed to be free of excretal contamination contained lactose fermenting, indol positive organisms. Clostridium Perfrigens is known to be present in the faecal discharges of man and higher animals. This organism is a possible pollution index and this research has been based on it. The organism is only looked for

in water supplies. When found in the presence of coliform organisms, it is regarded as confirming that the pollution is faecal in origin, while it's presence in the absence of coliform indicates distant faecal pollution. This is because C Perfrigens is a spore former and therefore can survive much longer in water compared to other index organisms.

The specific objectives of the study was to investigate the growth requirements of C Perfrigens, investigation of the sporulation requirements of C Perfrigens, the observation of the behaviour of negative spores of C Perfrigens introduced into natural water and the development of a selective and differential medium for the recovery of C. Perfrigens from suspensions using membrane filters. The complete sporulation requirements of bacteria cannot be easily investigated as it is very difficult to distinguish completely between factors and nutrients required for growth and for sporulation . In this study, maximal growth of C Perfrigens occurred in medium without lysine which also supported good growth of strain colo. Clostridium Perfrigens colo grew best in medium lacking riboflavin. Thus lysine and riboflavin were neither essential nor stimulatory for the two strains used.

A survey of water quality was therefore carried out in Kiambu district, employing coliform, faecal coliform and C. Perfrigens as index organisms of pollution, using membrane filter techniques. Nairobi river was also chosen as a site for study as none of the rivers and streams initially sampled provided an opportunity for studying the effects of different sources of pollution.

Planning for water supply in Nyeri town, Kenya/ S. Mwangi.- Nairobi:U.O.N, 1990. - 70 L.

Nyeri town is one of the fast growing towns. The town has the problem of inadequate water mostly due to increased population. To solve the problem the municipal council took over the management of water supply from the government in 1983. Lack of enough finance and community participation are some of the problems facing the municipal council .

The quality of water is more important than the quantity. The quality of water should fit its use. Various man made activities like agricultural wastes, industrial wastes and air pollution are some of the causes of water pollution. Urgent measures are necessary to curb or at least keep pollution under control.

Lack of initiative and enough funds to have water projects established are some of the setbacks. There is also lack of money for running the completed projects. The problem of inappropriate technology and unsatisfactory operation and maintenance reduces the required long term operation of a project. Such problems can be reduced by educating people on water rationing, water storage, reduction of wastage and towards a sense of responsibility.

In water treatment the following things are considered:- raw water storage, sedimentation and settling tanks, chemical assisted sedimentation, filtration, disposal of sludge from treatment works, water softening.

The town enjoys moderate climate because of the altitude. The town is served by four sewage systems. Most low income houses are served by water borne communal toilets connected to the central sewerage system. Unclassified houses use

pit latrines. In the fourth chapter the water source and treatment are discussed. Main source of water is (Ihua) reception station which receives water from Chania river. Also Nairobi river provides water and other areas get it pumped from the river.

On the treatment of water the following methods are discussed, sedimentation, filtration, chlorination, storage and distribution.

Rural water development in Kenya: a case study of Vihiga Division, Kakamega District/ J. I. Akelola.- Nairobi: UoN, 1987.- 202p.

The Kenya government has focused its attention on the needs of the rural areas in the country in an effort to raise rural standards of living as part of the overall strategy for economic development. The improvement of the health of the rural population through the provision of clean water has been identified as an essential component. The Kenya government takes as its national policy, the eventual provision of piped water supplies to the entire population in the country, by the year 2,000.

This paper concerns itself with a detailed examination of some of the problems likely to be encountered by the government in it's attempt to implement the policy declaration to provide "piped water for all". The study accepts the basic assumption that effective design and development of water supply projects in the rural areas of Kenya is an essential constituent for stimulating the economic development dependent upon many considerations, which are closely linked with efforts at raising rural living standards.

Vihiga division of Kakamega district was selected as being ideal for the study. It has a very high rural population density and an equally rapid population growth rate.

In this context the general null-hypothesis investigated states that environmental and soak-economic factors do not significantly affect water supply development in Vihiga division.

Regression analysis was used on part of the data collected in the field, covering factors impinging upon rural water supply development. Statistically significant relationships were found to exist when soak-economic data such as household population, education, distance to and from water source, per capita water consumption, and time taken to fetch water were regressed.

The study also includes an investigation into selected environmental factors influencing water development. It revealed that Vihiga division has many natural advantages. However, due to high population density, most of these sources are liable to pollution, thereby posing a clear health hazard. This is why treated water supplies are necessary.

Any efforts to quicken the pace of rural water supply development, must address itself particularly to the question of rural income. Development planners will also need to evaluate the present strategies used to supply piped water to rural areas and suggest cheaper alternatives. The value of self help in the achievement of water development targets needs to be emphasized as the current level of participation in Vihiga is rather low.

The quality of water in the Lake Victoria Basin and its protection/ B. S. Meadows.- Nairobi: Institute of Development Studies, UoN, 1979.- 15p.

The sources of data on water quality in lake the Victoria basin are collated and criteria for different uses suggested. This data is available from three main sources which are: data collected by the UNDP/WMO Nile Basin Hydromet study, monitoring programme of the water quality and pollution control section in the ministry of Water Development. Two short reports covering Nzoia and Nyando rivers have so far been prepared and the third source of data is ad hoc data collected in connection with specific water schemes.

The existing quality of surface and ground waters is then assessed in relation to potential development in the basin. There is clear relationship between water quality and geology for surface waters. Owing to the close contact between the water and the rocks, ground water is very greatly influenced by the geology. Throughout the catchment, the surface and ground water so far investigated in any detail are generally of really excellent chemical quality. There are no problems in excess levels of fluoride, where laying down quality criteria has many contentious aspects such as in many parts of the Rift valley catchment and the upper Athi. Nitrate levels and the salinity are neither high. The water quality for livestock watering is generally less stringent than for human consumption so there should be no constraints save in the need for water of good chemical and bacteriological quality for top dairy cattle. Water quality for most industrial use is excellent.

The current legislation on pollution prevention with special reference to the Water Act is reviewed and suggestions are made for improvements to the legislation in order to make pollution control more effective. All prospective water users must apply for a water permit before an abstraction of discharge and this is either granted or refused by a body independent from the Water Department, with the powers to the Tribunal - the Water Apportionment Board. Unless the Water Apportionment Board otherwise permits, all projects liable to cause pollution shall be prepared by a qualified Engineer.

A brief overview of the present policy with regard to establishing quality standards, for effluent is given, existing resources and its organization for enforcing pollution control legislation is also discussed.

The Ministry has established a well equipped laboratory in Nairobi where effluent can be tested to assess their toxicity.

An African dam: ecological survey of the Kamburu/Gitaru hydroelectric dam area, Kenya/ R.S. Odingo.- Stockholm: Swedish Natural Science Research Council, 1979.-183p.

Tana is the largest river in Kenya and the most important source of water power in the country. The upper Tana has seen the development of three hydroelectric power schemes, adding a total of more than 300 megawatts to Kenya's national grid. The three power stations have been brought about by single purpose dams each aimed primarily at the production of electricity.

A study of the hydrology of the area revealed high suspended sediment loads and high rates of siltation in the newly constructed dams with much of the erosion originating in the upper catchment areas in Muranga, Nyeri, and Kirinyaga districts of the Central Province of Kenya. The silt loads observed were found to be far above the average and in many cases as much as ten times higher than the figures used by consultants in calculating the useful life of Kamburu dam. Dam-side erosion is also expected to increase because of the observed large scale destruction of the natural vegetation associated with new clearings for agriculture as well as with increase in charcoal burning activities. Fish life has also been affected with the change from a riverine environment to a lacustrine one, with some species being eliminated while others have started adjusting to the new environment, which will take some time to stabilize.

Epidemiological studies revealed high incidence of Malaria as well as other water borne or water transmitted diseases. The incidence of schistosomiasis which is known to be endemic in the area was found to be low, even though appropriate host snails were found to be inhabiting the Kamburu dam and the tributaries on the Tana river above the dam and small streams flowing into the general dam area.

Scarcity of water for domestic use is one of the major health problems of the population groups in this and other parts of Machakos district. The more liberal availability of water for cooking, washing and bathing may have a beneficial influence on food and body hygiene, resulting for instance, to less diarrhoeal diseases, skin and eye disease.

The study contains an assessment of the overall impact of this new population on the physical, biological and social environments of the area. Recommendations are made for immediate action be taken to slow down the rapid erosion and silting affecting the Kamburu dam, on the incidence of disease and how it can be contained and on the demographic and social implications of the new developments taking place in the area, it is hoped that several follow up surveys to monitor the significant ecological changes taking place in the area will be carried out with a view to making necessary adjustments to ensure environmental stability of the region being studied.

Water supply in Kihingo location (Nakuru District)/ L. K. Waithaka.- Nairobi: University of Nairobi, 1990.- 42L.

The study sets out to look at water resource distribution and problems associated with water scarcity. It also looks at possible planning and implementation systems of water supply that can be adopted in bringing water to the people.
The government with the realization of the role that water would play in opening up remote regions to industrial and agricultural activities then aims at providing water within 4 Km to all families by the year 2,000.

Kihingo location in Nakuru District is located within the great Rift Valley floor. Many areas in the district experience water scarcity especially during the dry seasons. Productivity of domesticated animals is also reduced due to lack of enough water. Kihingo location has only two rivers which dry up between late December and early March which is a dry season. There are also two boreholes installed

with pumps. The pumps due to old age do not operate making water to be fetched manually. An earth dam is available but due to lack of an outlet it is always contaminated. So people have to spend much time and energy in order to enjoy safe clean water. Therefore it is necessary to look into this water problem more seriously with a view to finding a solution or at least ways of rectifying this unsanitary situation.

Field survey revealed that residents in Kihingo location have no treated or use untreated piped water. They fetch their water from various sources like streams and then boreholes in the dry season and also the local earth dam with it's dirty water, bad smell and taste. The long distances that have to be covered make other domestic activities unattended most of the time.

Water transportation is commonly done by donkey. Since water is fetched during the day and night time productivity is reduced.

Water borne disease are a health hazard to the people of Kihingo location since the available water is highly contaminated.

To control the problem of water scarcity, earth dams can be constructed to harness the flood waters which would last the dry period.

From this analysis, it can be concluded that the residents have an acute reliability problem with supply of water. Added to this, scarcity of safe water and most cases many water borne diseases are prevalent. In this connection the government and NGOs are urged to look into this health problem of the residents by opening up hospitals and new clinics in the location.

Problems related to rural water supply projects: a case study of the Kigumo water supply scheme/ K. Kariuki.- Nairobi: UoN, 1990.- 48L.

This paper looks into the performance of one rural water supply project so as to highlight on problems that such projects face. It reveals the shortcomings of the Kigumo water supply.

The Kigumo project aimed at supplying the entire Kigumo division with piped water. Most rural water supply projects in Kenya use rivers as their source of water. In areas without advantageous topography pumps are installed to pump water to reservoirs. Dams and lakes are also used as water sources in Kenya.

Smooth running and ultimate success of a project is highly dependent on careful planning and preparation. It's therefore necessary to improve the planning, technical and managerial capabilities within the country hence steps to review the programme need to be taken. Ccommunity participation is essential when planning the project.

A study on past projects show that operation and maintenance functions are better managed if they are decentralized.

Kigumo division is situated in the upper parts of the Tana river basin. Streams and rivulets on the slopes of the Aberdares and Mt. Kenya give this drainage basin a high potential for water resources development. On water supply, 40% of the population get their water from traditional water sources like streams and rivers. At times one has to walk considerable distances. In most service centres, water

transportation is by carts drawn by donkeys. Water is also collected into tanks from galvanized iron house roofs.

Organized water supply other than the described project is limited to three associations in Kigumo division. Untreated water is served to people within the vicinity. Boreholes are also used to serve mainly the trading centres. Lack of constant supply of water was attributed to poor management whereby the constraints in finances allocated by the central government led to it's dismal performance. Most people interviewed from the area stated that they have benefited from growth of industries, towns and promotion of trade. People from Nginda, Kamahua and sub-locations of Kinyone had a negative response on benefits from the scheme. The management to the scheme is poor due to bureaucratic hierarchy of authority with the top officers situated in the District headquarters far off from the major operation regions. Also the system of procurement of spares is bureaucratic and this causes delays.

It is also found that the Kigumo water project has failed to attain the set objectives despite the supportive role played by the community. The failure is attributed to financial constraints.

A study of filters as household water treatment facilities for rural areas/ J. Orech.- Nairobi:UoN, 1978.-104p.

Enough supply of good quality water is the basis for the promotion of environmental health and a high standard of living. In tropical areas enough and good quality water supply poses one of the biggest problems for the responsible authorities.

The available modern equipment designed to minimize operation and maintenance problems require a lot of money to buy and skills in operation. Once they are spoiled or damaged, they are difficult to repair due to lack of local expertise or spares. There is therefore a need for a field of activity in which locally available materials, skills and resources are used to develop a form of cheap technology which is appropriate for application in rural areas of developing countries. It is in this field of activity that this study is carried out.

This study starts by identifying the sources of water supply which are rivers and streams, lakes, springs, boreholes and rainfall. Work done in USA, Australia and Jamaica has shown that water supplied from rainwater units using artificial catchment in areas of low or average rainfall is not cheap.

The various methods available for making water safe and wholesome to the consumers are covered. These methods, the choice of which depends upon the characteristic of the raw water in consideration include storage and sedimentation, filtration, disinfection, small scale purification and boiling.

The problems of rural areas are usually lack of capital for costly investments, absence of local expertise and lack of spare parts. This study was conducted to find simple and cheap methods of water treatment suitable for these areas.

The design and construction of pilot plant is discussed. Figures to illustrate the principle and lay out of the pilot plant are given. The materials for the filter boxes are mainly concrete bricks and in some cases steel for the construction of

filter boxes, but in this study, the materials considered were timber, cement mortar and clay bricks, wood, charcoal, sand and gravel were used for the study as opposed to sand and gravel which are the two common filter media.

The experimental tests carried out were microbiological tests whose parameters were colony and coliform counts, physio-chemical tests in which the parameters measured were colour turbidity, PH and calorific value and two mechanical tests were conducted viz bending strength and compressive strength.

Sanitation field manual for Kenya.- GoK, UNDP and World Bank, 1987; 77p.

The manual is designed to give guidance on policy issues, strategies and technologies for improving sanitation in Kenya. The policies and strategies are intended for application in both rural and urban settings, but the technologies included in the manual are restricted to simple low-cost ones which are best suited to rural and peri-urban areas.

The manual gives a useful guide to technology selection and detailed recommendation for the design of single and twin pit VIP latrines, pour-flush toilets and septic tanks and on how to improve existing pit latrines in Kenya. Practical instruction on building these are given in appendices to the manual as are actual field experiences of those working on Kenyan sanitation projects.

In an effort to maximize available resources, programme planning, implementation and evaluations are paramount. To achieve these, the manual lays emphasis on the importance of involving all the parties concerned. It explains how to identify the programme area, carry out a survey, select the best alternatives, get approval for resources acquisition, make a plan of action and how to conduct evaluations. The data required in planning and an activity chart are also provided.

In order to facilitate realistic sanitation programme planning, implementation and evaluation, the manual incorporates socio-cultural issues. It includes a definition of culture and an analysis of some stimulating and inhibiting factors in the implementation of projects. It advocates health education as a strategy for changing behaviour and recommends community participation as a means of fostering acceptance of sanitation programmes. Detailed appendices are provided on socio-cultural data that needs to be collected for successful implementation of sanitation programmes.

The problems of sources and supply of water in Kerio Valley, Kenya/ A. K. Kiptoo.-Nairobi: University of Nairobi, 1987.- 72L.

A reliable and safe water supply is vital for both individual welfare and for community development. Some of the rural and urban poor communities of Kenya have none or minimal access to safe and reliable sources of water. This study then is on one such area called Soy location in Elgeyo District.

In Kerio Valley, the water available for use in homes for building and economic activities falls short of demand due to limited resources, inefficient collection methods and supply.

The Kenya Fluorspar Company (KFC) discharges waste water into river Kerio thus contaminating the water available for human and animal consumption.
The valley conditions can be considered as geographical accidents. The Elgeyo escarpment comprises of a series of steep uplands and flat plateaux, from which the Kerio Valley extends and whose average rainfall is merely 750 mm per annum. High temperatures or over 33°c promote high evapotranspiration and the unreliable rainfall making the valley's classification as ecologically of marginal potential.

The extent of water contamination is not explained since from the Elgeyo/ Marakwet District Water Engineer's information, water in the district has so far not been tested for any contamination.

Water in Kerio valley should be enough in quantity if properly harnessed and made available to the right people at the right time. The traditional water management should be directed towards the catchment of water from natural precipitation or underground water sources.

Some reasons why little has been done on Kerio Valley is due to poor communication making transportation of materials, equipment and personnel very difficult. Further, financial resources for water projects are limited with poor support from the beneficiaries.

On the climate of the area, mean maximum temperatures throughout the year are 28-30°c and mean minimum are 14-16°c. The high temperatures cause large volumes of water to be lost by evaporation.

The study recommends that water dams built should be covered to reduce evaporation while for piped water, pipes should be underground to reduce the temperature of the water.
The major income sources in the valley which involve growing of crops and livestock keeping are affected by water shortage. Many people lack good storage facilities and rainwater catchments and therefore so much water that could be tapped for use during dry periods results in floods. Also building construction is directly affected by water shortage during drought.

Although there are many plans for water supply projects in the valley, there are no signs of immediate implementation and completion.

Planning for basic infrastructural services in Thika with specific reference to water provision, sewerage and solid waste disposal/ B. M. C. Sibanda.- Nairobi: UoN,1980.- 144L. MA Planning.

This study concerns itself primarily with the land use organization as a factor that affects the cost, the efficiency and adequacy of basic infrastructure. The approach in the study is to adopt the technology which is appropriate to the level of development and also which can be afforded by the poor majority.

The fundamental problem in Thika and in many towns of developing countries is one of poor land-use organization. Development in Thika town is not coordinated so as to allow a more optimal system of infrastructural provision. Also most people in the town are low income earners so financial problem is a reality. The municipal financial resources are low since developing countries are poor and

cannot afford to spend large sums of money on basic infrastructure. There is also lack of or poor forward planning.

Thika town abstracts its raw water from Chania river. The Ministry of Water shows that the present water source will be adequate till the year 2,000. The intake point and the treatment plant are located on one side while the town continues to grow in the opposite direction. This means that the water service lines are getting longer and thus increase in the cost of water provision. Industry and residential areas, the major users of water are located further away from source. The increases intake of water by Nairobi from Chania river shows that the river will not provide water for the period planned. To minimize the cost of providing water then the lengths of the pipes should be minimized.

In water treatment water goes into the pumping house from the raw water channels. Water is fully treated by flocculation, sedimentation, rapid sand filtration and chlorination. Water storage is due to small treatment capacity and distribution system. The municipality should think of providing water from Thika and Komu rivers. It would be economical to provide untreated water to the industries which do not necessarily need treated water. Problems constraining water supply include: squatter settlements where the municipality cannot afford to extend services to these people due to lack of capital, communal stand pipes are shared by many households, individual connections are expensive to run, plans drawn by consultants cannot be met financially.

The sewerage system is faced with some problems like: lack of sewerage systems in squatter areas, sewerage systems in communal areas suffer from malfunctioning, 90% of industries discharge raw sewage into Thika river, treatment plant is overloaded, finance is still the biggest constraint.

On solid waste disposal identified problems include: sanitary landfill is too expensive, the town can not afford it , squatter settlements have no collection system for solid waste, vehicles are too few and cannot cope with the amount of solid waste generated. The present system is clearly inadequate and alternative ways of dealing with solid waste are therefore necessary

Nyeri district environmental assessment report/ M. J. Njenga.-Nairobi: National Environmental Secretariat,1980.-124p.

This report is part of an experimental series in district planning to determine whether improved resource data will enhance resource management and development. The objective of this report is to identify environmental pressure points related to development opportunities and anticipate possible environmental consequence of development.

The location of Nyeri district is between Mt. Kenya and the Aberdares. It receives relatively high rainfall and has rich volcanic soils hence it is one of the most fertile districts in Kenya.

Concerning ground water quality in the district it is classified as good and flows more or less in a south easterly direction from the high areas of Mt. Kenya and Aberdares. Results from Maragua river at Muranga road showed that bicarbonate, sodium, potassium levels were normal while calcium was low. High tur-

bidity and colour, nitrate, iron, permanganate value and BOD all suggest erosion and pollution by organic materials. Tana river results showed high salt content and high organic material.

Water conservation projects in the district include dams, boreholes, wells, water holes, water tanks, rock catchments and piped water projects. The main sources of water in the district are rivers and streams. The district receives adequate precipitation and has numerous streams flowing from the slopes of Mt. Kenya and Aberdares range.

The Ministry of Water Development is responsible for water supply in the district. Other agencies include the county council and Ministry of Health. They have a target to supply every home with piped water by the year 2000. Much water used in rural areas is still obtained directly from rivers and streams. Many of the dams used by the former settlers have fallen into disuse due to silting and require dredging.

Water supply for Nyeri town and surrounding areas is from Ihua and Chania both on the Chania river. Water quality varies with the source, from piped and treated water to ground water and direct flowing rivers. For water treatment chemicals used include chlorine, alum for sedimentation of heavy metal, soda ash for gauging the PH of water.

In waste disposal in rural areas domestic wastes are thrown into cattle sheds "bomas" for conversion into manure and pit latrines are common for human wastes. In urban areas most of the waste is simply dumped together along the roads and near residential areas in Nyeri, Karatina townships. A lot of wastes end up in streams and rivers passing near the towns. Attempts have been made to construct oxidation pools for industrial and town sewage. Often the pools are flooded, and overflow spilling untreated wastes into streams. Also the burning of solid wastes is uncontrolled.

Water harvesting in five African countries/ by M.D. Lee and J.T. Vissher.- Hague:IRC, 1990, 108p. Occasional paper, 14.

This is a review of water harvesting systems practised in Botswana, Kenya, Mali, Tanzania and Togo. The review was carried out by the IRC on behalf of UNICEF to document experiences in these countries.

All three water harvesting systems are being applied in the five African countries. These systems are the rooftop catchment, the surface catchment and the run off farming system.

Water harvesting involves the collection, concentration and storage of rainwater that runs off a natural or man-made catchment surface. Rudimentary water harvesting is being practised in most rural areas as part of the traditional water supply strategy. Many planners consider it a low priority due to costs, high user management needs and perceived quality problems. In areas where ground water is difficult to access or is saline, or where springs lack, water harvesting is gaining prominence. In Kenya the action plan for the arid and semi-arid lands from 1989 to 1993 aims at providing 25% of drinking and agricultural water needs through water harvesting by spending US$ 50 M.

The cost of systems, the service level provided to user communities and the potential for conflict over water use vary among systems and in the five countries. Some of the factors causing this variation include inflation, exchange rate conversions, exclusion or inclusion of project costs.

It is not possible to evaluate systems achievements as most water harvesting projects are still in a developmental stage.

Assumptions are being made on the quality of water provided by water harvesting systems. Generally, rooftop catchment tanks are assumed to provide high quality water. This is confirmed by a study in Botswana showing that coliform counts lay within WHO norms except for high Streptococci counts off the roof.

A number of key issues can be identified which have had an important impact on project results. These relate to technology selection, community involvement and capacity building/ and approaches to financing.

Conclusions can be drawn concerning the environments having greatest potential and need for water harvesting, the potential of different systems, the role of women in water harvesting and the transfer of information on experiences within and in the five countries. Individual country reviews are documented.

Evaluation of the CARE water supply programme in Kenya- WASH; 1984; 154p. WASH Field Report No. 106.

The report provides a list of documents that describe rural water activities in Kenya. Rationale for intervention in water supply is advocated as this offers direct health benefits for the target population. The implications of the relationship between water and health are summarized in the document. An appendix of water projection is provided in which project design, approach, final goal, intermediate goals, activities and evaluation is discussed.

The report outlines the selection criteria for CARE/Kenya water projects prior to financial year 1983 and a further criteria for the years 1984 to 1986 is also provided.

Guidelines to field officers performing CARE water projects in Kenya are provided with detailed project survey/proposal forms. Procedures for evaluation of CARE/Kenya water projects based on a modified version of the WHO are outlined.

Suggestion for data gathering techniques are provided. These relate to observation studies (inspection of latrines, observation at water points); observation of behaviour effected by hygiene education, comparison of two contrasting stratified samples, use of school children in data collection; workshops to identify and solve problems and household sample surveys.

The report provides discussion of data collection approaches as related to proposed CARE/Kenya Evaluation Procedures.

Finally the report provides a detailed job description of a community development technician and a proposal on selecting and evaluating an institution of maintenance training for water and sanitation facilities.

A field survey of NORAD supported projects.- Ministry of Water Development: GoK, 1986, 37, Report.

Twenty seven completed water supplies were studied out of a total of thirty six and three (3) completed sewerage schemes. Of the 27 completed water projects studied about 333,335 people have already benefited. These projects produce about 29507 M^3/d of treated domestic water giving the beneficiaries a crude average of 88 l/p/d. The total capital investment of the 27 water projects so far studied was about 261.48 million Kenya Shillings per capita. The average per capita cost for large piped water supplies in Kenya is Kshs. 1,200 (1983).

A summary information of the 27 projects studied is given.

Twenty of the schemes use river water as source and thus the raw water quality is very bad especially in the rainy season. The rest of the schemes use ground water as their main raw water source and one of them uses lake water.

The designed production of the 27 projects studied in this survey is 55434 m^3/d represents 53% of design production.

Frequent shut downs resulting in intermittent production has also been observed. Good operations and maintenance is the Key to making the schemes function.

Rehabilitation of plants is proceeding on with chemical feeding pumps being replaced by gravity dosers and improved fluctuation systems. About 80% of the design equipment is now of the gravity flow type while the dosing pumps are being phased out where possible.

Simple to operate, easy to maintain designs should be recommended.

After sales services should be obligatory to all agents and suppliers of equipment and machinery.

Poor media selection has been observed in almost all the water supplies visited.

In summary, it can be said that almost all plants have the necessary treatment facilities to handle the designed duties. However, inadequate operation and maintenance routines together with inappropriate instrumentation have led to poor performances.

A list of the projects included in the study is given in a table which gives information on the overall status of each project at the time of the visit.

The impact of industrial development on environmental quality, with special reference of KMC and East Africa Portland Cement Factory in Athi River town/P. K. Kyalo.-Nairobi: UoN, 1985.-169L. MA in Planning Environmental Studies.

Kenya like most developing countries experienced rapid industrialization during the last decade and like most of them no effective measures were taken to safeguard the environment from industrial pollution. There is need to establish pollution standards for all industrial establishments that emit gaseous or particulate discharges.

Athi River town has a number of major industrial undertakings. The main problem with respect to industrial undertakings within these industries has been

one of misuse and mismanagement of basic natural resources like air, water, land etc. Athi River the major source of water for the industries and people is under the threat of pollution from industrial activities. The proper communication in Athi river town makes it even more attractive for industrial development.

Two rivers supply water, these are Athi-Kitengela river and stony Athi river. However, they are not capable of meeting the total estimated supply during low flows. The industries also use boreholes.

Rofe Kennard and Lapworth propose construction of Athi Dam, Kitengela Dam and Kapio Dam at the upper reaches of the Athi and Kitengela rivers.

Some of the primary factors influencing industrial development in Athi River town are discussed which include: communication, land availability, proximity to Nairobi, industrial linkage and interdependence on raw materials, water, labour, government policy.

The industrial growth potential in Athi is considerable but can be affected by continued resource misuse. The study being mainly focussed on the Kenya Meat Commission and the East Africa Portland Cement Factory shows that the town industries have no sound environmental protection policies. It is revealed that national policies on industrial development do not reflect enough seriousness on environmental protection. Though the industries continue to grow, they have created major environmental problems which the country might find hard to solve.

The government lacks a legal framework of law that deals specifically with environmental protection. The study therefore emphasizes the urgent need for the enactment of such a law by parliament.

It is shown that our land, air and water resources have limits and their demand is growing. Thus decision on industrial development and other activities should be built on proper understanding of the need to protect the quality of our environment.

National policies should aim at protecting the environment and resources to avoid the problems facing developed and highly industrialized nations.

Study on water sector training needs- Kenya/FINNIDA and MoWD; 1990. Report.

This report is the result of a study carried out through a bilateral agreement between the governments of Finland and Kenya. The overall purpose of this study was to identify the most important training needs within the sector. The study was done in two phases: data collection phase and training needs study. The report begins with an examination of the geography and population of Kenya and the basic structural characteristics of the economy. Past performance is reviewed as well as the financial policy. It is noted that since 1963 the country has experienced a decade of rapid growth (1963-1973); a period of decelerating growth (1974-1979); a period of macroeconomic imbalance and stabilization (1980-1985) and finally, beginning 1985 a period of renewed growth. The report notes that Kenya has varied climatic zones caused by variations in altitude. Average rainfall is 450 mm which is unevenly distributed with some areas receiving as little as 250 mm per annum. Systematic investigation into ground water potential is being carried

out through the water Resources Assessment programme (WRAP). All possible water resources are under investigation. With the water sector development the government aims at bringing about a rural-urban balance and to open up semi-arid and arid lands for increased economy. Sector organizations and institutions involved in water and sanitation are identified. Manpower and training in the sector is examined. The report notes that there is a big difference in the number of professional technicians in the sector. Technical staff are only 1/3 of all staff which implies overmanning in support staff. The people served ratio in Kenya is 1:535 indicating high staffing level and low productivity. Manpower training needs of different water sector organization are discussed. An examination of the training institutes and the universities is made. Finally a proposal of projects and recommendation for the water sector are given. The report has in its appendix a terms of reference for a study on water sector training needs in Kenya.

Training curriculum for water specialists/ M. Tsunoda and K. S. Makhanu.- Paper presented at seminar on water ,sanitation and the environment, 25-29th November, 1991, Nairobi. p.2

The training of water specialists has been spread over the entire spectrum of Civil Engineering disciplines at various levels. The courses have ranged from certificate, artisan, diploma, civil engineering degree, geography, meteorology, hydrology and environmental studies.

Water engineering is a dynamic discipline which has to change with the increasing demand for water as well as the advancement of technology in water resources harnessing. Roughly about 97% of the earth's water resources are oceans and are saline. Only 2.5% of the world's water is fresh water and out of that a small fraction is available to man. The rapidly increasing world population dictates that new technologies have to be sought in order to convert potential water resources into actual water resources that are usable to man.

The training of water specialists has a strong bearing on the success of this inevitable development. This is especially realistic in the third world countries where cheap technology is required in order to optimally manage their water resources against the primary necessities such as provision of shelter, food, health and sanitation. A review of the training curricula for water specialists at various levels and from various institutions is presented and proposal for incorporating new disciplines are presented in this paper.

Demand driven approach for sustainability/ Anne Saxen Rosendahl. - from (sustainability of water and sanitation systems edited by John Pickford et al..); WEDC, 1996. 153p. ISBN 1-85339-339-8.

This book is an edited summary of the presentations made at the 21st WEDC Conference held in Kampala in September 1995. The abstract is from one of the papers presented at the conference.

The paper examines the Kenya Finland Western Water Supply Programme. This programme has the overall objective of enabling the rural communities in Western

Province to develop and mange sustainable water projects. The author reveals that during the first implementation phase more than 3,300 water points and 50 piped water supplies were constructed or rehabilitated. All these were implemented using the Supply Driven Approach, which was found inappropriate.

Phase IV introduced the Demand Driven Approach, as an operational strategy in which the planned activities are determined by the people's demand, willingness and ability to participate in the implementation process and in operations and maintenance of water supplies.

The demand driven strategy empowers the beneficiaries to become controllers of their own development. Under this new strategy the programme has prepared promotional materials in the form of modules to facilitate the communities toward water supply development and sustainability. Each module carries specific information regarding water supply development and sustainability.

The author details the procedures for development of water supplies including the roles and responsibilities of parties involved.

It is noted that the role of the Kenya Finland Western Water Supply programme will mainly be advisory and catalytic in the development process. The programme will provide limited support for the water development.

Sanitation options for Kibera low-income area/L. Macharia.-Tampere:Tampere University of Technology; 97p.

Kibera is a roughly 2.5 Km^2 squatter settlement about 7 Km from downtown Nairobi. The population is about 450,000 people and the population density is 180,000 Km^2. Houses are made of temporary materials. The area is poorly served with basic infrastructure. The residents are mainly tenants of very low socio-economic status.

The main objective of this study was to propose practical alternatives to improve sanitation in Kibera. The study involved carrying out interviews among the residents. The aim of the field survey was to identify the needs of the residents and to find out their ability and willingness to pay for basic urban services. Possibilities of community participation and management were looked into.

The results show that residents have the willingness and ability to pay for basic services provided at a level that they can afford. The scope of community participation is wide in this area.

Roles of various possible participants were studied. These include the government, Nairobi City Commission (NCC), National Housing Corporation, Non Governmental Organizations (NGOs), External Support Agencies (ESAs), local politicians and Kibera tenants and landlords. An informal settlements department is proposed within NCC to oversee developments in informal settlements.

In the development of Kibera, provision of access and solving land tenure issues are prerequisites for adequate success of any sanitation method. Shallow sewers with either communal ablution blocks or plot toilet and bathroom are proposed. Main water reticulation by NCC is proposed while the community or individuals could construct the minor water pipes. Storm water drainage should be either open unlined earth drains or lined earth drains. Silage disposal should be

arranged either with excreta or with storm water disposal. Solid waste management could be either partially or fully community based.

These alternatives were analyzed and the cost estimated. The choice will depend on further analysis and preparation of bills of quantities. Community participation should be an integral part of the project while total cost recovery in the long term is recommended. The project is adduced to be considered financially viable.

Lake Basin wells pilot project.- DHV Consulting Engineers; GoK and Netherlands; 1982, 247p. Paper.

This is a document on a pilot project to investigate the feasibility of constructing shallow wells in the Lake Basin Area, financed by the Netherlands financial aid programme to Kenya.

Three distinct types of project activities that can be distinguished are reconnaissance survey, survey/well siting and well construction

The reconnaissance survey and well siting activities ran almost parallel with well construction following some time later. The survey aims at obtaining information on the shallow to medium-depth ground water hydrology of the area, and on the existing rural water supply situation. It was found that in the Nyanza province a total of approximately 450 wells have been dug under the Ministry of Health programmes. These have been equipped with a hand pump of a local make. Less than 10% of these pumps are still more less operational.

The chemical water quality of the shallow wells was found to be generally good except in parts of Kano Plains and the areas around the lake in South Nyanza where high salinity was encountered.

Surveying for well sites has been carried out using manually operated survey drilling equipment. The applicability of this method proved to be rather limited in the Lake Basin Area. The main reason being that alluvial deposits are much more limited. The area shows a large proportion of consolidated sediments and weathered or non-weathered bedrock, where hand-drilling cannot be used.

Out of the 370 survey drilling only 13 could be approved for construction by means of hand-drilling and 3 by means of hand-digging.

Based on the experience obtained during the pilot project, it is assessed that 30(±) percent of the area of Nyanza Province shallow wells can be successfully constructed.

On the basis of the survey and construction experience obtained it is estimated that approximately 5-10% of the shallow wells can be made with HHD hand drilling techniques, whereas for the remainder hand digging appears to be the most feasible solution.

Based on existing demographic data a total of approximately 5 million people would be living in the rural areas of Nyanza Province by the year 2,000. After subtracting those people that live in areas where piped supplies are located about 4.5 million would still have to be provided with water supplies.

Rural water supply hand pumps project .- World Bank (World Bank technical paper No. 6); 1983; 89p.

This is a summary report on laboratory test water assessments of 12 brands of hand-operated water pumps carried out at a special installation of the Consumers' Association, Testing and Research laboratory, Gosfield. Two of the pumps were shallow well force pumps and the rest were deep well force pumps.

The test programme was extensive and took about 20 months to complete. It included detailed inspection of the pumps as received, including their packaging, engineering assessment with suggestion for designed improvements endurance performance before and user trials. Tests carried out included endurance, performance before and after endurance, impact and handle shock where applicable. Assessments of ease of installation, maintenance and repair were also made. The pumps are dealt with individually and brief details are given of all test results, summarized finally in a verdict.

Many general observations are reported highlighting features which have become apparent as the testing progressed. Recommendations have been made to aid pump selection and improve designs. Technical details of the tests were given in an interim report. The material is intended to assist hand pump manufacturers in improving the quality of their products and to assist the authorities of developing countries in their decision making process on the local manufacturing or import of hand pumps.

Women and the transport of water/ Val Curtis.- London:Intermediate Technology Publications, 1985; 48p. Book.

This book examines some of the problems women have with the haulage of water and investigates whether improved means of transport could help relieve their burden. The book is divided into two parts. Part one looks at the scale of the problem and introduces some alternative transport ideas. Part two is based on field research in Kenya.

In the absence of tap water the majority of rural people rely on women and children for the transportation of water. Many women spend 5 hours of a sixteen hour working day collecting a single load of water. The work is arduous, leads to injury and deformity.

Much time and effort has gone into installing systems to bring water nearer to the homes but these have not been sustainable so most African women have to continue to carry water to their homes the traditional way. Methods of porterage differ with regions. In Asia the shoulder pole and the yoke are used extensively, in China, they use carts and in the Andes the Lamas.

Improvement in rural transport in general and in water carrying can offer some means of helping poor rural people improve their circumstances.

The total workload of women in rural areas is very high. In an investigation carried out by the author in Kenya his findings showed that women went to bed an hour later and had only a few hours rest during the day.

The effects of having to carry water can be divided into three categories: health, economic and social. Carrying loads for long distances requires a substantial

amount of energy which has to come from metabolized food. Since the rural poor often experience shortfalls in available food most women risk malnutrition and become anaemic. Methods of water carrying can result in injury and deformity. People who carry water on their backs with a head strap have marked cranial depression. Maasai, Kamba and Kikuyu women in Kenya exhibit this.

Alternative water carrying technologies are suggested. They include carrying aids; wheelbarrows and handcarts and animal transport and others. The book ends with a survey on the water supply situation in Kenya. The author identifies the problems and offers solutions.

Rainwater harvesting: the collection of rainfall and run off in rural areas/ Arnold Pacey and African Cullis .-London: ITDG, 1986; 216p; ISBN- 0946 688 222. Book.

This is a handbook on the design, organization, and overall implementation of appropriate rainwater harvesting schemes. The main interest of the authors has been methods of collecting and conserving rainwater at an early stage as possible in the hydrogeological cycle to ensure the best use of rainfall, before it has run away into rivers and ground water, or has disappeared through evaporation.

The authors describe systems which they believe could hold out the greatest immediate hope for thousands of scattered , small communities that cannot be served by more centralized water supply schemes in the foreseeable future.

The book defines rainwater harvesting as the gathering and storage of water running off surfaces on which rain has directly fallen and to the harvesting of valley flood water of stream flow.

The material is clearly presented with over fifty line illustrations, eight pages of halftones and ten technical 'information boxes'. It has an extensive bibliography and reference section, case study material of work in Africa, India and South East Asia is included and provides practical examples of the sorts of problems encountered and lessons learned when trying to implement rainwater harvesting schemes in rural areas.

The book is intended for development workers, project planners or managers, policy makers and academics.

Technical and non-technical aspects of externally supported rural water supply projects in developing countries/ Katko Tapio .- Tampere:Tampere University of Technology, 1987; 112p. ISBN - 951-721-207-0.

The study widely covers the technical and non-technical aspects of externally supported rural water supply projects in developing countries.

Improved water supply has some positive impact on health conditions. The benefits increase by proper sanitation and health education. The allocations by international organizations to the water supply sector have typically been two to four percent of their total assistance. The water decade has hardly managed to attract additional external resources to the sector.

A survey was done on the major constraints in rural water supply in four selected countries. Foreign experts as well as representatives of the national governments were interviewed. The difficulties in operation and maintenance combined with logistics were the most severe constraints in all countries as seen both by national governments and foreign experts. The developing countries laid more stress on the lack of trained personnel and funding, whereas the foreign experts and external agencies were more concerned about inadequate cost recovery.

Appropriate technology has technical environmental, economical, financial, social and cultural dimensions. In the implementation of rural water supply in developing countries, low cost technology is in most cases appropriate. However, also high technology, for instance in telecommunication, mapping or in the inventory of deep ground water resources, is needed. Applied technical research in practical water engineering should be increased.

Community participation should not be seen merely as a social activity but should also include involvement and contribution. Pricing of water must be introduced. Women, the main drawers of water, should be involved at different stages of projects. Because of the huge number of external agencies in the sector, coordination is imperative.

Community self-improvement in water supply and sanitation.- The Hague:IRC, 1988.

This is a training manual for community based workers. These workers are seen as useful in assisting the community to develop an understanding of the linkage between water supply, sanitation and hygiene education and improved health. The manual argues that communities can, with assistance from the community workers look for the best feasible solutions considering technical, financial, cultural and social conditions.

The manual is divided into three parts which give information on working with the community; introduction to water, sanitation and health and the related burdens and health risks; options for simple self-help improvements including organizational guidelines.

The part covering working with the community gives ideas and suggestions on how to stimulate and guide the community; to identify their problems and felt need in water supply, sanitation and health; to work out their priorities for improvements; to apply for minor financial and/or technical external support; to implement the improvements; and to operate and maintain these improvements.

In part two, the manual outlines the important linkage between water, sanitation, hygiene and health. The burdens and health risks in water and sanitation practices are discussed.

Part three offers a number of technical options for self-help improvements. To implement these inputs both the community based worker and the community are required. Most are simple to construct, operate and maintain and may require minor or no inputs from outside the community.

Adding guinea worm control components: guidelines of water and sanitation projects.- WASH .- WASH technical report No. 51, 1988; 73p.

This report provides guidelines for adding a guinea worm component to existing large scale national water and sanitation projects. Background information on the diseases is provided. It is a disease which infects rural people who use contaminated water sources. The disease is easy to control and its incidence can be used to test the success of water and sanitation projects in a given geographical area.

The life cycle of the guinea worm is given. Infection of the guinea worm is an indicator of poverty. Girls and women are found to have a higher incidence of the disease than men due to their roles as drawers of water. The World Health Organization has officially endorsed a guinea worm control strategy which includes four major elements.

The report looks at the UNICEF/Togo Guinea Worm Programme. A four day conference to discuss and plan a coordinated inter-service strategy to control guinea worm was held. The immediate outcome of the conference was the establishment of a regional advisory group to implement guinea worm control activities.

The timing, order, and relative importance of interrelated guinea worm disease control strategies will vary according to the nature of the water supply and sanitation programme intervention as well as the scope of existing guinea worm activities. A table shows that guinea worm control activities should be undertaken in various phases of water and sanitation programmes.

A step by step guide to adding guinea worm control activities is provided as collecting information on guinea worm control efforts; identifying interested organizational collaborators or partners; forming a guinea worm task force; identifying guinea worm zones in the project area; deciding on strategy; training personnel; implementing the strategy and evaluating the impact of the programme.

Community health education is stressed as a key to the long term success of any guinea worm control strategy.

Domestic Water consumption patterns in selected areas in Nairobi/ Ngari Samuel.-Tampere:Tampere University of Technology, 1986; 61p.

Domestic water consumption has formed about 50% of the total water supply in Nairobi for the last 10 years. Nairobi City Commission (NCC), which is responsible for the water supply in the city, has rightly classified domestic demand rates.

This study examines the per capita water consumption and variation in domestic water usage in Nairobi West Madaraka and Kahawa West housing estates. A total of 2600 meters which is 3% of all water connections in Nairobi was read. A questionnaire survey was conducted for the purpose of population estimate for each area. Master meters were located at the entry of each study area which had been isolated from the neighbouring distribution networks. Domestic water consumption figures from the billing records of the NCC were also examined.

The results from this study showed that the trend in per capita water consumption is consistent with the classification chosen. The medium income per capita figure of 115 1/cap/day compared favourably with 136 1/cap/day from the

design file and 115 1/cap /day from other studies of similar areas. The chosen high income area was conclusively not representative with 120 1/cap/day compared with 270 1/cap/day used in design in similar areas. The peak factors also showed the expected trend recording to the location classification.

Although these figures obtained from this study are not adequate for design or prognosis, they are nevertheless useful in conjunction with other results which could be investigated for other similar areas.

Remote sensing and GIS for the district water assessment and planning, Samburu District, Kenya / F. K. Karanga.- Paper presented at seminar on water ,sanitation and the environment, 25-29th November, 1991, Nairobi. p. 17

The last few decades have witnessed a gradual creeping of the usage of Geographical Information Systems (GIS) into various technical fields. Water resources management has not been spared. Attention is therefore being given to possible uses of these powerful tools especially in water resources surveys and planning mainly as a way of augmenting the conventional methods used in such surveys.

An enormous range of GIS exists in the market today, with a wide range of capabilities. For water resource studies the more appealing ones are those capable of analyzing remotely sensed images and those which can interrelate with other existing databases (oracle, Dbase, Lotus etc) as well as being capable of a wide range of operations more specific to GIS's (digitizing, map calculations, map crossing, 2-dimensional table operators etc).

Water resources assessment is basically an assessment of all the available water resources in a given area and balancing these with the existing water demand within the same area. The assessment of the available water resources on one hand needs a balancing of all the available spatial inputs (rainfall, run-off, run-in, evaporation etc), while the water demand on the other hand needs an assessment of all the water requirements (human consumption, livestock use, irrigation, industries and even wildlife use , where applicable). Remotely sensed images are already extensively used in the data analyses for such balances.

A case study demonstrating such an application has been made for Samburu District, using Thematic Mapper images and the 'Integrated Land and Watershed Management Information System' GIS.

Models of management systems for the operation and maintenance of rural water supplies and sanitation systems.-Environmental Health Project.- WHO/ Water Supply and Sanitation collaborative Council, 1993; 82p.

The actual number of people served by water supply and sanitation facilities is often less than supposed because many facilities are either inoperative or operating at less than design capacity. In such cases it is usually because management systems have failed to provide the necessary guidance and structure for effective operation and maintenance (O&M).

This report considers the many issues and actors that influence the develop-

ment of O&M facilities in developing countries. It describes models in eight representative countries and offers guidance to planners and designers in selecting the most appropriate one.

Management models are often characterized by the number of management tiers involved. The first tier is the government agency responsible for O&M at the national level. The second tier represents an intermediate body. The third tier is composed of local communities that operate and maintain their own facilities.

A number of issues are presented as influencing O&M management models. These include the capacity of traditional community organizations, health education and community participation, participation of women and several other factors.

Case studies of Botswana, Yemen, Sudan, Indonesia, Benin and Costa Rica are presented. Conclusions are drawn from these case studies which demonstrate a range of management models for the operation and maintenance of rural water supply and sanitation systems. Each model has been shaped by the needs and conditions of a particular country and although most of them employ a three tier management model, the responsibility given to each tier varies considerably.

Potential of remote sensing in hydrological studies/ H. R. Muturi.- Paper presented at seminar on water, sanitation and the environment, 25-29th November, 1991, Nairobi; p 88.

Traditional methods of monitoring the earth's water resources depended upon in situ measurements made at specific points or taking of samples from discrete sites. Ground water can be studied by sample collection from wells, boreholes while oceans, lakes and rivers can be studied by samples collected from the surface.

In situ water measurements made at different locations can be used to build up a record of variation within the water body and such approaches can only form a piece meal attempt to studying the complex and dynamic characteristics of water masses that might be of interest to students and researchers in hydrology.

Thus remote sensing is a useful tool that can be used for resource mapping , monitoring and inventorying of natural resources and provides valuable perspective in areas that are difficult to study in detail using point measurements. Remotely sensed data can be useful in studying resources over large areas and satellite sensors provide the opportunity for regular observations of resources located even in very remote regions of the earth. Satellite data can provide valuable supplements to field data by revealing broad scale patterns that are difficult to locate at the surface.

Currently, several remote sensing satellites are in space and are capable of probing and identifying a variety of physical characteristics that might otherwise be missed by conventional ground measurement techniques. Satellite data can be interrelated to locate ground water sources through identification of fractured areas, faults, jointing and folded areas such as anticline and syncline.

Water resources management: a legal and environmental perspective/ R. Mwangi.- Paper presented at seminar on water, sanitation and the environment, 25-29th November, 1991, Nairobi. p. 61

Fresh water is a very limited and unevenly distributed resource. Although the total extent of the world's water bodies cover 71% of the globe with a total volume of 1.4 billion cubic kilometres, 97% constitutes salt water. Of the remaining 3%, 2% is 'locked up' in solar ice sheets and not readily available. Only 1% of the world's free water is therefore readily available for use.

The abuse or misuse of fresh water by industry or agriculture aggravates the scarcity especially in the more arid regions. It is therefore necessary that prudent and sound management policies should be practised to safeguard and economize on the little that is available. To this end, many scientific and legal methods have been developed and adopted.

The paper examines a number of those natural and human factors which together affect the availability of usable water, either qualitatively or quantitatively, and the interaction between natural water systems and other systems (e.g. the biosphere). Also reviewed is the scientific methods of water management to improve resource availability.

Secondly, the paper examines broadly the legislation which provides for control, preservation, allocation and protection of water supplies thus providing for legally enforceable management policy with punitive remedies, dwelling specifically on the Kenya Water Act.

Health education in developing countries/ A. C. Holmes.- in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 77-79.

This document gives an introduction on health education for public health workers, teachers, community development officers, junior government officers and district administration in designing health education programmes. The problems of health is looked at from the side of the community (human beings and animals, housing, public facilities, climate and other geographical aspects); characteristic diseases (kinds of disease present, number of people affected, geographical distribution, characteristics of community sections affected, seasonal occurrence, nature, virulence, endemic/epidemic frequencies); and authority (set-up of health authority system, money and staff resources, attitudes to problems of ill-health, policy with regard to priorities). Problems at the human level are that people do not always know causes and effects of diseases, that they suffer from many different kinds of conditions and illnesses, often in combination, frequently caused by customs or habits. It is therefore necessary to change (part of) their life style.

The legal compulsion approach, follow-the-leader approach and didactic approach are rejected by the author in favour of health education. Various teaching methods, including teaching through similarities and associations, two-character play, celebrities on tape, discussion groups and conferences are discussed, as well

as problems in using pictorial and audiovisual aids, such as, audiovisual distraction, local colour, preferences, perspective, speed and timing. The need to pretest aids is stressed. Other teaching aids discussed are exhibitions, film, filmstrips, mechanical displays and models (page turner, mirror box, reflector box, running light displays), printed material, manipulated pictures (flannel graph, plastograph and magnetic board), poster, wall charts and ancillary aids (puppets and games such as a health version of "snakes and ladders" used in Kenya). Apart from an increase in health knowledge, beliefs and habits will often need to be changed. In order to help people to change their habits, health education should distinguish between positive, negative and neutral habits. Goals wanted by the people should be established , e.g. taste-oriented rather than health oriented nutrition, and new wants should be created e.g. on the basis of prestige or envy. Planning for a health education programme should be preceded by action from the authorities to give the good example, e.g. by removal of fly breeding places in a fly eradication campaign.

After investigating problems, establishing priorities and paying attention to what people want done, a preliminary survey should be conducted to gain knowledge of resistances and favourable attitudes; difference between individuals, groups and communities in attitudes; level of education, visual understanding and innovativeness; local power structure; opinion leader; role of the district council; undercurrent rivalries and jealousies; previous health programmes; reactions observed and cooperation received; and distribution of disease, causes and effects, local conditions. An example of a tuberculosis eradication campaign is given and attention is paid to personal characteristics, training and roles of professional health education workers.

Impact of economics of community water supply: a study of rural water investment in Kenya/ by I. D. Carruthers.-Kent: Wye College, 1973, (Agrarian Development Studies Report No. 6.)

This monograph documents experience and discusses problems related to rural water development in Kenya. Chapter one examines resources availability and exploitation. It notes that water supply is seen by many rural folk to be an important input for agricultural production and personal welfare. The Kenya government having recognized these needs has embarked upon an ambitious investment programme to provide potable water to all by the year 2000. However, due to the slow pace of public efforts self-help water projects are being initiated. Interest in rural water development is increasing with full realization that rural areas will continue to contain the bulk of the population and reduce urban-rural income disparities. The cities in developing countries have water supply systems which are overextended and operating above design capacity. This often leads to serious deterioration in the quality of service e.g. low pressures, contamination of mains with sewage, use of polluted alternative supplies. The chapter shows a table of water supply condition in selected cities of developing countries. A further table shows drainage areas and main river run off. Population distribution patterns closely follows rainfall distribution

Planning for water and waste in hot countries/J. Pickford. - London: WEDC, 1977, 110p.

There is an important relationship between sanitation and agriculture in all parts of the world. In agricultural areas, the utilization of human and animal wastes is of great importance.

Health standards of peasant farmers are very low due to the continuing high incidence of faecal borne diseases and wide spread malnutrition. Disposal of organic wastes requires special attention to control these diseases. Raising of nutritional levels of existing populations will require increased food production, soil fertility should be maintained by use of human and animal excreta together with community wastes. A properly designed and supervised composting system will substantially reduce faecal born diseases.

An evaluation of village supplies in Lesotho found that water supplies have been the responsibility of the Department of Community and Rural Development. People have moved away from the broader educational and "people centred" activities towards "project centredness". Self help labour is mostly used in construction activities since it is cheaper than daily paid labour. People having an improved supply do not use more water and there is no association between distances from the source and water use.

In Nigeria the scarcity of domestic water supply has assumed a wide dimension in many parts of the country. The large administrative and commercial centres are provided piped water but the quantity available for consumption is far below the minimum requirements. The rural people depend on local sources which are unreliable, unhygienic and not easily accessible.

Political leadership is also required in planning for health care. In developing countries, the only way forward is on a 'do it yourself' basis. The conscious support of the population is also important in planning for health.

A progress report on the Zaina environmental sanitation scheme/ K. W. H. Fenwick; in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 58-59.

A field experiment was carried out to measure the impact of a rural water and sanitation self-help project in Zaina, Kenya, consisting of a modern water supply with farm and school connections, washing and waste disposal facilities in school, a village storage tank, multiple draw-off points, and an enclosed laundry unit. Health education was given simultaneously with the construction of demonstration aqua-privies and latrines with concrete slabs. Before and after the implementation of the programme, surveys were conducted in Zaina and a control village based on the socioeconomic status, personal health, housing, nutrition and sanitation, complemented by pathological surveys. Results showed a greater rate of progress in Zaina than in the control area, in health and development - especially dairy farming. It should be noted, however, that the group of landless farmers in Zaina amounted to 30% in 1961, with a survey coverage of 86%, and to 29% in

1965, with a response of less than 70%, while for the control village these data showed 22% in 1961 with a response of 79% and 17% in 1965, with a response of over 90%. The presence of latrines in Zaina increased for 84% to 96%, with reported use rising from 98% to 99% while dropping in the control area from 94% to 91%, with reported use also dropping from 99% to 98% The level of maintenance observed fell sharply in both the experimental and the control village, probably due to a rise in hygienic standards applied by the interviewers. The author remarks on the lack of enthusiasm for additional projects on latrine, floor and fireplace improvements because of restricted finances, but mentions the building of a women's social hall and the organization of family planning instruction as by-products of the development scheme.

The case for rural water in Kenya / B. Jakobsen, J. Ascroft and H. Padfield in Strategies for improving social welfare, proceedings of a workshop held at the Institute of Development Studies, Nairobi, May 31- June 3, 1971.- in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 82-84

An exploratory "ex-post facto" field study was carried out in high rainfall and high population density area (Zaina), in Central Kenya, to determine the major effects of a small scale piped water supply scheme. The scheme had been functioning for ten years. The control area was selected for comparison in the same location, which was matched on all major characteristics except for the water supply. Data was collected by participant observation over a ten week period by the female member of the research team, followed by a survey of a systematic random sample of 173 households. The sample was drawn from the land registration office for registered farmers and from a list of landless villagers in the chief's camp.

The effects of a piped supply were classified as direct effects of water per se (quantity, quality, accessibility, reliability) and of time release; indirect effect of adoption and expansion of livestock activities, of improvement in animal health and welfare, of improvement in crop husbandry, of improvement in human health and welfare, of increase in formal and informal social participation and of increase in farm welfare; and negative effects, of nonpayment of water fees, of loss of employment for water hauliers and of changes in land tenure.

Indicators used to measure the indirect effects were the number of grade livestock, yearly income from dairy milk production, small scale irrigation, membership of voluntary associations, in particular women's groups and more intensive agriculture. No empirical data were collected on public health and informal social participation, but participant observation suggested an improvement in both fields.

Data were analyzed separately for farmers and villagers in both areas, while farmers were subdivided into more and less progressive, the latter subdivision allowing no statistically reliable conclusions however. The data bore out that

the two areas were basically similar except for their water supplies. Results indicated that only half of the scheme population benefited from a year-round supply, presumably due to the limited capacity of the supply and the population growth in the area, but the use of neighbours' and communal tanks increased the population benefiting to 4/5ths. Time gains for the functioning parts of the scheme were 35 minutes per person per day, with an average of three (mostly female) water-hauling members in each household.

No significant differences were found for adoption and expansion of livestock activities and improvement of farm enterprise but the average yearly income from dairy milk sales of prcgressive farmers was nearly three times that of the control area. Membership of women's self-help organization was almost twice as high in the supply area.

In the control area water hauliers were employed by 30% of the farmers and 22% of the villagers, while in the supply area these figures were 10% and 0% respectively, suggesting loss of work and a short term negative impact on the scheme. Nonpayment of the fixed rated (Kshs. 60/year for individual tanks and 20/ year for communal tanks) was found to be substantial, with no payment by all villagers and by 25 % f the farmers. Payment of smaller amounts linked to crop sales could improve this situation. Cutting off of non payers had started recently. The number of farmers increasing their holdings to two or more plots was substantially higher in the supply area than in the control area, indicating a tendency of less fortunate farmers to sell up and join the city's job seeking proletariat.

The authors conclude that there is no single outstanding effect of introducing water for human and animal consumption in a high density, high potential area. If production effects are wanted, additional inputs are necessary. When piped water is provided as an isolated input, the chief effect will be on welfare. The introduction of water schemes is one major aspect of a comprehensive development programme. In view of the short term impact on less progressive farmers with less water needs who in effect subsidize more progressive farmers with greater water needs, the authors advise the enumeration and classification of beneficiary populations in terms of call indicators by means of survey sampling, in addition to the technical surveys carried out.

The rural development fund - Kenya/ Lise Ø stergaard, 1986.

The Rural Development Fund (RDF) was established in 1974/75 to combine two different programmes, the District Development Grant and the Rural Works Programme aimed at supporting small scale development projects in rural areas of Kenya.

The objective was to mobilize local under utilized resources for rural development by assisting self help groups in providing financial and technical assistance.

RDF has had serious administrative problems over the years. These related to bureaucratic machinery, and low completion of projects.

The impact of RDF on women can be seen in various perspectives. It may increase the income generating ability and the labour burden of women in a positive as well as a negative way.

A number of recommendations on the usefulness of RDF are noted. It is seen as a potentially suitable instrument to support women's productive efforts in rural development in Kenya.

The reports advocates for an improved system of information about the fund to enable women benefit from it. Further, it suggests that a simple and clear communication line from the grassroot to the ministry and back is imperative in order to avoid standstill and failures. It suggests that RDF focus strongly on education, teaching women the necessary skills and tasks to run these projects.

Measures to coordinate women aspects are also suggested at national, provincial and district level.

Issues in development research: the case of water in Kenya/ H. Padfield. Paper presented at the workshop on strategies for improving rural welfare, May 31-June 3, 1971 . - in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 128-130.

The relation between policy and science is discussed with regard to the water development programme in Kenya. Numerous and varying water systems exist, on which no regular feedback is available, while a water development policy is becoming an operational reality. This policy is based on the social and political situation and defines water development schemes primarily as human impact programmes.

The role of the scientist is limited to assisting the planners in forming a policy rationale. This rationale will be biased by the type of science involved (economics, sociology, anthropology). In Kenya the present rationale is a macro-economic one, which defines water development as production impact programmes.

The author distinguished four biases from this contradiction between policy (human impact programmes) and policy rationale (production impact programmes):

(1) An overemphasis on the singular importance of water development expenditures for economic development, which is not borne out by the actual number of schemes and the number of people these schemes have to serve. Nor is it apparent from the planned and actual proportions of the total budget spent on water, which were 4.04% and 1.99% for 1968/1969 respectively, and should be 4.47 % in 1973/4.

(2) The use of economic cost/benefit criteria to develop decision rules for the implementation (and evaluation) of policies which are the consequence of welfare norms and social demands. The use of before-after studies in time and motion to measure production benefits is criticized for its relatively high costs.

(3) The emphasis on production as the prime objective of water development. The concept of "released time" is attacked as actual results of a piped supply could be more leisure or open unemployment and, at the best, an equal quantity of water for the water hauliers, who usually belong to the lower strata; while their employers from the higher strata will get equal and often larger quantities of water and save costs of wages.

(4) The use of areas as a basic concept for water development programmes and impact studies, while ignoring the sociology and micro-economics of beneficiary populations. In low as well as high potential areas microstrata of the poor will exist, causing competition for benefits.

A hypothetical case is used to illustrate the effects of production oriented selection criteria for scheme allocation and a social welfare oriented design (with e.g. low per capita capacity and non metered house connections) on the operation and maintenance of the scheme.

The author stresses the importance of broad interdisciplinary social science research, studying differential impacts on various institutions, socioeconomic classes and economic activities. The existing roles in the distribution system (hauliers for self, for self as well as others, employers of hauliers) and existing water consumption patterns should be studied and compared, taking into account other status classifications (age, sex, kinship, ceremonial position, political and economic position, occupation, size and type of farm etc). He also advocates the development of selection criteria for calls for behaviour specific schemes, rather than area specific schemes, such as need criteria, social stability and cost criteria.

Community participation in water supply and sanitation programmes: suggestions for priority research areas and strategies/ J. Stromberg.-in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p.181-182.

A distinction is made between the necessity to identify or develop appropriate technologies ('hardware') and to define and overcome major behaviourial and operational problems ('software'). The interaction between the hardware and software of appropriate technology will be essential for the solving of water supply and sanitation problems at village level.

Community participation is a key factor, but there is an unfortunate tendency to interpret this in terms of "cheap labour" and to burden the villagers with too heavy responsibilities, while the assessment of the community's own needs and priorities, as seen by themselves, is neglected. A second misconception is the assumption that the communities lack the ability to define realizable needs and priorities, and to choose, plan and implement solutions, so that the intervention strategies are technically oriented and centrally based. Outside expertise is necessary but must be made to harmonize with community priorities and needs.

The primary health care approach calls for a partnership between the participating community and extra-community resources and support, and close links with other sectorial activities, such as nutrition, mother and child health, immunization, family planning, education, agriculture, housing etc.

Research priority should be given to matters of installation and maintenance. With large percentages of pumps out of order, it seems more reasonable to focus first on problems of providing and maintaining pumps than on attitudinal questions of why people do not use pumps when they are provided. Other research

priorities are the development of training programmes for technical staff to work with communities rather than for communities, planning methods which can be used by communities, schedules for construction and operation, which are adapted to the time frame and work habits of the community, adapted arrangements for loans and financial support mechanisms in construction and maintenance and adapted management/collection/financial schemes.

Most research attention should be directed towards community oriented operation and maintenance schemes, including the development of training and maintenance schemes for local technicians, with the extra community support necessary. For this reason all questions and problems relate to the technical design and testing. Emphasis should be placed on directly applicable results, necessitating the improvement of communication channels between the various levels and agencies and the building up of multi disciplinary institutional strength.

Toward a fuller appreciation of community involvement/ G.A. Vierstra.- paper presented at the international training seminar on community water supply in developing countries, 6-10 September, 1976.- in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 194-196.

Local participation in water development projects should not be limited to self-help activities in the construction phase of a supply, but include identification of community priorities, collective decision making and cooperative action to attain designated goals. An example of gradual mobilization of community involvement for an improved water supply is the Kiaria Self-Help Water Project in Central Kenya. The project, extension of the hydro donated to the local secondary school for the village water supply, was initiated in early 1969 by two community leaders. A committee was formed, including six other men and two women, and the project was discussed in the weekly village meetings, in which initial contributions in both labour and cash, membership fees and monthly maintenance payments were fixed. At first scepticism prevailed and only 20% of the local households joined the project. The membership meeting voted for home standpipes but against irrigation, private storage tanks and water meters. Problems due to attempts of an influential villager to change the siting of the supply extension solved by technical arguments (the insufficient altitude of the site). Construction began in August 1969 and membership rose to 40%. Problems with failure to fulfil labour obligations resulted in the decision of a general meeting to strike the members concerned off the rolls. Construction was completed in July 1970.

Pollution from upstream villages was a problem, but suggestions for quality improvement were rejected in favour of a cattle dip in 1972. In 1973, project members voted for contributions for an additional electric pump to increase water quantity. Membership continued to grow and in 1974, 80% of the households had joined, paying an extra sum to compensate for failure to provide free labour. Disconnections due to failure in paying maintenance fees were few. Apart from

domestic use, piped water was used for watering domestic animals, and average use was 35 litres per head per day. Because of its muddy appearance only half of the members used it to for drinking water; many preferred to continue using rain-water or well water for this purpose.

Socioeconomic impacts of the improved supply have seen an increase in cattle raising, including the construction of a cattle dip, an extension of similar water projects to adjacent sections and project for electrification.

The author concludes that local initiative , commitment to wide responsibility, user participation in project decision making, even distribution of benefits and gradual mobilization of the community by sustained effort all contributed to the success of the project. He stresses the influence which the stage of development of the community has on its capacity of successful community involvement, and advocates the use of "mobilizers" for guiding the community involvement process, when communities lack a "cooperative mind". Suggestions for a community participation approach are to use persons trained in mobilizing communities, to begin community participation at the earliest possible phase and to promote participation by women whenever culturally possible. A high degree of community control be accepted over all project acts and decision in planning, design, construction, operation and maintenance phases. This implies the use of technologies suited to village levels. Community members should be trained in management adminstration, maintenance and repair and a clear definition and division of responsibilities of government and community should be made. A social analysis is necessary in addition to the usual technical/ health/demographical ones. On a major (regional) scale prior to selection and allocation, in order to classify villages on the degree of probable receptiveness to an improved water supply. Action research on the process of community involvement should be included in rural water programmes, and a reference catalogue of management systems, based on case studies of water supply projects under various social, economic and actual conditions should be compiled.

Gender participation in community structures for water management in Ghana/ Jessie Sena Kuma. - a paper presented at the ITN conference Harare, 5-8 December, 1994.

The significance of community participation in managing water and sanitation facilities in beneficiary communities has been acknowledged by the five main projects operating in the water and sanitation sector in Ghana. In addition to the general community participation, strategies have been evolved to involve women in decision making at all the stages of planning, implementation and evaluation of the programmes in the communities. To be able to achieve the objectives of this strategy and sustain it, institutional structures have been put in place from the governmental to community levels.

At the community level, the institutional structure in place is the management group referred to as the water and sanitation (WATSAN) Committee. The importance of the role of women is equally reflected in the minimum number of women who have to be elected to these committees. For these committees to function

effectively capacity building activities have been designed for the members of the committee.

However, experience has indicated that, women are not fully participating in the activities as their men folk even though water and sanitation activities are primarily female responsibilities. In view of this, it is a myth to infer that once a project recognizes the importance of community participation women will automatically be involved in water and sanitation activities. It is becoming clear that unless women are specifically targeted for water and sanitation activities and strategies developed to enhance their participation, women's participation will not go beyond tokenism.

The role of cost recovery in water supply in developing countries/ by T. Katko. - Tampere: Tampere University of Technology, 1989. - 246p. Book.

The study deals extensively with cost recovery in water supply in developing countries covering the costs, consumer's ability and willingness to pay, water tariff structures as well as fee collection and financial management.

Cost recovery is one of the key requirements for sustainable development in water supply and sanitation. The fundamental requirements for introduction of cost recovery in water supply is that used technology is capable of supplying consumers with water. The policy of supplying free or very cheap water has often led to very inequitable situations. The governments of developing countries, in spite of external support have not been able to arrange water supply to all and only some consumers receive free water. This service benefits mainly the better off consumers instead of the poor in cites and rural areas. A better and more equitable method would be to collect water fees from middle level and large consumers via progressive tariffs.

The best evidence of consumers' actual willingness to pay for operative service is the commonly practised vending and reselling of water. Consumers may pay 20 to 30 times more for vended water compared to the alternative sources This door to door is a challenge to water suppliers. Water charge structures and collection require innovative solutions. In addition to monthly billing several other alternatives exist from spot cash payments to seasonal ones. In community managed systems consumers can make largely non-cash contributions. In rural areas the major constraint in cost recovery is the lack of proper institutions which could delegate as much responsibility as possible to the local level.

The institutional problems seem to be the result of the inappropriate role of the parties concerned; the government, the water utilities, the consumers and the private sector. The government should concentrate on policy issues and support whereas the others should share the tasks of construction, operation, maintenance and management.

On the whole water supply should be seen as an infrastructure service rather than a social service because water supply always involves certain costs. Since water resources and cost vary a lot in different conditions, several technical alternatives, instead of only one, should be offered to consumers. This would make it possible to charge each consumer group fairly.

Defining Community management/ Matthew N. Kariuki. - a paper presented at the ITN conference Harare, 5-8 December, 1994.

Defining community management is not easy. Community management as currently perceived in the water sector may be considered to have evolved over the last years. However, there are examples of various forms of community management which have existed for the last two decades.

Examples of various forms of community management in Kenya, Malawi, Uganda and Lesotho have been briefly described. The contemporary view of community management as analyzed and reported by the Working Group on Institutional Management Options of the WSS Collaborative Council is cited. The IMO report was presented in the 3rd Collaborative Council meeting in Barbados in October/November 1995.

Sustainable community management may be considered to revolve around five important principles i.e. *enabling environment, institutional development, human resources development, technology and level of service and financing*

There are two management options which are considered to define sustainable community management. These are public ownership with operation delegated to communities and community ownership and operation.

Both options could yield success in the management of water supply projects. However, the choice and implementation of either option should depend on the socioeconomic status of the respective community and the political environment and legal framework in which the community operates.

The impact of rural water supply projects on women/ M. Whiting and A. Krystall.- in Participation and education in community water supply and sanitation programmes: a selected and annotated bibliography/ prepared by Christine Van Wijk-Sijbesma.- the Hague:IRC, 1979; p. 206-207.

A study of water collection and water use patterns was carried out in 4 rural communities in Kenya. It dealt with the impact on women's time budgets and with perceived personal and general benefits, negative impacts and problems. The communities were chosen from 53 self-help water projects. Selection criteria were the varying potentials of the areas (high, medium and low potential) and the level of service (two schemes with communal water points, one with house connections and one with both). Self-help contributions in labour and local materials for 49 of these projects amounted to 41% of the total costs. Data was collected before and after installation of a modern supply in 3 communities and from users and non-users in the 4th. Reliability, representativeness and comparability of the data are low, however, because the 50 female respondents in each community were selected from the attendants of a public meeting called for this purpose, because the women interviewed during the follow up study were not necessarily the same as those interviewed for the baseline and because the data collection for the baseline was during the dry season, and for the follow-up during the short rains. The study should therefore be viewed as a series of case studies.

It was found that a negative relation existed between the number of trips and

the time needed for collection, regardless of any improvement to the system. Six hours was found to be the maximum amount of time households were willing to spend on the daily water collection. Some, or all, of the time saved through a closer supply was used for increasing the amount of or water collected for household and animal use. Those families who used to fetch water regularly for various purposes about the house tended to go more often, and thus fetch more water from a closer supply. Families who usually fetch water for a specific purpose each time ("single-purpose trips"), did not, as a rule, go more often, consequently they gained time for other activities. No reduction in workload was found for the women interviewed, because they no longer got assistance from other (mainly other female) members of the household in water carrying. Appreciation of health benefits for children and adults was relatively low, but cleanliness of children and time advantages in water collection were values. Other perceived benefits were time gains, personal hygiene, clothe washing for adults, regularity of meals in one village, and in another, with a high number of grade cattle, provision of drinking water for animals.

The highest general advantage perceived in all communities was for farming in general, followed by cleanliness of the children (with regard to household hygiene), and attendance of meetings (regarding sociability). The main perceived negative impact was that of self-help and was negligible. Perceived negative effects for water hauliers were mentioned in only one community by 3% of the respondents. The complete questionnaire and baseline study data on 8 additional communities are added in two annexes to the report.

Governance and water resources in Africa: linking water with institutional development/ Cleophas O. Torori. - a paper presented at the ITN conference Harare, 5-8 December, 1994.

The experiences of many countries in Africa has shown that whether a rich resource endowment promotes economic growth depends not so much on the resources themselves, but how the resources are being valued, used and managed. This in turn depends primarily on the governance systems, policies and institutions in the community. Sustainable development itself depends on there being systems of governance which promote community involvement in natural resource management and problem solving. The concept of governance in relation to the environment has primarily been developed in the international context. This paper examines how this concept can be understood at the national and local levels, and in the context of the needs and concerns of local communities. The term governance as it relates to the decision making process and its interaction between the community and the state and between states has been addressed.

This paper discusses environmental governance and institutional development in local level water resources management with reference to dry land Africa. The roles of the citizens and government, and of social reciprocity are examined in the context of environmental management. The increasing potential for conflict over water resources prompts an urgent examination of past approaches to resource management. An innovative approach is being taken to ground governance in a

specific natural resource- water- at the national and local levels which may assist in developing viable new approaches.

The paper also addresses the importance of conducting policy research in developing countries to generate options for policy reform which would support sustainable and equitable community based water resource management. Building a process of consultation with stakeholders through which potential users of the research are involved throughout the research process, including policy makers, NGOs and community organizations is discussed.

Collaboration in water and waste engineering in developing countries/ J. Pickford and M. Murphy. - London: WEDC, 1979, 139p.

Progress in the field of community water supply and sanitation in developing countries has been slow. The recent survey of water supply and excreta and waste disposal services done by the WHO in 1975 found that 62% of the third world population excluding China lacked safe water supply and others lacked adequate sanitation.

In Brazil, there is a high rate of population growth and industrial expansion. Due to its territorial extent, diversity in regional resources and climatic problems of water and waste disposal reach great proportions. The provision of water and sewerage facilities by the end of the 60s was not favourable. The government then initiated the National Sanitation Plan (PLANASA) which provides finance for specific public health engineering works in accordance with regional programmes prepared by the state based sanitation companies. It also provides treated water and conventional sewage facilities.

The incidence of water-borne diseases and other intestinal disturbances caused by pathogenic micro organisms has decreased after the implementation of PLANASA. Life expectancy has also increased.

In Northern Ghana, a regional water supplies development programme was implemented as part of Ghana's Upper Regional Water Supply Project. This project was jointly financed by the government of Canada through a loan administered by CIDA and funds provided by the government of Ghana. The project aimed at producing safe water for domestic purposes to the rural population of the upper region, involving villages in operations and maintenance of hand pumps and sanitation conditions at the well site.

Sana'a the capital city of Yemen Arab Republic is growing rapidly and there is a high rate of population increase. Poor sanitary facilities call for modern sewerage and refuse collection services.

A study conducted by Howard and Sons revealed a serious problem of abstraction due to increases in domestic and irrigation demands which has caused a significant decline in the water table. Sana'a has no municipal or public sewerage system. Water-borne diseases abound due to poor sanitation. The environment had to be improved through effluent reuse and consideration of disposal methods.

The south pacific Island has also been examined and reveals endemic cases of filariasis and typhoid.

Water; a sector policy paper. - SNV Netherlands Development Organization, 1986; 51p.

SNV has been involved with water development in Kenya since 1974. Up to date the experience comprises of some 50 man years, made up by 19 assignments to 10 host organizations.

The main purpose of this water policy paper is to analyze this past experiences with the water sector. Based upon this analysis policy recommendations relating to (future) assignments by SNV-Kenya in this sector will be formulated.

The water programmes of the host organizations SNV has been involved in are/were mainly focused on water supplies for people and livestock as an integral part of such supplies. This is the approach reflected in this paper. Other approaches might apply for arid and semi-arid areas.

In chapter 2, the general situation on water development has been described. It deals with the efforts made by the GoK - MOWD to achieve its target of providing safe and accessible water to the entire population by the year 2000. The chapter also describes four donor supported programmes in the water development sector in Kenya. They are programmes supported by Swedish International Development Authority (SIDA), the Norwegian Agency for International Development (NORAD), the Kenya - Finland Cooperation (KEFINCO), and the Lake Basin Development Authority.

Chapter 3 describes SNV's involvement in the water development sector in Kenya. Lessons learned in these years are analyzed. Based upon this analysis the conclusions and recommendations are formulated in Chapter 4 and summarized in Chapter 5.

This paper should not be interpreted as an expression of static policy, but rather as a strategy for SNV-Kenya to participate in the dynamic process of water development.

Kenya water development department, country situation paper, Kenya, Nairobi: 1967. 18p.

Kenya is a country lying in the equatorial latitudes and experiences differences in climatic conditions. The country is generally hilly and has numerous springs and streams which rise on hill slopes and feed rivers which are perennial.

Rainfall is average although there are extremes in rainfall distribution with some areas receiving inadequate precipitation to ensure enough vegetation for nomadic pastoral peoples requirements whereas others receiving more precipitation than is required.

Kenya possesses extensive ground water resources which are under developed, except in Nairobi. The conservation, control, apportionment and use of the water resources of Kenya falls under the provisions of the Water Act Cap. 372 of the Laws of Kenya. The Water Development Department (now Ministry of water) implements the government's water policy throughout Kenya. Water supplies in the rural areas of Kenya shall be developed.

The municipal and local authorities operate and manage 12 gazetted urban water supplies.

In the arid and semi-arid areas of Kenya the provision of improved water supplies for the people and their livestock is a social necessity.

There is need for water conservation in the drier areas of Kenya and a number of conservation techniques have been introduced with successful results. There are subsurface dams and rock catchments.

Most sources of water in Kenya remain comparatively free from chemical or biological pollution. Incidents have been recorded however, both inland and at the coast and it can be seen that as the country develops pollution becomes increasingly serious. There are many instances of pollution affecting the sea or fresh water areas. River flooding in Kenya is not disastrous as in the other countries. Flood control measures have been confined to localized embankments to contain spilling from the rivers flowing into lake Victoria.

Study of the water sector in the rural development fund. - GoK - Ministry of Planning and National Development and DANIDA, 1990; 33p. Main Report.

The report outlines the findings and recommendations of the RDF water projects in Kenya. The objective of the RDF at inception was to stimulate development at the grassroot level that was based on user ownership, and maintenance.

The report notes that RDF water supply projects are approved and implemented with insufficient preparation both on the technical side and on the mobilization and participation of the beneficiaries.

New RDF objectives give scope for better preparation and follow up. One of the objectives suggested is that community based water supply projects should be operated and maintained by users. In line with this objective several recommendations are presented.

The report reveals that there exists 1000 RDF water projects. A selective study of these projects was undertaken in the following areas: high potential areas -Kiambu; medium potential area - Siaya and South Nyanza districts; semi-arid area - Kitui district; arid area - Garissa and Wajir districts; coast area - Kilifi district.

Projects visited in the select sample are listed and limitations of the study due to a number of factors are outlined.

The study observed that there are various organizational problems related to project procedures. All these are enumerated. The study further observes problems with the technical implementing ministries like MoWD which start projects but do not have capacity to implement all of them.

The report provides a list of water supply projects and indicates the operation and maintenance situation as it was found in the field. On the sociological aspect the study team found that there lacks a definite system on how user committees are formed or elected. Attitudes of the beneficiaries are also documented.

The design and construction of small earth dams in Kenya/ R. B. Sawdon. - Nairobi: Government of Kenya, 1969, 12p.

Small earth dams refer to dams in which the maximum water depth does not exceed 16 feet or whose storage capacity does not exceed 50 acres.

Dams are constructed to store and conserve water flowing in a river or stream for use during periods of dry season.

The majority of dams built in Kenya are subsidiary dams. Before subsidy can be granted and before the dam can be built an application for water permit must be made by the person requiring the dam. This gives one the licence to abstract water from a river.

The capacity of the dams should be sufficient to provide water throughout periods of prolonged drought. This makes it necessary for the engineer to know the actual demand to calculate the storage capacity,. A suitable site for constructing the dam should be chosen. In designing the spillway, it is necessary to estimate the run-off. Experience shows that the most common form of dam failure is "over tapping" due to inadequate spillways.

In construction of earth dams, two main types of embankments are used - homogeneous and zoned. For homogeneous construction, coarse grained soil is suitable. Dams should be provided with draw-off pipes to ensure that water users downstream get their fair share of catchment run-off. Before commencing any work, the operator must be fully conversant with the design drawing. He shall locate all benchmarks and reference pegs and be satisfied that the dam can be adequately set out from the information.

The dam walls should be trimmed off by hand to ensure a smooth and even finish and the wall and top of the dam should be grassed.

In case there is danger of siltation the dam run-off on the sides of the reservoir cut off drains can be dug to pass this to downstream of the dam.

Soil and water conservation in Kenya. - D.A.E (University of Nairobi) and SIDA, 1986, 576p.

The rapid population growth and raising expectations in Kenya calls for an urgent increase in output from land on a sustainable basis. This calls for proper utilization of soil and semi-arid parts of the country e.g. Machakos. There is inadequate supply of both surface and ground water resources. Current population projections for the future enable one to estimate the future demand for water. Rainfall is characterized by low total amounts, strong seasonal concentration and a high temporal and spatial variation from year to year and season to season. There is over exploitation of the vegetation to supply fuel wood requirements. This makes the wide variety of plants and soils in the grazing lands to exhibit degradation. Production systems are based more on subsistence strategies than on commercial practices. Small scale pastoralists place great cultural value on communal organization and public control of resources. There is indiscriminate burning of vegetation resulting from farming practices like the use of fire for land cleaning, renewal of grass cover, tick control, honey collection and hunting.

Planning is needed for integrated management of grazing land resources. Water

management both of sources and distribution is a bottleneck to grazing, land management and improvement.

In most parts of Kenya like in Baringo district run off harvesting is practised. In areas where rainfall is used insufficiently like in Kitui district, drought and famine are synonymous. Soil conservation should therefore be carried out in such areas. In some areas with dense population and small farm sizes especially in Central Province it is not easy to obtain sites for water ways for disposal of run-off. In such areas closer spacing of the terraces to hasten the formation of level bench terraces would diminish run-off to negligible amounts.

Women hand pump mechanics in Kenya/ by Lane Hoffman in Waterlines Vol. 11 no.2 (1992); p 19-21.

This paper notes the importance of putting the tasks of operation and maintenance of hand pumps into the hand of the people who are the main users, the women. The paper notes that the women of western province in Kenya have been trained and equipped with essential tools to repair hand pumps under a government supported rural water supply programme funded by FINNIDA.

Women are seen as the key factor in the successful operation and maintenance of hand pumps in their villages. They are responsible for the availability of water in their homes on a daily basis hence, the responsibility of ensuring efficient functioning hand pumps. This has reduced the time spent in fetching water from far off water points and decreased the expenses involved in hand pump repair.

The new role and status assumed by the women mechanics has motivated them into commitment and devotion to work. However, the paper notes that the new roles assumed by women have brought with them new problems. These are unrelated to the project or the beneficiary communities. They relate to the costs. The tasks undertaken have no pay or remuneration of any kind yet they are time consuming. There is therefore a loss of work days when they have to operate and repair the pumps in several villages.

The apparent revelation of this paper is that the full cost of women's participation in hand pump maintenance had not been appreciated. The paper concludes that on the whole, the value of the women mechanics' time and work was slowly experiencing recognition.

Political and administrative factors influencing Kisumu Municipal Council in service provision, housing, water and health.

Food, shelter and health are the basic human needs. There are two types of medical institutions in Kenya, public and private. These institutions face problems of overcrowding, long waiting lists, unavailability of drugs. This paper presents a case study of health, water and housing in Kisumu district.

According to the 1981 annual report of the Provincial Medical Officer of Health, Nyanza Province and that of the municipality (1983) shows that a large population suffered from Malaria while very few people suffered from Bilharzia. The incidence of Malaria and water borne diseases are equally demonstrated in Kisumu.

Kisumu is considered an epidemic focus of CHOLERA which breaks and spreads fast in the peri-urban zones. The problem of water-borne disease is serious during heavy rainfall. Health care facilities in Kisumu are inadequate.

Due to the incidence of tropical disease, demand for health services is high. Kisumu gets its water from two sources - the Kajulu water works on Nyando escarpment and the Lake intake and treatment works on the shores of lake Victoria. The method of raw water treatment employed is a conventional two stage with chemical assistance and disinfection. The Watson Bank Reservoir was constructed in 1970 to provided storage for consumers in the higher areas. Most of the residents in Kisumu get their water from Kibuye reservoir tanks.

Kisumu lacks water facilities. The old and new water pumps were to be repaired since water pumps at Kajulu were plagued by frequent mechanical breakdowns. Sedimentation tanks also need repair. There was a problem of lack of spare parts due to lack of finance.

The quality of water provided to Kisumu residents was poor because of lack of supplies especially chemical and fuel. The council supplies poor quality due to lack of equipment for testing water and there is evidence that Kisumu residents have been consuming low quality water.

Sustainable water pollution control technology in the south: issues and options/ by Kenneth O. Iwugo; Waterlines Vol. 14 no. 1 (July, 1995), p. 5-9.

With the advent of independence in the last 50 years low-income countries in Sub-Saharan Africa have experienced rapid urbanization, unregulated exploitation of mineral resources, unplanned industrialization and ambitious agricultural development projects. This has led to increased environmental degradation and in particular all types of water pollution.

Poor water supply and environmental infrastructure are noted in the countries of the south. All forms of land based water pollution persist and lack of technological, economic and legislative mechanisms are noted.

A number of factors are described as characterizing water-borne sanitation systems. These are identified as a low rate of household connections to sewers, low volumetric capacity, small decentralized sewage treatment plants, extensive use of septic tanks, unregulated discharges of untreated and unsuitably pretreated, industrial waste waters into open drains and the discharge of leachate from unregulated and unattended waste dumps into open drains and sewerage systems.

Dissolved oxygen depletion and eutrophication are identified as the most visible water pollution problems in developing countries. The paper notes that developing countries in Africa and Asia lack effluent quality standards. Systematic and reliable data on sewage, sewage effluent, and river quality is also scarce. The paper reveals that there has been rapid advance in the process development and full scale trials of several low-technology waste water treatment plants such as waste stabilizing ponds, constructed wetland (reed beds) rotating biological contractors, up flow anaerobic sludge beds and bio-sand filter. Trials have been made

in India, Brazil, Colombia, Kenya, Tanzania, Zambia and Zimbabwe among other countries.

Stages of development of sewage treatment plants are suggested and strategies and implementation mechanisms for water pollution control are provided.

Clean up your act: development theatre for water and sanitation/ Louise Levert in Waterlines Vol. 14 no. 1 (July 1995); p. 27-31.

The experience of Rural Domestic Water Supply and Sanitation Project (RDWSSP II) based in Nyanza shows that getting a message across to the community is not a simple case of having trainers in the field. The programme aimed at spreading the message about the benefits of better hygiene practices among other objectives. The long term objective is to provide 1000 water points and a large number of latrines through community participation. A pilot programme using two local theatre groups is decided. The process of executing the message is outlined. Villages as well as schools form the basis of the action from the two groups. Evaluations of the audiences's reaction are carried out by both the theatre groups and external researchers. From the two evaluations the audience reacted by indicating both weaknesses and strengths and how improvements would be done. Results of these activities revealed that drama was most interest-provoking as what was remembered came mostly from plays. An extensive evaluation of the people's reaction is provided. However, limitation to the use of theatre was noted. The findings of the pilot project suggest that theatre for development should be combined with other ongoing pilot projects which involve schools and other institutions. The paper presents the ten messages which formed the basis of the pilot study, statistical information and respondents' answers to the survey carried out after the pilot study is also provided.

Drinking water deterioration: an urgent problem part 2/ Teun Bastemeyer and Micheal D. Lee in Waterlines Vol. 11 no. 2 (1992) p. 22-25.

The authors define small water sources as those 'generally used by smaller communities and are affected most closely by the communities themselves.' Large water sources are seen as those which usually support a mix of large and small communities at the different locations, and their problems have a wider range of both indirect and direct causes.

Problems affecting the former water resources are summarized in a table. These are contamination, chemical pollution, high turbidity, pit latrine seepage, septic tank overflow; problems of human and animal waste disposal and environmental degradation. Five categories of impacts of the small water sources are identified. These are microbiological contamination, chemical pollution, yield reduction from failing supply, yield reduction from competing demand and yield reduction from land use change.

As for large water sources a table is provided summarizing the impacts on quantity, quality and reliability. These impacts include the exploitation of ground

water beyond sustainable yields; seasoned changes in river flow and quality, the pollution of surface and subsurface sources by industrial discharges, pollution by agricultural chemicals and pollution by sewage waste.

Future actions aimed at addressing the problems from national, regional and local levels are advocated. Suggestions for improving and alleviating the situation include improved household sanitation and at a collective level; physical protection of water supply systems; soil and water conservation, reforestation; treatment of industrial waste and controlled use of agricultural chemicals.

Actions speak: the study of hygiene behaviour in water and sanitation projects. - edited by Marieke T. Boot and Sandy Cairncross. - The Hague: IRC, 1993. - 139p. ISBN 90-6687-023-0.

This book is the outcome of a workshop on the measurement of hygiene behaviour, held in Oxford, England, in April 1991. It takes the papers and discussions from the workshop as the basis for a comprehensive analysis of the ways that hygiene behaviour can best be studied and interpreted so as to provide information needed to get the best out of water supply and sanitation and hygiene education projects.

A liberal use of practical examples helps to demonstrate the book's recommended approaches for overcoming recognized difficulties in gathering and analyzing data on sometimes sensitive and personal topics. The combination of anecdotes and practical advice covers the planning and pretesting of hygiene behaviour studies, including the involvement of community members in study and design and information gathering. It discusses the pros and cons of different interviews and observation methods, and the types of behaviours which are most relevant to the achievement of health improvements.

Among it's conclusions is an emphasis on the importance of understanding the local socioeconomic and cultural influences on people's behaviour as a key input to subsequent project initiatives.

The role of small irrigation schemes in Africa/ Geoff Pearce.

The rapid increase in population in African countries has created the need for improved systems of agricultural production. Irrigation is often promoted as a means of meeting these requirements, but is not the only choice.

The need for irrigation varies from zone to zone depending on rainfall potential. Although there is a large amount of land suitable for irrigation development in Africa, the water resources available are generally less than those in other regions of the world and are unevenly distributed. High evaporation causes further problems.

Small scale irrigation makes up about 33% of Africa's present irrigated areas. These systems consist mainly of the use of tradition methods, such as simple river diversions and pumping from lakes. These schemes are easily adapted to suit local conditions. Constraints to the successful development of new formal

small irrigation schemes have been assessed in Zimbabwe and Kenya. In Kenya they have been carried out with the full support of the Irrigation and Drainage branch of the Ministry of Agriculture.

The Gem Rai, Nyanza rice scheme was found to be an efficient user of water, reflecting the fact that water flowed from field to field. The major problem faced by local farmers was de-silting of the schemes channel network before fields are prepared.

At the Kwa Chai scheme in Machakos, irrigation using small basins is practised. The scheme receives water from a nearby spring and grows vegetables throughout the year. And in Kamleza scheme in Taveta it was dependent on adjacent commercial schemes not to disrupt supply from the shared springs. Difficulties were experienced in distributing water to farmers by complicated field channel lay outs.

In 1993 performance assessment studies were carried out at four other schemes in central province.

The MIDAS design software has been developed to help local irrigation departments. It processes raw survey data to produce a contoured representation of the ground surface.

Operation and maintenance of rural and urban water supply and sanitation systems: a workshop report in support of the Africa 2000 initiative. - WHO, Brazaville. 46p.

Many water projects in African countries show little sustainability after years of external support because of inadequate resources for operation and maintenance of facilities and insufficient health education of users.

The problem has been aggravated by the adverse effects of drought in 34 countries in Southern Africa and the Sahelian zone.

In a number of cities poor O&M has resulted in more than 50% of water produced being unaccounted for. Key issues were identified by the O&M working group of the Water Supply and Sanitation Collaborative Council in past meetings. These include inadequate data on O&M, inadequate policies legal framework and over lapping responsibilities and political interference.

The report also gives a brief overview of major constraints of O&M in the region. To address these constraints the report overview advocates a genuine government commitment that will guarantee a strong political will in the rural water supply and sanitation sector, an equitable distribution of resources, significant investments, establishment of strong sector institutions, policies and legislation defining the role of sector actors. Recommendations concerning O&M for both urban and rural water supply are given including those for urban and rural sanitation and the role of the Africa 2000 initiative.

Part 2 of the document consists of the full workshop report. In this part the objectives of the workshop are outlined. Achievements of the working group on O&M are identified and country presentations made.

The need for champions in rural water supply/ Tapio Katko in Waterlines Vol. 12 no. 3 (1994); p. 19-22.

The article recognises the long tradition of water supply cooperation in rural areas of Finland. The role of an individual in championing the establishment of a sustainable water supply system is appreciated.

Over the years the role of a champion acting in the key role of management of water supply systems has had tremendous impact through his innovativeness and creativity. Finland has had water supply cooperation most of which served less than 100 people. The cooperative consists of consumers, the board, and the manager, who is referred to as the champion . The consumers who are the beneficiaries have always paid the major part of the capital costs.

Initiators have mainly been civil servants or shop owners who know and understand the local community well. As the role leader, it is he who sells the idea of common water supply.

The champion is involved in the construction and day to day management of water at sometimes nominal pay. He continues to remain involved in the project during times when other people loose interest.

It is noted that men with some technical and engineering background, as well as police officers, have often been the champions in rural centres in Finland.

The general implication for the Finnish study is that instead of having collective community participation, champions should be sought for promoting and implementing rural water supplies. As the case deals with a country in the north, the article suggests that the applicability of the champion approach should be tested in the south where different social and cultural preferences will determine the effectiveness of this method.

Guidelines for the development of country strategies for the 1990s: African water supply and sanitation sector conference, Abidjan, May 10-11, 1990. 15p.

The 1980s were declared the International Water Supply and Sanitation Decade by the United Nations to encourage governments and donors to provide all communities with adequate services by the end of the decade. That objective has not been accomplished. However, considerable advances were made in developing more cost effective approaches.

The new methods include use of greater variety of technologies which are more responsive to the users' socioeconomic environment, and which stress the participation of communities.

The objective of the paper is to help countries develop strategies for the sector which will enhance the chances of achieving more rapid progress toward the achievement of these targets in the 1990s.

The paper presents a sector programme outline which can be adapted by each country to its own situation. The programme outline briefly discusses issues, explains the process of programme development and suggests policies and strategies.

The paper then concludes with suggestions on how international collaboration can contribute to a country's development of the sector.

A draft of this paper was presented by the African Development Bank as a contribution towards the development of sector strategies for the 1990s. Its final version reflects the African countries and ESAs during the Abidjan conference.

Report of the workshop on chemical hazards for African countries, Nairobi September 14-18, 1987. - UNEP/WHO; 77p.

This workshop attended by representatives from 23 African countries had the following objectives:-

- review and assess the magnitude of chemical hazards on Africa;
- review and assess the current status of capabilities for dealing with these hazards;
- explore possibilities for cooperation between individual countries and on a regional basis with the involvement of the United Nations system and identify priorities for action.

Countries had been requested to prepare papers giving national background information, national experience on health and environmental problems due to chemicals. An analysis of the papers indicated that the main concerns of countries in the region were pesticides, occupational health, chemical safety and environmental pollution. The report reveals that all countries be they industrialized or developing face a number of environmental hazards, which may affect human health. Constraints to the solution of environmental hazards are identified as lack of sufficient data on health effects, continuing conflict between development aims and environmental goals.

Primary prevention is advocated as the only important and effective means to chemical safety. Further, a multidisciplinary approach with appropriate legislation backed by implementing capability and advisory toxicological services is stressed.

One paper highlighted exposure to organic dust, silica dust and asbestos, emission of sulphur dioxide, arsenic and fluorine compounds as some of the chemical hazards experienced in the Africa region. The workshop recognized the need for the use of pesticides in public health and agriculture. However, integrated pest management programmes should be developed and their application promoted.

Issues of chemical safety are examined and an evaluation made of environmental pollution. Conclusions and recommendations are drawn.

Pollution effects of brewery wastes: Ruaraka river: 17th WEDC conference. Infrastructure, environment, water and people, Nairobi, Kenya 1991. p.17-24.

This paper reports the results of a two year study on the pollution effects of brewery waste water on the Ruaraka river. As preliminary investigation to an extensive river pollution study, samples were taken twice weekly between August 1988 and June 1990 from two sampling points immediately upstream and downstream of the point of discharge of the tusker brewery waste water into the river.

The samples were analyzed for BOD and COD as well as other parameters.

The results of this preliminary investigation showed that whilst the average BOD of the river water was about 6.9 mg/l at the section just above the waste water outfall, the average BOD of the river water at the sampling point immediately below the outfall was about 115.6 mg/l. Similarly the average COD concentrations for the upstream and downstream sections were 34.7 mg/l and 240.4 mg/l respectively. If the brewery waste water was treated in an anaerobic pond having only 45% BOD reduction deficiency before discharge, it is estimated that the average BOD concentration of the river water at the downstream section would only be about 65 mg/l. Studies carried out at the waste water showed that it would be possible to achieve a BOD reduction of 45% or more in laboratory scale anaerobic pond units.

Evaluation of waste water treatment alternatives in Kenya/ S. M. M. Gatundu. - University of New Brunswick, 1991. - 69p. Report.

Treatment of domestic and industrial wastes is a recent endeavour in Kenya that became a requirement in every town after Kenya attained her independence some 28 years ago. During this period, a tremendous change in domestic waste collection and treatment has taken place in the entire country whereby different types of waste water treatment alternatives have been constructed in various towns.

Most of these treatment alternatives pose operation and maintenance problems due to their complexity, lack of spare parts for the broken machineries and equipment, lack of qualified staff and lack of attention of these plants from senior council staff.

This report examines the design, construction, operation and maintenance of various existing treatment alternatives. Effluent data from all sources has shown a Biochemical Oxygen Demand (BOD) level almost constantly higher than the 20 mg/l standard set for any effluent discharged into natural rivers.

After comparing all the alternatives, it has been concluded that facultative waste stabilization pond or oxidation ditch (where the topography of the land is not suitable for a pond) are best suited for future waste water treatment in Kenya. These will simply lead to operation failure due to lack of qualified staff.

NGOs, women and community water/ I. B. Bassir.-17th WEDC conference: Infrastructure,environment,water and people, Nairobi, Kenya 1991. p.7-10.

The need for safe water for domestic use was recognized in the plan of action of the United Nations Mar del Plata water conference (1977) and motivated the launching of the International Drinking Water and Sanitation Decade (1980-1990). However, according to available data the decade target for full coverage in Africa will not be met by the end of the century. Water for domestic use still remains inadequate despite great efforts in the area of water resources development. Rural dwellers have not been able to get the projected benefits from water investment because of poor operations and maintenance . This has been made worse by increase in population. Poverty and dependence are major obstacles to sustainable

water resource development. Governments have identified several obstacles such as (1) fragmented sector policies due to competition for donor funding (2) weak or non existent institutions (3) lack of adequately trained manpower among others. The paper offers solutions to community water supply. These include community involvement in design, implementation and financing. Available evidence shows that schemes developed by the communities stand the greatest chance of being maintained in working condition. Case studies of two projects in two African counties reveal the success of this strategy. The paper argues that NGOs can impart useful organizational assistance to communities. This would include access to additional resources, assistance in the determination of infrastructure requirements and enhancing access to training. Finally the paper suggests that since women stand to benefit more with improved water supplies they should play key roles in the development of the water sector.

Development in sanitation: consultative meeting organized by the LBDA, BKH and UNDP/WB-RWSG, 14-15 February, 1994. 25p. Report.

The objective of this meeting was to review the approach and implementation method of 3 large sanitation programmes and to prepare a paper on issues which are found to be relevant to be taken into account when designing approaches and implementation methods of similar programmes.

Participants were experts and staff of organizations with a broad knowledge on the design and implementation of sanitation programmes. The three sanitation programmes are HESAWA in Tanzania, RUWASA in Uganda and RDWSSP II in Kenya.

The topics for the meeting included mobilization, planning and implementation, technology choice, health education and training. The paper highlights the objectives of the RDWSSP II programme and its organization. Experiences in sanitation from 1985 to the present are evaluated. It is observed that although the VIP latrine was popular with the communities, its cost was beyond the reach of the ordinary person. Replication was therefore low. Hygiene education created the necessary awareness although tangible indicators could not be quantified.

The project purpose and strategy of RUWASA is explained. An evaluation of the sanitation situation before the water strategy is made as well as the outcome. Lessons learned and conclusions are drawn. Some of these lessons reveal that sanitation programmes stand to be successful if the software mobilization activities accompanied by hygiene education are carried out ahead of the hardware activities including production and distribution of sanitation equipment.

NGO projects: a report on the study of Non-Governmental Organizations and self-help projects supported by the Swedish government in Kenya/SIDA; 1993 64p. Report.

This report examines SIDA support to the Kenya water sector since 1984. At its inception the support was channelled through NGOs such as KWAHO and organizations working with NGOs and Self-Help groups.

The present SIDA support to rural water and sanitation is confined to two agreements, the environmental health programme with MoH and the specific agreement with MoWD.

The linkages with government organs and among various NGOs are weak. Selection by the NGOs of communities to be supported have been done with adequate consultations and are viewed to be in line with the requirements of the SIDA 'Water Strategy.

Capacity building in the projects is seen as an ongoing but long-term process. Gender orientation is accepted and promoted at head offices of the organizations although the gender roles achievements differ depending on cultures and settings of the area the projects are operating in.

Whereas monitoring and follow up is satisfactory, the comparative cost analysis are not presently possible to carry out as there is no measuring yardstick. Standards and units for measuring costs are not well developed in both government and NGO projects.

Comparison of NGO activities with the Government projects reveals more flexibility in NGO programmes. However, the overview of sector problems with respect to planning and engineering capacity may be the weak points in the NGOs.

Network on services for the urban poor: follow up of the working group on organization/ Water Supply and Sanitation Collaborative Council; 1995. 172p. Report.

The report outlines the research output of the water supply and sanitation collaborative Council Network on services for the urban poor. It is the result of a study conducted in the period September 1993 - November 1994.

The network is one of the "mandated activities" established at the September 1993 Rabat Meeting of the Collaborative Council. In that meeting it was decided to undertake, through an agile network, follow up activities to the former Working Group on Urbanization (WG/U) including the disseminaion of the working group's findings, the gathering of feedback from the field on their application and the updating of the WG/U information bank. UNCHS (Habitat) the government of Italy, CERFE, USAID, the Environmental Health Project (formerly WASH) and WEDC (UK) from the operational core group of the network.

The report is composed of three parts. The first one briefly described the institutional framework of the network and the activities undertaken since September 1993. The second part contains the findings of the research conducted on the new inputs that have been included in the Network Information Bank. The third part presents suggestions about general urban issues as a new research theme for the network and some concluding remarks and recommendations.

The first annex contains the outcomes of an analysis of some development interventions in the field of water supply and sanitation. The second and third annexes contain the list of texts or studies employed to the preparation of this report and for the WG/U report.

Domestic water use and environmental health in East Africa: twenty five years after the drawers of water/ IIED; London School of Hygiene and Tropical Medicine, 1995. - 231

This concept note outlines the principle elements of a comprehensive reassessment of domestic water use and environmental health in East Africa, building upon the landmark study Drawers of Water produced some twenty-five years ago. The project which is to begin in June of 1995, will require three and a half years to complete and will encompass five main phases:- (1) survey research design and field testing (2) data collection and analysis - original drawers of water sites (3) participatory research design and field testing (4) data collection and analysis - selected drawers of water sites; and (5) policy review, documentation and dissemination.

This is a collaborative research project. The objectives of this research are outlined and include replicating the original Drawers of Water research as closely as possible in order to carry out a repeat cross sectional study of domestic water use and environmental health across a wide spectrum of rural and urban communities in Kenya, Tanzania and Uganda; reconstructing the history of domestic water supply and environmental health trends; and examining the roles of government, non-governmental and local institutional actors and initiatives played in improving access to reliable water supplies and adequate sanitation. The note also outlines five key direct outputs of the project after its completion.

What price water? User participation in paying for community based water supply/ C. W. Sijbesma. - The Hague: IRC, 1989. - 82p. - Occasional paper series No. 10.

The improvements in water supply call for money and other resources for both investment and operation, maintenance and repair. This publication discusses the need to supplement resources through financial contribution from user communities of water supply programmes . The paper attempts to catalogue community financing systems: what mechanisms for cost recovery are available, under what circumstances could they be applied and what are their advantages? Special attention is paid to introducing the option to the community and organizational development at the local level to support the chosen revenue generating system.

The aim of the paper is to provide a set of practical guidelines for project staff with both a technical or social background who are involved in planning, implementation and operational management of piped community water supplies. The contents of the publication could also be useful background for policy advisers considering the ins and outs of charging for rural and peri-urban water . An extensive subject index and selected readings have been added to facilitate the paper's use as a reference document. The text is highlighted by illustrative cases in indented examples, taken either from the literature or from personal experiences of the author and contributors. Most of the cases refer to small scale experiments or projects. The paper was initially prepared for use in IRC supported public stand post water supplies (PSWS) demonstration projects.

Sustainable sewerage: guidelines for community schemes/ R. A. Reed. - ITDG, 1995. - xiv, 97p.

Sanitation is one of the most basic infrastructure services and one which many poor communities find themselves unable to afford. In most countries the demand for sewerage greatly exceeds the resources available to provide it. There are, however, ways in which conventional schemes can be modified - or new schemes planned, so that the costs both of construction and maintenance can be brought within the reach of more people.

This handbook describes these schemes and suggests objective methods of prioritizing communities' needs for sewerage. It surveys the planning, selection, design, management and maintenance of community schemes, and provides technical and financial suggestions on cost effective practice and procedures. Non-conventional options are discussed as well as the conventional approach to sewerage design and implementation.

The book follows the stages involved in the design, construction, operation and maintenance of a sewerage scheme.

Chapter 1 gives the background on why sewerage might be considered necessary by a community and explains the constraints on installation. Chapter 2 suggests a methodology for selecting the communities that should have priority for the provision of sewerage. Chapter 3 is provided for the benefit of readers who are unaware of how sewerage schemes are normally designed. Chapter 4 examines ways of minimizing cost of constructing new sewerage schemes. Chapter 5 discusses one of the biggest problems with existing schemes, that of poor connection rates. Chapter 6 tackles the problems of operation and maintenance and chapter 7 examines ways of keeping tariff collection to a minimum whilst ensuring that the tariff is collected.

Study into water lifting for irrigation by pumping; small scale irrigation development project (SSIDP)/GoK; 1987; 79p.

One of the constraints of irrigation schemes, has been the problems and costs related to the operation and maintenance of their pumping stations. This factor has also hindered further development of the sector. British International was contracted by SSIDP of the Ministry of Agriculture to conduct a study into methods of water lifting for irrigation, by pumping.

In general the pump most appropriate to any particular scheme, is dependent upon the required duty. The various types of pumps are discussed in this report, together with their advantages, disadvantages and the most appropriate type of installation.

As most types of pumps are represented in Kenya, it is reasonable to assume that spare parts for the small centrifugal pump or turbine pump appropriate to the small scale farmer should be available. For larger mixed flow or axial pumps, it is essential for the project to maintain adequate stocks of spares.

Electricity is one of the cheapest and most reliable source of power. Energy costs when using electric motors are approximately half that when using diesel engines. Solar is seen as not economically justifiable at current costs.

Detailed information and guidance is provided on design considerations. Useful economic information is also provided on establishing the correct economic pipeline and on establishing the operating range of the pump by comparing the pump and system characteristics.

A survey of the main manufacturers and their agents was made. The services provided by each supplier was evaluated and the results tabulated.

Finally, a case study was included to illustrate the processes involved in the design and selection of appropriate installations and plant.

Geophysical methods in ground water exploration in Kenya and their combined application in basement complex areas/ by J. M. Muraguri. - Tampere: Tampere University of Technology, 19981. - 87p. Thesis.

The first step in successful ground water development is the selection of proper well sites first ascertaining the presence of suitable aquifers and then finding the best place for wells from the point of view of quantity, quality and depth of ground water and absence of potential contamination by low quality water.

In "new" areas where there are no existing wells optimum well location requires exploration and intensive study commencing with reconnaissance type surveys to delineate the more promising zones followed by geophysical surveys and test drilling. This thesis paper considers some hydrogeological exploration methods with particular emphasis on geophysical surveys namely geo-electrical sounding method, seismic refraction method, magnetic methods, well logging as well as test drilling.

The paper further considers the suitability of geo-electrical sounding and seismic shooting either combined or singly, in obtaining sufficient and unambiguous results on the hydrogeological conditions in basement complex areas of Kenya.

Wastewater irrigation in developing countries: health effects and technical solutions, summary of World Bank technical paper No. 51/ by Hillel I. Shuval. - UNDP/World Bank, 1986. - xvii, 56p.

This discussion paper on waste water irrigation in developing counties is for administrators and planners as well as for professionals in the fields of agriculture, water resources, urban development, public health, and environmental protection. It provides a concise introduction to the policy and technological aspects of recycling waste water from urban areas for agriculture irrigation. Such agricultural endeavours help countries to conserve their resources, develop their economy and protect he environment.

The paper consists of a non technical summary of 324 paper UNDP-World Bank report (World Bank Technical Paper No. 51) which was the culmination of a three year interdisciplinary global study of the latest developments in the field. The technical recommendations and policy guidelines in this document have been reviewed by a group of environmental scientists and epidemiologists convened by the World Health Organization, the United Nations Environmental Programme, the

United Nations Development Programme and the World Bank (Engelberg Report 1985), and in 1988 by a WHO group of experts. These groups have judged that the principles presented in this paper provide a sound scientific and public health basis for planning wastewater irrigation projects.

Although this report concentrates on the problems of developing countries and some of the solutions uniquely suitable to such areas, the general approach and the underlying scientific and
technical principles are also applicable to industrialized countries.

Improving environmental health conditions in low income settlements: a community based approach to identify needs and priorities/ by UNEP;WHO.-Geneva, 1987.-61p.

An increasing proportion of people in the third world live in urban areas. Rapid urbanization is occurring as a result of high rates of natural population increase in cities, in addition to irrigation from rural areas. The formal production of low cost housing has fallen far behind the demand, with the result that much of the increase in urban population has been accommodated informally (and often illegally).

There are associations between low quality residential environments and poor health. Poor sanitation, insufficient water supply, poor water quality, overcrowding, inadequate garbage disposal are common place. All these have adverse effects on health.

Governments have increasingly sought to develop policies to meet basic needs of the majority of population. Primary health care aimed at strengthening individual and collective responses to health needs is one example: upgrading and improving existing slums and squatter settlements is another. Such upgrading has many advantages: it does not displace the population; it promotes and channels initiative in the community and it improves people's health status.

This publication offers guidance to communities on how they can identify and gather information about environmental factors affecting health problems and determine priorities for action.

Various survey techniques that are inexpensive and do not require sophisticated knowledge or expertise are described in detail as are the principle means of analysis and collating the information obtained.

Ground water exploration and assessment in developing countries. -edited by T. S. Katko.-a report on the workshop held 28 November, 1984 at Tampere University of Technology.

The seasonal fluctuations of rainfall are quite important when we consider the availability of water resources. Fluctuations of rainfall are much higher in Dodoma than in Stockholm. Ground water is therefore more important as a reservoir.

Based on papers and discussions of the seminars the following remarks can be concluded.

(1) Proper ground water investigations have to be carried out before drilling
(2) Recent trends of ground water utilization seem to have been like a pendulum. In the 60s the enthusiasm was high towards deep ground water but in the 70s the shallow ground water was partly overemphasized(3) The geophysical prospecting data is information of secondary character and has to be properly interpreted. The soil and rock properties have to be studied in combination of different methods
(4) System collection of data and the accuracy of this data were pointed out both by project wise and permanent ground water data banks
(5) It was noted that there are different potential sources of ground water pollution in developing countries. In some places it will be difficult to arrange proper protection because of different interests of different economic sectors.
(6) The users have to pay for water supply. The most economic solutions should be chosen and quite often this means proper financial input for ground water investigations.

Ground water is a renewable natural resource. It is valuable and worth of proper management and protection.

Application of health education to water supply and sanitation projects in Africa: WASH technical report No. 15. - WASH, 1982. 369p.

Health education has frequently been characterized as the dissemination of health and health related information. The assumption has been that when people are properly informed, they will behave in ways that will have a positive impact on health. However, health education programmes which consist solely of information giving activities do not themselves result in the desired behaviour change.

Linking health education and community participation are especially essential in their application to water and sanitation programmes. As part of the development of a health strategy for the region it is felt that promotion and application of better health education programme, planning, implementation and evaluation is necessary.

Using the framework of existing water and sanitation projects in the Africa region a three-pronged strategy is envisaged:

- improvement of current health education projects;
- strengthening of institutional and individual capability in health education in Africa
- development of a health education capability within the Africa Bureau of AID

To ensure that effective action will be taken, these three strategic elements are based on several important operational principles:-

- maximum use of available resources is encouraged
- active continuous consultations with field based development workers is to be undertaken
- flexibility of response to articulated needs with the possibility of providing varied kinds of assistance is built into the strategy.

Assessment of the regional advisory water and sanitation function in Nairobi, Kenya/ by Per Kökeritz. - 1994, 38p.

A post of a regional adviser in the field of water and sanitation was established in September 1990, based at the Development Cooperation Office at the Swedish Embassy in Nairobi. The overall objective was to increase the efficiency and quality of the Swedish assistance to countries in the region, primarily Ethiopia, Kenya, Tanzania and Uganda.

The adviser would provide support to SIDA in Stockholm, the DCO's and the projects encourage exchange of experience in the region, stimulate the development of appropriate techniques and approaches and promote utilization and development of local human resources.

The adviser has been able to establish good contacts e.g. with networks, and to support promising local initiatives with remarkable results. Other tasks have emanated from the adviser's own initiative and the result of contacts in the region. The adviser's input to SIDA programmes have been geared to the use of participatory methods and a sustainable community based approach using experience from other programmes in the region.

Generally, the work of the adviser has been very much appreciated in the region. The assessment supports the view, that a regionally based post can spend more time on travel in the region and benefit from the continuous contacts with various activities and actors in Nairobi.

The posting at the embassy in Nairobi seems to have been of value. It has given the adviser access to information from all types of programmes.
If SIDA is continuing its support to the water and sanitation field in the region the experience so far clearly points at the usefulness of a post of this kind.

Financing waste water service in developing countries/ by James Mc Cullough. - WASH, 1993; 43p. - WASH technical report No. 80.

In recent decades, central governments in many developing countries have found it easy to obtain financial and technical assistance for water system construction. Rising urban demand for clean and safe water combined with health and environmental concerns, has spurred donor agencies to fund water projects. However, two aspects of expanded water services have received less attention; treatment and disposal of the high quantities of waste water that result and financing mechanisms for both operations and maintenance and capital investment in the water sector.

This report provides information about current waste water financing practices in both industrialized and developing countries. United States, Korean and French cases provide a broader basis for comparing policy and regulator climates, detecting trends in decentralization and evaluating the feasibility of sectorial financial autonomy.

These case studies provide three quite different approaches to the sector. The United States is a completely decentralized model in which the central government's role has been confined to financing and broad regulation of the sector.

France provides a case example that combines the European River Basin Authority model with municipal ownership of water supply and sanitation systems and heavy reliance on private firms to manage the systems under long-term contracts. Korea provides an example of a country that is decentralizing authority. For the wastewater sector and also greatly increasing overall capital investment, while shifting the burden of cost recovery to users.

Source book for gender issues at the policy level in the water and sanitation sector/by Wendy Wakeman; Susan Davis et al.-UNDP/World Bank, 1996.-102p.

The source book has been created to provide agency staff with information and methods related to gender and development policy issues. It presents ideas, methods and experiences concerning the incorporation of gender issues into policies. It discusses concepts, the relation of gender issues to sector policies and methodologies used. It looks at numerous ways policies have been created and implemented over the past few decades and what has worked and what has not worked. The source book ends with suggestions for future research and analysis on the way to make gender and development policy operational in the water and sanitation sector.

The first chapter considers gender issues within the water and sanitation sector. Chapter two analyzes gender issues at the policy level. The third chapter reviews the experiences several agencies have had trying to implement gender aspects of policies, while chapter four examines the various methods organisations have utilized over the years. Chapter five looks at one of the most common techniques: training and chapter six, the conclusion summarizes some of the lessons encountered in the previous sections.

The source book may be used in several ways depending on the user's needs. If interested in conceptual issues, the reader may wish to focus on chapters one and two. If the area of concern is methodologies, then chapters five and six should be consulted. Chapters three and four will be helpful to those seeking summaries to agencies' policies.

Operation and Maintenance Working Group: report to the Water Supply and Sanitation Collaborative Council. - Geneva: WHO, 1995; 42p.

The Operation and Maintenance Working Group (the Group) was launched at a meeting attended by selected external support agencies at the Hague in 1988. The group's mandate was to initiate cooperation between external support agencies and developing countries, enabling them to develop tools and methodologies for the formation, implementation, monitoring and evaluation of programmes to improve their operation and maintenance (O&M) procedures.

The document affirms that O&M should be viewed not only under a technological or operational perspective, but also, and more importantly, should take into account the aspects associated with overall performance to the water supply and sanitation facilities.

Aspects such as institutional arrangements, organization of the water supply

and sanitation services and sound resources management, should thus be among the issues to be tackled in the development of programmes addressing improved operation and maintenance.

Group members have prepared a number of tools. These include guidelines, manuals and training packages.

Selected case studies covering different aspects of asset management and sustainability of WSS systems have also been prepared. Other case studies have been presented at workshops.

A status assessment tool was developed as a response to the lack of suitable guidelines for assessing the status of O&M in both urban and rural areas. Other tools include: a guide for managers of water utilities, leakage control, training package, upgrading of drinking water treatment plants. Training package of O&M management in rural areas and model of management systems; others include a manual on technology choice and a network survey manual which will assess performance of drinking water production.

Informal settlement in Nairobi.-Public Health Department.-1991.

In general, the report details the problems of informal settlements in Nairobi which stems mainly from lack of planning, rapid population growth, and low income of the community living in the settlements.

Piped water is nonexistent or inadequate. Polluted rain and river water is used. The Public Health Department in collaboration with various governmental and non governmental organizations and the NCC Water and Sewerage Departments are involved in providing piped water.

The report reveals lack of water-borne sanitation. Pit latrine and indiscriminate disposal of human waste is the norm rather than the exception. Soil conditions are unfavourable for the construction of pit latrines. Due to overcrowding, pit latrines are constructed on the periphery and others next to dwelling houses. They are difficult to empty when filled up and this causes fly-breeding. Rain water and sullage form pools of stagnant water.

Lack of a clear policy on land tenure causes inadequate and poor services. Insecurity and lack of sense of belonging results in negative attitude regarding any new ideas. There is no collaboration of agencies involved in the settlements.

Assessment of the operation and maintenance component of water supply projects/ James K. Jordan; Peter Buijs; Alan S. Wyatt. - WASH, 1986; 90p. WASH technical report No. 35.

Effective operations and maintenance (O&M) of water systems requires systematic planning as the project is being designed. This planning, however, is frequently overlooked. Part of the reason of poor O&M is lack of a planning tool that my be used by water system project designers to assess the likely effectiveness of the operations and maintenance component.

This guide has been developed to fill this need. It contains information concerning the operations and maintenance of water supply systems and four O&M

assessment guides. The guides are organized in a question-and-answer format that address the critical elements involved in operating and maintaining a water system. These elements are institutional capability, system operations and maintenance, spare parts and supplies, logistics, finance, records and human resources and training.

The four O&M guides that have been developed represent the types of water supply systems generally found in least developed countries. These systems are as follows:-

1) reticulated systems fed from either springs or streams
2) water systems using hand pumps
3) water systems using electrically powered pump sets drawing from ground water resources.
4) water systems requiring treatment works

KWAHO experiences in water and sanitation: case study in Kibera peri-urban.-Kenya Water for Health Organization 1980 - 1990.

The report documents very briefly KWAHO's activities and achievements in the Peri-Urban areas in Nairobi between 1980 -1990.

KWAHO assisted in the formation of women groups and provision of water storage tanks to the women groups. The women groups buy water from Nairobi City Council in whole sale and then retail it.

KWAHO has assisted to improve existing pit latrines by helping to construct 14 VIP's for demonstration in communal places and in schools. KWAHO has also assisted in acquiring special exhauster van through funding from NORAD.

The Special Pit Emptying vehicle is administered by a committee of nine Members drawn from the community. This has resulted in reduced cost of water, increased usage and improved sanitation

The community manages and maintains exhauster service. The project is self sustaining from money paid by the community for the exhauster service.

NGO support to informal settlements. a case study of Kibera, Nairobi, 1991.

The report discusses the conditions in the Kibera slums and documents the activities of two NGOs KWAHO and UNDUGU Society in Kibera.

Water is supplied on an ad-hoc-basis. Water connection is provided by NCC to community or vendors after paying the necessary connection fees. Water costs between 50-60 cents per litre. Level of service is low and water is costly to the consumers. KWAHO has assisted in the formation of women groups and purchase of water tanks to women groups. Women groups sell water at 30 cents per 20 litres container - resulting in reduced cost of water.

Pit latrines are constructed by the landlords and are shared between 50 - 100 people, and therefore difficult to keep them (pit latrines) clean. KWAHO has assisted in the construction of VIPs and provides training for the construction. KWAHO with NORAD's financial assistance secured a special emptying vehicle - the MICROVAC.

The special latrines emptying vehicle is managed by the community, and residents pay full cost of emptying which is Kshs 150, per truck load.

The community participation and formation of women groups results in reduced cost of water services. The projects are sustainable because of the community involvement, willingness and capability to pay for services.

The special latrine emptying vehicle is suitable for such poorly planned and densely populated areas, with limited accessibility.

There are however, operational problems of emptying vehicle arising from puncturing of the vehicle tires by broken bottles and the vehicle getting stuck in the mud. The dense faecal matter also make emptying difficult. Some communities also look down upon the exhauster service as culturally unacceptable.

The VIPs are costly (kshs.8,000-10,000) and because of lack of secure land tenure, Landlords are unwilling to construct them.

Kericho sanitation project: final design draft report; 1992.

The report discusses water, sanitation and solid waste situation in Kericho town including a detailed design for the improvement of two peri-urban areas (the Somali land Swahili Villages).

There are no house connections and even where they are some were found to utilize river water for washing of clothes, cars, and bathing children. River water although polluted is major source of drinking water supply. Water kiosks are being installed and water costs about 50 cents per litre. The price seems to encourage non consumptive use.

Public latrines are in use but are in poor conditions. There is no organized care and maintenance.

Lessons learned include, target groups to receive organizational support, implementation and evaluation of activities in order to mobilize all resources available and increase sustainability. Consideration be made of slums adjacent to the project area in the overall planning, and Use of VIPs to be recommended and promoted in the slum areas.

Community mobilization in sanitary project: a case study of Maina Village, Nyahururu.

The report is a detailed analysis of Maina Village in Nyahururu Town. The community mobilization through KWAHO involvement has transformed the Maina Village from a slum to show case. There are good experiences on land tenure.

The report does not mention any specific issues relating to water supply. The report, however, discusses water-borne sanitation.

The sanitation facilities were poor. KWAHO entered into an agreement with DANIDA to provide support services in connection with sanitation and sewerage project. KWAHO's role was to mobilize the community and train them on the importance of health and management of solid waste.

Pit latrines were used for sanitation. With KWAHO's assistance and community participation, the community has been able to implement Residential Sanita-

tion Units (RSU) and additional pit latrines.

Where sewers are not provided, VIPs are provided one for a maximum of 15 people. The RSU and latrines are constructed up to the base level by the project and the tenants or plot owners finish the superstructure using materials of their choice. The toilets and VIPs construction costs are high due to poor soil conditions and water logging (Kshs. 25,000-50,000).

Community views, ideas and participation are important ingredients in community based projects. Training is an important component in health and sanitation related projects. Communities are willing and able to chose technology appropriate to their situation. Women have a special role in health and sanitation projects. NGOs have the ability and capacity to effectively mobilize grassroots communities. Land tenure system are crucial for the success of the Programme in the informal settlements.

Kibera baseline survey Laini Saba preliminary report: problems identified by the community leaders, 1988.

The report is a summary of the community needs identified by community leaders in Kibera. These include: roads, water supply, sanitation, garbage collection, educational facilities, and health.

The community is served by isolated water points that sell water exorbitantly at 50 cents per litre. Community taps serve 69% of households; vendors 24% of the households. Five per cent have house taps. 83% of the community taps are owned by entrepreneurs.. bout 0.5% of the households get water from the seasonal stream that passes through Kibera. Water points are of low pressure which results in irregular flow.

About 99.5% use pit latrines, but there is no organized programme for emptying when they fill up. The toilets overflow and mix with sullage from the households. There is no organization in the management of pit latrines. New toilets are dug when the old ones fill up. Toilets are shared by as many as 20 households.

Lessons learned include, overcharging in water due to inadequate supply, the community is willing and able to pay for water and that lack of adequate and costly water forces the community to use polluted river water.

A comparison between a "planned slum" and an "unplanned slum": case study, Kitui village and Kayamba, 1991.

The report details a comparative study between a planned slum and an unplanned slum in Nairobi-Kitui and Kayamba, respectively.

Kitui is bordered on the upper side by Biafra Estate and Majengo. Kayamba slum is located alongside enterprise road in industrial area behind Kamal Mechanical Engineering works and Kenya Commercial Bank and Ngong River on the other side.

Undugu Society has helped to construct water tanks through women groups. Water sold by women groups at given water points

In Kayamba, this aspect is not well covered. Generally, water is found in water points owned by individuals and it costs around 50 cent per 20 litres.

Through Undugu's advice and support, dwellers have dug drains for rain water and collect water for home use other than drinking. Maintenance of drains has also been ensured. Pit latrines were being dug at the time. The toilets were to be shared between 10 households and would be locked when not in use. Dwellers clean the toilets. Toilets double as bathrooms.

There is poor drainage due to inadequate channels and lack of maintenance. Kiosks are near each other and this results in more sullage being discharged which leads to dirty atmosphere and mosquito menace. Individual liquid wastes also combine with stagnant water leading to an awful situation. Excreta falls directly into the Ngong River. There are no bathrooms and people bathe outside at night.

Due to Undugu participation in the management of the slum (Kitui), the community feels confident about the length of occupation although it is an illegal settlement.

The presence of Undugu has influenced significantly the high level of service of water supply and sanitation and in other community services: education, housing, health.

Undugu has also helped in construction of compost pits for garbage and refuse. Because of scarcity of land, litter and garbage can be seen scattered openly in Kitui. Undugu cannot guarantee tenure or security from eviction but pleads in favour of the dwellers against eviction by the NCC. Undugu helps the people to help themselves and at times Undugu requires residents to cotribute part of the capital. There is willingness and capability to pay for services. Coordinated planning reduces poor conditions in the slums, e.g. toilets, housing units, garbage disposal, etc.

Congestion and human response to getting rid of waste: a review of community based environmental sanitation improvements as analyzed in case studies of two informal settlements: Kibera (1992) and Maina Village (1993), 1995.

The report is an analysis and update of information about conditions in two formal settlements Kibera in Nairobi and Maina Village in Nyahururu. The role of community and NGO in the provision of services is demonstrated and limitations and lessons learned discussed.

There is limited access to water, which is supplied by vendors. Water frequently gets disconnected due to nonpayment. Over 800 water vendors in Kibera are connected to the NCC mains. Water prices are inflated due to shortages. The community kiosks run by women groups with the support of NGOs result in controlled water prices.

There is a sewer-line that runs through Kibera, but pit latrines are the primary excreta disposal facility. KWAHO's support for an exhauster emptying vehicle worked for only two years 1991 - 1993. The failure of the emptying service was due to inadequate maintenance. The administration (Chief and DO) tried to manage the vehicle on behalf of the community, but this too collapsed.

Servicing of pit latrines is no longer practised and filled ones are abandoned

or covered with other substructures such as kiosks. This has resulted in increased cases of intestinal parasites like worms. NCC has introduced monthly deworming programmes.

Main supply of water is from a spring which is in poor condition. The council has failed to increase water supply from the spring. The community is using buckets to draw water from spring and this increases health risks.

In the early 1990's there was a DANIDA funded Sewerage House Connection Project (SHCP) which was functional with assistance of KWAHO and community participation. SHCP has now ceased to be operational due to blockages caused by misuse and inadequate piped overflow in the area due to high water table and increased population.

The collapse of the latrine emptying Programme was due to institutional arrangement and unclear ownership. Community participation collapsed in the Maina village due to change in tenure and enlargement of the settlement area, and the inadequate water supply. The NGOs role would be to create self-reliance among the people. Land tenure is an essential factor in upgrading or improving infrastructure in informal settlements.

Tanzania Bondeni community land trust project, Voi municipality, 1992.

The report describes the outcome of the government's effort to improve the living condition of the poor in urban settlements and to make upgrading programmes self sustaining and replaceable.

Before implementation of the project, Tanzania Bondeni had insufficient water supplies, with the result that residents turned to the polluted Voi river for additional source of water. Sanitation was very poor further contributing to pollution of the Voi river.

Formation of Community Land Trust (CLT) tenure model in terms of recognized and acceptance of the situation created by the squatters has resulted in improvement of health and sanitation through provision of water supply and sanitation facilities.

Involvement of the community in the planning and execution of the development project was important. The community should also be made aware of the costs and repayment logistics for the infrastructural improvements.

Nairobi's informal settlements: an inventory.-Nairobi: Matrix Development Consultants, 1993.

The report details the locations and characteristics of the informal settlements of Nairobi. The report provides up- to -date information on size, location and densities of informal settlements in the seven Nairobi divisions: Makadara, Langata, Kasarani, Dagoretti, Embakasi, Pumwani and Parklands. The message inferred from this report concerning water supply for these areas is as follows:

Langata— Kibera: Water is obtained from water kiosks and is sold at between ksh. 30 cents to 70 cents per 20 litres. Most of the water kiosks are run by women committees. 75 - 90 per cent of the population is served by the kiosks. Water is

also obtained from the Nairobi Dam and rain water harvesting.

Makadara— Water is sold from water points (kiosks) at between 40 cents to one shilling per twenty litres.

Kasarani— Water is obtained from communal water taps at between 30 cents to one shilling per twenty litres. Stand pipes are also found in some areas in Kahawa and Roysambu as well as from rain catchment and river water.

Dagoretti— Water is obtained from a water kiosk and costs between 50 cents and 80 cents per twenty litres. In Kawangware and Kangemi stand pipes are provided by the landlords.

Embakasi— There are communal water pipes. Besides water is obtained from Getathuru and the Nairobi River and from sunken wells.

Pumwani— There is some free water but this results to long queues. Some prefer to travel and buy where there are no queues. Water costs between 50 cents and one shilling for twenty litres . Rain water is also harvested.

Regarding sanitation it is observed that one pit latrine is used by between 30-40 people. Between 50 and 500 people share a toilet in Kibera. KWAHO has assisted in the provision of VIPs. Korogocho uses open spaces and in some cases toilets are built next to living rooms.

An evaluation of the environmental, economic and social impacts of the environment projects/ by Environment and Urban Development Training Project (EUDTP).-Kenya

The report highlights sanitation and drainage facilities in Kisii, Homa Bay and Busia towns through Environmental and Urban Development Training Project (EUDTP) The message obtained in this report is as follows:

Kisii — There are mechanisms to control storm water through Daraja Mbili market. And on water supply and sanitation:

Prior to project: Lack of proper sanitary facilities at Market. One dilapidated, filled pit latrine existed. Because of heavy erosion, the latrine was almost collapsing. There was no clean running water.

After project: Four VIP latrines constructed.

Homa Bay— Control of storm water through site and service Shauri Yako slum open fish market. In Shauri Yako slum there is:

In adequate water supply, very poor sanitation and waste disposal, poor drain-age

Prior: poor sanitation facilities made the area an epidemic zone for diarrhoea, worm infection. Most landlords had not provided latrines as required by the law. Hence some section of the drains were being used as sanitary facilities.

After: The drainage channel through the slum of Lake Victoria was restored

Results: Drainage sanitation resulted in improved human health in several ways. (Previously, Shauri Yako slum village had been worst hit by typhoid, dysentery, cholera and other forms of water borne diseases).

The EUDTP as a facilitator achieved positive results. The projects were of benefit in environmental economic and social terms to the residents, local and central Government.

The willingness to pay for the maintenance of the project was overwhelming (but only as an appreciation).

It also noted that the availability of committed and trusted facilitator, be it the government, NGO or individual, is crucial for the success of these projects.

Rapid appraisal of the environmental health situation in the Mukuru and Soweto slum in Nairobi, 1991.

The report describes the health, water supply, sanitation and drainage situation in the Mukuru and Soweto slum villages in Nairobi.

The quantity of water which is distributed through water kiosks is adequate. However, the selling price at 50-70 cents per 20 litres is exorbitant. The quality of water subsequently stored by consumers is likely to deteriorate since the method of storage is unsuitable.

Sanitation is poor. Besides, being insufficient for the large population, pit latrines are shallow, up to 2.5m deep.

Consumers need to be sensitized on clean, and safe water storage.

These slums should be regarded as a permanent feature of the City. Low cost excreta disposal system e.g. the VIP latrines should be built where space allows or sanitary blocks connecting to nearby sewer. The residents should be sensitized on the health hazards arising from unsanitary disposal of urine and excreta.

Annual CSD (Child Survival and Development) progress report.-Kisumu: CSD; 1993.

The report describes the progress of all the CSD projects planned for 1993 and reviews the pace for the implementation of the project. Project activities aimed at improving health status of the peri-urban and rural municipality population so as to reduce the incidence and prevalence of water and sanitation related diseases and conditions.

Community participation in provision of water and sanitation services was encouraged. Demonstration VIP latrines were built. Toilet slabs were provided to slum dwellers to assist them construct individual household toilets.

There was enthusiasm in the implementation of water supply and sanitation related projects planned for the year.

Construction constraints included delay in supply and construction materials, lack of implementation logistics, and inadequate skilled staff.

Concept paper on peri-urban development/ by Kenya Water for Health Organization, 1991.

The paper describes the situation, activities and achievements of KWAHO in Kibera slum in Nairobi, and Maina village in Nyahururu.

Good quality of water is available in sufficient quantities in Maina Village. Kibera Village has no reliable city water supply. Lack of sufficient water supply and poor

storage of the little available poses a serious health hazard.

Sanitation and waste disposal facilities are especially poor and poses serious health hazards in the two slum villages.

Residents are willing and able to pay for services such as water supply.

Involvement of NGO e.g KWAHO has progressively transformed the sanitation situation by application of appropriate technology e.g construction of VIP latrines and provisions of exhauster services in Kibera. They have also provided sanitary blocks connected to municipal sewer in Maina.

In conclusion a collective and integrated approach is necessary for improvement of slum villages, for recognizing their permanence.

Sanitation options for Kibera low-income area in Nairobi, 1992.

The project examines the situation at Kibera slum village including infrastructure, community and NGO involvement in improvement of the living environment. The project proposes some practical alternatives to improve water supply and sanitation in Kibera.

Water Supply— The residents have the will and ability to pay for the basic services such as provision of enough water by Nairobi City Council at suitable rates.

Sanitation— When land tenure issues have been solved, sanitary blocks, sewers or toilets within plots may be constructed to improve sanitation in Kibera.

Conclusions— Solution in land tenure problems in the informal sector is a prerequisite to improvement of any infrastructural services in the informal settlements.

The role of the NGO,s Government departments and the community has been underlined. Uncoordinated role from each of the above has resulted in duplication of effort. The formation of an informal settlements department in Nairobi City Council, has been recommended.

Improving environmental sanitation in informal settlements.-Nairobi City Commission, Public Health Department, Sep. 10-13, 1991

The report is a summary of deliberation of a four day workshop held at Safari Club Hotel Naivasha from 10-13 September 1991 with operational and policy level staff of NCC, the Provincial Office and key Ministries. The objectives of the workshop were

i) To identify and prioritize the key environmental sanitation problems,
ii) To review the lessons learned from successful development activities in informal settlement, and
iii) To develop an action plan recommendations from improvements in these settlements.

The workshop was preceded by field visits to Mathare and Pumwani-Kitui, in order to raise problem awareness and to view alternatives on the intermediate solutions that have been successful.

The workshop attempted to prioritize the problems using participatory method, with a view to examining alternative strategies. Knowledge and experience of

people who have been working and are in touch with communities in informal settlements and also with expertise for alternative solutions was required.

There were no specific issues discussed on water and sanitation per se but in general terms, issues related to such were discussed.

- Lack of recognition of existing informal settlements by government and local authorities and them not being covered by planning and development legislation, are bottlenecks to actions aimed at improving these conditions.
- It was observed that Lack of land tenure prevents intervention of potential development agencies including local authorities.
- Lack of social cohesion due to migrator tendencies also make community resources utilization difficult.
- Limited information base for development and for estimation of the resource required.

There were specific recommendation made on informal settlements so that they can be accommodated in the overall planning process. The specific recommendations were made on the following areas: land, policy, resources, information, and institution framework.

An action plan was proposed, where a task force formation was recommended by 1992, under the chairmanship of the Provincial Commissioner and informal settlement unit in NCC.

Urban water supply and sanitation management project (UWASAM). Workshop Held in April 1996 in Kericho

The report presents the result of a 3 day workshop held in Kericho on public awareness on water supply and sanitation. The objectives of the workshop were: to create public awareness on water supply and sanitation in Kericho; to involve grassroots community in the development and the management of water and sanitation facilities in Kericho among others. A number of problems in water supply and sanitation are noted:

- Overloading a line with consumer has led to a shortage of clean water. This has resulted in water related diseases due to use of raw water.
- Lack of waste water drainage system in the unplanned settlement has also led to water pollution and foul smell, water borne and air borne diseases.
- Lack of awareness due to low level of participation by councillors.
- Pit latrines are not enough and too close to house.
- Water collection points are too few for the demand.
- Nonexistent sanitary facilities due to mushrooming of residential houses.

The report recommends that leaders must create awareness. Every landlord must provide basic services to the tenants. Where there are no sanitary facilities further construction of houses should be stopped until such facilities are provided. Tenants to demand their rights; landlord to provide. The report further recommends Municipal Intervention to enforce byelaws; offer technical advice; control planning; and fund where possible.

Urban basic services programme.- UNICEF; November, 1989

The report describes the package of basic urban services to be supported by social mobilization and community participation. The report also avers that providing services and seeking community participation, has proved to be the effective way of meeting the minimal needs of basic services.

To improve conditions of life and the urban slum dwellers, community organization can be done in such a way that enables community to basically learn why good environmental sanitation is important to health and how to keep drinking water safely. The capacity to pay for water should be addressed and the municipalities to install a sufficient number of communal taps to regulate the selling of water at kiosks.

It was observed that there is lack of knowledge of how to organize the community, how to attract the community to accept measures leading to change of their attitudes.

Community participation in local planning and involvement of key agents to change with small doses of financial and material resources has a greater multiplication effect.

Integrated basic services approach i.e. water and sanitation and other basic services needs are also important.

Malindi sanitation and hygiene education feasibility study; 1993

The report presents information upon which the execution of a sanitation and hygiene education project can be carried out.

Simple pit latrines have been designed to address low in come households. Impermeable pits are required in areas with high ground water table such as low income high density areas with well water sources like Shela and Barani. Lined pits are required in areas of poor soil condition where sand may be deep. Latrines are to be upgraded to VIP level with material choices depending on needs and ability to pay. Capability to pay is instrumental for sustainable development of the sanitation infrastructure.

The principle hurdles to community participation are cultural taboos concerning handling of excreta, little willingness by squatters to make decision on any measures and the absentee Landlords.

Community based water and sanitation project 1989-93, GOK/UNICEF, 1989.

The report describes UNICEF's plan for achieving the GOK goals in water supply and sanitation in the 5 year period of July 1989 - June 1994. Briefly the objectives are to:-

- Provide access to portable water through construction of new improved water sources in six rural districts.
- Improve sanitation by construction of VIP latrines in the same areas.
- Study and experiment community participation in water supply and sanitation in slum and squatter settlements.

The report reveals the Impact of poor water quality on health and inaccessibil-

ity of sufficient amounts of water.

On sanitation it details the need to improve the populations knowledge and practice of appropriate sanitation of hygiene (esp. in terms of apt disposal of human faeces and in terms of individual community sanitary practices.

Since more than 50% of Nairobi and Kisumu population live in slum and squatter settlements: more detailed information is required on access, coverage and affordable water supply; enhance knowledge, change of attitude for better facilities in sanitation and hygiene; improve community organization and women involvement in water supply and sanitation development; increase access to increased water supply and sanitation in the slum areas; and involve the recipient communities in local planning and sharing in the costs of construction.

Urban basic services (Nairobi, Mombasa, Kisumu) plan of operations (1989-1993)

The report describes a Situation Analysis of the basic urban needs. It also analyzes the impacts expected to arise from the suggested solutions. 40-60% of Nairobi population live in slum and squatter settlement areas which has no adequate clean water. Water which is available in communal taps or kiosks, is often either too expensive or of limited supply. In the squatter and slum areas prevalence of diarrhoea and worm infestation indicate poor level of sanitation. Improved access, coverage, affordability, and save water availability should be the goals of any improvement of the basic services. There will be a notable impact of any improvement on sanitation on diarrhoea and worms in children. A situation to determine access, coverage and affordability of water by using water kiosks is necessary.

Urban basic needs in Nairobi, 1990

This is a report of a study which examined the consumption pattern of the basic needs by the urban poor in Nairobi, against the background of the Kenya's urban investment strategy under SAP's.

Most of the spontaneous settlements are poorly supplied with water. The City Council provides standpipes at water kiosks and charges at the usual rates. However, the vendors sell water 3 times the cost of water in other planned areas.

In the low income settlement, pit latrines are the main mode of sanitation where there is also lack of sufficient water. Since water borne sanitation systems are expensive people in these settlements can be encouraged to use alternative modes such as VIP latrines. Lack of baths leads to people using pit latrines for bathing resulting in rapid filling and overflowing.

The report recommends that Water undertakers should regulate the prices of water charged by vendors, besides bringing sufficient water to the residents.

It states that formation of welfare associations whose aims are to improve or maintain a level of sanitation has already produced positive results. Community participation should be emphasized to improve the conditions in these areas.

Towards a Kariobangi urban programme.-Submission to Action Aid Urban Programme Task Force. December 1990. Action Aid-Kenya (AAK)

The report presents a summary of the Kariobangi Urban Programme which is the work of AAK to rid poverty in Kariobangi Region. This will in turn serve as an example to other upcoming urban settlements in Kenya. Kariobangi is the only AAK urban region in Kenya. The programme has been supported by two studies on Kariobangi. The first study by Matrix Consultants examined the growth of urban areas in Kenya, urban-rural poverty, rural-urban balance and strategy, informal settlements, intervention by NGO's and Government policy towards informal settlements, development of the Kariobangi-Korogocho settlement giving some historical background, population, land use and tenure, living conditions, economic circumstances, residents needs and priorities. The second study by AAK examined the following:-

Main problem areas: Possibilities of developing a community based programme; strategies for intervention in response to identified community needs; integration and participation.

AAK has intervened in improving the lot of the urban poor because:

- Urbanization is an inevitable and growing phenomena in Kenya.
- Poverty amongst the Urban poor is more severe than in the rural poor.
- The Urban poor turn the wheels of the economy in cities. They are also the major consumers of various products and a source of political power. They also have very low literacy levels.

Identified problems faced by the urban poor, among others include lack of adequate housing, lack of adequate water supply and proper sanitation, poor communication facilities, inadequate educational facilities, and lack of land tenure.

Information and analysis suggest that a programme based on elements similar to rural areas is essential. Given the homogeneity and internal organization of each slum village, community mobilization and participation is necessary for the success of any urban - poor programme. The Kariobangi area has considerable potential for effective community participation for collective improvement of living standards and urban environment. There are incidences of risks of diseases preventable by environmental sanitation improvement.

AAK recommends the development of land tenure where a group title is issued by GoK, provision of stand pipes by the Government and an improvement of roads and access.

Situation analysis for Kariobangi region/Action-Aid Kenya, 1990

The report presents the necessary information for a comprehensive community built programme required to address the poverty problems in Kariobangi in a holistic sense. The information for the situation analysis was intended to assist in designing meaningful and realistic intervention into the problems.

Sanitation in Kariobangi poses a great health hazard, there are too few latrines to cater for the large population. There are no public toilets. Human waste is scattered about the few private toilets which are kept locked. Bathrooms are non-existent and people bath next to open drains which are always blocked and water

stinks as it stagnates. Garbage is not regularly collected leading to accumulation in the dumping area.

Clean and treated water is distributed through water kiosks and these are not sufficient. This water gets contaminated during storage due to dirty containers and poor housing.

The residents do not feel motivated to improve their living conditions since they do not have legal rights to the land they live on as they feel insecure.

Over population leads to serious deterioration in shelter, water supply, drainage, and health facilities.

There is an interruption of social organization - due to diverse ethnicity in the area, people live as individuals. It is therefore difficult to unite them for any community activity, hence, communal facilities are in most cases ignored.

Recommendations include need to involve village representatives in solving problems affecting the area e.g. education, health, sanitation; and community participation should be enhanced through involvement of community members in planning, implementation, and maintenance of any project intended to assist them.

An assessment of road maintenance and liquid waste management practices suggested improvements in Nanyuki town, 1996

The project report describes the current road maintenance programme and the management of liquid wastes in Nanyuki. The project proposes improvements in the sanitation services to residents not connected to the existing sewerage network, and also maintenance of roads within the jurisdiction of the Nanyuki Municipal Council.

The night soil and pit latrines modes of sanitation are used in the Majengo area.

Night soil and sludge exhausted from septic tanks and pit latrines are deposited in the inlet of the sewage lagoon.

Emptying of septic tanks and latrines is not done regularly. Night soil modes of sanitation will be phased out and replaced by a forthcoming sewerage system. It is recommended that exhauster services be improved.

Kariobangi urban development area. sample survey report/Action-Aid. July 1991

The report presents findings of a census (ref. 30) and the sample survey which obtained the basic data for effective planning, implementation, monitoring and evaluation of the activities to meet objectives of AAK.

The report also provides additional data to the Urban Development Area (UDA) which could not be accommodated in the baseline survey. This information include data and nutrition, acceptance of family planning, sanitation, disability, source of family income and peoples perception to social problems.

Majority of the residents use rubbish points and 'other' toilet facilities as human waste disposal points. There seems to be few individual or communal latrines. There is great likelihood that sanitation is very poor in the development area and therefore possibility of outbreak of cholera or typhoid. The children

under five suffer from frequent diarrhoea due to contaminated foodstuffs.

The accessibility and cost of the water consumed in the area was found to be unsatisfactory. The per-capita water consumption was very low and the amount available was inadequate.

It is recommended that more safer toilets should be built. These toilets should be cleaned easily and the population should be educated on how to keep the toilets clean. It is also important to educate the residents on how to handle and store water. In general it is important to note the proper disposal of water and hygienic practices are the factors that will have substantial effect on improving health. Hygienic condition need to be improved through water disposal, more improved latrines and drainage of excess waste especially during the rainy season.

Garbage collection should be improved by either providing more refuse trucks or educating the population about effective environmental management.

UNDP/WORLD BANK, UNICEF, HABITAT, Government of Uganda. Proceedings of regional urban sanitation workshop: Eastern and South Eastern Africa, 23rd-26th May 1994.

The report presents proceedings of Regional Urban Sanitation. The workshop discussed sanitation aspects in Eastern and South Eastern Africa. Some of the problems and common constraints recognized at the end of the workshop included inappropriate policies and regulatory framework, inappropriate institutional arrangements and a narrow range of technological options available to the users, insufficient attention given to community/user participation in the overall process of sanitation improvements. Enabling and hindering factors in sanitation and informal settlement are:

Finance:

Hindering— lack of funds at all levels leads to expensive services

Enabling: beneficiary contribution

Technology: Hindering— inapt technology, unsuitable soil, high water table, site limitations and unplanned developments.

Institutional Issues/Partnership:

Hindering— rigid and/or inapt by law, low priority given to low income area, provider dependency, land tenure (problems), poor information flow

Government Policy/Legislation:

Hindering— lack of legislation and enforcement.

Enabling— incentives to move to other urban centres, land reformation, government support not provided.

Community Participation/ Social Cultural:

Hindering— lack of awareness/knowledge, lack of community empowerment, underestimation of community ability.

Enabling— community involvement, homogeneity, heterogeneity of communities.

Sanitation issues urgent in Kenyan Urban Slum areas are:-

Planning tools and institutional arrangements— participatory appraisals; match

between financing arrangements, choice of technology and institutional arrangements.

Financing Mechanism— informal settlements should have a high priority in resource allocation.

Technology— new design guidelines- simplified sewerage/experience in other country.

Policy/Legislation— review laws related to sanitation; government recognizes the informal section upgrading e.g. in Mathare, Nyahuhuru; land tenure - formalize land ownership in government land.

Sanitation for an urban low housing scheme/ Civil Engineering Department, University of Nairobi, 1987

The report presents the conditions of water supply and sanitation facilities in the Mathare Valley Slum Villages. The report also contains suggested sanitation technologies appropriate to this area.

Residents depended on water kiosks for their water supply used for drinking, bathing and cooking. For washing clothes the residents depend on the heavily polluted Mathare river. The supply from the Kiosks was said to be reliable. Communal lavatories connected to sewers have been provided. These are insufficient and the situation leads to indiscriminate defection around the toilets. Overflowing sewage from the manholes on sewers which cross the area is another problem. Sullage and sewage (from the manholes) also flood the drains which are already blocked with garbage. Refuse is scattered or heaped and burnt, thus adding to air pollution.

It is recommended that communal channel toilet blocks be provided by the City Council Maintenance and cleaning should be left to the user community. This also can be achieved by allocating different toilet blocks to particular households.

Improvement of unsewered sanitation for the underprivileged urban dwellers. - Civil Department, University of nairobi, June, 1994

The report highlights the plight of the underprivileged urban dwellers with respect to sanitation in the Mathare slum. The report contains also recommendations of ways to improve the level of sanitation in Mathare.

The Mathare Valley Slum is relatively well served with clean water from the Nairobi City Council. Water is reliably supplied through the ring main type distribution system. Water is sold from the water kiosks at one shillings per 20 litres jerrican. Drainage around the water selling points is poor. A few people use the heavily polluted water from the Mathare river for washing.

Drainage system is very poor. Overflowing sewage (from sewers passing through the area) stagnates in the drains which are blocked with garbage. Inaccessibility into the slum by the Nairobi City Council refuse collection trucks result in garbage rotting heaps.

Excreta disposal in Mathare is by communal latrines connection to sewers. However, these are few and are poorly maintained. People indiscriminately defecate around it.

A large number of residents use latrines provided and maintained by landlord. Some of these are poorly maintained and others have collapsed.

The community has not been involved in any effort to improve the sanitation programmes. Public education in sanitation, hygiene, maintenance, and the advantages of different kinds of construction technologies especially of pit latrines are recommended.

Introduction to applied environmental planning and natural principles in urban development: field course/ Ol Kalau Town Council

The report discusses Environmental Action plan for Ol Kalou a town in Central Province.

Serving an average of 50, the latrines are inadequate. During the rainy season they fill up very fast with ground water. Inadequate exhauster services compound the problem leading to frequent overflows.

It recommends the installation of a sewerage system and off site treatment plant and direct kitchen washing to open drains; increase the number of toilet in town's open air market; raise level of latrines in the low income area of Huruma to prevent flooding inside; construction of VIP where there is poor construction, depth of pit should not be less than 25 feet and area of 3 feet by 4 feet to prevent speedy filling.

The community needs to be sensitized on the benefits of these measures.

Service improvement demonstration project: analysis of the present service delivery and recommendation for improvement in Othaya Town, 1995.

The report describes the current situation of the solid and liquid waster management in Othaya Town and suggests some practical methods of improvement.

The water supply to the town is far less than the demand, resulting in water rationing. This especially affects the peri-urban areas with the resulting serious shortage.

The town's urban area is served by septic tanks and cess pools. The peri - urban pit latrine is the most common method of excreta disposal. Sullage is discharged into open channels and road reserve, or other indiscriminate disposal methods.

To avoid indiscriminate disposal of sludge from septic tanks and pit latrines, it is recommended that exhausted operations and charges be coordinated by the town council. Construction of sludge drying beds is also recommended for safe disposal of sludge. Land owners whose premises have overflowing sanitation facilities should be prosecuted. Council/Local Government byelaws need to be enforced.

Make your town a green town, Runyenjes environmental and development plan and action plans. February 1995

The report presents the results of a 3 day training workshop in Runyenjes with the objectives of demonstrating the cause of environmental problems, numerous solutions, planning and design steps. Action plans are also set out.

It identifies the problem of waste water from back of the houses and inadequate water supply caused by poor planning of the water system and poverty. This results in wasted time used to fetch water from far, and poor health. Toilets are not sufficiently provided leading to human waste being scattered everywhere and pollution in general.

Make your township a green town. Eldoret environment and urban development training project. June 1995

The report presents the results of a 3 day training workshop held in Eldoret with the objective of demonstrating the cause of environmental problems, solutions, planning, and design steps. Action plans are also set out.

Peri-Urban area water supply and sanitation problems identified include lack of safe drinking water; insufficient water kiosks and; inadequate roof water catchment; absence of sewers or blocked sewers due to improper use; poor liquid waste disposal. Generally, the report notes inadequate sanitation facilities. Pit latrines are used very close to a well and to the unprotected spring, leading to pollution. Most of the problems are attributed to poverty and lack of awareness. Public education and community participation are recommended.

Make your town a green town: Machakos environment and urban development training project. March, 1995

The report presents the result of a three day training workshop on environmental planning carried out by Green Town Project Team. The report aims at raising the level of awareness of environmental matters and providing guideline for identification and management of environmental problems.

Problems identified in the slum areas were poor sanitation and lack of latrines in Miwani, leading to deplorable conditions. The reasons include lack of planning in the freeway-hold areas, poverty of the residents and lack of awareness.

Problems identified in Muoroto, Majengo include human waste in deserted houses due to inadequate toilet facilities - leading to air pollution, diseases and nuisance.

Possible solutions to identified problems were enforcement of municipal byelaws; public education and proper maintenance by the council, Public Health Officers, Community and Chiefs.

Environmental development plan and action plan: Malindi environment and urban development training project, June 1994

The report presents a 2 week field course programme on environmental planning carried out in Malindi Town. The course was intended to raise the level of awareness for the need to protect the natural environment.

Sanitation of the densely populated area is in the form of pit latrines which are in direct contact with ground water level leading to pollution in well water which is drawn in the same area. Water is supplied from wells located near pit latrines ad soak pits, not covered and protected multiple buckets are used to draw water.

The town has inadequate hygiene and social responsibility. There is a need for concerted effort between the community, the council, and the district to solve the existing problems including water and sanitation. A programme for community education and mobilization about water pollution dangers is necessary.

Make your town a green town: Kericho environment and urban development training project, April 1995

This report presents the result of a 3 day training workshop held in Kericho with the objectives of creating awareness on the environment, discussion of environmental problems, causes and effects, development of solutions which are easy to implement, and formation of an action group. The report identifies the problems of pollution of water sources, discharge of raw sewage into river, lack of public awareness. Other problems include insufficient public service sanitary facilities, inadequate liquid waste, poor planning and absentee landlords

Possible solutions to identified problems include, public education by trainers and community participation.

Environmental development plan and action plans: Webuye environment and urban development training project. July 1994

The report presents the result of a 2 week field course on environmental planning carried out in Webuye Town. The course was intended to raise the level of awareness of environmental matters and at the time provide a guideline for the identification and management of environmental problems.

Problems identified include use of pit latrines which pollute spring water leading to water borne diseases.

Recommendations include the improvement of water springs at NCPB by protecting spring, building a wall protecting direct flow to pipe; education of the community on proper use of springs; provision of pit latrines at the Muslim estate and emptying them regularly.

Resources— Community participation; human and hired services; town council.

Constraints inlcude lack of community understanding; lack of space; rocky ground; high water table; poor accessibility of latrines; unplanned human settlements.

Nanyuki town environmental development plan: green town project.-Ministry of Local Government, July 1996.

The report presents the results of a 3 day workshop held in Nanyuki to address the causes of environmental problems, numerous solutions, planning and design steps. The workshop also examined the interrelationship between the identified problems.

The workshop identified a number of problems in the Majengo area as water shortage, water pollution in Nanyuki and Hikii rivers, poor garbage collection, lack of sufficient public toilets and use of bucket latrines, ignorance of the environmental issues and blocked drains.

The suggested solutions to these problems include environmental public awareness campaign, regular collection and disposal of garbage and provision of dustbins, provision of appropriate public latrine facilities, proper design of drains, stop garbage damping into rivers, expansion of sewage system, stop car wash at river banks.

In solving the problems, the following constraints were envisaged:-

- Lack of equipment and funds.
- Ignorance (i.e. negative attitude)
- Lack of law enforcement.

Shelter and services for the poor in Nairobi, Kenya. paper presented at the "Expert Group Meeting on shelter and service for the poor in metropolitan region. January 12-16, 199_? Nagoya, Japan". UNCRD

The report presents a study which examined the magnitude of shelter in basic urban services deficiencies in poor settlements in Nairobi and which analyzed the effectiveness of government policy responses. The aims of the study were to:-

- describe social and economic characteristics of slum and squatter settlements
- examine key issues in providing shelter and services to the poor such as:-
- the extent and modes of community participation
- resource mobilization for the provision of shelter and services
- role of informal sector in basic services
- role of self help in upgrading programmes.
- analyze alternative institutional arrangements and management approaches utilized in providing shelter and services to the poor.
- identify alternative strategies for effective provision of shelter and basic urban services to slum dwellers and squatters.

Examples of Kibera and Mathare Valley Slum in Nairobi.

Water Supply— 92% of Kibera residents obtain water from communal taps. 5% have private stand pipes and 3% have none. This 3% draw their water from running streams or from nearby dam. Communal taps are rented from City Council by individuals who sell the water to residents. During the rainy season, many residents tap water from roof catchment thus reducing water demand. Water is prone to pollution due to poor methods of storage.

Sanitation- There are no regular sewage disposal services in Kibera. Most of the plots have detached pit latrines which serve between 30-300 people. The

overuse of latrines and the fact that they are irregularly cleaned and emptied, leads to unsanitary condition which worsen in rainy seasons. Some residents use open spaces between plots. Sullage from household is disposed by flowing on to open ground outside dwellings. In Mathare, the communal block latrines are in a state of general disrepair. Kibera does not have regular disposal service. In some cases, inhabitants dig holes to burn their refuse but more often refuse is thrown outside dwellings to the nearest open space. There is no access to such heaped garbage.

Recommendations— In view of the rapid urbanization in Kenya, the Government should prepare appropriate settlement strategies. It is possible to make improvements but not completely solve the problems faced by squatters; Any analysis of the problems should identify the structural limitations of upgrading policies and also the important preconditions for possible achievements.

Kisumu municipality: health and nutrition survey baseline information, April 1994

The report documents health and nutrition survey for Kisumu Municipality urban poor areas. It also looks at environmental pollution in the peri-Urban areas.

The municipality is supplied by tap water as well as borehole and lake/river water.

Regarding sanitation 70% of households use latrines; 12% use non conventional toilet facilities whereas some use the bush as toilets. Diarrhoeal diseases are common due to poor sanitation.

It is recommended that the problem of environmental pollution in the peri-urban areas of the municipality be addressed.

Manual for special pit latrine emptying vehicles.-Manus Coffey Associates Ltd. 1989

The report is a brief description of three types of latrine emptying vehicle designs that include costs of purchase, delivery, maintenance and running costs. The report compares use of these specially designed vehicles to conventional ones.

It present three different configurations of pit emptying vehicles that are suitably designed for use in low-cost sanitation of developing countries in site with limited accessibility. The vehicles have been tested in Kenya and Lesotho, and have been found suitable Developed specifically for cost effective operation and low maintenance, the Winget Tanker results from extensive tests in developing countries backed by over 20 years of experience in handling solid and liquid wastes.

This is an innovative technology for use in urban slum areas as has been the case in Kibera. However, the Kibera experience is not all that without concerns for the use of the equipment.

Long-term sustainability of innovative technologies needs to be ascertained before such technologies are applied wholesale.

Best practice initiative in Kenya for Habitat II: prepared under the auspices of the Kenya National Security Committee for Habitat II, Nairobi, 1996

The report presents and discusses Best Practice initiatives in Kenya for habitat II Conference on human settlements held in Istanbul, Turkey. The report contains what is considered Best Practices which can be replicated or adapted in Kenya or elsewhere. In the water supply and sanitation sector, Kitui, Kanuku and Kinyugo villages in Nairobi are presented as best practices. This presents the situation before and after the Undugu upgrading programme.

The community, Undugu society and the local administration discussed and community self-help group (registered with the ministry of culture and social services) set up to manage water kiosks, Undugu society assisted with loans to install water kiosks, administration, and NCC agreed to approve and make water connections.

- Community self-help group says the bills form proceeds from water sales.
- The price of water is the minimum affordable by the community.
- Undugu secured revolving grant from UNICEF and seven water kiosks were established in the 3 villages.
- Groups organized selling arrangements and each individual within the group has his/her day of selling water.
- With the help of Undugu, Pit latrines have been constructed. Community contributed all unskilled labour and little fund to pay for skilled labour.
- Undugu offered money for supervision and material
- After success of first phase, UNICEF offered more funds for further construction.
- Water borne toilets were constructed near the sewer line using UNICEF funds through Child Survival Development Programme.
- Community maintains the toilets by cleaning and maintaining the VIPs. Community also contributes money for emptying of the VIP when filled-up.
- Low cost bathrooms constructed along drainage paths.
- Problems of delay in emptying by NCC and smell when there is no water to flush and children 1-5 years old relieve in the open spaces when adults leave for work as the latter leave with the keys.
- Community maintains drainage and discipline errant members.

Success of the Best Practice attributable to:-

- Community participation
- The administration and NCC willingness for assistance
- Income from water sales has enabled sustainable provision of water supply and surplus funds used to put up rental rooms for more income generation and money used to purchase land elsewhere.
- Community using appropriate and affordable technology to harness water for other uses other than drinking.
- NGOs assistance with little funds has realized Best Practice initiative.

Nairobi informal settlements/ Matrix Development Consultants. March, 1993. (An Inventory Prepared for USAID/REDSO/ESA)

The report presents an inventory of accurate information on the location and characteristics of the informal settlements in Nairobi. The information is intended to be used as a basis for formulating policies and strategies in Nairobi city and in particular for informal settlements. The report also contains up - to date (1993) population densities in the informal settlements.

Summary of urban services provided: Urban services are nonexistent or minimal.

i) Water is only provided to a few stand pipes. 85% of households obtain water from kiosks at a price 4-5 times higher per litre than paid in other areas. Other sources of water are roof catchment, boreholes and rivers.

ii) Sanitation is inadequate. 94% do not have access to adequate sanitation. Roads, pathways and drainage channels are earth and flooding is common. Refuse is not collected and is found in unsanitary piles and blocking drainage channels.

Sanitation is provided by pit latrines shared by many users. Poor sanitation, lack of portable water, poor drainage, uncollected refuse and overcrowding, leads to higher rate of morbidity and mortality are prevalent.

Experiences learned include an increase of water kiosks and the and regulating the prices charged for water.

While in many urban areas in Africa well-designed and constructed pit latrines are highly suitable, in Nairobi, because of high densities, they pose considerable health hazards in many sections.

UNICEF/Mombasa Municipal Council CSD programme, 1989-1993. review report.-Municipal Council of Mombasa.

The report gives a summary of the activities that have been undertaken and those accomplished by the end of a CSD Programme Plan for the Period 1989-1993. The project intends to plan and implement specific activities including development and dissemination of CSD messages and information. Included in this project are Health Care, School Nutrition Programme, mosquito control, water development, Municipal Council of Mombasa, Local Administration and Communities.

There are three water supply projects funded by UNICEF. This include: Mwamlai-Miritini, Soweto, Mwasaratu and Makubarini-Maweni. Inadequate supply of clean and portable water persists and the community have to walk long distances to water points. Improvement of water has been achieved but women groups have not yet been connected due to lack of deposit (funds). In Mwamlai-Miritini the women group benefit from sale of water. The project also aims at improving excreta disposal by construction of VIP latrines in schools.

Lack of adequate water constraints the use of toilets and there are difficulties in emptying filled up VIPS. Political element retards the progress of the project. Poor community participation, and influx of the community to the area due to water availability are some of the constraints.

Kibera slum settlement state of water and sanitation. June 1994

The report describes Kibera Slums in relation to its Location, the village population and the state of the infrastructure. The report presents a detailed summary of the water supply and sanitation situation.

Water supply messages in the report are as follows:

- A total of 829 water points (kiosks) serve the Kibera settlement
- Cost of water vary between Kshs. 1 to 3 per 20 litres to community and private vendors, respectively, (NCC basic rate is Kshs. 0.04 per 20 litres).
- At the privately operated water points, price is elastic and is determined by the supply and demand. During shortages 20 litres can cost Kshs. 5.
- Public water points in each village vary between 4-8% of the total, perhaps due to reliability as all have storage facilities and also residents can walk to where water is cheaper, average walking distance 40m.
- Water is available in villages for a relatively short duration usually from 5 am.
- The per capita water consumption varies between 15-35 litres per day with an average of 23 litres per day.

Sanitation messages in the report include:

- Pit latrines is the excreta disposal method. There are about 2887 pit latrines
- In the entire Kibera settlement an average of 170 people per toilet.
- The soil condition in Kibera is not suitable for pit latrines —rocky and water logged.
- Many latrines discharge directly into water body or drain.
- Part of population uses 'flying toilet' where defecation is done inside house, wrapped in paper and thrown in drains, stream or on house roofs.
- Some NGOs have built some VIP demonstration toilets.
- KWAHO helped acquire an exhauster service in 1991, this facility however has not been a sustainable solution.
- Drainage is also poor. There is voluntary solid waste collection activity by the AFYA groups but it is not a sustainable solution.

Several lessons are documented as follows:

- Exploitation of the community by private vendors —Kshs. 5 per 20 litres water
- Serious difficulties were experienced in organization for sustainable community management of exhauster services —now toilets which fill up are abandoned without being replaced.
- Suitable technologies for excreta disposal need to be evaluated.
- Community is able and paying at very high rates for water.

Health in urban setting.-Nairobi Primary Health Care Unit, June 1993

This is a report on the establishment of Primary Health Care (PHC) Unit in the Nairobi City Council's Public Health Department. It was a report on a Workshop held at Masinga Tourist Lodge, Machakos, Kenya, 2-5 March, 1993.

The Urban Slum project - Nairobi City Council is aimed at the improvement of health of the community in seven major informal resettlements in Nairobi. The project is funded by UNFPA. The areas covered are Kibera, Kawangware, Kangemi,

Mathare, Korogocho, Kabiobangi, and Pumwani.

Activities include raising health awareness through workshop, improvement of sanitation, construction of VIP latrine, and provision of water points.

Achievements include the training of volunteers awareness workshops for field officers or projects.

Negative attitude of health workers, lack of policy guidelines, lack of adequate information, high mobility of community and leadership wrangle within volunteers are the experiences and lessons learned.

Urban basic services: Kisumu Municipality/UNICEF Child Survival and Development Programme. Annual Review 1989 and Plan of action January 1990-June 1991

The report discusses a UNICEF (CSD) programme in Kisumu Municipality. The issues addressed include: health, economic activities, water, sanitation, housing, education/social mobilization and community participation. The Kisumu CSD Programme has eight packages covering health, immunization and development, water, sanitation and disabled children. It also discusses abandoned/street children and their social mobilization, nutrition for Pre school children, women and economic activities.

The programme has extended water supply through water points to 20 women groups out of the existing 60, each group serving a population of at least 200 people. It has also constructed roof catchment in 10 schools, 10 shallow wells and Protecting 10 springs.

20 VIP latrines for demonstration have been constructed to create awareness of the need for individual latrines.

GOK/UNICEF situation analysis of children and women in Kenya. May 1992.

The report is a detailed situation analysis of children and women in Kenya of 1991 including the National Context, i.e. Demographic, economic, social, cultural factors, environmental and information on social mobilization for participation in Rural and Urban areas. Main areas addressed in the Urban areas are: Urbanization trends and consequences, access to basic services, women headed households in urban areas and future direction and gender analysis where health, water and sanitation issues are discussed.

Messages

- Deterioration of drinking water supplies and sanitary conditions are common causes of health hazards.
- Women should be involved as decision makers in water programmes, selection of sources, maintenance and management.
- improved water supplies need to be combined with improved sanitation and health education
- survey has shown that toilets are the most used form of sanitation.
- ignorance, poor sanitation and failure to build or use toilets are major concern.

The GOK policy objectives;

- Universal access to safe drinking water by the year 2000
- universal access to sanitary methods of excreta disposal by the year 200 GOK strategy to meet the goal.
- increased support to NGO efforts to promote water supply and sanitation activities at community level.
- more attention of low-cost affordable and sustainable technologies.
- accelerated promotion of community based water supply and sanitation system.

In informal settlements, the level of service is very low sometimes lower than that of some rural areas. An approach on the lines adopted for rural water supplies may have to be adopted for these urban areas if affordable and suitable services are to be realized.

Survey of informal settlements in Nairobi.-National Cooperation Housing Union Ltd, Nairobi, Kenya 1990.

The report is a summary of a survey conducted in informal settlements in Nairobi. The information was gathered from representative 5% sample in a study area. The survey questionnaire requested a number of issues: among them sanitation condition, water sources, garbage collection methods and infrastructure. The total number of informal settlements covered were 78. The report has details of each informal settlement situation.

Water Supply Situation

- Water is bought from water point, from Kiosks owned by residents. Water costs between 40 cents and one shilling per 20 litres.
- Water is also obtained from the Nairobi Dam by those in lower parts of Soweto, Laini Saba and Silanda settlements.
- Water collected at a fee of 10 cents per 20 litre container by members and tapped from rooftops during rainy season (Kibera).
- Some large aluminium tanks to store water (Korogocho)
- Fixed water taps near the rented structure (Kawangware) and water Kiosks in Riruta.
- Kangemi (both kiosks and taps)
- Kagichu in Riruta fetched from nearby well.
- In Gigiri, water bought at 1.00 per 20 litres from BP Shell Petrol station, or fetched from the nearby river. Water from Getathuru and Nairobi River, sunk wells in Mwangenye and Gutari Marigu.
- Water is freely provided by NCC and there are communal taps (Mashimoni, Majengo, Digo and Ndagoroni). This encourages long queues and some people fetch water and sell at 1.00 per 20 litres, to those who do not wait.

Sanitation Situation

- Byelaw 217 (4) requires one latrine and one ablution for each family or group not exceeding 6 persons.
- Toilets are shared by 30-40 persons. Most bathe at night in toilets.
- Pit latrines are required by the byelaws at least 30 feet from the nearest habit-

able room, but in reality usually within 10 feet.

- Children relieve themselves outside on foot paths.
- Toilets are so few and in pathetic conditions and they have no privacy (Kibera)
- No emptying of filled toilets due to higher fee paid to NCC leads to using filled up latrines.
- About 40% relieve in open spaces as a single pit serves between 50-500 people (kibera)
- Some parts in Mathare, Riruta, Kariobangi North are connected to trunk sewer and also some parts of Githurai and Roysambu.
- In Mathare a few toilets are provided by NCC.

Refuse

- In most cases refuse is emptied into rivers or just outside a structure, and in some cases dumped into a pit and then burned, dumped on roads or on foot path.
- Human waste is sometimes wrapped in paper.
- Sometimes NCC collects refuse which is dumped in heaps, and in some areas NCC says it is not responsible in collecting refuse in illegal settlements.

Recommendations

- Government to recognize slum settlements and provide funding for the provision of infrastructure.
- Government should relax rules governing public land on to which some of the informal settlements are located.
- Efforts should be made to coordinate the work of NGO's in informal settlements.
- NGO's and community based organization should identify women groups and help them to be more viable.
- Threats of eviction need to be lessened.
- Further detailed studies are recommended in specific areas.

Nairobi informal settlements: an inventory. For USAID/REDSO/ESA. March 1993.

The report is an inventory of informal settlements in Kenya, done by Matrix Consultants, for USAID/REDSO/ESA. The study was conducted in the seven divisions in Nairobi. The study was conducted through literature review on informal settlements, identification of settlements using existing maps and an aerial photography and photography on ground and visits where uncertainty existed.

The level of service differ from settlement, depending on the age of settlement, type of land tenure, geographical location, and access to wage employment. There is in general unavailability, inadequacy ad un reliability of water supply system in informal settlements. In the larger settlements, NCC provided stand pipes, which are metered and franchised to Kiosks owned by private individuals or community based organizations, and water vendors who sell water by wheelbarrow, retail 3 or more times the tariff charged by NCC.

11.7% of plots have water available directly to plots. But majority of population 85.6% obtain water from kiosks. Other sources are roof catchment, bore-

holes and river water. 80% of households complain of water shortages and dry pipes.

Pit latrines is the major method of excreta disposal but pit latrines are inadequate, e.g. 60% of households in Kibera and Korogocho have no access to a toilet, and share pit latrines.

Many settlements have no provision for baths or showers. In Mukuru 85% do not have access to showers and baths, in Korogocho 65% Kawangware 55% and in Kibera 54%. Pit latrines where they exist double as toilet and baths.

The drainage is poor and is usually non existent, where it exists it is open drains which are frequently choked with refuse. Korogocho, through Undugu Society, have cement-lined drains, but are also often blocked by garbage. Most informal settlements are littered with refuse and are contaminated with rotting waste.

There are no specific recommendations or new lessons learned in this report. The report however details the status-quo in informal settlements but makes no specific recommendations. The report however summarizes the various organizations that are involved in the informal settlements, including also the community based organizations such as women groups. The report has detailed information on who is doing what in the informal settlements in Nairobi.

Sanitation in Kibera: a case outline and some future directions. 1995

The report is a summary of a field survey in the nine villages that make up Kibera. The local water committee in each village assisted in data/information gathering from the residents. The survey focused on latrines, but also on water supply, drainage, refuse collection and access.

Several water mains run through Kibera. Metered water connection from the mains can be obtained through the Nairobi City Council, after permission from the chief, at a cost of Kshs. 2,000 for meter and license. The cost of the water pipes from the mains is also borne by the applicant. Pressure in the mains differs and some of the mains have very little water or no water for weeks, especially during the dry seasons and during the Nairobi show, when water is directed to the show ground.

Some individuals use booster pumps resulting to other kiosks having dry mains. During the whole year, many mains have water for only restricted hours per day, usually early morning. Most residents obtain water from the kiosks at a fee that ranged from kshs. 1 to 3 for 20 litres. There are also water kiosks run by committees established with the help of KWAHO and are funded by UNICEF. Water from the latter kiosks is sold at Kshs. 1 per 20 litres. The water consumption is depended upon the family income and the distance to the kiosks. The level of water use endangers personal hygiene as evidenced by high incidence of sanitation related diseases and skin infections in Kibera.

There are several sewer lines that run through Kibera, but connections are not allowed because of the illegal nature of the settlement. Pit latrine is the excreta disposal method. Most households have access to pit latrines but one latrine can serve as many as between 50 to 200 persons. Emptying services are provided by NCC at a fee of Kshs. 1000 per load. Accessibility of pit latrines is also a problem.

An alternative method used to empty filled up latrines is to open them during the rainy season and the contents spill out and drain away over the roads. Latrines are kept clean by the landlady, if she also lives in the compound, which is frequently the case. Sometimes maintenance is done in turn by the tenants. But lack of water, cost of water and slab cleaning result in poor services. VIPs have been constructed in the area but lack of emptying services render their use ineffective.

There is no solid waste collection and heaps of garbage are scattered throughout the area. In some villages communities have organized ways of dealing with solid waste menace such as digging pits and burning the waste in them. There are also no drainage facilities in the area.

The density of population in Kibera indicate the feasibility of reduced cost on sewerage to improve sanitation. However, scarcity and cost of water and use of solid material could render sewerage system ineffective. Experience in other peri-urban areas in Kenya show that sewered latrines become blocked within months. With the help of UNICEF, KWAHO is looking into possibilities of obtaining custody of the Mini Vacuum Tanker and to repair it. The Mini tanker is not able to serve all the houses because of narrow footpaths.

In Dar-es-Sallam, Tanzania, a manual pit emptying technology (PATET) has proved to be technically feasible. A special type of slab, SAN-plat, is suitable for use in both Mini Tanker and MAPET systems.

Waste disposal in Nairobi slums.-Nairobi:Civil Engineering Department, University of Nairobi, 1989.

The report presents the state of infrastructure services in slum areas in Nairobi, Kawangware, Mathare, Korogocho, Pumwani, and Kibera. The report highlights the current improvement being undertaken in the areas and outlines useful recommendations.

Water kiosks is the main source of water. The price at which water is sold could be reduced. A mall percentage of residents is accessible to clean water but majority use the heavily polluted river water in Mathare.

Sullage and other forms of water is directly discharged into open ground or drains, thus taking care to avoid directing it to the pit latrines which would otherwise fill too soon. Excreta disposal is largely by pit latrines where in some cases they are too shallow owing to the nearness of the rock to the surface. Pit latrines in some cases are in various stages of disrepair. Other forms are communal sanitary blocks. Garbage collection by the city council is rare if at all and garbage is heaped in open spaces within the slums. A method of disposal is by burning which leads to air pollution.

Water is still inadequate. Price charged at the water kiosks needs to be regulated by the city council. Where water charges is incorporated into the rent (for those plots connected directly to a water supply), there is less rationing and no storage in unsanitary containers.

Community education on the benefit accruing from a clean environment is very essential. Construction of the improved toilets and increasing the number of excreta disposal facilities is very urgent.

Action towards a better Nairobi: The Nairobi we want. Report and Recommendations of Nairobi City Commission. 1993.

This was a report on the recommendation in a convention for the Nairobi City. The convention looked at the many issues/concerns facing the Nairobi residents. Included in the deliberations was the issue of water supply and sanitation.

There is a shortfall in bulk supply and distribution of water needed to meet the demand. The water situation has been made worse due to high growth of population and low-income areas than were anticipated. But the Third Water Supply project should alleviate the problem.

Sanitation facilities are inadequate due to higher housing densities than was originally planned. Low-cost informal housing has gone up in areas not originally intended for residential development.

Recommendations

- provide adequate and reliable portable water supply and effective disposal sewage.
- the cost of water supply and sanitation be fairly distributed among the users.
- existing management system and physical infrastructure were basically sound. Any reform should take these existing facilities as the starting point.
- Master plans to take into account the growth trends of Nairobi City and its environs.
- All discharge of sewage into river should be stopped and damage repaired where possible.
- Collection points for solid waste should be distributed in low-income areas. Refuse could be buried and the leachate discharged into sewer or septic tanks.
- Public Health Act be revised and all laws and byelaws relating to water management be enforced.
- the laws dealing with tariff CAP 372 THE WATER ACT AND CAP 265 the Local Government Act be amended to place responsibility with the council.

Field testing of VISP in the Kwa-Rhonda settlement, Nakuru, Kenya: socio-economic and infrastructure survey. report on Phase 3.-Habitat settlement upgrading programme.

In addition to the objectives set out in phase 2, the report also outlines the assistance required to be given to community and municipal council in identifying a course of action which ensures effective planning and implementation of some suggestions for informal settlements improvements.

The main problem identified by the tenants were water supply, insufficient number of latrines and their unhygienic condition.

Planning for infrastructural services is hampered and done on an ad-hoc basis without a proper master plan, which would otherwise incorporate the upgrading and improvement of informal settlements.

There is a great potential for community involvement in the planning and management of community services. To be targeted for this potential exploitation is the landlord group.

Field testing of VISP in the Kwa-Rhonda settlement, Nakuru, Kenya: socio-economic and infrastructure survey. report on Phase. 2.-Habitant Settlement Upgrading Programme

The report outlines how the maps and the aerial photographs, could be used as a tool to enhance community involvement in planning and regularization and infrastructural improvements. The report also presents the present infrastructural problems with the aim of prioritizing future improvement of activities. The report describes proposed workshops with tenants, landlords and municipal officials. The aim of the workshops being to extract information on the problems in services such as water supply, sanitation, solid waste disposal, environmental cleanliness, etc.

Urban water supply and sanitation management (UWASAM), Kitale, 1995

The report is a summary of deliberations on a workshop held to create public awareness on water supply and sanitation in Kitale to improve the relationship between the consumers and Kitale Municipal Council. The workshop was facilitated by officials from the Ministry of Local Government and the GTZ.

It notes the irregular and inadequate water supply the very poor and inefficient solid waste management system, inadequate public latrines and poor maintenance of public toilets. Some lack public toilets.

The workshop recommends that the community, the Council and the Government to be involved in addressing water supply and sanitation.

Landlords should provide VIPs, the Chief to mobilize community and the council to create public awareness and enforce byelaws.

In addressing water shortage the workshop recommends the formation of self-help groups, and contribution from the residents, to prepare a Master plan on water supply and sanitation for the town.

The community should participate by collecting and burning garbage and dig compost pits. On the other hand the council should provide bins, transport and a dumping site, while the central government provides funds to purchase vehicles.

Low-income area water supply and sanitation in selected African cities. Tampere University of Technology Institute of Water and Environmental Engineering, 1994.

For Nairobi, the report is a review of the water supply and sanitation situation in the low income shanty areas of the city. The review highlights the fact that whereas substantial investments have been put in the water supply, delivery services input and sanitation provision and improvement has remained fairly insignificant. The information presented was mainly obtained from the reports while some information was also obtained from preliminary field surveys.

Only 17 per cent of low income housing have water inside houses. The commission supplies stand pipes and charges usual rates but the vendors overcharge.

Other sources of water in those areas are of roof catchment, river and borehole. In the slums, about 80 per cent consume between 40 - 80 litres of water per day, of which about 85 per cent is obtained from kiosks.

In some areas residents spend about 30 minutes in drawing water in the water kiosks. Some residents buy water from "water boys' who queue and later sell the water to the residents at their houses. During the rainy season, the demand for water in some areas is low because of water from roof catchment.

Communal toilets are the norm in most of the slum settlements. In most cases, the toilets double also as bathing places. Domestic washing of utensils and clothes is also a problem. Some use the washing inside the houses and others outside. In the disposal of the spent water - sullage becomes a big headache.

Solid waste collection is a big environmental problem in these areas. The collection of the solid waste by the council is unreliable. Another problem is that either the dumping site is too far away from houses or is just next to houses. Drainage is a big problem especially in the rainy season when the rain water mixes with overflowing pit latrines and fills the gullies around the dwelling units.

Policy changes by NCC and the local government are necessary for improved water supply and sanitation in low income areas. Evaluation of suitable exhauster system and solid waste management options is a challenge that needs attention. There is need for increased community involvement in the provision and management of water supply and sanitation facilities.

Improving urban services in Nairobi.-Operations Evaluation Department. June 1996.

This is a recent Operations Evaluation Department impact evaluation —Kenya Development of Housing, Water Supply, and Sanitation in Nairobi. It is based on five World Bank —supported urban service projects in Nairobi, which realized increased supply of portable water and affordable housing to the poor, improved sanitation and environmental conditions in the project sites, and increased access to social services.

The World Bank's water funded projects have resulted in an overall improved water supply situation in Nairobi. The improved and expanded infrastructure brought water and sewerage services to rapidly growing business areas and poor neighbourhoods in the Eastern section of Nairobi. The poor access to treated water improved, but irregular pricing practices by the kiosk operators kept costs high. The Nairobi Water and Sewerage Department increased the number of water kiosks in low income areas from about 150 in 1978 to nearly 1500 in 1994 and maintained low tariff for kiosk operators.

The increased number of kiosks reduced the distance to water sources resulting in reduced time to obtain water. This has led to an overall high level of water quality, and sufficient supply for cleaning and bathing. The number of households, however, sharing the services of a single kiosk are still high, sometimes one kiosks serving as many as 50 households. The kiosks operators charge water up to six times the lowest rates for house connections. To counter this, residents

are forming committees to manage their own kiosks and other NGOs are becoming involved.

The projects improved sanitation and the environment, but poor maintenance and inadequate garbage collection threaten sustainablity of benefits. There is increased use of water-borne toilets. But access to private toilets has declined, resulting in large number of households sharing toilet facilities. Drainage is still a night mare in the poor areas and inadequate garbage collection threaten sustainability of project benefits. The Department of Public Heath collects only about 20 per cent of the garbage generated in Nairobi.

Municipal service projects in weak institutional environments need strong and well targeted technical assistance. Investment projects need to integrate various service provisions so that the benefits of an improved service (such as drainage) are not negated by the absence of improvements in other services (waste collection).

Feasibility study on the Mathare 4A slum upgrading project. Result of the social economic survey in the Mathare 4A Pilot slum upgrading area, 1993.

The report presents Social economic survey data conducted in the Mathare 4A slums. The aim of this data is to:-delineate and define socioeconomic patterns and to identify and register potential beneficiaries in the area. Among the topics surveyed was the importance of possible improvement measures (sewerage, water, storm water, public toilets, public washing places, refuse collection, health facilities, etc).

Other information analyzed is the dwelling characteristics and the conditions of the environment.

The most visible deficiency is sewerage. All waste waters are drained in the open channels in the centre of narrow footpaths between structures. This poses a severe health hazard as evidenced by the high number of intestinal and other diseases. Whatever flows, ends into the already heavily polluted Mathare river. Water distribution is relatively well organized through water kiosks. However, the prices paid for water at kiosks are 4-5 times higher than those charged by NCC in other formal areas.

Excreta disposal is by a public toilet previously maintained by NCC but now neglected. The few common toilets, provided by some landlords, are insufficient. The residents who are inaccessible to the above facilities use the scarce open spaces or open channels excreta disposal. Refuse collection is nonexistent in this area. People throw refuse indiscriminately outside their doors, in open spaces or dumped where goats and cows feed on the portion of kitchen remains.

The survey found that the desire to have own toilet and a sewerage system was a top priority with the residents. The second priority is assurance of water supply probably by an own water connection. Improvement of the existing sanitary facilities was not given priority.

Countdown to Istanbul. Habitat II United Nations Conference on Human Settlements Istanbul, Turkey, June 1-14 1996. Water crisis for thirsty cities. Self help initiatives improve water availability in Kibera, Nairobi (pg 17-18).

The report describes water situation in different cities in the world. Increased human migration by the world population to the urban areas, will exert demand for water significantly. The report summarizes different water situations in poor urban areas in different cities of the world. In Nairobi at Kibera a success story is presented.

There are about six water mains running through Kibera, a settlement that covers an area of 225 hectares with an estimated population of 470,000 people. A metered water connection can be obtained through the Nairobi City Council, after permission from the Chief at a cost of Kshs. 2000 for meter and license. Most people obtain their water from the kiosks which are owned by private individuals. These sell water for 1 to 3 shillings per 20 litre container. The number of kiosks is estimated to be around 500.

Water availability is restricted to the times when there is water in the mains because most kiosks do not have tanks. The cost of water and scarcity of water results in a level of water use which endangers personal and environmental hygiene.

To improve on the availability of water, KWAHO trained resident health volunteers to form water committees with other residents and to establish kiosks. Each water committee consists of 20 persons, mostly women, who are registered as self-help groups with the Ministry of Culture and Social Services.

At present there are water committees in each of the nine villages which make up Kibera. With funds from UNICEF, pipes, taps and three 700 litre aluminum tanks were given to each committee over a period of two years. The water committees pays for water tanks platform (shillings 4,400), the metre and the license (shillings 2,000). The water is sold at 1 shilling for 20 litre container.

The group has been very successful in its operation. Group members take turns in attending to water kiosks and earn a fee of 20 shillings per day. Each month one member gets 1000 shillings from water sales profits. After six months the group installed another water tank. They have made a down payment for a plot in another area which they intend to construct rental houses. They have in addition saved 50,000 shillings which they want to invest in further improvements.

In order to reduce burden of water carrying and improve on environmental drainage, the committee has decided to construct an ablution block including washing tabs, bathrooms and latrines. Management of the ablution block will be done by the committee and residents will have to pay fee to use. The committee is discussing with the chief for use of a piece of land for that community purpose. KWAHO is providing the technical advice, with support from IRC International Water Sanitation Centre. Waste water from the ablution block is being looked into for possible reuse for other purposes.

The community involvement, the administration, the NGOs and funding agency, working in harmony have realized positive benefits in the provision of water services. The community has realized that with increased water use, drainage of wastewater has to be tackled.

Refuse disposal and salvage in Nairobi residential areas.-Nairobi: Civil Engineering Department, University of Nairobi, 1993.

The report presents the characteristics of refuse management in the three residential areas which include Mathare, Majengo, Pumwani areas in Nairobi. The report suggests some useful recommendations.

In both Mathare and Pumwani, refuse is indiscriminately discarded. The refuse is predominantly organic materials: food wastes, paper and plastic paper. There are no refuse storage facilities. Drains have been blocked with refuse. Burning is used as one method of refuse disposal with the attendant air pollution. Residents are unable to pay for individual dustbins. Further access to dumping areas are non existent making it impossible for any effort to collect refuse by the city council.

Accesses to refuse dumping sites within the residential areas have to be improved to attract any collection efforts by NCC or other players in the refuse management in Nairobi. The assumption that only the local authorities should be involved in cleaning and maintaining a healthy environment should be discarded and community participation and environmental cleanliness campaigns should be enhanced.

Nairobi master plan for sewer, sanitation and drainage: sanitation in unsewered areas, Draft Report, June 1996.-Nairobi: Nairobi City Council, Water and Sewerage Department 1996.

The draft report presents the results of the survey for the Nairobi Master Plan for the sanitation in the un sewered areas. The un sewered areas surveyed are informal settlements with the usual characteristic shortcomings of the urban infrastructure services such as :-insufficient water supply, lack of adequate excreta disposal systems, nonexistent refuse collection services, poor drainage, etc.

The report recommends some immediate and long term measures for the improvement to these community services and improvement of the living environment. The plan also proposes the cost of the immediate measures.

In spite of the fact that the informal settlements are now a permanent feature of the urban life, they continue to be excluded from the urban sector planning with the result that they suffer from the following shortcomings:-

Access Roads

- Accessibility in most slums is difficult with the result that services such as emptying filled pit latrines, collection of garbage, etc, cannot be done.

Water Supply

- Unreliable water supply, inadequate water kiosks, storage of water is inevitable but in unclean containers. Cost of water from kiosks or vendors is very high.
- Use of water from the highly polluted rivers by people who are not accessible to clean water from the kiosks or elsewhere.
- Stagnant water around the common water points which are poorly drained.

Sewage Disposal

- Insufficient number of pit latrines. Existing ones are shallow, unclean, over-

flowing and inaccessible for emptying.

- Indiscriminate excreta disposal to open spaces, around latrines.
- Overflowing latrines to open drains
- Overall result-severe health hazard.

Sullage and Storm Water drainage

- Discharge of household waste water to open drains outside
- Blocked drains with solid waste
- Unlimited drainage are prone to erosion in heavy rains.

Solid waste disposal

- Refuse collection services are nonexistent due to partly inaccessible dumping site.
- Indiscriminate throwing of garbage into open spaces, outside houses, drains
- Burning of garbage leading to air pollution
- Lack of awareness of hazards associated with indiscriminate garbage disposal.

As a prerequisite for any programme aimed at improving sanitation situation in the informal settlements a solution of land tenure problems and provision of adequate access has to be found.

Immediate Measures

- Public awareness of proper refuse collections methods, use of polluted water from rivers and clean water storage.
- Rehabilitation, improvement and increasing the sanitation and water supply facilities.
- Role of various participants in informal settlement upgrading programme should be recognized.
- Efforts by the government, NGO's, donor agencies and the communities should be wellcoordinated.

Field testing of visual planning (VISP) in the Kwa-Rhonda settlement, Nakuru, Kenya: report on Phase 1.-Habitat. Settlement Upgrading Programme. 1994.

The report presents the use of VISP for social economic and infrastructural survey in Kwa-Rhonda in Nakuru. The report also recognizes that informal settlements provides shelter to a large urban population, although they are illegal and therefore largely excluded from basic urban infrastructure and services. To improve living conditions of this population, legalizing and upgrading of these areas offer the best solution.

One constraints to this end is the lack of basic information for legalizing and improvement i.e. cadastral surveys and reliable information on actual patterns of land use, property and occupation. Due to the cost of time, traditional surveying methods are unsuitable for the informal settlement area. A new methodology to be used in the improvement of projects for low income settlements have been advised by Habitat called VISP. Using this new methodology it was found in Kwa-Rhonda that:

- there are no sewers and drainage and waste water and rain water flow into the earth roads resulting in deep ditches due to erosion.

- there is no solid waste collection and most of the waste is kept within the compounds.
- traditional latrines are provided in most compounds for disposal of human excreta. The number and conditions of latrines differ from one compound to another.
- there are no public water points but individual compound connections made by owners. Taps are often dry and people fetch water from kilometres away. Yet no appreciable storage is done in the compound to provide water during the dry days.

Building a community based activity needs a relatively stable community which is not the case in the urban low income areas due to the high mobility of the mainly tenant residents. Improvement of environmental conditions such as tanks for water supply, sufficient and adequate latrines and hygienic solid waste management should be a precondition for the legalization of slum areas. However, this would lead to increased rents thereby chasing away unable residents only to start other slums. Priorities for improvements in urban low income areas are totally dependent on the local circumstances. It is clear that the key to sustainable programmes for upgrading and improvement must involve communities from the start - in analyzing the current problems and in prioritizing the activities for improvement.

Second Mombasa and coastal water supply engineering and rehabilitation project: strategic study for sewerage drainage and sanitation.-National water conservation of pipes corporation; October 1995.

The report summarizes the findings of the strategic study aimed at improving and expanding the sewerage, drainage and sanitation facilities within Mombasa District. This study began in November 1994 and was to continue for 22 months. The findings would serve as a basic document for government and related agencies to access the current level of services and their adverse environmental consequences.

At present only about 12% of Mombasa's population is served by water borne sewerage systems and this discharge raw sewage to the inland creeks and the sea through outfall. The remainder of the population (88%) use on-site sanitation systems which due to their method of construction, have resulted in serious ground water pollution in the area. De-sludging services by MCM is inefficient.

3% of the population have no convenient access to water supply facilities. The present water supply system is inadequate. These people purchase water from vendors or kiosks.

Existing practices of storage, collection and disposal of water give rise to public health concerns with regard to communicable diseases.

Recommendations include modification of existing pit latrines and soakage pits; improved design and supervision of construction of appropriate affordable new facilities; motivation programme to create an awareness of the dangers of existing practices and the benefits of improvements and of obtaining sewer connections.

A report submitted towards project of "Population, Environment and Health and Family Planning Services in Urban Slums".- Nairobi City Council & United Nations Fund for Population Activities (UNTPA); 1994

The report presents a research study for the application of Rapid Assessment Techniques for determination of the state of environment in Kawangware and Kangemi slum areas. The study presented is a part of the overall project on Population, Environment and Heath/FP services in Urban slums of Nairobi. The study took 35 days in 1994.

Slums and uncontrolled settlements are characterized by low housing standards, lack of basic urban services like water, drainage, garbage collection, toilet, recreational facilities and inadequate health and family planning services. Another feature is the illegal status in terms of land and town planning techniques.

People's attitude towards garbage collection problem showed feelings of apathy and hopelessness about their environment. An effort needs to be made at community mobilization in order to create awareness about environmental aesthetic and hazards associated with poor disposal. Willing entrepreneurs should be encouraged to invest in refuse collection and recycling.

The community's feelings about environment cleanliness was found to be wanting. Scarcity of water was attributed to the landlords who were said to be closing water at various times. Water pollution was a problem arising from lack of drains and garbage collection facilities.

Recommendations include the improvement of the urban environment by promoting social organization awareness through participation of local communities in the identification of infrastructural service needs; empowerment of community groups, NGOs and individuals to assume the authority and responsibility for managing and enhancing their immediate environment.

Population, environment, and health/FP services in Nairobi slums.-United Nations Fund for Population Activities (UNFPA); 1995

The report presents the strategies taken and the result of UNFPA sponsored project which sought to extend the basic urban services to the under-served groups in seven slums area i.e. Kangemi, Kawangware, Kibera, Korogocho, Pumwani, Kariobangi and Mathare. The strategy utilizes the local "traditional" structures of the communities, i.e. community organization and resource mobilization to improve environmental conditions in the slums.

Only 11.7% of slum dwellers had water within their plots. The main source of water in slum areas are water kiosks controlled by influential individuals and sold at between 50 cents to Kshs. 5 per 20 litres. The aim of the project is to make potable water more accessible and to reduce its cost by at least 1/2 of the current rates.

A majority of slum dwellers rely on pit latrines for excreta disposal. Other sanitation facilities are few and far flung or are in deplorable condition. The aim of the project is to assist in the construction and maintenance of public toilets.

Roads and pathways are clogged by uncollected garbage which had indiscrimi-

nately been thrown. The aim of the project is to build garbage collection bins.

Extension of basics services to the slum areas has been hampered by the government's position that slum areas are illegal. The organized traditional community structures can be used to the advantage of *identification and prioritization of needs; identification of sites; and supply of unskilled labour during construction of sanitation and environmental facilities*:

Collaboration, coordination and cooperation with other agencies (e.g. NGOs and donors e.g. UNICEF) participating in slum improvement programmes is important. Evaluation of effects of impact, of the basic services extension programme would serve to provide a future indicator or impact of similar projects.

Case study of Ngong town.-Nairobi:University of Nairobi, Civil Engineering Department, 1996.

The report identifies significant health risk and environmental pollution sources in Ngong Town. The study presented is concentrating on storm water drainage, solid waste management, water waste and land use planning in Ngong.

The disposal of refuse generated from commercial and light industrial areas is on open undeveloped land. These disposal sites are likely to cease with the impending development of Ngong Town due to its proximity to Nairobi. More refuse is strewn indiscriminately around households. The collection of solid waste is by Town Council, but the level of service is inadequate.

Sewage is collected from sewered areas and treated in waste stabilization ponds. Sewers are poorly maintained and often blocked and spill overground posing a health hazard. Water supply is intermittent and rationed resulting in blockage in sewers. Septic tanks are used for sewage disposal in the unsewered areas. Seepage is a problem due to black cotton soil in the area. Also shallow rock inhibit the depth of the septic tank. The result is frequent filling and overflowing.

Pit latrines exist in Ngong Mathare area. Most latrines are poorly constructed, are shallow and uncovered.

Affordable and sustainable solution of environmental sanitation and water supply must involve the communities living in Ngong. Because land tenure is not a problem as most land is freehold, there is potential for good participation by the community.

Sanitation in developing countries: proceedings of a workshop on training held in Lobatse, Botswana 14-20 August 1980.-Ottawa:IDRC; SIDA, 1980.-172p.

The United Nations choose the 1980-1990 decade as a period when a special effort will be made to overcome the lack of adequate water supply and sanitation facilities for large sections of the populations of the less developed world. East and Southern Africa are areas where the scarcity of adequately trained personnel is acute and information on newly developed low-cost technologies is lacking. Two workshops on water supply and sanitation were held in 1980 in Malawi and Botswana respectively. Full delegations from Ethiopia, Tanzania, Malawi and Botswana and representatives from Kenya, Zambia, Lesotho Mozambique and Swaziland attended both workshops.

Topics of papers presented included use of dry pit latrines in rural and urban Ethiopia, pit latrines in Botswana and Malawi, on-site excreta disposal technologies, the Botswana aqua privy, septic tanks, sullage disposal in urban centres in relation to technology.

Urban basic needs assessment in Nairobi/ Peter Ondiege; P.M. Syagga. - Nairobi: University of Nairobi, 1990.- v,76p.

This study evaluates the consumption and supply of shelter, water, sanitation and education as basic needs for the urban poor and how their consumption and supply can be improved. As its main objective, the study documents the socio-economic status of the poor households in the slums and squatter settlements of Nairobi and determining their levels of consumption of these basic needs. Case study residential areas were Kibera, Kawangware, Shauri Moyo, Jerusalem, Kayole and Umoja II.

As noted, the low level of education of the residents in the slum/squatter settlement explains the lower average income levels. This in turn affects their living standards and their children's access to normal education and employment. Low income families and the urban poor can only afford housing constructed of non-durable materials. It is suggested that standards for infrastructure services be appropriate to be affordable by the urban poor.

Regarding water, what is required is efficient water supply by increasing water kiosks or most preferably by connecting water to every plot. The recommendation is that the City Commission regulates the price at which vendors should sell water. Tables used to explain the findings show that 54.4% of the households used pit latrines and these were mainly found in squatter and upgraded areas. Recommendations given are that services to be provided should be the ones urban poor need, an adequate and equitable revenue base for basic urban infrastructure and services.

Heavy metal analysis of sewage sludge by x-ray fluorescence technique and the environmental implications/ Maina David Muchori. - Nairobi: University of Nairobi, 1984.-154p.

In this project sewage sludge from Kariobangi Sewage treatment works in Nairobi, Kenya has been analyzed for its heavy metal content. The analyses were performed using x-ray flourescene technique. Atomic absorption spectroscopy method was also used, for some of the elements for comparison. Samples analyzed included the sludge itself, soils on which the sludge has been used and plants grown on such soil. For comparison purposes, soil samples, plants from areas where sludge is not used, fertilizers and manures were also analyzed. Soils and manures were found to contain the same heavy materials at slightly different levels. In addition to determining the total heavy metal contents in the soil samples, the available amount to the plant was also determined for manganese, copper, iron and Zinc by atomic absorption spectroscopy. The results obtained in this work indicate that the use of sewage sludge as a manure results in accumulation of some of these heavy metals in soil. The high levels of available contents of these metals especially manganese and copper in sludge enriched

soil may by phytotoxic. Analysis of fertilizer samples indicate that some metals such as strontium may accumulate in the soil if extensive use of fertilizers is practised. Analysis of plant materials grown on sludge enriched soil showed that these plants, for example cowpeas, spinach and sugerloaf had high levels of heavy metals. The study concludes that while usage of sludge as manure may still be the best method of disposal, there is a great need to monitor regularly the levels of heavy metals in sludge, soils and plants. Results of such monitoring may then be used to decide when and where sludge may be used as well as the type of plants that may be grown on sludge enriched soils.

Proceedings of a shallow wells workshop held in Kisumu on 10th-12th October 1983/ O. Ogembo. - Kisumu: Lake Basin Development Authority, 1983. - 173p.

The workshop objectives were to establish the preferred basis and methods for continuation of a Lake Basin Development Authority shallow wells programme, taking due account of technical, socio-cultural, organizational and financial aspects. The second was to create an opportunity for presentation and exchange of information between various groups and organizations who are, or may be involved in shallow well provisioning especially in the Lake Basin area.

A total of eight papers were presented at the workshop. A paper on the Lake Basin Development Authority as an organization and its activities towards shallow wells and low cost water supplies touched on its involvement in the provision of water and the organisational and technical aspects of a viable shallow wells project. A paper on technical features of shallow wells in Western Kenya provided by DHV Consultants considers the technical aspects of shallow wells provisioning in Nyanza based on the findings of a pilot programme. A similar paper by KEFINCO focusses on the alternative domestic water supplies being installed in areas of Western province jointly with the Ministry of Water Development. A paper entitled "Technical, maintenance and production aspects - comparative experiences" attempts to highlight some of the experiences of various countries, particularly but not only in Africa and draws some comparisons between the solutions proposed for the Lake Basin Area.

Other papers presented included an "Overview of the rural domestic water supply situation in the Lake Basin area", " A memorandum of the Netherlands government: a shallow wells programme for the Lake Basin Area", "Socio-cultural aspects of shallow wells implementation and usage" and "Shallow wells and health education".

A study of the effects of pollution on a tropical river in Kenya/Stephen Gichuki Njuguna.- Nairobi: University of Nairobi, 1978; 202 p.

The effects of pollution on Nairobi - Athi - Sabaki river are examined. Annual, seasonal, and longitudinal variations; and the physical and chemical parameters of the river are presented. Chemical concentrations were examined in relation to discharge.

Concentrations followed a similar longitudinal pattern with low levels in the unpolluted sections and exceedingly high levels in the polluted portions passing through the city centre. A generalized inverse relationship was found to exist between chemical concentration and discharge. Results indicate high nutrient and ionic levels in the

unpolluted sections in comparison with other sub-tropical and temperate rivers; but in the polluted sections the river does not exceed the pollution load found in the large temperate rivers. A simple DO-BOD mathematical model tested during the transition period from high flows to low flows (June - September) showed increased pollution loading and an extension further downstream of the polluted zone as flow declined. Degradation of water quality was found to begin after the first 20 km of the river extending 65 km downstream upto fourteen falls. During the dry season, complete deoxygenation occurred along 16 km of the most polluted reach with dissolved oxygen deficit values exceeding the highest possible value for dissolved oxygen saturation. Pollution is chiefly due to domestic and industrial wastes, and runoff. Evidence of complete recovery from the effects of urban pollution exists in the middle and lower courses of the river except for the high sediment loads (max. 4827 $mg.^{1-1}$) which have been attributed to increased pressure on land and decline in soil conservation measures in the upper catchment. A general absence of aquatic macrophytes in most parts of the river was ascribed to high turbidity and the physical action of the sediment, periodic spates and instability of the river bed. Even moderate control at the sources of the contaminants in the urban area and a check on the high erosion rate in the heavily cropped areas of the upper catchment will greatly improve the quality of the river.

The role of wind powered pumps in water supply and small scale irrigation in East Africa/ D.J. Hilton (1977). Paper presented at the 13th Annual Waste water reclamation by solar distillation/ M.M. Khalfan.- Nairobi: University of Nairobi, 1978. ;225p.

This thesis examines the operations of a solar still treating waste water. The history, development and principles of solar distillation are studied, in order to design an experimental solar still for the purpose of waste water distillation. Characteristics and variations due to physical, biological and chemical processes of waste water were studied. An experimental glass roof type solar still was constructed.

Waste water from the primary sedimentation tank at the Kariobangi sewage treatment works of the city of Nairobi was used in this study. Performance of the solar still, variations in wastewater quality and the distillate were also studied. Gases emitted were measured and attempts to identify them made. Six runs were conducted using batches of waste water.

It was established from the study that the performance of the experimental solar still was similar the one used for desalination purposes, except for the gases produced by the biological processes taking place in the waste water.

Water quality was found to change with time. The distillate was not contaminated by waste water during the study. It had an odour and a taste due to dissolved gases and possibly volatile matters. It also had low alkalinity values and zero hardness. The distillate was deficient of essential salts required for good health.

It was concluded that the incorporation of solar distillation process into a waste water reclamation scheme was feasible. By incorporating solar distillation into wastewater reclamation schemes, water shortage problems can be reduced, pollution and contamination of other sources minimized and health standards raised.

The rural water fluorides project, Kenya: technical report/ J. N. Gitonga and K.R.Nair. - Nairobi: Ministry of Water, 1982.; 181 p.

This report is on the distribution of fluorides and prevalence of endemic dental fluorosis in Kenya. Data collected from slightly over 29,000 people in Kenya during a survey was analyzed. It was found that chronic endemic fluorosis is widespread and acute and is a serious public health problem in many parts of Kenya. Results obtained from the analyses of over 1,200 water samples collected from boreholes and about 150 samples taken from surface water all over the country confirm that excessive fluoride concentrations occur in many parts of the country. After experimenting with the Nalgonda technique it was established that it is possible to reduce the fluoride content to about 1 ppm in raw water with less than 7 ppm fluoride. For raw water with higher fluoride content excessively large doses of alum and lime are required. These large doses of chemicals deteriorate the quality of water. Other materials like clay pots, wood charcoal, kaolin, and diatomaceous earth were tested. The experiments were carried out on both batch and continuous flow modes. Clay is able to reduce fluoride concentrations in water but the time required for effective reduction is very long. Wood charcoal, kaolin and ditomaceous earth were found to be ineffective. It is recommended that steps be taken to ensure that toothpastes with fluoride are discouraged and finally put out of use in high fluoride areas of the country. Relevant authorities and interested parties should do all they can to educate the population on fluoride. Programmes for assessing the impact of water defluoridation on public health should be initiated as soon as defluoridation starts in a given area.

Laboratory investigations of pilot upflow filter /Azam S. Jaffer.-Nairobi: Univerisity of Nairobi, 1978.; 202 p. M.Sc. Thesis

Experiments carried out in the Environmental Health Engineering laboratory of the Department of Civil Engineering, University of Nairobi, on a pilot up-flow filter showed that optimum conditions could be obtained which could provide the highest efficiency of filtration and which could be applicable to field operation conditions. Preliminary tests of raw water and sand were carried out, red coffee soil was used in creating artificial raw water because of its better uniform turbidity over black cotton soil and fuller's earth.

A concentration of 5gm/l was found to be effective for laboratory test runs for the up-flow filter. The sand tests showed that well graded sand passing through a sieve size of 2.38mm and retained on 0.595mm gave a very good sand medium for the up-flow filter.

Twenty-two (22) test runs carried out with the upflow filter using variable filtration rates for different sand bed depths and parameters of turbidity, colour and micro-organisms removed were determined. During the tests, the filter did not run dry and did not generate negative head. Further more, no mudballs were formed and filters rate controllers were not required. The optimum sand bed depth of 150 cm and a flow rate of 5m/hr provided maximum average removal of turbidity (67%), colour (85%) and micro-organisms (80%). PH values measured during the test runs varied between 6.5 and 7.5 for raw and treated water respectively.

Symposium of the East African Academy: the role of water resources in development, Nairobi, September 13th-16th, 1977, p.232-240.

The potential for utilizing the region's wind resources for pumping water is investigated. A considerable number of areas in East Africa have medium potential for strong winds. In many areas the wind tends to be strongest in the dry season when most water is required. Except where water has to be obtained from deep boreholes, power requirements for the provision of water to communities in East Africa is small. The net energy required to lift $10m^3$ of water (10,000 litres) per day to serve the minimum needs of 1,000 people or heards of cattle from a depth of 30m is equivalent to only 38 watts of continuous power or say 50 W after pump efficiency is taken into account. This energy can be supplied over a daily 6-hour period by a prime mover which provides an output power of only 240W (0.32 bhp). This falls well within the scope of a windmill, and could be provided by a 6m. diameter machine operating in a medium area. On the other hand, 240W represents a rather insignificant amount of power for a diesel or petrol engine. A small engine giving an output of say 1.5 kw (2bhp) would have completed the necessary pumping in less than one hour per day. Thus, it is not economic to use a diesel engine delivering less than 3 KW (4bhp) which is not being utilized for more than 2 - 4 hours per day on average.

For small water schemes, the windmill is generally to be preferred on the basis of lower maintenance cost and potentially greater reliability. In addition a windmill is comparatively simple, which enables maintenance and repairs to be performed by local personnel rather than relying on specialized personnel to come from Nairobi. In social terms, it has the advantage since it encourages greater local involvement and responsibility, a factor in rural community development.

Assessment of groundwater in the Nairobi area/ Joseph Nguiguti.-Paper presented at the 13th symposium of the East African Academy: The role of water resources in development, Nairobi, September 13-16th, 1977.; p. 64-73.

The assessment of groundwater in Nairobi area was executed during the UNDP/ WHO/NCC-SF sewerage and ground water survey carried out in Nairobi between 1972 and May 1975. The study was carried out in two stages. All existing data and available reports were evaluated during the first stage. A few measurements were taken during this time. A drilling programme along a 12 Km line in the Kabete area and 14 Km line along the Gigiri area was recommended. During the second stage of the survey drilling of 18 boreholes was carried out so as to locate well fields to determine usable water quantities in these areas. Results revealed that Kabete line boreholes can only yield between 100 and $200m^3$/day.

High fluoride values of upto 20mg/litre can be expected. The ground water potential in this area was estimated at 1800-$2200m^3$/day from a total of 12 boreholes. Due to the poor yield of the boreholes in this area and high fluoride content it was not considered practicable to utilize the ground water. For the Gigiri line, the best well fields were found to be between Kamiti and Kianjibe river valleys where 5 well fields would yield about $500m^3$/day.

The expected fluoride content of the mixed water from all the wells would be in

order of 2m/l. Both iron and manganese were found to be high. Concentrations of 0.8 and 2.4 mg/ iron and manganese respectively were encountered in some of the boreholes. Removal of these two would be required before mixing the water with city water. Cost of production was found to be Kshs.2.25/m^3 compared to Kshs.0.80/m^3 for surface water from existing water sources and the mid Chania phase II water project. The ground water potential was therefore considered unfavourable and the water too expensive

The supply of water to rural areas of Kenya for domestic purposes/ D. Baker.- Paper presented at the 13th Annual symposium of the East African Academy: The role of water resources in development, Nairobi, September 13-16th, 1977 p.144-149.

The supply of water to rural parts of Kenya can be categorised into two methods of approach. In the first, which is the government's Rural Water Supply Programme (RWS) contribution from the people of the area is generally minimal, while in the second, the self-help water supply programme, the community's contribution is expected to be much greater. Notable features lacking in the RWS Programme are:- attempts to motivate or involve the people i.e the recipients of the scheme in the planning, design or construction stages; the identification of the real social needs and constraints present in rural Kenyan society; determination of the best groupings for water supply systems; and educating the people, particulary women, in responsibilities that accompany a piped potable water supply. No matter how much a village needs a water supply system, if it does not perceive the value of the system, the usage rate will be low, system maintenance and local administration will be inadequate and vandalism could be a problem. There is need for proper coordination and amalgamation of the two rural water supply programmes in order to avoid wastage of scarce financial resources and bring the year 2000 goal of water for all closer to reality. A possible method of achieving this is put forward for consideration and adoption as a pilot study prior to making a final decision on the matter.

Environmental health aspects and flood control in Bunyala Location, Busia District, Western Province, Kenya/Duncan J.W. Kwamina.- Paper presented at the 13th Annual Symposium of the East African Academy : The role of water resources in development, Nairobi, September 13-16th, 1977, p.144-149.

The major part of Bunyala location in Busia District of Kenya is flooded during the months of May to June and August to October annually. The author carried out field visits in the area to assess the environmental health aspects and flood control measures in the location, in 1976. Many environmental disorders are reported. High incidences of cholera, malaria, schistosomiasis, and gastrointestional diseases are cited. Lack of proper sanitation is evident throughout the location. Water wells and a few pit latrines have been constructed in some areas. Pit latrines are however difficult to operate during the flooding periods.

Therefore, in order to improve the environmental health conditions in the location, it is logical to consider undertaking flood control measures. The construction of a dyke running along the north bank of the Nzoia river to Lake Victoria is a solution to the problem of flooding in areas such as Bukoma, Debani, Eburemid, Bwanjwane and Mudembi. Dyke construction in Kenya has reached a high level of technology and is economical. For success, dyke construction would have to be coupled with proper irrigation systems to ensure drainage of the area previously affected by flooding.

Associated with any flood control measures would be a programme established to ensure good sanitation (adequate numbers of water wells, septic tank/pit latrines and refuse deposits) and provision of health education in the area.

Pilot study for the rehabilitation of rural water supply schemes in Kenya/ M. N. Kariuki. - Nairobi: University of Nairobi, 1978.; 168 p.

This thesis investigates two rural water supply schemes, Siathani in Machakos district and Mutunguu in Meru district, both in Eastern province of Kenya. The Rural Water Supply Programme was started in Kenya in 1960 with assistance from WHO - UNICEF . The objective of the programme was to promote an awareness of public health as related to safe and adequate water supplies in the rural community. The conditions of many of the schemes constructed under this programme have deteriorated to such an extent that they require a major rehabilitation programme. This thesis explores the various aspects of the two schemes and attempts to establish a procedure of rehabilitating them, with a view of setting up a procedure for rehabilitating all other rural water schemes in Kenya. The major problems associated with Siathani scheme are water quality and reliability. The quality of water is far below WHO standards as the amount of dissolved chemicals is extremely high. Water reliability is erratic because of occasional failures of the pumping units. Development of a new source is discussed and recommended in this thesis. The main problems of the Mitunguu scheme are due to poor construction which resulted in occasional breakdowns of storage units and poor design of raw water gravity pipes. It is recommended that these units should be regularly inspected by the operational staff and faulty areas repaired in time.

A major rehabilitation programme is envisaged where all the storage units should be repaired. An attempt has also been made to find ways of promoting water sales so that revenue can be collected to ensure less government subsidy and hence a lower financial constraint in the operational and maintenance budgets of rural schemes.

The use of solar energy for groundwater extraction in rural water supply/ Walle J. Nauta (1977). - Paper presented at the 13th Annual Symposium of the East African Academy : the role of water resources in development, Nairobi, September 13-16th, 1977, p.24-49.

This paper examines the use of solar energy for groundwater extraction in rural water supply in Kenya. A pump, based on the principle where a solar motor receives energy from a water apparatus installed at Wajir in North Eastern Kenya is considered.

The pump is connected to a large water storage tank with a distribution system. Solar heat is converted into mechanical energy which is then used to operate the water pump. Favourable conditions exist in many parts of Kenya for the utilization of solar energy. Insolation is intense with a total duration of 3,000 hours per year. A solar pump with a capacity of $6m^3$ is capable of watering about 800 heads of cattle a day or a rural human population several times larger, in view of this, the value of such pumps should be obvious.

Solar energy has the great advantage of being free. However, it is a diffuse form of energy whose methods of collecting and converting into a useful form require considerable investment. Compared to other forms of energy powered pumps e.g diesel, less skilled manpower is required to operate. This makes them more suitable for use in remote areas. Both diesel and electricity, whatever the source, are bound to be expensive due to the high transportation and transmission costs in thinly populated areas. Maintenance is a less compelling necessity than with a diesel-powered pump. Neverthless, special attention is required for certain parts of the system. The collectors have to be kept clean and leakproof. The insulation has to be checked regularly and repaired where necessary. The gas system requires regular checks on leakage and loss of gas. Moreover, once or twice a year, general inspection and maintenance service has to be carried out by a specialist. These factors increase the operating expenses of the solar pump that are difficult to foresee and are seldom found in calculations determining the feasibility of solar installations.

Survey of public standpipes systems in Kenya/ Duncan, J.W. Kwamina.-paper presented at the seminar: Health facility planning in the developing countries, New York, U.S.A., December 3-5, 1977. 7 p.

The position of public standpipes system in some towns in Kenya is presented in the report. The most common faucet (outlet) mechanism for standpipes in use is the ordinary tap and self closing valve (fordilla and taylor 'waste not' valves). The water kiosk system and a combination of public water dispensing system (communal facilities) are found in estates and shanty towns. These serve majority of the poor people in the peri-urban and rural areas who cannot pay for metered water generally provided with the premises. The survey has revealed that public standpipes and the water kiosk system will continue to play an important role as transitional systems in solving the water supply problems in Kenya within the immediate future.

Groundwater research in the Taita Hills /Walle J Nauta. - Paper presented at the 13th Annual Symposium of the East African Academy : The role of water resources in the development, Nairobi, September 13-16th, 1977, p.74-89.

The Taita Hills in South East of Kenya rise between 1,500 and 2,000m from the surrounding peneplain (Alt.600-800m). The hills are important raincatchers with an annual precipitation of over 1,500 mm (against 500 mm on the plain). However, due to relief, runoff is very high and consequently rainfall and runoff data for the area are

inadequate. A study of the rocks reveals very low porosity and permability and much bigger values for fractured zones. These tend to complicate the uniformity of the aquifer concept and its application on the Taita Hills ground water regime. Their characteristic heterogeneity makes its questionable in how far any hydrological parameters can be determined. The hydrology of the area requires non-conventional approaches because of the complex structures of the metamorphic basement rocks in the hills, which differ from the precambrian system to which they belong. The best results for groundwater prospects are to be expected if a borehole can be sited on the intersection of major fault or joints systems with intensive interconnections of fractured zones, rather than on a zone of strong weathering with a fair storage capacity but limited transmissivity. Explosives should be used for artificial fracturing of the subsurface rock when drilling boreholes. This would increase the amount of fissure porosity which yields to the fracture system. Secondly, it causes artificial interconnections of existing fracture systems. Thirdly, due to increased flow, it may solve many of the existing salinity problems, provided that overpumping does not occur. No deep drilling operations are recommended since most weathering zones do not extend to great depths, and if so, they are likely to be clayey with low transmissivity since the non-soluble weathering products are not removed. A structural analysis of the metamorphic rocks in the area is recommended. This will facilitate complete understanding and knowledge of the fault and joint systems, which constitute the main means of groundwater movement in the area.

Combined treatment of domestic and industrial waste water/Yayehyirad Gashaw.-Tempere, Finland:Tempere University of Technlogy, 1984.; 93p.

This thesis comprises two parts. In part 1 (chapter 2-6) the activated sludge process kinetics and its capabilities are discussed. In addition, the characteristics of domestic, textile and tannery waste water and their effects on activated sludge treatment singly or when combined are briefly presented. Managerial and economic aspects of combined treatment are considered.

Part 2 (chapters 7-11) is the authors original work on combined treatment of tannery and/or textile waste water with domestic sewage in an activated sludge model. Four tests were carried out. The first on domestic sewage, the second on a combination of textile waste water and domestic sewage, the third on a combination of tannery waste water, domestic sewage and textile waste water and the fourth on a combination of tannery waste water and domestic sewage.

30% of industrial waste water was mixed with domestic sewage in the two cases while when all were mixed 60% industrial to 40% domestic sewage was reached. In all cases, with the proportions described, good substrate removal and complete nutrification was observed. Problems such as poor settling were encountered during the experiment. These are dealt with in the text. However, these problems did not affect the process greatly and good results were still obtained. Few oxygen uptake rate test done for toxicity and inhibition indicated that the waste water can sometimes be toxic or not depending on its concentration. Still, upto 30% both were found to be non-toxic for any strength

A rural water supply project: an evaluation of the success of Baraki water project/J. N. Karori.-Nairobi: University of Nairobi, 1986.-75p.

This thesis attempts to assess the success of Baraki water project in Kikuyu division, Kiambu district, Kenya. The problems which tend to limit the success of water projects in general and particulary those which face the Baraki water project have been examined and discussed. Baraki water project was assessed under the two major topics of technical and economic aspects. Technical aspects were further assessed under the design, construction and maintenance of the project. It was found that the technical aspects are generally good. The designers picked on a good source, Nyangara stream which has satisfactory capacity that no amount of daily pumping can significantly change the volume of the water flowing down the river. The river is permanent and no drought has ever dried it up. The water is colourless, odourless, tasteless and cool. Pipe sizing, the location of GMS pipe and the dam location are good. Maintenance and repair work on the water project is effective and efficient more so during the past one and a half years. Maintenance makes sure that elements are prepared soon enough to avoid unreliability due to the small storage tanks. High standard construction ensures that failures are rare. The cost benefit analysis revealed that benefits from Baraki water project exceeded the costs incurred. The implementation of the project does not seem to have occasioned any intangible or indirect costs to the people. There are no defaults in payment but a strong case against the payment system which is per household exitsting. The argument is that different households have different water needs and therefore there is a need for metre charges. Results showed that there is enough determination to keep the project alive. The general conclusion is that Baraki water project is indeed a success.

On-site excreta disposal technologies/ E.K. Simbeye. - paper presented at the workshop: sanitation in developing countries: training. - Lobatse, Botswana, August 14-20, 1980. p. 27-33.

This paper discusses on-site disposal systems for human excreta. Excreta can be both dangerous and useful. Proper disposal of faeces will minimize the spread of many diseases transmitted through contact with the skin, food and excreta contaminated water. Such diseases include hookworm, ascariasis, schistosomiasis, typhoid fever, dysentry, amoebiasis, cholera and other worm diseases.

Well prepared and treated excreta will make good manure, useful to small scale farmers. Many low cost technologies for dealing with excreta have been developed and are being tried. Improved pit latrines, composite latrines, pour flush aqua privies and septic tank latrines are among the low cost technologies. Three types of on-site dry latrines (ventilated Improved Latrines) i.e the direct vented pit; offset vented pit, and composite latrines are discussed.

In vented pit latrines, the slab has two holes. The first is for squatting while the second is fitted with a vent pipe. It operates anaerobically. Foul gases produced during decomposition are vented away through the flue provided. This type of latrine is odour free and if properly maintained it can be fly free too. For effectiver performance, contents should not be too dry. Various designs have been developed to facilitate easy

emptying and reuse of a latrine.

The offset vented pit (Reid Odourless Earth Closet, ROEC) consists of two separate units. The defecation unit and the holding (receiving) unit which is connected by a short length of piping (the chute). ROEC works like the vented pit latrine. It is anaerobic in action and gasses are vented away through the pipe and thus is odourless. Modified designs of ROEC are extended so that excreta drops directly into the pit. The chute is omitted . The modified ROEC is named Ventilated Indirect Pit Latrine (VIP). Another modification of ROEC is the alternating VIP latrine. Here the squatting plate in each latrine has two openings. During operation only one pit is used. When it fills up, the decomposed contents are removed for possible use in agriculture and the emptied pit returned to use again. Composting toilets that are either continuous or batch (alternating) have been developed. The composting chamber which is situated immediately below the toilet seat or squatting plate, has a slopping floor above which are suspended inverted "U" or "V" shaped channels. A lot of organic materials such as grass must be added to the latrine. As decomposition takes place temperature is raised to between 50 and 60°c which eliminates pathogens in the composite.

A study of upward flow pilot plant filters/ Eric K. Cheserem. - Nairobi: University of Nairobi, 1980. - 203p.

During this study, investigations on performance of pilot plant filters using raw water with no pretreatment were carried out . Two upward flow pilot plants were constructed. One plant was installed at the university of Nairobi's Environmental Health Laboratory and the other at the Kabete water works. The pilot plant at the University was operated with artificially prepared raw water turbidities ranging from 10FTU to 170 FTU. The pilot plant at Kabete water works used natural raw water gravitated from Ruiru dam having turbities ranging from 1 FTU to 10 FTU. Plankton inside the plant was investigated. A Filter medium of size 0.22mm and uniformity co-efficient of 2.46 was used . By using a large range of turbidity values (1-170 FTu) it was hoped that enough operational data would be obtained in order to determine the usefulness of an upward flow filter. Turbidity, colour, headloss development and PH variations were monitored. Nine test runs were carried out using variable filtration rates of 0.2m/hr to 1m/hr. A filter sand medium having an effective size of 0.22mm and a coefficient uniformity of 2.46 was found to be too fine for use in relatively high turbid water. Consequently, clogging of the filter would be a potential problem. Due to the size of the filter medium, proper backwashing of the bed was not possible. At 1m/hr, fluidisation of the filter bed was observed and the fine filter sand was easily washed to drainage. Downward flushing was not effective for filter cleaning. Turbidity reduction was in the order of 30% - 60% for the filter plant at the university while a more consistent turbidity reduction of 40%-50% was observed for the filter at Kabete water works. With proper filter backwashing, a gradually increasing headless development was observed over different depths of filter media. The operation of the pilot filter at Kabete has demonstrated that an upward flow filter can easily be operated to cater for filtration of water for a community by using a gravitational head. No power is required to pump, intake source is located on higher ground level while the treatment is located downstream.

Ground water development in Kenya/D.M. Kirori.-paper presented at the 13th annual symposium of the East African Academy: The role of water resources in development.-Nairobi, September 13-16th 1977; p.160-165.

Although the use of ground water in Kenya goes back many centuries, the development of ground water in Kenya started receiving considerable attention 50years ago. On the realisation that ground water was relatively cheaper and the fact that surface water was inadequate, particularly for domestic and livestock use. This paper gives a background on ground water development as a source of water supply in Kenya. The various aspects of ground water and its shortcomings have been discussed and projection proposals for the future suggested. By 1977, about 4,600 boreholes with an average depth of 106m had been drilled. Many of the sites were selected in a haphazard manner. Drilling was mostly by percussion method. About one third of all the boreholes have been chemically analysed to determine chloride content and total dissolved solids. The quantity and quality of water is localised and is dependent more on hydrological factors. A water quality and fluoride map of Kenya has been compiled based on this hydrological data. The data shows that water quality is generally good except in some localised zones of high fluoride. Ground water reservoirs have been significant becaus of their ability to store usable water especially during dry periods in the perennially water deficient areas of Eastern, South-Western and Northern Kenya. They constitute the most reliable source of water in the arid and semi-arid areas of Kenya. Ground water is widely, although not uniformly, distributed in the republic. Considering the total number of boreholes in the country today and their annual abstractions, ground water reservoirs all over the country are undeveloped, particularly in the uninhabited or sparsely inhabited areas where boreholes have to be drilled for domestic and livestock use. The large quantities of ground water available from storage aquifers should be developed for use in urban and rural areas, during droughts and for reclamation. These aquifers will then be replenished seasonally in periods of normal recharge. A proper scientific approach of the qualitative and quantitative evaluation of aquifer systems and dynamics, and better understanding of their role in the total hydrological environment needs to be addressed. The demand for water in the country is growing and an increasing percentage of this demand will be met from ground water resources.

The effects of Copper, Zinc and Chromium on the performance of model batch waste water stabilization ponds/ John N. Gikonyo. - Nairobi: University of Nairobi, 1978. - 129p

The performance of waste stabilization ponds may be affected by many factors. Some of which are: mixing, temperature, PH, sunlight and toxic substances. A model stabilization pond to study the effects of different concentrations of Copper, Zinc and Chromium was made. The waste water used was drawn from a primary stabilization pond. Glucose and tryptone were added to bring the organic loading to a reasonable level. The initial concentration of the metals were: 1,3,6 and 10mg/l. There was a control model pond without metal ions. Each batch of the waste water was allowed to stabilize for about 25 days, sampling was done every other day. Samples were taken

and analyses for COD, BOD, PH, DO and the metal ion concentration carried out. The waste water was also observed under a microscope in order to find out the micro-organisms present. No artificial lighting was used. The model ponds were placed in a room with sufficient natural sunlight to allow photosynthesis take place. There was no mixing as wind action was present. From the observations and experimental results obtained, it was apparent that the ponds maintained proper performance. Copper, Zinc, and Chromium concentrations of 1 to 10mg/1 did not seem to affect the performance of the stabilization pond. There was a tremendous growth of algae after the initial anaerobic action. Blue green algae and euglena were dominant. The population of micro-organisms did not appear to be affected significantly by various metal ion concentrations added to the waste water in the model ponds. In general, the ponds succeeded in precipitating the metals, thus reducing the effective concentrations in the upper water layers where algae and aerobic micro-organisms predominantly occur. It is recommended that where ponds are likely to receive known metal ions, proper monitoring of their level of concentration should be done, in conjunction with the usual parameters describing the performance of sewage treatment facility.

Women, water supply development and sanitation/ George O. Krhoda.- in African urban quarterly, Vol. 5 no. 3/4; p. 247 - 254.

This paper discusses the level of water supply in Kenya with a view to assessing women's participation in the provision of water and sanitation. Fetching water and firewood takes a disproportionate portion of the day for many rural women. The competence of the women in fetching the water tends to determine the daily actual supply and hence the level of consumption. A study on ten communities in Kenya on water use revealed that when household water intakes are below 50 litres/day, use of water for sanitation becomes irregular. Daily allocation for hygniene was found to be regular in households where intake was more than 70 litres/day. The participation of women in water supply and sanitation projects is inhibited by the following factors :- mistakes or shortcomings on the side of the planner, problems associated with the donor agencies and the role of the government in monitoring and evaluating water projects. Since women are the main carriers and users of water, planners need re-evaluate the meaning and implications for participation of women in water and sanitation projects. Planners and agency personnel usually go into a community with fixed ideas about the community's needs and mandate the project to be implemented in the region. Many water projects are financed and implemented by donor agencies and as a result there has been as many approaches to planning and implementation of water projects as the number of donor agencies. In addition, donors support a specific project which is implemented without consideration of other projects located in the same region which may increase the benefits of the target project. The objectives of the project, the role of women and the community as a whole in project formulation are expressed vaguely in an abstract manner. In most cases after a water supply project has been completed, the community does not know what to do next. Lack of adequate consideration for socio-cultural values of the community usually affects women more than men. In most cases men get employment in urban areas hence leaving the women and children in the rural areas. Illiteracy amongst women is relatively higher than amongst their

adult male counterparts. This causes suspension among the women and hence reduces their organisational abilities. In addition they find it difficult to follow manuals used in operation and maintenance of machines. Their role must however, move from that of being passive subjects of decision making to that of equal partners or initiators in the development of water in Kenya. The bottlenecks that inhibit their participation in water development should be removed. Their role as carriers of water, managers, users, family health educators, motivators and agents of change must be clear if the benefits of water supply and sanitation are to be achieved

Rural water supply problems in Kenya: a case study of Kipkelion division, Kericho district, Kenya/ Philips Kipsang Koskey.-Nairobi, University of Nairobi, 1986.-182p.

This study highlights the water supply problems facing rural communities in Kipkelion division, Kericho district, Kenya. Although efforts have been made to provide water to rural communities in Kenya, accessibility to potable water supplies is one of the problems experienced in Kipkelion division of Kericho district. The inhabitants have to walk long distances to fetch water for domestic use and for livestock. The carrying of water from distant sources wastes a lot of man-hours and affects people's health and agricultural productivity. Except for the Kipkelion water supply project, which is gazetted under the water programme and serving only 300 households (2.7%), the rest of the division's population comprising of 10,920 (93.3%) households do not have clean water supplies. The current sources of water which include waterholes, rivers and unprotected wells are exposed to pollution and infested with water related diseases. Monthly incidences reported by the Health Medical Office include: Bilharzia (10%), River Blindness (7%), Diarrhoea (20%), and infant mortality (3%). During the dry spell, water from natural holes and pools of stagnant water which are not adequately replenished has a bad taste and smell due to decaying organic and inorganic matter dropped into these water sources. In wet seasons, the litter and soils from the upper parts washed into water sources make the water unsuitable for human consumption. The study has further revealed that although piped water is available to urban dwellers of Kipkelion town, the people experience water shortages due to the problems of design, construction and poor management. An assessment is made of the performance and management of the water supply (under urban programme) with a view to examining how its planning has taken into account the increasing population, commercial and industrial growth rates in relation to the water supplied and the possibility of expanding it to serve the immediate rural population . A review of the current self help water supply projects in the area with a view to determining how they can be made more effective in order to enable the government achieve its policy objectives of providing safe and potable water for all by the year 2000, has been given.

Rural water supply in Kenya:a case study of Giathieko Self help water project in Giathieko Location, Kiambu District, Kenya/ Ann Wanjiku. -Nairobi: University of Nairobi, 1989.-71p.

This dissertation examines selected environmental and socio - economic factors that influence rural water supply in Giathieko Location, Kiambu district, Kenya. The primary objective of the Giathieko Self Help Water Project was to provide adequate and reliable water, reduce the amount of time spent fetching water from rivers and enable people to get water of acceptable quality and keep modern dairy cattle in order to enhance the social and economic welfare of the rural community. The original members of the project were 150 in 1970. By 1988 the number had increased to 294. The distribution of treated pipe water is from the Man made dam to the sedimentation tank at Kianjogu village. Here, the water is filtered using rapid sand filters, chlorinated, and then gravitated to Gatina and Gakoe village tanks. The distribution of water from this storage tanks to homesteads is accomplished by gravity. Community welfare has tremendously improved for an estimated 700 families that live in the area served. Provision of treated water has reduced incidences of water-borne diseases. Higher standards of hygiene resulting from the use of clean utensils, clothes, and personal cleanliness are evident. Time spent by housewives on household activities such as cleaning, food preservation, cultivation of vegetable gardens has contributed to improved family dietary standards and more time is available for children's care. Children who used to haul water for the family now spent much of their time on education or spot. Productive efficiency has been enhanced tremendously. Previously farmers found lack of water as a constraint to keeping grade cattle but the result of the project has been the adoption and increased livestock development which has further promoted the dairy industry leading to the construction of Gakoe milk collecting centre in 1986. Three self-help cattle dips, which use the project's water have been constructed. Farmers are able to practice zero grazing. The production of coffee and the quality of crop yields has increased. Farmers now spray their coffee more regularly against pests and diseases such as coffee berry due to the availability of more water for mixing chemicals. Owing to rapid population increase in the area, the water demand has outstripped supply. This has led to rationing. At least 80% of the people do not get water regularly and are forced to fetch water from rivers. There is evidence of wastage through burst pipes, leaking taps and technical problems associated with the design.

Water pollution bacteria in Kenya/ Saleh Idris Mohammed. - Nairobi: University of Nairobi, 1978. - 134p.

This thesis investigates the growth and sporulation requirements of two laboratory strains of clostridium perfrigens. The study was undertaken in order to elucidate the type of nutrients the natural environment must provide in order to support these activities. Employing membrane filter technique, a comparative study of C. perfriogens, total bacteria, total coliform and faecal coliform organisms as indeces of water pollution was undertaken while investigating the water quality of wells, boreholes, springs and rivers in Kiambu district of Kenya, and the Nairobi River. Before using C. Perfrigens

as an index organism, its nutritional requirements for growth and sporulation using chemically and partially defined media were first studied. The ability of this organism to germinate and multiply in a filter - sterilized river was also investigated. The turbidity and PH, as well as bacteriological quality of water samples from open dug wells, rivers, springs and boreholes were determined. The effect of rainfall on their water quality was also studied in details. Variations in nutritional requirements between C. Perfriogen strain 6 DO and Colo was observed. Isoleucine, Lysine, alamine, aspartic acid, riboflavin and uracil reported previously as required nutrients were absolutely essential to these strains. Alanine, was required as a stimulant for growth. Growth was not detected in a nitrogenous free carbohydrate medium, nor could lactic acid, pyruvic acid, succinic acid or oxaloactic acid be utilized for growth. Methionine was required by both strains for sporulation but one strain in addition required riboflavin, isoleucine, serine, andlysine. It was demonstrated that some nutrients, though not essential, are required either for thermoresistance or better spore crop production. The inhibition of sporulation in glucose medium was shown to be due to the development of high hydrogen ions concentration and not due to the presence of antagonistic intermediate or organic end products of fermentation. Studies on germination and growth of C.perfriogens in filter-sterilized river water at room temperature (18 to 22c) showed that multiplication of the organism did not occur. Germination was, however, detected and microcycle sporogenesis was indicated. A selective and differential solid medium containing glucose, solid sulfite, basic fuchsin and antibiotics for the recovery of C. Perfriogens from suspensions, using membrane filter technique, was developed. The importance of the use of blood in the medium, or an agar overlay, is discussed. The presence of faecal coliforms in water was the most reliable index of faecal contamination. C. perfriogens was not constantly detected in water known to be polluted with faecal matter. The possible factors influencing the apparent absence of the organism are discussed.

Investigations leading to defluoridation of water in Kenya/ W. M. Ndegwa. - Nairobi: University of Nairobi, 1980. - 186p.

The presence of fluoride in water has been the cause of incidences of dental fluorosis,or matted enamel and dental caries. The incidences have been more serious in third world countries such as Kenya, Ethiopia, Tanzania and Zambia. Fluoride levels greater than 30mg/l have been determined in Kenya. Three of the five boreholes serving Kiambu town, a small urban centre in the central province of Kenya have been abandoned dueto high concentration of fluoride. The remaining two that are currently supplying the town with water have fluoride concentrations of 11mg/l and 7 mg/l respectively. These levels are quite high. This thesis investigates methods that may be suitable for defluoridation of water supplies in Kenya. The Nalgonda method was applied in the research and experiments carried out on batch scale and in a leading flow pilot plant system. The results obtained showed that fluoride removal from the water was accomplished, and that the doses of alum and lime applied were quite high compared to those applied for turbidity removal. The results from the pilot plant showed that the method can be applied to a continuous flow process.

The second investigation involved charcoal which was packed in columns and a fluoride solution passed through the created bed. Fluoride removal with charcoal was found to be low, unless some treatment is applied.

The third investigation involved the clay pots. The clay used is commonly available in most parts of Kenya. Results revealed that clay has a higher removal capacity than charcoal. The fourth series of experiments involved the use of Kaolin. This mineral was collected from Kariandus factory in the Rift Valley province of Kenya. It was found that there was very little fluoride removal from water using this method. The fifth method was carried out with diatomaceous earth and volcanic ash. The former was obtained from Kariandus factory and the later from the Rift Valley province of Kenya. These minerals were found to increase fluoride concentration, if added to water. The Nalgonda method of defluoridation of water using alum and lime has been recommended as it is economical and effective. A design proposal for the Kiambu Town Water Supply has been given using this method. The units included in the design proposal are dosing, mixing, flocculation and sedimentation. Other units such as chlorination should be added to complete the treatment process.

Water supply in Rurii location Nyandurua district/ Miriam Ngotho.-Nairobi: University of Nairobi, 1990.-113p.

The study investigated water supply in Rurii location of Nyandarua District, Kenya. The relationship between the amount of water consumed and distance to the water was established. The quality of water from springs, boreholes, roof catchment, dams and wells was examined. Findings established that there existed a strong household correlation r = 0.7 between household size and the amount of water consumed. However, a weak positive correlation v=1.112 exists between the amount of water consumed and the distance covered from the homestead to the water source. Quality of the water was found suitable for all purposes inspite of some local variations in water quality. Springs are sparsely distributed but there are several boreholes in the location. However, very few of these are operational , most have been abandoned and others were being rehabilitated to supplement the available surface water. Rurii location does not have a permanent piped water supply scheme. The only operational scheme is Ngorongo water supply whose source is a dam which dries up during prolonged dry seasons. The government through the District Development Committee and the beneficiaries have rehabilitated some boreholes to supply water. It was evident that Rurii location could have had its own water supply scheme were it not for mismanagement of projects and lack of cooperation between the committee and the beneficiaries.

The study recommends that further investigations be carried out on the quality and quantity of water to enable planners and implementers of water schemes to supply water effectively in the near future. There should be cooperation amongst beneficiaries and the government officers in order to make water supply possible within the location. Homes should be guttered in order to facilitate roof catchment and existing boreholes be rehabilitated to supplement the meagre surface water resources.

Water development and the increasing incidence of mosquitoes and schistosomiasis in Kenya/ M. M. Nguunzi.-paper presented at the 13th Annual symposium of the East Africa Academy: the role of water resources in development.-Nairobi, September13-16, 1997.-p.137-143.

Many areas in Kenya have of late been experiencing an increasing infestation by mosquitoes with varying transmission capabilities. Schistosomiasis is also on the increase. The presence or absence of water development projects in relation to these increases is discussed and recommendations for action to be taken when planning and implementing such project are given. Water is a prerequisite for the breeding of mosquitoes which are the most common vectors of water-borne human diseases. Water is also a prerequisite for the completion of the schistosomiasisis life cycle with man being infected through contact with carcaride infested water. Some major irrigation schemes have been implemented in various parts of Kenya over the past two decades. Dams have also been built for electric power generation and to provide water for towns; piped water has been supplied to towns from boreholes and rivers, wells have been built as domestic water sources as well as plain water harvesting catchments for trapping rain storm water. The dams and irrigation schemes have created a favourable aquatic habitat for the breeding of snails and mosquitoes. Snails easily invade such waters. Twelve species of snails have been identified as actual or potential vectors of schisistosomiasis in Kenya.

An area survey carried out in 1956 before the implementation of the Mwea - Tebere irrigation scheme and in 1963 while the scheme was still under developement, showed no infection in primary school children. Results obtained in September 1977 showed that despite snail control measures undertaken over the years, the degree of infection was higher. Where clean tap water is unavailable and proper sanitary and recreational facilities are lacking, the infestation cycle is easily maintained through the permanent and semi-permanent rivers and dams. Swimming in such water is common for children and the water is normally fetched for domestic use. Schistosome Mansoni prevalence of 82 - 89% was found within the 0-19 age group in a village in Machakos. Improper disposal of human feaces and urine propagates infection of snails with schistosomes. Man gets into irrigation water as farming requires, and continues to get infected. Cycles involving animals and bird diseases also occur. Appropriate scientific planning and action should be undertaken prior to and after implementation of the schemes in order to help keep the disease at zero or insignificant levels. Continuous surveillance of all vectors and parasites they may transmit should be carried out throughout the existence of the schemes to avoid disease epidemics.

A study of filters as household water treatment facilities for rural areas/ Johnson Orech.-Nairobi: University of Nairobi, 1978.-104p.

An attempt has been made to develop filters using locally and easily available materials. The study was conducted to find simple and cheap methods for water treatment suitable for rural areas. Construction and operation of the filter was based on the slow sand filters kept as simple as possible. Three different materials i.e timber, cement mortar and clay bricks were used to construct filter boxes. Wood charcoal,

sand and gravel were used as filter media. Red coffee soil was taken as a source of turbidity for use in the study. One turbidity for use in the study. One litre of concentrated waste water was added twice a week to ensure that the raw water flowing into the filter had a constant supply of micro -organisms. Two Microbiological parameters were monitored during the study. They were the colony and coliform counts. Two mechanical tests were conducted to determine the blending strength and compressive strengths respectively. Performance effectiveness was studied by observing the behaviour of the filter box materials while they were under moist material for a period of time and by monitoring the the effluent quality variation with the length of filter run. The effluent quality variation was also compared to that of the household candle filter for the same run. The cement mortar was found to be an excellent material for filter boxes or water storage tanks and was therefore recommended. Charcoal that has not been pretreated should never be used as filter medium. It should first be heated at 200C^0 for at least 2 hours before being used. The charcoal should be replaced every week. The charcoal removed from the filter may be dried and used for cooking or heating purposes whereas sand and gravel may be washed and used for building and construction etc. Filter boxes or water storage tanks built from timber should have a seal of cement paste along the joints and should only be used where high quality water is not required. Filter boxes built of clay bricks should be lined on the inside with a 15 mm thick layer of cement before being used.

Performance of slow sand filters in Kenya/ Cecil G. Runji.-Nairobi: University of Nairobi, 1978.-251p.

This study sought to find out how well slow sand filters work under prevailing conditions in Kenya. Their application would save the country money which is normally used on chemicals and other control machinery normally associated with rapid filtration. A survey of existing slow sand filters was carried out to collect data on the design, operation, performance and maintenance of these water filters. The first part of the investigation was concerned with monitoring the performance of three filters under different operating conditions located at the Kabete water works which serves the city of Nairobi. The second part was concerned with the data collection from the field in order to find out how well other filters were performing. Raw water used in the pilot filter was tapped from the main pipeline bringing water from Ruiru dam into the treatment works at Kabete. The effect of filter cover size, the provision of a pretreatment unit (roughing factor) on the quality of the filtrate and the length of the filter runs were investigated. Experiments with a coarse medium (effective size 0.68 mm, coefficient of uniformity 1.4) gave unsatisfactory results filter covering had litter effect on both the lenghts of the run and filtrate quality. Provision of pretreatment unit improved the quality of raw water entering a filter and thus lengthened filter runs, but had no effect on the final filtrate quality. The coliform and E. Coli removal did not meet normal standards (WHO, 1971) and the pilot filter were particularly poor in dealing with silt. The filters were poorly designed and constructed. Performance generally was poor and the filters were badly operated and maintained. Iron removed was hardly affected by variations in filter medium size. It was therefore recommended that water being treated using slow sand filters should be chlorinated or disinfected and that

routine sampling and analysis be done as a general rule for all existing plants. Improvements in design, operation and maintenance are suggested. Operators of slow sand filters should be properly trained. Demonstrations on operation and maintenance of slow sand filters including filter cleaning, flow rate control, filter starting and stopping should be conducted by competent field officers. Horizontal or vertical flow pretreatment units should be provided to minimize high raw water turbidities.

Sanitation and disease transmission/ J. B. Subiya. - paper presented at a workshop: sanitation in developing countries. - Lobatse, Botswana, August 14-20, 1980. - p. 68 - 70. - ISBN 0-88936-293-9.

In this paper, the author has examined the transmission of water and sanitation related diseases in four categories. The first category being water-borne infections, e.g Typhoid, Cholera, Dysentery (bacillary and amoebic), Gastroenteritis, Hepatitis and other diarrhoeal diseases and infections. The second category consists of water-washed infections, e.g. skin infections such as Scabies, Yaws and Leprosy , eye infections such as Trachoma and Conjuctivitis. The third category consists of water-based infections, e.g. Schistosomiasis and Guinea worm. Last but not least are the water-related infections (some vector-borne diseases are caused by vectors that breed in water), e.g. Onchocerciasis, Malaria, Filariasis, Yellow fever, and Human Trypanosomiasis. A number of water and sanitation related diseases are spread by flies that carry infectious organisms from excreta and contaminate prepared foodstuffs that have not been hygienically stored. The ingestion of such contaminated food then leads to infection. Domestic water obtained from rivers and other unprotected sources that have been polluted with infected human excreta are another source of infection. Lack of water supplies and basic sanitation facilities, coupled with malnutrition, poor and inadequate housing and other socio-economic factors, particularly poverty, have resulted to high morbidity and mortality rates in developing countries. The prevalence of diseases caused by unsanitary conditions will, therefore, only reduce if and when communities in developing countries have adequate safe water supplies and safe methods of disposing of human wastes. The awareness of the need for safe water supplies and basic sanitation facilities is becoming greater as developing countries receive guidance from WHO and financial assistance from developed countries with an aim of attaining the objectives of the International Drinking Water Supply and Sanitation Decade, and the objectives f "health for all by the year 2000", in general.

Water and rural development/ Norman Scotney. (Paper presented at the 13th annual symposium of the East Africa Academy: the role of water resources in development, Nairobi, September 13-16th 1977). - p. 269-272.

Information collected by the author of this paper in Embu district, Kenya showed rapid development in Kyeni sublocation as compared to the neighbouring Gichera sublocation. The most obvious reason is that the difficulties experienced in obtaining any reasonable quantity of water in the dry season has largely been removed in the

case of Kyeni but still persists in Gichera. Five years saw a revolution in Kyeni. An extensive water supply reticulation and over 1,200 connections were made in the sub-location. As a result people have moved in and the population has increased, large areas of bush have been cleared for cultivation - principally maize and beans and public transport vehicles now ply the feeder roads. The price of land has risen steeply. Tea and coffee are cultivated as cash crops. By contrast, the adjacent sublocation, Gichera, just across a shallow valley, continues as before. Cattle and goats wander through the unimproved bush. Poor traditional-type houses are widely dispersed and the basic subsistence level of the people is low. When certain preconditions are met it does seem that water can act as a catalyst for development. When the ministry of water selects "high potential", "medium potential" and "low potential" areas based solely on the criterion of rainfall then it is looking in the wrong direction. For "development potential" attention must be directed to areas handicapped by limited water resources. Hence the impetus leading to irrigation schemes. A water authority should at some stage direct its attention to areas of economic difficulty. Some may prove to be the very areas where cost - benefit ratios will be most satisfactory. In Kenya the first necessary step is to adopt a more comprehensive approach to water provision. "Development", if it is to have meaning, must be development of people. They should be involved in it, have some control over their own water supplies, be consulted, participate in it and share responsibility for those amenities that affect their daily lives. People learn by doing and cope with responsibility by being handed responsibilities. A second precondition for disproportionate benefits to follow water development is the way of life, attitudes and capacity for initiative of the people involved.

The determination of water quality characteristics of runoff for consecutive storms within Nairobi's city centre with a view to planning for its proper management/ Peter Abwao.-Nairobi: University of Nairobi, 1993.-116p.

The study sets out to investigate the volume of storm water runoff generated from the city centre by a series of consecutive storms and to determine its chemical, physical and bacterial qualities. The study also examined the variation of some of these quality parameters with each storm. A comparison of runoff water quality characteristics with guideline values for various uses (i.e domestic, agricultural, industrial) was then performed. Ten samples were collected from selected sampling points within the first five minutes of each storm. Composite samples were used in order to minimise analysis costs. From the analysis, it was found that the city centre, owing to its high runoff coefficient (0.9), generates large volumes of surface runoff during the rainy season. This vast quantity of storm runoff water from the city centre constitutes a potential resource which can be harnessed to supplement the existing water supply which is inadequate to meet the current demands. Analytic results have revealed that the storm runoff water from the city centre is not as heavily contaminated as would have been expected. Furthermore, certain quality parameters such as cadmium, silver, molybdenum, nickel and selenium were not detected in the first three storm runoff samples indicating that the first few storms have a cleaning flush ("flush off") effect on the city centre. The quality parameters existing in considerably high concentra-

tions as to cause concern in the management of storm runoff water from the city centre were iron, manganese, total suspended solids, total dissolved solids, oxygen demand, colours and turbidity. However, all these quality parameters can be regulated through conventional water treatment except oxygen demand (BOD and COD) which will require aeration. The bacteriological quality, though poor can be improved through disinfection (e.g chlorination). This study has recommended that the storm drainage system within the city centre should be redesigned in order to cope with the rapid changes taking place in this area which are continuously increasing the impervious area and that cleaning the drainage network should be enforced as a way of minimising clogging of the drains.

Some aspects of the environmental impact of Bura irrigation and settlement project: an assessment study/ Johnson U Kitheka.-Nairobi: University of Nairobi, 1990. 151p.

This study assesses the impact of Bura irrigation and settlement project in Bura location of Tana River district, Kenya. The study assesses the extent to which vegetation and soil have been affected by the creation of the project. It also assess the consequences of such damages to the environment and the implications of such consequences on the human and livestock population in Bura location and also the consequences to the entire irrigation and settlement scheme. Bura irrigation and settlement project was set up in 1981 as a means of resettling the landless people of Kenya and also as a project aiming at opening up arid and semi-arid lands for agricultural development. This study has found that the creation of the Bura irrigation and settlement project has led to an increase in the population of man and his livestock. At present, the scheme has a tenant population of about 2,310 households, the average members per household being 7, bringing the total population to about 16,170. The increase in human and livestock population has led to a high rate of utilisation of the vegetation resources from the areas that surround the scheme. The utilisation of these resources was well above the regeneration capacity of the vegetation and the eventual effect was the depletion of vegetation cover in the location. The rate of soil erosion has increased and the associated siltation of the water resources is high. There is a shortage of wood fuel as well as pastures for livestock in the study area. Socio-economic effects or the destruction of the environment include: the increased distances farmers have to cover to fetch wood and thus less time for taking care of cotton in the irrigation fields. Majority of the residents keep livestock, with several herds concentrated in small areas resulting in trampling of the ground and thus leading to soil compaction

Water resources and water management in South Western Marsabit district/ Gernot Bake.-Nairobi: UNESCO, 1984. - 116p.

This study gives a scientific base to the proper exploration and use of the existing water resources in south western Marsabit district. It incorporates surface and subsurface hydrology. Exploration has determined that there is enough water to supply the entire area at the present stocking rate. Unfortunately, these water resources are

not equally distributed within the district. The theoretical capacity is never attained. This amount of water can only be made available if the pumps are kept running 24 hours a day throughout the year. Still, 50% of the capacity is never attained due to breakdowns and shortage of fuel. The present supply which is estimated at a working rate of 20-30% is not enough to meet both human and livestock needs especially with the continuing trend of sedimentation and concentration of livestock in very few places. It is proposed that shallow wells (approximately 10 m) be dug and made permanent by the use of concrete rings. It is hoped that all the suggested wells will have a practical capacity of $1m^3/h$ throughout the year. This gives a usage amount of $12m^3$/day or $4,380m^3$/year. People using the different water sources have to learn and understand that proper handling of the materials, technical equipment and the water is to their own benefit and is absolutely essential for their welfare. Therefore deliberate damage to equipment should lead to immediate action. Those responsible should pay for the damage in monetary or in livestock terms. Access to water sources should be granted only to those who have contributed to the installation. Boreholes run by the government should not provide water free but should charge enough to cover the costs of fuel and maintenance. The charges should depend on the number of livestock watered. All livestock owners have to be ordered not to graze within a radius of 1 Km of the water source and that they have to use marked tracks. Range managers should consider using the area around the water sources for demonstration and even experimental plots. Marketing facilities should also find their place here. Water management has to be integrated into the general policy of combating desertification in Marsabit district.

Some aspects of pollution in aquatic ecosystem: the case study of Lake Kanyaboli, West Alego, Siaya District, Kenya/ Anyona George Oduol. - University of Nairobi, 1991. 52p.

This dissertation looks into some aspects of pollution on the aquatic ecosystem of lake Kanyaboli, West Alego, Siaya District, Kenya. Results have shown that the Northern part of the lake has a higher pH value (8.2) than the Southern part (7.7). This lies within the range desired by Kenya Bureau of Standards (7.0 - 8.5) for drinking purposes. The water however, had low concentrations of major ions (Na, Ca, K, C1, SO_4, Mg) compared to desired standards. This was attributed to formation of the catchment area, which may, hold except for some elments. The conductivity of the lake is generally high (442.8) in the Northern part and (420) in the Southern part. Turbidity is also within the desired range for drinking water (Northern section 25 N.T.U. while the Southern is 10 N.T.U.), the desired level is 25 N.T.U. Total dissolved solids also was within the range (251) for the Northern part and 250 for the Southern part, desired range is 500). Except for the colour value (250) which was much higher than the desired value (5), the water in this lake seems to be favourable for drinking purposes. As the population increases in the area and agriculture becomes more efficient through the use of fertilizers and irrigation, pollution of the lake waters is likely to become greater. Only through the use of effective pollution control measures will it be possible to maintain the quality of the water required for viable ecology of the aquatic environment and other uses.

Non-conventional water sources: a review of ideas and possible applications in Kenya/ P. E. J. Jones.-paper presented at the 13th annual symposium of the East African Academy: role of water resources in development.- Nairobi, September 13-16, 1977. p. 49-56.

Several possibilities exist for producing small but useful quantities of water in dry areas. This paper reviews research literature on the less obvious sources of water. Dew, soil moisture, fog, mist and atmospheric vapour are considered as possible sources. In an experiment conducted in Egypt in 1955, dew collected on the inside and outside of a wooden funnel with an area of 1 m^2 gave a maximum collection on one night of 0.4 litres. At this rate, a standard house in Kenya with a roof area of 29 m^2 would collect 320 litres of dew water annually. There are many cases where dew is used in crop production. In California, tomatoes are grown in an area where no rain falls. Mist and fog interceptions on Table mountain and along the coast of South-West Africa were investigated in 1956 and 1962. Table mountain has an almost permanent covering of cloud. Rain gauges mounted with fog catchers intercepted fog equivalent to 3,294 mm of rain over a year compared to the actual rainfall over the same period of 1,940 mm. It was concluded that the amount of water available in the fog was about 12 times more than the amount intercepted. Extracting moisture from the atmosphere by absorption in hygroscopic substances has also been considered. A device similar to a solar still is used, where the sun's energy is used to distil water from silica gel or glycol instead of salty water. A yield of 1 lb of water per square foot is estimated. Approximately 1,000 litres per Km^2 a day can be realised from water vapour in Kenya's arid areas such as Wajir where typical humidity is 75% at 9 a.m. East African time. At an atmospheric pressure of 990 millibars, the air over Wajir contains about 15 g of water . The technology involved, though not fully understood from a theoretical or practical point of view is simple and in may cases will enable easily portable apparatus to be used. With full realisatioan that these possibilites exist, what remains are the techniques to be demonstrated to those who would use them. Consideration should be given to the application of various methods of exploiting these resources in the arid areas of Kenya,especially in the intermediate technology range.

Designing for development: what is appropriate technology for rural water and sanitation?/D. Henry.-paper presented at the workshop: water rela-ted problems in developing countries, scandinavian institute for African studies, October, 1977.-18p.

This paper gives a broader overview of the philosophy and methodology which guide decision making in rural water technology. It highlights some conceptual problems which exist in the rural water field in developing countries. One of the most glaring weakness in the rural water technology discussion is that women have never been encouraged to participate in the dialogue. Women carry almost 100% of the water used for domestic purposes and spend 50% of their time doing so. It is therefore difficult to make a breakthrough without involving women in water projects. There is a strong trend among international and bilateral organisations to produce grand strategies able to meet the rural water problems in developing countries. The problem

is that these grand strategies are based on limited knowledge and experience on the ground. The confusion is compounded by the fact that both the tactics and the tools for implementing the strategy are inadequate. Villagers don't want machines which will break and cannot be repaired. The challenge posed is to establish a system which will produce machines that will make poor people more productive, machines that will work, will last, and are affordable. In most cases, technology is not really selected, but is grabbed from the inventory of machines most familiar to the engineers in the field. Technology should be designed in collaboration with traditional society. Much of what is described as intermediate or appropriate technology falls in the category which includes technology that has been downgraded in the developed world. No criteria of objectives and performance are defined for the research and no critical evaluation or field testing is carried out.

In developing water systems, it must be ensured that the villager becomes an active member of the research team. For it is the villager, who is the focal point of all this activity and ultimately it is the villager who will judge if a serious effort is being made to solve his problems or if the engineers are merely continuing to tamper with his future.

Reservoir sedimentation and related implications:a case study of Masinga dam/J.M. Ndambuki.-Nairobi:University of Nairobi,1993.- 265p.

A study on reservoir sedimentation was carried out with reference to Masinga dam, a project of the Tana and Athi Rivers Development Authority (TARDA) and the Ministry of Land Reclamation, Regional and Water Development, Kenya. The study revealed that the rate of sediment accumulation in the reservoir is 4.21×10^6 M^3/annum. This rate is higher than that of 3.0×10^6 M^3/annum envisaged during design of the reservoir. As a result reservoir's life will be 370 years assuming that the current rate of siltation reduces the life span of the project by 130 years. The reservoir trap efficiency ranges from 28.82 to 99.9 % and aggradation is more significant in the sections where the channel enters the reservoir. Rivers Tana/Sagana and Maragua are heavily sediment laden with natural background levels reaching as high as 1,500 tonnes/day for Sagana and 100 tonnes/day for Maragua. During any runoff event, suspended sediment concentrations on the rising limp of the storm hygrograph are usually greater than those measured at equivalent flows on the falling limp.

Rural work camps/United Nations Environmental Programme (UNEP). - Nairobi: UNEP, 1988.-15p.

These operational guidelines are designed to enhance awareness at policy level regarding the need to carefully plan and manage the establishment, operation and closure of work camps, regardless of their purpose or anticipated lifespan. They are broad outlines, to be considered throughout project life as well as during post project closure. Work camps are generally conducted as part of the infrastructure for development projects, or as part of a business venture. As such their development is rarely considered as having a distinct role in the development process, but merely as a neces-

sary component of project infrastructure. However, if properly planned and managed, they may become vehicles for development, in which case they must be viewed as semi-permanent settlements, and need to be constructed accordingly. Properly managed rural work camps have an important role to play in developing infrastructure and introducing physically sound development practices to remote, rural areas. Camps may be built as simple housing for a specific project, and have little further development value on their own. They may be built for personnel brought to develop local infrastructure and provide additional infrastructural opportunities through introduction of camp facilities. Camps established in remote areas can play a catalytic role and develop into core rural centres for scattered local populations while introducing them to hitherto unavailable infrastructure. If a proposed camp has the potential to provide useful infrastructure, it should be built accordingly, with thought given to permanence and to continued or post closure use of the camp area and facilities by local people. Much of information gathering and plan formulation proposed in these guidelines are suited to the development of a generic system of requirements suited to the specific constraints and opportunities found in any given area. Awareness of the value of each site, interaction with local populations familiar with the sites and consideration of each project within the context of broader development issues will help maximise the development gain from each project and from each camp proposed.

Report on critical study of alternatives to centralized waterborne sewage for urban and rural areas: engineering feasibility and economics; illustrated by case studies/ Fred A.O. Otieno.-London: University of New Castle Upon Tyne, 1981. 219p.

This thesis examines alternatives to centralized waterborne sewage for urban and rural areas. Millions of people today would be enjoying better sanitation facilities if they did not get the impression that the centralised waterborne sewerage was the only proper and hygienic form of sanitation. The thesis looks at several other available alternatives, their advantages both socially and economically and their limitations. The study has shown that each area needs individual consideration, thus avoiding generalization. Where found to be appropriate, the economics involved have been discussed, though again this is very difficult to generalise, hence the limited amount of costing. Low-cost systems are the answer to many rural problems within the foreseeable future, not only because they are all that can be afforded, but also because they are often the only systems capable of reliable operation in the rural areas of developing countries. As countries develop, a number of the low-cost systems can be upgraded to meet the goas of a full and effective waterborne sewerage system; this must be considered when selecting the initial excreta disposal techniques.

It is essential to ensure that the sanitation system adopted has the following characteristics: wastes should be contained in a manner that will not give rise to either disease transmission to the user or infection of the soil, groundwater or surface water; contact between discharged wastes and people, animals or flies should be minimal; sanitation systems should be clean places; they should be kept as free as possible from smell and unsightly conditions; and systems should be able to accept without

malfunction the personal cleansing materials locally used which may include: sticks, stones, corn cobs, or large handfuls of grass or stones.

The design of a sanitation system should carefully consider the quantity of waste it must accept. Attempts have been made in the past to provide sanitation to rural communities but most of these well intentioned attempts have failed because the facilities supplied have been designed without detailed consideration for the traditions and requirements of the user communities. To be successful in changing sanitation practices of communities, it is necessary to have skilful and sensitive community workers who are in constant contact with the people.

Water supply and waste disposal management: impact evaluation guidelines/ United Nations Centre for Human Settlements (Habitat).-Nairobi: Habitat, 44p.

Little is known on the impact of providing clean water, sanitation services and waste disposal facilities. All but a few past evaluations have focused on health improvement, but studies have seldom yielded concrete results until recently. Very little effort has been focused to social, economic and development impacts. This report tries to clarify some of the issues the prospective evaluator may be confronted with, it provides a background to the evaluation process and acts as a guide for the evaluator in designing impact evaluation studies. The guidelines are written for those working in the water supply, sanitation and waste management sector. Increased awareness and measurement of the economic, social, health, community and environmental impacts triggered by the introduction of water supply, sanitation and solid waste disposal facilities could promote investments and the prioritisation of these elements in national plans. Impact evaluation studies focussing beyond health improvement and which include social, economic, community and environmental aspects, defined within a systematic logical evaluation framework (LEF), present an opportunity to determine the efficiency, effectiveness and overall benefits and effects of basic service intervention projects. Impact evaluation is at a stage where objectively verifiable indicators of impact and methodologies for their quantification can be consolidated and standardised within LEF to permit measurement of a project impact and promote awareness of the diverse benefits of the provision of such a project. The careful design of evaluation studies, use of appropriate and statistically representative methods of data gathering from reliable sources, technically correct data processing and adequately selected and trained evaluation teams are essential in ensuring unbiased and conclusive results. The evaluations that are most likely to yield conclusive results are those that focus on key issues, take into account behaviourial changes, are appropriately timed, are disaggregated to take account of age-rated basic-service utilisation patterns and are designed to minimise the effect of variables outside project intervention but have similar impacts. Careful selection and field testing of data collection procedures, such as observation, structured conversations and discussions and household surveys and the adoption of standard procedures for field/laboratory analyses are important in ensuring accuracy and replicability of the measured impact.

A report of the conditions of UNICEF assisted demonstration rural water supply in Kenya/ Robert E. Wignot.-Nairobi: UNICEF regional office, 1974.-28p.

This report evaluates the present conditions of the UNICEF assisted demonstration projects. It arises out of the need felt by UNICEF for a follow up study on its investments in Kenya. In 1960 the Ministry of Health and the Government of Kenya initiated the Environmental Sanitation Programme which involved the building of small rural water supplies. Its main objective was the demonstration of good sanitary practices, particulary in the environs of the smaller rural communities. In addition to promoting an awareness in the community of the benefits of adequate and safe water supplies, the programme was also concerned with improved methods of waste disposal in schools, health centres, markets and public meeting places. UNICEF provided US$ 1,034,372 worth of assistance to the programme. The contribution was in form of mechanical water pumps and diesel engines to power them, hydrams, hand pumps, piping and related materials such as asbestos, cement, roofing sheets for rain catchment in schools. The World Health Organisation (WHO) provided engineers and health inspectors as technical advisors to the programme. Initially, UNICEF's aid was being matched with the contributions from the local communities in the ratio of 60 to 40% respectively. In the beginning of 1970, the central government began contributing to the programme. UNICEF assistance decreased thereafter and ceased at the end of 1972. At the time of UNICEF's withdrawal, some 561 demonstration projects had been completed or were designed and initiated. Authorities agree that this programme has had the desired effect of showing the benefits of a permanent and safe water supply in the rural areas. Numerous communities in the country today are organising committees to develop their own water supplies. Water quantity rather than quality has been emphasised as priority of the programme. Public health officers have been able to implement a large number of water supply projects while working within a framework that emphasises standardisation whenever possible. Development and construction of water supplies have been given a high priority in keeping with the government's objective of supplying adequate water for domestic and livestock consumption for the whole country by the turn of the century. Operation and maintenance have not been given high priority but have been left to the local groups or authority to carry out. Follow up by officers to record progress and condition of the projects have been irregular. There is need for further assistance on the part of UNICEF and WHO to protect and maintain their investments in the programme. Technical advisors, funds to sponsor personnel for training and donation of additional vehicles are some of the more immediate needs mentioned.

Low cost technology options for sanitation: a state of the art review and annotated bibliography/ Polprasert W. Rybczynski.-Ottawa, Canada:IDRC, 1978.-184p.

This comprehensive technology review and bibliography describes alternative approaches to the collection, treatment, reuse and disposal of human wastes. It is designed to describe to the policy maker, administrator, and engineer, the broad range of approaches to human waste management available today. The review addresses three questions that permeate any discussion of appropriate waste disposal for developing regions. What are the options for excreta disposal in hot climates? What are the

techniques for reusing human wastes? and in view of the above, what are the waste disposal/ reuse options for cities and towns?

Whereas sewers were a solution to waste water problems in the industrialised countries in the mid 19th century, only 13% of the population in developing countries have in-house piped water connections. This means that, for the moment, the main problem of the majority of the population, which is not served by piped water is not waste water disposal, but excreta disposal. Pit latrines remains to date one of the most widely used technologies for excreta disposal. Vaults, septic tanks, aqua-privies, night soil collection and grey waters are the various methods that are used in excreta disposal. Techniques for reusing human waste are discussed. The widespread use of human excreta as a fertiliser source and examples where human excreta is treated as a valuable resource in Asia are cited. Tainan (in Taiwan) being case where night soil is used to fertilise fish ponds. The question of human waste is discussed under the following sections: fertilisation with treated and untreated night soil; irrigation with sewage and stabilisation ponds; algae production in high rate ponds; treatment with aquatic weeds; and the production of biogas using anaerobic digestion. Implications of options that ought to be considered in solving urban waste disposal problems such as the water borne and on site options are briefly discussed. The rest of the document is a bibliography comprising of documents that describe experiences and data useful in evaluation and implementation of technology related to human excreta and waste water disposal.

Cost recovery strategy for rural water delivery in Nigeria/ Dale Whittington; Apia Okorafor; Augustine Okore; Alexander McPhail.-Washington D.C.: World Bank, 1990. 36p.

This paper examines the complexities of political and economic factors which have contributed to the current impasse in rural water supply provision in Northern Anambra State in Nigeria. It is part of a larger effort by the World Bank's policy, research, and external initiative to develop methodologies for estimating households' willingness to pay for improved water services. Special emphasis has been given in this research program to testing the usefulness and reliability of contingent valuation techniques in developing countries. In-depth interviews were conducted with 395 households in three communities in the Nsukka district of Anambra state concerning their household water use and storage practices, water expenditures, willingness to pay for improved water supplies, and household socio-economic characteristics. After the surveys were analyzed, follow-up open-ended interviews were carried out with individuals and small groups of respondents and community leaders in the village in order to probe some of the results from the surveys.

This paper reports on what was learned from both the surveys and follow-up conversations, and examines the implications of these findings for cost recovery strategies in the rural water sector. Results of the analysis show that successful cost recovery in the rural water sector in Anambra state requires careful consideration of households' preferences regarding the way in which funds are collected for public water systems and the timing of such payments. Households do not want to pay for water in advance or commit themselves to a fixed monthly payment for water. People want the

freedom to buy water only when they use it. This is in part due to the seasonal nature of water use, many people do not want to buy water during the rainy season. Households also desire the flexibility and greater control over their cash flow in order to meet other pressing needs such as unexpected medical emergencies. Equally important is that households do not trust the government to provide a reliable public water supply, and thus do not want to pay in advance for a service they are not sure they will ever get. If they are required to pay a fixed fee every month, the survey results show that households are only willing to pay relatively small amounts for improved water services (i.e. less than what they are currently paying water vendors). Kiosk systems with metered private connections for some households appear to be the most promising way to recover costs and meet consumer's cash flow needs (and counter their reluctance to pay in advance for a service they are not sure the government will deliver). The kiosk system can provide cheaper, better quality and more reliable water than water vendors.

Rainwater harvesting for domestic water supply in Kisii district, Kenya/ John M. Omwenga. - Tempere, Harvanta: Tempere University of technology, 1984.; 132 p. ISBN 951-720-857-x

An assessment of the current water resources in Kisii district, Kenya has been carried out in this study and the state of water harvesting ascertained. Traditional water supply sources (rivers, streams, wells and springs) are being continually polluted by human and animal wastes, agro-chemicals used on the farms, and effluents from coffee and tea factories. Many people in the area suffer from water-borne diseases spread by contaminated water as depicted in the medical records of Kisii hospital. The area receives a lot of rainfall (over 2,000 mm annually) but some schools and other social institutions are threatened with closure for lack of water during the dry seasons. Many of the existing rain water harvesting systems are not well maintained. Storage tanks are under designed while many households cannot raise money to buy gutters and storage tanks. Water samples collected from these systems and other traditional sources were analyzed. Results showed that rainwater is generally of good chemical and bacteriological quality; whereas the water from other traditional sources in many cases is not as good.

Corrugated galvanized iron sheets were found to offer the best catchment. Runoff is good from such roofs and they have no bad effects on water quality. Cheap but durable storage facilities like granary basket tanks have been recommended for small households, while the more expensive but strong concrete block tanks or sub-surface tanks can be used for large volume storages for communities. Rainwater harvesting from roofs for drinking and other domestic purposes has proved to be a cheaper and practical solution to the water needs of Kisii people and is therefore recommended.

Waste stabilization ponds in Kenya/ J. I. Fraser. - paper presented at the seminar: sewage treatment. - Nairobi, November 16, 1973. p. 5.1 - 5.10

The author discusses waste stabilization ponds in Kenya. There were waste stabilization ponds (WSP) or pond systems in operation or under construction at about 35 locations in Kenya by 1973. Some are local authority facilities serving towns while others serve government establishments and generally come under the control of the Ministry of Works. Ponds are used for treating mixtures of domestic sewage and for processing waste water from such factories as the Kenya Meat Commission (Athi River) and Kenya Breweries (Nairobi). The biological processes taking place within a WSP system are controlled essentially by temperature, light intensity and detention time. This method of waste water treatment is very effective, therefore, in Kenya where ambient temperatures are high, solar radiation is at a global maximum and the large areas of land required are often freely available. Construction of ponds is usually by cut-and-fill methods, and as recirculation is rarely practised no mechanical or electrical equipment is required. Pond appearances are simple, and routing maintenance can be carried out by unskilled labourers. In addition to treating raw or screened sewage, waste stabilization ponds are used to treat night soil, the contents of conservancy tanks or aqua privies. Well maintained ponds, unless grossly overloaded are free from odours and insect nuisances. Domestic sewage in Kenya invariably contains pathogens and the streams into which the treated effluent are discharged are frequently used for watering livestock, laundering clothes, and may be used as a source of domestic water. In addition, some streams are seasonal and during the dry periods effluent may be the only flow in the stream. It is important, therefore to use maturation ponds to achieve an effluent with low suspended solid contents and a high degree of bacterial purity, as well as an acceptable standard for BOD. Flow measuring devices should be installed at all major ponds. Without effluent flow measurements it is difficult to determine actual loading rates and detention times, it is also impossible to asses the combined losses due to evaporation and seepage in the pond system. Ideally, a regular testing programme for effluent should be instituted in several ponds in different climatic zones in order to build up a body of performance data as an aid to design in future.

Water and health - Amboseli Masai/ R. Shaffer and D. Njai (1978).-Paper presented at the conference: Tropical water-related diseases, London, December 11-15th, 1978, 20 p.

This paper reports on a community based study of health and hygiene conducted in a semi-nomadic setting. The authors studied human health and certain health-related environmental factors pertaining to the Massai of Amboseli in Kenya. The Masai have occupied the Amboseli area for centuries, sharing its swamps' water and forage with wild animals. Their main sources of water are springs, boreholes, and rain ponds. During rains, each boma (kraal) draws from the nearest collection of water regardless of the quality of the solution. During the dry season the majority of bomas depend upon spring water which has been piped from the Amboseli park source to the grazing areas. 480 children under the age 5 years in 38 bomas in the area were stud-

ied. Contraindications were common: diarrhoea and parasite infections were rare despite the saturation level of flies and filth; anaemia was common despite the availability of meat; there was no correlation between distance of water source, consumption of water and prevalence of flies or fungal infections. 70% of the households moved during the year and changed their water sources accordingly. Trachoma prevalence in children under 5 years was 86%. Domestic water utilization averaged 3.48 litres per day. Most of the water was used for cooking and very little was used for ablution. Only 8% of questionnaire responses on utilization of water related to washing the body, suggesting practically no regular washing. Very few instances of child washing were observed and even less of laundry. When the researchers provided them with water through a plastic hose, everyone enjoyed washing.

Issues in development research: the case of water in Kenya/ Harland Padfield.- Nairobi: University of Nairobi, Institute for Development Studies, 1971. 20p.

This paper was originally a report prepared for the water development division of the Ministry of Agriculture, Kenya and read at the workshop on strategies for improving rural welfare, May 31st - June 3, 1971 held at the University of Nairobi. Development research is heavily biased towards application. Its effects frequently intrude on the logics of the research process. The success of any investment made in the cause of development should be gauged in the light of the objectives it sets out to achieve. The intended objectives of rural water supply projects in Kenya are rarely explicitly defined. Biases which result from the confusion of micro-economic rationale and the social and political realities underlying Kenya's water policy include over emphasis on the importance of water development expenditures, ignorance of the sociology and micro-economics of beneficiary populations, emphasis on production as the prime objective of water development and implicit reliance on cost/benefit criteria as the only operational index of performance. Regardless of its rationale, the water development policy is an expression of peoples' felt need. The program will continue regardless of lack of empirical proof of net income gains. The low per capita inputs of the schemes and the overall water expenditures relative to expenditures on roads, hospitals, schools, television and other programs where cost/benefit criteria have yet to be developed make cost/benefit studies for water a trivial but expensive exercise. The government policy states that water made available more easily and in large quantities could significantly raise the level of production per family. Consequently a significant proportion of the development budget goes to rural water development. The question is what proportion of a budget is significant?. A look at the actual as opposed to planned expenditures for 1968/69 water ranks 12th, accounting for less than 2% of the budget. Agriculture and roads are the giants of the budget with 21% and 23% respectively, over ten times the expenditure on water. The 1970/74 expenditure projections show virtually zero increase for water, relative to expenditures as a whole with 4.47% of the projected budget. Roads still rank first. As with schools, hospitals and roads, the government should get the maximum effectiveness from its expenditures. Behaviour cannot be hypothesized without first knowing the sociology and microeconomics of prevailing water systems. To maximize the benefits, more has to be done than just define impacts in terms of whole populations and areas. This means studying water

systems in sociological and micro-economic context in contrasting cultural and ecological settings. Then valid survey instruments and procedures could be designed for use in any area which would provide critical information quickly and cheaply. Basic hydrological, demographic and cost date would thus be the appropriate kind of data to feed into the decision making process.

A septic tank system for use on black cotton soil/ P. A. Campbell and D. D. Mara.-paper presented at the seminar: Sewage treatment.-Nairobi, November 16, 1973; p. 4.1 - 4.7.

This paper discusses the feasibility of using upward flow (anaerobic contact) filters to treat the effluent from septic tanks built in deep black cotton soil. Septic tanks are a convenient method of sewage treatment for small communities with a maximum of 300 people. However, septic tank effluent requires further treatment before disposal. This can be accomplished through surface irrigation, lagooning, and upward flow filtration.

Sub-surface irrigation in drainfield trenches is restricted to use in permeable soils whereas treatment in lagoons (oxidation ponds) is only suitable for communities with more than 350 people. The integration of the house foundation design with that of the septic tank system yields reasonably elegant solutions to the architectural and engineering problems associated with building houses and sewage disposal in areas with black cotton soils. The combination of strongman's foundation (a murram - hardcore foundation laid on black cotton soil), septic tanks and upflow filters with an irrigation (or transportation) area was found to be operationally and financially feasible. With the necessary technical development, agricultural instruction and back up facilities, the septic tank system promises to be a practical method of sewage treatment in areas of East Africa covered with black cotton soil.

Survey on contamination of water sources and household waters as an integrated part of impact management case: Moding and Elukongo sub-locations in Western Province of Kenya/ Pasi Lehmusluoto.- Nairobi: Kenya and Finnish International Development Agency, 1986. - 68p.

This report deals with microbial contamination of water sources and household water and the possibilities of pathogen and disease transmission though various pathways connected to water. Contamination was measured by membrane filter technic (faecal coliform) in the second half of 1984 in Elukongo and Moding sub-locations in Western province of Kenya. Four different types of water sources were examined, 78 unprotected springs, 6 shallow wells and 2 boreholes. A total of 216 households drawing water from the above sources were subsequently surveyed. A majority (54%) of the unprotected springs exceeded the value of 10 faecal coliform/100 ml, which has been applied as a narrative limit value for the rural areas. About 28% of the unprotected springs have been uncontaminated . In Moding, about 43% and in Elukongo about 19% of them have exceeded the above limit value of 10 faecal coliform/100 ml. The shallow wells in Moding generally exceed the limit value of 10 while in Elukongo

majority of the wells ran below this value. The two boreholes were not contaminated. Approximately 93% of the household water had more than 1 faecal coliform/100 ml, 78% exceeded the limit of 10 and 47% had more than 100. There was no marked difference as to whether the water was drawn from unprotected or protected springs, from a shallow well or from a borehole. The Kenya-Finland Primary Health Care programme currently in the area, is devoted to improving the sanitary situation by constructing mainly Ventilated Improved Pit larines (VIP) for demonstration purposes in public places and to assist in providing components of latrines, such as slabs and vent pipes to households. Integrated activities of water supply, sanitation, education and promotion are emphasized in details. Possibilities of rational future activities to improve the health situation in the two sub-locations are envisaged.

Operation and maintenance of sewage treatment in Kenya: some studies/ K. Y. Baliga.-paper presented at the seminar: sewage treatment.-Nairobi, November 16, 1973; p. 9.1-9.10

The present situation in some of the water treatment systems in Kenya with particular reference to operational and maintenance aspects are examined. The paper is based on observations made during field visits carried out between July 1971 and November 1973. Sewage treatment and disposal is receiving a lot of attention as witnessed by the many treatment and disposal systems in existence. However, examples presented so far show either breakdown of the system or a very low level of efficiency. At the Molo sewage works, the inclined screen has become horizontal as a result of corrosion of the iron bars. The raw sewage bypasses the screen carrying solids which are passed into the primary settling tank. Sludge withdrawal was not frequent. Scum on the settling tank was so thick, it looked like solid ground with vegetation. The effluent from the tank was found to carry suspended solids and large chunks of sludge. The suspended solid concentration in the secondary effluent was higher than the suspended solid concentration in the effluent. The filter bed had clogged in most places due to suspended solids in the influent. Sludge handling operations at the Nakuru sewage works were found to be incorrect. The septic tank at Limuru was observed to contain no scum, but the closing syphon in the outlet had broken down. The tracking filter bed which provides secondary treatment to the septic tank effluent was present but lacking a rotary distributor system. The septic tank effluent with a BOD of 420mg/l^5 that measured in May 1972, completely bypasses the filter. Elsewhere, the septic tank at Machakos had a thick scum, the dozing system made of iron had eroded and broken down. The septic tank showed signs of lack of inspection and regular maintenance. Lagoons serving a housing estate in Machakos needed clearing of shrubs. The tracking filter was literally submerged in the septic tank effluent. At the Kericho sewage treatment works, the tracking filter effluent looked no better than the primary effluent. Further investigations carried out at the Molo sewage works revealed that effluent was discharged into a small stream which was being used for domestic water supply a few kilometres downstream (MPN coliform count was + 180/100ml). Poor operation and maintenance has been linked to inadequate operator training.

Unit cost of domestic sewage disposal in Kenya/ R. J. Holland. - paper presented at the seminar: Sewage treatment.-Nairobi, November 19, 1973. -p. 3.1-3.9

This paper gives the estimated unit costs for operating the various types of domestic sewage disposal facilities in Kenya. The various methods of domestic sewage disposal in Kenya include disposal of sewage underground or by burial, bucket and pit latrines, aqua privies, cess pools, septic tanks and sewerage. The disposal of domestic sewage below the ground or by burial is a sanitary method best suited for scattered communities. Such a method requires neither equipment nor structures, its costs are negligible. The unit cost of a bucket lavatory comprising a leak-proof container from which nightsoil must be frequently emptied into a trench and rapidly buried must include the cost of collecting, conveying and disposing of the nightsoil. Bucket lavatories have to be emptied daily. Two buckets used alternatively can be expected to last a year before replacement is necessary. Pit latrines are usually constructed by the family who use them, and so the only expenditure is on material for constructing a small building over the latrine. In some cases, outside labour may be employed for digging the 15 to 30 feet deep hole. Aqua privies are a combination of a pit latrine and a small septic tank. The pit comprises a watertight tank with a high outlet, which allows excess liquid to overflow into a ground soakage system. Accumulated sludge must periodically be removed from the aqua privy tank. Thus the cost of sludge collection, transport and disposal must be included in the running costs of aqua privies. Cess pools are watertight sewage storage tanks. They should be large enough to hold all the sewage produced during the period before emptying which is often once a month. The frequency of emptying, coupled with the large volumes of retained liquid which must be collected, conveyed and disposed of, results in relatively very high running costs for cess pools. Septic tanks are watertight containers with a high outlet which discharges the liquid portion of the settled sewage into a ground soakage system or occasionally to a further treatment unit. It is necessary to remove sludge from a septic tank and so, once again allowance must be made for this when calculating costs. It is usually cheaper to construct a sewerage system before houses are built and roads surfaced. The cost of construction and of water used for flushing wastes has to be included in the calculations.

Effluent standards in Kenya/ B. S. Meadows.-paper presented at the seminar: sewage treatment.-Nairobi, November 16, 1973.-p. 2.1 - 2.14

This paper discusses the available information for establishing detailed effluent standards especially as concerns discharge into rivers. Under the 1951 Water Act of the laws of Kenya, permission is required to discharge effluent directly into a water body. When the Water Apportionment Board issues a permit, standards giving the maximum concentrates of potentially harmful substances in the effluent are incorporated into the agreement. The standards are laid down on the assumption that allowable concentrations will not affect the use of the river downstream. The standards are considered necessary at the very initial stages of the proposed works so that appropriate design measures for the treatment plant can be taken. A survey on all the major

rivers in Kenya was carried out and data collected on river flow, bed characteristics and water quality during the year 1971 to 1973. The water department is now in a position to establish realistic standards. For each river, there is data on the amount of dilution available, the subsequent downstream use of the river water, the self purification characteristics of the receiver, the composition of the effluent, the existing pollution load of the outfall, the water quality characteristics of the receiver that will affect the degree of toxicity exerted by the effluent and as much about its ecology as possible. Presently majority of the rivers are unpolluted and their water chemistry is not unusual. Dissolved oxygen levels are maintained at satisfactory concentrations with some rivers having a BOD of 10mg/l. The standards ensure that the effluent does not interfere with the river's use as a source of domestic water since the majority of the rural populations obtain their water directly from rivers. It is recommended that industrialists consider effluent treatment prior to establishing a factory since the choice of location could significantly affect effluent treatment costs.

The significance of fluoride in Kenyan water and tea leaves in relation to fluorosis and its effect on the enamel structure and restorative dentistry in general/ Gladys Nabubwaya Opinya.-Boston:Boston university, Goldman school of graduate dentistry, 1984.-237p.

Flouride electrode analysis was done on 21 water samples from springs, wells and boreholes. Spring water was found to have a fluoride concentration range of 0.2 - 1.2 ppm. Water from wells had a fluoride concentration of 0.2 - 0.3 ppm. Borehole water obtained from Nakuru and Naivasha in the Rift Valley, Kenya had a fluoride concentration range of 1.0 - 9.3 ppm. Concentrations above 1 ppm were considered high. Dental fluorosis is a public concern in Kenya and has been associated with the high fluoride levels in domestic water. An analysis of tea infusions brewed from loose Kenyan tea having a mean weight of 3.9 grams in 195 ml of deionised water (equivalent to a regular cup of tea) yielded 5 ppm fluoride. The tea infusions have been prepared in a manner similar to the way most Kenyan families brew their tea, by adding tea leaves to boiling water. In this study, the tea was boiled for 10 seconds. Prior to sieving, the tea was steeped for 4 minutes. This indicates that an individual ingesting a cup of tea 195 ml will have a fluoride intake of 980 mg. The Kenyan tea bags with an average weight of 1.8 gms yielded an average fluoride concentration of 1.9 ppm fluoride. A cup of tea (195 ml) brewed from Kenyan bags yielded a mean fluoride concentration of 380 mg. Extended boiling results in higher fluoride concentrations. After boiling for 30 seconds then boiling for 5 minutes without steeping, fluoride concentration increased from 4.2 ppm to 16 ppm fluoride. The American Salada tea had a mean fluoride concentration of 520 mg in 195 ml. Magnesium oxide and bone mea were used as chemical defluoridation agents to reduce excessive amounts of fluoride from artificial water samples with fluoride concentrations ranging from 1 to 9.3 ppm. These defluoridation procedures if utilised in rural areas will reduce the excess fluoride in borehole water to non toxic levels. The use of acid etch technique and composite restoration materials improved tooth morphology and enhanced the aesthetics of severely fluorised teeth.

National youth service, Yatta, Athi-river, surface water development/ Kulecho Isanya Kalamwa. - Nairobi: University of Nairobi, 1981. - 61p.

This project explores the existing possibilities of developing surface water for the National Youth Service farm located in Yatta, Eastern Province of Kenya. Only a small fraction of the farm is under cultivation due to lack of enough water. The immediate task is to supply this area with water from the cheapest possible source and one that would provide water for the longest possible period. The project was carried out with a view to selecting possible earthfill dam sites. Surveying and designing of one such site, estimating its capacity and total cost was done so as to serve as a guidelines for the remaining sites. The advantages and disadvantages of alternative sources were compared and more specifically the water - furrow from the Athi river. The irrigation area to be served was also considered. The total cost and advantages of constructing earthfill dams on the farm were compared to those of constructing a water furrow. The study established that storage dams have high maintenance and initial costs in addition the large surface area allows evaporation (estimated at 47, 000,000 litres per year). Surface dams do not provide a permanent solution to lack of water as they tend to fill up with sediments over a period of time. The possibility of a furrow from a permanently running river in this case the Athi river was found to be appropriate. A properly constructed furrow does not face the problem of sedimentation and the area it serves is not as limited as that of the dam. Since the furrow is from a permanent river which has a much bigger catchment area than the dams under consideration, the volume of furrow water is not a function of local climate as that of the dams; hence the area served by the furrow is fairly uniform. The furrow has very little risk of property damage compared to dams. Unlike dams which require energy to pump out water and thus increasing their costs, furrows on the other hand will only incur costs if pumping is done at higher levels. The study therefore concludes that furrowing is the most appropriate solution to the water shortage problem facing the National Youth Service farm.

Water contact and its relationship to schistosomiasis Mansoni in Lower Nduu, Northern Division of Machakos District, Kenya/ Johnson Munyao Musau. - Nairobi: University of Nairobi, 1977.-99p.

This study on water contact and its relationship to infection with schistosomiasis Mansoni sought to establish the social, economic and cultural factors which bring people into contact with water, a factor which influences the rate of infection with the disease within the population of lower Nduu Village of Matheini sublocation, Machakos district, Kenya. The disease also known as Bilharzia infects human beings when in contact with infected water. Results show that in Lower Nduu, very few people have any knowledge of the relationship between health and water. Majority of the households lack latrines. People defacate and urinate in the bushes around the river. The faeces/urine are washed by rain water during wet seasons into the river, which then transmits schistosomia. Since the people use the river and streams as a source of domestic water and recreation, bilharzia infection is rampant. The population in the area has no knowledge of the transmission route of schistosomiasis and this explains

why the prevalence of the disease is so high. Existing water sites are attractive recreation places for the young, as a result they have a higher contact rate with infested water than the adults and thus they show a higher prevalence rate of infection. Those who draw water and those engage in washing clothes in the infested river not only suffer from schistosomiasis but other waterborne diseases as well. It is recommended that the people be provided with safe water sources and be discouraged from using the river water. In cases where dams are being constructed to provide water, care must be taken to make sure that they do not become breeding grounds for snails, hosts of the schistosomiasis disease. The snails in the river should be killed and eliminated. A health education programme which incorporates social and economic efforts and needs of the people in the area should be initiated. Health educators must work in consultation with the people as it is their participation that will inspire the understanding, acceptance and active support of the programme. Instituting modern sanitation practices, purifying drinking water and providing rubber wading boots for those who must work in water would drastically halt the spread of Schistosomiasis Mansoni in the area.

Assessment of the microbiological quality of drinking water (boreholes and domestic tanks) in Kikuyu division of Kiambu district, Kenya/ Khalid Mohammed Saeed.-Nairobi: University of Nairobi, 1993.-110p.

This Thesis assesses the quality of water in domestic tanks supplied from 10 boreholes within 5 locations of Kikuyu division, Kiambu district, Kenya by determining the total bacterial count, faecal coliform, faecal streptococci, chlorine, pH and fluoride levels. Water samples were collected and analyzed from two boreholes and twelve domestic tanks in each location i.e Kinoo, Kikuyu, Muguga, Karani and Kabete. Total bacterial count was assessed using pour plate method. The number of coliform was determined using the multiple tube fermentation technique and computed from statistical tables. The total bacterial counts ranged from between 1 to 6,282 colonies per Ml of water, while the most probable number of coliforms ranged from 0 to 161. Faecal coliform was enumerated on the basis of positive or negative production of acid and gas at 44.5^0 C. Out of the 70 water samples screened for faecel coliform, 63 (93%) were positive. The feacal contamination was further confirmed by isolation of faecal streptococci using filtration technique and it was found that 71.4% of all the samples were positive for faecal streptococci with counts ranging from 1 to over 300 colonies. Sero-typing E. Coli isolates from water tank samples showed that 38 (79.2%) out of 48 were not enteropathogenic and 10 (20.8%) were enteropathogenic E. coli. In addition 20 (40.6%) of the E coli isolates were heat labile (LT) entorotoxin while all others were heat stable (ST) entorotoxin negative. All 10 (20.8%) enteropathogenic E. coli isolates were resistant to gentamicin but sensetive to Amphicilin (50%), contrimoxale (50%), kanamycin (50%), chloramphenicoli (40%), streptomycin (30%), tetracycline and sulphatriad (20%). The non enteropathogenic and enteropathogenic E. coli isolates showed significant sensitivity to cotrimoxale (64.6%), sulphatriad (43.8%), kanamycin (39.6%) and chloramphenicol (37.5%). The fluoride content obtained in water from all the locations was at the normal recommended levels except in Kabete where levels

were very high (7 - 9mg/l). Only three boreholes were found to be free of microbial contamination, while 7 were contaminated. The E. Coli. isolates from all boreholes were non-enteropathogenic whereas those isolates from water tank samples were either non-enteropathogenic or enteropathogenic. These results indicate that those contaminated boreholes and water tanks may present a potential health hazard to consumers. It is therefore advisable to disinfect water from the boreholes in the study area before distribution and to regularly clean, disinfect and maintain well storage tanks.

Rural water supply and sanitation in less developed countries: a selected annotated bibliography/ Anne U. White; Chris Seviour.-Ottawa: IDRC, 1974. -81p.

Most of the water found in rural areas of developing countries is not pure enough for minimal health requirements, many people do not have enough water and waste disposal facilities are inadequate. This is of considerable concern to governments and the international community. This bibliography presents an annotated from a selection of the available literature on the subject of water supply and sanitation. The bibliography lists articles on the subject of rural water supply and sanitation in less developed countries. They are listed according to whether they deal with general topics, technology or health and diseases. Other bibliographies on the same subject are also listed. The bibliography has been prepared as part of an investigation into the problems of water supply and sanitation in the developing countries. The invitation aims at finding ways in which the rate of progress in improving water supply and sanitation conditions can be accelerated partly but not exclusively through the application of research in science and technology. Much of the material is of fugitive nature - numerous short reports reproduced in small numbers and articles in journals with varying degrees of accessibility. Most fugitive materials are available to serious scholars and researchers upon request to the appropriate agency. Most of the material deal with rural areas but discussion of urban and rural policies and practices have been blended. There is little material on hydrology or related fields as this is a separate body of literature in itself. The selection attempts to illuminate questions of why and how water supplies and sanitation need to be improved, what sort of people various programmes would reach and how local people are or could be involved in improving their own facilities. It also includes practical questions on the available technology and administrative and financial arrangements.

Safe water supply detailed design survey under the communicable diseases research and control/Japan International Corporation Agency (JICA).- Nairobi: JICA, 1983.-218p.

This safe water supply detailed design survey project is an integral part of the communicable diseases research and control project in Kenya which is being executed under the international technical cooperation of the Japan Internaitonal Cooperation Agency (JICA). Its goal is to supply safe water to model camps and other surroundings. The survey areas covered by the project were classified into two categories:

hinterland and coastal area. Field surveys were carried out and data collected between 17th January and 15th February 1983. The Coastal area located where land elevation ranges between 10m and 30m above sea level is flat and covered with dry sandy soil. Apart from a local sugar factory with 16 labour camps scattered throughout the area which has water supply facilities, the rest of the population in the area depends on water from springs and wells. In most cases the amount of water available is limited. The Wells which are about 2.5m in diameter and 5 to 10m deep and springs are always subjected to pollution. The hinterland is hilly with some scattered rock outcrops. Elevation is about 150m above sea level. The Pemba river and its tributaries are a major source of domestic water. Four water connections along the water supply pipeline to Mombasa town are also considered as a water source. However, due to the water charges most people depend on the river. The small tributaries of the Pemba river not only dry up during the dry season but are also polluted with schistosomiasis haematobium and most people are infected with schistosomiasis. Based on the basic policy plan of safe water supply and the results from the field surveys such as geoelectric resistance surveys, yield tests etc., the following facilities were found to be suitable for the coastal area: shallow wells which are tightly covered at the top as a with a diameter of 2.5m and a depth of 10 - 20 m. A windmill and hand pump were proposed and washing space and bathing area were considered supplementary facilities. Based on the results from the field surveys, pumping ground water from shallow wells in the hinterland was impossible due to hydrogeological factors. Deep well construction is not suitable for the area due to power supply, operation and maintenance costs. Instead, three intakes should be installed along the water supply pipeline to Mombasa town that runs along the Pemba river and suitable washing space and bathing sheds be provided as supplementary facilities. The Kenya government should provide financial assistance in water charge payments.

Working with women and men on water and sanitation: an African field guide/The Hague: IRC, 1994.-98p.

This manual has been developed by a group of African women experts. It aims at guiding planners and field workers in the planning and implementation of water and sanitation projects and programmes with a gender awareness approach. It contains guidelines on involving women alongside men in all the stages of a project. It advocates for general gender awareness as the ideal situation in which women and men can participate on equal terms addressing the same issues. But so far, there are few projects that integrate gender awareness. A gender awareness project must explicitly state women's involvement, and expertise must be drawn equally from women and men. If expertise is not available among women it must be created within the projects. It is important that women are employed as project staff on equal basis as men. A good gender aware approach divides work, position and benefits equally between men and women. It is important that the water project identification team includes people with knowledge and/or experience on women and development, to ensure that all necessary information concerning gender issues will be taken into consideration. The team starts by defining general context of the project. This is followed by general strategies to ensure that gender awareness in all aspects of the project are formulated at this stage.

During the reconnaissance visit, it is possible to get a better idea of the technical conditions and the kind of services men and women are willing and capable to support. Chances of sustainability are greatest when men and women agree on the type of facilities needed and are both ready to support them.

Project objectives should clearly specify women's and men's roles, responsibilities and requirements in the project. This helps project staff to promote meaningful participation of all users or the whole community. A project team visiting a community should consist of at least a female and male project worker. This is to ensure that women as well men in the community can be easily consulted and that separate meetings with men and women can be held if necessary. All social data should be divided according to gender. A comparison of women's data with men's data provides better basis for planning shared responsibility and joint involvement of women and men in the project. Supporting agencies should apply a gender awareness approach by selecting only those community projects which propose shared responsibilities and benefits for both women and men.

Conceptual framework for municipal solid waste management in low income countries/Peter Schubeler.-Nairobi: UNDP;UNCHS;World Bank-UMP, 1996.-55p.

Municipal solid waste management (MSWM) is a major responsibility of the local government. The conceptual framework provides brief definitions of the main concepts of MSWM and identifies the goals and principles that normally guide MSWM systems development. It discusses key objectives and issues which should be addressed by MSWM strategies with regard to political, institutional, social, financial, economic and technical aspects. Municipal solid waste comprises refuse from households, non-hazardous solid wastes from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweepings. MSWM encompasses the functions of collection, transfer, treatment, recycling, resource recovery and disposal of municipal solid wastes. The first goal of MSWM is to protect the health of the population particularly that of low income groups. Other goals include promotion of environmental quality and sustainability, support of economic productivity and employment generation. Achievement of MSWM goals require sustainable systems of solid waste management which are adopted and carried out by the municipality and its communities.

To achieve sustainable and effective waste management, development strategies must go beyond purely technical considerations to formulate specific objectives and implement appropriate measures with regard to political, institutional, social, financial, economic and technical aspects of MSWM.

Political aspects concern the formulation of goals and priorities, determination of roles and jurisdiction, and the legal and regulatory framework. Institutional aspects on the other hand concern the distribution of functions and responsibilities and correspondence to organisational structures, procedures, methods, institutional capacities and private sector involvement. Social aspects of MSWM include the patterns of waste generation and handling of household and other users, community based waste management and the social conditions of waste workers. Fiinancial aspects involve budgeting and cost accounting, capital investment, cost recovery and cost reduction. Eco-

nomic aspects include the impact of services on economic activities, cost effectiveness of MSWM systems, macroeconomic dimensions of resource use and conservation, and income generation. Lastly, the technical aspects are concerned with the planning, implementation and maintenance of collection and transfer systems, waste recovery, final disposal and hazardous waste management.

A review of sanitation program evaluations in developing countries/ Ann La Fond.-Washington D.C.: UNICEF/EH, 1995.-61p.

This paper deals with the first phase of UNICEF's global evaluation of sanitation programmes aimed at analyzing experiences in the design and implementation of sanitation interventions in developing countries and to ascertain lessons in order to improve the effectiveness of future investments. It consists of a review and analysis of sanitation programme strategies of various implementing agencies, a summary of lessons learned and provisional programme guidelines for discussion among planners and managers.

Data was collected and findings presented under the topics of service delivery, the role of sanitation consumers, influencing behaviour, capacity building, economic and financing and intra and inter sectoral links. The choice of implementing institutions, division of responsibilities in service delivery, and coordination of the implementation process were found to be important for programme success. Sanitation programmes often suffer in the hands of weak public institutions. Programmes implemented by NGOs or the private sector separately or in collaboration with the government are more likely to succeed than programmes implemented by the government alone.

Involving consumers in project execution was found to yield greater community responsibility on the operation and maintenance of projects and better prospects for sustainability. Four factors were found to enhance the contribution of country participation to programme success. These were the use of existing community organisations rather than creating new ones, improving organisational capacity of community groups and their problem solving skills, involving women and including communities in the design, management, and financing of projects. Failure of sanitation projects is attributed to excessive emphasis on technology at the expense of changing consumer attitudes to latrine utilisation and maintenance and general hygiene. Success in influencing behaviourial change depended on four factors, a clear sense of purpose, use of participatory techniques, the inclusion of women as promoters/educators and the simultaneous employment of a range of techniques. Techniques for assessing hygiene must be readily available to programme planners. Sanitation projects should enable local institutions and people to address sanitation problems on a sustainable basis, a significant omission in most evaluations. Economics and finance did not feature prominently in the evaluations. Inadequate public sector financing often impedes the realisation of coverage and sustainability goals. The evaluations were deficient in information on the link between individual sanitation projects and overall sector development.

Case studies on promotion of appropriate sanitation systems/ Marga J. Alferink.-The Hague:IRC, 1995. - 57p.

This paper presents different case studies in which appropriate sanitation systems for safe excreta disposal have been introduced. The aim of the paper is to identify the different methodologies used to promote sanitation systems to the public. A number of factors were reviewed in order to distinguish between the different methodologies. These include the programme initiator, methods used for promotion, health education, materials used, contribution made by the community, unit of decision and selection of technology. The programmes presented in the case studies range from an approach where technology plays a central role to another where improvement of hygienic behaviour is the aim of the programme.

In Indonesia, Mozambique, India and Ghana sanitation systems or services are sold to the users in the private sector. Emphasis is on technology and no attention is paid to the promotion of improved hygienic behaviour such as washing hands or keeping facilities clean. Entrepreneurs are motivated to promote the system as their income depends on it. Under the system, health benefits will not materialise if users do not adopt improved hygienic behaviour.

In Brazil, Uganda and Baldia in Pakistan, the government sets up demonstration areas where sanitation systems are promoted by implementing the programme in the area. The approach enables future users to visit the demonstration area to see the technology and discuss with the owners of the sanitation systems their advantages and disadvantages. In China, Ghana, Bangladesh, Kenya, Pakistan, Botswana, Mexico and India the government or NGOs contact communities and offer them a predefined structure in which community members can participate in order to improve their sanitary facilities. In some programmes focus is on construction of sanitary facilities, while in other programmes hygiene education and construction receive similar attention. Person to person promotion is very effective.

In Burkina Faso, Honduras and Zimbabwe the government or NGO contacts the community and uses social marketing strategies. Project staff contact communities to promote the use of improved sanitation systems. In Lesotho, the government trains private builders and initiates hygiene education programmes. The trained entrepreneurs are stimulated to start producing and selling latrines of their own. Extension workers are also sent out to teach communities on hygiene and the importance of latrines.

A participatory poverty assessment study-Kenya, February-April 1994/ Deepa Narayan; David Nyamwaya.-Nairobi: World Bank, 1995.-100p.

This document reports on the findings of a participatory poverty assessment study undertaken by the government of Kenya and the World Bank during February - April 1994 to complement statistical studies on poverty in Kenya. The study was conducted in 7 districts considered to be among the poorest districts in Kenya, and two low income (slum) areas in Nairobi. Six districts were predominantly agricultural and one was pastoral nomadic. Five villages in each district were selected by random sample (total of 35 villages). The study's two objectives were to understand poverty from the poor man's perspective and from those providing services to the poor and to start a

process of dialogue between policy makers, district level service providers and the poor. In the six agricultural districts (Bomet, Busia, Kisumu, Kitui, Kwale and Nyamira), 63% of the households were ranked poor or very poor whereas in the nomadic district (Mandera), the figure was 77%. Generally 86.7% thought their situation would worsen and in some villages the figure was 95%. This means that in some areas of Kenya, almost every person thinks the situation is hopeless. Four major long range factors emerged from the reports each contributing independently to increasing poverty. First, inflation - the cost of basic commodities have been rising at a rate of 20-30% annually over the past 10 years, as much as 100-500% in a decade. Second, social breakdown - men who once priced wives and children as a mark of wealth are turning wives and children out of impoverished and overcrowded homes. Third, cost sharing strategy - such measures as cost sharing in education and health are being credited with slow improvements in Kenya's economy. At the same time they are slowly depriving the poor of education and health care. 65-75% of the populatopm is facing deprivation of these services, and lastly, demographic characteristics - increasing population, land fragmentation, breakdown of homes unemployment, and unmanageable school enrolment which in turn contributes to a worsening breakdown in education are quite evident. It was recommended that a closer dialogue should be established between district leaders and the poor in order to promote grassroot development, which both the study team and the poor thought would be greatly beneficial.

Managing development: experiences and lessons from Africa: final report, papers presented at conference: African Training for Leadership and Advanced Skills (ATLAS). - Harare, Zimbabwe May 5-9, 1994. 135p.

Participants of the African Training for Leadership and Advanced Skills (ATLAS) workshop were asked to develop a set of recommendations on their experiences while undergoing training in the United States as well as for the conference on "Managing development: experiences and lessons from Africa". For U.S. training, participants recommended that a research component be incorporated in the U.S. long term training curriculum, an internship programme be developed for short term professional training for practical exposure, a short term management course be given to U.S. trained graduates just before leaving for their respective countries to prepare them better in assuming leadership positions at home, African governments should not return or misappropriate donor funding that is destined for human resource development and collaboration in training between the U.S and Africa be strengthened.

For management training, the conference recommended that regional professional associations be formed to train African leaders on management, a follow up workshop be held to design a training manual on management and consultancy skills, African-American Institute (AAI) facilitate the publication and dissemination of case studies on management, and the production of videos pertinent to African management for use in training workshops and that capacity building in existing African institutions that deal with management be encouraged. As for strategies, it was recommended that management training should involve training delivered through regional workshops and seminars, short term courses of less than one year and long term training, creation of a database on continental management resources, sharing of research information

and management skills through journals, interregional seminars and workshops, privatisation of training needs in the public and private sector and local and international NGOs. Management training needs of all sectors of the economy were outlined as being interalia management of information systems, project management, policy management, consultancy skills, human resources management, organisational behaviour and strategic planning, corporate culture and vision and entrepreneurial skills development - business ethics, business plans and risk management.

Combined report on two regional workshops to review learning materials for water and health institutions in East Africa/ Regional Network Centre for Water and Waste Management (EA). Environmental Health Unit, AMREF. - Nairobi: AMREF, 1987. 60p.

A regional workshop held to review learning materials for training institutions in the water and sanitation sector in 1986 identified that there is a dire need to improve the learning materials situation in the institutions of East Africa and to identify ways in which the Regional Network Centre (RNC) would offer assistance. The level of learning materials was found to be low in Uganda and Tanzania due to constraints imposed by a general lack of foreign currency. The situation in Kenya was slightly better as some of the learning materials could be found in the open market. However, within the individual institutional libraries in Kenya, the situation was no better than in the other countries because of inadequate budgetary allocation for purchase of such learning material from the market. The workshop recommended that the Regional Network Centre for Water and Waste Management should assist the institutions by provision of such learning materials in three ways. One, the RNC prepares a joint proposal to donors requesting for assistance in the purchase of books (which the workshop identified and prioritized) on behalf of the institutions. RNC would then distribute the materials to various institutions in the region. Two, the RNC subscribes to essential journals in the field of water supply and sanitation on behalf of the institutions and three, the RNC through AMREF book distribution unit sets up a system through which the essential text books can be made available in selected bookshops within the countries of the region. The workshop identified need for teaching aids and recommended that six sets of the slide-sound modules plus adequate number of participants' notes be provided as soon as possible to the institutions, RNC provides assistance in the provision of reasonably priced slide projectors and cassette players to go with the sound modules. The workshop noted lack of adequate funding for research in various institutions and recommended that the RNC provides direct financial assistance to research programmes. It was also recommended that the RNC plays the role of facilitating exchange of research information within the institutions of the region. The workshop noted that it would be useful to have a forum, such as a bulletin or newsletter, where progress or development in water supply and sanitation technologies and programmes within the region can be reported for the benefit of staff and students in the three countries and recommended that RNC should find ways of establishing such a bulletin.

PROWWESS Eastern Africa assessment report: views of PROWWESS trained persons in 9 Afrian countries/ Joanne Harnemeijer.-Harare: UNDP/World Bank program, Regional Water and Sanitation Group-East Africa, 1994. - 33p.

A special intergovernmental project, under the UNDP, on the Promotion of the Role of Women in Water and Sanitation Services (PROWWESS) has been providing technical support and guidance to community based water and sanitation programmes in Africa since 1984. In East Africa, PROWWESS has been training trainers and field personnel on the design and use of participatory methods for involving communities and in particular women in the planning, implementation and evaluation of water and sanitation projects. The methodology used and promoted is SARAR (Self Esteem, Associative Strengths, Resourcefulness, Action planning and Responsibility). The purpose of SARAR is to shift from an autocratic to a participatory process. SARAR works on attitudes and values and aims at stimulating commitment and behaviour. The review of five countries (Tanzania, Kenya, Zimbabwe, Ethiopia and Uganda) shows that there has been a lot of room to set and follow a strategy for institutional rooting of participatory approaches since input depends on demand and funding from external sources with an interest focused on conventional projects. Where project and institutional interests occurred as in rural water supply in Uganda, acceptance and expansion was fast, but fortuitous. The Regional Water Sanitation Group-East Africa based experts provided the technical manpower support. Initially the manpower consisted only of three master trainers for the whole region. The input given by these trainers was in workshops and informal support to networks. The reviews demonstrate that there is need to give the methodology and the principle it stands for a higher profile with those whose support it needs for implementation. The reviews have made it clear that PROWWESS experts have had insufficient leverage on projects and programmes funded by other donors. In future, follow up should be part of the package for assistance to such projects. Opportunities for application should continue to be sought within World Bank funded projets and programmes. Action plans for countries selected should be drawn by core groups of PROWWESS trainees, and a budget to help networks start off should be secured.

Environmental management of urban solid wastes in developing countries/ Sandra J. Cointreau. - Washington D.C.: World Bank, 1982. - 212p.

Wastes are considered to be a nuisance everywhere. The health and economic costs of inadequate collection and management of solid wastes are rarely considered and it is against this background that environmental management of urban solid wastes in developing countries should be planned and implemented. The purpose of this document is to create an awareness of the need for competent management of solid wastes in urban areas, an understanding of the various systems available for the collection, transfer and disposal, an approach to the preparation and implementation of solid waste projects and the anticipation of potential problems and issues which may arise in project development.

It provides information and procedures for planning and implementation of solid waste management improvement. The scope includes solid waste components in urban development projects, water supply and drainage projects, and sanitation projects.

In each type of project, the key to upgrading the solid waste system is to deal directly with the city-wide institutional and financial management of its investment, operation and maintenance activities. Municipal refuse in cities of developing countries differs from that of industrialised countries in that waste densities are high, generally 2 to 3 times higher, composition is largely organic with the portion of vegetable/putrescible material typically 3 times higher, there may be substantial amounts of dust in the cities where sweeping and open ground storage is part of the collection system and particle size is much smaller often exhibiting less than half of the materials in the lower 50mm range that would be seen in refuse from industrialised countries. Selection of appropriate refuse management technology must therefore be considered. The guide is designed to facilitate project preparation, appraisal and implementation of bank financed solid waste projects in urban areas. The current bank objectives, policies and project requirements are summarised.

Guidelines for community management of rural water supply and sanitation systems: a contribution to the Africa 2000 water supply and sanitation for all initiative/ P. Taylor; N. R. Mudege.-Brazaville: WHO, 1995. - 54p.

These guidelines present the latest views on community management of rural water supply and sanitation systems with a literature review on how to work with the community to implement community management. It is intended to be used for training of government and non-governmental extension agents in water, sanitation and health services in rural areas. It also aims at relocating community participation experiences from the margins to the centre of community water supply and sanitation programmes in order to sustain adequate operation and maintenance activities. Community management is taken to mean that the beneficiaries of the water supply and sanitation services have the responsibility, authority and control over the development of their water and sanitation system. All other actors play supportive roles. Government and external agencies must establish the environment in which communities can construct, operate and manage improved water and sanitation facilities. Community management could be a national policy as are gravity fed piped schemes in Malawi or a local initiative just as the Ghana urban water and sewerage programme or at a project level as is Kwale project in Kenya. Governments, donors and communities will need to introduce substantial changes to what they do and how they do it necessitating policy changes at all levels. Institutionalising community management requires the creation of enabling and supportive legislative, administrative and financial policies. In addition, comprehensive human resource development within government sector institutions is required in order to adopt the new roles of government agencies. The government's role under community management has changed from that of being responsible for the operation and maintenance to that of assisting the community in operation and maintenance. Mechanisms within the community for managing the collection of funds, making payment and keeping accounts have to be established. Where possible, financial incentives will be put in place by external agencies to promote community management. The guide recommends the use of participatory methods as they constitute a process of building self esteem and self reliance in the community and ensure that the decisions reflect community priorities.

Source book for gender issues at the policy level in the water and sanitation sector/ Wendy Wakeman.-Rabat: WSCC, 1995. - 47p.

The source book for gender issues at the policy level in the water and sanitation sector is the collaborative council's mandated activity on gender issues. The document discusses how gender issues flow from the sector principles set forth at the 1992 Dublin international conference on water and the environment, introduce the topic of gender issues at policy level, discuss what agency policies have been, highlight tools used to implement policies and describe the experiences of a few agencies. Incorporating gender concerns into policy level and analyzing the results is a fairly new endeavour, much work remains to be done. While more and more agencies have general GAD (Gender And Development) policies as well as some specific gender aspects in their sector statements, the impact on the ground as concerns developing women and men, has not been as desired. Initially GAD focussed on the development of tools to address gender issues within project context only later did work ensue on policy development. As much as possible, attaining gender goals should be mainstreamed into regular budget processes thus becoming part of the ongoing project funding and not being separated from the core of the agency's work. The institutional framework has often been inadequate with key indicators not being developed to monitor the impact of policy on men and women in developing countries. Efforts should be made to pursue capacity building in developing countries' institutions and to promote the development of GAD agendas in developing countries. Aspects of sector policy which relate to gender issues should be formulated based on experiences at project level. Gender variables, along with other social issues such as ethnicity, religion and class can provide the sociological under spinning which help fit a demand based approach to a particular geographical setting. Much has been done at grassroot level by organisations in developing countries but more efforts need to be directed towards documenting, replicating, and expanding this experience. The source book has been created to provide methods and information related to gender and development issues. It looks at numerous ways in which policies have been created and implemented over the past few decades and what has worked and what has not. It concludes with suggestions for future research and analysis on the operation of GAD in the water and sanitation sector.

The contribution of people's participation: evidence from 121 rural water supply projects/Deepa Narayan.-Washington D.C: IBRD;World Bank, 1995.- 108p. (Environmentally sustainable development occasional papers series; no.1)

This study examines efforts to induce participation as a means of creating effective rural water systems and to build local capacity to manage them. The study specifically addresses the following questions:- does people's participation contribute to project effectiveness? How important is this contribution in relation to other factors? What factors and strategies influence participation in collective action? What are the lessons for the design of large scale water projects? To answer these questions, researchers studied evaluations of 121 completed rural water supply projects in 49 developing countries worldwide. Eighteen different agencies supported the projects,

which employed a variety of technical approaches. The results are clear: beneficiary participation contributed significantly to project effectiveness even after statistically controlling for the effects of seventeen other factors. The results are based on qualitative analyses of data across projects, sometimes over a decade or more. The proportion of water systems in good conditions, overall economic benefits, percentages of the target population reached, and environmental benefits rose significantly with participation. Participation also helped assure equality of access to facilities, although its effects were less pronounced in this outcome than in others already cited. The analysis reveals that participation fostered individual and community empowerment. It also promoted new water management and organisational skills in the community. Finally, it strengthened local organisations, which then went on to undertake other development activities. Although most projects identified women's participation as a target group, only 17% of the projects achieved high levels of involvement by women. High levels of beneficiary participation did not mean that women's participation was high. Women in most rural areas face many constraints when it comes to participation in development projects, and unless their involvement was specifically targeted, and resources to ensure their participation invested, it did not occur. Rural water projects must be redesigned in order to reach the one million rural poor who lack sustainable water supply. Redesign must encompass a shift from supply driven planning to demand responsive participatory approaches so as to ensure beneficiary participation, control and ownership.

Harvesting rainwater in semi-arid Africa: manual no.5-subsurface and sand-storage dams /Erik Nissen-Petersen; Michael Lee.-Nairobi: ASAL, 1990. 43p.

Harvesting rainwater in semi-arid Africa consists of 6 manuals: manual no.1 Water tanks with guttering and hand-pump; manual no.2 Small earth dam built by animal traction; manual no.3 Rock catchment dam with self-closing water tap; manual no.4 Shallow wells with bucket lift; manual no.5 Subsurface and sand-storage dams; and manual no.6. Spring protection. The manuals are based on practical experiences gained through building some 700 water structures for rainwater harvesting for self-help groups in semi-arid Kenya for over 14 years, by the author. The manuals provide an opportunity to develop low technology and labour intensive methods of harvesting rainwater and thereby enabling people and livestock in semi-arid regions of the country to have access to a steady water supply. Each manual deals with siting criteria, standard designs and bills of quantities in a simple text and drawings of subsurface and sand-storage dams. Manual no.5 which covers sub-surface and sand-storage is divided into four parts: surveyor's manual on sub-surface dam; surveyors manual on sand-storage dam; contractors manual on sub-surface dams; and contractor's manual on sand-storage dam. Subsurface dams are seepage prevention structures which are build across a sand river bed in order to improve productivity of the shallow well. They are only built if a shallow well situated upstream can produce water for nearly all months of the year. Three types of dams designed to prevent seepage are covered in the manual. The clay-plug dam which is basically a trench dug into the impermeable clay or rock layer below the river bed and filled with compacted clay soil to produce a impermeable barrier. The masonry sub-surface dam is a trench dug into the river bed

but a stone and mortar wall is built across the width of the river. The sand-storage dam is built where a rock outcrop is exposed or where the river floor below the sand consists of impermeable murram or clay. The principle idea is to prevent water seepage through a river bed and to drain the available moisture from around upstream of a shallow lined well sited in a river bed using seepage prevention structures built at suitable places downstream. The contractor's manual covers foundation digging, preparation for construction and building instructions including wall extensions.

Low-cost Urban Sanitation in Lesotho/ Isabel C. Blackett. - Washington D.C.: UNDP/World Bank Water and Sanitation Program, 1994.

This case study of Lesotho's urban sanitation project details the development of the programme from the pilot stage to what is now a national program. The low-cost sanitation program in Lesotho is a remarkable exception. It started as a pilot project for urban sanitation in 1980 and rural sanitation in 1983, and has since evolved into a nation wide program, with very few expatriate personnel, and a modest reliance on governmental or external financing. Some features of Lesotho's economy and social systems are unusual e.g men work as migrant workers in South Africa. Consequently an unusually high number of females head households and maintain jobs in the civil service, private sector and other decision-making positions. However, other aspects of the society are common to many developing countries. The key to the success of low-cost sanitation program in general, and particularly in the urban areas of Lesotho have been the affordable and acceptable latrine design, minimal direct grants or subsidies to householders. Latrine construction is done by the private sector.

Four widely applicable lessons emerged from Lesotho's urban and rural sanitation experience. First and foremost is to get the design right. Ensuring that the system is technically adequate, affordable and acceptable to the users then standardizing it for economy and simplicity. In this particular case, the VIP was the most appropriate latrine. In other situations different latrines may be required. Second, do not subsidize. Whenever possible, the users should finance their latrines themselves, or through a credit mechanism. The users should directly employ private sector local builders, who are trained in latrine construction. Third, focus on promotion. To attract the users, the issue of health and status should be addressed through various media and fourth, ensure proper institutional arrangements. Work with government structures if possible. Encourage collaboration with related programs, and keep running costs appropriate to government budgets, so that the local government can afford to take over the cost once donor financing is phased out.

A guide to health education in water and sanitation programmes/David Nyamwaya; Peter Akumu.-Nairobi: AMREF, 1986.-64p.

This guide stresses activities which can be undertaken at community level with little assistance from outside to motivate and improve health through utilisation of simple and safe water systems and human waste disposal methods in Kenya. The guide for anyone who is involved either directly or indirectly in attempts to help rural

and semi-urban communities improve their health, with water and sanitation as an entry point. It is meant to provide ideas and suggestions which can then be modified by health educators to suit specific local conditions and needs. The first part of the guide covers health education while the second part covers some common water and excreta disposal related diseases. Research carried out in Kajiado, Kilifi, Kwale, Kisii and South Nyanza shows that water related diseases prevail even in those communities which have access to improved water supplies. The provision of an improved water supply alone is not sufficient in eliminating or reducing disease. This may be due to the fact that people lack the appropriate knowledge in the proper use of water or they lack resources or the motivation to effect the appropriate behaviour or use improper water sources and use insufficient quantities of water or lack proper human waste disposal methods. It is necessary to effect changes in other aspects of life in order to improve the health of the community. A health education programme relating to water and sanitation planned and implemented within the context of primary health care covering the approach of the health worker, water, sanitation and disease, prevention of excreta disposal and water related diseases, domestic hygiene, mobilising the community; and methods of teaching and learning are provided in the first part of the guide. Four categories of water and excreta disposal related diseases namely water washed, water borne, water related and excreta disposal related diseases are covered. For each disease, a paragraph on description, its spread, symptoms, prevention and management is given. Water washed diseases such as diarrhoea and vomiting, dysentry, scabies, trachoma and conjuctivitis, water borne diseases such as typhoid, cholera, poliomyelitis, amoebiasis and hepatitis, water related diseases such as malaria and schistosomiasis and excreta disposal related diseases such as roundworm, and tapeworm have been covered and well illustrated in the second part of the guide.

Implementation of water supplies: the Kenya experience (1990) -In Water supply and sanitation in Africa: Laying the foundation for the 1990s. Country statements and external support agency reports presented at the Workshop and Sector Conference: Abidjan, Cote D'Ivoire May 7-11, 1990: All African Water Supply and Sanitation, Vol.2, PP.112-116.

The Ministry of Water Development in Kenya was created in 1974. Prior to its creation, implementation of the few existing water supplies which were mainly limited to the urban areas, was under the auspices of a small department in the Ministry of Agriculture. Since the creation of the ministry, the government has set targets to provide water to its citizens by the year 2000 and is determined to ensure that as many peope as possible have potable water as close to their homes as possible. A national hydrometric network has been established to cover all the drainage basins in the country for the purpose of collecting information on surface water. Data collection is given to planners to assist when planning future water supplies. With the use of modern equipment, the whole country is traversed in the search of ground water. Where ground water is available, it is developed for both domestic and animal consumption. Boreholes are drilled using the latest technologies available and supplies developed. Over 5,000 boreholes have so far been drilled. Water quality and pollution control division

has since 1972, ensured protection of the country's water resources from pollution. Its role encompasses the control and regulation of industrial and domestic effluent discharged into receiving water bodies. The department also monitors water in rivers, lakes, and aquifers coupled with physical, chemical, and bacteriological analysis of samples in water laboratories thus discharging the responsibility of quality control of water from water supply chemicals. These services have so far been decentralised by creating provincial laboratories manned by qualified chemists. Small test laboratories are also located in water supplies for day to day testing of water quality. A permanent presidential body to oversee the conservation of soil and water has been created. An annual tree planting day is observed each year. Many self-help water projects have failed due to high cost of operation and maintenance. In exceptional cases these projects have become very successful and have contributed remarkably to the provision of water to the people. Friendly countries and agencies have continued to assist Kenya to develop both rural and urban water supply projects. Notable ones have been the Sida, Finnida, NORAD, GTZ, JICA, The Wold Bank, ADB, EEC, DANIDA, USAID, Britain and Austria.

Water supply, sanitation, and environmental sustainability: the financing challenge /Ismail Serageldin.-Washington, D.C: World Bank, 1994. 35p.

This booklet describes some of the more imaginative and promising approaches to addressing the challenges facing the water supply and sanitation sector in developing countries at different levels ranging from self financed sewers in squatter settlements in Karachi, Pakistan, to the emergence of participatory river basin management in Brazil. It examines how the World Bank and other agencies can assist and encourage efforts aimed at providing environmentally sustainable water and sanitation services to growing populations that expect and have a right to decent living conditions. The water supply and sanitation sector faces two great challenges in developing countries. The first is to complete the "old agenda" of providing all people of the world with adequate water supply and sanitation services. Although considerable progress has been made, a lot remains to be done. One billion people still lack access to adequate water, and 1.7 billion do not have adequate sanitation facilities. Furthermore, the quality and reliability of existing services are often unacceptable. To compound the situation, the costs of providing services are rising substantially because of rapid urbanization, mismanagement of water resources, and the low efficiency of many water supply organizations. The proportion of public spending on provision of water and sanitation services has been high. Firstly, the low contribution of users has meant the supply agencies are not accountable to consumers. Secondly, these resources have been used primarily to subsidize services to the middle class and the rich. Thirdly, spending on household services has left few public resources available for wastewater treatment and management. The second challenge is the "new agenda" which requires that much greater attention be paid in ensuring that the use of water resources is sustainable in terms of both quality and quantity. In some respects, (high costs and limited resources) the situation confronting developing countries is smaller than that facing industrial countries. In other respects, the task for developing countries is

considerably more difficult. Water in developing countries is much more seriously degraded and is deteriorating rapidly. Fewer financial resources are available for environmental protection and institutional capacity is weaker. The overriding challenge to the developing world is to improve the well being of the poor in a way that is both environmentally and financially sustainable. Sound economic policies, which means fiscal common sense and maximum use of market instruments such as greater reliance on user charges for raising revenue, greater reliance on the private sector for provision of services and greater use of abstraction charges, pollution charges, and water markets for water resources management at the river basin level need not be emphasized. People have to be both the object and subject of development. They should decide on the services they want. Service institutions have to be responsive and accountable to the people. People's decisions on environmental policies and standards should be based on information from technicians.

Rock catchment dam with self-closing water tap/ E. Nissen-Petersen; M. Lee.- Nairobi: ASAL, 1990.- ii, 40p. (Harvesting rainwater in arid and semi-arid Africa manual no. 3)

The Surveyor's manual on rock catchment dams gives instructions on the siting and positioning of the dam wall. Other aspects covered are the size of dam, calculation of the required catchment area, dam design, dam wall volume calculations, standard designs, materials, labour and transport. In addition to these, bills of quantities and costing, site preparations, setting up the templates, preparing the foundations, bringing materials and the contractor to the site and maintaining and improving water quality have been discussed in detail.

Steps have been given on preparing the foundation, installing the draw-off pipe, constructing the dam wall, plastering the dam wall, laying out and building masonry gutters. Information on draw-off pipe and tapping station construction, quality control and maintenance is also included.

Self closing water taps in relation to the materials required and their cost, and installation have been discussed.

Balancing water demands with supplies: the role of management in a world of increasing scarcity/ Kenneth D. Frederick.-Washington D.C: World Bank, 1993. 72p.

The demand for water and the ability to control the location, timing and quality of the resources for human purposes have increased rapidly during the last half century. Control over the timing and location of water gained through investments in dams, reservoirs, wells, pumps and canals has been critical in converting a region's fugitive and uncertain natural water endowment into a reliable fresh water supply. This growth has also highlighted the limitations of the traditional supply approach to water planning. The options for increasing reliable supplies quickly become limited and expensive once the best sites for water projects are developed. As water development expands and the resources becomes scarce, the construction and management of water

projects lessens. Regulatory rather than economic instruments have been the primary tools used to allocate water, encourage conservation, and protect water quality. The results of these efforts have been characterised by significant but often disappointing water quality benefits and very high costs. These costs have led many poor countries to neglect efforts to protect their water resources. When water quality is allowed to deteriorate to a point that it is hazardous to human and ecological health or undermines water-based economic activities, such neglect is very short sighted. Protecting and restoring water quality is not only compatible with, but necessary for social and economic development. Many countries are now seeking cost-effective means of achieving water quality objectives. Effluent fees might provide incentives to adopt and develop measures to control water pollution. As fresh water supplies become increasingly scarce, relying more on price and markets to allocate and protect supplies would offer major advantages in many situations. Governments would still play an important role in defining and enforcing property rights, providing for public goods and third party interests and regulating prices and profits of monopolistic suppliers. Comprehensive water resource planning may be required to avoid conflicting and inefficient investment decisions. The paper recommends that institutional reforms to facilitate the reallocation of and to limit the demands on water supplies must take account of individual national priorities, cultural constraints, financial and technical capabilities as well as the current and future supply and demand for the resource.

Using water efficiently/ Mei Xie; Ulrich Kuffner; Guy Le Moigne.-Washington D.C: World Bank, 1993. 52p.

The paper briefly examines water allocation in various countries and regions. It discusses and clarifies some of the definitions of water use efficiencies (WUE) under various contexts. It presents estimates of sectoral efficiencies in irrigation and domestic/individual water use and provides intensive country examples. There is evidence that a worldwide shift in water resources allocation from agriculture to the urban sector is taking place, especially in developing countries. However, agricultural use will continue to dominate in the foreseeable future. Water savings are most likely to occur due to the improving efficiency in agriculture. Consequently, the World Bank's water policy should be focussed on dealing with water use efficiency issues. Technologically, there is great potential to improve water use in both agriculture and urban sectors. Despite demonstrated success in water use efficiency, resulting in savings and favourable experiences in many developing countries, advanced technologies such as sprinkler and drip systems are applied to less that 3% of the world's irrigated lands. A focus on technological dimensions of water use leads to the conclusions that at basin level, investment decisions need to be based on more comprehensive views of basin water use when considering whether a certain level of local efficiency is appropriate or should be increased. In areas where there is little return flow or recharge to be reused by downstream users, increasing local WUE through technological applications and managerial improvement is recommended. In areas where there is potential for reuse of seepage water or runoff losses in the basin especially where return flows are used repeatedly downstream, technological solutions and investments should be

adopted upstream in order to improve localized water use efficiency and thereby making more water available to upstream users. Such investments should be evaluated from water conservation point of view. Water conservation should be viewed in a cross sectoral rather than sectoral context. Contribution to industrial growth and development of other water dependent activities, particularly where further development has been hampered by water shortage, needs to be incorporated into evaluation measures. The World Bank should promote policies that accelerate the transition from water consuming to water saving economies. These policies should lead to the strengthening of management approaches to optimize overall water use and the promotion of water reuse programmes considering the role of water plays in the productivity of various sectors.

A socio-cultural investigation into the use and functioning of the completed shallow wells in Nyanza Province: main report/ Lake Basin Development Authority.-Kisumu: LBDA, 1983. - 194p.

This is the main report of a socio-cultural investigation into the use and functioning of shallow wells installed by the Lake Basin Development Authority (LBDA) in Nyanza Province. Focus is on effective local management of the wells. No village in the rural areas has reached a stage of technological self reliance so as to be able to deal with all the maintenance requirements of the hand pump which include manufacturing, distribution, importation of certain items, extension involvement and general supervision. However a system of reporting faults is very crucial at the local community level.

The focus therefore is on local organization and to find a sustainable management system for routine tasks. The first chapter deals with ownership of the well in relation to perceptions of ownership of traditional water sources and shallow wells. The local organization set-ups embracing traditional water sources and shallow wells have been discussed in the second chapter. The issues of the cost of handpump maintenance and local involvement are tackled in the following two chapters respectively. Other issues relate to distribution of wells and benefits, health and water education, water collection and water use.

Rainwater roof catchment systems: participants notes/ E.J. Schiller; B.G. Latham.-Washington D.C.:World Bank, 1986.-50p. (Information and training for low-cost water supply and sanitation no. 4.1). ISBN 0-8213-0799-1

This publication is part of a comprehensive set of training materials on low-cost water supply and sanitation. Rainwater harvesting is a means of taking water out of the hydrological cycle for either human or agricultural use. The rainfall is intercepted and collected on prepared water sheds.

The booklet discusses the feasibility of rainwater roof catchment systems while considering three major constraints i.e technical, economic and social. Technical constraints concern the availability of water, rainfall data, total demand compared to possible supply from the rainwater catchment area. Economic constraints involve the

cost of the system. The social constraints revolve around assessing the community and factors to be considered include traditional practices, role of women and children and collection of information on existing catchment technologies. Advantages and disadvantages of the rainwater roof catchment system have been listed.

Methods that can be used to determine tank volume such as dry season versus supply, mass curve analysis and mass curve with dimensionless constant analysis have been discussed and examples calculated.On the construction of the system, specifications and materials for the roof, gutter system and storage tank have been discussed. Requirements for the storage tank have been provided and different variations in tank design such as cement mortar jars, traditional basket jars, cast concrete ring tanks, ferrocement tanks, sheet metal tanks and reinforced concrete tanks discussed. Tips on the maintenance and monitoring of the system have also been given.

At the end of the document is a practical session. Background data on two case studies has been given and the participant is expected to determine whether the installation of a rainwater collection system is feasible in the first case and for the second case, prepare a list of support services needed for user/owner including what must be done, who is responsible, means to supply a service and benefits. A solution has been worked out and a sample list drawn.

The booklet contains slides and notes on their use and an introduction of rainwater catchment systems to villages in the Northeast part of Thailand.

Water tanks with guttering and hand-pump/E. Nissen-Petersen; M. Lee.- Nairobi: ASAL, 1990.-ii, 52p. (harvesting rainwater in Semi-Arid Africa manual no. 1)

The surveyor's manual on water tanks deals with two types of water tanks for roof catchments: A cylindrical tank with a volume of 21,000 litres made of ferrocement and roofed with iron sheets and a semi-spherical underground ferrocement tank extended above ground level with cylindrical wall of either blocks or stone masonry and roofed with iron sheets. The standard design of each has been given in diagrams. The formula for calculating the users' water needs which includes the average daily consumption of water from the tank per person or livestock, the number of days in the dry season and the number of people using the tank has also been given. A guide on calculating the volume of run-off from roofs, the bills of quantities and aspects to consider in quality control and maintenance is also included.

The contractor's manual on the two tanks mentioned above gives step by step instructions on site preparation, building, quality control, maintenance guidelines as well as instructions on cleaning and management of the extended ground tank and on gutters and hand pump. Instructions accompanied with illustrative diagrams on the manufacturing of V-shaped gutters, gutter hangers, installing V-shaped gutters manufacturing square gutters and their installation are given. Guidelines on the handpump regarding materials required, manufacturing instructions and installation and the necessary measurements have also been provided in the manual.

Small earth dam built by animal traction/ E. Nissen-Patersen; M. Lee.-Nairobi, ASAL, 1990.-ii, 27p. (harvesting rain water in semi-arid Africa manual no. 2)

The manual deals with the siting, standard design, bills of quantities and construction of small earth dams in simple text and drawings. The manual is based on practical experience gained by building some 700 water structures for rainwater harvesting in semi-arid Kenya over the last 14 years. Small earth dams discussed here can store from 500 to 10,000 cubic metres of water in banks of earth not more than 5 metres high and 60 metres long. They are built by manual labour and animal traction using ox scoops. The purpose is to have water closer to homesteads during rainy seasons and a few months thereafter in order to transfer labour from fetching water to other activities in the fields.

A certain degree of mobilization is necessary in the procedure of siting and designing the dam. Communities have to be made to realize their needs and the advantages of having water nearer to their homes hence the need for an information campaign. A choice is left by the surveyor for the group to select 3 viable sites from which he selects the most viable using various approaches. The contractor then takes over, construction work begins with marking out the outline of the dam wall before digging the trench. Systematic instructions are given on building the lower part of the dam wall, designing the two spillways and the crest, determining the height of a dam wall, protecting the dam wall and dam reservoir and improving inflow to dam reservoir.

The manual ends with guidelines on the requirements of labour, materials and transport. Additional information is given on the bills of quantities and costing and steps to be taken in maintenance in order to improve strength and stability of the small earthdam through planting grass on both sides of the dam wall to prevent erosion, digging contour lines on the catchment area, and frequently checking for animal burrows in the dam banks.

Participation in rainwater collection for low income communities and sustainable development.-Proceedings of the sixth international conference on rainwater catchment systems, Nairobi, Kenya 1-6 August 1993.-edited by G.K. Bambrah; F.O. Otieno; O.B. Thomas.-Nairobi: IRCSA, 1995.-502p.

The 6th International Conference on Rainwater Catchment Systems was held in Nairobi in August 1993. The theme of the Conference was "Participation in Rainwater Collection for Low Income Communities and Sustainable Development." More than 60 technical papers were presented from some 30 countries around the world. The papers have been put in various categories depending on their content. The various topics include policy issues, technology, socio-economic aspects, water quality, hydrology and agriculture. Relating to Kenya and concerning policy issues, a paper on the systematic analysis of the potential uses of rainwater harvesting in Kenya, another on rainwater harvesting in Nairobi; the possibilities and challenges and a third entitled "Towards an active involvement of the private sector for higher efficiency in the provision of water in towns with options for Kenya" have been discussed.

On technology, an overview on rainwater harvesting in urban environments in the form of a proposal for Nakuru town is presented. Rainwater harvesting in Kajiado district as a source of water supply, the restoration of the Bubisa reservoir in Marsabit District and Djabia rainwater harvesting systems for domestic water supply in Lamu are some of the topics covered under technology.

Medicine and health in Africa: a bibliography with critical abstracts 1984/ J. Paget Stanfield.-Bureau of Hygiene and Tropical Diseases/AMREF, 1988. xii, 528p.

This bibliography covers articles and books selected from a comprehensive list of African and international publications by the Bureau of Hygiene and Tropical Diseases in London. A few general reviews and topics which originated outside Africa have been included due to their significant bearing on medical and health care in Africa. The abstracts are divided into disciplines. Over half of the abstracts concern parasites, an indication of the priority accorded to tropical diseases. Sections on environmental and community health, nutrition, maternal and child health and communicable diseases are also dealt with in the first half.

There are several reports of effective community based water and waste management of projects. Parasitology takes up a large part of the bibliography with Malaria being well represented. In summary subjects covered are environmental and community health, disease and disease control and medical entomology. Under environmental health, topics covered include sanitation, water and its supplies, food, toxicology and disasters. In community health topics include nutrition and malnutrition, health status factors, health services, family health and traditional medicine. Microbiology and Microbial diseases - general bacteriology and bacterial diseases, fungi and fungal diseases parasitology and parasite diseases also form part of the collection in this bibliography.

Shallow wells with bucket lift/ E. Nissen-Patersen; M. Lee.-Nairobi, ASAL, 1990.-ii, 26p. (Harvesting rain water in semi-arid Africa manual no. 4)

In this manual on shallow wells aspects such as string considerations, tuning and excavation of a shallow well, materials, labour and transport requirements have been comprehensively handled. Bills of quantities and costing for items to be delivered either by the members of the community, the donor or ministry have been considered by giving formulas that could be used to calculate the total cost. Quality control and maintenance ensure that the instructions given are followed closely particularly the mixing of mortar and cement and the methods of constructing and reinforcing sources. Maintenance of the well would involve fencing off around the site to keep animals away.

The manual also gives steps to be followed in preparing the lining which involves making a foundation ring, well cover and the concrete blocks. Illustrations for each step with the required measurements have been given.

Building the well shaft involves constructing the shaft, sinking the well shaft and building a telescopic well shaft, incase in the process of sinking the well a stone too big to be removed is encountered. When a well shaft cannot be sunk any further, the well head can then be constructed. Guidelines have also been given on protecting well heads in river beds and on quality control and maintenance.

Kenya programme of action for children in the 1990s/UNICEF; Government of Kenya.-Nairobi: UNICEF, 1992.-115p.

Kenya's commitment to placing human welfare in its development process with an emphasis on women and children is demonstrated in various national development plans and policy documents and Kenya's participation in the world summit for children and ratification of the convention rights of the child in 1990.

This 1990 agenda details strategies activities and programmes geared towards achieving Kenyan goals for children based on the world summit goals.

During the mid-term (1991-1995) priority attention was to be given to national household welfare monitoring systems, household food security action plan, drought contingency and early warning plan, safety nets for vulnerable groups and an action plan for retrenched persons.

The various areas covered include poverty, nutrition, health education, environment, equity, protection and resource requirements. For each of these topics an introduction has been given and Kenyan goals for each clearly stated. Strategies, activities and programmes to achieve goals and ways of sequencing and programming activities have been discussed. Ways of monitoring and evaluating have been mentioned and a statement made on the agency to implement these activities before providing the resources required and the likely sources of these resources.

Spring protection/E. Nissen-Patersen; M. Lee.-Nairobi: ASAL, 1990.-ii, 29p. (harvesting rainwater in semi-arid Africa manual no. 6)

Two types of spring protection which harvest water flowing out of the ground are the hill-side spring and the underground spring. Unlike hill side springs, underground springs are easily accessible to water users. In their natural state, both types of springs are subject to damage by people and animals digging down into them to try and improve their discharge as they begin to dry up. This can block the spring which can easily be polluted by animals and livestock and diseases transferred to humans, hence the need for their protection.

In preparing a site for an underground spring, the original excavation which will have begun earlier by animals and people trying to access water in dry seasons, should be dug out to roughly 200 cm width preferably in the dry season. The floor of the staircase should have a slope of about 45^0 and be as even as possible. The requirements of materials, labour and transport are estimated by using a set of formulas explained with examples relating to drawings shown in the manual. A formula for estimating the type and weight of the required materials for the volume of the struc-

ture is also given. Bills of quantity for items to be delivered by the donor/ministry have to be calculated and an example of this has been given. Similar requirements with accompanying formulas have been documented for the hill-side spring protection.

The manual ends with step by step building instructions for the underground and hill-side spring protection. Diagrams to illustrate the intended outcome of each step are given.

Focus group discussion report; Western and Nyanza Provinces/ Diarrhoeal Disease Control(CDD) Management Division; District Health Management Team.-1988.

During Jan - Feb 1988 the Diarrhoeal Disease Control (CDD) Management unit and the Provincial and District Health Management Teams led 22 Focus Groups Discussions (FGD) among more than 5 major language/cultural groups in Western Kenya with assistance from other sectors, governmental and non-governmental organisations. The purpose of the activity was to enable CDD program planners to gather in depth data on the knowledge, attitudes and practices of the primary target audience in the pilot area. The primary audience comprised parents, secondary audience, comprised educators of parents, teachers among others and the tertiary audience was made up of opinion leaders at all levels of adminstration.

A review of the findings indicates that the study was worthwhile. The study findings indicate that in various areas of Western Kenya, there are predisposing population characteristics such as existing knowledge, beliefs and attitudes that facilitate their motivation for behaviour change directed toward control of diarrhoeal diseases. The central objectives of this study therefore were to generate ideas for message concepts and stimulate a rich level of thinking on specific aspects of the problem of diarrhoea. Secondary, was to uncover psychosocial motivations for reported attitudes and behaviours hence expand CDD programme planners' understanding of existing research findings, thirdly, to provide a direct link with the target population as they describe in detail and in their own language their thinking and behaviour in real-life situations and decision making.

In conclusion the study indicates that while several positive links exist in the chain of the initial motivation to act, mobilization of resources to enable the action, reactions towards the behaviour, encouragement or discouragement of the behaviour, there are some broken links which hinder the full realization of positive behaviour.

Sub-surface and Sand-storage dams/ Erik Nissen-Petersen; M. Lee. - Nairobi:ASAL, 1990. - ii, 43p. (Harvesting rainwater in semi-arid Africa manual no. 5).

This manual gives guidelines on sub-surface and sand-storage dams surveying and construction. The manual gives directions on site selection for a sub-surface dam of clay plug and of stone masonry and the standard designs for both. A description on the cost of materials, labour and transport requirements and as well as quality control and maintenance for both has also been given. Guidelines and discussions on site

selection, height of the dam wall, volume of the sub-surface reservoir and standard design for sand storage dams are given. Materials, labour and transport requirements together with the bill of quantities are also included. Step by step instructions on the construction of clay-plug sub-surface and stone masonry sub-surface dams also feature in the manual. Preparation of the foundation, the dam wall and the dam. On sand storage dams, the manual gives step by step construction instructions on laying the foundation, the templates, first extension of wall, further extensions of wall, filter box and tap stations, wing walls, shallow well tapping station and livestock trough.

Borehole site investigations Loruk area, Baringo District: water resource investigations./ Groundwater Survey (Kenya) Ltd 1992.

The report describes the results of a hydrogeological and geophysical investigation of eleven sites in the Loruk area of Baringo District in Kenya. Geophysical field measurements, field observations and geological information were used to assess the water resources at the different locations. Prospects for drilling a productive borehole were considered good at 7 of the sites while 2 were considered fair. Drilling was not recommended at two sites.

For the sites, where no boreholes are possible, alternative water development options are described such as spring protection and shallow wells. In two cases both options of boreholes and shallow wells are possible.

Groundwater survey (Kenya) Ltd was commissioned by the United Nations International Children's Fund (UNICEF) with the objective of undertaking a detailed hydrogeological and geophysical investigation of 11 sites in Nginyang and Kabartonjo divisions of Baringo District. The sites are all situated east of the Tugen Hills. The results of the field investigations are described and the locations of the measurements, the present water sources and the recommended drill sites are marked on a location map. The eleven sites discussed are Chepilat, Chepkewet, Kariablakwa, Lobotiun, Lokorbabim, Naiben, Ngaratuko, Parchar, Sesoi, Sibilo and Yatiya.

Kenya-Farmers groups and community support project (First Phase): final design paper/ IFAD et al.-Nairobi: IFAD, 1984.-112p.

The report includes the details of the first two years of the five year project in Siaya District. The report contains some discussions and an estimate of cost for the entire 5 year period. The project has been discussed in the broader context of development support for poor small holders and the rural poor in the Western and Nyanza provinces, identified as target area for the first phase of survival fund operations in Kenya.

In general a background on Kenya and the economic status of the country, the five year development plan, the agricultural sector, management of development and the main institutions and services supporting agricultural development have been given. Survival Fund's focus for assistance to Kenya and the project area has also been spelt out. The project objectives and rationale, its description and components, cost and financing, implementation benefits and impacts have been discussed.

The most important contribution the farmers groups and community support project would make is to provide the means for poor small holders and their community to help themselves by taking a more active role in their own development, improving their situation in terms of income, living conditions and physical health. Some issues, agreements and recommendations for achieving successful project implementation have been raised.

For more information cost tables, Survival Fund's objectives and operational framework, project training programmes, relationships between the first, and second phases and the terms of reference have been included.

Rainwater harvesting: the collection of rainfall and run-off in rural areas/ Arnold Pacey; Adrian Cullis.- London: IT Publications, 1986. - viii, 216p.

This book aims to give some information that has been considered missing on designing and implementing schemes that were socially, technically, economically and environmentally appropriate for use in different patterns of livelihood and organization. It therefore emphasises the importance of such interdependent dimensions of rural development. It has a mixture of technical and non-technical matters that help stimulate the awareness of factors often overlooked by the single subject specialist. The book is intended for rural development workers especially those involved with water resources for domestic and agricultural purposes.

On technical perspectives rainwater collection, water and rainfall resources have been discussed and the use of rainwater collected. The aspect of rainwater collection has been defined broadly in the context of other related aspects. The design of rainwater tanks or runoff farming systems for a specific area requires a detailed analysis and it is therefore an essential task to collect information which clarifies different views and seeks common ground between them. The third chapter analyses this aspect in detail. Technical assistance packages in relation to rainwater tanks with examples from various countries indicate that there is still more to be done and recommendations on how to improve on this are documented in the fourth chapter. Various designs for drinking water systems have also been discussed before looking at various ways in which run-off water has been used for farming. The book ends with a chapter on the economics and future prospects of rainwater in relation to all the aspects discussed previously as well as the benefits that would be reaped from them.

UNICEF 1994: community-based water supply and sanitation projects: Baringo and Kisumu districts; UNICEF Kenya Country Office.

Universal access to safe drinking water and adequate environmental sanitation are the main goals for the water and sanitation sector. As a result of a unique partnership between the community, the government of Kenya, non governmental organisations including church organisations, external donor agencies and UNICEF networking in Baringo and Kisumu districts, many community based water and sanitation projects are being implemented.

The water and sanitation sector objectives are to increase access to safe drinking water and adequate means of waste disposal, reduce the prevalence of water-borne diseases such as diarrhoea and reduce the drudgery of fetching water in rural areas. To achieve these objectives, replicable water supply and sanitation systems are given priority. Systems which are easy to install, operate, maintain and with affordable recurrent costs for the benefiting community are preferred.

Any development project undertaken in Baringo and Kisumu is affected by geographical, economic and socio-cultural factors. Activities carried out in implementing these projects include community leadership training, community participation and social mobilisation, involving women in projects and training in operation and management. An overview of these activities has been discussed briefly.

Nairobi City Commission planning session July 1989 - June 1990. - Nairobi: Nairobi City Commission, 1989. - 56p.

Despite limited and already strained financial resources, the health and lives of women and children can be effectively improved using simple low cost technologies. Such would include the provision of adequate and clean water, improved sanitation, better waste disposal and nutrition through community participation. Aspects covered in this document are on health, nutrition, basic education, women economic activities, water and sanitation and children in difficult circumstances.

The launching of the Nairobi City Child Survival development programme in 1988 signified a formal commitment by the City Commission to implement public health care in general and child survival development programme in particular as part and parcel of the basic services to the urban dwellers, using a multi-disciplinary and participatory approach. The broad objectives on health include increasing immunization coverage from 69% to 80% in the city in general. The other was to ensure that every expectant and nursing mother maintain good health through improving the quality of service in Nairobi City Commission health facilities. Strategies were laid for these objectives and schedules for implementation drawn. Some of the nutrition objectives included training 30 mothers of malnourished children in income generation, evaluating infant feeding, health and nutrition seminars and to carry out a nutrition, health, family planning baseline survey in Kianda village and Kibera. Provision of water points to women's groups, VIP latrines, water kiosks, general sanitation formed the objectives for water and sanitation.

Tabular representations of the plans of action for these sectors form the greater part of this document.

Sanitation of Ruiru town and its environs/ Wamunyu, Mativo. - JKUAT, 1995.

The main objective of this study was to study the current sanitation of Ruiru, evaluate the impact of the existing sanitation situation on the residents of the town and propose improvements and alternatives that are technically feasible, acceptable to the town residents, healthy in application and within the economic means of the inhabitants. The author studied water supply, sewage disposal, storm water disposal, solid waste disposal, industrial waste disposal and their effect on the residents' health.

According to the findings, Ruiru's growth has outstripped the water supply. The main supply of water for the town is 100mm diameter pipe which was designed for the shopping centre. Several boreholes have been sunk and the Ruiru river also acts as a source of water for the area. Prisons Staff Training College has its own established water supply system with two boreholes. Most residents of Githiomi and Gitabaya have dug shallow wells in their plots, and supplement by trapping rainwater from their roofs for use in the dry season. Most of the industries discharge their untreated effluent into Ruiru river.

Proposed sanitation alternatives for industrial waste disposal, excreta disposal, storm water drainage, solid waste management and water supply have been given at the end of the study.

Gender, environment and development in Kenya: a grassroots perspective/ Barbara Thomas-Slayter et al. - Boulder, CO: Lynne Rienner,1995. - xii,247p. ISBN 1-55587-419-3.

The book focuses on ways community institutions and specifically women and their groups or organisations respond to changing resource conditions. It also focuses on their strategies for regulating access to resources for themselves and others and for gaining control of critical resources such as soils, water and woodlands. The impact on local decision making, changing gender roles, rural stratification, community relations and other variables within the social and political environment have also been examined.

Five case studies have been discussed and first part of the book sets the conceptual and geographic contexts of the cases. Ways in which Kenyan women are redefining their roles have been considered. Questions on gendered space and gendered organisation have also been raised. An introduction to some of the strategies households adopt for advancing the productivity and welfare of their members and a range of economic, ecological and political considerations that affect local communities and shape the opportunities and constraints experienced by men and women have been given.

The second part includes the five case studies where focus is on a sub-location analyzing specific ecological, gender, community and resource issues within the community and incorporating the author's perspectives and insights on the constraints and opportunities that the community faces in the development process. Changes in gendered knowledge and practice over time specifically in a drought situation have been explored. The role of wild foods and indigenous plants as poor people's drought and famine reserves has also been considered. The seventh, entitled "A pocket of poverty: linking water, health and gender-based responsibilities in South Kamwango", explores gender-based roles in securing a livelihood and sustaining the family within the context of severe problems in health and mortality.

The third and final part considers the implications of the preceding discussions and offers policy options for exploration.

Country strategy for strengthening environmental considerations in Danish Development Assistance to Kenya.-Copenhagen: Danida Information Office, 1989.-116p.-ISBN 87-7265-073-7.

In May 1987 the Danish parliament decided that an action plan should be elaborated to strengthen environment considerations in the Danish Development Assistance programme. The decision was partly inspired by the report "Our common future: by the World Commission on Environment and Development. It called for a plan of action composing 3 different parts which were an overall strategy containing the general principles for integrating environmental considerations with the development assistance programme published in January 1988. The second was sectional strategies outlining the principles for strengthening environmental aspects in development assistance provided in the main sectors of concentration of Danish aid published 1988/89. The third was country strategies providing a coherent framework for paying more attention to environmental issues in planning and implementing Danish development assistance in Kenya, Tanzania, the Sudan, India and Bangladesh.

This report is the country strategy for Kenya. The issue of economic policies and environmental attitudes of the Kenyan community has been considered. The challenge facing Kenya is how well environmental considerations are likely to be integrated into macro-economic policies and development plans. Key issues on the Kenya's Sustainable Development Agenda that have been discussed include Kenya's sustainable development and equity, achieving food security, maintaining biological biodiversity, harvesting water, securing energy resources, industrial production and improving shelter and human health.

Efforts towards sustainable development in Kenya involve integrating environment and economic development, strengthening environmental and resource management agencies, strengthening environmental laws and enforcement, mobilising science and technology, making informed choices and investing in the future. The document ends with operational guidelines of the Danish development assistance to Kenya

Listening to the people: social aspects of dry-land management. - proceedings of an international workshop held in Nairobi, 14-18 December 1993.-edited by Daniel Stiles.-Nairobi: UNEP, 1994.-xii, 212p.

The aim of the workshop was to develop a better understanding of community participation and bottom-up development and achieving sustainable development in the dry lands and to make recommendations in the same direction. The participants represented governments, donor agencies, the United Nations system, Non Governmental Organisations (NGOs) and local communities. The papers analyzed the experiences of more than three decades of governments, donor agencies and NGOs in promoting economic development in the dry-lands of developing countries. For strategies of land degradation to be meaningful, they must result in fundamental changes in the power relationships between the various actors at international, national and local level. Effective communication channels are vital to enable communities in drought prone areas to express their needs and development priorities.

Areas stressed by participants included reforming land tenure rights on the basis of existing systems of ownership and use of planners to recognise the institutions, systems of indigenous knowledge and management structures that already exist. The importance of allowing women equal participation in the decision making process, increasing their production and management capacity and in addition, earning their own income was stressed.

For effective strategies in combating desertification useful recommendations, on what donor agencies and international bodies can do and on the formulation of government and land tenure policies and on gender issues, have been listed. Other recommendations are on the necessity of making use of indigenous knowledge systems, importance of community participation for biodiversity conservation and sustainable development and finally recommendations for follow up action mostly by UNEP.

Women, trees and forests in Africa: a resource guide/ Paula J. Williams. - Nairobi: Environment Liaison Centre International, 1992. - 89p.

This work is designed as a resource guide for non-governmental organisations and others working on field-level forestry development activities with women in Africa. It presents findings from a project on women's participation in forestry activities in Africa. The project involved case studies in 8 African countries. Several organisations and many individuals have therefore contributed to this guide. The document first discusses women, trees and forests in Africa, reviewing how women use and manage trees and forest resources for various purposes such as fuel, food and animal fodder. It shares the vision for working with women on forestry activities not only as labourers but as full participants in all phases of development whether in problem identification, project design, implementation, monitoring and evaluation or programme and policy planning.

Information is provided on constraints, issues and strategies that have been successfully used in actual field projects. This is given in the form of summarised case studies. A comparison has been raised in the fourth section of the resource guide of the issues and strategies from the series of projects studied. The major issues handled are education and training, land and trees, time and labour, income and employment, organisations and groups mobility and material resources.

The recommendations given concern what can be done at the project level and within the forestry sector and on general development. Ideas have been suggested on how governments, donors and bilateral and multilateral organisations can help support field workers and NGOs. Additional information that would be helpful to those working with women on forestry activities in Africa include lists on organisations and publications, relevant documentation and audio-visual materials as well as a list of participants in women and forestry projects.

Environmental education: an approach to sustainable development.-edited by Harmut Schnieder; Jacoline vinke; Winifred Weekes-Vagliani.-Paris: Organisation for Economic Co-operation and Development, 1993.- 258p. ISBN 92-64-13771-8

This volume highlights the nature of environmental education and its role in environmental management. Part one presents an analytical overview perspective on environmental education, first by drawing on school based experiences in industrial countries. The objectives of the paper, actors and approaches in environmental education in developing countries are supposed to provide an insight into what is happening in the field of environmental education in developing countries, demonstrate the weaknesses and strengths of existing environmental education activities and programmes and to identify cost-effective ways to create environmental literacy in developing countries. Whether environmental education can be considered successful with regard to it's success in demonstrating the direct economic and health benefits of conserving natural resources and an improved environment is questioned. Does it succeed in reaching people who are not necessarily interested in environmental issues? Does environmental education induce people to change their practices and take action? Has environmental education been sustainable are some of the questions asked.

The second part is devoted to specific experiences from developing countries which illustrate a wide variety of approaches. Included is a case of environmental education and awareness raising at the grassroot level by Kenya Energy and Environment Organisation (KENGO). Approaches to environmental education and awareness raising which include co-operation with the media, development of information and educational material and field extension programmes are given.

The OXFAM gender training manual/Suzanne Williams; Janet Seed; Adelina Mwau.-Oxford: OXFAM, 1994.-xiv, 634p.

OXFAM's Gender and Development Unit (GADU) was set up in 1985 to address a growing concern that many development initiatives, far from benefiting women, were actually marginalising them and rendering them powerless. Since the early days of GADU's existence, gender training has been a key strategy used to sensitise OXFAM staff and partners to gender issues and to learn from their grassroots experiences.

This manual is the result of the work of gender trainers all over the world, over many years. Majority of the activities presented here have been used by OXFAM trainers in workshops and training courses in Africa, Asia, Latin America and the Middle East or in courses run in the UK for OXFAM staff. The manual is designed for the use of staff of Non Governmental Organisations (NGOs) who have some experience in running workshops or training courses and for experienced gender trainers. It aims at providing practical tools for the training of development workers who are in a position to influence the planning and implementation of development and relief programmes at different levels. A feature of this manual is that it combines self-awareness through activities that address women's and men's self-awareness and gender awareness with training in methods of gender analysis.

The manual begins with ideas and information for the trainer or facilitator with the introductory section offering a brief summary of the key concepts related to gender and development. Guidelines are provided with details on the principles behind gender training and steps to follow when planning and carrying out a workshop.

The third section has the topic sections in the order they should be used. By selecting the topics needed one should be able to run a range of different courses appropriate to the needs of a group, from a day long gender analysis workshop for NGO emergency staff to a two-week course for project workers on gender awareness, analysis and planning. The sections include sharing work experience and consensus in developing gender awareness and self awareness for women and men. These are followed by gender analysis and more in-depth exploration of concepts and ideas about development and relief work, gender sensitive appraisal and planning, gender and global issues, working with men and women in NGOs in villages and communities.

The tenth and eleventh sections are on gender and communications and on strategies for change respectively. The last section concludes with activities designed for participants and facilitators to evaluate what has and has not been learned.

Groundwork: African women as environmental managers.- edited by Shanyisa Anota Khasiani.-Nairobi: ACTS Press, 1992.-vii, 131p.-ISBN 9966-41-034-1.

The problems of environmental degradation observed in Kenya are intertwined with those of women. Women are regarded as the first casualties of environmental degradation as their task involves dealing with natural resources most of the time. The volume reflects Kenya women's concern and involvement with current local, national and global issues.

The interruption of the ecological balance and women's secure position in traditional Kenyan societies by colonisation and the changes that accompanied it are discussed. The role of Women in natural resources aimed at meeting basic needs have been tackled. An evaluation of the Mutomo Soil and Water Conservation Programme in Kitui district has also been made. The concern that African governments can only attain sustainable and equitable economic growth in the next century, through involving the population in the designing and implementation of development programmes has been raised.

An examination of wood fuel as a traditional source of domestic fuel energy and the increasing inaccessibility to it which threatens women has been made. This affects their welfare and that of their families. Communication aspects of environment management have also been discussed. The role of women in oral literature, in recording and therefore preserving the environment and the impact of environmental law and policy on the role of women in environmental management has been discussed. The need to harmonize and unify environmental law in order to protect the environment has been emphasized.

In conclusion Kenya ecosystems and populations are in a crisis, mostly affecting women in the rural areas who depend directly on the natural environment. This has been perceived as an outcome of colonization and westernisation and the resultant development strategies that have rejected traditional African farming systems and women's central role in them.

Women and development: a Kenya guide/ compiled by Mazingira institute. - Nairobi: Mazingira Institute, 1992. - 136p. ISBN 9966-9876-6.

This guide contains brief profiles of 188 organisations presented in alphabetical order. The purpose of the guide is to cover women's programmes hence only those activities by these organisations which focus on women have been looked at. It also has an updated review of women's groups in Kenya and a section on libraries and other resource centres where readers can find information on women in development in Kenya.

The guide offers a picture of a diverse and active group of organisations working for advancement of women and the development of society as a whole. The material included in this volume illustrates the importance of NGOs as partners in development, working together with community organisations, government and aid agencies.

The overview on the women's group movement in Kenya describes the importance and contribution of these groups. For some it is a chance to save for better roofs over their houses, for others a place to exchange information on improved farming methods among other issues. A close look at the development of the Maendeleo ya Wanawake Organisation has been taken. Other aspects discussed are membership and participation. Figures for women's groups membership between 1978-1988 in the 8 provinces of the country have been given.

Information has been given on information sources on women in Kenya indicating the name of the organisation, physical location and address, telephone contact, type of library or resource centre, user services offered and the nature of the catalogue.

The profiles of women's organisations and agencies serving women in Kenya have the name of the organisation and complete address, contact person, projects being carried out, publications by the organisation, source of assistance and other organisations they may be affiliated to. The guide ends with an index of organisations.

The other policy.-edited by Frances Stewart et al.-Washington: IT publications, 1990.

This publication contains the proceedings and papers presented at a conference organised by Appropriate Technology International and the Institute of Social Studies, which focused on policy, environment and the development of small-scale enterprises. It was held in June 1989 in The Hague. Netherlands. Key issues presented at the conference and described in detail in the book are on policy approaches, policies and places, policies and rural industrialization and policy experience and policy problems. The keynote speaker pointed out the hostile policy environment toward the choice of efficient and effective low-cost technologies employed in small-scale enterprises and explained ways in which this policy environment can be changed.

The most interesting aspects of the conference as noted were the presentation of six case studies from papers presented in regional conferences held in Asia, Africa and Latin America. They analyzed in-depth factors that helped explain why policies that could promote the use of appropriate technology in small enterprise development were never adopted. First, the Director of the African programme of the International Fund

for Agricultural Development (IFAD), briefly reviewed the lessons learned in a study of five countries namely Kenya, Malawi, Niger, Madagascar and Ghana. The impact of the structural adjustment on the rural poor and the importance of non-farm activities in rural areas in African countries were examined. The case study of a rice husker in the Dominical republic pointed out three key areas which need attention. First, the political economy for technological development needs to be viewed as a complex interaction between economic and technological differentiation. Second, if development planning exists it should counteract urban and rural biases and third, have large development agencies like the World Bank or small ones like Dutch, work at the top to undo particular biases and at the technological base to allow technological differentiation

Evaluation of self help water projects in Thika District/M.N. Wandiga.-JKUAT, 1990.

The major objectives of this evaluative study are to assess the degree of service of completed water supplies, to find out how this might be increased by improvement in operation and maintenance, to provide feedback to planners on the validity of the original planning assumptions particularly regarding benefits.

Women and children are the main bearers of water in Thika district. The provision of domestic water supply has facilitated a more hygienic household environment, encouraged the use of water-sealed privies and permitted more household gardens. Community participation and local initiative and innovation are aspects considered as sources of success. Personnel for sustaining operations require adequate training and follow up on the same. It is felt that time lapse is necessary for project outputs to adjust themselves and become part of community life. In relation to water projects recommendations include surveying pipe installation for even gradients. System reliability is identified to be the primary concern of the self-help group, for instance, installing more than one well and handpumps to serve a community or by providing standby pumping units for a pumped system.

The green book: a manual to support organising a national assembly of women and the environment/Joan Martin-Brown.-Washington D.C.: UNEP, 1993.-216p.

This manual presents material to enable every country to convene a National Assembly of women and the environment. The national assembly is proposed to support implementation of chapter 24 of agenda 21, the blueprint for action towards equitable and sustainable development that resulted from the'1992 United Nations Conference on Environment and Development (UNCED). It also proposed to support preparations for the fourth UN world conference on women and partnership among bilateral and multilateral, non-governmental and private organisations.

The first part of the manual provides the rationale and mandate for a National Assembly of women and the environment. Mandates enabling women and the environment and convening national assemblies include the governing council of the United Nations Environment programme, United Nations Conference on Environment and Development, United Nations Development Programme, United Nations Divisions for

the Advancement of Women (Vienna) and UNICEF.

Part II documents the activities involved in laying the groundwork for a National Assembly. Reports on seminars and 4 regional assemblies namely the African women's assembly, the Arab women's assembly, Latin America and the Caribbean Regional Assembly and the Asia-Pacific Regional Assembly all on women and environment are given. The goals of a Regional Assembly are listed as to engage women in an assessment of ecosystem and environmental condition in their region, recommend action for the ministries in the region, encourage future collaboration and co-operation in each region on ecosystem management among others.

The last part gives the rationale for convening a National Assembly of women and environment and the actual operating principles and guideline for a National Assembly and organisational approaches.

The effects of sewerage effluent on human health and environment: the case of Mulanthankari, Meru/ James M. Mwitari. - Nairobi: AMREF, 1996.

The objective of this study was to assess the effects of sewerage effluent on human health and the environment. The specific objectives described are to determine the prevalence of infections related to sewerage effluent in the area, assess the feelings of the community towards the disposal of sewage into water bodies and determine conformity to established standards of the effluent disposed into the rivers and springs. Another objective was to assess the opinion of various government ministries and departments and especially health, local government and ministry of water towards disposal of sewage effluent into springs, streams and rivers in the area.

All the people interviewed knew about sewage but still drunk contaminated water without boiling. It was found that the rate of latrine usage stood at 95.3% suggesting that diseases associated with faecal contamination did not have a direct influence on the high prevalence rate of such diseases in the area. The recommendations were that the municipal council is pressurised to consider improving the quality of the effluent by bringing it to the recommended standards and that regular sampling of sewerage effluent especially where it joins the water bodies be done regularly. A similar in-depth study preferable during the rainy season is also recommended for comparison with the dry period study.

A guide to health promotion through water and sanitation/ D. Nyamwaya; K. K. Munguti; P. Akuma. - Nairobi: AMREF, 1994. - vi, 68p.

Provision of an improved water supply alone is not sufficient to eliminate or reduce diseases related to water and sanitation. This is because many lack appropriate knowledge on proper use of water, lack the necessary resources and breakdowns of the improved water system among others . Health promotion in this book is taken to include health education, community mobilisation, application of technical knowledge on the causes and prevention of specific diseases.

Health education is crucial in health promotion as it contributes to the improvement of people's health. It has been revealed that workers do not understand fully how

some of the diseases are spread. It should be emphasised however that almost all water and sanitation related diseases can be prevented through proper human waste and refuse disposal and by utilising adequate and safe water. This is the role of the health educator who should then plan a programme for latrine construction after consulting the community. Water collection and transportation, storage and personal hygiene are all aspects that should be taken care of to prevent diseases.

The second part covers community action on community mobilisation, identifying and defining the steps and activities necessary to achieve health promotion in water and sanitation projects. Various issues necessary for improved management and maintenance of water and sanitation projects are presented. The third part discusses some common diseases, their causes, mode of transmission, how they can be controlled and prevented.

Rain catchment and water supply in rural Africa: a manual/ Erik Nissen-Petersen. - Nairobi, 1982.

This manual attempts to find a practical solution to water problems in semi arid and arid lands. The manual discusses water requirements, calculating the consumption rates of domestic water, water for livestock, the water cycle and rainfall patterns in various countries in Africa. An analysis of three types of catchment areas i.e the total run-off, half run-off and the quarter run-off and a description of earth subsurface dam, concrete gravity demand and concrete arch dam have been given.

After determining the volume of water needed and where to get it from, the fourth chapter deals with storage tanks and reservoirs and how to decide on the capacity of the tanks required depending on the needs. The manual goes further to discuss how to locate well sites, different types of wells with pictures to differentiate them. Advantages of each have been given. Aspects to consider in making a choice of design include cost, procedure of construction, limitation of evaporation and prevention of contamination.

The last chapter of this manual gives step by step drawings and instructions for the construction of the choice made. Specified lists of working time and materials have also been provided to obtain good results from the construction work.

Changing sanitation practices; a socio-cultural approach/ David Omambia.- in Society, environment and health in low income countries. - Karolinska Institutet IHCAR, 1990

A latrine construction campaign in Busia district illustrates several common obstacles. During a cholera outbreak in Magombe sub-location in 1975, the Ministry of Health started the campaign which focused upon latrine construction, shallow wells and health education. This article is as a result of a socio-cultural survey done in the area to explore community beliefs, attitudes and practices regarding water, faecal disposal and related health practices. This survey was carried out because disease outbreaks still persisted even after the campaign in which health education had been in-

corporated. The survey then raised the question why communities are so slow to adopt practices that they obviously know improve health.

After the survey some factors that were likely to affect sanitation practices at least in East Africa were found to be;

(i) socio-cultural factors hindering sharing of latrines between children and their parents-in-law and between parents and children, especially of the opposite sex.

(ii) fear of witchcraft and sorcery, the belief being that body wastes should be care fully hidden not to attract the attention of malicious neighbours.

(iii) latrine construction is laborious, women and older men may not be able to dig since the younger men work away from home and costs are high.

(iv) others are social factors, environmental factors, legislation and the widely held belief that children's body waste is harmless.

The author ends by giving socio-cultural aspects of planning and implementing health education in the context of sanitation projects.

Some environmental problems and planning perspectives in irrigation settlement schemes: a case of Mwea irrigation settlement scheme, Kenya/Samson Wokabi Mwangi.-Moi University, 1995.

Environmental problems which have increased in the recent past are posing a major threat to irrigation development. This study aims at examining cases and causes of some environmental and health problems and planning related issues in Mwea irrigation settlement scheme. The scheme was compared to a neighbouring off-scheme area where irrigation activities were absent. The results showed that there has been a registered increase in real and potential human health problems originating from the emergence of new diseases, the expansion of the vector base and ease of spread of water borne diseases.

The study area has been analyzed with regard to its location, physical layout, the natural environment, drainage and irrigation systems, growth, expansion and operation of the settlement scheme and the organisational aspect of the scheme. The sample area size of 200 respondents representing 6.17% of the total population was selected on the basis of experience gained through the pilot survey and previous studies done in the area. The environmental problems discussed relate to household level and household comparison, demographic and family characteristics, housing conditions, water supply and sanitation systems energy sources and uses and human health. The implications of each of the problems have been discussed.

From the comparison, it is concluded that most of the problems observed were unique consequences of irrigation development since they were absent in the control region. The recommendation is made that an environmental plan be instituted in the Mwea Irrigation Scheme management structure to ensure that the stress on the irrigation settlement ecosystem is within its capacity.

hindering its promotion. A total of 80 respondents out of 104 were selected using simple random sampling method and interviewed using an interview schedule. The results are tabulated and some conclusions reached indicated that most of the VIP latrines were not properly constructed as 52% were defective. Majority of the respondents were knowledgeable of the principle design of the VIP latrines and formal education had an influence on the VIP latrine construction. All adults were using VIP latrines and children too were encouraged to use it as early as 4 years. Recommendations are given at the end from the findings and conclusions.

Training needs assessment for women at grassroot level/ Philip Thiuri. - Nairobi:INADES Formation, 1991.

It is a fact that the improvement of the welfare of women would be a giant step towards enabling them to participate effectively in the planning and implementation of life. Projects and programmes have been devoted to intensifying what women are doing, but hardly assess what they can do given their potential and that of their environment. By raising awareness women will be able to increase the range of development of activities they engage in.

The main purpose of this survey is to generate first hand information from the women themselves of their felt needs for training. The information assembled will be used by INADES- Formation Kenya (IFK) to develop and implement realistic training programmes for women at the grassroot level with particular emphasis on rural women. Some general objectives stated include finding out the actual needs of the grassroot women, assess their training needs, the impact of this training on women, document the usefulness of various training approaches and identify gaps that exist in the field of women training.

The study not only answers the question on whether a training programme is advisable but also provides guidelines on what such a programme should consist of, how and when it can be implemented. Conclusions relating to demographic and social-economic profiles, group management practices, income generating activities, problems and their solutions and training needs are made.

Recommendations given are derived from the conclusions drawn from the collected information. They contain only the broad profile of a suitable programme for the training of women at grassroot level.

Rapid appraisal of the environmental health situation in the Mukuru and Soweto slum villages of Nairobi/ Margaret Oyuga. - Nairobi: AMREF, 1991. - (Urban child survival and development project).

The assessment was commissioned to look into the water, sanitation and environmental health situation in the sampled villages of Soweto and Mukuru. Special focus was on the availability and portability of water for human consumption, excreta and liquid waste disposal including waste water, collection and disposal of solid wastes and the nature and disposal of industrial waste and effluence. The assessment involved observations, individual in-depth interviews with community leaders and focus

group discussions with the village health committees.

In the Mukuru village area, collection and storage of water was done in open containers increasing chances of contamination. The 1,594 latrines were an insignificant number considering the population of 65,000 people. The assessment team observed solid waste management problems, and health hazards resulting from factory effluent. Although the Soweto village is well served with water points, the supply is irregular. This village experiences problems with excreta and urine disposal but not much with kitchen wastes and drainage.

One significant factor that the appraisal team noted during the assessment was the unusual concern by the community with the poor environmental health and sanitary conditions. Some support and guidance therefore such as that provided by the AMREF Child Survival Development Programme through community health workers and leaders could play a great role in providing a lasting solution to environmental sanitation and informal settlements problems. Recommendations have been listed for each problem identified.

Assessment of knowledge, attitudes and practices in handling domestic water: a survey done in Nawanyago sub-country, Kamuli district, Uganda/ Elizabeth Mboizi. - Nairobi: AMREF, 1992.

The main aim of the study is to take a closer look at knowledge, attitudes and water handling practices in Nawanyago sub-county of Kamuli district in Uganda. The objectives were to assess the level of community participation in provision of domestic water, determine water handling practices both at source and at home, determine the level of knowledge regarding water contamination, identify attitudes and beliefs regarding water safety, assess walking distances to water sources and identify methods of excreta disposal.

The study covered 22 sampled homes and 19 sampled water sources in Nawanyago sub-country. Findings indicated that 68.7% of the population sampled knew the necessity of cleaning containers but very few actually cleaned them. They also knew the dangers of contaminating water sources. Latrines were constructed and members of the household made use of them but 13.5% of them were too close to the houses.

Recommendations given indicate the need for health education programmes both in schools and in the communities specifically teaching hygiene education, simple technology of protecting water sources and the importance of keeping latrines clean.

Involving women in planning and implementing environmental health improvements / Joseph M. Waithaka; Joshua N. Kingori.-in society, environment and health in low-income countries. - Korolinska Insitutet IHCAR, 1990.

In Kenya, as in most developing countries, women have traditionally had little say in decision making and especially at community level but have played an almost exclusively domestic role. With the economic changes however, the situation is changing. With increased basic education and situations where husbands work far away from home, women have had to become more independent. Women and children are gener-

society such women, youth etcetera. Although co-operative societies are modern organisations, the traditional African societies had many institutions that were similar in structure and objectives to the modern co-operatives. These groups have helped promote economic activities. Initiatives in soil and water conservation and tree planting in agriculture, livestock and bee keeping in cottage and small-scale industries have been recorded. These initiatives have had major contributions in Machakos. The success of the local initiatives has come with considerable support from a variety of sources such as private, public, individuals, NGOs and international agencies.

When planning for rural development, planners and policy makers concerned with regional/rural development should take into account responses and strategies initiated by local people, especially by women.

Women and the environment/Annabel Rodda.-London: Zed books, 1991.- vii, 180p.-(Women and world development series). ISBN 0-86232-985-X.

The book focuses on the importance of women in relation to environment and development. Many women's relationship with the environment in the developing countries is vital to their daily lives for example in the provision of water, fuel and food.

The main purpose of this book as a resource tool is to provide information and raise awareness. Key environmental issues showing the complexity of the interaction between human activities and physical environment have been set out. This is in relation to the natural and socio-cultural environment. The importance of women in the environment in their different roles as users, producers, consumers and managers has been examined. It details their work as collectors of fuel and water, as farmers, income earners and as discerning consumers and practising environmental managers too. The effect of the environment on the lives of women in relation to health and other social and economic aspects have been analyzed. Detailed also is the effect of environmental degradation on their lives and the outcome of environmental disasters.

The positive action taken by women despite the limiting constraints with special attention given to education and communication and the practical ways of conserving and improving the environment are highlighted. Specific case studies have been used to serve as models and provide detailed information. Cases cited include "People, pumps and agencies: the South Coast handpump project", "Participatory development planning for sustainable development with women's groups in Kenya" among others.

The final section concerns women's participation and includes strategies for planning and suggestions for research. The annexes provide more detailed reference information with guidance for study and action.

Sanitation without water/ Uno Winblad; Wen Kilama. - SIDA, 1980. - vi, 129p.

A large number of diseases are spread directly through man's contact with human excrement, indirectly via water, food and soil or via carriers and vectors like flies, cockroaches and mosquitoes. Simple disposal systems like defecation in the bush, in fields or in open pits may have no adverse effects for small, scattered populations. But when used in densely built up areas, such practices could be out right dangerous. Unlike other kinds of latrines the compost latrines can be used under the most difficult

soil and ground water conditions. Pit latrines are not as adaptable but where they can be built they are unsurpassed in simplicity and economy.

This book has been designed to meet the increasing demand for practical information on how to design, build and operate compost latrines and improved pit latrines for individual households. It is a well illustrated manual primarily for health officers, sanitarians, medical auxiliaries and village technicians in Africa.

The first part covers a chapter on sanitation and disease in relation to the common routes of transmission. Included is infection from ingestion of contaminated food or drink, infection from ingestion of beef or pork infected with tapeworm, infection from contact with water and soil and infection via insect vectors. The second chapter has dealt with the various aspects of composting such as aeration, temperature, moisture, compost as a fertilizer and soil conditions among others.

In the second part, thirteen different dry sanitation systems from various parts of the world are described with illustrations and pictures to demonstrate the range of technical solutions already in use. The technical components of a latrine system and how to combine the components into latrines to fit specific local conditions is useful information given in chapters four and five.

The book ends with instructions on the proper use, careful upkeep and adequate disposal of the contents and an appendix on various ways of controlling flies which include mechanical, thermal, chemical and biological control methods.

Water supply and sanitation: a national training seminar, 9 - 13 November 1987, Nairobi Kenya. - Nairobi: INSTRAW, 1987. - 52p.

The national training seminar on women, water supply and sanitation was convened at the United Nations offices in Nairobi Kenya from 9 to 13 November 1987 by International Research and Training Institute for the Advancement of Women (INSTRAW) with assistance from the International Labour Organisation.

The substantive issues have been presented in five modules which include (i) introduction to the International Drinking Water Supply and Sanitation Decade (IDWSSSD) and International Advancement of Women (ii) Participation of women in planning water supply and sanitation projects; (iii) Involvement of women in choice of technology and implementation of water supply and sanitation projects; (iv) Role of women in education and training activities for water supply and sanitation and (v) Evaluation of water supply and sanitation projects.

Under the first module the presenter noted that any strategy for women's participation needed to consider water supply and sanitation as an integral part of the entire development process along with other socio-economic factors. In this connection INSTRAW was seeking to make an important contribution to the implementation of the objectives of the IDWSSD which were to assist, stimulate through research, training, collection and dissemination of information,the advancement of women and their integration in the development process both as participants and as beneficiaries.

In the second module it was felt that donors should be more flexible in their approach and view themselves as partners. In addition, women and women's needs were not well represented at various stages of decision-making. The cost of implementing a water and sanitation programme especially in rural areas and the planning stage of

A guide for health education in water and environmental sanitation/David Nyamwaya.- Mimeo, 1984. 25p.

One objective of UNICEF is to reduce water related diseases through the provision of improved water systems. However, it was discovered from studies conducted that several water related diseases such as Diarrhoea, Trachoma, Bilharzia, Malaria and skin infections were still prevalent in communities that have access to piped water. Reasons for this occurrence could be that piped water may be available but be of poor quality if not treated, people resort to unimproved water resources when piped water systems break down, people lack knowledge of proper use of water and sometimes when they have the knowledge, they lack the motivation to effect the appropriate behaviour.

This guide is to assist health educators motivate individuals and their communities in order to improve their health through the provision and proper utilisation of safe water. It is intended for all people involved in assisting rural and semi urban communities in health and other development. Included also are artists involved in production of media that could be used for health education purposes. To improve the health of the community changes should also be effected in other aspects of life. This being the case health education in relation to water use should be seen as an integral part of primary health care. Primary health care aims at providing services which are accessible to and affordable to a particular community, the key concept being community involvement.

The guide analyses the need for health education, and further lists social and psychological factors necessary for effective communication. The effectiveness of a health message depends very much on the medium/media used to transmit it. Various types of media have been discussed briefly, leaving the educators to explore the possibility of using any of them.

The guide ends with actions to be taken by community members to reduce water related diseases when managing, collecting, transporting, storing and using water and sanitation.

Farmers' groups and community support project: final design paper. - Nairobi: IFAD, 1984.-112p.

The objective of the mission, was to review the implementation progress of the farmers' groups and community support project reflecting factors that enhance implementation, constraints and problems, examine the ability of the project to meet set objectives within a reviewed time frame and the allocated financing. The mission also hoped to propose ways of improving implementation and draw out lessons of experience that may be useful in designing similar projects in the future. The Farmers Groups and Community Support Project (FGCSP) is a pilot project designed to provide small holders and the rural poor in Siaya district with an integrated package of development support channelled through the district administration and farmers groups. The general objectives of the FGCSP project are (i) to intensify and diversify agricultural production, increase and improve the productivity of small holder farmers (ii) to reduce mortality, improve health and nutrition (iii) to provide means for more community

participation in the development process (iv) to facilitate more effectively cost effective and coordinated provision of government services to the rural community.

The project's general organisation and management is discussed in the project implementation review. Constraints and problems have been highlighted and proposals for improvement and sustainability have been made. The training programme is the single largest realization of the project and is responsible for the strong motivation of staff and the good awareness of the objectives of the district focus policy. Findings, problems and constraints and proposals for improvement on implementation are given on each of the areas discussed which include agriculture and livestock input, supply/ credit scheme, groups and community mobilization, rural water supply, community based health care programme and fisheries development.

After giving conclusions and recommendations the document ends with annexes on projections of the population coverage by community health workers and related costs, analysis of the strategy for maternal and child health care, an organisation of drug supply for the child health care programme and persons met by the mission.

How to construct a brick V.I.P. latrine: a step by step manual for training public health technicians. - Nairobi: AMREF; KWAHO, 1994?.-42p.

Prevention of diseases such as Dysentery, Cholera, Bilharzia and Roundworm need a combination of control measures. These measures include safe excreta disposal so as not to contaminate the soil surface or the water supply, good personal hygiene and good food hygiene. The manual is a guide on the construction of a brick ventilated and improved latrine. As long as the principles of the VIP latrine are followed and good building construction is done, the actual materials and design can be adapted to suit local and individual household conditions.

The manual provides latrine designs depending on the materials available and a list of all the materials and tools required for the construction of a brick VIP latrine. Steps to be taken when constructing with the required measurements are stated at every stage. The various stages, where clearly illustrated instructions have been given include choosing a site; setting out the pit; digging the pit; constructing the pit, floor slab, the walls; roofing and keeping the latrine clean.

UNICEF module for education for child survival and development in Eastern and Southern Africa/P. Muyanda-Mutebi.-UNESCO/UNICEF ESARO Cooperative Programme, 1987. 140p.

A seminar on basic education for health held in Nyeri, Kenya from 9th to 12th March, 1986 and another on basic education for child survival and development held in Nazareth Ethiopia from 28th October to 2nd November, 1985 identified lack of appropriate teaching and learning materials as one of the leading problems in the development of desirable education programmes. This module is a result of a UNICEF supported workshop on the production of teaching and learning materials for education in Primary Health Care held in Nairobi from 9th to 20th February 1987. The targeted

Curriculum developers, teachers, trainers, inspectors of schools, trainers of environmental workers, community development officers in Eastern and Southern Africa could find this module helpful. Primary school age children whether in or outside the formal education system will be the ultimate beneficiaries.

To provide guidance on the content and methodology of teaching environmental and population education, three major themes have been expounded. Under understanding environment and population education the reader is made to understand what environmental and population education mean and how they have developed with time. Crucial information on essential knowledge about the environment and how various elements interact within it forms the second part of the module.

The major environmental problems in Eastern and Southern Africa and have been cited and some solutions suggested. The major categories of problems include devegetation and soils degradation and desertification water supply and sanitation, wildlife conservation and management problems, pollution and natural disasters. Each chapter has a defined goal theme and sub-themes. Specific objectives of each subtheme are clearly stated with various activities and the necessary procedures outlined.

Machakos diocese rain water tank programme/Catholic diocese of Machakos.-1987.-15p.

In 1983, the Development office of the Catholic Diocese of Machakos introduced a newly designed water tank for roof catchment. The interest of the people of Machakos District in this tank was so enormous that the idea developed into a programme. The technical design and the method of implementation made the programme a success. The tanks are intended for storing rainwater harvested from corrugated iron sheet roofs. They are cylindrical, made from concrete and reinforced with barbed wire. The mould consists of corrugated iron sheets of 24 gauge that are semi circular.

In implementing the programme, small and medium sized tanks were made only for group members which could have been women groups, agricultural groups and special water tank groups. Financing through these groups helped the community members pay for the tanks.

A list of materials and tools required for constructing these tanks and the costs have been given. In addition, step by step instruction for building 4000, 5400 and 13,500 litre tanks have been given in English and Swahilii. A pictorial illustration of the tanks ends the booklet.

Proposed environmental sanitation programme: eighth phase 1970-1971/ Government of Kenya. - Nairobi: WHO; UNICEF; MoH, 1969. - 206p.

The WHO/UNICEF assisted Environmental Health Programme in Kenya, known as WHO Project-0002 was started in August 1960 with the objective of developing rural water supplies, improving excreta disposal systems and training environmental health staff in practical aspects of rural environmental sanitation. The programme has mainly concentrated on the development of rural water supplies, a major environmental problem in rural Kenya.

The programme was divided into 8 phases. Phase 8 differs from the previous phases in two main aspects i.e. the integrated approach of rural development and the Government's matching contribution where the Ministry of Health proposes to promote 62 rural water supplies from its sanitation vote. This document is therefore divided into two parts, where part 1 includes WHO/UNICEF assisted rural water supply schemes and part 2 the Ministry of Health assisted schemes.

A general description of each of the pilot areas with regard to geographical information such as rainfall, altitude, population, surface area and occupation of people is given and capital costs for the programme estimated. In relation to the Environmental Sanitation Programme, the body giving assistance for environmental sanitation work which could either be UNICEF, the County Council or WHO had been identified.

In addition to the number of schemes proposed for each district, the location of the area to be assisted, population of surrounding areas, distance to be covered, the cost breakdown of each of the materials to be used have been discussed in detail.

Children and environment: a UNICEF strategy for sustainable development/ P. E. Mandl. - New York: UNICEF, 1989. - 35p.

In this UNICEF policy review on children and environment, the impact of environmental degradation on the health and well being of children and women has been discussed. It analyses environment threats such as how interaction between poverty and the environmental leads to degradation, the effects of deforestation on land and water and how the standards of living of the rural and urban poor adversely affect the well being of children. Global warming and environmental pollution, natural and man made disasters have all been considered as stakes in sustainable development.

An analysis was undertaken to determine the extent which environmental considerations such as health, nutrition, water supply, sanitation and environment education in schools were reflected in existing or proposed UNICEF programmes. It was found that there was quite a significant range of environment related components in current UNICEF assisted programmes. Areas identified where UNICEF concentrates its action to strengthen programmes with components of environment impact and to ensure sustainability include situation analysis to highlight needs of children and women for appropriate planning, country programme monitoring and evaluation, child survival and development. UNICEF's work in promoting child survival, development and protection seeks to improve human environment by combating disease, malnutrition and by promoting education to reduce the mortality rate in all the programme areas assisted by UNICEF. The interaction of women as farmers, food producers and household managers with the environment, has a direct impact on the well being of children. All UNICEF water supply and sanitation co-operation centres have the objective of securing child health and well being through the improvement in the physical, biological and social environment of children and their communities. Other objectives that relate to the environment are food and nutrition, education, urban basic services and appropriate technology.

Sanitation, health and the community in Kibwezi/ A. Oendo.-AMREF, 1983.-39p.

The recommendations and declaration at the Alma Ata conference on Primary Health Care underline the importance of sufficient clean water, adequate sanitation for health. The Africa Medical and Research Foundation (AMREF) has established a community based health care programme in Kibwezi to support the principles outlined in this conference. This study intends to provide the needed information and insights into the values, attitudes and problems of the communities with regard to sanitation. Kibwezi area was selected on the basis of being a hardship area with scanty and unreliable rainfall, diseases associated with unsanitary disposal of excreta and lack of personal hygiene. It is also an area of recent settlement and due to lack of services, AMREF was asked to establish a community based health care programme. The study was done to support and assist the objectives of this programme.

More precisely the purpose of this study was to avail information that would facilitate the effort to promote latrine ownership and use. Secondly, it was to enable health planners and promoters help the communities in the sanitary disposal of excreta. Thirdly, to show what community initiatives that existed and how they could be enhanced to promote latrine ownership and use and finally to show what community values and attitudes could be utilized to facilitate better and widespread latrine use.

To get information, visits were made to various homes and where community based health care programmes were running, discussions were held with community health workers. Meetings were held with Locational Community Development Assistants in order to know about sanitation efforts being made at community level.

As a result of the efforts made by the AMREF community based care programme, the use of latrines has increased greatly with reduced problems of ownership and use. This could be attributed to the Health Education given, urbanisation of some of the members, protection of families from wild animals and the Chief's Act that has made people construct latrines. Technological problems that need to be addressed include low cost methods of preventing the collapse of pits in areas with loose soil, low cost methods of building mounted latrines and penetrating hard rocks close to the surface, low cost construction of slabs or hygienic floors and the construction of inexpensive but durable superstructures.

However, latrine promotion efforts must aim at low cost facilities if they are to succeed. In addition, they have to determine the income of the people and the nature and order of their priorities.

Water strategy: water supply programmes for rural areas/ Swedish International Development Authority.-2nd edition.-SIDA, 1987. 23p.

The supply of water for domestic purposes has been an integral part of Sida's development co-operation programmes since the mid 1980's . The paper documents the experiences of Sida's co-operation in the domestic water sector in five countries. It is useful in identifying projects, assessing of requests for follow-up and control of projects in evaluations, discussing with recipient countries and for information regarding assistance in the water sector.

Target groups for Swedish assistance in water supply are the poorer groups in the rural areas. Women and children constitute important groups that should be reached on account of their special position in the handling and use of water. The main goal of Swedish assistance to the water sector, is directed towards creating better prospects for social development and economic growth by providing improved water supply that is continuous, of better quality and greater quantity and is easily accessible in addition to improved hygiene and health.

Areas of assistance in water supply identified include construction of new installations, operation and maintenance, rehabilitation, enlargements and extensions, water quality and legislative measures and water tariffs with priority given to activities which encourage continuous use of water. Experiences gained from already existing programmes, the problems and possible solutions have been given. Guidelines for water supply and sanitation in the rural areas as concerns rehabilitation programmes, technology choice, protecting water resources, educating the communities and organisation of follow-up and evaluation programmes have been given.

Water activities in the UNICEF supported districts and municipalities/ UNICEF. - Nairobi: UNICEF, 1992. - 12p.

The UNICEF supported Districts and municipalities analyzed from January to December, 1992 were Baringo, Kisumu, Kwale, South Nyanza, Embu and Kitui districts. A summary of water projects in Kisumu, Mombasa and Nairobi municipalities within the same period has also been provided.

The information has been provided in a tabular form with information given on particular places in the district or municipality. The types of water projects which include community training, drilling of wells and, leadership have been mentioned. The 1992 budget for each of these projects, the number of people served, the implementing partners such as Action Aid, African Inland Church, and the Church of the Province of Kenya among others and a mention of the project status are included in this summary report.

Maasai soil and water conservation programme: a project proposal/ Christian Mission Aid. - 1989.

The aim of the Christian Mission Aid in soil and water projects is to contribute to agricultural development through specific activities designed to help make adequate food available to the people and to improve the production, preservation, utilization and marketing of agricultural commodities. These include forests, soil and water conservation techniques.

Early in 1987 Christian Mission Aid was requested to do some agricultural and development work in the Olooltepes area of maasai land. The pilot project carried out showed that indigenous Maasai people, traditionally nomadic pastoralists with little experience and history in agriculture depended almost entirely on their cattle. In times of drought and famine, they depended on external food supplies for survival. For the maasai to be a productive community, the pastoral complex needs to be revised and

re-established and a new approach taken towards agriculture as a variable and realistic alternative.

The Olooltepes maasai expressed a desire for a farm project and showed determination by working many acres of land by hand. Christian Mission Aid's objectives aim at encouraging and solidifying this determination into viable and productive lifestyles. Raising enough crops each year in the Olooltepes area to sell to the neighbours at a fair price and introducing the planting of three fruit trees in each homestead are some of the long term objectives of Christian Mission Aid.

As concerns the water points, the objective is to plant live fences and re-vegetate all the three water points to prevent soil erosion and trampling by livestock and to encourage farmers to scoop a shallow water catchment at the lower part of the Olooltepes centre using oxen.

Other agencies cooperating are the Ministry of Environment and Natural Resources, Ministry of Agriculture, local CPK officials and local DDC (District Development Committee).

Food, environment and health: a guide for primary school teachers/ T. Williams.-Geneva: WHO, 1990.-ix, 129p.

Many of the acute health problems in developing countries especially where malnutrition and food borne diseases are common arise because of poor sanitation and personal hygiene standards. The value of education in promoting healthier habits relating to food, personal hygiene and the environment is receiving increasing recognition. This is more relevant in primary schools where appropriate health education programmes can be a means of motivating young people to adopt healthier lifestyles and influencing the older members of the society.

This is a resource book to assist teachers in planning and implementing health education programmes. The prevailing conditions and principle needs of the community should therefore be known to the teacher.

Topics covered include food, its nutritional values, how to produce and keep it safe. As concerns safe collection and disposal of wastes, the use of latrines, composting, burying and incineration of solid waste are some of the topics discussed. Methods of making water safe such as boiling, filtration, use of chemical disinfectants have been briefly mentioned. Other areas covered include personal hygiene, keeping homes clean and tidy, the roles of insects, pests and animals in spreading disease.

The guide is heavily illustrated making it even clearer for the user.

Practical strategies for promoting personal hygiene and good sanitation/ Bernard K. Mwalenga.-in a sub-regional UNICEF workshop in support of child survival and development, Nairobi 9-21-Feb 1987.-p. 57-66

This paper concerns itself with the implementation of a strategy for involving active community participation in health development. A primary health care strategy requires that community members should participate fully and at all levels in the planning and implementation of all programmes aimed at improving their health and well

being. However, it is noted that this is not an automatic process as preparation to acquire new values through a well planned education system is necessary.

Understanding the causes of ill health, the need to find acceptable solutions and guiding communities on actual problem solving activities and eventual evaluation is necessary. This is with relation to personal hygiene, good sanitation with regard to safe disposal of human excreta in latrines and closets, keeping excreta disposal areas clean to avoid fly breeding and foul smell and proper disposal of household waste water.

Finally, a discussion on community participation and strategies for health action have been laid out. These are obtained from the community as it is in a better position to decide what should receive immediate attention and what resources are required and the subsequent programmes which are supposed to benefit them. In community participation, training is a prerequisite and therefore teaching and learning materials should be developed.

Workshop on management of community participation in rural water supply and sanitation projects:community involvement with specific reference to Kenya-Finland rural water development project.-Nakuru, Kenya, 23-26 May, 1988.

This project is based on an agreement on the technical cooperation between the governments of Kenya and Finland signed in 1975. It covers 3,654 Km^2 and an estimated population of 1 million people. Areas covered are parts of Kakamega, Busia and Bungoma districts in Western province and parts of Siaya in Nyanza province. Its main objectives are to provide clean water closer to communities within the project area, create village level maintenance system to ensure that safe clean water is used for both human and livestock consumption and to create self reliance among the beneficiaries. Various steps on how communities get involved have been discussed. The role of the community in spring protection, shallow well construction and bore hole construction have also been listed. The article ends with some brief discussion on procedures for land ownership and community training.

Hydrogeology of Eastern Isiolo district/ B. Lester. - Nairobi: Ministry of Planning and National Development, 1985. 17p.

The report is a review of previous hydrogeological investigations conducted in Eastern Isiolo district which aim at providing, in the absence of comprehensive geophysical surveys, guidelines for future borehole drilling operations. In the case of Eastern Isiolo district, the area west of Garba Tulla where water problems tend to be large scale and where groundwater development involving expensive borehole drilling operations, is proposed as the solution, the need to prepare a concise hydrogeological report to guide development planners was felt.

The main sources of ground water in Eastern Isiolo are Merti beds and Alluvial deposits. The sedimentary Merti beds of the late Pliocene age which contain the principal productive aquifer for the area, underlie Eastern Isiolo, Southern Wajir and most

of Garissa District. Alluvial deposits of pleistocene and Holocene are intermittent and the local sources of water supply in Isiolo District, the two main water sources being the Ewaso Ngiro and Galana Gof.

Recommendations made are that deep boreholes drilled in the Merti beds be confined to the fresh ground water zone to a recommended minimum depth of 110 metres. Secondly, fresh water supplies could be developed along the Ewaso Ngiro from shallow gravel-packed boreholes drilled within the immediate flood plain to a recommended maximum depth of 50 metres. No boreholes either shallow or deep, should be drilled along the Galana Gof east of Benane. Fresh water supplies can be developed from clay fill sub-surface dams in the sandy river bed.

Strengthening primary health care in Kenya through community financing based on the Bamako initiative: training of community health workers. Sigoti location, Kisumu district.

Kisumu is one of the first districts in Kenya to be selected for the implementation of the Bamako initiative or Primary Health Care (PHC). The Bamako initiative is a bold new strategy to reinvigorate the concept of primary health care by making low cost health services affordable and manageable in areas where they are most needed. The training objectives and expectations involve preparing community health workers to recognise and treat common diseases in the area, manage drugs and to know and appreciate the prevention of immuniseable diseases and selling of drugs as a means of initiating community projects for self reliance . The training course content covers the mode of contracting worms and their prevention, aspects on anaemia, diarrhoea, scabies, eye infection, AIDS, malaria, drug management. Finally, the training was evaluated on a one to one basis through discussions.

Community financing of primary health care; the Bamako initiative in Kenya.

The Bamako initiative was a result of the World Health Organisation's African Regional Committee meeting of health ministers at Bamako, Mali convened in September 1987. The aim was to accelerate the implementation of primary health care at district level, giving priority to women and children. It aims at strengthening community based actions for improving the survival and quality of life of women and children and in particular, through developing a system of community financing based mainly on the supply and sale of basic essential drugs and supplies.

The Kenyan programme of the Bamako initiative aims at strengthening community capacity to organise health activities and district management systems in order to increase and sustain public health care coverage. It also aims at strengthening the essential drugs supply system, ensure financing or recurrent costs with the aim of community self reliance. Financing for public health care through the Bamako Initiative is carried out through the sale of mosquito nets impregnated with insecticide, community self help contributions and income generating activities like selling baskets, handicrafts, rice and fish from community owned rice fields and fish ponds. Village health committees have been formed to manage the revenue collected under

the project and have a bank account with a commercial bank.

There have been efforts to promote community involvement in public health care and a nationwide attempt at social mobilisation and creating awareness as well as training of community health workers.

The UNICEF assisted water and environmental sanitation (WES) programme aims at increasing access to portable water within a kilometre of every household and improving sanitation in the UNICEF assisted districts. The public health technicians and community health workers provide education in schools and to the community on the importance of constructing and using latrines in every home.

People, pumps and agencies: the south coast handpump project with particular emphasis on Kenya Water for Health Organisation (KWAHO)/ Deepa Narayan-Parker. - New York: UNDP/PROWWESS, 1988. - 39p. (UNDP/ PROWWESS technical series).

This is the success story of one programme in the coastal province of Kenya which begun as small South Coast Handpump testing project in 1983. Over a period of time the project changed, evolved and grew into the district-wide Kwale Water Supply and Sanitation Project covering an area 27 times larger than the scope of the original project. The Kwale project succeeded because it was able to develop mutually supportive relationships between community groups, government ministries, an NGO and other external donors (Swedish International Development Agency) who were willing to make long term commitments, take risks and work together. This collaboration was made possible by a shared vision and growing conviction of the centrality of women and the communities in achieving success. Despite different disciplinary and political philosophies, the partnership stood because of one shared overriding goal i.e achieving sustainable operation of community owned water supply systems.

The Kwale experience highlights the total inappropriateness of the "blueprint" approach, a framework that assumes all is known and predictable before a project begins. Instead, what is needed for low cost community based water supply and sanitation programmes is an alternative framework that gives people's involvement and community management a central place, identifies shared goals acceptable to technical and social personnel, integrates one overriding goal with supportive management and organisational tasks and functions, defines the primary management tasks as designing a "learning environment", makes two-way information flow a central management task and facilitates inter-agency collaboration.

Project components need to be conceptualised so as to have implications for all project staff while at the same time contributing towards community management and effective utilisation of facilities. The Kwale experience suggests light project components all of which have implications for managers, technical and social project staff. These are village level operation and management of maintenance technology, community organisation, operation and maintenance; service level and affordability, cost recovery and financial management, complementing of water and sanitation, monitoring, research and evaluation and developing human resources.

The closer the project is to attaining the concept of village level operation and management of maintenance, the easier it is to achieve community management. Community organisation requires specialised expertise and training in participatory methods. Community organisation costs in Kwale ranged from 15-20% of the total project costs. Training of even illiterate older women and men in operation and maintenance of pumps is possible and saves on recurrent costs. The issue of service level had to be discussed with the community. The overriding goal should be effective utilisation rather than functioning.

Feedback to Ministry of Health, Kenya, on work carried out in Kenya between July 1984 and November 1985/ J.P Ranken.-Institute of Child Health.-17p.

Action Research was carried out in 3 districts in Kenya, within the terms of reference of the District Health Management in conjunction with the University of Nairobi, Department of Community Health and Advanced Nursing. The purpose of the paper is to highlight important issues in improving the effectiveness of District Health Management. Action to be taken has been suggested with regard to the research findings. These relate to issues in management for Primary Health Care, the roles of individual members of the District Health Management Team (DHMT), strengthening the DHMT, management structures, resources in terms of people and transport and support for District Health Managers in career development.

A Suggestion given is that the paper could be used as a basis for discussion within the Ministry of Health or/and other relevant bodies.

A baseline study on Pumwani slum: a report submitted to the African Evangelistic Enterprise/ Philista P. M. Onyango. - Nairobi: University of Nairobi, 1989.

The study was conducted in 4 villages of the Pumwani slum, namely, Kitui, Kinyagi, Kanuki and Majengo. The main purpose of the study was to provide the African Evangelistic Enterprise with baseline information on these villages with the aim of enhancing and strengthening services being provided by St. John's community center on the villages. Results showed that majority of the residents are women who head their households, with large families and that houses are overcrowded and the environmental conditions are extremely poor. Incomes are also very low due to underdeveloped skills and unemployment.

The physical environment showed low standard of poorly constructed houses, inadequate water facilities, very poor sanitary conditions and drainage systems, lack of adequate toilet facilities, poor disposal of rubbish and uncollected garbage and overcrowding being the order of the day.

The report gives some basic descriptive information of Pumwani slum residents with regard to their age and sex, education, representation of ethnic groups, occupation, marital status, religions denominations, family size, children age groups and school attendance and income distribution of residents. Programmes needed most in the area include income generation, health and sanitation programmes and transport. Majority of the residents get their water from the taps as indicated by 85% of respon-

dents with 15% drawing it from dams, wells and rivers. Some tabulation has been given indicating types of toilets, sewage system and garbage collection in Pumwani.

Need was felt to give immediate attention to the environmental conditions of the area, expand vocational training programmes and develop new ones, improve quality of education and engage the services of a person with experience in community mobilisation.

GoK and UNICEF 1992-1993 community based water and sanitation project.

The Kenya government has made and continues to make tremendous efforts in providing rural communities with safe drinking water and adequate sanitation. Four broad areas of focus for water and sanitation strategies include urban, peri-urban, rural, the arid and semi arid lands. Implementation activities considered in Kisumu and Baringo districts include training, health and hygiene education, sanitation, structural development and water quality testing and treatment. In training, community leadership, organisation and management, water caretaker, community health workers and artisan training were experimented in the two districts.

The project will be financed through the government of Kenya, UNICEF and the communities. Evaluation activities will be done by the UNICEF Water and Sanitation Section, the District Water Office with help of NGO programme coordinators and implementing agencies. A tabulated proposed plan of action on project components, objectives and feasibility and a budget proposal for the two districts has been provided.

District profiles provided deal with typographical assessment, demographic and settlement patterns, sanitation needs, surface water resources, water demand and supplies and existing implementing capacities among others.

Socio-cultural investigation into the use and functioning of the completed shallow wells in Nyanza province: findings and recommendations. - Lake Basin Development Authority, 1983.

This is a summary of the main findings and recommendations of the socio-cultural investigation into the use and functioning of shallow wells installed by the Lake Basin Development Authority (LBDA) in Nyanza province. The purpose was to investigate local level management of the shallow wells in the context of ownership structure, organisational set-up, maintenance system, charges, community involvement, distribution of benefits and health.

Majority of the community members, it was established, were in favour of communally owned wells managed by local water management committees and supported by the LBDA in order to guarantee universal accessibility. Recommendations with regard to local level organization of the wells include having a democratically elected and highly motivated Well Management Committee established before any well is installed. Water users shared a communal responsibility for the hygiene and the cleanliness at the source and this responsibility could also be extended to the shallow wells to prevent the site from lapsing into a state of disrepair. It was recommended that well users start paying for the recurrent maintenance costs of the wells. The management

committee was incharge of this.

Local community involvement is crucial in ensuring proper maintenance on a sustainable basis. The preparation of the village for the reception of a well should be done by a deliberate effort to involve the community. LBDA had the role to organize water education programmes that impress on the villagers the value of safe and clean water.

A detailed "Rural water supply plan" for the whole LBDA area was recommend taking into account the population, the water supply situation, rainfall frequency and development potential. In order to avoid users resorting to unimproved water sources, the amount of clean and safe water available should satisfy their total demands not just a part of their demands.

African waste forum '94: proceedings of a regional training workshop, Nairobi, 23-25 November, 1994.

Pollution from waste is one of the most insidious threats to the environment of cities in the developing world. It poses a great threat to the health of a large proportion of the population and in particular the urban poor. In many urban areas of African countries, capacity for waste management is limited and the problem worsens with the combined effects of urbanisation and increasing waste production. However, various initiatives have been taken and Habitat (UNCHS) has given technical assistance and capacity building in waste management. In Nairobi, Kenya, for example, the centre has initiated, as part of the global project on small scale composting, a demonstration of small scale composting for the organic fraction of municipal refuse.

As part of Habitat's ongoing efforts to develop sustainable solid-waste strategies, they organised the "African Waste Forum '94", a combined training course with the aim of building capacity amongst national and local governments for waste management, prioritising issues on waste management including application of appropriate and innovative technologies for waste reduction and reuse. The other aim was to transfer appropriate methods and approaches between developing countries through documentation and demonstration of best practices. The workshop produced a report on the seminar proceedings, conclusions and recommendations, background documentation and documented case studies of best practices for waste management. It also produced local official entrepreneurs and NGOs sensitised to sustainable methods of waste management. Aspects discussed included solid waste management, water recycling and reuse and waste water treatment.

Refuse collection vehicles for developing countries. United Nations Centre for Human Settlements (Habitat).

Managing solid waste is one of the most costly urban services to provide. This publication intends to assist those who influence public and private investments in refuse transport facilities in developing countries. It seeks to assist decision makers, solid waste management service engineers and consultants engaged in planning and provision of refuse disposal facilities and manufacturers of refuse vehicles.

The specific purpose of the report is to provide information on the availability and application of appropriate motorised refuse collection vehicles, provide technical information for the design and manufacture of alternative vehicles responsive to local production and operational capacities.

The report discusses the problems of solid waste disposal in developing countries, factors affecting waste collection systems and vehicle choice, refuse collection vehicles, characteristics of motorised and non-motorised vehicles and ways in which waste collection systems can be optimised.

The waste collection systems costs are composed of cost of planning, waste collection equipment and labour, garage facilities and civil works. The report ends with an example on economic and financial costing.

The conservation of drinking water supplies; techniques for low income settlements/ UNHCS. - Nairobi: UNHCS, 1989.

Programmes for the conservation of drinking water supplies are relevant to communities with inadequate water supplies. This is because conserved water can be used to improve the overall supply situation by reducing amount of water lost through leakage in the distribution system or reducing the level of water consumption in middle income and upper income communities.

This report is intended to increase awareness on the role water conservation can play in utilising existing water resources to meet the needs of unserved communities and improve current levels of urban service. It therefore addresses senior decision makers, engineers and planners engaged in the provision of water supplies in developing countries and especially in low income settlements.

The report documents methods of water conservation and identifies them as structural, operational, financial and socio-political. These methods are then discussed in details giving illustrations and case studies from the United States of America and Mexico city.

It then recommends that governments ensure that public water supply authorities initiate water conservation programmes to permit maximum use of existing supplies. Governments should publish their experiences in water conservation for others to learn. It is also recommended that a set of modern standards, specifications, building regulations and codes of practice be produced by agencies such as the World Bank in collaboration with governments.

The design of shallow sewer systems. UNCHS, Habitat, Nairobi 1986.

The specific objective of this publication is to introduce innovative low cost sanitation technology, known as shallow sewerage and to present a methodology and criteria for its planning, design and implementation. It's a technology that meets the requirements of a majority of urban slums and squatter settlements of developing countries. The manual has been prepared as a design tool for national planners and engineers engaged in the provision of infrastructural services to these settlements.

The characteristics of shallow sewerage, its mode of operation, the system's advantages, components and parts with illustrative diagrams and their applicability in developing countries have been discussed. Design consideration for a shallow sewer, based on the concept of ensuring that peak daily flows carry away any solids deposited during periods of low flow. Various kinds of traps, sewer ventilation, pipes and inspection chambers are aspects that have been discussed in the second chapter.

In planning for shallow sewers, aspects to be considered are the area where the project is to be carried out, a physical survey of the place, sample socio-economic survey, the institution requirements of the organisation to be involved. An extensive community involvement, acceptance and participation is also crucial and various stages through which this should follow have been described. The two last chapters give the techniques of construction and maintenance of the shallow sewers and a cost breakdown before ending with various case studies relating to low income settlements.

Visit to Western Kenya 9-5 October, 1993/ F. A. Classen.-Nairobi: UNICEF, 1983.-9p.

This is a report of a visit to Western Kenya intended for some observers to attend a shallow wells workshop organized by the Lake Basin Development Authority and to follow up on ongoing appropriate technology activities in Western Province. The three day workshop on shallow wells organized by the Lake Basin Development Authority (LBDA) and sponsored by the Netherlands Government was attended by 75 people representing various government ministries, international organisations, consultants and non-government groups.

The objectives of the workshop were to establish the preferred basis and methods for continuation on a LBDA shallow wells programme taking due account of technical, social cultural and financial aspects and to create the opportunity for presentation and exchange of information between various groups and organizations who are, or maybe involved in shallow wells provision, especially within the LBDA area of operation.

Significant issues identified for any shallow wells programme included well ownership, selection criteria for target groups and sites, domestic water supply methods and cost levels, organizational capability of LBDA to implement a shallow wells programme, community participation, maintenance/manufacturing standardization, education and training, water health and sanitation. Recommendations were also given.

On the follow up on ongoing appropriate technology activities in the Western province, various places were visited including the Diocese of Maseno South which is active in promoting fuel efficient charcoal and wood stoves. The visit was also to allow group conduct field testing of the newly developed maize sheller. The Labour-Time Study Research Project of the School of Agriculture of the University of Nairobi was also visited. The project is involved in research on time spent by small scale farmers and their families at the Kone rice scheme near Kisumu. Other places visited were Ilesi potteries in Kakamega and Western college of Arts and Applied Science (WECO) where commercial products such as India Mark II handpump and UNICEF umeme jiko have been produced. WECO was in the process of acquiring an iron foundry and plans to use the UNICEF maize shelter for training in model making and casting were in process.

A healthy home and a healthy community: child survival, the first five years/ Department of Adult Education.-Nairobi: Government of Kenya, 1986.-37p.

The book is on human health whose basic requirements are enough clean water, food and air. It is expected that after reading the book one should be able to explain how to keep ones body clean and healthy, describe a good site for building a home, describe a healthy and safe home and explain the dangers of getting rid of wastes carelessly. One should also be in a position to explain how to make water safe for drinking and cooking, describe how to handle, store and prepare food in a clean way, tell how to prevent accidents in the home and community.

The topics are backed with illustrative pictures and the text presented in clear simple English with an activity at the end of each topic.

Status report Baringo and Kisumu January -September 1991/ J. Fox.- Nairobi: UNICEF; Ministry of Water Development, 1991.-35p.

The specific objectives of this programme are to provide 200,000 people in Baringo and Kisumu Districts with adequate clean water at an average cost of US$ 19 per person; To introduce health education and environmental sanitation practice to the same people and to reduce morbidity and mortality rates due to water related diseases.

As reported community leadership training is in operation in Kisumu and Baringo and is being fully utilized. The government's counterparts are aware of the activities taking place in these areas and are showing positive interest in the methodology. The technologies being used in Kisumu and Baringo are appropriate to the environmental needs of the particular areas concerned and are within the capacity of the implementing partners. The need for careful planning and scaling up implementation schedules to an unchangeable level was felt. On completing the current project, the technology to be used on boreholes in the nomadic areas would be different. This and the fact that communities are also different explains the need for careful planning. The change in the price structure for materials would require taking an approach that is cost effective.

Building an alliance between the Government of Kenya and non governmental organization partners at district levels has clearly shown results in these two districts. The programmes are now well established and it is suggested that a thorough evaluation, led by an external team of evaluators, be carried out in order to guide the project forward and help potential donors keep track of the progress being made.

Rain water: an under utilised resource/John Mbugua; Eric Nissen-Petersen.- Nairobi: SIDA, 1995.-29p.

This information is intended to impart on the reader the potential and basic technology of rainwater harvesting. It is based on practical experience gained in the implementation of a rainwater harvesting project in rural Kenya. The potential of rainwater harvesting has been analyzed in the context of various agro-ecological zones, at household level and in relation to the environment. Experiences gained during the planning

and implementation of a rainwater harvesting project in three locations of Laikipia district i.e Sipilili, Olmorau and Machunguru locations, show that a well planned rainwater harvesting initiative can bring about sustainable development to a community in an isolated and marginal area far away from rivers and other water resources. On making an overall assessment, several independent evaluation teams gave a positive feedback. After 10 years of implementation, the programme has considerably improved the living standard of the communities with regard to water availability, health improvement, farm management and overall socio-economic factors that affect the people.

When planning rainwater harvesting projects, the entire process of conception, initiation, construction, operation and maintenance of a rainwater based system has been discussed. The emphasis however is that the projects should be managed and maintained by the communities themselves with minimum backstopping by donors and technocrats. The projects therefore should be simple, easy to operate, manageable, not reliant on imported technology and have low maintenance costs.

The various points to consider in the construction of roof catchment tanks include calculating the household water demand, volume of the tank required, calculating run-off from ground surfaces and the design of the tank.

What makes hygiene education successful?: experience from Togo, Sri Lanka and Yemen and its relevance for project design/ B. Fillsbury; M. Yacoob; P. Bourne.-Washington D.C :WASH, 1988.-64p. (WASH activity No. 369).

Hygiene education is now recognized as an essential part of water supply and sanitation projects. Project experience and related literature point to several projects that have been successful in implementing effective and well received hygiene education. This report attempts to analyze these projects and to consolidate lessons learned so that they can be used in other countries under diverse circumstances. This report should be used together with two other reports which provide guidance for designing and implementing water projects likely to be sustainable and improve health. These reports are "Guidelines for Designing a Hygiene Education program in water supply and sanitation for Regional/District level personnel by Mayling Simpson-Herbert and May Yacoob (WASH Field Report No. 218, 1987)" and "New participatory frameworks for the design and management of sustainable water supply and sanitation projects by Pawa Donnely-Roark (WASH Technical Report No. 52, 1987)".

Three hygiene education programs stand out as providing instructive case studies and valuable lessons for the design and implementation of hygiene education programs in water supply and sanitation projects. They are the Togo rural water and sanitation project whose goal is to improve the health of approximately 600,000 people in 745 rural villages through the provision of safe drinking water. The project begun in 1981 and completed in December 1987. Its success is due to the project's emphasis on community participation and carefully developed training for all project participants.

Lessons learned from the Health Education project launched in South Coastal Communities in Sri Lanka as part of the Matara Water Supply program were that while the

content of the project is important, finding the right person to direct it is crucial. An extensive study of the community needs to be undertaken prior to initiating the project and that evaluation should be an integral part of the process.

A hygiene and sanitation education campaign in the Yemen Arab Republic carried out simultaneously with the construction of an improved water supply system was effectively implemented. The idea of linking hygiene education to water project construction activities clearly provided a convincing reason for the campaign. It also helped direct villagers attention to the campaign. The report ends with key issues learnt in the three case studies that can be taken as guidance for hygiene education elsewhere.

Solid waste management in low income housing projects: the scope for community participation/ United Nations Centre for Human Settlements. Nairobi: UNCHS, 1989.

Waste management systems which include community participation and do not require high technology and inappropriate machinery might prove to be sustainable at community level, since income generating waste management systems can be maintained by low income communities. The manual shows the possible scope of community participation in solid waste management. Benefits of waste management have been identified as the production of fertiliser through composting, recovery of energy through biogas, recycling of various waste materials and land reclamation. Waste collection systems such as no collection, door to door collection, kerb side collection, block collection and communal depots have been discussed briefly. Household waste disposal methods such as dumping, composting, incineration, reserve recovery have been analyzed in the fifth chapter. Recovery methods have been given with experience from different countries. The manual ends with examples of community participation in recycling.

Report of a mission to Kenya on human development/ P. Achola et al.- UNDP, 1992.-62p.

What does human development mean in Kenya and how is UNDP going to promote it. The UNDP mission to Kenya on Human Development gives a report of the composite findings from various snapshots of what human development means in practice in different parts of Kenya. It is a result of talking to people whom a human development approach is intended and to those who are trying to help them at the moment. The basic purpose of the mission was to determine if and how UNDP should devote resources in its fifth cycle in Kenya (1993 to 1997) to improving the Human Development situation in the country. More specifically the mission was to determine if and how assistance to the sectors of women in development, health, education for all, environment, water development and urban poverty could contribute to improving Kenya's performance in terms of the Human Development Index.

The mission gives a definition of human development in the Kenyan context and points out its four basic elements which are poverty, inequality, human survival and environmental degradation. Sustained attention to these elements is necessary for any progress to be made towards meeting the basic objective which is to create an enabling environment for people to enjoy long, healthy and creative lives. The mission observed that Human Development problems in Kenya were due to social dislocation resulting from social change and social problems due to population growth. From the findings, it is necessary to describe the potential target population, sectors and programmes which could be supported, when developing a human development strategy. An important question was the extent to which the mission thought UNDP could participate in promoting Human Development in Kenya. The extent to which water development in Kenya can promote and support human development and whether and how UNDP might foster this was also a question of concern. Bearing in mind commitments from the fourth cycle, the considerations of proposals from various sectors might be incorporated into UNDP's fifth cycle for Kenya commencing in January 1993. The report ends with a proposal on the next steps to be taken if elements of the human development approach are to be incorporated into future UNDP programmes in Kenya.

Applied community participation in sanitation provision/ Mbere Nomtuse. - a paper presented at a workshop on training: sanitation in developing countries, Lobatse, Botswana, August 14-20, 1980. - p118-122.

This paper discusses community participation within the context of sanitation. The community can be involved at the initial stages by defining its "felt need". This is done by requesting for the project, in this case sanitation, and making it a priority. The community need not only request for the project but may also be required to show some capability of being able to fulfil some of the projects requirements in terms of providing voluntary labour. This results in the government or aid agency responding to the felt need.

Certain criteria must be met if the sanitation units are not to stretch beyond the household capabilities. These are that the units must be affordable by the community or households not only at the construction stage but over the entire life of the units thereby minimising both operational and repair costs. Early in the project, it must be established that the technology will be socially appropriate, well designed, and hygienic and the people themselves will want to use it and be able to maintain it. Social and behaviourial obstacles can be overcome by the promotion of local leadership which is also one of the aims of community participation. Local leadership and can be achieved through local committees.

Methodology has to be developed to stimulate committee involvement in all stages of planning, construction, maintenance and use. The committee will also organise labour and community helpers to assist project personnel in census taking, social and soil surveys and gathering locally available construction materials. A greater degree of control over the development of various activities is necessary and training of committee members in administrative and technical skills.

There are different levels in the educational component of projects: skilled workers—sewage and construction engineers, sociologists, anthropologists, adult education personnel, middle level workers such as sanitarians e.g. health inspectors, field workers - the personnel who are in constant contact with the community e.g. sanitation assistants and family welfare educators. All these are required personnel and they need education and training. A successful educational component will result in well designed, well constructed and acceptable units, which will be maintained and used by the community and will result in health benefits.

Traditional village institutions in environmental management: erosion control in Katheka, Kenya/ B. Thomas-Slayter; Charity Kabutha; Richard Ford. - Nairobi: ACTS press, 1991. - vii, 34p (From the ground up cast study series; No. 01). ISBN 9966-41-019-8.

Soil loss is a major environmental problem in Kenya. Studies indicate that the country is losing a large share of its top soil in the high to medium potential areas and much more in the semi-arid areas. Alarming rates of soil loss of up to 32 tonnes per hectare over three orders of magnitude greater than the rate of soil formation have been recorded. This case study examines soil conservation practices in Katheka sub-location of Machokos district. The study examines past, present and future needs of effective resource management in the sub-location's three villages.

It presents recommendations on village level environmental management, emphasising lessons on building both local and external institutional capacity for resource management. Mwethya groups have been very instrumental and through them women learned how to lay terraces with grass, plans for drainage, gully management and water catchment. The study makes suggestions for future policies and projects through community institutions and participation. For instance, local labour and resources combined with modest external assistance and managed by viable village or grassroot institutions with committed leadership can foster sustainable development. Much has been accomplished in this sub-location but the report indicated it is still poor. It's recorded successes, however, suggest that the collective decision and action power of the community regarding resource use and abuse are key to attaining sustainable development. For Katheka the community based approach seems to have gained much more for the community that could individual efforts.

Seminar report on hygiene education in water supply and sanitation programmes/ AMREF. - Nairobi: AMREF, 1990. - 26p.

In order to promote appreciation of the importance of hygiene education as an integral part of water supply and sanitation programmes and to facilitate the exchange of learning materials between producers and users in the East African regions, a seminar on Hygiene Education in Water and Sanitation Programmes was organized. The specific objectives stated by the Regional Network Centre for Water and Waste Management (EA), that organized it include among others identifying priorities in hygiene education, and constraints in the production and use of learning materials.

From the participants presentations with representation from Uganda, Sudan, Ethiopia, Tanzania and Zimbabwe various ideas on producing and obtaining appropriate learning materials were given. It was reported that in Uganda, it is appreciated that health is everybody's business and there are no restrictions on reproducing materials. Organizations or individuals are free to adopt, adapt or copy any of the materials with due acknowledgement of UNICEF - Uganda. Places where information can be obtained include IDRC, specialised information bodies such as WASH and the International Women's Tribune. The best solution to information requirements however is to produce one's own because needs vary from country to country, programme to programme and even more from one individual to another. In Ethiopia, the ministry of health, works closely with the ministry of information. There are several regional radio programmes in different languages and the daily newspapers also have health education columns that are used to convey water and sanitation messages.

In adopting the best control measures of water related diseases, whether in giving hygiene education or in producing learning materials, simple and accurate messages in a well thought out sequence are more likely to be adopted than complicated and over ambitious ones.

The role of communities in the management of improved rural water supplies in developing countries: phase 2 participatory field research and development of strategies, methods and tools: project proposal/ IRC. - The Hague: IRC, 1994.-64p.

This document constitutes a proposal for an action research project to assist communities and agencies in six developing countries in assessing and enhancing management for improved water supply systems. The initiative for the project was taken in 1992, on the basis of a review of information on community management. It was further developed during a workshop on community managed water supplies held in November 1992 at the IRC in the Netherlands.

During the workshop, partner organsations from seven developing countries shared their experiences on communities managing their own water supply systems. They compared their findings with literature by IRC. Many problems still need to be addressed, in particular with regard to adequately serving all groups in the community, developing appropriate management and financing systems, ensuring an adequate gender balance in decision making and control and protecting and managing water resources.

The proposal comprises research carried out in different communities with various types of functioning and self managed water supply systems. The shift in terminology from community participation to community management is indicative of an important and challenging transformation of perspective in the water sector. On the basis of current experience the prospects for successful community management appears to be quite promising. Example in literature exist of communities displaying high level and ability of taking care of both traditional and improved water supply systems. In other cases, communities do not accept full responsibility for improved water supply systems, pay little or nothing for their construction and upkeep and have

little real control over them. The true potential of communities to take a higher degree of management responsibility is not yet known.

This proposal concerns a participatory research project, where water supply and management problems are assessed by local men and women in selected communities. Subsequently, approaches, methods and tools will be developed and tested in a participatory manner in order to address the find weaknesses. The project will have a rural focus because community management of water supplies is more common in these areas and the type of water systems installed (handpumps, piped gravity systems) are more suitable for local management.

Anaerobic digestion as a rural sanitation option/ R. Crothers. - Paper presented at the workshop: sanitation in developing countries, Lobatse, Botswana, August 14-20, 1980. p34-40.

Anaerobic digestion refers to the process of fermentation of organic materials in a non-oxygen environment. The process can be artificially stimulated inside air tight containers, usually of masonry or metal construction, better known as anaerobic digesters or biogas plants. The biogas label stems from the mixture of methane and carbon dioxide that is produced during fermentation.

Although the rate of digestion can be affected by a variety of factors, three basic stages occur. The liquid slurry is first broken down into soluble compounds, such as sugars, through the action of enzymes. Secondly facultative anaerobic bacteria produce volatile fatty acids and some alcohol, carbon dioxide, ammonia and hydrogen. Lastly, strictly anaerobic bacteria produce combustible methane gas.

During anaerobic digestion, presence of free ammonia, temperature effects and other factors cause a drastic reduction in the number of pathogen bacteria and parasitic lava. This is why anaerobic digestion is of sanitation interest. The effluent does not normally attract flies and can be made unsuitable for the breeding of mosquito larvae. Use of anaerobic digestion as a means of waste treatment has additional benefits in reducing the amount of suspended solids and in eliminating noxious odours.

The production of nitrogen rich fertilisers through anaerobic digestion or animal manure and vegetable matter improves soil fertility. Anaerobic digestion is now used as an energy source where the resulting methane gas is used for cooking, lighting, or replacing diesel fuel in engines. According to the Chinese who have the greatest experience with small scale anaerobic digesters, rural biogas digesters are 30% technique and 70% management. The application of anaerobic digestion in China began in 1950s with a view to using the fertiliser, energy and sanitation aspects of the process. Improvements in low cost construction techniques have led to the establishment of 7 million biogas plants since 1970. By 1978, 50,000 biogas plants had been established in India in response to the escalating costs of other energy sources. The plants consist of a divided fermentation chamber, floating gas cap, and inlet and outlet pipes and are used to produce both fertiliser and energy. Between 500 and 1,000 plants were operated in France in the 1940s. The process was seen as useful in the treatment of sewage during the 1950s.

In Botswana where in some cases the underlying rock, sand or high water tables make pit latrines impossible, small anaerobic digesters could be the solution

Meeting the needs of the poor for water supply and waste disposal/Fredrick L. Golladay.-Washington DC: World Bank, 1983, 52p. (WB Tech. Paper AT for WSS V.13).

This paper examines communication problems common between low-income communities and technical bureaucrats. It is noted that formal organisations such as governments in most cases apply rigid approaches on communities which fail the adoption test for affordable technologies.

This paper highlights illustrative examples of Sri Lanka, Cuba, India and China who in the 1970s had achieved a high physical quality of life despite their meagre resources. Participatory approaches provided the most important success factors. In this context the household unit provided the essential skills, products and processes which could have otherwise been taken for granted. Wrong targets and failure to enlist community support from various leaders could have led to irrelevant practices.

The most effective approach composed of community participation through consultations with representatives and authority groups. Government inputs should be appealing so as to encourage positive action on community projects. Any unavoidable external skills could then be incorporated when need is apparent.

Public and private sector (within the community) should be harmonised at action level. The legal environment to ensure innovative and rewarding changes in land use and technology e.g. construction should be assessed in a more realistic manner. Such minimal conditions and specifications can permit successful investment in water supply and sanitation projects appropriate to meet the community's health needs.

Country profile: water and environmental sanitation sector.-Nairobi:UNICEF, 1994.-12p.

The UNICEF water and environmental sanitation programme outlines some challenges it faces as child mortality due to diarrhoea, inadequate safe drinking water, poor environmental sanitation, population pressure adversely affect the provision of facilities and even after they are provided good use is not automatically going to be the result. Attitudes and perceptions influence the use of these facilities. To reduce the costs in water provision, low cost technological approaches are preferred. These include construction and development of shallow wells and boreholes equipped with hand pumps, spring development, roof and rock catchment systems and water jars for homesteads.

Another challenge to the UNICEF Kenya Country Office is the scaling down of its activities from six to two rural districts i.e Baringo and Kisumu and the Nairobi municipality in the light of a shortfall in expected donor resources. These areas in the new programme period 1994-98 are receiving multi-sectoral support for community based development for children and women. The objectives of the programme are to increase access to safe drinking water. This is 28 litres per person per day within 1.5 kilometre of the homestead for about 320,000 people and to enhance waste disposal for about 220,000 people in Baringo, Kisumu and Kibera slums. Other objectives include reducing the prevalence of water-borne diseases such as diarrhoea, drudgery on women when fetching water in rural areas and retail price of water in Kibera slums by

50%. Empowering communities and women in particular in water and sanitation activities, supporting the government to develop policy guidelines for the health education component of the programme and strengthening the water and sanitation monitoring system for policy formulation other anticipated goals of the WES programme.

UNICEF Drought Emergency Programme has been assisting the Ministry of Water Development in Wajir and Mandera Districts to repair and maintain essential water supplies. In response to an appeal presented by the Office of the President in the form of an investment proposal on the National Drought Recovery Programme, the UNICEF water programme for NEP was revised. A one year action plan covering July 1993 - June 1994 was prepared. An outline of the plan has been given. Information on the UNICEF Kenya Refugee Water Supply Programme of 1991-1994 and the Participatory Hygiene Education Training Project of Baringo District Kenya by WES has also been provided.

Searching for freshwater, the human imperative.-Ottawa:IDRC, 1989.-42p.

This IDRC publication summarises the human quest for an adequate quantity and quality of freshwater and its proper maintenance. Critical factors such as the world's growing population and related industrial activities have continued to place tremendous ecological stress on water resources and their protection from human or non-human pollutants. The publication highlights the role of IDRC in people's daily lives and how it has succeeded in collaboration with other partners for the last 18 years. Through this experience gained, new knowledge and cost-effective measures for the success of UN Decade have been described. Scientists, technologists and the participating institutions, utilizing technologies to suit their localities and environments have been mentioned as illustrative examples. In terms of improving water supply sources and decent sanitation, water borne diseases which were once chronically hazardous have been tackled with a good measure of success. Some of the diseases mentioned are cholera, typhoid amoebic and bacillary dysentery, poliomyelitis, hepatitis, guinea worms, and schistosomiasis to which 1.8 billion people were exposed. However, the Kenya Medical Research Institute (KEMRI) in Kenya was able to tackle schistosomiasis in Mwea with IDRC's participation at community level through health education intervention. Some improvements in community health were recorded.

According to this report only 30% of the world's total water supply is safe and fresh. Most of the groundwater is locked away by geological formations. In addition freshwater availability varies by climate, especially hydrological cycles. Water supply in rural areas is very problematic. Borehole technology was enhanced in Uganda in 1981 by rehabilitation. Water contamination in cities such as Bangkok, Cairo, Dakar, Mexico and Sao Paulo also has been noted. In all these cities and countries like Philippines, Brazil, Chile Malaysia, Morocco, Peru, Singapore, Thailand, Lebanon and India, appropriate standards have been achieved by simple water purification technologies.

Village water supply: a World Bank Paper.-Washington DC: World Bank, 1976.-96p.

This World Bank Paper notes that rural populations have had poor access to adequate water supply and sanitation and that as the population increases the situation will worsen. According to WHO (1970) surveys water-borne diseases were particularly rampant in Asian countries. Governments needed impact action programme from which the urban experiences provided significant insights. The benchmark Community according to the World Bank was population ranging from 300-10,000, and generally the urban community was well serviced by piped and more hygienic sources.

However, nearly one third of the world's rural population has no proper water supply. To improve on this deplorable situation, the United Nations Development Decade (1971-80) set global goals. In rural India 64 million people in 16,000 villages would be involved in gigantic construction investments. Success rate was bound to vary from country to country because the rural communities could only afford shallow wells, and handpumps in the long term. Urban areas attracted more investment whereas the rural populations who needed these facilities were characterised by inadequate financing, lack of suitable personnel, poor capacity building for sustainability, no community water policies, undefined or overlapping responsibilities, unaffordable charges or ownership claim. There was lack of appreciation in public health education. It is in this kind of situation that the World Bank began to shift its lending programmes toward rural impact achievements for water supply and sanitation. A set of responsibilities for community participation at its early realisation was then established so that rural populations could increase their coverage in the prevailing circumstances. This paper is the outcome of such concerns as based on the Inter-American Development Bank and WHO's survey of water supply and sewage disposal experience (1970).

Methods for gathering socio-cultural data for water supply and sanitation projects/ Mayling Simpson Herbert. -Washington DC: The World Bank [IBRD], 1983.-29p. (TAG Technical Note no.1).

This informal technical paper highlights the development and implementation aspects in the low-cost water supply and sanitation projects and activities. It is noted that the International Drinking Water Supply and Sanitation Decade elicited such discussions. This report is particularly aimed at engineers at the planning level where the apparent need for socio-cultural data is acute.

To illustrate socio-cultural data needs, engineers and designers will have to probe several aspects of community life for key information, for instance, use of local expertise and materials, local leadership, local preferences, traditional patterns of water use and associated excreta disposal beliefs etc. The list is reinforced by demographic, health, occupational, organisational aspects, participation and level of interest. In some instances, castings for physical structures, water use patterns, defecation habits, local technology and resource availability need to be mapped.

In this report, four common basic kinds of data gathering methods are mentioned and discussed as follows:- Participant observation, key informant, interviewing, open-ended interviewing and lastly surveys. For all these methods (strengths) advantages

and disadvantages (weakness) can be noted. Participant observation method was most appropriate for water supply and sanitation projects. Key-informants may conceal their own behavioral traits. Relevant surveys for new cultural or community situations may be difficult to design. By means of Annex I and II, sample questions and data sheets, illustrative responses can be studied. It is noted that the choice of data gathering mainly depends on the availability of social scientists, funds, time and what the data will be used for.

Community management of rural water supply and sanitation services/ Carolyn McCommon; D. Warner; D. Yohalem.-Washington DC: IBRD;World Bank, 1990. -49p. (WASH Technical Report no.67).

This discussion paper emphasises on the need for strong community management of rural water supply and sanitation systems at a reasonably sustainable level. Community management implies that the rural beneficiaries will take responsibility for their perceived needs in delivery mechanisms and their associated costs. According to (WHO 1978) 58% of the rural residents have little access to improved water supplies while 84% experience inadequate sanitation conditions. It examines the capital costs, maintenance, actual demand patterns, willingness to pay for these services by the community. For effectiveness, externally generated planned assistance should ideally fit into community efforts, otherwise the projects fail.

Drawing from field experience in six other countries, including Kenya, this discussion demonstrates immediate problems to which the community responded in the Kwale District Water Supply and Sanitation Project initiated in 1983 by the Ministry. It involved the various key sector agencies, and particularly the Kenya Water for Health (KWAHO) a local non-government organisation (NGO). There had been a history of failed water schemes. The desperate community managed to revise and implement a successful workplan. With focused cooperation in an integrated district level environment, including a supportive administration and volunteers, simple low cost water supplies enhanced by relevant health education were constructed. Extension agents were involved and later phased out, village leadership (committees) were elected and a sense of ownership instilled in the communities through their control of the water supply and sanitation structures. Women as key participants were further encouraged to undertake the traditional repair and maintenance role hitherto gendered to men. Local fund raising through water committees for management and sustainability was largely achieved for these projects to warrant impact assessment.

Sanitation and health: a study of three SIDA- supported programmes in Kenya, April 1987/ Uno Winblad. - Pataholm: Winblad Konsult AB, [198-], 26p.

The study lays emphasis on the importance of faecal free environment through latrine provision around local areas. Mention is made of cat methods, one-day latrines, sanitation technology, teaching manuals and an environmental health profile for the particular locality. These elements are considered by the author to be essential ingredients for basic sanitation and health studies.

In this study, the districts involved are Kwale District Community Water Supply and Sanitation Project and Tharaka in Eastern Province.

The typical programme requires the building of a small number of demonstration Ventilated Improved Latrines (VIPs) and distributing slabs and vent pipes to some households. Sanitary targets are designed for health improvement through community participation (Kwale 1985). Expenses for latrine construction, early adopter approaches and varieties are applied. According to SIDA estimates (1986) 3 million Kenyans were vectored by schistosomiasis.

In the health sector, the Ministry of Health - SIDA Monitoring Unit (1986) aimed at protected springs, masonry water tanks, and gravity systems for improved water. Demonstration VIP latrines, slabs, vent pipes, drainage, incinerator, repair of permanent drains and stagnant waters were attended to. The report emphasises the importance of local initiatives in responding to these innovations. No commitment was made to build structures in these projects for the particular communities. In this approach it was hoped that environmental impact should equally challenge the participating communities.

Handpumps: toward a sustainable technology; research and development during the water supply and sanitation Decade/John Reynolds.-Washington DC: IBRD/World Bank, 1992.-153p.-(Water Sanitation Report 5).

This report presents the major aspects of handpump research and development and as to its justification for use in developing sustainable manufacture, installation and maintenance. According to the International Water Decade, 2 billion people in the rural areas had but, to drink unsafe water since groundwater provided the major supply source. Handpumps would certainly provide the desirable booster for the health of millions.

The acceptability, working life, maintenance and repair features are crucial to the village technology. This concept is summarised as Village Level Operator Maintenance (VLOM). Communities can decide on when, who will service these pumps and the due direct payments involved. Demand spurs manufacturing on large-scale and to the home markets as well.

Global research demonstrates Kenya's experience (1985) with the AFRIDEV pump which appears effective. Priority was initially placed on maintenance design especially from Malawi, with manufacturing done in Kenya a little later.

Modifications and the desirable technical details were incorporated in 187 and successfully tested in the Kwale Water and Sanitation Project (KWSP). Most field trials incorporated in the pump construction were well proved including maintenance recommendations. In this Report, illustrative fittings and plans are sketched for various pump types such as India's Mark I and II and Bangladesh's Tara Direct Action Pump. Several Laboratory tests including detailed regimes are also included. Recommended AFRIDEV depth levels and several design manufacturing by the East African Foundry Works for deep-wells are included.

African indigenous knowledge and its relevance to sustainable development/ Andre Lalonde.-In: concepts and cases.-edited by Julian T. Inglis.-Ottawa: IP on traditional ecological knowledge;IDRC, 1993.-142p.

In this paper the author draws his contribution from the fact that researchers recognise and continue to appreciate the role of indigenous knowledge in local ecosystems and biodiversity projects, policies and practices for sustainable development. The World Commission on Environment and Development (WCED) restates the right of all the relevant traditional roles in the complex resource development and management, including water conservation and anti-desertification practices. The author continues to highlight the salient differences in the African approach to modern scientific knowledge systems, pointing out that useful indigenous approaches have tended to be undervalued or replaced by colonial state policies. However, opportunities still exist for maintaining and transferring indigenous ecological knowledge as a case study illustrates in four resource areas: maintenance of biological biodiversity, biological and crop pest control strategies, recycling and fixing of soil nutrients and lastly strategies to conserve soil and water in the Barabaig Pastoral Management Project in Tanzania. In this case study, lack of water is the most limiting factor in common property relations. In this pastoral environmental, seasonal grazing regimes were recognised for proper land use planning. Routes to accessing surface water available to all Barabaig interests are not restricted. Water resources so available are restricted in such way that over use is avoided. As a management approach to the water resources, diversions and contamination tendencies are not acceptable to this pastoral community.

Health and disease in Africa: the community approach.-edited by Clifford G. Gould.-Nairobi: East African Literature Bureau, 1971.-372p.

This is a Conference Proceedings Report organised in 24 sessions covering several medical topics and with a regional perspective. Nearly all the case studies recorded are drawn from the countries in the Eastern and Central Africa Region in the period from the 1960s and through the 1970s.

In turn, the sessions mentioned above revolve around a relevant theme such as community health, social and cultural factors in health and disease pattern, endemicity, epidemiological assessments for prevention and control, transmission factors of parasitic diseases, immunisation problems and coverage among others.

These reports and individual contributions highlight how water plays a central role in health and disease dynamics. It is indicated that water can and actually plays a very important role as a natural facilitator of disease control and health promotion if pollutants are reduced to a minimum. However, these papers vividly demonstrate that water-borne diseases prevalent in hot climates can aid to cause havoc to communities if contaminated by pollutants and consumed by humans.

This report has also demonstrated relationship between water management schemes and the spread of tropical infections especially where irrigation projects to increase food production is equally justifiable. Galole, Perkerra, Mwea Tebere, Ahero, Bunyala are cited locations which manifest such conditions. Bilharzia and malaria are particularly prevalent. Land use patterns by populations increase and relocations have changed

the ecological habitats to new strains of diseases causing and infesting insects. To most of these health situations, general control measures, are mentioned, particularly the health seeking behaviours of the affected communities.

Wastewater irrigation in developing countries: health effects and technical solutions/Hiller I. Shuval.-Washington DC: IBRD, 1990.-56p. (Summary World Bank Technical Paper no.51).

This paper summarises the environmental problems associated with improper wastewater disposal practices in urban areas due to contamination through pathogenic micro-organisms or toxic chemicals. Since purification costs are high for developing countries, recycling or reuse would be the immediate alternative. In this case, wastewater irrigation provides the economic justification for this solution by recycling waste water for agricultural productivity. Bunzlau (Germany), China and other Asian countries provide good examples. The differential status for regulated or unregulated disposal are noted. Reclaimed water through irrigation has afforded fodder crops, seeds, landscaping, recreational lakes.

The shortest infection route from infested water to the susceptible human is through ingestion. Noting that the survival of these pathogens is entirely water dependant, effective treatment or purifications process become more important. Food sources such as salads and vegetables are grown using raw wastewater irrigation and as such technical solutions to stem disease transmission are a crucial necessity. Technologies of various simplicity and affordability such as stabilization ponds can be set up. These are able to hold sewage for up to 25 days by means of biological and physical processes. Concrete tanks are however a little bit expensive. The sedimentation for removal of most pathogens of the helminthic type is quite effective. Other control measures described include seasonal storage reservoirs, drip irrigation tubes and agronomic disinfection by occupation health workers.

Assignment children: a journal concerned with children, women and youth in development; people, water and sanitation.-Geneva:UNICEF, 1979.-45/46 (Spring 1979).

This Dossier draws from several institutions and methodologies in Part I, showing how successful water supply and sanitation can be achieved. The UNICEF/WHO Joint Committee on Health Policy - JCHP summarises the acute, yet unmet water supply and sanitation facilities for the majority. Six case studies from Bangladesh, Columbia, Ghana, India, Nepal and Philippines, factoring the determinants in each case are given. Irrelevant political, urban bias, undue concentration on grandiose engineering projects adversely affect rural populations. There is a real need to involve community participation as part of the public health care (PHC) Kenya, Malawi and Lesotho demonstrate the success in this approach. Village discussions, women in leadership roles and matters of practical concern are encouraged. Major operational problems in relation to perceived and real benefits are highlighted when improved water supply and sanitation education is effected. This kind of practical awareness leads to proper

pollution habits for the avoidance of universe risks. The UN water Decade (1981-90) emphasis participatory approaches targeting community acceptance and action. Self-reliance and new alternative provide sources of action including control and a new approach.

The participatory input had so far been under utilized. In urban slums, uneven water scarcities are evident for the millions as well. The children, aged and the poor disadvantaged usually face the hostile environmental hazards fully. Nevertheless, the urban development theories in most cases do sideline such marginal groups, with no assurance of safe and adequate water supply. However, despite the inherent structural problems as mentioned above, some success stories have been recorded for Colombia,. Bangladesh, India and Mali. Women's Self-help in Kenya's Kandara, Wangapala, Kitui, Lusigito, Turkana, Baringo (Masai) are described.

Water, wastes and health in hot climates.-edited by R. Feachem; M. Mcgarry; D. Mara.-London: Wiley, 1977. 399p.

The health aspects of water supplies in hot climates are accounted for by the manner in which water related infections occur, prevail and impact on human beings.

This book provides a comprehensive classification including : water-borne water-washed and water-based diseases and their major characteristics. Insect vectors and disease transmission in relation to sanitation problems to health are detailed. Each of the 20 chapters provide experiences by experts with numerous illustrations, sketches, tables and maps where necessary. The experts are mainly engineers, irrigation, community health and government agencies in water related resources and management. The existence of water bodies (man-made) and natural are also noted in relation to quality and treatment standards . Community based water sources, and planning in crisis situations are described and how effective operations can be accomplished. Domestic water use, choice, treatment and economics are described.

Institutional sanitation development by specific programmes for Latin America are provided.

The last chapter on sanitation discusses housing, waste collection, transportation, treatment and reuse potentials. Indian rural village sanitation practices and problems are demonstrated, including solid waste management. The long, technical descriptions highlight contrasting backgrounds as they differ with cold climates in tackling the various health and environmental problems. This comparative perspective affords insights into the nature and problems of water supply and sanitation approaches, technologies and assessment for environmental health practices.

Kuishi maisha yenya afya kwenye kingo za Mto Tana=healthy living beside the River Tana . - Nairobi: KWAHO. 49p.

This educational health tract covers the area among the Orma Wadei (Waday) Society. The germ theory among these pastoral peoples is unknown and for a long time, no effort had been made to achieve health education.

In this community, AFRIDEV pumps are in place, but for water treatment to remove contamination, no uniform solution has been attempted.

KWAHO's Division of Community Health Education materials in its shallow well programme is presented for culture specific audiences. The definition of germs, their mode of spread, effects on people and the need for family protection is diagrammatically sketched in Swahili language. Diseases common to this community are mentioned such as bilharzia and the other water related diseases. Water committees and their role in community participation are highlighted.

Contaminating excreta in germ infested water also causes diarrhoea, vomiting and worms by feeding on human. Boiling, filtering are recommended control measures. Transmission is by hand, dung, garbage, flies through feeding and food storage without proper cover. Other killer diseases are associated with water pollution from toxic or chemical sources. This booklet is written, illustrated and presented in a simple language. Many of the man-made causes of disease spread can easily be eliminated through added efforts on personal hygiene and general cleanliness.

Continuing education for health workers: Planning district programmes. Nairobi: AMREF; 1983.-237p.

This document provides a detailed introduction into the key issues involved for medical health personnel in their continuing education. It is noted that to remain effective, these workers, even after their initial training or qualification will still be encouraged to pursue upgrading courses. This document indicates how important it is that the best administrative approach be established. Who, where, when and the risk factors associated to achieve this programme approach at district level are considered. However, the most important aspect is to reduce the chances of negative outcomes which can feature during professional isolation, ignorance, inefficiency, disabilities and the like.

Hints are provided as to how to organise the planning, type of services, inventories, trainers, refreshers, budgeting and evaluation for modification if necessary according to the diserable or deserving programmes.

Baseline survey techniques are detailed in relation to health needs and service component, resources and other indicators. The environmental health questionnaire aptly relates the health workers competence against the chance that real human health improvement will be achieved by the specific district communities.

Environmental data needs will cover conditions such as dining, washroom, latrines, compound, Kitchen in built-up settlement. Relevant subjects would include refuse-excreta disposal management, promised inspection, slab construction, vermin control measures, public health law (application), buildings, food inspection especially meat, and water supplies in relation to communicable disease potential.

The proper understanding of how these training modules interrelate to achieve some decent health for the community is very crucial. The administrative concerns, materials, health-driven issues, skills and application of evaluative techniques summarise the context of this elaborate training guideline.

SIDA-supported health programmes in Kenya: Project document 1995/6 - 1997/8/Ministry of Health.- Nairobi: MoH, 1995, 93p.

This project document describes Kenya's health policy framework. The background, the situations analysis, strategic imperatives and reform agenda in health policy are highlighted. The specific SIDA-health support objectives in particular, health policy, capacity building in primary health care, environmental health community education, reproductive health and Moi University linkoping collaboration are focussed.

Detailed budget proposals are provided in tabular form by accounting for the devalued Kenyan shilling. Public policy matters account for 69.48% of SIDA's support intervention in demographic, disease transmission. The role of collaboration by NGOs is noted and appreciated, including key district level decentralised channelling of funding aimed at possible administrative efficiency.

Community mobilization are key movers in programme development for health and minor water supply projects. Emphasis and attention is placed on training and education especially in new technologies and approaches.

Disadvantaged, vulnerable or marginal groups will be approached especially in Rift and Eastern provinces. These areas pose major morbidity cases mainly attributed to unsafe and inadequate water supplies. Disease vectors are quite common.

The current latrine coverage of 50% and water supply of 45% can and should be improved. Affordable construction, collection storage and use will be encouraged. Sanitation methods such as pit, cat, septic tanks or VIP for the public will be community based. These programmes are identical at the Nairobi Headquarters, Kisumu, Siaya and Nandi. Budget figures in Kenya shillings are shown below in (brackets).
1995-96 (24,000,000); 1996-97 (21,000,000); 1997-98 (21,000,000)

Water and war: symposium on water in armed conflicts, Montreal 21st-23rd November 1994.-Geneva.-International Committee of the Red Cross(ICRC): 1995.-167P.

Vulnerability to facilities due to war attached on established water networks is of current major concern. This magnitude is such that a need to project freshwater supplies is paramount for basic life support of the populations at risk. This report highlights these concerns by noting that in war situations water supply and distribution channels become the immediate targets, thereby heightening rapid response to safeguard public health. Lack of water or abundant yet contaminated sources require immediate remedial response in such situations by utilising the existing legal provisions and the technical capabilities available.

Water as a vital, multifuctional resource serves the health function as well as habitat, carrier and industrial production processes. Due to the uneven regional scarcities, environmental migration, drought driven crop failures, unsafe water resources and especially the water related diseases, high infant morbidity and mortality is experienced.

This report presents the interrelationships that emerge between the water resources, health factors on the quality scale as they impinge on water-borne diseases.

The destruction of water supply networks has been documented in recent case studies for Lebanon, Aden, Iraq, Rwanda and Yugoslavia. Press photographs illustra-

tive of environmental health impacts have been provided. The recommendations agreed upon emphasise the necessity for absolute water supply system protection. Improved capacity for essential network reconstruction, private sector involvement on humanitarian basis are crucial. Information requirements regarding devastation awareness, predicted water shortages, medical alerts and rules governing water supply protection, installation and improvements attendant to these are obligatory.

Khartoum Workshop on: Epidemiology of Water and Environmentally Related Diseases (main report) Volume 1, Nairobi: NETWAS(AMREF); 1990 23p.

This seminar report conducted between 17th to 20th December 1990 by the school of Hygiene and Environmental Studies, University of Khartoum for academics and professionals details the results of key paper presentations from participants. NETWAS (AMREF) stressed that 80% of all sickness was attributable to inadequate water supply and sanitation and its training function will disseminate intersectoral and technical information in an effort to eradicate these diseases.

The epidemiological aspects of water-related disease and on how best to break their transmission routes are established. Community involvement and its significance is noted. So far, research had established that positive impacts in water supply and sanitation in an integrated environment with other basic services are attainable in public health for communities. Water-treatment methods if effective and low-cost are recommended. Pathogenic removal, storage, sediment coagulation and flocculation, irrespective of water source provides a key intervention. For instance, in Sudan it is reported that 70% of hospital cases are due to gastro-intestinal infections, a major public health concern. Contaminated, viral abundance can be minimised by removal through chemical, biological, anaerobic digestion and composting means.

The size of schistosomiasis, its health, economic effects, treatment and control considering dangers of chemical solutions are tackled in this report.

The relationship between irrigation and malarial endemicity was clarified, including problem areas and solution provisions. Four task presentation tables are used to illustrate various collaborative activities for future seminars where engineers and other professionals are represented or involved.

Participatory methods training of trainers workshop 23rd March to 1st April 1992. Nairobi/Water Resources Commission/UNDP World Bank- Regional Water and Sanitation Group, Eastern Africa.-RWSG/NETWAS, 1992, 72p.

The Kibwezi Regional Workshop on participatory evaluation and monitoring methods (November 1990) provides the essential prelude and impetus to promote PROWESS - Promotion of the Role Women in Environmental Sanitation Services. These projects were mainly located in Eastern and Southern Africa. Within this context, PROWESS, a special UNDP project drew constant attention and scrutiny to demonstrate how women's involvement in water supply and sanitation management and maintenance became institutionalized. It was noted that there were massive water supply installations in most countries for the 1970's and much of the 1980's in response to the

International Decade for Water Supply (1981-90). The concerned felt the necessity that any community involvement had to move along with supply efforts in a more consultative environment to justify the huge investments as measured along service. Success, and women were particularly targeted to increase effective sustainability and as crucial partners. This household level status required enhanced decision making components with the supposed benefits in mind. Africa, Middle East and Latin America provides exciting examples.

The benefits include better maintenance, higher cost recoveries, improved practices and other spilt-over socio-economic gains. Understandably, target-oriented top-down approaches have so far tended to demonstrate failures.

Awassa in Southern Region of Ethiopia case (1991) workshop trained trainers from government in a learner-centred mode. The self-esteem, associative, strength, resourcefulness action planning and responsibility (SARAR) approach was used with some considerable degree of success. Water Supply and Sewerage Authority (WSSA) administrators were confident about the critical capacity building and self-reliance afforded by this workshop for Ethiopia in particular.

Slow sand filtration/Huisman, L. and Wood, W.E.-Geneva: WHO, 1974, 122p.

This book suggests that safe water quality from source for drinking or domestic use should contain less harmful agents even when ingested over prolonged periods. The removal of pathogenic, parasitic, radioactive or toxic substances from surface water according to the (WHO 1971) International standards for drinking water acceptable levels is discussed. However, of all the elaborate treatment methods - such as distillation, electrodialysis, - filtration as an ancient water technology is still effective, and affordable, espeically in resource scarce countries. Factors which determine mode of treatment depend on raw water sources and treatment processes for their purification.

Sand filters are more common for surface, than underground sources. The reason for filtration is historically linked to the bacteriological success in purification achieved during much of the 19th century Europe.

Several elements of a sand filter are illustrated, including site photographs. India, Britain, Surinam, Ruhr, Rotterdam and Amsterdam are covered. Slow sand filters are popular due to improved water quality, simple construction, cost and ease of operation, conservation and sludge storage.

These technologies enhance the general environmental stability and are desirable. Several detailed designs are diagrammatically provided.

The operation and maintenance aspects regarding the commissioning, cleaning and resanding (mechanical methods) with the associated factors are given. The determination of choice of method is mainly influenced by the need to which the water will be put.

Detailed technical annexes on various kinds of slow sand filtration systems such as under-drainage are provided.

Participatory hygiene promotion artists workshop.-Maseno, Kenya, 11 -15 April 1994.-35p.

The Participatory Learning Network (PALNET) organised a 5 day workshop at Esiepala Cultural Centre in Maseno, Kenya which brought together artists and trainers from Uganda and Kenya. Its objectives were to enrich artists' skills in designing, reproducing and adapting participatory hygiene promotion materials; to develop a field oriented guide for artists and; to design sequenced prototype kits for hygiene promotion.

Attributes of a good participatory artist were discussed.

Participants were introduced to participatory materials and tools such as unserialised posters, flexi-flans, barriers matrix, sanitation ladder and three pile sorting. Oral (faecal) contamination routes were discussed with a purpose of enabling participants understand commonly spread faecal-oral diseases and preventive measures.

In order to enhance artists' creativity in the reproduction of participatory hygiene related visual aids, material reproduction techniques, drawing guidelines, colouring, electrical stencil cutting, desktop publishing, silk screen printing and graphic design were introduced to the participants.

The setting up of resource centres for the inventory and storage of materials was suggested. The resource centres would provide access to resource materials and equipment, provide workshop and teaching facilities, provide a local body of knowledge and experience on health education and offer technical support to artists and agencies in implementing health education programmes.

Lastly an evaluation of the tools discussed was made and tools for adoption recommended.

Rain water catchment systems: proceedings of the second national conference in rainwater catchment systems in Kenya, Nairobi, 30th August-4th September, 1992.-edited by G.K. Bambrah et al.-Nairobi; 262p.

Rain water harvesting in Kenya is a very important water supply source than ground water. Problems of collection, storage and use including the environmental health impact or potential are introduced in these proceedings. This report, arranged by sections provides expert contributions on the art and status of Rain Water Harvesting (RWH) and it's principles. Kenyan's vital demographic and other relevant background information, the gender role matters are presented. According to an observation 25 water deficit districts account for 88% land mass and only 35% of the population, concentration in only 12% of the land mass. Roofs are major catchment sites for runoff water whereas storage is achieved by an assortment of tanks used for domestic, livestock, agriculture (cistern irrigation), dams and reservoirs.

Important estimates are provided for sub-Saharan Africa by the "Sahara and Sahel Observatory" whose forecasts indicate that for East Africa populations will rise tremendously resulting in corresponding demand as follows: 1988 (116.3m people), 2000 (168.9m) and 2025 (324m). This projected population numbers will necessitate a gross demand of 800 cubic metres per capita per year.

The gender variable for Kenya illustrates women's central role as managers. In most cases, women are prime movers as far as primary health care is concerned. Community appraisal and cost management potential are detailed in section 2.

Vulnerable groups are treated in section 3 while environmental matters, and particularly the quality of urban runoff, water pollution, risks from refuse are well articulated. Key case studies on this aspect is provided for the Siaya Health Education Water and Sanitation Project (SHEWAS). Crucial discussions, several illustrative RWH diagrams in tabular form including useful source reference are also provided.

Technology, gender and power in Africa/Patricia Stamp.-Ottawa: International Development Research Centre, 1989. 185p. (Technical Study 63e).

This book is a summary of the academic basis of power in gender issues, drawing several documented examples from Africa and elsewhere.

Relying on quotable texts, examples are given for Sudan in which the women's marginalisation with their male counterparts in power relations is exemplified. Modern water pumps are in place though women have to stay in long line ups to the sources. There are frequent pump breakdowns which can be frustrating. The high cost of donkey journeys, in addition to the seasonal character of water sources challenge the women's role and access to the enabling technology. Referring to several other cases, solar pumps availability helped to change the women's work patterns such that questions of technology were heightened. A detailed case study of Mwea Rice Irrigation scheme shows how women appeared less empowered in relation to their husbands in exploiting the economic opportunities afforded by a government parastatal, the National Irrigation Board. Women supplied the key labour, but little was spared to reward their effort. In fact, it is shown that they actually suffered most due to their inability to maintain a minimum household health status. Polluted water causing rampant schistosomiasis, diarrhoea provided real havoc for child survival and nutritional intervention. Even the local "Maendeleo Ya Wanawake" Organisation merely acted partisan in crucial resource matters by piecemeal contribution to their rural sisters. The material water collections resources and technologies were dominated by the elitist groups. Nicaraguan women never used latrines and in Panama women acted as resource guides.

In summary, the existing research designs have continued to maintain certain discriminative or undesirable construction and when analyzed proved incapable as approaches to alleviating women's problems.

Water for rural communities: helping people help themselves/ John Briscoe; David de Ferranti. - Washington D.C.: World Bank, 1988. 32p.

This world Bank paper presents summaries of the salient factors considered beneficial to community water supply, placing the people's role at the centre of success in partnership. The role of international facilitation as community coordinators is provided.

It is noted that prior programmes of external support agencies such as the world bank often failed due to marginalising the community's role in the water supply and

sanitation sector activities. As a corrective response, community participation in decision making , investment, maintenance, organisation of these programmes was encouraged as a shift in policy approach. Governments and donor agencies would better act as facilitators. Water availability and quality, was improved and morbidity and mortality levels from cause agents were reduced. Structural adjustment policies are generally inflationary, giving rise to vulnerable groups which have to be catered for. Examples from Kenya, Tanzania, Malawi illustrate the various levels of success or possible reasons for failure. Other lessons (in box cases) are drawn from South East Asia, India, China and Cote d'Ivoire.

Generally, consumer willingness to take responsibilities for these programmes helped achieve some considerable success and benefits, despite the various pitfalls for all agencies involved. In Colombia, promoters play a key success role as well as in Malawi. Figures, tables box cases provided illustrate useful insights into the facilitating and controlling requirements for the possible success of community water supply and sanitation projects and programmes.

Expert communication meeting on how to involve women in rural water supply, sanitation and water resources protection project/Penina A. Ochola. - Report of the workshop proceedings, Naro Moru, Kenya, 15-27 February 1993.-49p.

This report is the outcome of a suggested field manual initiated by the Dutch Government for Participatory Workshops. It covers projects in Africa, Latin America and Asia. The purpose of this manual is to assist agencies plan and execute gender-sensitive water projects through the project cycles in an apparently hitherto neglected area of concern. This two-week workshop drew representative participants from Africa, Asia and Latin America for which the manuals were planned.

The Kenyan delegate depicted the struggling experience to see through the several projects. White elephant or failed pump projects have of late received the community participatory therapy.

Zimbabwe depicted the team approach faced with the challenge of sustaining women's participation in pump maintenance and how they tackled the issue.

Ghana's case involved a social researchers' effort to change people's unhygienic behaviours where water defecation is common.

The message is that the ideas which emerged from project experiences by the participants aimed at gender-specific matters and their possible solutions.

This report summarises practical inputs and strategic interests, including the various steps taken into account for the manual compilation. The rationale for women empowerment, participatory and project sustainability is presented. Dam construction habitat changes favourable to parasitic and water-borne disease, chemical pollutants (fertilizer-pesticides) sources are well linked to environmental impacts. Such vital linkages in turn affect the health status of the communities. NGO profiles such as WEDNET-ELCI and other women research questions are tackled.

Kenya poverty assessment report/ the World Bank. - 1995.- xxi, 115p.

This report details on the participatory poverty assessment (PPA 1994) and the welfare monitoring survey (WMS 1992) Techniques are applied to the new understanding of the poverty characteristics, levels and recent trends in Kenya. It clarifies the economic or significant factors which influence the dynamics of the well-being in the rural and particularly the urban poor. Rural infrastructure is statistically tied to family or district level data in relation to the relative water supply and sanitation scarcities. It is noted that the canning approaches to water supply and environmental hygiene management require decentralised community level control, ownership and participation. The government, donors and the community as the key actors in this sector need to introduce participatory approaches for all projects. PPA poverty experiences would provide the critical insights for small and self-supportive communities. Relevant, timely donor funding, a favourable legal framework facilitated by government, the enabling technical and material support would be quite essential for the desired achievements. This kind of arrangement has in fact elicited the new rural water fund concept which should also take into account the requirements of the most vulnerable people in both the rural and urban settings. Hopefully, such vulnerable groups would eventually benefit from the costing and expenditure knowledge as practised by the richer strata.

Chapter 1 gives Kenya's poverty profiles 1982-1992 indicating the differential changes that have so far taken place. Chapter 2 highlights the need for rural revitalisation; particularly for districts in Kwale, Nyamira and Busia Water Supply and Sanitation projects. Water coverage, distance reductions to source and quality are the key issues considered. Poverty-focused public expenditure and related activities in the health sector are presented.

Compensatory subsidy for the very poor as evidenced by indicators would target the slums described. Several annexes, tables, explanations, box cases indicating poverty magnitudes are generously provided as sources to the several field studies documented.

Rain and storm water harvesting in rural areas/United Nations Environment Programme (UNEP).-Dublin: Tycooly, 1983. 238p. Report.

This book reports discussions by UNEP consultants held in Nairobi on 30th October 1979 to deliberate on rain and storm water harvesting in Africa, Asia, Australia, Central America, China the Pacific and the Middle East.

Water harvesting is the deliberate collection of rainwater from surface catchments and its storage to provide an adequate supply of water when needed. This process differs from the natural runoff into perennial rivers which is then controlled and stored in dams and reservoirs. Many regions in the world where rainfall is heavy by some season and scarce in others would benefit due to storage capabilities during the drier periods.

The purpose of the Nairobi meeting was to assemble the existing technologies for water harvesting and to select the most feasible and effective methods for follow-up demonstrations in the field, observing the operational conditions by climatic zoning and to recommend to the communities concerned. This exhaustive information in-

cluding the recommendations made represent the initial effort to focus on several methodologies for wider application and promotion. The importance of achieving safe water harvesting is highly desirable. The world-wide technologies so far compiled relating to the collection, storage, treatment, distribution and use of rainwater and stormwater harvesting in rural areas are provided in summary. This listing also includes all the other forms of precipitation as sources of safe water supply.

Will Africa have enough water?/Catherine Amida.-in the Daily Nation, Tuesday November 10, 1992. p17. Col. 1

In the face of the devastating drought that has hit parts of Africa, any drop of water means the difference between life and death for the affected people. But is unfortunate that the quality of most of the water so consumed in Africa is below most of the accepted standards of safe drinking water.

This special report on water crises in Africa addresses this problem. In some parts of Africa, it is common to encounter people whose warm smiles reveal yellow and brown teeth much like tar-stained by heavy smokers. However, most people do not smoke as such. Indeed it is the effect of water they drink in some parts of Africa where water is fully concentrated with fluoride. How safe is the water we drink in Africa? A part from the familiar use of senses of smell, taste and sight, it is not easy to tell what undesirable elements may be contained in the water. World Health Organisation (WHO) figures reveal that only 10% of the water drank in Africa is acceptable to its guideline standards.

The dangers of not accessing water at all include the inevitable risk of poor hygiene causing or occasioning a myriad of diseases such as scabies, typhoid, schistosomiasis, resulting in increased infant, child and mother mortality.

Kenya country gender profile/ The Royal Netherlands (DGIS). - Nairobi: Acts, 1994. 106p.

The publication provides the researched gender profile concerns into the mainstream issues. Sectoral problems of development such as environment, health, water, new technologies, empowerment for women are described and analyzed.

Presentation is made in seven chapters. Health and other relevant data derived from National sources and surveys are utilised extensively to demonstrate the gender sensitive aspects of women's participation. Key demographic issues such as morbidity, mortality age-specific rates are included to address such issues. Living conditions, especially the access to safe and adequate water supplies are noted. From the environmental point of view 50% of all diseases in Kenya are attributed to lack of or use of impure water with rural women being the most affected.

Tabular indicators reveal that although 92% of planned urban supplies are in place, access is possible to only 53% in slums and 42% in the rural areas. Regional variations are given and accounted for. For instance, Kakamega is under covered as compared to Embu in the case of improved sanitation and safe water sourcing. Pollution by seasonal variations are also accounted for in five districts for which UNICEF has published field data.

Lack of personnel, financial constraints and negative or unprepared community attitudes will hamper both the quantitive and qualitative targets for quite some time. Increasing pollution, the inability or disposal difficulties of excreta from the most vulnerable groups (65%) of the population remains a matter of national concern. Data on excreta disposal means for unplanned areas in Nairobi, Mombasa and Kisumu show critical inadequacies. For instance, Kisumu records impressive facilities, yet the environmental situation would indicate otherwise.

Evaluation for village water supply planning/Sandy Cairncross.-Chichester: Wiley and Sons, 1980. 179p.

This book presents the need for increased evaluation activity, particularly acute in the village water supply sector. The general goal of the International Drinking Water Supply and Sanitation Decade (1981-90) is to improve the water and sanitary services enjoyed by the population of the developing countries. The particular goal is to provide all the world's population with adequate access to safe water and hygienic latrines by the chosen time and technologies.

This book is also a methodological handbook to assist those actually designing or performing an evaluation of the water programme. The nature and purpose of rural water supply, construction, appropriate technology, the importance of good maintenance, the need for water quality surveillance, the possibility of achieving health benefits, the role of community participation, the need for communication and extension services, the difficulty of reaching the poorest groups, the need for sound administration and financial planning, the possibility of achieving a wide range of benefits are all addressed. There exists some considerable evidence that the improvements in domestic water supplies should go hand in hand with improvements in excreta disposal if the health benefits from each investment are to be maximised.

The Kenya national environment action plan (NEAP) Report/Ministry of Environment and Natural Resources.-Nairobi: MENR, 1994. 203p.

This report is the product of several efforts by the nine national task forces for the plan, providing a comprehensive presentation in eleven chapters. The water resources, environmental pollution control, waste management including their health impact are described and analyzed in chapters 4 through 7.

Pollution is defined as the presence in the air, water or land of those contaminants in quantities which are uncomfortable, injurious or harmful to human, plant or animal life and property. This report typifies such pollution as; gaseous, liquid and solid. Gaseous emissions mainly impact on climatic changes and ozone depletion causing skin cancers of one kind or another through ultra-violet action, acid rain and forest destruction. Liquid wastes are emitted by growing populations as they exploit agricultural resources in industrial processes through pollutant discharges and various effluents.

Solid wastes are mainly composed of municipal and urban domestic organic garbage. The main problems concern the collection, storage and disposal of these ever increasing loads. Land fills are bloated, groundwater contaminated with a sickening smelly experience. Policy wise, pollution control can be achieved through legislation. Bacterial solutions include constructed wetlands for water purification (swamps, ponds). Industrial effluents include textile toxic elements in which PH depressions exacerbate pollution. Noise is also mentioned causing learning impairment, chronic headaches, stress and general fatigue unacceptable to human well-being.

This report provides several interconnected policy, financial and management tips in an attempt to solve these health-related problems resulting from the degraded environment.

Water reuse a realistic step/Beatrice Moraa. - in water and wastewater magazine, February 1990, p.14. cited in the Standard 4th July 1990 p.15 col.1

The journal informs on how wastewater reclamation can solve major water shortage problems in rapidly growing urban areas in the developing countries of Latin America, Asia and Africa. The rate of urbanisation is more rapid than the case for the developed world. The inevitable consequence of urban growth is the inadequacy of water resources for disposal of waste-waters.

Water reclamation for non-potable reuse has emerged as a realistic option for new sources of water meeting urban needs in the industrialised world. There exist potential and attractive applications for cities in the developing world. A few of these cities have developed such water supplies adequate to match with the demand.

Reclaimed water can be used in agriculture, industries or households. The article stresses that customers can choose to pay lesser price per unit of reclaimed water than for the freshwater alternative. Urban reclaimed water for irrigation is quite economical since its nutrient contents produce the more attractive lawns, reducing or eliminating the need for commercial fertilizers. Brazil is a classic example of this aspect.

It is cautioned that health hazards be avoided in the reuse of waste-water. Wholesale ingestion should be avoided at all costs. The most important quality objective is that the water must be adequately disinfected for disease control. The best attributes required of the water should be present: clear, colourless, odourless and with the required turbidity.

Waste stabilization ponds: a design manual for Eastern Africa/D. D. Mara.- Leeds: ODA; Lagoon Technology International, 1992. 122p.

Waste Stabilization Ponds (WSP) are a most appropriate method of wastewater treatment. They are widely used and are particularly appropriate in warm climates of developing countries.

This manual will permit engineers in government and private sector in East African Region to design, construct, operate, maintain, monitor and evaluate pond stabilization systems more effectively.

Pond effluent are especially suitable for crop irrigation and fish pond. Stabilization and pond systems may therefore achieve an increasingly important role inn food production in the region.

This manual is intended as a comprehensive guide for the design, operation and maintenance monitoring and evaluation and upgrading of WSP systems in Eastern Africa.

Section 2 reviews WSP usage in some of the countries in the region while section 3 provides brief functional principles. The process design of different pond types (anaerobic, facultative and maturation) is described in detail in section 4. Annexed examples in section 5 details physical design, section 6 the operation and maintenance requirements, recommendations for routing effluent and quality monitoring. Section 7 provides pond rehabilitation and upgrading is described section 8. A checklist for the environmental impact of WSP is annexed. Finally, section 10 covers agricultural and acquacultural use of treated effluents with emphasis on measures for the protection of public health.

The tears of the crocodile: From Rio to reality in the developing world/ N. Middleton; P. Okeefe; S. Moyo.-Nairobi: East African Educational Publication, 1994. 228p.

This Earth Summit (1992) report notes that the acute poverty experienced by the developing world will continue to exacerbate environmental degradation and pollution mainly pushed to the south by the spread of the Northern consumption patterns. The United Nations conference on Environment and Development (UNCED) seems lopsided and biased in it s understanding of the pollutes pays principle. Telling statistics reveal that the south produces only 10% emissions, reabsorbing 90% whereas the north produces 90% emissions but can barely reabsorb 10%. These global north concerns demonstrate interest-driven industrial activities.

The eleven chapters give participatory approaches regarding grass root water and waste management efforts, citing comparative international data in water supply and sanitation. Water supplies though abundant provide a problem in distribution by region and by country. The potential for increasing or improving safe water coverage is hampered by population increase, corruption, poverty and attitudinal rigidities to behavioral change. It is indicted that in 1990, 1.33 billion people did not get safe water against 2.25 billion without proper sanitation. Paragraph 47 of Agenda 21 notes that the consumption of contaminated water accounted for 80% of all diseases, one third of the deaths and other water related risks. The common disease mentioned include: diarrhoea, typhoid, cholera, yellow fever, roundworms, malaria, schistosomiasis (bilharzia), onchocerciasis (river blindness) guinea worms and liver-fluke. Sub-Saharan Africa realised a 40% safe water and 30% sanitation provision rates according to the UNDP's Development Report (P.130) (1991-92). The authors provide exciting and informed critiques regarding the underlying long-term causes of and solutions to environmental pollution. Sound disposal techniques supported by implementing the WHO guidelines and observing the Bamako Convention to ban to imports into Africa and the control of transboundary movement of hazardous wastes (1991) should be pursued.

Effects of industries and other land use systems on the water quality within Nairobi river sub-catchments/ Shadrack M. Kithiia.-University of Nairobi, 1992.-163p.

This thesis examines water quality and its deteriorations in the upper-Athi Nairobi Sun-catchments covering 1154.4 km2 with an annual discharge of 9.9 $x10^4$ m3 per year; basing on field and laboratory analysis of water quality.

The assessment of land use for industrial and agricultural activities demonstrates how useful the industrial (manufacturing) and agricultural (irrigation) activities are to the measures of water quality deterioration. Collected water samples from the two distinctive land use activities analyzed by the different water quality parameters, notably the presence of heavy metals and pesticides were recorded. The findings show that water quality deteriorated from river to another in relation to land use activities. Ngong river exhibited the highest water quality deteriorations at 0.42 Embakasi, Nairobi river at 0.39 Dandora and the least, Kamiti river at Kasarani. Harmful effects to humans due to domestic water usages were therefore established. Fluoride, malathion, pesticides (DDT) surpassed WHO's and the Kenyan guidelines standards and recommended levels for drinking water quality.

The evaluation of water quality status by different uses within the study area for groundwater and surface is recommended with the attendant human health aspects. Proper land-water conservation practices incorporated within the overall water resources management is noted. Sources of water pollutants will be managed for quality improvement and monitoring.

Water supply and sanitation versus human health/J. S. Kilani.-in technological solutions for economic development in Kenya: now and the 21st century. -edited by G.S. Agoki et.al.-JKUCAT, JICA, 1991 pp. 50-64.

Water is both a basic need for life and it can be a vehicle for deadly pathogens. While for many decades, sanitary engineers and health professionals have considered safe water as a prerequisite for a comprehensive, effective medical intervention, economists and planners have rightly questioned the benefits of water supply. The other health interventions have competed the with water sector for resource allocation giving rise to a credibility gap that, the medical professionals and the sanitary engineers have not been quite successful at resolving.

This paper is an attempt to show that innovative approaches can overcome professional barriers between health specialists and decision makers and between economists and engineers.

The paper further highlights that (1) main health aspects accrue from the availability for unlimited quantities for water, whatever its quality. (2) wastewater recycling is necessary for increasing water resources and appropriate health safeguards can be developed with respect to each usage category. (3) The assessment of the impact of water management projects needs to encompass the overall change expected to result from the project. (4) Engineers techniques and non-medical interventions in water management can be shown as the most cost-effective measures for disease control. Hopefully, this paper effectively assists water engineers and researchers in related fields.

Water in: a household welfare monitoring and evaluation survey of South Nyanza district.-Nairobi: UNICEF, July 1991. pp 80-88.

In this report, the availability of clean potable water within easy reach sustains vital life processes.

Sources of water, during both rainy and dry seasons are discussed. Several tables including accessibility in table 6.6 are given and household distribution by the water source. Reliability of supply, fetching and quality including its treatment methods have been discussed and supported by field statistics. Distance of water sources, storage and control of these sources are some of the issues and interests discussed in this study.

Sanitation has been studied in the last chapter, concentrating on the availability and type of toilets owned by the households. The availability of bathing facilities at the house, and the probing of water-borne and related diseases including diarrhoea, malaria and the connected issues are presented.

Table 6.7 indicates the distribution of household toilet facilities by division while table 6.8 shows the cases due to water-related diseases by division. This study will hopefully appeal to the teachers, environmentalists, researchers or even individuals working in familiar or similar fields. The message is that effective water resource management has a direct bearing on economic activities of particular communities and due attention to the communities and relevant issues could serve as a good starting point.

Working group of the water supply and sanitation collaborative council: report for consideration at the Barbados meeting, 30th October-3rd November 1995. - 20p.

This report on the promotion of Sanitation is a response to the telling situation where millions of people are unserved and undeserved in sanitary provision including the group findings and recommendations. It is noted that the group between global population growth and sanitation provision is widening to unacceptable levels (2 billion projected to 2025A.D)

Problems identified include: political will, low prestige for the sector, poor policy and institutional frameworks for sanitation programme implementation, inappropriate approaches to most needy rural and urban populations. Better demonstrated programmes should be put in place. Change by community participation has been established for the better. Important working principles for success include demand-based sanitation programmes, incremental affordability and sustainability, gender-sensitivity at all stages and levels, including biocultural understanding.

Programme features are given pin pointing certain wrong assumptions commonly held about sanitation. Apart from such advocacy, a new people principle based programmes should be incorporated. A more rigorous professional focus on sanitation science is suggested. Several demonstration programmes are cited e.g. India's Sulabh International Sanitation Programme serving 35,000 people; SARAR Participatory Hygiene and Sanitation Transformation (PHAST) methodologies for Eastern and Southern Africa (1993); PROWESS for Kenya, Uganda, Zimbabwe and Botswana sites;

HESAWA school health clubs and sanitation package for Tanzania (1994) Lombok (Indonesia) sanitation programme whose 46 private entrepreneurs have assisted build over 20,000 latrines each year. Other projects cited are: Mvulamanzi Trust Sanitation, Zimbabwe and Kumasi Sanitation (Ghana).

Proceedings of the operation and maintenance working group meeting, Geneva 31st May-3rd June 1994/ World Health Organisation.-Geneva: WHO, 1994.-54p.

The Water Supply and Sanitation Collaborative Council's efforts and meetings notably (Oslo 1991) provides the background on how it would relate host institutions and the WHO for the operation and maintenance programmes.

Eight detailed presentations on experience in operational maintenance are given. Perceptual leadership, gender and skills training are highlighted to demonstrate partnership activities in latrine emptying systems as those used in Dar-es-Salaam. Mozambique faces unique problems in establishing and sustaining standardised systems, decentralisation, political and tariff policies. Fisalabad Water and Sanitation Agency in Pakistan provides the infrastructual and institutional example through improved management interventions. The reduction and control of uncounted for water in Sao Paulo, Brazil presents a successful three-step action in reducing leakages to acceptable levels. General problems and how to address them are presented in one of the papers. In Geneva, a successful methodology of leakage detection and control is established. The central America, Panama and Dominican Republic CAPRE-GTZ 12-country coordinating committee since 1993 has adopted progressive low-consumption leakage costs. A case study on a pilot community-based rural water and sanitation project for Ghana is given for borehole drilling with handpump committees, capacity interventions and productivity gains. Several constraints are evident in all these cases and possible solutions suggested in each case. Proposed additional activities of the working group for sustained success are suggested. Summary Annex 1,2,3 and 4 complete this elaborate document.

Environmental health engineering in the tropics/Sandy Cairncross; Richard Feacham.-Chichester: Wiley and Sons, 1983. 283p.

Many major infectious diseases in tropical and developing countries can be controlled by various environmental interventions,

This book describes these infections and the interventions that could be used effectively against them. The book is arranged in sixteen chapters each divided in four parts: health and pollution water supply, excreta and refuse, treatment disposal and reuse and the environmental modifications in vector-borne diseases.

The infections described include diarrhoeal diseases, the common gut worms, guinea worms, schistosomiasis, malaria, bancroftian filariasis and other mosquito or insect borne infections.

The environmental interventions that receive most attention include domestic water supplies and improved excreta disposal and the relationships between these interventions and infections disease are clearly documented in detail.

This book is also concerned with engineering methods to improving the health of the poorest sections of the world's populations. It also addresses the availability of the know-how and the technology to bring about the desirable improvement and facilities to the poor at a cost which they and their governments can afford.

This book is intended for both those from the engineering backgrounds and those from the medical, and particularly public health, researchers and other practitioners.

Proceedings of the advisory committee meeting of the operation and maintenance working group, Geneva 26th February-1st March 1991.-Geneva: WHO-GTZ, 1991.-31p.

This report demonstrates that despite reported cases of successful water supply and sanitation schemes, progress in sustaining even 50% of the existing operation and maintenance (O&M) systems is unreliable in most cases. Therefore a strong case for concerted efforts to correct this situation so that no lost opportunities recur is studied. Governments and external support agencies as partners should help avoid major losses in operation and maintenance investments, especially at the design stages and the long-term sustainability.

Meetings since 1988-1990 identified major constraints regarding their effectiveness, proposed coordination efforts and key issues. Inadequate data, misuse of funds, poor management of the existing water supply and sanitation facilities, inappropriate system design, the low profile of operation and maintenance, inadequate legal polices and political interference are the key problems. Specific activities to address these for desirable improvement are suggested.

Criteria for national and several global project proposals are described. Guideline for comprehensive O&M should include the following components: background objectives, scope description, estimated costs, outputs, assessment of O&M, the status of WSS systems resources, training (human resources development) in O&M. Key recommendations by the Advisory committee include WHO's focal promotion; funding to implement projects; prioritisation of operation and maintenance in sectoral concerns of external support agencies (ESA's). Several guidelines are provided in an Appendix.

Proceedings of the meeting of the operation and maintenance working group Geneva, 19-22 June 1990:Case studies on O&M of rural and urban water supply systems.-edited by H. J. McPherson.-Geneva: WHO-GTZ; 1990.-131p.

This volume reiterates the realisation that somewhere between 30% and 60% of all water supply facilities are not operational at any given time and that maintenance is of a crucial concern for governments and partner agencies.

The World Health Organisation has since 1988 formed a working Group of some 40 water sector organisations globally whose participants account for the cited country papers from Zambia, Malawi, Zaire, Sudan Lesotho, India, Vietnam, Brazil, Mexico, Ghana, Nepal and the Asiatic Region. This volume highlights the causes and problems due to operation and maintenance and the decade's lessons.

For improved operations and maintenance in the sector, funding, external support, appropriate technology use, proper system design, institutional performance for long term sustainability provide matters of relevant concern.

A detailed description for the sustainability of rural water supply in Sudan and the key role of operation and maintenance strategy is presented. Technology selection for Lesotho is cited as gravity systems with a few handpumps. Projects for the Ghana water and sewerage corporation in the community context and the progress achieved are noted. Funding in Zambia and Malawi are described. Gravity fed schemes for Zaire projects are described. Hanoi's Integrated Management Teams demonstrate success in environmental pollution control. Deep well handpumps for India, leakage control for unaccounted for water in Grater Kathmandu (Nepal) and Brazil's case are given in detail.

Food, water and family health: a manual for community educators/ Lucy Clerk; Ettice de Loache.-Geneva: WHO;UNDP, 1994.-v, 99p.

This manual is intended for community educators in this case teachers, health workers and community organisers involved in promoting healthy practices. Family members sharing knowledge with relatives, neighbours and friends are also valuable educators.

The time and energy spend by women and young girls fetching and transporting water, lack of clean and safe water, open drains and puddles filled with faeces which make life unhealthy and uncomfortable, flimsy latrines and disposal of children's faeces all over the community, people defecating or urinating near water sources and sharing of water with animals, are some of the problems common to communities that are discussed.

Diseases such as cholera, typhoid, dysentry, bilharzia, malaria and worm infections caused by unclean water and bad sanitation are mentioned. Ways of keeping water supplies safe and some rules for safe water for the community are suggested.

Formation of water users' groups and water committees can help communities improve their environment. Their functions and responsibilities are discussed. A checklist for getting and maintaining tube wells has also been provided.

Methods such as boiling, chlorination, filtration, sedimentation and radiation (sunlight) which can be used for making drinking water safer have been discussed. Proper latrine use and maintenance is also included.

Health problems such as diarrhoea, guinea worm, schistosomiasis, AIDS and malaria have also been examined in terms of their transmission routes, prevention and control.

Personal health and hygiene and the importance of good nutrition and body cleanliness are stressed. Maintaining of kitchen gardens, composting, planting trees and fish farming by communities are suggested.

The importance of a woman's health during pregnancy is also included in this manual. Warning signs during pregnancy, family planning and immunisation are discussed. The manual is accompanied by some posters depicting some of the topics tackled.

Low-cost water supply for human consumption, cattle watering and small-scale irrigation/ DHV Consulting Engineers.-DHV, 1983.-79p.

This Publication estimates that 4 billion people are unlikely to have sufficient clean drinking water at their disposal and that low-cost investments in the construction of wells, boreholes with locally made equipments such as pumps, spare parts for productive use, will certainly appeal. Populations to be served are estimated to vary from 250 for some handpumps to 750 people by the cylinder types. Water from aquifers nearest to surface is bacterially polluted so that drilled wells of atleast 10m deep are suitable. The SWN 80 and SWN81 pump types can lift water from depths of upto 100m.

Groundwater survey methods and equipment is achieved by villager knowledge, areal vegetation and photography and test drilling to establish availability, quantity and quality. This publication provides descriptions of sizes, number of structural components for variety of hand and mechanical dug or drilled pumps and well specifications. Several simple diagrams are given to illustrate the various features depending on the intended purpose of each component.

Proximity of irrigation wells to the house is recommended for enhanced food production. Pump attendants will be selected by community users themselves or a group of villages can appoint one of its mechanics to serve 100 wells for 25,000 people. Sub-workshop work can be commerce, while the central workshop stores supplies, manufactures, assembles and trains the pump artisans. The success of pump functioning and repair mainly depends on user behaviour. Clean water availability affects health positively, the reverse is disease endemicity. Pump technology to support water supply and sanitation sustainability is quite crucial. General and specific operational instructions are provided for sustainable performance.

Parasitic disease in water resources development: the need for intersectoral negotiation/ WHO.-Geneva: WHO, 1993. 152p.

This book provides the documented health impact of various water resource development projects in which prevention and control measures could mitigate adverse effects for several African, American, Caribbean, South East Asia and West Pacific regions. The main cause of aggravated health risks is the demographic and health ecosystem changes bearing on man made structures like dam sites or built up environments. Irrigation systems for agricultural or domestic water consumption strain the resource capacity of the ecosystem balance, triggering the presence of several parasitic diseases hence the undesirable environmental health problems.

Several country experiences and examples are provided from water development schemes, small village dams, vertical control programmes. Failure in health policy implementation and agreements at the United Nations level is highlighted.

Coloured photographs in text clearly depict irrigation malaria links, schistosomiasis prevalence, strip mining and mosquito linkages. Population groups at risk of health problems include settled, migrant workers, fishermen, tourists and project workers according to their proximity and association with water bodies. Proposed environmental control measures like, the design and construction of canals, including their

operation and maintenance, environmental modification by drainage and filling of water bodies, adequate water supplies, latrines, bathing facilities, health education are particularly encouraged.

This report decries the imbalance between the beneficiaries who in most cases dwell in elitist far off places from the troublesome water sites at the expense of the quality of life of the risk groups. A number of policy guidelines for improvement are given.

Surface water drainage for low income countries/ WHO;UNEP.-Geneva: WHO, 1991.-88p.

The problem of unsuitable location of built up houses creates the serious lack of drainage especially for low lying coastal cities like Bangkok, Calcutta, Colombo, Manila, Dar-es-salaam, Jakarta, Guyana, Lagos and Recife. The flood impact feature as a significant health concern for basic human survival. Deaths, burials beneath landslides or collapsing homes are common. Faecal oral infections through contaminated water consumption become inevitable. Abundant surface water is highly characterised by pathogenic sources, triggering endemic schistosomiasis, microscopic parasites causing debilitating suffering to humans. The urban poor can only build on marginal land. Rational planning should help stem this trend. All these activities clearly require effective and collaborative approaches by civic maintenance engineers, planners, municipal drainage , community cooperation or participation for a common good. Street clearing and solid waste collection services by whoever is responsible should help as a health solution. Drainage programmes should include key elements for initiation, planning construction and maintenance. Rehabilitation measures, the importance of community involvement is emphasised. The community participation is fully appreciated through felt needs by establishing drainage committees. Motivated, voluntary membership, justifying payments where necessary is a recommended approach. The need to keep a constant dissemination in and awareness of drainage issues for comfort, safety, financial gain and other socio-economic desirables is presented. Figures and cross sectional diagrams are provided.

Health aspects of water supply and sanitation: participants notes/ L. Obeng.-Washington D.C: World Bank, 1986.-41p. (Information and training for low-cost water supply and sanitation; No. 3.1) ISBN 0-8213-0797-5.

This training module considers the health aspects of water supply and sanitation by disease description, transmission routes and possible control measures.

Disease description transmitted by various pathogen presence in water or excreta include viruses (through ingestion or inhalation), bacteria and helminths. Viruses thrive in cool temperatures. Bacteria ingested in water, food, bust or through the lungs, faeces in eyes attack the intestinal tract of man or other animals causing diarrhoea and dysentry. Helminths are parasitic worms in human hosts - roundworms, tapeworms and hookworms.

Associated to water supply and sanitation all these water related diseases are significant. The main control measure is provision of an improved water supply and sanitation programme in which hygienic contributions at the personal level through cleanliness is crucial. Diagrammatic group enteric worm infections are provided. Illustrative sketches drawn from a South East Asia family are presented . Faecal health problems appear too common in North Africa. The patterns of disease transmission appear too natural. Although cholera is acute, it is still deplorable that 15m children under 5 years are lost to diarrhoea annually. Change in health behaviour, cleanliness, accompanied by improved water supply and sanitation facilities have demonstrated the long term benefit to the communities. Illustrative tables are provided.

Waste treatment and resource recovery: participants' notes/J. Broome.-Washington D.C.: World Bank, 1986.-40p. (Information and training in low-cost water supply and sanitation; No. 5.4). ISBN 0-8213-0807-6.

This training module explains how to remove organic matter sewage pollution and pathogen disease causing organisms responsible for the diseases. In hot climates, treating sewage by natural processes in waste stabilization ponds at low cost to achieve safe levels is common. Waste stabilization ponds occur as anaerobic, facultative and maturation ponds. Anaerobic bacteria breakdown organic matter in sludge producing gas which is lost to the atmosphere and solubles to other ponds. Facultative ponds remove biochemical oxygen demand (BOD) including pathogens. Maturation ponds upgrade effluent by low concentration of organic material with high algae for pathogen removal. The various pond types require specific design principles for treatment. These are well explained in the document.

In the resource recovery context, the biogas process illustrates how animal manure, human waste, sewage sludge, crop residues are digested into biogas (methane energy) and carbon dioxide, cheap for developing country uses. However, some technical, social, and economic problems are evident.

Excreta reuse in aquaculture has found historic application through the pond system for food production, fish and water crops. China, Indonesia, India, Germany, Israel, Malaysia, Thailand and Vietnam are cited. Advantages and disadvantages of these processes are described. Public health concerns in fish, arise due to the usual presence of pathogenic agents of one kind or the other, causing the various infections. In China, Korea, and Taiwan local infections prevalence may reach as high as 60%.

Hygiene education: participants notes/D. Hine.-Washington D.C: World Bank, 1986.-37p. (Information and training for low-cost water supply and sanitation; No. 3.1) ISBN 0-8213-0798-3.

This training manual presents hygiene education as a team approach, the understanding of the community and developing the programme for change.

It has been noted that a water supply and sanitation programme is a long term commitment in which project staff need to supply the technology with a good understanding of how to make people respond to behavioral changes. Background informa-

tion regarding community leadership, custom, visiting time, sex or gender sensitive encounters need to be understood. In so doing, community needs could unfold, making it even easier to involve several members.

A western Nigerian village water system is given as a demonstration of the above observations. In this case, sanitation had been put in place by all counts, including professional input. Shortly thereafter people abandoned it for old water sources due to taste reasons, despite the guinea worm fear. Appropriate technology requires back-up for behaviourial change in perception of diseases. The community leaders provide encouragement and guidance or fully participate with minimal conflict. Formal and informal type leaders when identified should be appreciated. Promotion of community hygiene committee should involve women in important roles since they too have essential household responsibilities fully tied to water resources. Community awareness, needs and practices based on piped water supply, garbage or refuse collection, water, latrines and defecation clean ups of sites should be encouraged. Hygiene messages based on community beliefs, project staff training and how to get messages across is noted and illustrative photographs provided.

Waterborne sanitation: 5.2/World Bank; UNDP.-Washington D.C: World Bank, 1986.-63p.

This training module discusses the key construction aspects of septic tanks as they relate to water borne sanitation in the disposal of liquid effluent and sludge. Underground location enables waste water treatment from individual homes, buildings and hotels. Permeable soil availability to a water supply connection with septic tanks affords the highest level of sanitation service possible by current technologies. On site septic tanks need to involve public or municipal funding. The expensive costs involved in septic tanks makes them more common in cities. Operation and maintenance aspects are of considerable importance.

The alternative sewage disposal technologies are discussed. For example, the small bore connectivity networks of Australia and Alabama in the U.S.A. are provided. Conventional sewage common in Europe is a product of several steps and historical events. Ditches were first dug to remove storm water runoffs, pipes where later laid in these ditches, then covered. This resulted in a sophisticated underground network. Water supplies extension had to be made, through distribution networks to individual homes. Waste water from homes provided dumps necessitating water and waste treatment plants to control diseases and pollution. Solution in developing countries need well directed cheap alternatives. Several illustrations, figures and photographs are provided for demonstrative purposes.

Operation and maintenance of urban water supply and sanitation systems: a guide for managers/WHO.-Geneva:WHO, 1994.-102p.

This guide commends some of the remarkable achievements of the IWSS Decade 1981-90 but decries that the water supply and sanitation facilities so far put in place do not always function continuously, efficiently and to full capacity, mainly due to the general neglect. The idea is to increase their working life span through operation and

maintenance activities. The WHO Programme Work 1990-1995 has taken up this matter to improve institutional performance at community level in planning, organising and financing water supply and sanitation to achieve beneficial results. This guide provides the detailed description of such participation with a view to increasing water supply and sanitation coverage, adequacy, the limiting of substandard effluent, causes of pollution, managing the large unaccounted for water, increasing the staff morale, the reduction of repair and replacement costs which are already excessive because of neglect. Technological options suitable to particular situations will need to be assessed. This publication provides a management approach to serve as a basis for the managerial capabilities required to achieve acceptable quality, continuity, reliability and cost for all on-going operations and maintenance activities or those planned.

Analysis of those participating agencies by system, different management levels, priority responsibilities, conceptual and methodology approaches for measures for implementation are provided.

The very purpose of installing operating and maintaining water supply and sanitation projects should serve and justify the associated improvement of health and environmental hygiene for the particular community. Illustrative figures are provided.

The design of ventilated improved pit latrines (VIPs)/ Duncan D. Mara.- Washington D. C.: UNDP;World Bank, 1984.-73p.

The introduction in this document notes that excreta related diseases are responsible for the high morbidity and mortality cases and numbers for low income countries, where adequate water supplies and sanitary facilities are typically poor and unreliable . The World Bank's concerns in VIP latrine technology is to link these to sanitary conditions in order to reduce prevalent cases and infection incidence . Toilets for all ages should be used, kept clean and effective treatment of excreta and sewage prior to discharge or reuse is desirable. An adequate daily water supply estimated at 30-50 litres per capita per day for minimal control of water borne modes of disease transmission are the key proposed solutions. To achieve these, the various types of pit latrines, especially VIPs, including their design are presented in this document. Several sections in pit, cover slab and foundation structure, superstructure, vent pipe, fabrication, emptying of pits, double and multi compartment, soakaway are diagrammatically illustrated.

Background factors such as housing density, water supply levels, ground conditions, ground water pollution potential and socio-cultural matters for acceptance are presented. The costing aspects are considered and case studies by tabular presentation for Zimbabwe, Botswana, Tanzania, Ghana and Brazil are given. A detailed annex for illustrative purposes is included.

Guide to sanitation in natural disasters/M. Assar.-Geneva: WHO, 1971. 135p.

This guide describes the aftermath effects of natural disasters on the affected populations where they are left homeless, deprived of adequate food, shelter, clothing and highly vulnerable health environment. Natural catastrophes generally cause chaos through confusion and panic and as such, sanitation personnel should access such a

handy guide. Training when necessary can also be achieved.

This guide provides the planing aspects to health authorities, environmental health workers preparedness and document development to minimise or eliminate ill health impact. This is a general document of basic principles for improvisation when necessary. The contents simplify environmental health concerns and measures appropriate even in normal situations. Sanitation requirement and standards can be fully tested after the emergency situation. Equipment specifications, consultancies with security or other participants is crucial in real emergency situations. Some of the most serious disasters like, war are man made and imposed so that skilful handling by relief agencies is desirable and commendable. Epidemics also provide challenging situations regarding the health conditions of the general population at risk. The guide discusses disaster types, their sources and results. Storms, landslides, accidents causing loss or damage to human life and property including animals is presented. The planning and administration of environmental health aspects and activities are highlighted for a coordinate action plan. The personnel search, rescue and evacuation activities entail a health hazard in one way or another. Scenic photographs illustrated diagrams and annexes are provided.

Getting together and just doing it: UNICEF's experience in integrated area based programming; working with communities in Baringo district/UNICEF. -Nairobi: UNICEF, 1991. - 14p.

During 1989/90, an interactive methodology introduced with the help of UNICEF at sub-locational level began to emerge in Baringo district around the need to improve water supply. It's objective was to build linkages with communities and to involve the people in a bottom-up approach to district development. The methodology also caught up in Kisumu district of Nyanza province. This document thus attempts to describe the formal and informal processes that led to this development.

The Government of Kenya and UNICEF Child Survival Development (CSD) programme was launched in Baringo district in 1987. Two years later there was still no visible impact on the people. It was realised that there was no way the government and UNICEF would succeed on their own.

In this respect, a meeting of all NGOs, church groups and others who were active in the district was convened. The result was a unique partnership - the District Water Development Committee (DWDC) comprising of not only ministry staff and the UNICEF team but anyone within the district with the implementing capacity to build water structures. The DWDC acts as the coordinating structure of a network of collaborating organisations throughout Baringo district. Meetings were then arranged and communities asked to identify their biggest problems. It was clearly revealed that access to clean water was the first priority. Ideas on how the communities intended to solve their problems and how willing they were to involve themselves were discussed. They raised money and provided labour. In order to build capacity at community level and build strong linkages between the communities and districts structures, training in management, organisation and planning was done. Six people from each focus area were trained using participatory methods.

In Baringo where water resources are limited and population density low, decentralised water technologies e.g roof catchments tanks, shallow wells with handpumps, and gravity distribution were found to be more effective and sustainable. Using such technologies individual communities can own and manage their own schemes and also learn how to use and replicate the technologies. Formal and informal structures working in this area have been described.

In order to maintain success and sustainable management of the projects, training for water committee members was done. They later designed their own management system. The role of networking and some reflection of UNICEF staff working with communities in Baringo and Kisumu have been given at the end of the document.

Guidelines for drinking water quality: volume 1 recommendations/ WHO.- Geneva:WHO, 1984.-xi, 130p. ISBN 92 4 154168 7.

These guidelines are intended for use as a basis for developing standards, which, if properly implemented will ensure safety of drinking water supplies. The primary aim of these guideline is the protection of public health and thus the elimination or reduction to a minimum, of constituents of water that can be hazardous to the health and well being of the community.

A guideline value represents the level of a constituent that ensures aesthetically pleasing water and does not result in any significant health risk for the consumer. The quality of water defined is such that it is suitable for human consumption and domestic purposes.

The bacteriological and biological quality of drinking water and guideline values for piped and unpiped water supplies, bottled drinking water and emergency supplies of drinking water are discussed. Instructions on frequency of water sampling, collection, storage and transport of water samples for bacteriological examination are given. Various techniques and procedures for the detection of coliform organisms such as multiple tube method and membrane filtration techniques are also discussed.

The importance of effective monitoring has been emphasised. Sampling frequency, accuracy of analysis, sample size and quality assurance for piped supplies, untreated unpiped supplies, bottled water, emergency and temporary water supplies are explained and remedial measures are provided.

Evidence that can be used in setting guideline values have been summarised. Instructions on designing a sampling programme, sample collection and analysis are given. Remedial action to be taken in order to correct contamination problems are discussed.

Radioactive materials found in drinking water, guideline values and methods of examining Alpha and Beta activity have been discussed. Remedial measures for radioactive contaminants are provided.

Guidelines for drinking water quality: volume 2 health criteria and other supporting information/WHO.-Geneva: WHO, 1984.-ix, 325p. ISBN 92 4 154169 5.

This second volume sets out the health criteria for drinking water pollutants and other constituents with a view to recommending guideline values. In addition it provides information on the detection of contaminants in water and control measures.

It thus reviews the evidence for recommending guideline values, summarises and evaluates the available information on the health and sensory effects of drinking water constituents and provides a convenient reference source for those involved in developing and implementing standards.

The microbiological and biological aspects of drinking water quality are covered in Parts I and II of this volume. In addition to a description of water borne bacterial pathogens, including the rationale for using indicator organisms, detailed information on the surveillance requirements and safeguarding of bacteriological quality of drinking water supplies is provided. Sub-sections deal with the collection, storage and transportation of water samples, recommended methods for the detection of various microorganisms and disinfection practices. A brief account of viruses in drinking water is included as well.

A wide range of health related inorganic and organic chemicals are considered and reviewed in detail and guideline values set. The information on health effects considered in the development of the guideline values, together with other supporting data, is summarised in Parts III and IV of this volume.

The information contained in these summaries includes the (a) general description of the chemical, its major sources and concentrations in water; (b) information on routes of human exposure; (c) metabolism; and (d) evidence of health effects. Each summary contains a list of the relevant references.

In Part V, basic information used in arriving at the guideline values is summarised with reference to the source, occurrence, routes of exposure and health effects. It also provides information on influence of temperature, dissolved oxygen and pH on drinking water quality.

Part V deals with radioactive materials in drinking water and explains the basis for the guideline values for gross alpha and gross beta activity. It also gives guidance on the application of these guideline values in practice.

Guidelines for drinking water quality: volume 3 drinking water quality control in small-community supplies/ WHO. - Geneva: WHO, 1985. - vii, 121p. ISBN 92 4 154170 9.

This volume hopes to be useful to all those concerned with drinking water quality in the rural areas of developing countries, including not only laboratory staff, field workers in surveillance programmes, and those engaged in carrying out remedial measures for safeguarding drinking water quality but also administrators and other officials responsible for drawing up or improving national drinking water quality control programmes.

It deals specifically with drinking water supplies for small communities and particulary those in rural areas, with the main emphasis on the microbiological quality of such supplies. It contains information on sanitary inspections, the collection of water samples, simple methods for bacteriological analysis, and methods for determining residual chlorine, suitable for use in rural areas, which take account of the difficulties likely to be faced in the field. It also covers the remedial and preventive measures necessary if water quality is to be maintained, and the community participation which is essential in combating water borne enteric diseases. Selected guideline values for drinking water quality relevant to small community supplies are also given.

Assessment of fresh water quality: report on the results of the WHO/UNEP programme on health related environmental monitoring/Global Environmental Monitoring System. - WHO;UNEP, 1988. 80p.

Within the framework of UNEP's Global Environmental Monitoring System (GEMS) is a project known as GEMS/WATER. This project includes the collection of data for about 50 different indicators of water quality. The objective of this report is to provide an evaluation of global water quality in which special attention is paid to the regional differences by the GEMS/WATER programme.

The report discusses the availability of fresh water resources for human use worldwide. Water availability in relation to population growth from 1975 to the year 2000 and water use by continent have been given in the form of graphs. Water use and its effect on water quality and the links between water use and water quality are discussed. It is predicted that by the year 2000 the global expansion of irrigated farmland will lead to water needs for irrigation alone equivalent to the total world use in 1980. It is also predicted that industrial water needs will grow at a slower pace than domestic consumption needs due to internal water recycling and water-conscious technologies.

The report traces a history of water quality problems since medieval times. Water quality requirements for drinking water, raw water sources for public supply, agriculture and industrial use, fisheries, wildlife and recreational use are provided.

Microbiological and biological agents present in water that may be of danger to human health have been discussed. Morbidity and mortality rates due to water related diseases in Africa, Asia and Latin America are provided.

Organic material in the form of domestic sewage, municipal wastes and effluent from agro-industry, industrial effluent and land use (afforestation and intensive agriculture) and their effects on water quality are some of the water pollution sources that have been discussed in details.

The report concludes by giving the global trends in water pollution. Control measures such as sewage disposal regulations, construction of city sewerage schemes, waste water treatment installations, industrial effluent treatment and recycling, substitution of harmful or deleterious consumer products and banning of hazardous pesticides (DDT) and industrial chemicals are suggested.

Urban sanitation: the challenge to communities, private sector actors, local governments and external support agencies/ Peter Schübeler. - Proceedings of the 11th Aguasan workshop, Gersau, Switzerland, 26-30 June, 1995.

Each case, has been discussed under the subtopics of project description; actors and challenges; and organisational setting and limits. A comparative review of the cases and an assessment of the approaches of each case has been made.

The main issues of urban sanitation that were seen by the workshop participants have been discussed. Recommendations based on the projects' as well as personal experiences were formulated. The conclusions that emerged, i.e the role of user communities in urban sanitation; relationships between users, governments and private sector actors; appropriate technology and access to credit; and scaling-up and replication of the approaches have been summarised.

The contents of the workshop deliberations have been outlined and interpreted employing conceptual tools. Project strategies have also been assessed in terms of their orientation towards particular social groups, types of residential area, functions of service delivery and/or overall processes of infrastructure management.

Comparative study on pit emptying technologies, Dar es Salaam, Tanzania 1991/1992: final report/ WASTE consultants. - Gouda, Netherlands: WASTE Consultants, 1993. 59.

The comparative study on pit emptying technologies (COMPET) in Dar-es-salaam was initiated at a round table meeting of pit emptying experts. The reason for choosing Dar-es-salaam as the location for the study was its representation of third world cities in terms of large scale application of on-site sanitation facilities, large unplanned squatter areas with limited access to the conventional pit emptying technologies; limited financial resources and the growing tendency of diminishing government support to public services.

The objectives of the study were to collect and compare data on the different available pit emptying technologies; to identify and evaluate the major parameters of different pit emptying technologies and to develop guidelines on the choice of pit emptying technology packages and their implementation.

The methodology used for the comparison of the technologies has been presented and describes how three separate studies have been carried out. The performance of three pit emptying technologies i.e by large tanker, mini tanker and MAPET have been compared using a set of indicators which give the quality and quantity of pit emptying services. The Data collection methods used for the study have been discussed. The problems encountered and the actual and optimal performances are enumerated.

Background information on the sanitation situation in Dar-es-salaam has been provided. The piped sewerage systems, sewage treatment systems, septic tanks, pit latrines and pit emptying systems are mentioned.

The organisational framework of the Dar-es-salaam Sewerage and Sanitation Department (DSSD) is presented. Its characteristics, organisation, equipment, location and communication, fees, revenue, wages and unofficial activities are discussed. The MAPET (Manual for Pit Emptying Technology) and how it operates are also discussed.

The findings of the data collection on the operations of the pit emptying technologies, the cost of the pit emptying operations, the customers' experiences and opinions, and on the technical capacities of the pit emptying equipment are presented. The parameters of a satisfactory pit emptying service, followed by recommendations on pit emptying as part of urban sanitation services an on possible improvements on the service in Dar-es-salaam have been discussed.

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