GOVERNMENT OF THE REPUBLIC OF ZAMBIA

REPORT OF THE NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF WATER SUPPLY AND SANITATION FACILITIES,

FAIRMOUNT HOTEL - LIVINGSTONE

21st to 24th April 1997

WHO

Acknowledgement

The editorial, secretarial and compilation of the report was done on behalf of the Government of the Republic of Zambia by Mr. S.T. Chisanga, Ministry of Health (MOH), Mr. G. Bulenge, Water Sector Development Group (WSDG) and Mr. M. Musambo, World Health Organisation (WHO), Lusaka office.

Sincerely thanks to the above mentioned and all those who made this workshop possible.

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1.0 Introduction

The provision of sufficient quantities of portable water, and availability of effective sanitation services, represent a fundamental factor amongst the different aspects associated with the social industrial and economic development of a nation. Maximum health and economical growth can only be achieved if water supply and sanitation facilities operate continuously and to full capacity in conformity with acceptable standards of quality. It is not realistic to aim at a state of sustainable development without including a process intended to reach such endeavour.

Adequate operation, maintenance and sound management are aspects directly related to the effectiveness and quality of services and are crucial to the attainment of the benefits that should accrue from the construction of facilities.

2.0 Workshop Summary

A national workshop on operation, maintenance and management of urban and rural water supply and sanitation facilities was held in Livingstone City in Zambia from 21st April to 24th April 1997, as part of the overall efforts involved in the process of development of the Africa 2000 initiative. This workshop was sponsored by the World Health Organisation and was carried out in collaboration with the Operation and Maintenance Working Group of the Water Supply and sanitation Collaboration Council representative.

The workshop dealt with the overall aspects of sustainability of water supply and sanitation systems, special emphasis was placed on aspects dealing with technology, organisation and management of operation and maintenance of urban and rural facilities. After the deliberations, the workshop came up with Action Plans and Recommendations for both urban and rural water supply and sanitation systems.

In an introductory speech, the Workshop Co-ordinator and member of the PCU, Mr. S.T. Chisanga reminded the participants of the importance of an efficient operation, maintenance and management system for satisfactory service delivery that will enhance the well being of the Zambia citizen.

His excellency, the resident representative for WHO in Zambia, Dr. W.S. Boayue recommended the government in its efforts to reforming the water supply and sanitation sector and reminded the participant that the workshop had come at the right time. He also urged the participants to address all issues concerning operation and maintenance.

The workshop was opened by the honourable the deputy minister for Southern Province Mr. Elias Miyanda, MP who in his opening remarks alluded the WHO for sponsoring the workshop. He also prised the Working Group for its tireless efforts in developing operation and maintenance materials for use in uplifting the standards of services in the sector. He also urged participants to take full advantage of the workshop.

See annex for the full speeches.

3.0 Workshop Objectives

The objectives of the workshop were as follows:

1. To present the tools (manuals, guidelines and training packages) produced by the Operation and Maintenance Working Group of the Water Supply and Sanitation Collaborative Council as well as other relevant materials for the sustainability of the sector;
2. To analyse the sector, with emphasis on operation and maintenance aspects, in the light of case studies describing the performance of the water and sanitation services in urban and rural communities;
3. To have the outline of an action plan with proposition on mechanisms for operation, maintenance and management improvement;
4. To elaborate recommendations on the mechanisms for the evaluation and monitoring of progress of the recommended action;
5. To serve as a forum for exchange of information and experiences.

4.0 Participants

The workshop attended by 23 participants drawn from Ministry of Local Government and Housing (MLGH), Ministry of Energy and Water Development (MEWD), Ministry of Health (MOH), Care International, JICA, UNICEF, Higher Institutions of Learning and Lusaka Water and Sewerage Company. The workshop co-ordinator came from the Ministry of Health and the two facilitators came from World Health Organisation-Lusaka and Water Sector Development Group respectively. The moderator came from World Health Organisation headquarters in Geneva Switzerland, the observer came from WHO regional headquarters in Brazzaville-Congo. **See annex III for the list of participants.**

The workshop was opened by the Honourable Deputy Minister for Southern Province Mr. Elias Miyanda. **See Annex VI for the minister's speech.**

5.0 Workshop Proceedings

The workshop was conducted through case studies, visualized presentations (of urban, peri-urban and rural water supply and sanitation) presentations from participants, plenary discussions, working group discussions, Operation, maintenance and management tools presentations and briefings on the same.

5.1 Operation and Maintenance tools

Mr. J.A. Hueb the Civil and Sanitary Engineer from World Health Organisation (WHO) headquarters in Geneva, explained to the participants the essence of the workshop. He further on briefed the workshop on the Operation and Maintenance Working Group (OMWG) of the WHO (its composition and history) which is behind the formulation (authoring and development) of the O&M tools for the water supply and sanitation sector.

Mr. Hueb went through the tools presented and elaborated on the use and importance of each. He also briefed the workshop on the principles of O&M and the new tools being prepared by the OMWG on Leakage Control. The Leakage Control tool will consist of:

- control systems
- Mapping
- Improvement of House Connections
- Operation Control
- Reviewing of criteria for design and construction
- Maintenance of pipe distribution systems corrective maintenance
- Macrometering
- Quality of materials and equipment

He also talked generally on the Global Water and Sanitation Coverage, the population unserved,(Water Supply-Global and Sanitation-Global).

5.2 Africa 2000

Mr. M. Musambo the Health Economist from WHO Lusaka office briefed the workshop on the background and objectives of the Africa 2000. He further on informed the participants that Africa 2000 is an International co-operative effort to expand water supply and sanitation services in Africa. It represents a radical change in attitudes towards, the implementation and development of water and sanitation development. And that it is an initiative of African government to accelerate progress for enabling all Africans to have access to safe water and sanitation. This initiative puts leadership of water and sanitation development in hands of African governments. He also talked about the Brazzaville conversion

and the Four (4) Action Point Plan (complementary approaches) - Brazzaville Declaration which was signed in June 1996. as indicated below:

1. Set priorities based on :
- expressed desires of the people
- bottom up planning to ensure that people's voices are heard and that investments match needs.

2. Mobilise local skills and resources, and enhance them where necessary, in order to:
- ensure optimum use of community management and local resources,
- implement appropriate affordable solutions,
- improve the efficiency and effectiveness of investments,
- increase sustainability

3. Ensure that water and sanitation partnership for health and development involve:
- communities, local governments, non governmental organisations and private sector in concerted efforts to address common problems and prevent wasteful duplication,
- governments who will co-ordinator water supply and sanitation programmes through interministerial co-operation which takes full advantage of the capabilities of all potential partners.

4. Ensure that requests for external support are based on:
- nationally prepared plans and programmes, not on donor-driven priorities,
- programmes reflecting people's real needs,
- powerful social and economic arguments for greater government investments in water supply and sanitation,
- demonstrable political commitment and resolve to the sector,
- efficient use that builds national capacity and reduces dependency.

He also elaborated on the way forward for Zambia as far as Africa 2000 is concerned.

5.3 Water Supply and Sanitation sector reforms

The S.T. Chisanga member of the Programme Co-ordination Unit and Mr. G. Bulenge, Assistant Technical Specialist - WSDG talked about the current water supply and sanitation sector reforms being carried out in Zambia. They also elaborated on the seven sector principals guiding the re-organisation of the sector as listed below:

1. Separation of Water Resources Management functions from Water Supply and Sanitation

2. Separation of Regulatory and Executive Functions within the Water Supply and Sanitation Sector
3. Devolution of Authority to Local Authorities and Private Enterprises
4. Achievement of Full Cost Recovery for Water Supply and Sanitation services through User Charges in the Long Run
5. Human Resources Development Leading to More Effective Institutions
6. Technology Appropriate to Local Conditions
7. Increased Government Priority and Budget Allocation for the Sector.

Mr. J. Sichone, the Human Resource Development Specialist-WSDG talked more on the human resource development part of the reforms and emphasised more on Competence Based Modular Training (CBMT) being introduced in the sector.

5.4 WASHE

Mr. I.J. Mbewe the co-ordinator for National WASHE explained to the workshop the concept of WASHE. He also elaborated the structure of WASHE (i.e. the V-WASHE, the D-WASHE and the N-WASHE). He went on further to explain what N-WASHE and CMMU are doing and thus pointed out some of activities under the two units as indicated below:

- Development of tools for community participation
- Database development and updating
- Hygiene Education
- Training of Enumerators
- Analysing and improving upon the maintenance systems being used in the rural water supply and sanitation

Mr. S. Mathur from UNICEF complemented Mr. Mbewe's speech by giving out the background history of WASHE and the success to date. He further on talked about the projects which are being /have been funded by UNICEF to further community participation/management of rural water supply and sanitation especially in the Southern Province. He also gave some statistics on trained pump minders, and pointed out that the percentages of non-functioning handpumps have reduced from 40% to 20%. The average number of people being served per water point in the Southern Province have also reduced from 500 to 250, this is due to the construction and rehabilitation of a good number of water points.

5.5 Case studies presentations

Case study papers were presented by different resource persons as shown below:

1	Mr I.J. Mbewe	N-WASHE	Case study on Operation and Maintenance of Rural Water Supply in Zambia.
2.	Mr. G. Mukosayi Dr. T.J. Fatchi	Ndola City Council Ndola City Council	Case study on Ndola Water Supply and Sanitation - Urban and Peri-Urban.
3.	Mr. E. Mondoloka Mrs. R Miyoba	Livingstone City Council Livingstone City Council	Case study on Livingstone Urban and Peri-Urban water supply and sanitation
4.	Mr W. Sepete	Southern Province	Case study on the Sanitation situation in the Southern Province
5.	Mr. W. Sepete	Monze District	Case study on the Development of Monze District Rural Water Supply and Sanitation sector
6	Mr. P L.M. Kimena	Lusaka City	Case Study on the Operation and Maintenance of Lusaka Urban Water Supply and Sanitation systems by the Lusaka Water and Sewerage company

Note: See the appendix to the report for the Case Study reports.

5.6 Working Group Sessions

5.6.1 Session 1

Objective

In the first working group session the participants discussed **Issues affecting the performance of the water supply and sanitation sector in Zambia (success, weaknesses, potential, obstacles etc.)** The objective of this working group session was to analyse the water supply and sanitation sector performance over the past years and identification of the positive and negative aspects concerning institutional, management, and operational aspects. Considering that the workshop have to lead to the preparation of a concrete action plan, the potential for implementation of the plan to be formulated, as well as the expected obstacles were to be identified.

Key Aspects
This session was focused on analysis of the water supply and sanitation sector. Two major aspects were considered: past experience and future perspectives. The working groups discussed the following aspects:

- Past experience

-Success: success (qualitative, and quantitative), aims achieved, strengths.
-Weaknesses: failures, weaknesses, difficulties, bottlenecks

- Future perspectives

-Potentials: potentials, ideas, wishes, trends, unused abilities.
-Obstacles: obstacles, resistances, unfavourable framework conditions.

The two groups were told to assess the success and weaknesses of the water supply and sanitation sector over the past years. This was with the intention that somebody wants to improve the efficiency and effectiveness of the water supply and sanitation sector, Factors were identified which can help facilitate the process (potentials) and those that will hinder the process (obstacles) and the findings where recorded on cards.

The first working group looked at **urban and peri-urban issues**, and the following points came up as in table one

Table 1

URBAN AND PERI-URBAN WATER SUPPLY AND SANITATION
Future Perspectives

Successes (Positives)	*Obstacles (Negatives)*
• Potential for extra capacity • Formation of Cus • Adequate facilities for capacity building • Improved conditions of services • rehabilitated infrastructure • expansion of the system • improved quality of life • Private sector participation • improvement in participation • In-depth plan in place • evaluate appropriate technology • national policy committee be formed • recommended appropriate designs/technology • implementation of O&M management systems • development of water schemes to match with sanitation • tailored courses for sector staff ECZ to strengthen laws	• political interference • weak economy • brain drain

• easy accessibility to water facilities • improvement for environment • less water borne diseases • few losses in the distribution systems • willingness to pay • economical tariffs • effective cost recovery system in unplanned settlement. • computerised billing • standardised technology • expansion of revenue base • transfer of WSS responsibilities from MEWD to Local government. • draft bill be passed as soon as possible	

Table 2

Past Perspective

Successes (positive)	*Obstacles (negatives)*
• Population was proportional to facilities • infrastructure was okay or good • formation of separate WSS departments in councils • qualified manpower • vandalism was absent • positive commitment towards work • financial position was sound • less political interferences • by-laws were enforced.	• dependence on expatriate staff • infrastructure designed to carter for privileged few • less emphasis on training • more-investment • unrealistic tariffs • no cost recovery in peri-urban • lack of community participation/appreciation • lack of commercialisation • design period of infrastructure has been out

The second group looked at **Rural water supply and sanitation**, and the following points came up as in table three.

Table 3

RURAL WATER SUPPLY AND SANITATION
Future perspectives

Successes (Positives)	*Obstacles (Negatives)*
• adequate training for extension staff • establishment of information systems • sufficient and safe water by the 2000 • effective management • establishment of monitoring systems • conducive political environment • creation of co-ordination body	• political interference • inadequate resources • poorly planned settlement schemes • geographical obstacles • insufficient funds • poor road network • natural calamities

• good linkage among partners • adequate guidelines on RWSS • appropriate technologies • development of adequate support services • more skills training • time saved for other works	• donor dependence

Table 4

Past Perspective

Successes (positives)	*Obstacles(negatives)*
• Collaboration among stakeholders • community participation • deep wells constructed in a durable manner • change of attitudes to use latrines • minimal vandalism in rural areas • increased coverage • decentralisation • establishment and development of WASHE communities	• ineffective management • difficulties in distribution of tools to participants • inadequate training for extension staff • non existence of information systems • inappropriate technologies • inadequate support services • poor linkage among partners • weak institution capacities at all levels

5.6.2 Session 2

Objective

The objective of this working group session was to **identify the priority Operation and Maintenance issues to be tackled to achieve improved efficiency and effectiveness of the water supply and sanitation sector**. Such issues included institutional aspects, management, technical issues, cost recovery, etc.

Key aspects

- To elaborate potentials, ideas, vision for strengthening and improvements of O&M systems at national and local levels.
- Identify the issues to be tackled in the preparation of an action plan conducive to improved operation, maintenance and management practices.
- Grouping the above lists of issues according to priority areas.
- recording the ideas on cards.

The priority lists was as listed below:

Urban and peri-urban water Supply and Sanitation

1 National Plan Formulated
2 Resource mobilisation
3 Build.capacity (manpower)
4 Rehabilitate Infrastructure-secure plant, tools and equipment
5 Develop O&M guidelines-establishing a functional organisational structure-develop technical inventory and database
6 enactment of the WSS bill
7 commercialise utilities
8 sensitisation of the community-encourage community participation in peri-urban
9 devise system of cost recovery in peri-urban-widen the revenue base-govt. commitment to pay for WSS services
10 improve co-ordination with town planners-improve information flow/communication
11. adherence to and enforcement of by-laws
12. expansion of the WSS systems.

Rural Water Supply and Sanitation

Local
1 establishment of D-WASHEs and V-WASHEs
2 improvement community management
3 skills training to extension and local communities-capacity building at national level
4 increased funding-development of information system
5. encourage private parts dealers
6 gender promotion

National
1 advocacy and awareness campaigns
2 collaboration of partners in the sector
3 training of trainers
4 improved monitoring systems
5. standardised technology
6. updating of existing facilities
7 enactment of WSS act
8 recruitment of qualified staff
9 applied research in WSS installations
10 increased funding
11 production of spare parts
12. production community management tools
13. production of guidelines
14. improved usage of child to child tools

5.7 Action Plans

In the third and last session, the working groups discussed (depending on the out come of sessions one and two) and came up with **action plans (both for Rural WSS and Urban and Peri-Urban) which consisted of activities, responsible organisations and time frame needed to implement the work at National level** as shown below:

Table 5

Urban and Peri-Urban

ACTION	EXPECTED RESULTS	ACTIVITIES	RESPONSIBLE INSTITUTION/S	COMPLETION TIME
1. ***Formulate action plan***	Action plan formulated to provide guidelines of O&M systems	• consultative meeting for all stakeholders • Formulation of a working committee • Development of TOR • Assessment study carried out	• MLGH • Stakeholder • Working group • MLGH	June 1997 June 1997 Aug. 1997 Jan. 1998
2. Resource mobilisation	Get enough to facilitate implementation of action of plan	• sell the action to Govt, Donors, lending institutions etc.	• MLGH, MOH	Jan 1998
3. Building Capacity	Trained/skilled manpower, well developed organisation structure, efficiently managed utilities	• identification of training needs • identification of training institutions • introduction of in-house training • job evaluation and description	• WSDG/DISS, consultant • stakeholders, consultant, MDU • stakeholders, consultant • stakeholders consultant	Jan 1998 Jan 1998 Jan. 1988 Jan 1988
4.Rehabilitate infrastructure	re-stored schemes to original capacities	• design and tender documents prepared/received • construction of and installation of plant completed secure tools and equipment • supervision	• stakeholders, consultant • stakeholders, contractor • stakeholders	April, 1998 Jan. 2000. Jan. 2000,
5. Development of O & M guidelines	optimised life span and efficiency infrastructure plant and equipment	• carry out an inventory of plant and equipment • review and update O & M procedures. production of manuals	• stakeholders • stakeholders	April 1998 Jan 1998,
6. Development of technical information				

		• acquisition of equipment for storage/analysis of data base	• stakeholder	Jan 1998
7 Lobby/advocate for enactment of the WSS Bill	facilitate an enabling environment for formulation of CU's	• bill drafting • press statement • ministerial/political speeches • sensitisation of politicians	• stakeholder, consultant • stakeholder, public media • stakeholder, politicians • stakeholders, politicians	Jan. 1996 Jan 1996 Jan 1996 Jan 1996
8. Commercialisation of utilities	utilities operates viably and on a sustainable basis	• formation of board • granting of autonomy • review of tariffs (economical levels) • improve on the billing system (computerised system) • widen the revenue base • develop a system to recover debts from govt • formulation of an effective accounting system (guidelines) •	• L.As • Govt. • board • utility • utility • utility • WSDG	April 1998 March 1998 April 1998 April 1998 Feb. 1998 Feb. 1998 Jan 1997
9. Sensitize the community	reduced theft, vandalism, increased willingness to pay	• inculcate a sense of responsibility to the community • develop an effective awareness publicity • improvement information flow/communication	• utilities, residents • utilities/ residents • utilities/ residents	Jan 1998 Jan 1998 Feb.1998
10. Action of co-ordination with town planners	harmonised development	• liaison meetings • establishment of communication channels	• utilities, LA's • utilities, LA's	Aug. 1997 Aug. 1997
11. Enforcement of by-laws	total compliance to by-laws by consumers	• publicise by-laws • capacity building of law enforcers • prosecution of offenders	• utilities, Govt • utilities, Govt • utilities, LA's	On-going
12 Expansion of WSS schemes	increases coverage & reduction of water borne	• source funds • entice private sector participation • carry out studies on	• utility, Govt • utility • utilities town	Jan. 1998 April 1998 Jan. 1998

	diseases, improvement in the condition of living/production	development growth	planners	

Table 6

ACTION PLAN - RURAL

ACTION	EXPECTED RESULTS	ACTIVITY	RESPONSIBLE INSTITUTION	COMPLETION TIME
1. To undertake advocacy and awareness campaign	increased understanding by all stakeholders and communities	• communication through TV, radio and posters • workshops/seminars/meetings • drama/play/demonstration	• WSDG. WHO. UNICEF. MOH • WSDG, WHO, UNICEF, MOH • WSDG, WHO, UNICEF, MOH	1997-2000/ On-going quarterly On-going
2. To improve collaboration of partners in the sector	improved co-ordination among partners	• to strengthen the capacity of DISS • co-ordination of the activities of RWSS	• WSGD • DISS	On-going
3. To improve community management	improved O & M management	• skills training of extension officers • prepare strategy monitoring management • skills training of local community	• MOH, WSDG • Line Ministries • NGOs	4th Quarter 1997 1st Quarter On going
4. Human resource development	high level of services	• recruit qualified staff • train staff in collaboration with WSDG • career development	• LAs • WHO, UNICEF • WSDG, LAs	2000 2000 2000
5. To develop information system	updated data available on RWSS	• production of information, education and communication (IEC) materials	• CMMU	On-going
6. To improve	improved O & M of RWSS	• production of guidelines for	• N-WASHE	Dec. 1997

monitoring & evaluation for WSS sector		reporting and updating of O & M activities • development of software • implementation/ utilisation of at district and national level	• UNICEF/ WHO • Joint Monitoring Programme	
7. To advocate for enactment of WSS Act	working framework for the sector in place	• holding workshops, seminars for politicians • draft recommendation to PCU	• PCU • National Workshop	3rd quarter 1997 24th April, 1997
8. To improve appropriate technology	standardisation of policy	• produce guidelines of technical O & M • produce community management tools • consolidate research studies n WSS and come up with an appropriate design • preparation of a standardised designs (head pump, Pit-latrines etc.)	• CMMU/WSDG • DISS/WSDG • N-WASHE • Standardisation committee	Dec. 1997 Dec. 1997 Dec 1998
9 To mobilise resources	increased funding to the WSS	• preparation of project proposals to solicit funds from donors • procurement of transport/machinery/logistics	• D-WASHE • DISS	3rd Quarter On-going

6.0 Recommendations

General

- Operation, maintenance and management of water supply and sanitation systems should be given the highest possible priority in sector development for the achievement of the maximum capacity of the established facilities and to ensure the sustainability of the existing systems.

- The participants of the workshop recognising the key role of the Programme Co-ordination Unit (PCU) in the sector co-ordination and development recommend that the action plan derived from this event be considered and adopted as an important instrument in the implementation of its policies and strategies.
- The action plan produced by the workshop be further elaborated in order to be converted into a detailed workplan that could be used as guidelines for the implementation of the proposed activities. The PCU is requested to co-ordinate the preparation of this detailed workplan in close collaboration with the stakeholder involved.
- Should the PCU adopt this action plan for incorporation in its development preparation then it should initiate contact, co-ordinate and liase with stakeholders to ensure its implementation.
- training on different aspects of operation, maintenance and management is a major requirement in the sector development process. Training institutions should be identified, and training programmes should be formulated in order to ensure the sustainable development of the sector.
- The PCU is requested to appoint a National Institution to act as a focal point on operation and maintenance issues and to establish mechanisms to liase this institution with the Operation and Maintenance Working Group of the Water Supply and Sanitation Collaborative Council.
- The undertaking of action aimed at the improvement sustainability of the water supply and sanitation sector should require investments which are currently not available. In order to ensure the availability of the action plan generated by this workshop, it is recommended that a fund be created with the participation of the Government, donor agencies and lending institutions, under the co-ordination of PCU.
- The organisation and development of the water supply and sanitation sector requires the availability of sound legal framework. The enactment of the water supply and sanitation bill should be expedited in order to facilitate the sector transformation as established in the national policy.
- The workshop acknowledges and endorses the Government efforts on decentralisation of water supply and sanitation agencies and recommends that this process should be intensified in order to expedite the improvement of efficiency and effectiveness of the sector. It is strongly recommended that the urban agencies should be completely autonomous and financially self-sufficient in order to ensure their sustainability.
- The process of empowerment of the rural communities to manage their own water and sanitation facilities has proved to be effective and a viable alternative to the overall management of the rural sector. The different stockholders responsible for this process should now move into a large scale programme aimed at enhancing community management of WSS services.

ANNEX I

NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF WATER SUPPLY AND SANITATION SYSTEMS
NEW FAIRMOUNT HOTEL
LIVINGSTONE, ZAMBIA
21st to 24th April, 1997

0900 hours: Official Opening Programme

- Welcome Address by the Chairman of the workshop organising committee- Mr. S.T. Chisanga
- Address by WHO Resident Representative to Zambia - Dr. W.S. Boayue
- Keynote address by the guest of Honour and Official opening of the workshop - Honourable Deputy Minister for southern Province Hon. E.M. Miyanda, MP.
- Vote of thanks by one of the participants (Mr. J. Sichone)
- Break for refreshments and then Guest of Honour departs.

ANNEX II

PROGRAMME OF THE NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF RURAL AND URBAN WATER SUPPLY AND SANITATION SYSTEMS.
NEW FAIRMOUNT HOTEL, LIVING
21st to 24th April 1997

DAY 1 21st April 1997
MORNING

0800 hours	:	Registration
Opening session		
0900 hours	:	Welcome address by the Chairman of the Workshop organising committee
0915 hours	:	WHO Representative's address
0940 hours	:	Opening Address by the Guest of Honour
0955 hours	:	Vote of Thanks
1000 hours	***:***	***Tea/Coffee Break***
1030 hours	:	Introduction of participants, nomination of Chairman, Repporteur and Facilitator
1045 hours	:	Objectives of the Workshop
1100 hours	:	Progress Report on Africa 2000
1115 hours	:	Introduction of Operation and Maintenance Working Group
1200 hours	***:***	***Lunch***

AFTERNOON

Plenary Presentations

1300 hours	:	Operation and Maintenance Principles
1400 hours	:	Case studies on Operation and Maintenance of urban, peri-urban, and rural water supply and sanitation
1500 hours		***Tea/Coffee Break***

Working Group Session

1600 hours	:	Issues affecting the performance of the water supply and sanitation sector in Zambia (success, weaknesses, potential, obstacles);

DAY 2 22nd April 1997
MORNING

Plenary Presentation

0830	:	Presentation on the finding of the workshop group sessions
0930	:	Tools prepared by the Operation and Maintenance Working Group
1000 hours	***:***	***Tea/Coffee Break***
1030 hours	:	Approaches for management of water supply and sanitation services
1115 hours	:	Key activities for optimization of water supply and sanitation services
1200 hours	***:***	***Lunch***

AFTERNOON

Working Group Session

1300 hours		Identification of priority issues in the light of case studies and findings of the previous sessions;
1530 hours	***:***	***Tea/Coffee Break***

Plenary Presentation

1600 hours	:	Conclusions of the working group session on priority issues

DAY 3 23RD APRIL 1997
MORNING

Plenary Presentation

0830 hours	:	Technical and Institutional aspects of operation and maintenance

Working Group Session

1030 hours	:	Definition of priority action activities conducive to the optimization of urban and rural water supply and sanitation systems to be implemented at National and District Levels over the 1997-2000
1200 hours	***:***	***Lunch***

AFTERNOON

Plenary Session

1300 hours	:	Presentation on the conclusion of the group session on action and activities for the optimization of water supply and sanitation services.

Working Session

1400 hours	:	Final agreement on action plan Recommendations of the workshop
1530 hours	***:***	***Coffee/Tea Break***
1600 hours	:	Final agreement on action plan and recommendations

DAY 4 24th April 1997
MORNING

Plenary Session

0830 hours	:	Presentation of findings and final agreement on recommendations
1000 hours	***:***	***Tea/Coffee Break***
1030 hours	:	Panel on institutional arrangements for the follow-up of the workshop recommendations and action plan
1115 hours	:	Panel of external co-operation
1145 hours	:	Closing remarks

1200 hours : Close

AFTERNOON

Field visit

ANNEX III

NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF RURAL AND URBAN WATER SUPPLY AND SANITATION SYSTEMS
AT NEW FAIRMOUNT HOTEL-LIVINGSTONE
21st to 24th April 1997

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ANNEX IV

WELCOME SPEECH BY THE WORKSHOP CO-ORDINATOR - MR. S.T. CHISANGA

HON DEPUTY MINISTER
HIS EXCELLENCY THE RESIDENT WHO REPRESENTATIVE TO ZAMBIA, THE PERMANENT SECRETARY AND THE ENTIRE ENTOURAGE FROM THE OFFICE OF THE DEPUTY MINISTER, FACILITATORS, FROM THE WHO OFFICES IN GENEVA AND BRAZZAVILLE DISTINGUISHED PARTICIPANTS, LADIES AND GENTLEMEN.

IT IS A MATTER OF IMMENSE PLEASURE FOR ME TO HAVE THIS OPPORTUNITY, ON BEHALF OF THE PROGRAMME CO-ORDINATING UNIT IN THE WATER SUPPLY AND SANITATION SECTOR TO WELCOME YOU ALL. WE MEET HERE TODAY, TO FOCUS ON WATER SUPPLY AND SANITATION, WITH A PARTICULAR EMPHASIS ON SYSTEM OPERATION, MAINTENANCE AND MANAGEMENT CONSIDERING THAT OUR COVERAGE LEVELS FOR BOTH WATER SUPPLY AND SANITATION ARE STILL VERY LOW AND ARE GETTING EVEN LOWER WITH THE INCREASING POPULATION, IT BECOMES INCUMBENT UPON ALL OF US OPERATING WHATEVER SYSTEMS MAY BE AVAILABLE FRO PUBLIC USE, TO DO SO IN A MOST PROFICIENT MANNER. EFFICIENCY IN MAINTENANCE AND MANAGEMENT, HELPS ENSURE SATISFACTORY SERVICE AND SATISFACTION OF CONSUMERS DEMANDS. THOSE OF US WHO ARE PROFESSIONALS IN THE ART OF ENGINEERING ETIQUETTES, MAY HAVE OUR OWN OPERATION DIFFICULTIES. BUT THE CONSUMER IS USUALLY NOT INTERESTED IN OUR EXCUSES; NEVER MIND HOW GOOD WE MAY THINK ARE.

WE THEREFORE, HAVE NO CHOICE, BUT TO TRY AND FIND WORKABLE WAYS OF IMPROVING OUR PERFORMANCES. THERE CANNOT BE A BETTER WAY TO STRIKE A COMMON APPROACH THAN THIS WORKSHOP.

WE ARE THEREFORE INDEBTED TO YOU, MR. MINISTER, YOUR EXCELLENCY, LADIES AND GENTLEMEN TO GRACE THIS OCCASION WITH YOUR PRESENCE. WE ARE ALL MOST GRATEFUL.

LET ME NOW ASK HIS EXCELLENCY, DR. W.S. BOAYUE TO MAKE SOME REMARKS.

ANNEX V

OPENING ADDRESS BY THE WORLD HEALTH ORGANISATION RESIDENT REPRESENTATIVE TO ZAMBIA, DR. WILFRED S. BOAYUE, AT THE NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF RURAL AND URBAN WATER SUPPLY AND SANITATION SYSTEMS AT NEW FAIRMOUNT HOTEL-LIVINGSTONE ON 21ST APRIL 1997

THE HONOURABLE MINSTER FOR SOUTHERN PROVINCE,
THE CHAIRMAN OF THE ORGANISING COMMITTEE,
THE PERMANENT SECRETARY, SOUTHERN PROVINCE
WHO FACILITATORS FROM GENEVA AND BRAZZAVILLE
PARTICIPANTS DISTINGUISHED LADIES AND GENTLEMEN

ON BEHALF OF THE WORLD HEALTH ORGANISATION WE WANT TO THANK THE GOVERNMENT OF ZAMBIA FOR THIS EXAMPLE OF OUR CONTINUING COLLABORATION TO LIFT THE STANDARD OF LIFE OF THE PEOPLE OF ZAMBIA. THIS IMPORTANT WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF RURAL AND URBAN WATER SUPPLY AND SANITATION SYSTEMS, IS BEING SPONSORED BY THE WORLD HEALTH ORGANISATION, AND IS ORGANISED IN COLLABORATION WITH THE MINISTRY OF HEALTH, MINISTRY OF ENERGY AND WATER DEVELOPMENT AND THE MINISTRY OF LOCAL GOVERNMENT AND HOUSING.

THE WORLD HEALTH ORGANISATION IS PLEASED THAT THE WORKSHOP IS FINALLY TAKING PLACE AFTER BEING DELAYED FOR A FEW MONTHS. IT IS BEING HELD AGAINST THE BACKGROUND OF AFRICA'S GROWING CONCERN FOR NURTURING INCREASED INNOVATIVE IDEAS FOR SUSTAINING THE WATER SUPPLY AND SANITATION SECTOR. THE WORKSHOP IS BEING ORGANISED IN ZAMBIA AS PART OF THE OVERALL EFFORTS INVOLVED IN THE PROCESS OF DEVELOPMENT OF THE AFRICA 2000 INITIATIVE. THIS IS PART OF THE COLLABORATION WITH THE OPERATION AND MAINTENANCE WORKING GROUP OF THE WATER SUPPLY AND SANITATION COLLABORATIVE COUNCIL.

THE LACK OF ACCESS TO ADEQUATE SAFE WATER AND PROPER SANITATION ARE MAJOR PUBIC HEALTH PROBLEMS FACING MANY OF OUR COMMUNITIES. IN RURAL

ZAMBIA, FOR EXAMPLE, IT IS ESTIMATED THAT 46% OF THE RURAL POPULATION HAS ACCESS TO SAFE WATER AND 23% OF RURAL POPULATION HAS ACCESS TO PROPER SANITATION.

INADEQUATE SAFE WATER SUPPLIES AND POOR SANITATION ARE THEREFORE MAJOR FACTORS CONTRIBUTING TO AFRICA'S HEAVY DISEASE BURDEN. IT IS ESTIMATED THAT CLOSE TO 80% OF THE SUFFERING OF OUR PEOPLE FROM ILL HEALTH IS ATTRIBUTABLE TO THE DEFICIENCIES IN OUR WATER SUPPLY AND SANITATION. OUR ENVIRONMENT THEREFORE PLAYS A CRITICAL ROLE IN OUR POOR QUALITY OF LIFE.

THE SOCIO-ECONOMIC CONSEQUENCES OF THIS UNACCEPTABLE STATE OF AFFAIRS, ARE NOT ONLY DEHUMANISING, BUT ARE ALSO COSTLY IN TERMS OF THE HEALTH AND ECONOMIC LIFE OF A COUNTRY.

THE DETERIORATING STATE OF WATER SUPPLY AND ENVIRONMENT SANITATION IN OUR RURAL AND URBAN COMMUNITIES HAS RESULTED IN THE RECENT WAVE OF CHOLERA, DIARRHOEA AND DYSENTERY OUTBREAKS WHICH WE HAVE SUFFERED IN THE PAST FEW YEARS.

IT IS AGAINST THIS BACKGROUND THAT NATIONAL EFFORTS LIKE THIS ONE, ARE WARMLY ENCOURAGED BY THE WORLD HEALTH ORGANISATION WHICH STRIVES TO PROMOTE GOOD HEALTH IN MEMBERS STATES THROUGH COLLABORATION WITH NATIONAL AUTHORITIES AND OTHER STAKEHOLDERS.

LET ME REMIND THE PARTICIPANTS ABOUT THE WORKSHOP OBJECTIVES. YOU HAVE A HEAVY SCHEDULE BEFORE YOU WHICH WILL REQUIRE YOUR FULL CONCENTRATION AND PARTICIPATION. THE OBJECTIVES ARE:

1. TO PRESENT THE TOOLS (MANUALS, GUIDELINES AND TRAINING PACKAGES) PRODUCED BY THE OPERATION AND MAINTENANCE WORKING GROUP OF THE WATER SUPPLY AND SANITATION COLLABORATIVE COUNCIL AS WELL AS OTHER RELEVANT MATERIALS RELATED TO THE SUSTAINABILITY OF THE SECTOR.
2. TO ANALYSE THE SECTOR, WITH EMPHASIS ON OPERATION AND MAINTENANCE ASPECTS, IN THE LIGHT OF CASE STUDIES, DESCRIBING THE PERFORMANCE OF THE WATER AND SANITATION SERVICES IN URBAN AND RURAL COMMUNITIES.

3. TO CONTRIBUTE TOWARDS THE DEFINITION OF OPTIONS FOR THE OPTIMISATION AND SUSTAINABILITY OF SERVICES.
4. TO HAVE THE OUTLINE OF AN ACTION PLAN WITH PROPOSITIONS ON MECHANISMS FOR OPERATION, MAINTENANCE AND MANAGEMENT IMPROVEMENTS.
5. TO ELABORATE RECOMMENDATIONS ON THE MECHANISMS FOR THE EVALUATION AND MONITORING OF PROGRESS OF THE RECOMMENDED ACTION.
6. TO SERVE AS A FORUM FOR EXCHANGE INFORMATION AND EXPERIENCES.

THIS WORKSHOP IS COMING AT THE TIME WHEN REFORMS ARE BEING DISCUSSED IN THE WATER SUPPLY AND SANITATION SECTOR. WE WILL, THEREFORE URGE ALL THE PARTICIPANTS TO TAKE FULL ADVANTAGE OF THIS OPPORTUNITY TO ADDRESS ALL THE ISSUES OF OPERATION, MAINTENANCE AND MANAGEMENT WHICH WILL FACILITATE SUSTAINING THESE PUBLIC SERVICES FOR THE BENEFITS OF THE COMMUNITIES WE SEEK TO SERVE. THE CHALLENGE IS TO CREATE ENVIRONMENTS WHICH ARE SUPPORTIVE OF HEALTH BY USING EFFECTIVELY THE LIMITED RESOURCES AVAILABLE TO US AND OUR COMMUNITIES. WE CAN START BY DOING WELL THE SIMPLE THINGS THAT WE KNOW.

DURING THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE FROM 1981 - 1990 WHICH HAD HE OBJECTIVE OF PROVIDING SAFE AND ADEQUATE DRINKING WATER AND APPROPRIATE SANITATION FOR AS MANY PEOPLE AS POSSIBLE, THE INTERNATIONAL COMMUNITY WORKED TOGETHER TO TRY TO REALISE THIS GOAL. THE DECADE STIMULATED GOVERNMENTS, COMMUNITIES AND EXTERNAL SUPPORT AGENCIES TO MOBILISE RESOURCES FOR THE DEVELOPMENT OF WATER SUPPLIES AND SANITATION.

FOR THESE BENEFITS TO BE FULLY REALISED, THE WATER AND SANITATION FACILITIES PROVED DURING THE DECADE MUST BE MAINTAINED SO THAT THEY FUNCTION PROPERLY AND AT CAPACITY.

HOWEVER, AS WE ARE ALL AWARE, THIS IS FAR FROM BEING THE CASE IN ALOT OF INSTANCES. ALTHOUGH RESOURCES HAVE BEEN USED FOR PLANNING, DESIGN AND CONSTRUCTION OF FACILITIES, ATTENTION TO OPERATION, MAINTENANCE AND PROGRAMME EVALUATION HAVE BEEN IGNORED. THIS HAS RESULTED IN THE FAILURE OF UTILITIES TO ACCOMPLISH THEIR INTENDED PURPOSES.

WE WISH YOU VERY FRUITFUL DELIBERATIONS OVER THE DAYS AHEAD. LET US KEEP BEFORE US THE FACT THAT ALTHOUGH OUR PROBLEMS ARE GREAT, WE CAN DO MUCH TO OVERCOME THEM BY LEARNING TO DO WELL THE SIMPLE SMALL THINGS.

ANNEX VI

OPENING REMARKS BY THE DEPUTY MINISTER FOR SOUTHERN PROVINCE, HON. E.M. MIYANDA, MP AT THE NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF RURAL AND URBAN WATER SUPPLY AND SANITATION SYSTEMS AT NEW FAIRMOUNT HOTEL, LIVINGSTONE ON 21 APRIL 1997.

THE CHAIRMAN OF THE ORGANISING COMMITTEE,
THE PERMANENT SECRETARY, SOUTHERN PROVINCE, HIS EXCELLENCY THE WHO REPRESENTATIVE TO ZAMBIA,
WHO FACILITATORS FROM GENEVA AND BRAZZAVILLE,
PARTICIPANTS,
LADIES AND GENTLEMEN.

I FEEL GREATLY HONOURED TO OFFICIATE AT THIS WORKSHOP ON OPERATION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS SUPPORTED BY THE WORLD HEALTH ORGANISATION, HERE IN THE TOURIST CAPITAL OF LIVINGSTONE.

WATER SUPPLY AND SANITATION TOGETHER CONSTITUTE ONE OF THE MAJOR HUMAN CONSIDERATIONS IN DEVELOPMENT. ANY WHERE HUMAN SETTLEMENT TAKES PLACE, ADEQUATE AND SAFE WATER SUPPLIES AND SANITATION ARE ISSUES OF PARAMOUNT IMPORTANCE THAT MUST BE GIVEN PRIORITY CONSIDERATION WHEN COMPETING FOR RESOURCES. GROWING POPULATIONS AND ALL HUMAN GROWTH CENTRES, NEED ADEQUATE SERVICES, BOTH FOR WATER SUPPLY AND SANITATION. INADEQUACIES IN ANY OF THESE SERVICES QUICKLY SHOW BY WAY OF DISASTROUS CONSEQUENCES APART FROM CREATING DIFFICULTIES.
WE ARE AWARE, MR CHAIRMAN, THAT BADLY MANAGED SYSTEMS HAVE RESULTED IN LOSS OF LIFE THROUGH OUTBREAKS OF DISEASES; SUCH AS CHOLERA, DYSENTERY, TYPHOID, ETC. THE LIST IS ENDLESS. NONE ADHERENCE TO OPERATIONAL PROCEDURES AND MANAGEMENT SYSTEMS AND DISREGARD OF MAINTENANCE PRINCIPLES HAVE RESULTED IN FREQUENT BREAKDOWNS AND CONTAMINATION OF THE ENVIRONMENT, RESULTING IN UNCALLED FOR DISEASE OUTBREAKS.

IT IS THEREFORE HEARTENING THAT THE WORKSHOP WE ARE ALL PARTICIPATING IN, TODAY, WILL AMONG OTHER THINGS, COME UP WITH CORRECTIVE MEASURES IN AN

ACTION ORIENTED PLAN TO ADDRESS AND IMPROVE ON OPERATION, MAINTENANCE AND MANAGEMENT SYSTEMS.

OFTEN ENOUGH THE PUBLIC HAS RAISED QUITE LEGITIMATE OUTCRIES ABOUT INADEQUACIES IN THE SYSTEMS TO PROVIDE SATISFACTORY SERVICES. SUCH EXPRESSIONS OF CONCERN BY CONSUMERS SHOULD BE TAKEN SERIOUSLY AS THEY GAUGE OUR PUBLIC PERFORMANCE IN THESE AREAS. MANAGEMENT DIFFICULTIES, SHOULD NOT BE EXCUSES FOR PROVIDING UNSATISFACTORY SERVICES. THIS WORKSHOP, WHICH AIMS AT PROVIDING MANAGEMENT CAPACITY TO FORESTALL SUCH DEFICIENCIES AND RESTORE CONSUMER CONFIDENCE.

MR. CHAIRMAN, I AM THE FIRST TO AGREE THAT ZAMBIA, AT THE MOMENT, IS NOT ENDOWED WITH ALL NECESSARY RESOURCES, BUT WHATEVER IS AVAILABLE MUST BE UTILISED TO THE FULL FOR THE BENEFIT OF THE COMMUNITIES WE SERVE.

IT IS COMMON SITE, THAT WHEREVER ONE GOES IN OUR URBAN AREAS AND TOWNSHIPS, ONE COMES ACROSS HEAPS OF GARBAGE, UNCOLLECTED DEAD ANIMALS, OVER FLOWING AND BROKEN SEWER AND WATER PIPES, LENDING CREDENCE TO THE PREVAILING HEALTH CRISIS IN OUR ENVIRONMENT, MAKING IT UNCONDUCIVE TO GOOD LIVING AND HEALTH. THESE BAD PRACTICES WHICH APPEAR TO BE RECEIVING ACCEPTANCE IN SOME QUARTERS IN OUR SOCIETY BECAUSE THEY DO NOT SEE ANY ACTION ABOUT THEM, MUST NOT BE ALLOWED TO TAKE ROOT AND SHOULD THEREFORE BE STOPPED IMMEDIATELY, IF WE ARE TO ENHANCE NOT ONLY THE QUALITY APPEARANCE OF OUR ENVIRONMENT, BUT ALSO TO PREVENT SOME OF THE PREVALENT DISEASES OF POOR SANITATION.

IT IS THEREFORE, MY HOPE THAT THE TRAINING MATERIALS AND THE SKILLS YOU WILL ACQUIRE FROM THIS WORKSHOP, SHALL ENABLE YOU TO PRODUCE APPROPRIATE GUIDELINES ON THE OPERATION, MAINTENANCE, AND MANAGEMENT OF WATER SUPPLY AND SANITATION SYSTEMS IN THE COUNTRY.

MR. CHAIRMAN, THOUGH THE TECHNOLOGY AND INFRASTRUCTURE MAY BE OLD, IT IS MOSTLY, IN MY VIEW, MANAGEMENT AND LACK OF PROPER MAINTENANCE PROCEDURES, THAT HAVE OFTEN LET US DOWN. I CHALLENGE YOU, THEREFORE, THROUGH THIS WORKSHOP, TO COME UP WITH STRATEGIES THAT WILL HELP US

IMPROVE UPON OUR OPERATIONS AND MAXIMISE BENEFITS TO THE COMMUNITIES WE SERVE.

BEFORE I END MY REMARKS, LET ME PUT ON RECORD, MY PERSONAL AND GOVERNMENT'S GRATITUDE FOR THE FINANCIAL, TECHNICAL AND MATERIAL SUPPORT WE CONTINUE TO RECEIVE FROM THE WORLD HEALTH ORGANISATION, AND IN PARTICULAR FOR SUPPORTING THE HOLDING OF THIS WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF THE WATER SUPPLY AND SANITATION SYSTEMS WHICH IS BEING FACILITATED BY WHO OFFICIALS FROM GENEVA AND BRAZZAVILLE. TO US THIS IS A CLEAR DEMONSTRATION OF YOUR ORGANISATION'S COMMITMENT TO IMPROVING THE HEALTH STATUS OF ALL ZAMBIANS THROUGH APPROPRIATE HEALTH INTERVENTIONS SUCH AS THIS ONE. WE ARE MOST GRATEFUL.

AS OUR NEEDS ARE ENDLESS, I WISH TO MAKE AN EARNEST APPEAL, TO YOUR EXCELLENCY, TO BEAR WITH US WHEN WE COME BACK TO SEEK FOR YOUR ASSISTANCE. WE PROMISE TO PUT WHATEVER SUPPORT WE RECEIVE TO GOOD USE FOR THE BENEFIT OF OUR PEOPLE.

I FURTHER TAKE THIS OPPORTUNITY, TO RECOGNISE AND EXTEND OUR SINCERE THANKS AND APPRECIATION, TO ALL OUR CO-OPERATING PARTNERS AND STAKEHOLDERS THAT ARE REPRESENTED HERE AND EVEN THOSE UNABLE TO BE HERE WITH US TODAY FOR THE SUPPORT THEY CONTINUE TO GIVE US, PARTICULARLY IN THE WATER SUPPLY AND SANITATION SECTOR.
LASTLY, BUT NOT THE LEAST, I WISH TO THANK THE ORGANISERS OF THE WORKSHOP FOR A JOB WELL DONE, AND FOR HAVING CONSIDERED LIVINGSTONE, THE VENUE. PLEASE FEEL AT HOME AND WELCOME.

FOR YOU PARTICIPANTS, THE WORK IS JUST ABOUT TO START AND PLEASE TAKE ADVANTAGE OF THE OPPORTUNITY, AND INITIATE IMPROVEMENTS TO PUBLIC SERVICE SYSTEMS THAT YOU ARE RESPONSIBLE FOR.

IT IS NOW MY HONOUR, PRIVILEGE AND PLEASURE, TO DECLARE THE OPERATION, MAINTENANCE AND MANAGEMENT OF WATER SUPPLY AND SANITATION SYSTEMS WORKSHOP OFFICIALLY OPEN.

THANKYOU.

APPENDIX

CASE STUDY PAPERS
PRESENTED AT

THE NATIONAL WORKSHOP ON OPERATION, MAINTENANCE AND MANAGEMENT OF WATER SUPPLY AND SANITATION FACILITIES.

FAIRMOUNT HOTEL - LIVINGSTONE
21st to 24th April 1997

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CASE STUDY ON
OPERATION AND MAINTENANCE (O&M) OF NDOLA URBAN AND PERI-URBAN WATER SUPPLY AND SANITATION SYSTEMS

PREPARED BY:

Mr. G. Mukosayi - Director of Water and Sewerage-Ndola City Council
Dr. T.J. Fatch - Acting Director of Health-Ndola City Council

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1.0 EXECUTIVE SUMMARY

The population of Ndola Urban (648,074) has 80% of the people with access to Council water supply, and 50% have sanitation services in form of waterborne, while the rest use pit latrines and septic tanks.

The water sources are surface and ground water, sewerage systems is the major of form effluent disposal from domestic and industrial premises.

The aged water and sanitation system operate below capacity due to defective equipment.

The city has (4) four water and (3) three sewage treatment works. The total reservoir capacity represents 73% of the current daily production.

The department practices passive leakage control. Although 98% of water losses occur within the premises of the consumers, there are no measures for water conservation as at the premises of the consumer conservation.

Although preventive maintenance on equipment like switch gears is carried out by contractors, the department only carries out corrective maintenance on its pumps and motors.

Due to council's problems, the required spare parts and water treatment chemicals cannot be procured when required.

The water quality control undertaken by the laboratory is limited due o lack of funds to purchase the required reagents and media.

The institutional framework for cost recovery does not exist. Consumers are charged fixed rates irrespective of consumption.

The local political consideration to the communities coupled with indebtedness from government institutions and inability to service water bill arrears have constrained improved performance in water and sanitation by councils.

Solid waste management is in disarray due to lack of refuse collection vehicles and council's liquidity position cannot support the purchase of a new fleet of refuse collection vehicles.

The Water and Sewerage department has critical shortage of qualified manpower and recruitment schemes have been unsuccessful due to poor conditions of service. These has been very little working relationship with other stakeholders in water supply and sanitation sector.

2.0 INTRODUCTION

Ndola is the administrative headquarters for the Copperbelt Province and has over the years developed into a major industrial and commercial centre. The area covers 100,000 hectares. It accommodates strategic industries manufacturing products to support the mining, industrial and agricultural sectors of the economy. The notable industries being, Petroleum Oil Refining, Lime Quarrying, Cement manufacturing and Textiles.

The present population of Ndola is about 448,074 with a growth rate of 2.95% per year. Approximately 80% and 50% of the population is served by the council's water and sanitation services respectively. The rest of the population is dependant on boreholes, wells, springs and streams for the water supply and on pit latrines and septic tanks for sanitation.

The major health indicator are:

Infant mortality rate 68.9/1000 live births
General death rate 1.3%
Under five mortality rate 114/1000
The life expectancy for female is 51.1 years and males 49.3 years in 1990.

Ndola is presently supplied with water from four sources, two surface and two ground water. Waste water of domestic and industrial nature that is generated in the city is conveyed by gravity and pumping at 3 NO. pumping stations to three sewage treatment works with the effluent being discharged into the Kafubu river, a major source of water for the city.

Without exception all of the city's old water and sanitation schemes are not operating to expectations, principally due to malfunction in broken down mechanical and electrical equipment which are in most, absolete and unserviceable and are therefore in need of replacement.

The recently commissioned schemes are also being operated far below their design capacities due to breakdown of some equipment which cannot be easily repaired or replaced due to lack of funds.

Solid waste management poses serious public health problems in the city. The council's liquidity problem has unabled replacement of depleted fleet of refuse trucks, in 1972-1975, when the population of Ndola was 180,000, the council had (14) fourteen refuse trucks on the road. This causes the refuse collection exercise to be conducted haphazardly and only targeting sensitive institutions such as hospitals, hotels, town centre and parts of high cost residential areas. With (2) two refuse trucks, only 20% of the refuse is collected in the city.

The bulk of the refuse in low cost housing areas, market and open spaces poses an eye sore to the members of the public and general embarrassment to the council. Until the central government purchases adequate reuse trucks for the major cities of Lusaka, Ndola and Kitwe, it would not be possible to address the problem of solid waste management. The entire cities would be engulfed in refuse and diseases associated with poor solid waste disposal would be the order of the day. Plans to attract investors in Zambia will be difficult with poor sanitation and solid management systems.

3.0 WATER SUPPLY AND SANITATION INSTITUTIONS

The Water and Sewerage Department of the council is charged with the responsibility of providing water supply and sanitation services to the serviced areas of the city. The department has five sections, viz. water undertaking, sewerage, accountancy, administration and laboratory. The department has a critical shortage of qualified personnel at all levels in the technical and accountancy sections. Recruitment efforts have been unsuccessful due to unattractive remuneration and conditions of service obtaining in the council. There is very little working relationship with other institutions of government in the sector like Department of water Affairs and Department of Public Works.

Participants of NGOs in the provision of water and sewerage services has been minimal in the past but the recent endeavours by the Rotary Club, Catholic Dioceses and World Vision are very much appreciated and encouraged.

Although there is no presence of the private sector in the provision of water supply services, a few firms offering septic tank emptying and sewer unblocking services have of late been established.

4.0 EXISTING WATER AND SANITATION FACILITIES

Ndola is fairly well serviced by water and sewerage systems in comparison with other towns in the Copperbelt.

Ndola is supplied with water from Kafubu, Itawa, Misundu Stage I and II treatment plants.

Domestic and industrial waste generated in the sewered areas of Ndola are conveyed for treatment at the sewage treatment plants, namely Old Kanini, New Kanini and Lubuto. The Plants are of the conventional (trickling filter) type. Details of the above mentioned installations are given in Table 3.1 and 3.2.

TABLE 3.1 DESIGN AND ACTUAL CAPACITIES (1996) OF WATER TREATMENT PLANTS

PLANT	YEAR COMMISSIONED	DESIGNED CAPACITY (M3/d)	ACTUAL CAPACITY (M3/D)
Itawa	1955	25900	14100
Kafubu	1966	81800	62200
Misundu I	1985	55000	28500
Misundu II	1991	45000	27500
	TOTAL	**207,700**	**129,700**

TABLE 3.2 DESIGN FLOWS AND ACTUAL FLOWS (1996) OF SEWERAGE TREATMENT PLANTS

IN-PLANT	YEAR COMMISSIONED	DESIGN IN-FLOW (M3/d)	ACTUAL IN-FLOW (M3/d)
Old Kanini	1958	11,400	23300
New Kanini	1992	9000	23200
Lubuto (Old)	1972	22700	15500
Lubuto (StageIV)	1994	9000	13800
	TOTAL	**52,100**	**75,800**

It is evident from the two tables that the Water Treatment Plants are under producing whilst sewerage plants are overloaded.

The primary water distribution network (rising and falling mains consists of steel and concrete pipes whilst asbestos cement pipes are the most predominating in the secondary distribution system, the pipe network is in a fairly good condition. However, the same cannot be said of the sewer network, especially the trunk sewers which are either corroded or partially blocked by silt. The pipes used are mainly made of reinforced concrete for trunk mains and the service lines, are of clay, PVC and asbestos cement.

Ndola has 15 service reservoirs with a total capacity of 96,000 m3 representing 73% of the current daily production. There are three sewage and one water pumping station in operation.

For house water connections, galvanised iron pipes (GI) are universally in use and problem of corrosion are not prevalent.

In the absence of both bulk and consumer meters, unaccounted for water cannot be quantified.

5.0 OPERATION AND MAINTENANCE ASPECTS

As mentioned earlier in the report all the bulk meters at treatment plants and in the distributions systems (districts) are either non-existence or in unoperatable state.

Leakage control comprises the over activities and routines necessary to maintain losses in the system at a minimum level. Leakage control encompasses both leakage detection and leak location. However, the department currently practices passive leakage control due to logistical factors but mostly lack of institutional capacity.

The department maintains water reticulation and sewerage maps which need to be periodically reviewed and updated.

Although a recent report pilot study (NORPLAN) revealed that most losses take place within the consumers' premises as a result of defective plumbing fittings and negligence, there are currently no water conservation measures being undertaken.

The equipment in the water and sewerage treatment installations mainly comprises transformers, switch gears, motors, pumps, meters, protection and process instruments. Due to absent of expertise and tools, the department has a policy of contracting out periodic

preventative maintenance on its transformers and switch gears. However preventative maintenance of pumps and motors is now rarely undertaken as a result of:

- Lack of replacement plants, lubricants and other requisites
- Non availability of stand-by units in most cases
- Lack of appreciation of the strategy by unqualified personnel manning the equipments

In view of the reasons cited above, the department carries out only corrective maintenance of pumps and motors i.e. equipment is repaired when it breaks down. However, the speed at which this is done greatly depends on the availability of fund to procure the required replacement parts since they are not ever stocked. in some cases the lack of tools which have to be borrowed or hired also affects the repair duration.

Maintenance of the distribution network and water and sewerage treatment installations is carried out under trying conditions. In view of the lack of funds, even though the maintenance of the later often takes precedence over the former.

Aluminium Sulphate and Chlorine are respectively used for coagulation and disinfection at the Water Works. However, the actual position is that for the part one and half years, the department has due to financial constraints been unable to procure and stock aluminium sulphate. Chlorine is also only dosed at Itawa and Kafubu Water Works. The non application of aluminium sulphate undoubtedly impacts on the efficiency of the treatment units and ultimately on the quantity and quality of the treated water and this is a big problem for Ndola in view of the raw water.

The department has got a laboratory at which both raw and treated water is analysed weekly. Corrective measures are taken whenever the quality of the water is objectionable. Even if the lab. is relatively well equipped, testing is limited to a number of parameters owing to lack of reagents and media. Analysis of both sewerage influent and effluent has never been performed for a long time now, this is due to non availability of an incubator.

6.0 COMMERCIAL ASPECTS

The department being part of the council which is a service organisation has no cost recovery framework.

Even though tariff setting for water and sanitation services is very similar to any other commercial/industrial activity, there are many differences due to the nature of these services. The strategy for tariff setting is complex because it has an impact on the behaviour of the individuals in terms of water consumption and also in their willingness to support the system. It is therefore very important to understand the different options for the tariff structures and their technical, social and economic implications.

Although the present tariff structure which is in use is according to different categories of consumers , profile is based on metered consumption, but consumers are currently charged flat rates. Clearly this type of rate is not perpetuated since the marginal use or wasting is zero.

A policy of metering has always existed in the council but is restricted to domestic consumers in high and medium cost areas and industrial, commercial and industrial consumers. However, the policy has not been implemented in the past 10 years or so due to the fact that metering involves maintenance and administration costs on which the return when dealing with low income/low use consumers has just justified the cost. Presently a high percentage of house connections are metered, however, a high number of these are not working due to lack of maintenance systems, repair facilities and spare parts. Even the few that are working are rarely used for billing purposes.

In the absence of a working metering system and lack of control and monitoring by senior staff and auditors, the incidence of illegal connections are high.

Billing is done on computer and the bills are hand delivered to consumers. Settlement of bills at one pay point which is the revenue hall at civic centre.

7.0 CONSTRAINTS FOR IMPROVED PERFORMANCE

- The present institution framework for the provision of water and sanitation serves is not ideal for an improved and sustainable service delivery. The hope for the future lies in commercialisation of the sector.
- Due to poor financial position the council cannot afford to institute preventive maintenance to plant and equipment to plant and equipment in the water and sewerage schemes. In addition the heavy indebtedness of the government departments in settling water bills has aggravated the situation.
- Political considerations have not helped the council to improve its operation capacity. There has been resistance from local political leadership to increase water tariffs to commensurate with the services provided by the council. The local leadership has not sensitised the community to participate in environmental cleanliness and involve the people in refuse removal, cleaning, burying to facilitate good environmental sanitation. The communities have been passive and require the council to execute all duties concerning solid waste management.
- There is lack of community participation in water and sanitation programmes in shanty compounds. Communities are not involved during, planning implementation, monitoring and evaluation of water and sanitation community projects
- Vandalism-there is abuse and theft of existing installations which are difficult to replace.
- Unsatisfactory water tariff systems: there is high defaulting rate on water bills due to lack of civic responsibilities along consumers.
- Solid waste management and sanitation in general seems not to attack donor support as compared to water programmes.

8.0 PERSPECTIVES FOR THE FUTURE

Upon noting adequacies in the existing operational arrangements in local authorities, the government realises that the need to sustainable local management of urban development is the building of capacity within councils to plan, finance operate and maintain infrastructure and services and to this end embark on a programme of Urban Restructuring of the Water Supply Projects (URWSP) to address these issues.

The project comprises of three components as follows:

a. water supply and sanitation system rehabilitation

b. community based water supply and sanitation demonstration projects

c. sectoral and local government reform and capacity building.

CASE STUDY ON

1. OPERATION AND MAINTENANCE (O&M) OF LIVINGSTONE URBAN AND PERI-URBAN WATER SUPPLY AND SANITATION SYSTEMS

PREPARED BY:

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1.0 INTRODUCTION

Livingstone draws its raw water from the Zambezi River about 5km away from the water treatment plant along Mushili road in Hilcrest.

The raw water quality is quite good and devoid of industrial discharges. However, the turbidity of the raw water can rise to maximum of about 35 NTU during the wet season (see Table I).

The population of Livingstone was estimated at 96,623 in 1990 census and is expected to increase to approximately 128,151 by the year 2000 according to the draft report on Institutional Analysis and Tariff Study, water and sewerage sector, dated February 1995. The water demand calculation is based on the council's serviced area and population figures in the report. See Table 2.

Despite an average daily pumping rate of 36,00 m3/hour demand is not met because of massive losses in the distribution systems. The sewerage system is also broken down due to old age and vandalism. Sewage spillages are a frequent sight, especially in Maramba and Malota areas.

The water supply system serves about 98% of the population. The incidences of diarrhoeal diseases is relatively low. While malaria prevalence is about 30%, probably due to many pools of water in the residential areas brought about by leaking taps and pipes.

2.0 RAW WATER INTAKE

There are three pumping stations at the raw water intake along the banks of the Zambezi River. Pump station NO. 1 was commissioned in 1956 and was used upto 1994. The second pumping station was commissioned in 1964 and will be phased out because of absolete machines and control panels. This station has only one pump running which has a capacity of up 1200m3/hour. Pump station NO. 3 which was commissioned in 1986 will remain in service. This station will have its pumps will be modified in order to improve capacity while the two gates of the suction compartments have already been enlarged in order to improve the hydraulics. The surge protection equipments have been repaired. All the work mentioned above had been funded under the now ending ADB rehabilitation programme.

3.0 WATER TREATMENT

The water treatment plants uses conventional treatment methods which are flocculation, sedimentation, filtration and disinfection.

In coagulation/flocculation process which is basically for the removal of colloids ($10mm^{-3}$ to 10mm-6) which are often clay particles but may also be organic from wastes, the coagulant being used is aluminium sulphate and this has been found suitable for Zambia as a whole. Coagulation causes micro flocs to be formed and the size of these flocs are increased in the flocculation process to make settling possible. The settling process after increase in particle size is what is called sedimentation and takes place only when the particle density is greater than that of water.

After sedimentation the next treatment process is filtration in the gravity filters. These are intended to remove suspended solids, colloids and micro organisms. The filters use sand as media and effect treatment by sedimentation onto the filter media and absorption into media (e.g. colloids). It can now be stated that since about 98% of Livingstone residents get their water from Council water supply it can be deduced that water borne diseases are rare. But

other water related diseases, like malaria are quite common, especially with so many leakages in the distribution system The malaria incidence is 30% for Livingstone.

The treatment facilities consist of two plants. The old plant was rehabilitated in 1995 and has capacity of 25,000m3/d. The production of water is limited by the pumping capacity and the two rising mains

4.0 SERVICE RESERVOIRS

From the water treatment plant the water enters into eight reservoirs of total capacity 31,300m3 Ample storage is available for the system. There are also two elevated tanks of 1000m3 total capacity meant to cater for the high level zone but are not in use and the pressure zoning is non existent And because of this the high level areas do experience shortages

The pressure zoning will be done under the 'nine towns water supply and sanitation rehabilitation' funded by NORAD and the World Bank. The rehabilitation programme has been divided into lots as follows:

Lot 1. Rising Main. Minor works only (for raw water)

Lot 2 Airport Pumping Station

Lot 3: Pressure zoning

Lot 4 Sewage collection system. Included here are service and partial replacement of sewerage pipelines in Airport Compound, replacement of part of sewerage pipelines in Maramba Township, and the supply of pipes, fittings and materials for use by the council in the Nottie Brodie area.

The tender documents have been prepared according to the above.

5.0 THE DISTRIBUTION SYSTEM

The distribution system consists of AC and steel mains down to 100mm diameter and galvanised Iron pipes for less than 75mm diameter. See Table 3

The distribution system was originally divided into two zones, but alot of connections have been made To obtain adequate pressure in the distribution system, it is proposed to divide the system into three pressure zones.

A leak detection and repair team has been constituted. Training will be provided under the Interconsult consultancy. Equipment will also be provided.

There are many leaks in the system and includes running taps. At present the distribution system accounts for abut 50% water loss.

6.0 LABORATORY FACILITIES AND MONITORING PROGRAMME

Equipment which was not available in water works laboratory will be procured under the NORAD/World Bank rehabilitation programme.

A monitoring programme is in place and the main parameters are residual chlorine, turbidity and chemical dose. The problem faced in monitoring programmes is lack of reagent and lack of qualified personnel. Coliform and faecal coliform bacteria counts are not done, for instance. The qualification for laboratory personnel should be as given in Table 4.0.

There will be some on the job training' under the above rehabilitation programme. It will greatly help but it will not be a complete solution.

7.0 SEWAGE COLLECTION

The system is dilapidated due to old age and vandalism. It has also exceeded its design life in most areas. The system in Maramba and airport compounds will be rehabilitated as mentioned earlier. The Linda sewerage system is also in a bad shape but it will not be rehabilitated because the money which was allocated to the project was not enough.

The sewage re-pumping stations are Libuyu, Linda and Town centre. There is another pumping station at the sewage stabilisation ponds which pumps into ponds. Livingstone sewage is treated using stabilisation ponds. Treatment in the stabilisation ponds is effected by natural means. There is biological degradation of organic matters by saprophytic bacteria. Other important groups in sewage treatment are:

- Aerobic (need dissolved oxygen)
- Anaerobic (do not need dissolved oxygen)
- Facultative (can use dissolved oxygen if present and can do without it if absent)
- Pathogenic - These are disease causing bacteria and in sewage treatment these are ingested by predator organisms.

Other special groups important in sewage treatment are protozoa and viruses. Sewage contains also Helminths which are parasitic worms which inhabit in certain parts of the Human body. Good treatment kills all these.

The ponds have not yet started spilling since they were commissioned in July 1995. The sewage effluent outfall pipes lead to the Zambezi River The sewage stabilisation ponds system is a non-conventional system fit for developing countries as it needs less capital investment. And it is almost maintenance free It produces effluents of good quality.

the main parameters in sewage treatment are suspended solids. BOD (Biochemical Oxygen demand) and coliform counts. In Livingstone the above tests have not yet being carried out because of lack of reagents and equipment. There is also need for trained staff as mentioned earlier.

The main disadvantage with this method of treatment is that it needs large areas of land

8.0 OPERATION AND MAINTENANCE

The programme of maintenance at the moment depends on reported faults. Preventive maintenance has been difficult to carry out because of lack of transport. the department has only one 2X4 Van which has to take care of all transport needs of the sections.

Communication is also a very big problem. Mobilisation during emergencies has been impossible. Telephones are non existent, though walkie-talkies would be more appropriate.

Procurement of spare parts is an impossible task because of the liquidity position of the water undertaking. The main consumers of water are Government Institutions and those who are dependent on Government in one way or another. This is so because the private sector is almost non existent.

Government Institutions like the hospitals, Zambia Air Force Base and many others know that supplies of water cannot be disconnected and hence do not bother to pay even when payments for water are included in their budgets.

9.0 COMMERCIAL ASPECTS

The department has a water and sewage billing system based on metered and unmetered consumption, but almost 100% of the consumers are billed at a fixed rate. This is so because of vandalised meters and transport problems. At present the tariffs are not based on assessed water consumption for different categories of consumers. This is because efforts to increase water charges have received no support from the council.

The present flat rates are:

- High/Medium cost K7,400.00 per month
- Low cost K3,800.00 per month

The peri-urban receives treated water and the department has started the sensitisation of the communities so that they become partners in the water supply and sanitation improvement programme.

10.0 CONCLUSION

The water sector in Livingstone could do better if it were autonomous. It cannot discharge its functions properly as a department of the council.

However, the future is bright especially with the Urban Restructuring and Water Supply Project (URWSP) Programmes inplace. Physical work is expected to begin this year. And the Water Supply and Sanitation bill is about to be passed which will facilitate the formation of commercially viable water utilities in the province and in the country.

TABLE I

Raw Water Quality of Zambezi River

PARAMETER	AVERAGE OR SINGLE VALUE	GUIDELINES VALUE FOR TREATED WATER	REMARKS
pH	7.3	6.5-8.5	Varies between 6.7 and 7.8
Total alkalinity (mg CaCO3)	25, 80-100		Big difference between sources of date
Total Hardiness	34	500	
Turbidity (NTU)	5	5 (preferably for disinfection efficiency)	Maximum 35
Colour (mg pt/L)	20	15	Maximum 125
Conductivity (ms/cm)	81		
Total Iron (mg/L)	(0), 0.08	0.3	
Total Manganese (mg/L)	(0)	0.1	0:33 mg/L in the Water Works date tested 1981

TABLE II

Water Demand in Livingstone

	POPULATION	SPECIFIC CONSUMPTION L/c/d	WATER DEMAND M3/DAY
HIGH COST	16,000	250	4,000
MEDIUM COST	6,000	150	900
LOW COST	38,000	30	3,040
NON-CONVENTIONAL	37,000	30	1,110
SUB-TOTAL (I)	102,000	118	12,050
LOSSES, 30% OF (I)		35	3,615
TOTAL AVERAGE DAILY DEMAND		**153**	**15,665**

NOTE: The figure of 30% loss is theoretical and represents a system in good operation.

TABLE III

Distribution System in Livingstone

TYPE	DIMENSION (mm)	LENGTH (Km)	AGE (Year)	BURSTS 1995	
				NOs	BURSTS PER Km
GI	3/4 Inch	4.0	20-30	6	1.5
STEEL	1-1 1/2 Inch	7.0	20-30	13	1.5
STEEL	50	15.0	30-40	8	0.5
STEEL	75	7.0	60-70	10	1.4
STEEL	100	12.0	60-70	10	0.8
STEEL	150	1.6	60-70	8	5.3
AC	50	6.0	30-40	10	1.7
AC	75	25.0	20-25	80	3.2
AC	100	18.0	20-30	40	2.2
AC	150	20.0	30-40	60	3.0
AC	200	1.8	14-25	6	3.3
AC	225	13.5	20-45	67	5.0

AC	250	2.0	30-35	0	-
AC	300	4.0	14	1	0.25
TOTAL		114.8		319	2.8

TABLE IV

Laboratory Personnel

POSITION	LEVEL OF EDUCATION	SUGGESTED COURSES
Biochemist or Senior Biochemist	University Degree	BSc with chemistry and mathematics or (if incharge of waste water treatment) Biology with at least 2nd year maths
Laboratory technologist	Diploma	Laboratory Technology from Everlyn Hone college. Water Engineering from NRDC or HND from CBU
Laboratory Technician	Certificate	Laboratory Technician from Everlyn Hone College
Laboratory Assistant	Certificate Grade 12	From Lusaka Trades Schools

REFERENCES

1. Norpalan A.S. - Water Quality Report
2. Norplan A.S. - Leak Detection Programme
3. Norplan A.S - Detail Design report.

CASE STUDY ON

2. SOLID WASTE MANAGEMENT IN LIVINGSTONE CITY

1.0 INTRODUCTION

Livingstone district has an estimated population of 96,623 spread over an area of approximately 1,427 square kilometres of which 282 square kilometres is urban and 1,145 square kilometres is rural. The growth rate of Livingstone is 0.016.

Estimated Population of Livingstone by Residential areas 1997.

Rural		10,553
Airport		1,841
Dambwa North	8,257	
Nakatindi/Institute/college		3,052
Kashitu/Indeco		2,695
Dambwa site and Service		4,093
Dambwa central		4,476
Zambia Railways		2,627
Cold storage/Sawmills		3,213
Linda		6,485
Central police		5,108
Livingstone Central		6,835
Nottie Brodie/Hilcrest		4,305
Hilcrest		3,710
Maramba		9,732
Malota		5,998
Ngwenya		3,724
Libuyu		9,929
TOTAL		**96,623**

TABLE I
Refuse Generation and Disposal

Demographic Characteristics Population	**1990 84,000**	**1997 96,623**	**2000 109,000**
Residential areas			
High Income	15%	15%	20%
Medium Income	5%	5%	10%
Low Income	80%	80%	73%
Estimated population by income bracket			
High income	12,00	14,493	21,800
Medium income	4,200	4,831	7,630
Low income	67,200	77,299	79,570
Estimated Daily Refuse Generation	Kg	Kg	Kg
High income areas	11,340	13,044	19,620
Medium income areas	2,940	3,382	5,341
Low income areas	26,880	30,920	31,828
TOTAL REFUSE DAILY (Kg)	**41,160**	**47,346**	**56,189**

Refuse estimated disposal 1,400 kg (1.4 Tons).
(The tipper collects approximately loads of 700 Kg refuse per day)

Assumed refuse generation rates:

- High income areas 0.9 kg/c/d
- Medium income areas 0.7 kg/c/d
- Low income areas 0.4 kg/c/d

Health indicators measuring quality of solid waste disposal

a. Diarrhoeal diseases prevalence rate - 12.3%
b. Number of eye diseases prevalence rate - 4.1%
c. Quantity of refuse accumulations - 46 Tonnes
d. Number of rat infection complaints received per month - 3%

2.0 PUBLIC CLEANSING

Public cleansing includes refuse collection and disposal, town and street cleansing, vacuum tanker and public toilets.

a) Types and refuse sources
The solid waste handled by Livingstone council is categories as follows:
- Domestic and garden waste-from residential
- Trade and commercial waste - from trading premises
- Industrial waste- from industrial premises. This comprises of paper, metal cans, glass, plastics, vegetable, leftover food or garbage, building rubble, ash and sweepings.

Refuse is disposed at off Lusaka road 5 km from town centre by way of sanitary land fill.

Solid waste in Livingstone is managed by council with an exceptional of waste from hospital and clinics, which is managed by the hospital authorities and burnt at a central incinerator.

The overall goals of the city solid waste management are:
- Improved and safe guard of public health and welfare
- Protection of environmental quality
- Minimising Public nuisance and cost

3.0 CAPACITY OF THE COUNCIL TO COPE WITH THE PRESENT SITUATION

The present situation of the solid waste management in the city is very much inadequate in that; there is only one tipper truck which consistently breaks down and is also used as a hearse. The organisation of the Public Cleansing is such that it is headed by a Cleansing Superintendent who is responsible to senior Health Inspector while he is responsible for the Cleansing Foreman, C/F who is responsible for driver and chargehands who inturn are responsible for the refuse collecting team of 10 workers. Two workers are controlling the tipping at the dump site. Town and street section is serviced by 35 workers and of these they are six (6) women, the rest are men.

3.1 Sanitation Facilities

The waterborne sanitation covers most of town area and is about 70%. While 20% of town still uses aqua privies and pit latrines. The remaining 10% is serviced with septic tanks and soakaways.

A team of hygiene Assistance comprising of 5 women and 3 men which comes to 8 workers is assigned to Health Educate Residents from door to door advising them on many health issues including advising residents to be responsible for their own refuse and encouraging the community to be digging refuse pits in the back yard for refuse disposal.

PUSH-CARE is the only NGO which has to a greater extent assisted the council with sanitation programmes especially in the compound of Malota. For a number of years now PUSH-CARE has worked hand in hand with the city council through the steering committee which was established.

3.2 Constraints of Public Cleansing

Over the years services has suffered greatly due to the following factors:

a) Non-availability of refuse collection vehicles and other utility vehicles

Ideally the council requires at least 15 road worth refuse collection vehicles if the refuse produced is to be collected without undue delays. It must be remembered that Livingstone is hot and therefore organic waste quickly becomes putrid. At the moment there is as shown below:

TABLE II

NO. AT HAND	NO. REQUIRED	REMARKS
Refuse collection Trucks-1	14	-
Vacuum Tanker-2	2	Possible runners only lack spare parts.
Utility Vans-Nil	2	One possible runner requires spare parts

b) Lack of adequate and suitable cleansing implements, equipments and chemicals.

At present moment there are only a few cleaning tools that cannot go round cleaning teams. this is due to Financial problems. As a result streets, storm water drains and townships are not as clean as they are suppose to be.

c) State of disrepair of public conveniences.

The present state of disrepair of public toilets and those found in markets, community halls and taverns are a great concern to the council where possible out breaks of epidemics such as cholera, dysentery and other diarrhoea diseases would occur. The rate at which fittings are being damaged and stolen in these public facilities is alarming. The cost of cisterns and squatting pans and chemicals is beyond the council's financial capabilities.

3.3 Management of Waste Disposal

To maximise the efficiency and effectiveness of investments in this area there is need for Project designers to address issues like:

a) A comprehensive policy frame work should be adopted which should take into account all physical, technical, financial, environmental, social and cultural aspects of the City's solid waste management.

b) Plans for improving waste operations and facilities, vehicles maintenance and repair, staff training, management practices and systems, facility sites, financial scheme for capital and recurring costs and provisions for involving the public in solid waste planning and decision making process.

c) Encourage formal city solid waste services to integrate existing informal city solid waste management services so that efficiency and safety are maintained and the warfare of the scavenging community protected.

d) To improve city solid waste management, the potential for introducing or expanding private sector involvements through contractual arrangements should be evaluated.

CASE STUDY ON
RURAL WATER SUPPLY SANITATION SITUATION IN MONZE DISTRICT

PREPARED BY:

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1.0 FUNDAMENTAL CONCEPTS

Sanitation may be defined as the control of those factors of the environment affecting public health. The fundamental principles being found in the science of bacteriology, biology, entomology, chemistry and physics with engineering application of the basic principles of these science to the design of machinery and structures it has been possible to develop modern life and present day civilisation.

The history of sanitation is the record of development and subsequent application of these services to public health.

Initial sanitary efforts was to secure safe water supplies and sanitary methods for sewage disposal. Broadly speaking these factors in man's environment which can and actually affect adversely or otherwise his health include, food he eats, the air he breaths, the housing methods, disposal of the human significance, the sanitary state of the environment to mention but a few.

During the past 30 years the world has changed ideologically and socially perhaps more profoundly than in any previous decade. One thing that has remained unchanged, however- the will to live is stronger everywhere in the world than it has ever been. The developed world has made appreciable stride towards the improvement of environment sanitation resulting into the reduction or the virtual elimination of insect sewage or rodent borne diseases such as malaria, cholera, typhoid, typhus and dysentery. Measures for the protection of drinking water, for the disposal of sewage, for the safeguard of food etc. have paid enormous dividends in the saving of human lives and in the even greater saving of the Kwacha.

Yet for well, over three quarters of the world population, these beneficent results are still largely to be attained. Neither personnel, funds, understanding nor political will are available in sufficient amounts to bring even a tithe of the benefits the developed world has been fortunate enough to gain. Zambia is largely rural, and the sanitation in this rural part can only be described as dismal, pathetic and highly unsatisfactory and yet the cry from the people there is for the provision of hospitals and health centres and the politicians echo this cry leaving the environmental sanitation completely unattended to. Yes we need these hospitals health centres etc. for they have their own roles to play but why should this be at the expense of environmental sanitation? Patients are treated for a variety of these infections and preventable diseases and those who are like to recover go back to the contaminated environment and the cycle starts again resulting into the expenditure of millions of the scarce kwacha.

As long as the attitude remains unchanged towards priorities in the health delivery system, as long as environment manipulation in favour of good health remains a pipe dream, mother Africa and Zambia in particular will continue to experience untold deaths of innocent people arising from disease associated with insanitary environment.

it is difficult to imagine any clean and sanitary environment without water. Invariably the progress of sanitation throughout the world has been closely associated with the availability of water. It is this water which is not readily available to the rural part of the district under consideration but the argument can be applied to any rural district in the country. The urban ones are not also spared from this situation. In the absence of readily available water the only means open to the people in their endeavour to dispose off the human waste is by the conservancy system taking the form of pit latrines, in certain cases ventilated improved pit latrines (VIPS). The applicable science assumes that the faecal matter whilst in the pit will be subjected to bacterial break down into simpler substances of effluent and sludge with the former percolating or seeping away into the soil and the sludge remaining behind situated well away from source of water supplies and being inaccessible to flies and other vermins which can in turn contaminate food etc.

The district health profile should include among other things a list of common diseases by age groups at a given time of the year procured by carrying out of a very detailed and comprehensive community diagnosis. This should be followed by the setting up of priorities strategies and programmes of how the health officials intend to tackle these diseases so as to render them to be no longer a major public health problem. After a set time a situational analysis should be carried out to determine the cost effectiveness of the measures earlier on employed.

The report under consideration highlights some of the activities the WASHE team has embarked on since 1996 October over a period of three years in the field of water supplies and as sanitation with a view of improving the lot of the people in as far as the standard of living is concerned. Unfortunately the report does not indicate what diseases associated with water and sanitation are prevalent as of now so as to facilitate a comprehensive analysis of the effectiveness of the measures that will have been put in place at the end of the three years.

2.0 WATER SUPPLY AND SANITATION SYSTEM IN MONZE DISTRICT

Located in the Southern Province of Zambia, with a population of just over 180,000. 157,000 being rural which is (87%) with 3% annual growth.

Economy
Is basically agricultural. Of 454 water points more that 1/4 are not functioning. The coverage rate of working water points is 1 per 480 people.

13% of the total population is urban which is being served by a reticulation water supply system though even with this population, a good portion of which is in shanty compounds served by shallow wells and isolated stand pipes.

District population	180,005
Rural population	157,139
Area of district (Km2)	854
population density p/Km2	32.4
Total number of water points	454
Water point density (wp/Km2)	1.11
Estimated Nation WP density	1.30
Relative Coverage all water points (P/wp)	1.346
Relative Coverage water points in use only	1.48
Estimated National Relative Coverage all Water points	1.231

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WATER POINT "IN USE AND NOT IN USE" BY TECHNOLOGY TYPE

TYPE	HAND DUGWELL WITH BUCKET & &WINDLASS WATER POINT TYPE	IN USE	NOT IN USE	TOTAL
A	Bucket &Windlass	191	72	263
D	Borehole with Hand pump	134	52	186
G	Windmill	2	3	6
	TOTAL	**327**	**127**	**454**

Due to the draught for the last few years the water table had considerable dropped necessitating redeepening of many wells though frustrated by the presence of the hardrock, insome cases.

Many boreholes are not functioning due to defective handpumps due to non availability of spare parts even for standard pump (India Mark II). The district has not been able to provide a reliable repair service, villages for a long time had not been trained in carrying out minor repairs but this is changing now in certain cases boreholes are faced with the problem of collapsing, drying or clogging .

Many people are walking long distances to collect water. There is need to rehabilitate existing water points and to construct new ones. There is a committee in Monze called WASHE comprising of representatives from the District Council , Ministry of Health, Department of Water Affairs, Education, Community Develoment, Central Statistics, NGOs e.g., DAPP Family Farms Limited, Monze Diocese, World Vision International, etc. which reports to the District Development Co-ordinating Committee on all aspects of water supply, sanitation, hygiene and health education providing a link between the village communities and the authorities.

WASHE's role since its initiation in 1996 has been to improve the rural water supply and sanitation facilities over a period of three years by:

i) Standardisation of hand pump technology India Mark II has been chosen

ii) Putting in place a strategy for the repair and maintenance of handpumps, training of sixteen pump minders, each serving a catchment area of a rural health centre. Prior to training the pump minders, a fixed fee system had been introduced for the repair of defective hand pumps for staff district.

iii) Improving communication between the village communities and the district by channelling requests through the D-WASHE. In 1995 Africare initiated the repair and replacement of defective hand pumps, in 1996 also experienced donor activity, including the drilling of 20 new boreholes by UNICEF. A number of dug wells were also rehabilitated by drilling the logistical and community liaison aspects of this work highlighted the need for the committee to set a rational framework for the point improvements in the districts and for promoting community management.

The WASHE committee tasked itself to :

- Provide a vision by setting specific objectives with time scales and targets.
- Act as a yard stick for measuring progress
- priorities needs
- Enable optimum use of resources and harmonise the work of different actors
- Enable realistic budgeting and help in identifying where additional resources are needed.
- Provide a policy framework and guidelines for donors and implementing agencies
- Help secure the commitment of all actors.

Since the community has now come to understand and appreciate the role played by WASHE there has been better co-ordination of actors ability to plan effectively less resistance to community contribution less interference and more understanding from politicians for more information to water supply, see attached paper. No mention has been made on quality control.

2.1 SANITATION

Broadly speaking embraces all the factors mentioned earlier on, lack or deficiency of which has led to a number of disease patterns as reflected in the paper on incidences of diseases.

Directly the insanitary state of the district in particular, and the province at large is led to a widespread out-break of cholera which by 5th February 1997 led to 147 cases out of which 12

died, 13 unconfirmed deaths from the villages were reported also. This basically due to lack of wholesome potable and readily accessible water supply and safe means of human excreta disposal. Monze Township was not spared either since the shanty compounds are not supplied with potable water and proper sanitation.

No accurate data exists on latrine coverage in the district, but the NGOs especially DAPP have concluded that in villages where they operate just 30% of house holds have some form on latrine accommodation, Cost technical know how and access to materials are a factor in the low rate of coverage.

Taboo/customs/traditions forbid people being seen going into latrines when there is so much bush around. Also the idea of sharing a toilet by men with women and children is just not on. This therefore is not a priority. The picture is more or less the same in other districts as well.

3.0 PERSPECTIVES FOR THE FUTURE

3.1 WATER SUPPLY

WASHE will encourage rehabilitation of defective water points and the provision of new ones. Boreholes and dugwells are the main sources of water, for the latter India Mark II handpump will be the standard of choice.

WASHE will promote community management of rural water supplies by:
- Encouraging the formation of village WASHE committees
- Training pump caretakers and private sector pump minders
- Ensuring the supply of spare parts for sale
- Encouraging the routine care and maintenance of dug wells.

WASHE will further:
- Adopt selector criteria to enable objective decision making in the allocation of new water points and to prioritise needs.
- Maintain up to date database of all water points in the district including records of all new and rehabilitated sources.
- Prepare an annual workplan to achieve the objectives and targets of the development plan and secure any additional resources needed for its implentation (e.g. by preparing budgets and making proposals to donors)
- Monitor and evaluate progress in reaching targets set out in the plan.

3.1.1 TARGETS

By the end of 1998-9, the number of working water points should be doubled from 327 (in 1995) to 654. This means an annual provision of an extra 109 working water points per year through rehabilitation and the instaliation of new points. This will increase the coverage rate of 1 working water point per 240 people or 1 per 5.5 Km2 provided the anticipated level of funding is secured.

Work plans and the agencies involved are detailed in table 3 & 4 in the report attached.

3.1.2 FUTURE STRATEGY FOR SANITATION

The objective is to reduce sanitation related diseases through the provision of latrines, refuse pits etc.

Committee (WASHE) to come up one standard plan or design for the latrine for the community using local materials as far as possible which should be affordable attracting little outside

assistance. DAPP and Health Department are currently using similar designs requiring only one pocket of cement. The current subsidy of cement and reinforcing bars will eventually be reduced if not done away with completely. WASHE will train private latrines builders who will be hired by the community.

TARGET (by the end of 1998-9)

- To double house hold latrines coverage (up to 60% approximately)
- To reduce the subsidy provided

Since no accurate data is available to the current coverage rate of 30% should be taken only as a rough guide. It is estimated that doubling the coverage rate would require the construction of approximately 5,000 latrines over three years.

For activities see table 3 & 4 in the attached report. Unfortunately no expenditures are reflected for the activities undertaken by Monze WASHE so far.

CASE STUDY ON

RURAL WATER SUPPLY OPERATION AND MAINTENECE SYSTEMS IN ZAMBIA.

PREPARED BY:

Mr. I.J. Mbewe-Coordinator, National WASHE

SUMMARY

For many, the concept of operation and maintenance in rural water supply is a technical matter. This applies in practically all spheres of life. The operation and maintenance of a motor vehicle for instance infers trained drivers and mechanics to check the lights, ensure tyres are pumped to the correct pressure through to carrying out major servicing or engine overhaul. For rural water supply the concept has been seen no differently. Trained "pump minders" equipped with tools and spare parts are viewed as the answer.

Once the concept of community management of rural water supplies is embraced (which is the case in Zambia) it assures that communities have greater responsibility for operation and maintenance. Experience is showing that the pump minder alone is not enough to achieve the required level of operation and maintenance. This paper outlines some of the issues and suggests one possible approach which may help to address the problem. This approach is being persued by the Government of Zambia.

The Key elements of sustainable maintenance and management of rural water and sanitation are :

- **Capacity building** at district, sub-district and community levels for enhanced planning, decision making implementation, operation and management
- **Sector Integration and linkages** to ensure that WASHE interventions are linked to other key sectors such as health, education and environment programmes
- **Community Management and Empowerment** to ensure that appropriate policies facilitate and support community empowerment especially for women and that training be provided for decision making, planning, implementation, management for WASHE programme
- **Advocacy and Mobilisation** to ensure that WASHE concerns are on the political agenda at all levels and to ensure that government, support agencies, NGOs and communities are mobilised for WASHE programmes
- **Service Delivery** that promotion of WASHE services be facilitated rather than be delivered by government and that communities be given choices regarding technologies and there costs

1 INTRODUCTION

1.1 General

In 1993 Community Management and Monitoring (CMMU) was mandated to address issues of long term sustainability of rural water supply and sanitation (RWSS). CMMU started with research on what was the prevailing situation in the country by:-

- Conducting an inventory of all water points in the country
- Collecting information on best practices, ideas, knowledge and materials around the country.

It was evident during this research that some regions have great chances of success in terms of sustainability. The research also showed the different approaches and designs being used by different projects which varied from one area to another, though most projects agree on standard approaches and designs. The absence of standardised approaches and designs meant differences in quality of delivery and facilities.

1.2 Inventory of water points

From the National Water Point Inventory the following is the analysis:-

- There are 24,020 water points in the country
- 72% of these water facilities are in use
- 43% of the population has access to a protected source if all water points are in use, but 29% when only water point in use are considered
- There are over 40 types of handpumps scattered all over the country
- There are four main technology used in Zambia which is sub-divided into eight divisions as indicated below:

CLASS	DESCRIPTION	IN USE	NOT IN USE	TOTAL	% IN USE
A	Hand dug well with bucket and windlass	6690	3266	9956	67
B	Tube well with bucket and windlass	109	60	169	64
C	Jetted well with hand pump	215	105	320	67
D	Borehole with hand pump	2144	1030	3174	68
E	Hand dug well with hand pump	476	338	814	58
F	Tube well with hand pump	5	9	14	36
G	Hand dug well/borehole with windmill	39	46	85	46
H	Protected spring	31	5	36	86
P	Private well (usually unprotected)	7701	1751	9452	81
	TOTALS	17410	6610	24020	72

2 INSTITUTIONAL ARRANGEMENTS

The problems which have led to the present rural water supply and sanitation situation are:-

- Weak co-ordination and co-operation among actors.
  Presently a considerable number of government institutions, donors, NGOs and private organisations/individuals are involved in RWSS sub-sector. The management of WASHE services are split among various government ministries, departments and district councils. The resulting situation is poor planning, implementation and management of the programmes.

- Poor Operation and Maintenance of facilities
  There is inadequate definition of roles and responsibilities for all actors resulting in poor operation of facilities as actors think it is the responsibility of the other actor to undertake such works, in some cases there is duplication and wastage of resources if all work on the same programme.

- Inadequate Community Involvement and Participation
  When communities are not fully involved in all the stages (i.e. planning, implementation, operation and maintenance) of the project, they will not regard the facility as theirs and hence their unwillingness to contribute towards maintenance leading to short life span of the facility.

- Limited Financial Resources to rehabilitate and upgrade existing RWSS facilities.
  The involvement of the communities should be encouraged so that they contribute towards their programmes. The use of existing resources and appropriate technologies should also be encouraged and promoted.

It will be recalled that considerable number of government institutions, donors, NGOs and private sector are all involved in water supply and sanitation. Development and management is split among various ministries, departments and district councils. The division of roles and responsibilities are not always clear as availability of resources often dictates as who plays an active role.

This lack of clear definition of roles and responsibilities of actors especially as it relates to rural water supply and sanitation has resulted in unco-ordinated approaches to the provision of WASHE services. Establishment of WASHE committees helps to build collaboration and co-operation among actors. It should also be noted that information on many RWSS programmes within and outside this country indicate that WASHE desired goals can not be attained when ministries, departments and donors/NGOs work in isolation. There is a need for broad based approaches which allow experts from different institutions to co-ordinate their efforts. RWSS requires organisation, sensitisation and mobilisation of the communities, this is only possible in a multi-disciplinary frame work like WASHE. In this situation the technical staff will liaise with social scientists and health workers who have the skill and ability to sensitise and mobilise communities.
The style of working obviously requires change of attitudes on the part of all actors at all levels including owners of the facilities.

The development objective of WASHE is the development/establishment and maintenance of institutional capacities at district and community levels to sustain water and sanitation facilities through motivation, awareness campaigns and health education. Some of the medium objectives are:-

(a) Development of integrated capacities of actors through resource mobilisation
(b) Devolution of management responsibilities to the lowest level possible
(c) Establishment of intersectoral planning
(d) Establishment of WASHE committees at various levels whose members have a common goal rather than individual representatives of institutions where they come from.

It could be seen from the previous discussion that WASHE is promoting community based management of water and sanitation programmes.

The community based management is supported by the elaboration of the National Water Policy and the development of the principles for the Sectors reorganisation which has major inferences for the Sector as a whole. In essence the Government is placing responsibility for water supply and sanitation firmly in the hands of the rural population. This means that rural communities must take on the management, operation and maintenance of their own water supply facilities. In reality however, this is not a particularly new concept. For many years, donors, NGOs and Government Ministries have been promoting the concept of community participation in rural water supply and sanitation. These developments are in fact the recognition and support by GRZ of this concept. The task in hand therefore is to develop strategies to support the concept of community participation, operation, maintenance and management in rural water supply and sanitation.

3 OPERATION AND MAINTENANCE

There are a number of common operation and maintenance mechanisms which have been applied to rural water supply and sanitation in the past. Typically they have been technically oriented, i.e. training and equipping mechanics or well minders. However, in the context of rural water supply and sanitation, which is to be community based this classic approach of a technically oriented maintenance option is not sufficient to ensure sustainability.

Consider the Sector principle of *full cost recovery in the long run*. In Zambia at present full cost recovery may be achievable in large urban piped supplies but the situation is significantly

different in the rural setting. In reality, almost 90% of all the capital investment costs for rural water supplies in Zambia are currently being met by external aid agencies. It is likely that this will be the situation for the foreseeable future.
Even the cheaper technology options such as the handdug well or tube well are beyond the reach of most rural communities.

It is however considered that rural communities can afford the operation and maintenance costs and have the ability to manage their facilities once they have developed the capacity to do so. This means that issues, other than technical issues have to be addressed within the community. In order for a community to successfully operate and maintain their facilities they must be assisted to develop the capacity to make informed decisions regarding not only issues of operation and maintenance but also a range of issues of community management which directly affect operation and maintenance. These issues may be divided into three distinct phases; pre construction, construction and post construction phases.

Pre Construction Phase

In order for a community to fully understand an operation and maintenance concept they must understand the technology which they will receive and what this technology infers for them. Prior to any physical work being carried out the community should be involved in the following areas:

- a meeting or a series of meetings at which they decide that this is the type of development they require.
- Be provided with an explanation of the implications of such development i.e. costs etc.
- if a number of technology options are available the community must be allowed to select which is the most appropriate for them.
- they must arrive at a consensus themselves and agree to carry out the work which in turn infers the establishment of some form of organisational structure (usually a village water/well committee) which will manage the intervention.
- Be helped to select a suitable site for the intervention which will satisfy all or at least most of the potential users.

During the construction phase the community (possibly through the village well committee) will need to.
- organise labour, materials and other community inputs.
- familiarise themselves with the technology being developed.
- commence preparation for operation and maintenance which should include fund raising collection mechanisms, selection of community members for training and liaise with project and Government intervention team.

All of these activities are considered necessary to build the capacity of the community and equip them with the necessary skills to carry out sustainable operation and maintenance procedures.

Once construction has been completed a number of issues have to be addressed to ensure sustainability.
- ownership of the new facility must be passed on to the community in full
- the community must accept this new responsibility
- the community should be encouraged to establish a maintenance support system such as a regular fund collection mechanism or a system which allows payment in kind. This means that the skills for this now need to be in place to manage these systems.
- the community will have to identify suitable members who will be responsible for the maintenance.
- the necessary training to achieve these skills will have to be passed on to the communities by this stage.

It is clear that operation and maintenance of community based rural water supply systems is not a technical matter but a community management matter. Even in the recent past many rural water supply projects were based on the provision of service through the development of a new well without providing the necessary training in community management.

4 TYPES OF MAINTENANCE SYSTEMS IN ZAMBIA

Let us examine the major types of operation and maintenance systems. In general there are four common options which can be classified as follows:

- the one tier system
- the two tier system
- the three tier system; and
- the centralised system

Each of these options entail different ways of sharing costs and responsibilities. Hence it is necessary to adopt one system which is most appropriate to the communities being served and the support mechanism being proposed.

One Tier System
The One Tier system is based on total community self reliance in operation and maintenance. In this system all operation, works and costs are borne by the communities.

Two Tier System
This system is based on total elimination of community responsibilities. In this system minor repairs are carried out by an area/block mechanic while major repairs by a district mobile maintenance team.

Three Tier System
This system is based on partial community reliance in which the community shares responsibility with the area mechanic and mobile maintenance team. In this system the community carries out preventive maintenance while the area mechanic carries simple repairs and the district mobile maintenance team carries out major repairs.

Centralised Maintenance System

This is based on total elimination of community responsibilities. The district mobile maintenance team tours the villages/communities repairing and maintaining the facilities.

Until recently (i.e. outside individual donor/NGO initiatives) operation and maintenance of rural water supplies in Zambia has been a centralised system which has not been successful. The two and three tier systems have been put in place with support from donor or NGO organisations in some parts of the country and with some measure of success. However at present it is donor dependent particularly in relation to transport. Another problem Zambia faces is the density of population in many rural areas. There are not sufficient numbers of water points to support block or area mechanics.

Ideally, a one tier system would be preferred but there are many implications and problems which must be addressed in moving from what is by and large centralised maintenance to a community managed system.

Some of the issues are

- acceptance of the system at all levels
- training in all areas of community management to achieve sustainable operation and maintenance
- the integration of community management in all rural water supply and sanitation projects

- considerable time must be spent on community management thus slowing down production of water points or extending the life of the project.
- different disciplines, sociologists or community educators must be employed to promote community management
- extra costs per water point will be incurred (but should be beneficial in the longer term)
- standardisation (handpumps, construction techniques) becomes an issue
- promotion of the concept in the private sector will be important
- follow up support and monitoring will be necessary for rural communities

5 WASHE (WATER, SANITATION AND HEALTH EDUCATION)

Experience from different institutions within the country has shown that many of the issues and problems associated with community managed water supply systems could not be fully be addressed by one Ministry, Department or NGO/Donor, neither when the same institutions work in isolation. Hence the development of WASHE concept.

The concept which has been developed in Zambia for the past 10 years promotes an intersectoral and integrated approach to development, operation, management and maintenance of rural water supply and sanitation programmes. The concept of WASHE is based on participatory planning, implementation and monitoring of the programmes by considering all actors at all levels. The development objectives of WASHE is the establishment of sustainable water and sanitation through health education.

In practice this is achieved by

- development of integrated capacities of all actors through resource mobilisation
- devolution of management responsibilities to the lowest level through improvement in decision making, commitment, community involvement/participation and capacity building.
- establishment of intersectoral planning
- establishment of WASHE Committees at district and community level whose members have a common goal rather than individual representations of claims or organisations they come from.

The WASHE Committee at district level among other functions have to establish support services to the communities to enhance the success of community management.

6 SOME OF COMMUNITY MANAGEMENT ISSUES THAT HAVE BEEN ADDRESSED AFTER THE FORMATION OF WASHE COMMITTEES

1.	**Community demand for improved source**	Sub-district level using participation methodologies developed by the Community Management and Monitoring Unit have helped to identify the felt need of the community.
2.	**Choice of technology**	The modules produced by the Community Management and Monitoring Unit gives indicative capital and recurrent cost of a technology. The communities therefore are able to choose a technology that will satisfy their needs in terms of service levels as well as be affordable
3.	**Cost Recovery**	The communities are educated on different financing options in terms of capital and recurrent costs. These options were known after a research was carried out in the country.
4.	**Empowerment and control**	V-WASHE have been formed as an institution that will facilitate communities to have a say in the planning of their facilities. The rural

		water supply and sanitation facilities are handed over to the owners for operation and maintenance
5.	**Institution capacity**	WASHE has promoted the development and maintenance of V-WASHE, the training of Trainers (sub-district) district level staff. WASHE has facilitated the tapping of existing potential at district and community level.
6.	**Support services**	The D-WASHE, are developing training programmes both for communities and sub-district that will enhance their capacity to take new roles and responsibilities. The district makes spares available at cost, eventually the private sector should take this role.

CONCLUSION

In Zambia operation and Maintenance of rural water supply and sanitation is now considered a management issue as against technical issue, hence all strategies and policies formulated/to be formulated as general to address management issues.

To address some of the management issues the CMMU and N-WASHE are further developing and elaborating the WASHE concept in which issues of management will be addressed. Some of the issues that are already being addressed are:

- Institution capacities (at district and community level) are being developed to be effective and representative of community organisations to manage their facilities,
-involvement and participation of the communities in planning, implementation, monitoring and evaluation through the sue of participatory methodologies has helped to address the issues of empowerment and ownership of the facilities
-cost recovery through the development of information system, financial arrangement and encouragement of use of appropriate technologies
- the institution of WASHE as a strategy will help to ensure government agencies fulfil their vital role of motivating to the communities using the limited availability resources.

CASE STUDY ON

OPERATION AND MAINTENANCE (O&M) OF LUSAKA URBAN WATER SUPPLY AND SANITATION SYSTEMS

BY THE LUSAKA WATER AND SEWERAGE COMPANY LIMITED

PREPARED BY:

Mr. P.P.L.M. Kimena-Senior Water Enigneer, Dept Of Water Affairs Headquaters

0. INTRODUCTION

Greater Lusaka was created in 1970, on a relative flat topography ranging from 1260 to 1300 meters above sea level that enjoys mean annual precipitation of 800 mm and the mean monthly temperature lowest of 16 degrees Celsius in June/July and 24 degrees Celsius in October, when the area under the city Council's jurisdiction was extended from 93 km2 to 360 km2. The south and south-western areas form the city's commercial and industrial districts. The high density residential areas are found in the eastern parts of the city and the high density in the north and western parts.

The population of Lusaka grew very rapidly in the decade following independence (1964-1974) when it increased from 123,146 to 421,000. This rapid increase of 13.4% coincided with the upsurge in the country's economic growth. The growth rate however fell in the period between 1974 to 1990 when the last national census gave the population of Lusaka as 982,362. This drop in population growth rate (5.9%) in Lusaka coincides with the declining economic performance of the country during the same period.

Water Supply and Sanitation in Lusaka, formerly managed by the Lusaka Urban District Council, is now the responsibility of the Lusaka Water and Sewerage Company (LWSC). Lusaka, like most of other similar cities, has always had to cope with the problem of matching the water supply to the ever increasing demand. On the whole, water supply in the city is inadequate and at times is of poor quality. Surveys carried out in the mid 80s showed that the amount of water uncounted-for was approximately 60% comparison of figures of water production and billing for 1987 showed that these losses were still very high and averages 65% of total production. Analysis of water samples taken from some parts of the city often showed that the water was at times polluted by faecal matters and therefore substandard. The reason for this was mainly due to the breakdown of water disinfecting equipments which made it impossible to maintain adequate amount of residual chlorine in the system. Strides, however, have been taken by the new company to improve the level of service.

Approximately half of the built up area of Lusaka City is served with a total length of Sewage Collection system of nearly 450 km. The size of the main trunk sewers vary from 300 mm to 1000 mm in diameter. These mains together with the seven pump stations deliver the bulk of the sewage to the two main sewage conventional treatment plants at Manchichi and Chunga. The two plants have a total capacity of 27,000m3/d which account for 70% of collected sewage. The remaining 30% of the sewage is treated in four oxidation ponds located at Chelston, Matero, Ngwerere and Kaunda Square. Septic tanks are widely used in the rest of the unsewered areas except in the high density areas where aqua privies and traditional pit latrines are the main means of disposal.

Incidences water borne infections in the City has, fortunately, not been attributed to water supplied by Lusaka Water and Sewerage Company (LWSC). Many cases of cholera have originated from unplanned settlements that have no access to safe drinking water supplies and sanitation services. Water sources in these areas is commonly traditional unprotected shallow open wells usually very close to pit latrines.

WATER SUPPLY AND SANITATION INSTITUTION

The Lusaka Water and Sewerage Company Limited established under the companies' Act is fully owned by the Lusaka City Council. The Council appoints Directors of the Board and these may be prominent persons in business sector or government. LWSC has four divisions namely Engineering, Human Resources, Commercial and Finance, each headed by a director. The four directors are accountable to the Managing Director that is answerable to the Board of Directors. The division consists of departments i.e. Commercial Division comprises of four

departments namely Commercial, Projects, Customer Information and Revenue. Each of the division is headed by a Manager.

With regard to human resources, LWSC inherited a work force most of which was unskilled from the council. At that time there was less than 13 professional staff and in excess of 278 unskilled staff. This had a telling effect on the provision of sustained service. In attaining efficient and effective service company management has improved conditions to attract young and dynamic professional staff.

The company shares and benefits from information from other institutions in the Water Sector. Currently, there is no room for private participation in the company. Non Governmental Organisations (NGOs) only participate in the Peri-Urban projects. The Urban Water and Sanitation Services are a responsibility of the company.

WATER SUPPLY AND SANITATION FACILITIES

In a water and sewerage utility the primary objective is the provision of a high quality service both quantitatively and qualitatively. The service must be self sustaining to meet the demand in an environmentally acceptable quality. Service sustenance is a collective responsibility of all specialised disciplines and the consumer. One of the major contributors to the sustenance of a water and Sanitation Utility and perhaps the most critical effective and efficient, is the use of machinery and equipment.

Machinery and Equipment sustenance is a result of both Operation and Maintenance Management.

This paper attempts to look at some issues of machinery and equipment sustenance based on the experience drawn from Lusaka Water and Sewerage Company Ltd in Lusaka , Zambia.

LWSC inherited machinery and equipment that was dilapidated and lot of it scrap. Both the potable and waste water infrastructure was inadequate. While total potable water production is 190,000m3/day against the estimated city's requirement of 350,000 m3/day, the waste water treatment is estimated to cover about 30% of the total need to prevent environmental pollution.

Therefore, the status of the whole infrastructure has made both maintenance and operation very costly.

Ilolanda conventional water treatment plant was constructed next to Kafue river, 50 km to the south-west of the city. The initial phase of 45,450 m3/day treatment plant capacity was commissioned in 1970. Subsequent phases have been added over the years so that the present design capacity is 110,000 m3/day. The plant has a total number of 30 vertical flow sedimentation tanks and 20 rapid sand filters. Until recently many of the number of the treatment plant units had been run down due to lack of maintenance and wrong operation. Chemical mixing tanks and equipment were badly corroded so that they were only partially effective, the sedimentation tanks' desludging system was not functioning while the filter operation control mechanism had broken down. Consequently, the plant could only produce approximately 80,000 m3/day instead of the its design capacity of 110,000 m3/day and the remainder is from underground sources. This scenario places the operation department in a very awkward position. Climatic factors such as the repeated drought that rocked the southern region threatened further the ability to maintain production level. The current reckless disposal of waste to surface water courses makes acceptable quality water very expensive. The uncoordinated approach of the city council on development programmes of the city creates further problems on the development of the water supply network.

With regard to wastewater, LWSC inherited the wastewater treatment plants that are not only inadequate but dilapidated. Approximately half of the built up area of Lusaka City is served

with a total length of Sewage collection system nearly 450 km. The size of the main trunk sewers vary from 300 mm to 1000 mm in diameter. These mains together with seven pump stations deliver the bulk of the sewage to the two main conventional sewage treatment plants at Manchichi and Chunga. The two plants have a total capacity of 27,000m3/day which accounts for 70% of collected sewage. The remaining 30% of the sewage is treated in four stabilization ponds located in Chelston, Matero, Ngwerere and Kaunda Square. The inadequacy of treatment capacity together with dilapidation of treatment units posses a great danger to the environment and human health. as a result, the company is under threat by the Environmental Council of Zambia (ECZ), the industry, the general public and the Ministry of Environment. Similarly, the uncoordinated Lusaka City development equally effects wastewater collection.

Septic tanks are widely used in the rest of the unsewered areas except in the high density areas where aqua privies and traditional pit latrines are the main means of disposal. Two localities near the city centres are still served by night soil bucket system. Emptying of the septic tanks and aqua privies is becoming increasingly difficulty as most of the vacuum tankers are broken down.

The existing water distribution systems has been expanded piecemeal with little regard to the original design capacities for the various pipes. This unplanned expansion has resulted in the originally defined district pressure zones being interconnected in many parts of the city resulting in chronic water shortages. Generally steel pipes have been used for sizes of 200 mm diameter and greater, while smaller pipes leak because of inadequate protection against corrosion. Inelasticity of asbestos cement pipes make them liable to bursts due to surge pressure caused by sudden stoppages of pumps when power fails. This is common phenomenon. Although leakages are common in older pipes, there are two particular sections that need immediate replacement. the 450 mm diameter steel main, serving Matero and Industrial areas and a similar main running from Lusaka Water Works to Woodlands received attention due to excessive leakage. Leakage from these pipes was a threat to private property. Besides leakages from the defective pipe, most of the valves and pipes fittings also leaked due to lack of proper maintenance and replacement.

The total storage capacity in the Lusaka Water Supply system is 42,170 m3. This is equivalent to 15 hours average daily water demand for the city. The storage is divided into reservoir units scattered in different locations. Some reservoirs are not in operation due to severe leakages caused by structural deterioration, while others cannot be fully utilised for other reasons like inoperative or faulty installations. Float valves in many reservoirs are out of order so that the tanks often overflow. These problems further reduce the storage capacity which in place is not adequate to cater for emergencies during interruption of water production.

OPERATION AND MAINTENANCE ASPECTS

Flow recorders and bulk meters (at production and distribution stages) which for a long time were out of order have now been replaced and new level recorders for reservoirs are installed. The meters are read on daily basis. This has enhanced reliable record keeping and general control of water supply operations. The records of the daily consumption together with the knowledge of pumping capacity will show when there is need for service/repair of meters. Normally the water meter will wear out inside after use, and may be quite clogged by sediments entering the strainer by following the water flow. Clogging of the strainer in a water meter, will create more head loss, and sometimes result in very low or no water pressure or flow to the consumers. If a particle enters through the strainer, it can clog the chamber consisting of rotating parts, and thus the meter cannot show any consumption at all. There is the need for immediate service/repair. Repair/service/cleaning of strainer of the meters should be done every 3-4 years depending on the quality of the water. The important of bulk meters at both stages is particularly in loss detection.

Leakages detection, in both rising main and distribution network, has continued to be one of the company's major operational problems. It is well appreciated that the City of Lusaka is large and a small work force may not be found in all areas of the city. In most cases the maintenance department has reacted on public information. Although LWSC is attempting to divide the city into zones, lack of adequate resources has hindered the company from carrying out an inventory of pipes and fittings with corresponding size and length for both water supply and sewerage systems. Maintenance of the pipe distribution network is always corrective other than preventive.

The wastewater treatment plants are not only inadequate but need serious attention.

In enhancing sustainability of consumer services, water supply and sewage plants and machinery must be in good condition all the time. The inadequate supply of spare parts limits proper maintenance programmes. Maintenance is more emphasised on water treatment plant together with borehole water supply devices than on wastewater treatment plants. Routine checks on mechanical and electrical equipment together with all the accessories are carried out. Replacement of worn out parts, tightening loose one, and dusting is done during routine checks depending on spare part stocks available. Preventive maintenance is very necessary to prevent occurrence of major breakdowns which tend to be very costly and disrupts consumer services.

LWSC has entered into agreement with a South African company which supplies water purification chemicals. The company has adequate stocks of chemicals. The company has one laboratory at the treatment plant that monitors the quality of both the raw and product water. Various parameters of concern are monitored. Adequate chlorine residual is maintained in the distribution.

Although LWSC transport position needs improvement, the company has effective communication. The company has, besides telephone facilities, in built radio communication in its fleet. This has eased communication and reactive tasks are effectively performed in relatively record time.

COMMERCIAL ASPECTS

One of LWSC key Corporate objective is to achieve financial viability and to operate on a sustainable commercial basis. A two fold approach that seek to realise the above is in place. On the one hand LWSC allocates cost among consumers according to the burden they impose on delivery system and on the other seeks to identify and manage cost drivers and systematically tries to eliminate non value adding activities.

Presently , there are about 12,000 registered customers with meters. These represent about 43% of the customer base within the boundary of Lusaka City. Because a large percentage of customers are on assessment (fixed charge), Lusaka Water and Sewerage company suffers loss through water wastage as the mechanism to deter this is missing. Often, disputes over consumption arise and this has had negative impact (on revenue collection). Most of the meters are found in the prime areas of Lusaka. Commercial customers and those customers who live in low density areas fall in this category.

Illegal connections is one of the principal problems that LWSC faces today. Prominent of these may either be in form of illegal connection after disconnection or tapping from supply line without registering.

Some punitive measures are in place to deter illegal connections. What is lacking, however, is persistent follow up on those properties that are known to be disconnected but have not yet come to settle bills. Routine inspection wing is being developed.

Tariff design in LWSC is premised on the overall objective of making the company commercially viable in the near future. Commercial viability means ensuring that LWSC achieves full cost recovery through its tariffs. Critical inputs in tariff design includes operating expenses, depreciation on revolved assets, interest payable on debt, opportunity cost of capital and revenue requirements.

Presently, the tariff structure separates water supply servers and on-site sanitation and there are in fact three types of charges which include; initial, recurring charges and miscellaneous. There are four water supply tariff categories namely Tariff 1: Commercial and Industrial customers; Tariff 2: High density residences with communal taps (social); Tariff 3: High density residences with individual taps; and Tariff 4: Low density, commercial residences and special connections (domestic).

The initial charges comprise connection charges which is payment towards the provision and laying of a supply line, and deposits which vary by customer and serve as a guarantee against non-payment of bills from customers.

Recurring charges are billed monthly and consist of standing charge that metered customers pay towards meter maintenance, progressive consumption charge. Customers who do not have meters are on assessment charge. Miscellaneous charge comprise reconnection charge and meter inspection fee.

The sewerage services tariff categories include domestic sewerage tariff; Tariff C: customers discharging light trade effluent with BOD less than 1000 ppm; Tariff D: customers discharging moderate trade effluent with BOD between 1000 and 2000 ppm: Tariff E: customers discharging moderate trade effluent with BOD in excess of 2000 ppm ; and Tariff for sewage discharged by Vacuum Tankers.

Connection charge is the only initial charge for sewerage and the volume charge is based on 90% water consumption.

Customers in need of services from LWSC are registered on one of the two standard forms for customer registration. One of these two standard forms is for new customers wanting to be connected to the supply line and the other is for customers wishing to change addresses. For non registered customers LWSC from time to time advertise giving amnesty to potential customers to come and register. After the amnesty period non registered properties once found are disconnected.

One of the major threats being faced by LWSC is from demanding customers who expect superior customer service. Customers want to pay for actual consumption. As a result they would like to be metered and the meters to be read on monthly basis. In respect to customer demands and the changing legislative and regulatory environment, LWSC is rethinking its strategy on metering. Although their exist no policy will highlight the justification for metering, capital requirements and commitment to allocate adequate financial resources.

With regard to billing, five steps are taken. These include compilation of meter readings, data entry into the computer through a batch processing system, data validation, data verification (check and recheck) and billing production. While some bills, through a courier and company staff, are delivered by hand, others are mailed by post to customers. Customers are expected to settle their bills within Fourteen days. Presently the major instrument being used to persuade customers to pay is through disconnections.

As mentioned above tariffs for metered properties are designed such that they include a standing charge that customers pay towards meter maintenance. Despite the fact that customers pay for regular meter maintenance, a comprehensive meter maintenance program for metered customers does not exist. What is available, however, is capacity to remedy problems with faulty meters once it is reported by customer.

The levels of non revenue water with respect to daily water production for LWSC is quite significant and for sometime will remain an area of concern for the company especially as it strives to achieve commercial viability through a customer driven focus. The problem is historical in nature and hinges on cultural background where people believed that water is free. In its continued effort to reorient the mental maps of the general public on the need to pay for water, through various media the situation is slowly changing. Concerted efforts is required if this is to pay off. Water vending points are being set up in peri-urban areas where people pay in advance for the service.

COMPANY CONSTRAINTS FOR IMPROVED PERFORMANCE

Although LWSC desire is to provide quality service to her esteemed customers, there is hindrance to improve performance arising from institutional, technical, financial, human resources social, political and other constraints. While water and wastewater treatment capacity are inadequate and infrastructure dilapidated, spare parts are not readily available. The company has no sufficient knowledge of the insufficient pipe network. Prompt response to breakdowns, connections and identification of illegal connections programme is slowed by inadequate transport. Financially, LWSC is owed huge sums of money by her major customers. The biggest defaulters are government departments. When these are threatened with disconnection political pressure, even from State House, is exerted on the company to restore services. The delayed settlement of bills by government departments is cripping the company. It means that the desired quantity of spare parts and chemicals cannot be procured at the right time. What this also means is that condition of service cannot be improved to attract and retains skilled human resources. The majority of people including politicians have grown with the belief that water is God given commodity and thus they should not pay for it. They have not understood that processing water, like any other product processed, cost money and more so to bring it into or near the homes through pipelines. Others may want to pay for the services but their budgets are over stretched and settling a water bill is not their priority.

PERSPECTIVES FOR THE FUTURE

LWSC goal is to match with changing current and future demand. In this respect, there are plans to improve the water supply to the city by construction of an additional 30,000 m3/day capacity treatment facility at Kafue to be financed by NORAD. Secondly, another daily volume of 42,000 m3 from the north-west of Lusaka City groundwater development project to be financed by the European Union together with about 600 m3/h flow from ADB funded groundwater development in Chelston will add to the surface sources. With regard to sanitation, LWSC is faced with a challenge of investing her financial resources into wastewater treatment plants and the sewerage network extension. The inadequate and dilapidated wastewater treatment plants need to be upgraded and rehabilitated. The Sewerage network too needs to be extended to new area that have been developed. The facilities will fail if improved operation and maintenance programmes are not in place.

In her endeavour to provide sustained quality service, LWSC will embark on an ambitious Human Resources Development Plan to equip staff in all departments necessary skills improved condition of service is the ultimate goal to retain and attract qualified human resources. To achieve this objective the company desires to mobilise financial resources through improved billing together with debt collection methods and increased customer base.