

**THE RURAL WATER, SANITATION, AND HEALTH COMPONENT OF MASH:
PROPOSALS FOR THE RURAL WATER SUPPLY AND HESP PROGRAMS
OF THE MALAWI MINISTRY OF WORKS AND SUPPLIES AND
MINISTRY OF HEALTH**

Prepared for the USAID Mission to the Republic of Malawi
under WASH Activity No. 329

by

Dennis B. Warner

April 1987

**Water and Sanitation for Health Project
Contract No. 5942-C-00-4085-00, Project No. 936-5942
is sponsored by the Office of Health, Bureau for Science and Technology
U.S. Agency for International Development
Washington, DC 20523**

Table of Contents

	Page
THE RURAL WATER, SANITATION, AND HEALTH COMPONENT OF MASH.....	1
1. Introduction.....	1
2. Background.....	1
3. Needs Assessment.....	2
4. Program Characteristics.....	3
5. Budget.....	3
APPENDICES	
A. ISSUES AFFECTING THE MOWS.....	7
A.1 Construction of New Schemes.....	7
A.2 Staffing.....	14
A.3 Financing of Maintenance Systems.....	14
A.4 Salaries and Allowances.....	15
A.5 Water Quality Monitoring.....	17
A.6 Water Quality Standards.....	18
A.7 Water Treatment.....	20
A.8 Computer-Assisted Design.....	21
A.9 Information Systems.....	22
A.10 Self-Help Contributions.....	22
A.11 Training.....	23
A.12 Vehicles and Equipment.....	25
B. ISSUES AFFECTING THE MOH.....	26
B.1 Expansion of the HESP Program.....	26
B.2 Staffing.....	26
B.3 Salaries and Allowances.....	28
B.4 Training.....	28
C. ISSUES AFFECTING BOTH THE MOWS AND THE MOH.....	31
C.1 Program Coordinating Committee.....	31
C.2 Annual Reviews.....	31
C.3 Annual Work Plans.....	34
C.4 USAID Program Evaluations.....	34
C.5 Total Contributions by USAID, GOM, and Local Communities for Water and HESP Programs in MASH.....	39

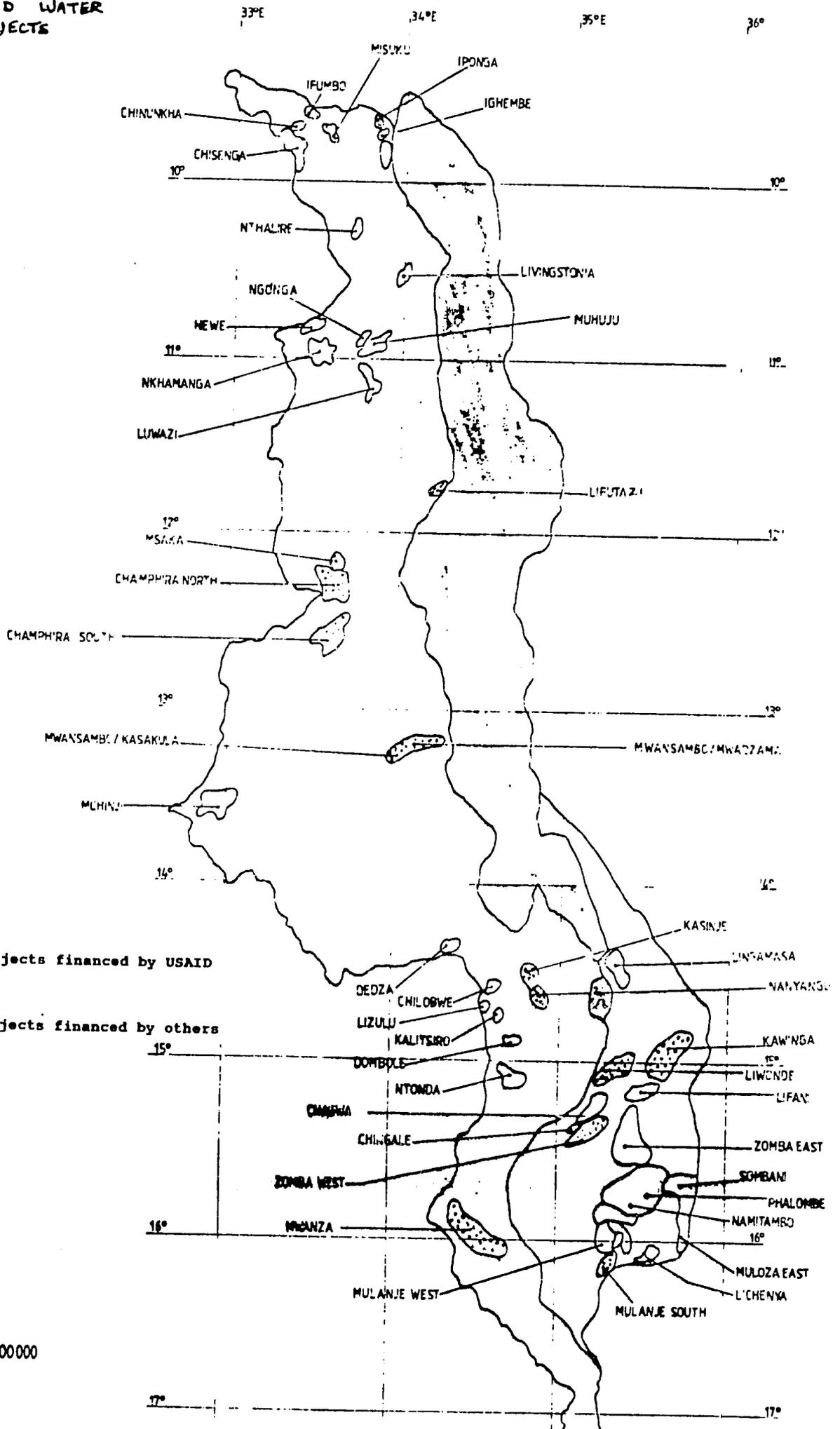
Table of Contents (cont'd)

	Page
D. TABLES SHOWN IN U.S. DOLLARS..... (See Tables 14 - 20 below.)	44
E. LOGICAL FRAMEWORK.....	52
F. RECOMMENDED CONDITIONS PRECEDENT FOR THE WATER AND SANITATION COMPONENT.....	57
 TABLES	
1. Cost Estimate: HESP.....	5
2. Cost Estimate: Community Water Supply.....	6
3. Potential MOWS Construction Projects.....	9
4. Option 1: MOWS Construction Program.....	10
5. Option 2: MOWS Construction Program.....	11
6. Option 3: MOWS Construction Program.....	12
7. Cost Estimate: Community Water Supply.....	13
8. MOWS Training Needs: Community Water Supply.....	24
9. Cost Estimate: HESP.....	27
10. MOH Training Needs: HESP Program.....	30
11. Rural Water, Health, and Sanitation Component: USAID Contributions by Fiscal Year.....	41
12. Rural Water, Health, and Sanitation Component: GOM Contributions by Fiscal Year.....	42
13. Rural Water, Health, and Sanitation Component: Total Community and GOM Contributions.....	43
14. Potential MOWS Construction Projects (in US \$).....	45
15. Option 1: MOWS Construction Program (in US \$).....	46

Table of Contents (cont'd)

	Page
16. Option 2: MOWS Construction Program (in US \$).....	47
17. Option 3: MOWS Construction Program (in US \$).....	48
18. Rural Water, Health, and Sanitation Component: USAID Contributions by Fiscal Year (in US \$).....	49
19. Rural Water, Health, and Sanitation Component: GOM Contributions by Fiscal Year (in US \$).....	50
20. Rural Water, Health, and Sanitation Component: Total Community and GOM Contributions (in US \$).....	51
 FIGURES	
1. Implementation Schedule for Rural Water Schemes.....	8
2. Allocation of HESP Expenditures for Salaries and Allowances.....	29
3. General Evaluation Model for Water and Sanitation Projects.....	35
4. Evaluation Model for Water Supply, Sanitation, and Hygiene Education Component of MASH.....	37
 REFERENCES	 58

**EXISTING RURAL
PIPED WATER
PROJECTS**



- KEY**
- Projects financed by USAID
 - Projects financed by others

Scale 1:2 200 000

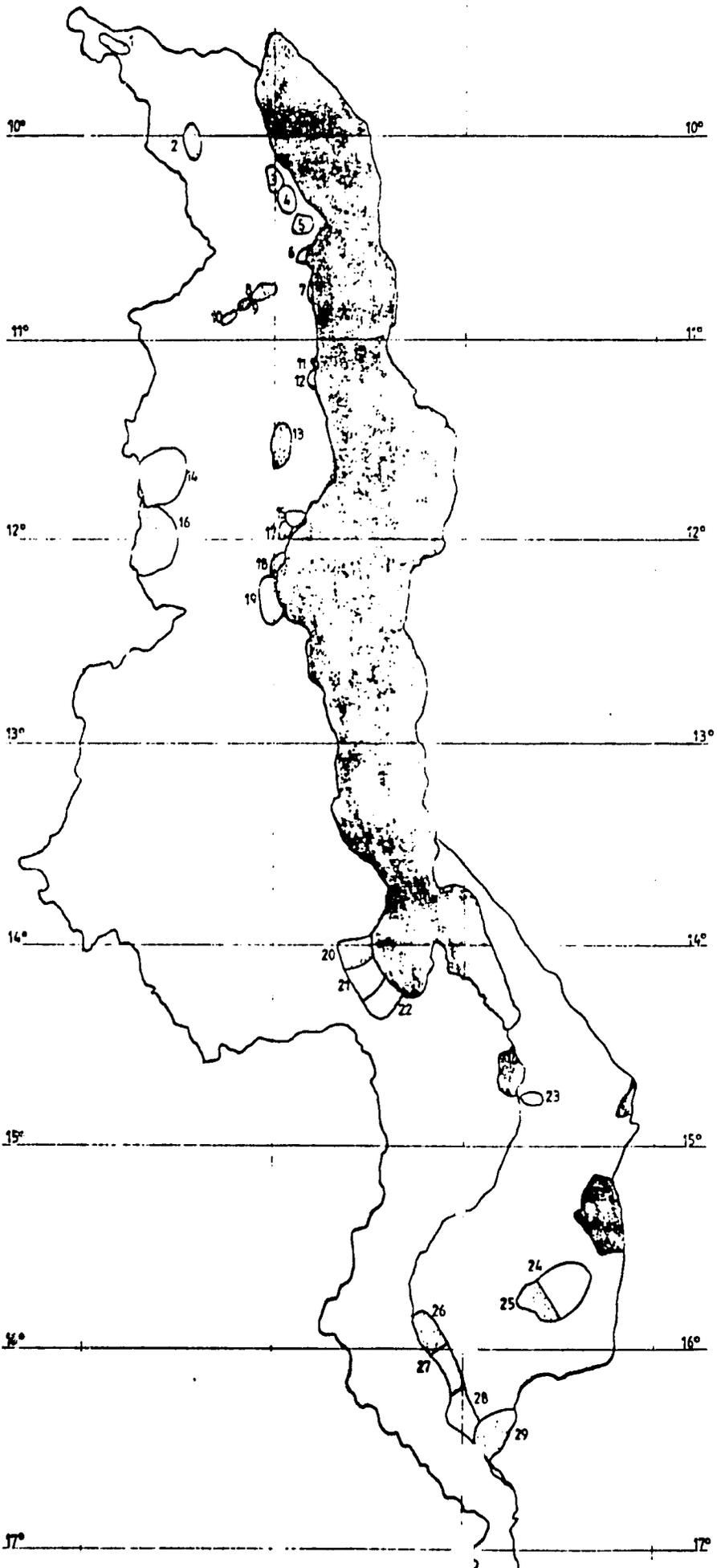
RURAL PIPED WATER
PROPOSED PROJECTS

33°E

34°E

35°E

36°E



LEGEND

- OPTION 2 PROJECTS
- OTHER OPTIONS

Scale 1:2200,000

- 1 CHATERWA
- 2 SEKWA
- 3 RUWILE
- 4 WONYWE
- 5 CHILUMBA
- 6 CHITIMBA
- 7 THIMBA
- 8 NTCHENACHENA
- 9 MUHUJU
- 10 NGONGA
- 11 RUARWE
- 12 USISYA
- 13 LUWAWA
- 14 MZIMBA II
- 15 KAWIYA
- 16 MZIMBA I
- 17 KAWIYA II
- 18 MLOWI
- 19 DWAMBACI
- 20 GOLOMOTI I
- 21 GOLOMOTI II
- 22 GOLOMOTI III
- 23 MASANJE
- 24 PHALOMBE
- 25 NAKITAMBO
- 26 SHIRE EAST BANK I
- 27 SHIRE EAST BANK II
- 28 SHIRE EAST BANK III
- 29 SANKHULANI

THE RURAL WATER, SANITATION, AND HEALTH COMPONENT OF MASH

1. Introduction

The Rural Water Supply, Sanitation, and Health component of MASH consists of the Rural Self-Help Piped Water Supply Program and its associated Hygiene Education and Sanitation Promotion (HESP) Program. The water supply program is implemented by the Ministry of Works and Supplies (MOWS) and the HESP Program is implemented by the Ministry of Health (MOH).

The goal of this component is to improve health and basic living conditions among the rural populations of Malawi through improvements in environmental health conditions and increases in disposable time for women and children. The purpose of the component is to strengthen the delivery of primary health care (PHC) services in rural communities through the integrated expansion of the PHC elements of water supplies, hygiene education, and sanitation. To support the goal and purpose, the output of the component will be to provide water supply coverage to an additional 245,000 rural Malawians and sanitation and hygiene education assistance to an additional 1,000,000 rural inhabitants.

2. Background

Malawi has a long history of developing self-help piped water supply projects in rural areas. Starting in 1968, the GOM through a variety of ministries and departments has developed a decentralized process involving a high degree of community participation in the planning, mobilization, construction, and maintenance of simple gravity-fed community water systems. These systems emphasize low-cost technologies, in that they take water from mountainous streams in protected forest catchments and pipe it by gravity to agricultural villages in the inhabited areas below. With few exceptions, the water is untreated. The systems are designed to deliver 36 liters/capita/day of water at communal standpipes. No charge is levied for the water, but the beneficiary communities are expected to organize themselves into a series of committees to provide self-help labor inputs, local construction materials, and long-term maintenance services. To date, a total of 50 schemes have been completed, with another five still under construction. These schemes are providing water of generally good quality and ample quantity to approximately 1,000,000 people.

In 1980, USAID agreed to provide the GOM a total of \$6,000,000 for support of the water program through 1985 (subsequently extended to December 1988). The USAID grant, however, strengthened the then-existing water program by incorporating into it a Health Education and Sanitation Promotion component to be implemented by the MOH. The HESP component was given responsibility to promote improved latrines, washing slabs, and a variety of behavioral practices intended to maximize the health benefits resulting from the improved water supplies. By mid-1986, the MOWS with USAID-financing had undertaken 18 new schemes serving 265,000 people, while the MOH had provided HESP services reaching an estimated 270,000 people. USAID mid-term (1983) and final (1986) project evaluations found the programs in both ministries to be effectively implemented and, in general, to have achieved more than anticipated by the

Project Paper. Of particular interest was the development within rural communities of widespread demand for HESP services as well as water supply services. Although HESP had received only 5 percent of the original USAID grant, the effectiveness of the MOH staff in providing focused hygiene and sanitation guidance to rural communities has resulted in the generation of widespread demand for such services in communities untouched by HESP activities. Moreover, both the MOH and the MOWS are pleased with the inter-ministerial involvement they have had under the USAID grant and both have expressed strong interest in expanding the HESP component in order to fully complement the well established water program.

3. Needs Assessment

Although the current USAID water and sanitation program has proved to be highly effective and successful in meeting its initial objectives, much remains to be done in rural Malawi. There is considerable potential for expanding and strengthening the programs within both the MOWS and MOH to reach yet-unserved populations.

In the rural water sector, approximately 1,500,000 people will eventually receive piped water from existing schemes and schemes currently under construction. Approximately 422,000 of this population will be served by schemes financed by the first USAID program (1981-1988). It is estimated that perhaps 1,000,000 additional rural inhabitants could be reached with gravity systems similar to those in use today. In November and December 1986, the MOWS carried out a feasibility study of 19 potential new rural water schemes in which the design population (in year 2002) was estimated to be 618,000. This feasibility study was used as the basis for selecting the schemes proposed for the MASH grant. Even more schemes could be identified if the MOWS had sufficient manpower and transport resources to undertake the task.

There is little doubt that high demand exists within rural communities for new water schemes and that these communities are willing to fully participate in planning, construction, and maintenance. The Malawi piped water program is known throughout the land, and there exists a large backlog of requests for new projects from local communities, district councils, and Members of Parliament.

In the rural sanitation sector, the MOH has only scratched the surface of sanitation needs with the HESP program. Although 270,000 people had been reached with HESP services through 1986, the MOH continually found itself underfunded and unable to effectively promote widespread construction of sanitary pit latrines, washing slabs, and other sanitation facilities. The MOH now wants to strengthen HESP services in the areas targeted in the current HESP program and to expand these activities to all other rural water schemes, both new and old. Thus, the potential clients for future HESP services are the 1,000,000-plus rural inhabitants currently served by piped water projects and the 245,000 to be served by the proposed new USAID-financed schemes. In time, the MOH intends to institutionalize HESP as a permanent operational unit in the ministry and eventually reach all rural Malawians including those outside of piped water areas.

4. Program Characteristics

To carry out the program purpose of strengthening the delivery of primary health care services in rural communities through the integrated expansion of the PHC elements of water supplies, sanitation, and hygiene education, a number of features of the current rural water program must be strengthened. Within both the MOWS and MOH, increased emphasis will be given to strengthening the capacity of the MOWS to deliver services and the capacity of local communities to maintain the water and sanitation facilities built under the program. The two ministries will be encouraged to work together more closely by increasing the number of joint training programs, supporting joint study tours of water and sanitation programs in neighboring countries, and establishing a Program Coordinating Committee to review and coordinate field activities.

Both ministries suffer from a shortage of staff at the headquarters and field levels. A manpower needs assessment will be carried out to define problem areas and recommend appropriate staff increases. Specialized in-service training will be expanded in each ministry and selected off-shore training for senior and supervisory staff will be added to the program.

The MOWS will implement 14 new water schemes, mostly in the underserved Northern Region, having a design population of 245,000. In addition, the ministry will replace deteriorating A-C pipes with new PVC pipes in an older scheme in Mulanje District. The MOWS will routinely construct washing slabs at all water taps in the new schemes, while the MOH will add washing slabs to the 8,000 existing water taps having none at present. There will be greater emphasis on applied research studies, including a study of willingness-to-pay for maintenance services and a variety of applied investigations on water treatment, system reliability, and health impacts. A major innovation will be the establishment of routine monitoring of water quality at all rural schemes. Associated with the monitoring program will be the adoption of temporary rural water quality guidelines appropriate to the conditions found in rural Malawi today. The MOWS also will institute computer-assisted design procedures and will consider establishing an information management system.

The MOH intends to expand HESP services to all 55 existing water schemes by the end of the six-year MASH program. In addition to constructing over 8,000 washing slabs, the MOH intends to build 10 demonstration VIP latrines annually in each of 17 districts. It also plans to set up a Sanitation Research Unit to carry out applied investigations into appropriate and cost-effective designs for pit latrines and other sanitation facilities.

In the new program, both ministries will prepare an annual review of their respective activities for submission to USAID along with an annual work plan for the coming year. USAID will provide short-term consultants on an as-needed basis to assist the MOWS and MOH, but no long-term contractor or resident expatriate advisers are anticipated in this plan.

5. Budget

USAID will develop a separate program budget with the MOWS and another with the MOH. Each budget will reflect the total costs of the entire program, whether rural water or HESP, of that ministry. To the maximum extent

possible, the allocation of financial responsibilities between USAID, the MOWS, and the MOH will be based on the objective of strengthening the two Malawian ministries so that they will be capable of sustaining their respective programs after completion of the MASH grant in 1994. In general, USAID will support all expenditures for commodities (pipes, steel bars, cement), vehicles, equipment, tools, supplies, fuel, and repairs in both the rural water and HESP programs, while the two ministries will assume most responsibilities for salaries and allowances. The local communities will provide self-help labor, local materials, and, in some instances, cash contributions.

Overall USAID contributions to the water and sanitation component of MASH will be approximately K17,100,000 (\$7,400,000).⁽¹⁾ The GOM will contribute an estimated K3,100,000 (\$1,300,000), and local communities will provide the equivalent of K2,700,000 (\$1,200,000).

Because of the extensive construction of new water schemes, the bulk of USAID financial support will go to the MOWS, which will receive K14,070,000, or 86 percent of the total MASH component for water and sanitation. The water program will be provided with USAID funds totaling K11,600,000 for construction (82%), K1,860,000 for maintenance (13%), K100,000 for information services (1%), and K500,000 for contingencies (4%). In addition, USAID will make available approximately \$650,000 of HRID dollar funds to support off-shore training and specialized technical consultancies. The MOWS will support all salaries and allowances, which will total K1,810,000 over the six years of the program. The local communities will contribute the equivalent of K2,590,000 in labor for construction and maintenance, local materials, and some cash.

For the MOH, USAID will contribute K2,900,000 of MASH funds for HESP activities and \$147,000 of HRID funds for off-shore training. In order to provide HESP services to all water schemes in Malawi, the MOH will have to add 125 new field personnel to its staff as well as four additional senior professional officers at headquarters and regional levels. These new personnel will have to be added to the 89 HESP staff currently on the MOH payroll. Current HESP salary expenditures are approximately K104,000 per year. The ministry will be unable at first to carry the salary burden for the new staff. These new staff members, therefore, will be initially supported by USAID, but over the course of the six-year MASH program will be gradually shifted to the MOH account. USAID will contribute approximately K750,000 towards salaries and allowances, while the MOH will provide K1,270,000 (representing K675,000 for existing staff and K595,000 for new staff). Community inputs to the HESP program will be the equivalent of K150,000 for self-help labor on the construction of washing slabs and demonstration VIP latrines and for local materials.

Table 1 and 2 summarize the overall budgets for the MOWS rural water program and the MOH HESP program.

⁽¹⁾ March 1987 exchange rate: \$1.00 = K2.30

TABLE 1

Cost Estimate: HESP (in 1000's)

Program Expenditure	USAID \$	USAID K*	MOH K	Community K
Salaries - HQ	-	32	58	-
Salaries - Field Staff	-	496	822	-
Materials and Supplies				
VIP Demo Latrines	-	340	-	5
Washing Slabs	-	469	-	16
Vehicles	-	921	-	-
Tools and Equipment	-	52	-	-
Operating Costs				
Subsistence	-	84	148	-
Fuel and Maintenance	-	316	-	-
Training				
In Service	-	135	241	-
Off Shore	147	-	-	-
Sanitary Research Unit				
Materials & Equipment	-	33	-	-
Tools & Equipment	-	35	-	-
Self Help	-	-	-	131
Contingencies @ 5%	-	100	-	-
Total (MOH)	147	3013	1269	152

* Includes 10% annual inflation rate.

TABLE 2

Cost Estimate: Community Water Supply (in 1000's)

Program Expenditure	USAID \$	USAID K*	MDWS K	Community K
Construction Program				
Commodities	-	9008	-	-
Salaries - HQ Staff	-	-	60	-
Salaries - Field Staff	-	-	346	-
Vehicles and Equipment	-	1217	-	-
Tools and Miscellaneous	-	107	-	-
Operating Costs	-	1275	180	-
Self Help	-	-	-	1600
Sub-Total	0	11607	586	1600
Maintenance Program				
Spares and Replacements	-	640	-	132
Salaries - HQ Staff	-	-	120	-
Salaries - Field Staff	-	-	360	-
Tools and Misc.	-	160	-	-
Vehicles (Motorcycles)	-	21	-	-
Operating Costs:				
Subsistence	-	-	144	-
Fuel and Maintenance	-	704	-	-
Training	-	72	358	-
Water Quality Monitoring	-	264	178	-
Self Help	-	-	-	858
Sub-Total	0	1861	1160	990
Information Resources Prog.				
Special Field Studies	85	60	35	-
Information Systems	15	-	-	-
Coordination	-	5	33	-
Computer Assisted Design	25	40	-	-
Evaluation	125	-	-	-
Off Shore Training	403	-	-	-
Sub-Total	653	105	68	0
Contingencies @ 5%	0	500	0	0
Total (MDWS)	653	14073	1814	2590

* Includes 10% annual inflation rate.

APPENDIX A

ISSUES AFFECTING THE MOWS

A.1 Construction of New Schemes

It is estimated that over 1,000,000 rural inhabitants could be served by gravity piped schemes in Malawi. In November and December 1986, the MOWS carried out a feasibility study of 19 potential new schemes which had a design population (projected to the year 2002) of 618,000. After some rearrangements, additions, and deletions of schemes, a final set of 25 new projects plus five augmentation (expansion or rehabilitation) schemes was developed. (See Table 3.) This global list was then reduced to the following three options:

	Total USAID/MASH Contribution to MOWS (in 1000\$) (in 1000K)		Amount Available for Commodities (in 1000K)	PV of Commodity Funds @ 10%/yr (in 1000K)
Option 1	4,500	10,350	7,762	5,822
Option 2	6,000	13,800	10,350	7,725
Option 3	7,500	17,250	12,939	9,704

It was assumed that construction costs of commodities (pipes mainly) in the MASH program would comprise about 75 percent of total USAID contributions, as is the case in the current USAID water program. The funds available for commodities in each option were then discounted at a compounded annual rate of 10 percent to account for inflationary effects on prices at the time of purchase. Most commodities have their origin outside of Malawi, and world commodity prices have been rising faster in recent years than Malawian commodities and salaries. The present value (PV) of these discounted funds, given in the last column of the above table, was used to determine the total construction budget and number of schemes to be included in each option. The three options are shown in Tables 4, 5, and 6.

Option 2, having 14 new schemes and one augmentation project, was chosen for inclusion in the MASH program. Overall contributions to the construction costs of these 15 schemes includes K7,790,000 from USAID, K840,000 from the MOWS, and K1,600 in labor inputs from the communities. The design population for these schemes is estimated at 245,000. Figure 1 presents the implementation schedule for the proposed schemes.

These projected construction costs, as well as estimated costs for the corresponding maintenance program and information resources program, are given in Table 7. This table represents the total estimated costs of MOWS activities within the MASH program.

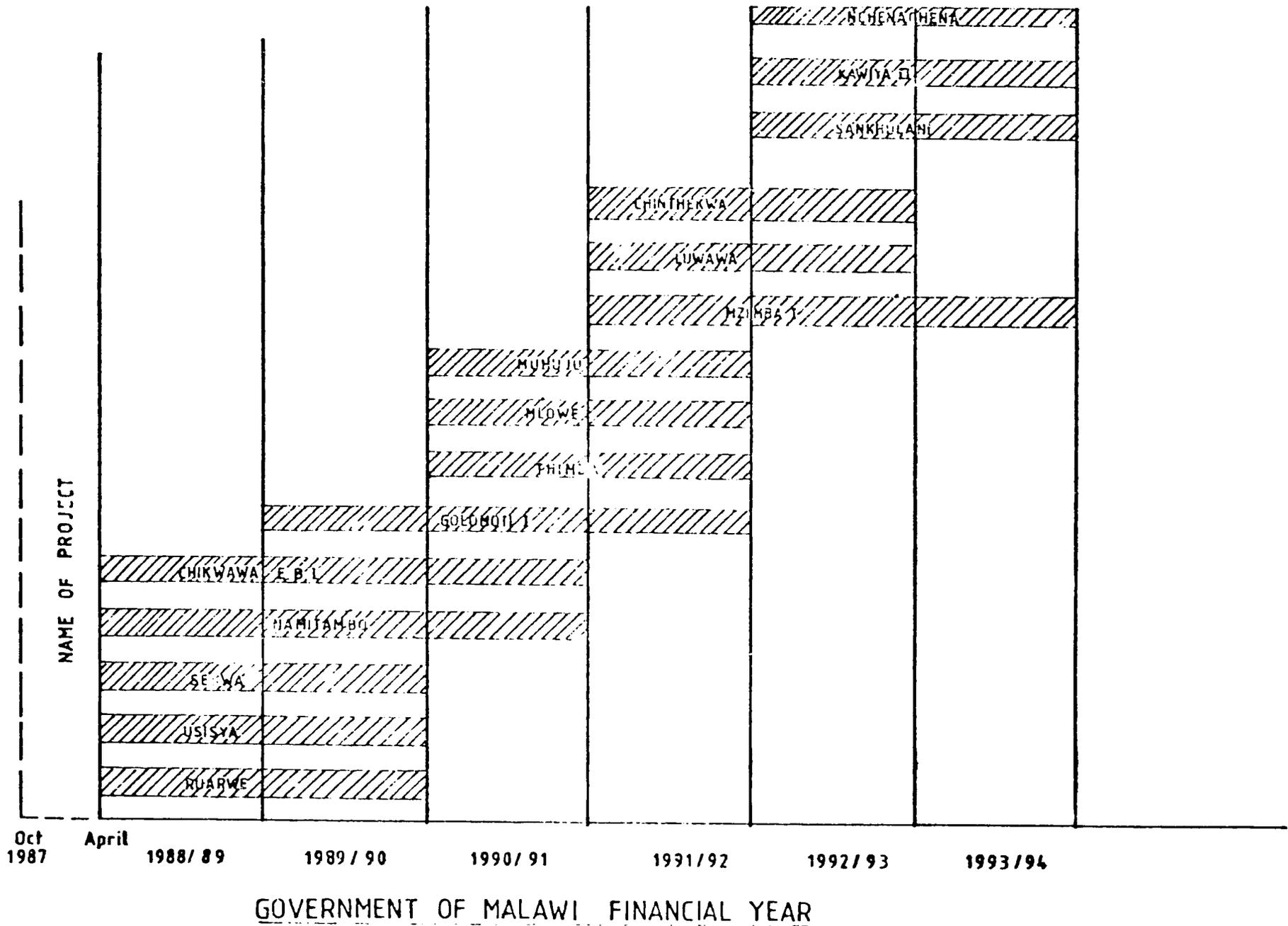


Figure 1. IMPLEMENTATION SCHEDULE FOR RURAL WATER SCHEMES

TABLE 3

POTENTIAL MOWS CONSTRUCTION PROJECTS (IN KWACHA)

No	Reg. District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Operating Costs (GOM)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
1	N	Chitipa	3.8	73180	4570	10980	1830	910	91470	21360	112830
2	N	Chitipa	6	88680	5420	13000	2160	1980	110340	31000	141340
3	N	Rumphi	11.3	262940	16430	39440	6570	3290	328670	73060	401730
4	N	Karonga	11.4	368540	23030	55280	9210	4610	460670	76350	537020
5	N	Karonga	10	328480	20530	49270	8210	4110	410600	70920	481520
6	N	Karonga/Rumphi	6.5	118010	7380	17700	2950	1480	147520	43180	190700
7	N	Rumphi	3.2	62720	3920	9410	1570	780	78400	16000	94400
8	N	Nkhata Bay	5.3	149090	9320	22380	3730	1860	186360	33730	220090
9	N	Nkhata Bay	17.4	416840	26050	62526	10420	5210	521046	98920	619866
10	N	Nkhata Bay	12.8	320400	20025	48060	8010	4000	400495	58000	458495
11	N	Nkhata Bay	18	517820	32360	77670	12950	6478	647278	104530	751808
12	N	Nkhotakota	18.7	592020	37000	88800	14800	7400	740020	107780	847780
13	N	Mzimba	108.4	3500700	218790	525100	87520	43760	4375870	814100	5189970
14	N	Mzimba	106.2	3770346	235650	565550	94260	47130	4712930	843300	5356230
15	N	Nkhata Bay	1.2	17090	1070	2560	430	210	21380	5570	26930
16	N	Nkhata Bay	7.2	99600	6220	14940	2490	1240	124490	42000	166490
17	C	Salima/Dedza	39.2	611460	38220	91720	15290	7640	764330	195600	959930
18	C	Salima/Dedza	10.9	377710	23610	56660	9440	4720	472140	162000	634140
19	C	Salima/Dedza	45.3	1380900	86310	207140	34520	17260	1726130	597400	2323530
20	S	Machinga	28.5	779980	48750	117000	19500	9750	974980	171840	1146820
21	S	Thyolo	10.7	294040	18380	44110	7350	3680	367560	75540	443100
22	S	Chikwawa/Nsanje	9.6	271380	16960	40710	6780	3390	339220	67130	406350
23	S	Chikwawa/Nsanje	35.8	936800	58550	140520	23420	11710	1171000	175000	1346000
24	S	Chikwawa/Nsanje	35.8	936800	58550	140520	23420	11710	1171000	175000	1346000
25	S	Zomba									
26	S	Chiradz./Mulanje							0		0
27	S	Mulanje	-	380000	7150	0	21450	0	408600	28500	437200
28	N	Rumphi	-	730000	13720	0	41180	0	784900	54900	839800
29	N	Rumphi	8.4	106880	6680	16032	2672	1336	133600	33400	167000
30	N	Karonga	3.5	44288	2768	6643	1107	554	55360	13840	69200
		Chilumba *	6.2	79744	4984	11962	1994	997	99681	24920	124601
Totals			581.3	17616432	1052397	2475663	475233	206295	21826020	4014950	25840970

* augmentation scheme

TABLE 4

OPTION 1: MOWS CONSTRUCTION PROGRAM (IN KWACHA)

No.	Reg. District	Project	Design Popx1000	Commdities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Costs (GOM)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
2	N	Chitipa	8	88680	5420	13000	2160	1080	110340	31000	141340
7	N	Rumphi	3.2	62720	3920	9410	1570	780	78400	16000	94400
8	N	Nkhata Bay	5.3	149090	9320	22360	3730	1860	186360	33730	220090
10	N	Nkhata Bay	12.8	320400	20025	48060	8010	4000	400495	58000	458495
13	N	Mzimba	108.4	3500700	218790	525100	87520	43760	4375870	814100	5189970
15	N	Nkhata Bay	1.2	17090	1070	2560	430	210	21360	5570	26930
16	N	Nkhata Bay	7.2	99600	6220	14940	2490	1240	124490	42000	166490
22	S	Chikwawa/Nsanje	9.6	271380	16960	40710	6780	3390	339220	67130	406350
28	S	Chiradz./Mulanje	-	380000	7150	0	21450	0	408600	28600	437200
28	N	Rumphi	8.4	106880	6680	16032	2672	1336	133600	33400	167000
Totals			162.1	4996540	295555	692172	136812	57656	8178735	1129530	7308265

*Augmentation scheme

TABLE 5

OPTION 2: MOWS CONSTRUCTION PROGRAM (IN KWACHA)

No.	Reg.	District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Operating Costs (GOM)	Tools & Ml (USAID)	Project Costs	Self-Help Value	Project Value
1	N	Chitipa	Chintekwa	3.8	73180	4570	10980	1830	910	91470	21360	112830
2	N	Chitipa	Sekwa	6	88680	5420	13000	2160	1080	110340	31000	141340
3	N	Rumphi	Nchenachena	11.3	262940	16430	39440	6570	3290	328670	73060	401730
7	N	Rumphi	Thiaba	3.2	62720	3920	9410	1570	780	78400	16000	94400
8	N	Nkhata Bay	Luwawa	5.3	149090	9320	22360	3730	1860	186360	33730	220090
10	N	Nkhata Bay	Kawiya II	12.8	320400	20025	48060	8010	4000	400495	58000	458495
11	N	Nkhata Bay	Mlowe	18	517820	32360	77670	12950	6478	647278	104530	751808
13	N	Mzimba	Mzimba I	108.4	3500700	218790	525100	87520	43760	4375870	814100	5189970
15	N	Nkhata Bay	Ruarwe	1.2	17090	1070	2560	430	210	21360	5570	26930
16	N	Nkhata Bay	Usisya	7.2	99600	6220	14940	2490	1240	124490	42000	166490
17	C	Salima/Dedsza	Golonoti I	39.2	611460	38220	91720	15290	7640	764330	195600	959930
21	S	Thyolo	Sankhuleni	10.7	294040	18380	44110	7350	3680	367560	75540	443100
22	S	Chikwawa/Nsanje	Shire EB I	9.6	271380	16960	40710	6780	3390	339220	67130	406350
28	S	Chiradz./Mulanje	Namitambo *	-	380000	7150	0	21450	0	408600	28600	437200
28	N	Rumphi	Muhuju *	8.4	106880	6680	16032	2672	1336	133600	33400	167000
Totals				245.1	6755980	405515	956092	180802	79654	8378043	1599820	9977663

* Augmentation scheme

TABLE 6

OPTION 3: MOWS CONSTRUCTION PROGRAM (IN KWACHA)

No.	Reg.	District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating (USAID)	Costs (GOM)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
1	N	Chitipa	Chintekwa	3.8	73180	4570	10980	1830	910	91470	21360	112830
2	N	Chitipa	Sekwa	6	88680	5420	13000	2160	1080	110340	31000	141340
3	N	Rumphi	Nchenachena	11.3	262940	16430	39440	6570	3290	328670	73080	401750
4	N	Karonga	Ruwile	11.4	368540	23030	55280	9210	4610	460670	76350	537020
6	N	Karonga/Rumphi	Chitimba	6.5	118010	7380	17700	2950	1480	147520	43180	190700
7	N	Rumphi	Thimba	3.2	62720	3920	9410	1570	780	78400	16000	94400
8	N	Nkhata Bay	Luwawa	5.3	149090	9320	22360	3730	1860	186360	33730	220090
9	N	Nkhata Bay	Kawiya I	17.4	416840	26050	62526	10420	5210	521048	98920	619968
10	N	Nkhata Bay	Kawiya II	12.8	320400	20025	48060	8010	4000	400495	58000	458495
11	N	Nkhata Bay	Mlowe	18	517820	32360	77670	12950	6478	647276	104530	751808
13	N	Mzimba	Msimba I	108.4	3500700	218790	525100	87520	43760	4375870	814100	5189970
15	N	Nkhata Bay	Ruarwe	1.2	17090	1070	2560	430	210	21360	5570	26930
16	N	Nkhata Bay	Usisya	7.2	99600	6220	14940	2490	1240	124490	42000	166490
17	C	Salima/Dedza	Goloroti I	39.2	611460	38220	91720	15290	7640	764330	195800	959930
21	S	Thyolo	Sankhuleni	10.7	294040	18380	44110	7350	3680	367560	75540	443100
22	S	Chikwawa/Nsanje	Shire EB I	9.6	271380	16960	40710	6780	3390	339220	67130	406350
26	S	Chirad./Mulanje	Namitambo *	-	380000	7150	0	21450	0	408600	28600	437200
27	S	Mulanje	Phalombe *	-	730000	13720	0	41180	0	784900	54900	839800
28	N	Rumphi	Muhuju *	8.4	106880	6680	16032	2672	1338	133800	33400	167000
29	N	Rumphi	Ng'onga *	3.5	44288	2768	6643	1107	554	55360	13640	69200
Totals				283.9	8433658	478463	1098241	245669	91508	10347539	1886810	12234349

*Augmentation scheme

TABLE 7

Cost Estimate: Community Water Supply (in 1000's)

Program Expenditure	USAID \$	USAID K*	MDWS K	Community K
Construction Program				
Commodities	-	9008	-	-
Salaries - HQ Staff	-	-	60	-
Salaries - Field Staff	-	-	346	-
Vehicles and Equipment	-	1217	-	-
Tools and Miscellaneous	-	107	-	-
Operating Costs	-	1275	180	-
Self Help	-	-	-	1600
Sub-Total	0	11607	586	1600
Maintenance Program				
Spares and Replacements	-	640	-	132
Salaries - HQ Staff	-	-	120	-
Salaries - Field Staff	-	-	360	-
Tools and Misc.	-	160	-	-
Vehicles (Motorcycles)	-	21	-	-
Operating Costs:				
Subsistence	-	-	144	-
Fuel and Maintenance	-	704	-	-
Training	-	72	358	-
Water Quality Monitoring	-	264	178	-
Self Help	-	-	-	858
Sub-Total	0	1861	1160	990
Information Resources Prog.				
Special Field Studies	85	60	35	-
Information Systems	15	-	-	-
Coordination	-	5	33	-
Computer Assisted Design	25	40	-	-
Evaluation	125	-	-	-
Off Shore Training	403	-	-	-
Sub-Total	653	105	68	0
Contingencies @ 5%	0	500	0	0
Total (MDWS)	653	14673	1814	2590

* Includes 10% annual inflation rate.

A.2 Staffing

There is a severe shortage of engineering staff within the Rural Water Section (RWS) of the MOWS to carry out the current and future rural water programs. The RWS has only two Malawian project engineers, who are currently directing nearly all rural construction and maintenance works. (The major exception is the large Mpira-Balaka rural water scheme in Ntcheu and Machinga Districts which has additional engineers from both the MOWS and DANIDA.) Although the two RWS engineers, by virtue of dedication and hard work, have been able to maintain a high level of construction activities in the rural program over the past two years, they have had little time for long-term planning, new project preparation, or maintenance management. This shortage of senior technical staff is the most serious weakness in the MOWS rural water program.

Within the RWS, there are at present established positions for two senior-level engineers and seven project engineers. In the past, these positions were filled by a combination of expatriate experts, Malawian nationals, and U.S. Peace Corps and British VSO volunteers. The establishment of a new USAID-funded water program will require a minimum of five engineers at headquarters (or at regional centers) to direct construction on new schemes and supervise maintenance on the growing number of completed schemes.

The staffing needs for the field are not well known. At present, there are 14 technical officers and assistants supervising approximately 90 Rural Water Operators (RWOs) and Monitoring Assistants (MAs). (RWOs directly supervise project construction, then remain as MAs to oversee monitoring and maintenance activities on the completed schemes.) Approximately 10 additional MAs will be needed to monitor the schemes proposed in the new USAID grant. However, whether this will require an increase in current field staff levels or whether it will be possible to have a smaller field staff carry out monitoring and maintenance activities is uncertain at this time.

To address the problems of insufficient engineering staff and uncertainties regarding the number and ranking of field staff, a manpower needs assessment should be carried out during the first year (1988/89) of the USAID grant on the rural water program in the MOWS (and on the HESP program in the MOH, as well). A manpower survey was one of several key recommendations resulting from the 1986 final evaluation of the current USAID-financed rural water program (WASH Field Report No. 186). The results of this assessment will be used by the MOWS to prepare a staffing plan for submission with the Annual Work Plan for the second program year (1989/90).

A.3 Financing of Maintenance Systems

Maintenance costs for completed water schemes are financed partially from the recurrent budget in the form of salaries for the Monitoring Assistants, spares and replacements, and transport and partially by the local communities in the form of cash contributions and in-kind (mostly labor) contributions. Over the past two years (1985/86 and 1986/87), the MOWS has budgeted an estimated K370,000 and K230,000, respectively, for maintenance of rural schemes.

The best available estimate of current rural maintenance costs was developed by Msukwa (1986) on the basis of detailed field investigations of five completed schemes (2 USAID; 3 non-USAID). Msukwa found that total maintenance costs averaged K0.26/cap/yr, of which the MOWS spent K0.07/cap/yr on major maintenance and K0.05/cap/yr on routine maintenance. The local communities were estimated to contribute nothing to major maintenance, but to routine maintenance they provided K0.02/cap/yr in cash and the equivalent of K0.13/cap/yr in labor. Thus, total maintenance was found to average K0.26/cap/yr, of which approximately one-half was provided by the MOWS and one-half by the communities.

It is expected that these maintenance costs will rise in the future as the best sites for rural water schemes become developed and the remaining sites become more complex and costly (for example, the need for water treatment, more complex intake structures, more meters of pipeline per person served). To insure that future maintenance needs are met, the MOWS has two basic options: either include sufficient funds in the recurrent budget for the expanding rural water program or develop methods of cost recovery (either partial or total) within the recipient communities. Although the imposition of rural water tariffs is not considered to be politically feasible at this time (because the people in the project communities have been promised free water in return for their voluntary participation in project construction), there is some evidence that rural water users are willing and able to pay for maintenance services on their systems.

Assessing the "willingness-to-pay" (WTP) for system operation and maintenance will be a high priority task in the first year of the new program. Recent WTP field investigations by the WASH Project have developed a contingent valuation procedure involving surveys within sample villages. This procedure will be applied to a selected group of project villages during the first year (1988/89) to determine local attitudes towards system maintenance and the types and amounts of contributions they would be willing to pay to support it. The MOWS will use the results of this study to prepare a proposed maintenance financing program for submission with the Annual Work Plan for the second program year (1989/90).

A.4 Salaries and Allowances

Under the current rural piped water program, USAID has been supporting the salaries of all field personnel holding nonestablished positions. These positions include approximately 90 RWOs and MAs of various grades. The MOWS has been responsible for the salaries of all headquarters staff (Project Engineers) and senior technical staff (Senior Technical Officers, Technical Officers, and Technical Assistants) in the field. According to the final project evaluation (WASH Field Report No. 186), USAID salary support in the current project, as projected through December 1987, will be approximately \$300,000, while the MOWS over the same period will have expenditures equivalent to \$290,000 for headquarters salaries, \$110,000 for overhead support, and \$244,000 for major maintenance works. At present, it is estimated that MOWS expenditures on headquarters salaries in support of the rural water program are approximately K90,000 per year.

Under the MASH grant, the MOWS will assume responsibility for all salaries associated with the rural water program. This will include an estimated K406,000 for headquarters and field staff salaries allocated to construction activities, a total of K480,000 for headquarters and field staff salaries for maintenance activities, and approximately K42,000 for technical staff involved in water quality monitoring. It is expected that at least three additional engineers will be added to the program, as well as three senior technical field staff, 20 RWOs (who will convert to MAs upon completion of project construction), plus four water quality technicians.

The MOWS also will be responsible for payment of all personal allowances and subsistence payments to individuals for nights out, travel, and training courses. This will amount to approximately K886,000 over the life of the grant (1988-1994). A summary of the salary and allowances to be provided by the MOWS over the six-year grant period is as follows:

<u>MOWS Program Expenditures</u>	<u>Amount (in 1000K)</u>	<u>Equivalent Amount (in 1000\$)</u>
Salaries:		
Construction		
Headquarters	60	26
Field staff	346	150
Maintenance		
Headquarters	120	52
Field staff	360	157
Water Quality Monitoring		
Headquarters	3	1
Field staff	39	17
Subtotal (Salaries)	K928	\$403
Allowances/Subsistence:		
Construction	180	78
Maintenance	144	63
Water Quality Monitoring	136	59
Training	358	156
Special Field Studies	35	15
Coordination	33	14
Subtotal (Allowances)	K886	\$385
Total (Salaries & Allow.)	K1,814	\$789

(Note: No allowance has been made for inflation in the above table.)

A.5 Water Quality Monitoring

Rural water supply development must have an effective program of water quality monitoring in order to ensure that safe water is provided by the systems and to identify periods during which contaminants hazardous to health may enter the networks. Malawi does not have routine monitoring of rural water supplies at present, although the Central Water Laboratory (CWL) in Lilongwe analyzes on request approximately 1,500 rural water samples annually. As a result of a \$99,000 contribution by USAID in the current water program, the CWL facilities are well-equipped to carry out the full range of bacteriological, physical, and chemical analyses of water. There is a lack, however, of operational funds for staff and transport to conduct routine visits to all MOWS rural water schemes.

A special water quality study of six USAID-financed schemes was made in 1985-86 by the CWL. The results showed the presence of faecal indicator bacteria in all schemes. Of 302 water samples taken from intakes and taps during the July through September 1985 dry season, faecal coliform (FC) counts averaged between 10 FC/100ml and 30 FC/100ml, while faecal streptococci (FS) counts averaged between 30 FS/100ml and 50 FS/100ml. For untreated surface water supplies these bacterial counts are quite low in comparison to unprotected traditional sources of water which often have faecal organism concentrations more than ten times higher. The above dry season counts can be considered to be acceptable for the current level of development and resources available in rural Malawi. In the wet season of January through April 1986, however, a total of 214 water samples from the same schemes showed FC and FS counts more than double those measured during the previous dry season, and two of the schemes had individual FC and FS counts exceeding 100 faecal organisms/100ml.

While the presence of faecal organisms is to be expected in all untreated surface water supply systems, even those coming from well-designed intakes in protected forest reserves, as in the case of the Malawi rural water program, it is nonetheless necessary to know when the naturally-occurring contaminant load is exceeding the normal range so that special precautions can be taken to protect the health of the water users. On the basis of existing, but limited information available from the CWL, the general quality of water in the rural piped systems is good and represents a vast improvement over traditional sources previously used by the people. Water quality monitoring, therefore, is particularly important in, first, identifying new catchments which have acceptable water quality for untreated systems and, second, to identify changes in water quality in the completed schemes which may affect health.

The MOWS through the staff and facilities of the CWL will establish a comprehensive program of monitoring the water quality of all existing rural piped schemes, including all existing systems, both USAID and non-USAID, plus all new schemes to be constructed under the MASH grant. The monitoring program will consist of monthly field visits to all schemes based on the average of one visit for each 12,500 population. For small schemes of 10,000 population or less, for example, there would be a single visit each month. For a large scheme of 60,000, however, four visits per month would be made. At each visit, a series of water samples will be taken and immediately tested for faecal organisms with the aid of portable test kits. It is estimated that over the course of a year the full monitoring program will entail approximately 1,000 or more field visits and around 10,000 water samples. These tests will be limited to the basic measurement of FC and FS bacteria. Where

necessary, samples will be brought back to the CWL in Lilongwe for more complete analyses.

Additional resources needed by the CWL to carry out the above program include staff, transport, field test kits, supplies, and operating costs. The MOWS will be responsible for all salaries and allowances, while USAID will provide funding for motorcycles, fuel and maintenance, equipment, and supplies. It is estimated that four additional field technicians will be needed to carry out the program. Total costs for the six-year program period will be K264,000 for USAID and K178,000 for the MOWS. Details of the monitoring program are as follows:

Water Quality Monitoring Expenditures	Amount (in 1000K)		Equivalent Amount (in 1000\$)	
	USAID	MOWS	USAID	MOWS
Salaries:				
Headquarters	--	3	--	1.3
Field Staff	--	39	--	17
Field Test Kits	35	--	15	--
Expendables	54	--	23	--
Motorcycles	25	--	11	--
Operating Costs:				
Subsistence	--	136	--	59
Fuel and Maintenance	150	--	65	--
	—	—	—	—
Total (WQ Monitoring)	K264	K178	\$115	\$77

A.6 Water Quality Standards

Malawi, as with the vast majority of developing countries, has not developed its own set of water quality standards for rural conditions, but instead relies upon the guidelines recommended by the World Health Organization (WHO). For rural areas, it is widely accepted that the most important aspect in water quality is the microbiological safety of drinking water supplies. Few, if any, physico-chemical parameters have universal significance in rural water supplies and, as a result, bacteriological quality has become the most widespread measure of the safety of water supplies in rural areas. The primary bacterial indicator chosen for this purpose is the faecal coliform group, in particular *Escherichia coli*. WHO (1985) recommends as a "guideline" that untreated water supplies, whether piped or unpiped, contain no faecal coliforms in any bacteriological test.

Faecal coliforms and a related group, faecal streptococci, are found in large numbers in the faeces of humans and other warm-blooded animals. Their presence in water supplies is an indication of faecal pollution and a warning sign of potential hazards to health, although there is no clear relationship between the amount of faecal contamination and the corresponding health risk to the consumer of the water. It should be noted that faecal coliforms are characteristically found in almost all naturally occurring surface waters,

including those originating in "protected" catchment areas. Chlorination, often accompanied by filtration, is usually the only way to completely eliminate such organisms.

Most countries in Tropical Africa have avoided the difficult issue of faecal pollution and health by simply adopting the WHO guidelines as national standards. As a result, most countries have unrealistically high (zero faecal coliform content) rural water quality standards that cannot be achieved with available resources and, therefore, are basically ignored. Such standards provide little guidance for operational activities and probably contribute to an overall disregard for water quality issues.

If Malawi is to effectively use the results of a program of routine water quality monitoring of all rural piped water supplies, it must have water quality standards that are appropriate to the current levels of development, available resources, and needs of the people. There is a growing international awareness of the need for such standards. At a recent United Nations conference on water resources management (United Nations, 1987), the final report of the meeting stated: "Differential standards might be appropriate in situations where they expedited realistic, affordable goals and encouraged the expansion of water services to communities which would otherwise not receive them."

The Senior Water Chemist in the MOWS Central Water Laboratory in Lilongwe has proposed a revised set of standards for untreated drinking water supplies in Malawi. These standards are presented as "tentative guidelines" for untreated drinking water in the National Water Resources Master Plan (1986):

<u>Faecal Organisms</u> <u>per 100 ml</u>	<u>Suggested Action</u>
(a) 0	Satisfactory, continue monitoring at regular intervals.
(b) 1 - 10	Re-test to see if original sample accidentally contaminated. If re-test confirms presence of faecal organisms, remove obvious sources of pollution and monitor to see if situation improves.
(c) 11 - 25	As in (b), and increase frequency of monitoring to see if pollution persistent or intermittent.
(d) 26 - 50	As in (c), disinfect source if possible. If pollution reappears after chlorination, notify District Health Inspector.
(e) 51 - 100	As in (d), seek specialist advice and if possible consider routine disinfection or advise people to boil their drinking water.

- (f) 100+ As in (e), if contamination persistent at this level and where routine disinfection not feasible, consider alternative supply.

As part of the new six-year health grant, the above standards will be officially adopted by the MOWS as temporary guidelines for new and existing rural water systems. The WHO guidelines will remain the ideal and ultimate goal, but the criteria outlined above will provide the basis for decisions regarding the addition of water treatment and the selection of new catchments for future development.

A.7 Water Treatment

Since its origins in 1968, the Malawi rural piped water program has been based on the delivery of low-cost, untreated water to rural communities. Water intakes have been built in mountainous streams surrounded by protected forest catchments. This has minimized the effects of pollution arising from human settlements and cultivation. In recent years, however, the need for water treatment in certain project areas has become apparent. Slow sand filters have been recently constructed at the Dombole project (financed by Canadian CIDA) in Ntcheu District and at the Mwanza project (financed by USAID) in Chikwawa District. Preliminary results from these schemes indicate that slow sand filters reduce faecal coliform counts by about one-half, but may promote the growth of other bacterial organisms. More long-term monitoring and applied research on these filters is necessary before their general applicability to Malawian conditions can be accepted.

As the rural piped water program expands, it will include an increasing number of new catchment areas with marginal water quality. The best sites, i.e., those having well protected catchments and good intake locations, have already been developed, and future schemes at times will be required to include catchment areas containing some human settlements and cultivated areas. A survey of 19 potential new catchment areas conducted by the MOWS in November and December 1986 showed that most had relatively high faecal coliform counts (between 100FC/100ml and 400FC/100ml) and several had high turbidity loads (between 20 NTU and 80 NTU). If the waters from these new catchments are to match the quality levels of existing schemes, new methods of catchment protection and water treatment will have to be developed by the MOWS.

Some methods are relatively simple and low-cost, while others are more complicated and expensive. For example, the assistance of the Forest Department can be enlisted in removing illegal habitations and cultivation from officially-designated forest reserves. Moreover, the construction of a water system tends to lower the bacterial count in the water as it moves through pipelines and is held temporarily in storage tanks. Both actions--improving the catchment and building the system--usually result in improved water quality to the consumer. Other relatively simple actions could be taken, including the redesign of storage tanks to serve as sedimentation tanks during the rainy season when stream flows, bacterial counts, and sediment loads are all high. Simple disinfection with chlorine tablets or powder at the main storage tank is another low-cost approach to improving water quality.

None of the above methods need involve expensive equipment or highly-trained operators. Where such simple approaches are inadequate, the MOWS can consider installing slow sand filters. However, slow sand filters are relatively costly, about K46,000 for materials at current (1987) prices and, if the turbidity level in the incoming water exceeds 20 NTU, may require pre-treatment by roughing filters, which cost an additional K46,000.

It must be remembered that the purpose of water treatment in a rural program should not be to produce urban-level water quality meeting WHO standards but to improve the quality of water such that it is adequate and reasonably safe for the rural populations using it. The measure of adequacy in Malawi will be the temporary water quality guidelines contained in the National Water Resources Master Plan (1986) and described earlier in Section A.6. It will be the responsibility of the MOWS to interpret these guidelines and to develop appropriate methods of water treatment for rural schemes with water quality problems.

A.8 Computer-Assisted Design

The present shortage of engineering staff in the Rural Water Section of the MOWS and the future demands for increased attention to planning, design, construction supervision, and maintenance management point out the need to improve and speed up the process of project design and cost estimation. Current methods for pipeline design involve laborious trial-and-error calculations involving hydraulic gradients, pipe friction factors, and pipe flow formulae. For large schemes, these calculations often take two days or more. New computer-assisted procedures, however, can reduce the time needed for preliminary designs and cost estimates to a matter of hours and, thus, provide opportunities for investigating a wider range of design layouts.

During the new six-year program, the MOWS will institute computer-assisted design procedures within the Rural Water Section. This will involve the procurement of a microcomputer and appropriate software and the establishment of a training program for project designers. The World Bank has developed a computer-based design package for pipelines and water distribution systems termed Microcomputer Programs for Improved Planning and Design of Water Supply and Waste Disposal Systems (1985). The package is complete with instruction manuals and program disks for IBM-compatible computers. In early 1986, a World Bank consultant gave a one-week training course to MOWS staff on various applications of the World Bank package. The response of the staff was enthusiastic but, because the course was too short and a computer was not readily available for use afterwards, computer-assisted design procedures did not become established in the MOWS.

The costs of establishing computerized design methods are modest. The software package is freely available from the World Bank and the MOWS already has two copies. An IBM-compatible computer with the necessary peripheral equipment can be obtained locally for about K40,000 and a two to three-week training course by two outside consultants would cost approximately \$25,000. All costs for equipment and training will be borne by USAID through the MASH and HRID grants.

A.9 Information Systems

The Rural Water Section of the MOWS has an extremely antiquated system of acquiring, recording, storing, and retrieving information on the rural water program. Information on individual water schemes, which includes memos, correspondence, design calculation, and maps, are stored in sequential order in traditional paper file folders. Additional data in the form of monitoring and maintenance reports from the field are also collected and stored in a variety of locations at headquarters. There is no technical library of either reference documents or reports dealing with program activities. When specific information is needed, the appropriate file must be requested from the registry office. All too often, however, a particular report or field study cannot be located quickly and decisions must be made on the basis of personal recollections. Because overall program information is not readily available, the MOWS does not prepare any annual reports or progress summaries on the rural water program. The current system of information management has not been a major impediment to the progress of the rural water program only because the senior staff at headquarters is knowledgeable in all aspects of program activities and usually can respond to information needs on the basis of personal experiences.

The continued expansion of the water program and the growing complexity of systems will soon require a more formal and streamlined system of information management. The objectives of any new system should be (1) to provide systematic procedures for the collection, storage, and retrieval of information on the overall program as well as individual schemes, (2) to establish a library for reference materials and reports, and (3) to produce periodic reports on program status and progress. Many of the procedures meeting these objectives can be computerized. The microcomputer procured for computer-assisted design (Section A.8) could also be used in an information management system.

To investigate the feasibility of establishing new information management procedures, the MOWS will carry out a study of program needs during the first year of the new health grant (1988/89). USAID will provide an information systems expert who will spend approximately two to three weeks in Malawi to recommend appropriate procedures. The cost of the consultancy will be around \$15,000.

A.10 Self-Help Contributions

The contributions of local communities to project development are several, including participation in a series of project, tap, and health committees, mobilization of communities to participate in project implementation, voluntary labor inputs during construction, provision of local materials such as sand and gravel, participation in voluntary pipe repair teams, voluntary labor inputs during pipeline repairs, and cash contributions for purchase of replacement taps. By far, the greatest local input occurs during project construction, when hundreds and often thousands of local villagers participate in trench digging, pipe laying, and backfilling. Almost all (over 99%) of the more than 5500 kilometers of pipe trenches in the overall Malawi rural water program have been dug by voluntary labor, and most of it by women. Only a few kilometers of extremely difficult or isolated sections have been built with paid labor.

In the final evaluation of the current USAID project (WASH Field Report No. 186), self-help labor contributions were conservatively assessed at K0.50 per meter of trenching, with the total value of trenching labor in the project equivalent to \$837,000. There are grounds for revising this assessment of labor contributions upwards. In the large Mpira-Balaka water scheme, the MOWS is using directly-hired labor for a number of mains and branches. The costs of this labor are averaging as follows:

* Excavation	K4.00 per meter
Delivery to site	0.26 " "
* Stringing & laying	1.00 " "
Testing	0.10 " "
* Backfill & finish drain	1.00 " "
Total	K6.36 per meter

* Self-help components

Based on these figures, it was decided to use a self-help labor cost equivalent of K6.00 per meter for pipe diameters equal to or greater than 200 mm and K4.00 for pipe diameters less than 200 mm.

The above unit labor values were used to estimate the self-help component in new construction projects planned for the MASH program. For Option 2, this input totaled K1,600,000. On average, self-help labor equals about 16 percent of total project value, or 19 percent of project monetary costs.

For maintenance inputs, local contributions were assessed conservatively on the basis of the Msukwa (1986) findings that project beneficiaries contribute an average of K0.02 capita/year in cash and K0.13/capita/year in labor and materials. If it can be assumed that at least 1,100,000 people will be receiving piped water by the end of the MASH program, the maintenance contributions of the local communities, therefore, have a cash value of K132,000 and an in-kind value of K858,000.

A.11 Training

Two types of training support will be used in the MASH program: (1) in-service and local training which will be supported by MASH and the GOM, and (2) off-shore training which will be financed by USAID through the Human Resources and Institutional Development project. In-service training has been institutionalized within the rural water program of the MOWS for many years. A series of refresher and up-grading courses are routinely given to supervisory and monitoring staff during the rainy season of January to March at the MOWS Zomba Training Center. MASH support will be used to continue and strengthen these activities over the duration of the program. Total estimated costs for in-service training will be K358,000 for the MOWS and K72,000 for USAID.

Off-shore training includes study tours in neighboring African countries, short courses and seminars, and university degree training in engineering. Total estimated costs are \$403,000 of USAID funds, which will be drawn from the HRID project. Table 8 summarizes the MOWS training proposals. The off-shore training activities are listed in decreasing order of priority.

TABLE 8

MOWS TRAINING NEEDS: COMMUNITY WATER SUPPLY PROGRAM

Course Title	Staff Level	Trainees Per Course	Number of Courses	Duration	Contributions in 1,000s		
					M A S H		HRID
					MOWS (K)	USAID (K)	USAID (\$)
<u>In-Service Training:</u>							
1. Technical Refresher	Water Operators & Monitoring Assistants	105	1 per yr	1 wk	100	12	—
2. Supervisors' Workshop	Water Supervisors	15	1 per yr	1 wk	24	6	—
3. Senior Staff Workshop	Senior Staff	10	1 per yr	1 wk	16	4	—
4. Supervisors Tech. Course	Water Supervisors	12	1	30 wks	38	7	—
5. New Operator Training	Water Operators	20	1	4 wks	10	4	—
6. System Operation & Repair	Local Leaders & Repair Teams	400	1 per yr	1 wk	130	18	—
7. Local Project Visits	Local Leaders	200	1	1 day	6	1	—
8. Training of Trainers (with MOH)	Trainers (MOH, MOWS, CS)	12	1 per 3 yrs	2 wks	14	8	—
9. Joint Field Training (with MOH)	HAs, HSAs & MAs	18	2 per yr	1 wk	20	12	—
Sub-Total (In-Service)					350	72	—
<u>Off-Shore Training:</u>							
1. Regional Study Tours	Engineers and Supervisors	9	1 per yr	1 wk	—	—	70
2. Management Courses on WS&S	Senior Staff	2	1 per yr	6 wks	—	—	53
3. B.Sc. Civil Engineering	Engineers	1	3	3 yrs	—	—	188
4. M.Sc. Sanitary Engineering	Engineers	1	2	1 yr	—	—	50
5. Conferences/Seminars	Senior Staff	2	1 per yr	1 wk	—	—	31
6. Diploma: Evaluation Methods	Senior Staff	1	1	1 yr	—	—	11
Sub-Total (Off-Shore)					—	—	403

A.12 Vehicles and Equipment

The following vehicles and equipment will be needed by the MOWS to carry out the proposed construction and maintenance programs under MASH. Because of rapidly increasing prices, an additional 33 percent has been added to the overall estimated cost of the equipment.

Item	Quantity	Estimated Unit Price (in 1000K)	Total Cost (in 1000K)	Total Cost (in 1000\$)
7-ton Pipe Carrier Trucks	2	64	127	55
5-ton Drop Side Trucks	3	68	205	89
7-ton Tipper Trucks	2	70	140	61
Land Cruiser (4WD)	1	60	60	26
Light Pick-Up Trucks	4	36	144	63
Motorcycles	40	3.5	140	61
Concrete Mixers	3	19	58	25
Poker Vibrators	3	10	29	13
Portable Rock Drills	2	5	10	4
Sub-total			913	397
Add 33% Contingency			304	132
TOTAL			K1,217	\$529

APPENDIX B

ISSUES AFFECTING THE MOH

B.1 Expansion of the HESP Program

Despite a severe lack of funds for materials, supplies, and transport, the HESP program has proved to be highly effective in reaching rural populations and motivating them to improve their sanitation conditions. In the new MASH program, the MOH intends to expand HESP from the few targeted villages of the past to include both the 14 new water schemes in the construction program and all of the 55 existing rural water schemes. This will mean placing field personnel within all water project areas, providing them with tools and supplies, and maintaining continuous support to all field activities. (See Table 9.)

Among the activities the MOH intends to undertake will be the construction of 10 demonstration VIP latrines in each of 17 districts throughout the country. In addition, it wants to construct a washing slab at each of the 8,000 water taps in existing rural schemes. Volunteer labor will be used in these activities, but the MOH (with USAID funds) will provide the tools and materials. In time, the MOH intends to provide HESP services to all rural areas throughout the country.

B.2 Staffing

The MOH currently has one senior professional acting as HESP Coordinator, 14 Supervisors, 11 Health Assistants (HA), and 63 Health Surveillance Assistants (HSA) working in the HESP program. To carry out its goal of expanding HESP to all rural water schemes in the country, the ministry estimates it must recruit an additional four senior professionals, one to serve at headquarters and three to act as regional HESP coordinators. In addition, the MOH intends to add 9 Supervisors, 36 HAs, and 80 HSAs to the field staff. All of the above personnel will work full-time on HESP activities.

In posting new personnel to the field, the MOH will give priority to areas where new water schemes are being planned. Their intention is to have HESP personnel work alongside MOWS personnel during the initial mobilization and organization of project communities.

It is expected that new HESP personnel will be added gradually to the MOH ranks in order not to overburden the ministry with administrative and financial requirements. Full HESP staffing will not be achieved until the third or fourth year of the MASH program. To insure that HESP manpower needs will be properly identified, the MOH will carry out a manpower needs assessment during the first year of the program. The results of this assessment will be used by the MOH to prepare a staffing plan for submission with the Annual Work Plan for the second program year (1989/90).

TABLE 9

Cost Estimate: HESP (in 1000's)

Program Expenditure	USAID \$	USAID K*	MOH K	Community K
Salaries - HQ	-	32	58	-
Salaries - Field Staff	-	496	622	-
Materials and Supplies	-	-	-	-
VIP Demo Latrines	-	340	-	5
Washing Slabs	-	469	-	16
Vehicles	-	921	-	-
Tools and Equipment	-	52	-	-
Operating Costs	-	-	-	-
Subsistence	-	84	148	-
Fuel and Maintenance	-	316	-	-
Training	-	-	-	-
In Service	-	135	241	-
Off Shore	147	-	-	-
Sanitary Research Unit	-	-	-	-
Materials & Equipment	-	33	-	-
Tools & Equipment	-	35	-	-
Self Help	-	-	-	131
Contingencies @ 5%	-	100	-	-
Total (MOH)	147	3013	1269	152

* Includes 10% annual inflation rate.

B.3 Salaries and Allowances

Unlike the MOWS, the MOH is not in a position to support greatly expanded expenditures for salaries and allowances. The ministry has been supporting the salaries of all HESP personnel to date, but will not be able to assume immediate responsibility for all of the 125 new field personnel projected for the MASH program. The MOH, nevertheless, is prepared to eventually underwrite all salary costs of the total HESP program if USAID will support a gradual build-up of new HESP personnel in the early years of the MASH grant. It proposes that USAID assume all new salary costs for the first three years of the program, after which the MOH will gradually take on an increasingly larger proportion. The estimated allocation of the sharing of salaries and allowances will be approximately K747,000 to USAID and K1,269 to the MOH. (See Figure 2.)

B.4 Training

As in the case of the MOWS, the MOH will need both in-service and off-shore training. The in-service training will include courses currently being held for HSAs and HAs, plus several new courses directed at local villagers and at joint sessions for MOWS and MOH field staff. Total estimated in-service training costs are K241,000 for the MOH and K135,000 for USAID.

Off-shore training proposals include regional study tours, short courses in England and France, and the training of a sanitary engineer to the diploma level. Total costs are estimated to be \$147,000, of which all will be provided by the USAID HRID project. Table 10 summarizes the MOH/HESP training proposals. The off-shore activities are listed in decreasing order of priority.

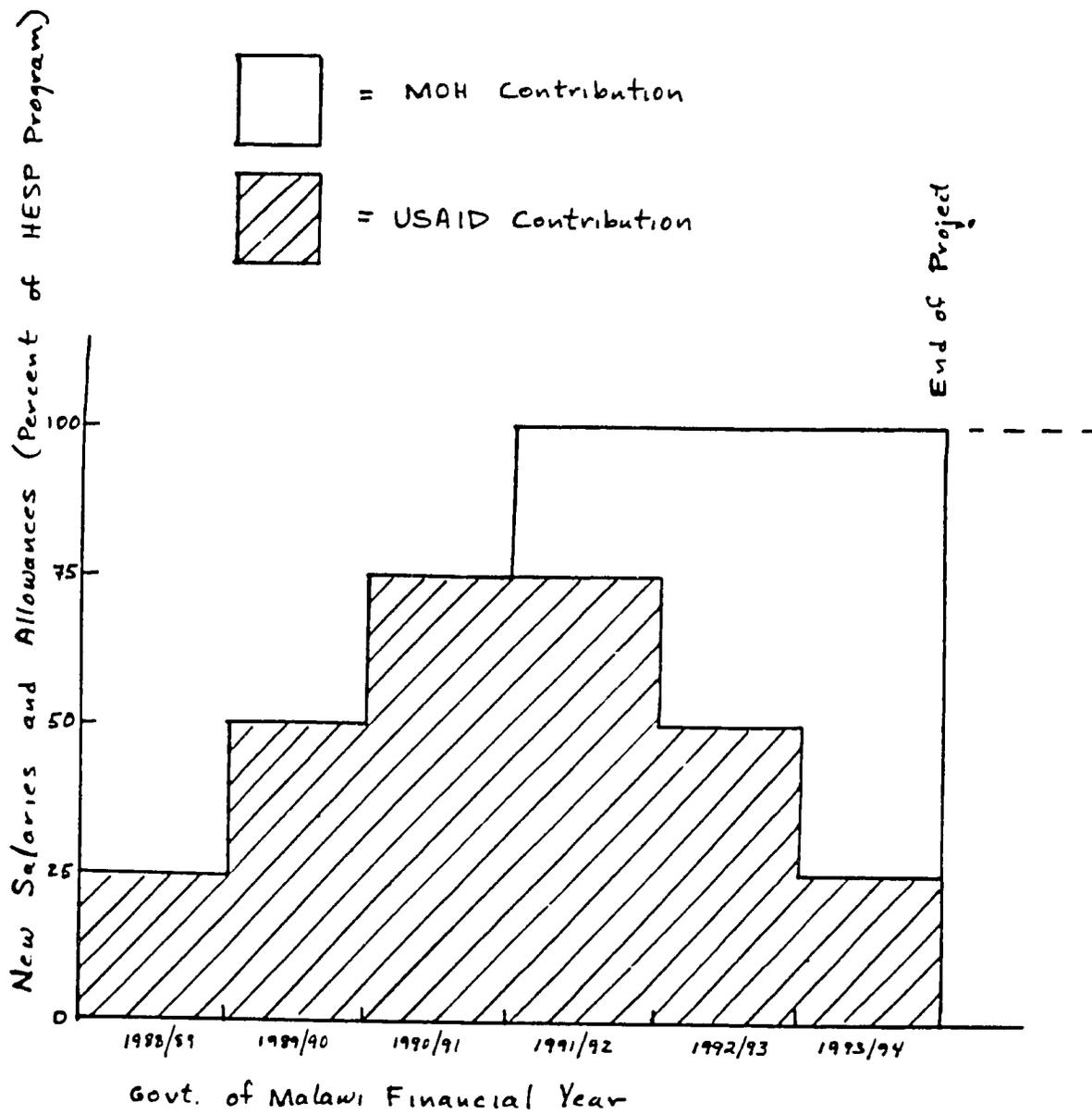


Figure 2. ALLOCATION OF HESP EXPENDITURES FOR SALARIES AND ALLOWANCES.

TABLE 10

MOH TRAINING NEEDS: HESP PROGRAM

Course Title	Staff Level	Trainees Per Course	Number of Courses	Duration	Contributions in 1,000s			
					M	A	S H	HRID
					MOWS (K)	USAID (K)	USAID (\$)	
<u>In-Service Training:</u>								
1. Trainer of Trainers (with MOWs)	Trainers (MOH, MOWS, CS)	12	1 per 3 yrs	2 wk	14	6	—	
2. Joint Field Training (with MOWS)	HAs, HSAs, & MAs	18	2 per yr	1 wk	21	10	—	
3. Training of Women & Tap Committees	Local Women & Tap Committees	30	8 per yr	1 wk	88	52	—	
4. Training of Village Health Committee	VHC Members	30	8 per yr	1 wk	88	52	—	
5. Training of New HSAs	New HSAs	80	1	1 wk	30	15	—	
Sub-Total (In-Service)					241	135	—	
<u>Off-Shore Training:</u>								
1. Regional Study Tours	Senior Staff	6	3	2 wks	—	—	12	
2. WEDC course: Comm. WS&S	Regional Staff	3	1	2 1/2 mos	—	—	9	
3. CEFIGRE course: WS&S Planning	Senior Staff	3	1	1 mo	—	—	16	
4. CEFIGRE course: Rural WS&S	Senior Staff	3	1	2 wks	—	—	40	
5. Diploma: Sanitary Engineering	Engineer	1	1	2 yrs	—	—	70	
Sub-Total (Off-Shore)					—	—	147	

APPENDIX C

ISSUES AFFECTING BOTH THE MOWS AND THE MOH

C.1 Program Coordinating Committee

Coordination between the MOWS and the MOH in the current USAID-financed water program has operated on an informal basis since program inception in 1981. While the coordination to date between the two ministries has been reasonably good, it could be better, and the new MASH program will need closer and more formal cooperation between the ministries if HESP objectives are to be realized. Both the mid-term and final evaluations of the current water program called for closer collaboration in the areas of finance and field operations.

To achieve this, the new program will have a Program Coordinating Committee composed of representatives of the MOWS and the MOH. This committee will meet regularly (at least once per quarter) to review current activities, to identify and resolve mutual problems, and to coordinate future work programs. The membership of the committee will be left for the GOM to decide, although it is recommended that the committee include permanent members from the Rural Water Section of the MOWS and the HESP program of the MOH. The selection of members should be based on their ability to contribute to interministerial problem-solving in the new MASH program. It is believed that the formal channel of communication represented by this committee will help to strengthen the existing information channels between the two ministries.

C.2 Annual Reviews

There is need for a periodic review of program status showing activities underway, progress since the last review, and overall status since the beginning of the program. Both the MOWS and the MOH will prepare a brief annual review of their activities and submit it to USAID along with the Annual Work Plan. The annual review should consist primarily of easy-to-measure statistical indices so as not to burden unduly either ministry with reporting requirements. Such reviews will serve as a rapid measure of program progress and will provide valuable input to subsequent mid-term and final program evaluations.

The following indices are suggested for these reviews:

(1) Annual Review of MOWS Activities:

New Water Projects Started: _____

Old Projects Under Construction: _____

Projects Completed: _____

<u>Program Expenditure*</u>	<u>Expenditure During Year (K)</u>	<u>Expenditure Cumulative to Date (K)</u>
Construction Program		
- Commodities	x	x
- Salaries	x	x
- Vehicles & Equipment	x	x
- Tools & Misc.	x	x
- Operating Costs	x	x
Maintenance Program	x	x
Water Quality Monitoring	x	x

* Note: USAID terminology for budget items differs slightly from that used by the GOM. The following USAID and MOWS terms have equivalent meaning:

<u>USAID Term</u>		<u>MOWS Term</u>
Commodities	=	003 Water Supplies
Vehicles and Equipment	=	006 Plant and Vehicles
Salaries	=	008 Personal Emoluments
Operating Costs	=	009 Running Expenses
Tools and Miscellaneous	=	010 Special Expenditure

<u>Activity</u>	<u>During Year</u>	<u>Cumulative to Date</u>
Kilometers of Trench	x	x
No. of Taps Installed	x	x
Population Served with Water	x	x
No. of Water Samples Tested	x	x

No. of HQ Staff (describe): _____

No. of Field Staff (describe): _____

Briefly identify any problem issues (causes, consequences, etc.):

(2) Annual Review of MOH Activities:

New HESP Project Areas Started: _____

Total HESP Project Areas: _____

New HESP Project Villages: _____

Total HESP Project Villages: _____

<u>Program Expenditure</u>	<u>Expenditure During Year (K)</u>	<u>Expenditure Cumulative to Date (K)</u>
Salaries	x	x
Vehicles & Equipment	x	x
Tools & Misc.	x	x
Operating Costs	x	x
Materials & Supplies	x	x
Training	x	x
Sanitary Research Unit	x	x

<u>Activity</u>	<u>During Year</u>	<u>Cumulative to Date</u>
No. of Washing Slabs Installed	x	x
No. of Latrines Constructed	x	x
Population Affected by HESP	x	x
No. of Water Samples Tested	x	x

No. of HQ staff (describe): _____

No. of Field Staff (describe): _____

Briefly identify any problem issues (causes, consequences, etc.):

C.3 Annual Work Plans

Annual work plans prepared by the MOWS and the MOH will be the primary source of information for USAID monitoring, review, and approval of GOM MASH activities. The MOWS will submit an annual plan on its proposed water supply program, while the MOH will provide an annual plan of the proposed HESP program. As described in Section C.2, each ministry will also provide an annual review of current activities along with the annual work plan for the following year. The annual review and annual work plan should contain similar types of information in order to assist USAID in its monitoring function.

The following categories of information are suggested for the annual work plan:

1. Future year projections of items, expenditures, and activities contained in the annual review (see Section C.2).
2. Bar chart of major project activities.
3. Discussion of special events (studies, evaluations, program changes, etc.)
4. Discussion of potential problem areas.

C.4 USAID Program Evaluations

USAID will carry out mid-term and final evaluations of the water supply and HESP program activities supported by the MASH grant. The purpose of these evaluations will be to assess the functioning, or operation, of the water supply and HESP programs and the utilization of program outputs by project beneficiaries. The emphasis of the mid-term evaluation will be to determine progress towards program objectives as set out in the logframe and to recommend any necessary changes or remedial actions to be undertaken during the remaining life of the MASH program. The final evaluation, on the other hand, will assess the extent of program achievements and will highlight issues and lessons of particular importance to future USAID programs for water, sanitation, and health. Both evaluations should be conducted by external experts, although it is suggested that MOWS and MOH personnel actively participate in the assessments in order to strengthen GOM capability to carry out its own evaluation exercises in the future.

It is recommended that mid-term and final evaluations have similar formats and follow the model used in the mid-term and final evaluations of the current USAID-financed water program. This model highlights the sequential nature of linkages from initial project input to ultimate project outputs and impacts, as shown in Figure 3.

Each level of Figure 3 represents an order of effects that are dependent upon all previous effects. The initial efficiency level consists of the immediate or direct consequences of project development, which include all project

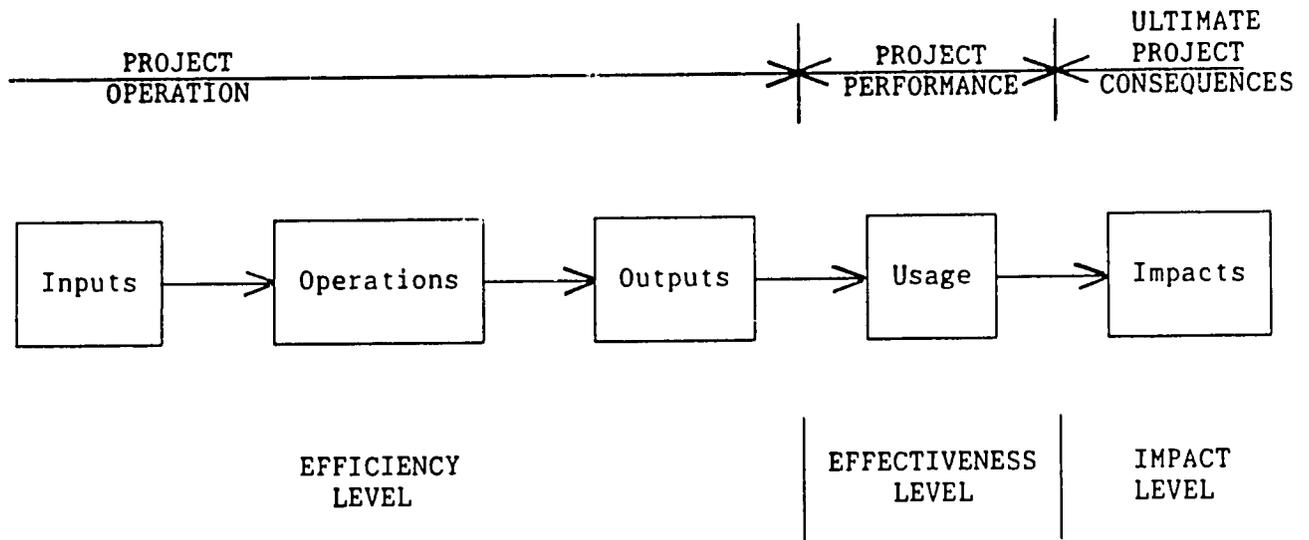


Figure 3. General Evaluation Model for Water and Sanitation Projects.

inputs, operations, and physical outputs under the control of project officials. These consequences can generally be assessed in straightforward physical units.

The secondary effectiveness level involves the more complex consequences of project performance, or the use of project systems. This includes the water use and sanitation practices adopted by the project communities as well as the types of health education and maintenance support the communities give to the new systems. Project officials cannot directly control these consequences. They can only hope to favorably influence the behavioral patterns in the recipient communities. Similarly, because of the difficulties in measuring behavior, surrogate, or indicator measures, often must be employed.

The third and final level is the impact level, which includes the ultimate health, economic, and social consequences of the project. To the policy maker, these are the long-run benefits that water and sanitation projects are intended to achieve. The existence of these impacts is dependent upon the occurrence of project outcomes at the earlier efficiency and effectiveness levels. Measurement of project impacts, however, is extraordinarily difficult and may require a disciplined research approach with strict project controls to produce meaningful results. The World Health Organization, in its Minimum Evaluation Procedure (WHO, 1983), advises against attempting to measure project impacts in operational field assessments.

The general evaluation model can be used to classify program assessments into the following five areas:

1. Program inputs by USAID, MOWS, MCH, and the local community.
2. Strengthening of institutions involved in the program.
3. Program outputs of community water supply and sanitation schemes.
4. Community utilization of water and sanitation systems.
5. Program impacts (health, economic, social, environmental).

Figure 4 is an expanded view of the evaluation model adopted for the MASH program. Primary emphasis should be placed on evaluating the efficiency and effectiveness levels, or program operations and program performance. Because these evaluations are intended to provide operational guidance, rather than fundamental research insights, only minor assessment efforts are needed on program impacts. This level, therefore, can be best assessed in terms of general qualitative descriptions or on the basis of any special field studies that may be carried out over the course of the program.

Program Operation

Program Performance

Program Impacts

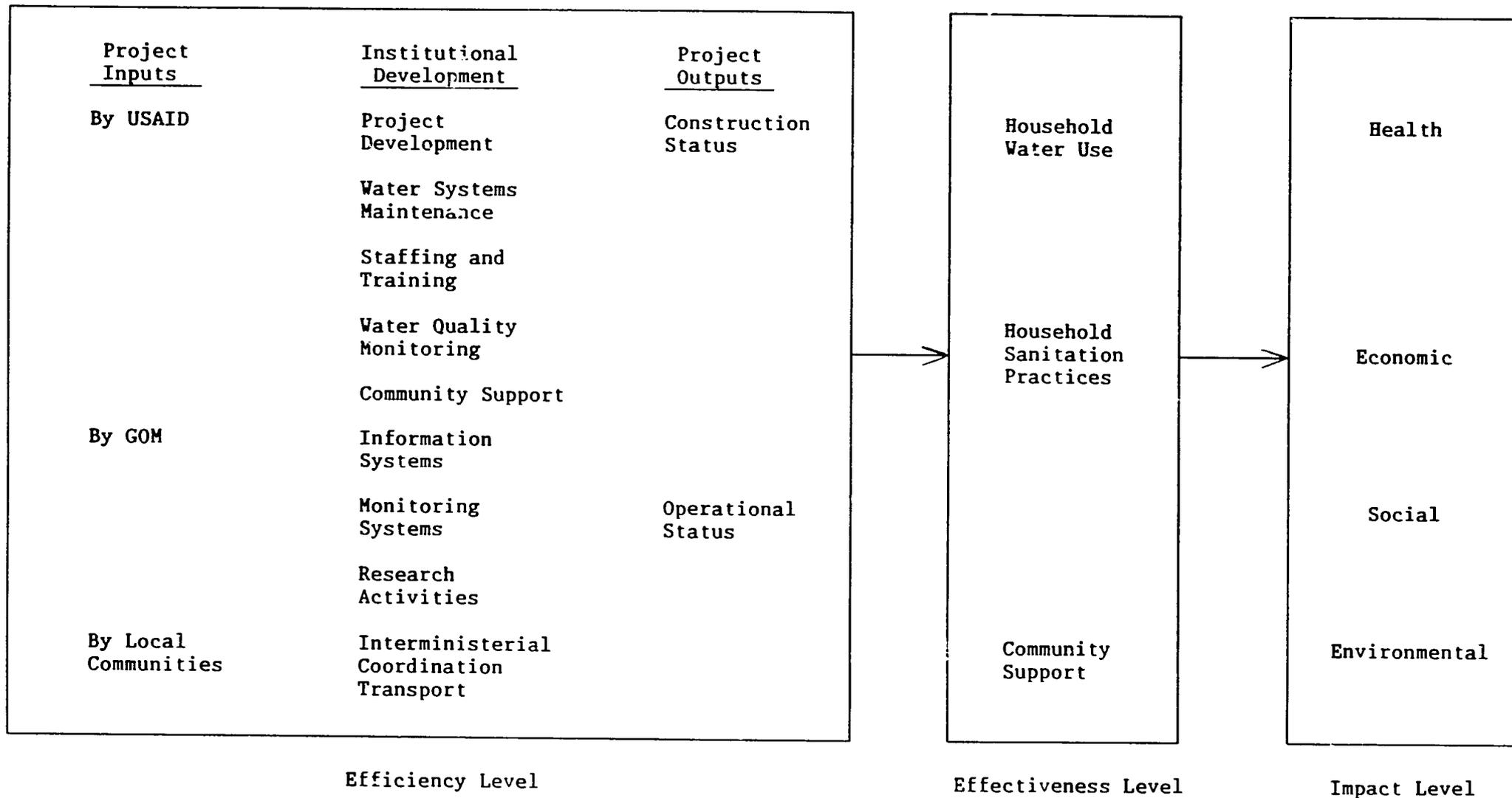


Figure 4. Evaluation Model for Water Supply, Sanitation, and Hygiene Education Component of MASH.

The following is a summary outline of the key program aspects recommended for the mid-term and final evaluations:

1. Program Operations: Inputs
 - 1.1 USAID Inputs
 - 1.1.1 Construction Program
 - 1.1.2 Maintenance Program
 - 1.1.3 Information Resources Program
 - 1.1.4 HESP Program
 - 1.2 GOM Inputs
 - 1.2.1 MOWS
 - 1.2.2 MOH
 - 1.3 Community Inputs
 - 1.4 Other Inputs
2. Program Operation: Institutional Development
 - 2.1 Program Development Activities of the MOWS
 - 2.1.1 Water Systems Planning
 - 2.1.2 Water Systems Design
 - 2.1.3 Water Systems Procurement
 - 2.1.4 Water Systems Construction
 - 2.1.5 Promotion of Water Project Committees
 - 2.2 Program Development Activities: MOH
 - 2.2.1 Hygiene Education
 - 2.2.2 Pit Latrines
 - 2.2.3 Washing Slabs
 - 2.2.4 Promotion of Village Health Committees
 - 2.3 Water Systems Maintenance
 - 2.3.1 Routine Operations and Maintenance
 - 2.3.2 Major Maintenance
 - 2.3.3 Financing of Maintenance Costs
 - 2.4 Staffing
 - 2.4.1 MOWS
 - 2.4.2 MOH
 - 2.5 Training
 - 2.5.1 In-Service Training: MOWS
 - 2.5.2 Off-Shore Training: MOWS
 - 2.5.3 In-Service Training: MOH
 - 2.5.4 Off-Shore Training: MOH
 - 2.6 Water Quality Monitoring
 - 2.6.1 Organization of Monitoring Operations
 - 2.6.2 Monitoring Coverage
 - 2.7 Community Support
 - 2.7.1 Status of Committees
 - 2.7.2 Institutional Linkages of Committees
 - 2.8 Information Systems
 - 2.8.1 MOWS
 - 2.8.2 MOH
 - 2.9 Monitoring Activities
 - 2.9.1 MOWS
 - 2.9.2 MOH
 - 2.10 Research and Special Studies
 - 2.10.1 Engineering and Technical Studies
 - 2.10.2 Social and Health Studies

- 2.11 Interministerial Coordination
 - 2.11.1 Program Coordinating Committee
 - 2.11.2 Project-Level Coordination
- 3. Program Operation: Status of Schemes
 - 3.1 Construction Status
 - 3.1.1 Water Systems
 - 3.1.2 Pit Latrines
 - 3.1.3 Washing Slabs
 - 3.2 Operational Status
 - 3.2.1 Water Quantity
 - 3.2.2 Water Quality
 - 3.2.3 System Reliability
 - 3.2.4 System Accessibility
 - 3.2.5 System Sanitation
- 4. Program Utilization
 - 4.1 Household Water Use
 - 4.1.1 Sources and Uses of Household Water
 - 4.1.2 Water Consumption
 - 4.2 Household Sanitation Practices
 - 4.2.1 Water-Related Uses
 - 4.2.2 Latrine Usage
 - 4.3 Community Support Practices
 - 4.3.1 Enforcement of Water Use and Sanitation Practices
 - 4.3.2 Community Input During Construction
 - 4.3.3 Community Input for Maintenance
- 5. Program Impacts
 - 5.1 Health Impacts
 - 5.1.1 Diarrheal Disease
 - 5.1.2 Effects on Other Diseases
 - 5.2 Economic Impacts
 - 5.2.1 Time Savings
 - 5.2.2 Other Productive Outputs
 - 5.3 Social Impacts
 - 5.3.1 Experience in Project Development
 - 5.3.2 Effect of Cooperative Activities
 - 5.3.3 Involvement of Women
 - 5.4 Environmental Impacts
 - 5.4.1 Effects of Changes in Water and Land Use
 - 5.4.2 Wastewater Disposal

C.5 Total Contributions by USAID, GOM, and Local Communities for Water and HESP Programs in MASH

Overall contributions for the proposed water and HESP programs in MASH will total almost K23 million (\$10 million) over the period of 1988-1994. A summary of estimated contributions from USAID, the GOM, and local communities is as follows:

<u>Source of Contribution to MASH</u>	<u>Amount (in 1000K) K</u>	<u>Equivalent (in 1000\$) US\$</u>
USAID	17,086	7,429
GOM		
- MOH	1,269	552
- MOWS	1,790	778
Local Communities	2,742	1,192
	<hr/>	<hr/>
TOTAL	K22,887	\$9,951

As shown above, USAID will provide K17.1 million (\$7.4 million), the GOM through the MOWS and the MOH will contribute K3.1 million (\$1.3 million), and the local communities will contribute the equivalent of K2.7 million (\$1.2 million). These contributions will occur over the period covered by U.S. fiscal years FY88 through FY93. It is assumed that program funding will begin at the start of the Malawi fiscal year (April 1, 1988) which will be the mid-point of U.S. FY88. For this reason, program funding in the first U.S. fiscal year will be smaller than in subsequent years.

Year-by-year contributions over the life of the MASH water and HESP programs are shown in Table 11 (USAID contributions), Table 12 (GOM contributions), and Table 13 (local community contributions).

TABLE 11

 RURAL WATER, HEALTH, AND SANITATION COMPONENT
 USAID CONTRIBUTIONS BY FISCAL YEAR (IN 1000 K)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000K)						LOP TOTAL (K)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
CONSTRUCTION PROG							
COMMODITIES	450	1351	2252	2252	1802	901	9008
VEHICLES & EQUIP	217	300	300	200	150	50	1217
TOOLS & MISC	20	20	20	20	20	7	107
OPERATING COSTS	125	250	250	250	250	150	1275
SUB-TOTAL	812	1921	2822	2722	2222	1108	11607
MAINTENANCE PROG							
SPARES & REPLACE	50	100	125	125	125	115	640
TOOLS & MISC	20	30	30	30	30	20	160
VEHICLES (MOTORCYL)	5	5	5	5	1	0	21
OP CSTS FUEL & MAINT	59	125	125	130	130	135	704
TRAINING	10	15	15	15	10	7	72
WQ MONITORING	50	60	50	45	30	29	264
SUB-TOTAL	194	335	350	350	326	306	1861
INFO RESOURCES PROG							
SPEC FIELD STUDIES	20	0	20	0	20	0	60
COORDINATION	1	1	1	1	1	0	5
COMP ASST DESIGN	40	0	0	0	0	0	40
SUB-TOTAL	61	1	21	1	21	0	105
HESP PROGRAM							
SALARIES - HQ	2	4	9	9	5	3	32
SALARIES-FIELD STFF	30	84	124	129	89	40	496
MATLS & SUPPLIES:							
-VIP DEMO LATRINES	15	40	65	70	75	75	340
-WASHING SLABS	20	40	69	100	120	120	469
-VEHICLES	71	150	250	250	150	50	921
-TOOLS & EQUIP	5	10	10	10	10	7	52
OPERATING COSTS:							
-SUBSISTANCE	5	12	15	20	20	12	84
-FUEL & MAINT	31	35	50	75	75	50	316
-INSERVICE TRAIN	15	20	25	25	25	25	135
SAN RESRCH UNIT:							
-MATLS & SUPPLIES	0	5	6	7	8	7	33
-TOOLS & EQUIP	0	5	6	8	9	7	35
SUB-TOTAL	194	405	629	703	586	396	2913
CONTINGENCIES							
MOWS	25	100	100	100	100	75	500
MOH	5	20	20	20	20	15	100
SUB-TOTAL	30	120	120	120	120	90	600
TOTAL (USAID)	1291	2782	3942	3888	3275	1900	17086

TABLE 12

RURAL WATER, HEALTH, AND SANITATION COMPONENT
GOM CONTRIBUTIONS BY FISCAL YEAR (IN 1000 K)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000K)						LOP TOTAL (K)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
MIN OF HEALTH							
SALARIES:							
-HQ	4	8	8	10	12	16	58
-FIELD STAFF	50	95	100	146	193	238	822
OPERATING COSTS							
-SUBSISTENCE	9	18	18	27	34	42	148
IN SERVICE TRAINING	20	30	30	40	55	66	241
SUB-TOTAL (MOH)	83	151	156	223	294	362	1269
MIN OF WORKS							
SALARIES:							
-HQ	14	25	30	36	37	38	180
-FIELD STAFF	55	115	120	135	140	141	706
OPERATING COSTS							
-SUBSISTENCE	29	56	57	59	61	62	324
TRAINING	38	60	60	70	70	60	358
WQ MONITORING	30	30	35	35	30	18	178
SPEC FIELD STUDIES	10	0	15	0	10	0	35
COORDINATION	3	6	6	6	6	6	33
SUB-TOTAL (MOWS)	179	292	323	341	354	301	1790
TOTAL (GOM)	262	443	479	564	648	663	3059

TABLE 13

RURAL WATER, HEALTH, AND SANITATION COMPONENT
TOTAL COMMUNITY AND GOM CONTRIBUTIONS (IN 1000 K)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000K)						LOP TOTAL (K)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
COMMUNITY SELF-HELP							
-WATER PROJECTS	225	450	475	500	500	440	2590
-HESP PROJECTS	10	22	25	28	32	35	152
SUB-TOTAL (SELF-HELP)	235	472	500	528	532	475	2742
SUB-TOTAL (GOM)	262	443	479	564	648	687	3083
TOTAL (SELF-HELP + GOM)	497	915	979	1092	1180	1162	5825

APPENDIX D

TABLES SHOWN IN U.S. DOLLARS

This Section contains tables in U.S. dollars (\$). The tables repeat those in the text, which are in Kwacha (K). For the sake of comparison, the tables are as follows:

<u>K</u>		<u>US \$</u>
Table 3	=	Table 14
Table 4	=	Table 15
Table 5	=	Table 16
Table 6	=	Table 17
Table 11	=	Table 18
Table 12	=	Table 19
Table 13	=	Table 20

TABLE 14

POTENTIAL MOWS CONSTRUCTION PROJECTS (IN US \$)

No.	Reg. District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value	
1	N Chitipa	Chintekwa	3.8	31817	1987	4774	796	396	39770	9287	49057
2	N Chitipa	Sekwa	6	38557	2357	5652	939	470	47974	13478	61452
3	N Rumphi	Nchenachena	11.3	114322	7143	17148	2857	1430	142900	31765	174665
4	N Karonga	Ruwile	11.4	160235	10013	24035	4004	2004	200291	33196	233487
5	N Karonga	Wowwe	10	142817	8926	21422	3570	1787	178522	30835	209357
6	N Karonga/Rumphi	Chitimba	6.5	51309	3209	7696	1283	643	64139	18774	82913
7	N Rumphi	Thimba	3.2	27270	1704	4091	683	339	34087	6957	41043
8	N Nkhata Bay	Luwawa	5.3	64822	4052	9722	1622	809	81026	14665	95691
9	N Nkhata Bay	Kawiya I	17.4	181235	11326	27185	4530	2265	226542	43009	269550
10	N Nkhata Bay	Kawiya II	12.8	139304	8707	20896	3483	1739	174128	25217	199346
11	N Nkhata Bay	Mlowe	18	225139	14070	33770	5630	2817	281425	45448	326873
12	N Nkhotakota	Dwambazi	18.7	257400	16087	38609	6435	3217	321748	46852	368600
13	N Mzimba	Mzimba I	108.4	1522043	95126	228304	38052	19026	1902552	353957	2256509
14	N Mzimba	Mzimba II	106.2	1639278	102457	245891	40983	20491	2049100	279696	2328796
15	N Nkhata Bay	Ruarwe	1.2	7430	465	1113	187	91	9287	2422	11709
16	N Nkhata Bay	Usisya	7.2	43304	2704	6496	1083	539	54126	18261	72387
17	C Salima/Dedza	Golomoti I	39.2	265852	16617	39878	6648	3322	332317	85043	417361
18	C Salima/Dedza	Golomoti II	10.9	164222	10265	24635	4104	2052	205278	70435	275713
19	C Salima/Dedza	Golomoti II	45.3	600391	37526	90061	15009	7504	750491	259739	1010230
20	S Machinga	Masanje	28.5	339122	21196	50870	8478	4239	423904	74713	498617
21	S Thyolo	Sankhuleni	10.7	127843	7991	19178	3196	1600	159809	32843	192652
22	S Chikwawa/Nsanje	Shire EB I	9.6	117991	7374	17700	2948	1474	147487	29187	176674
23	S Chikwawa/Nsanje	Shire EB II	35.8	407304	25457	61096	10183	5091	509130	76087	585217
24	S Chikwawa/Nsanje	Shire EB II	35.8	407304	25457	61096	10183	5091	509130	76087	585217
25	S Zomba	Zomba South	-	0	0	0	0	0	0	0	0
26	S Chiradz./Mulanje	Nasitambo *	-	165217	3109	0	9320	0	177652	12435	190087
27	S Mulanje	Phalombe *	-	317391	5965	0	17904	0	341261	23870	365130
28	N Rumphi	Muhuju *	8.4	46470	2904	6970	1162	581	58087	14522	72609
29	N Rumphi	Ng'onga *	3.5	19256	1203	2888	481	241	24070	6017	30087
30	N Karonga	Chilumba *	6.2	34671	2167	5201	867	433	43340	10835	54174
Totals			581.3	7659318	457564	1076375	206623	89693	9489574	1745030	11235204

* Augmentation scheme

TABLE 15

OPTION 1: MOWS CONSTRUCTION PROGRAM (IN US \$)

No.	Reg. District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Costs (GOM)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
2	N	Chitipa	6	38557	2357	5652	939	470	47974	13478	61452
7	N	Rumphi	3.2	27270	1704	4091	683	339	34087	6957	41043
8	N	Nkhata Bay	5.3	64822	4052	9722	1622	809	81026	14665	95691
10	N	Nkhata Bay	12.8	139304	8707	20896	3483	1739	174128	25217	199346
13	N	Mzimba	108.4	1522043	95126	228304	38052	19026	1902552	353957	2256509
15	N	Nkhata Bay	1.2	7430	465	1113	187	91	9287	2422	11709
16	N	Nkhata Bay	7.2	43304	2704	6496	1083	539	54126	18261	72387
22	S	Chikwawa/Nsanje	9.6	117991	7374	17700	2948	1474	147487	29187	176674
26	S	Chiradz./Hulanje	-	165217	3109	0	9326	0	177652	12435	190087
28	N	Rumphi	8.4	46470	2904	6970	1162	581	58087	14522	72609
Totals			162.1	2172409	128502	300944	59483	25068	2686407	491100	3177507

TABLE 16

OPTION 2: MOWS CONSTRUCTION PROGRAM (IN US \$)

No.	Reg. District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating (USAID)	Costs (GOM)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
1	N Chitipa	Chintekwa	3.8	31817	1987	4774	796	396	39770	9287	49057
2	N Chitipa	Sekwa	6	38557	2357	5652	939	470	47974	13478	61452
3	N Rumphi	Nchenachena	11.3	114322	7143	17148	2857	1430	142900	31765	174665
7	N Rumphi	Thimba	3.2	27270	1704	4091	683	339	34087	6957	41043
8	N Nkhata Bay	Luwawa	5.3	64822	4052	9722	1622	809	81026	14665	95691
10	N Nkhata Bay	Kawiya II	12.8	139304	8707	20896	3483	1739	174128	25217	199346
11	N Nkhata Bay	Mlowe	18	225139	14070	33770	5630	2817	281425	45448	326873
13	N Mzimba	Mzimba I	108.4	1522043	95126	228304	38052	19026	1902552	353957	2256509
15	N Nkhata Bay	Ruarwe	1.2	7430	465	1113	187	91	9287	2422	11709
16	N Nkhata Bay	Usisya	7.2	43304	2704	6496	1083	539	54126	18261	72387
17	C Salima/Dedsza	Golomoti I	39.2	265852	16617	39878	6648	3322	332317	85043	417361
21	S Thyolo	Sankhuleni	10.7	127843	7991	19178	3196	1600	159809	32843	192652
22	S Chikwawa/Nsanje	Shire EB I	9.6	117991	7374	17700	2948	1474	147487	29187	176674
26	S Chirad./Mulanje	Namitambo *	-	165217	3109	0	9326	0	177652	12435	190087
28	N Rumphi	Muhuju *	8.4	46470	2904	6970	1162	581	58087	14522	72609
Totals			245.1	2937383	176311	415692	78610	34632	3642627	695487	4338114

* Augmentation scheme

TABLE 17

OPTION 3: MOWS CONSTRUCTION PROGRAM (IN US \$)

No.	Reg. District	Project	Design Popx1000	Commodities (USAID)	Salaries (GOM)	Operating Costs (USAID)	Tools & Mi (USAID)	Project Costs	Self-Help Value	Project Value
1	N	Chitipa	3.8	31817	1987	4774	796	39770	9287	49057
2	N	Chitipa	6	38557	2357	5652	939	47974	13478	61452
3	N	Rumphi	11.3	114322	7143	17148	2857	142900	31765	174665
4	N	Karonga	11.4	160235	10013	24035	4004	200291	33198	233487
6	N	Karonga/Rumphi	6.5	51309	3209	7696	1283	64139	18774	82913
7	N	Rumphi	3.2	27270	1704	4091	683	34087	6957	41043
8	N	Nkhata Bay	5.3	64822	4052	9722	1622	81026	14665	95691
9	N	Nkhata Bay	17.4	181235	11326	27185	4530	226542	43009	269550
10	N	Nkhata Bay	12.8	139304	8707	20896	3483	174128	25217	199346
11	N	Nkhata Bay	18	225139	14070	33770	5630	281425	45448	326873
13	N	Mzimba	108.4	1522043	95126	228304	38052	190252	353957	2256509
15	N	Nkhata Bay	1.2	7430	465	1113	187	9287	2422	11709
16	N	Nkhata Bay	7.2	43304	2704	6496	1083	54126	18261	72387
17	C	Salima/Dedsza	39.2	265852	16617	39878	6648	332317	85043	417361
21	S	Thyolo	10.7	127843	7991	19178	3196	159809	32843	192652
22	S	Chikwawa/Nsanje	9.6	117991	7374	17700	2948	147487	29187	176674
26	S	Chiradz./Mulanje	-	165217	3109	0	9326	177652	12435	190087
27	S	Mulanje	-	317391	5965	0	17904	341261	23870	365130
28	N	Rumphi	8.4	46470	2904	6970	1162	58087	14522	72609
29	N	Rumphi	3.5	19256	1203	2888	481	24070	6017	30087
Totals			283.9	3666808	208027	477496	106813	4498930	820352	5319282

*Augmentation scheme

TABLE 18

 RURAL WATER, HEALTH, AND SANITATION COMPONENT
 USAID CONTRIBUTIONS BY FISCAL YEAR (IN 1000 US \$)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000 US \$)						LOP TOTAL (K)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
CONSTRUCTION PROG							
COMMODITIES	196	587	979	979	783	392	3917
VEHICLES & EQUIP	94	130	130	87	65	22	529
TOOLS & MISC	9	9	9	9	9	3	47
OPERATING COSTS	54	109	109	109	109	65	554
SUB-TOTAL	353	835	1227	1183	906	482	5047
MAINTENANCE PROG							
SPARES & REPLACE	22	43	54	54	54	50	278
TOOLS & MISC	9	13	13	13	13	9	70
VEHICLES (MOTORCYL)	2	2	2	2	0	0	9
OP CSTS FUEL & MAINT	26	54	54	57	57	59	306
TRAINING	4	7	7	7	4	3	31
WQ MONITORING	22	26	22	20	13	13	115
SUB-TOTAL	84	146	152	152	142	133	809
INFO RESOURCES PROG							
SPEC FIELD STUDIES	9	0	9	0	9	0	26
COORDINATION	0	0	0	0	0	0	2
COMP ASST DESIGN	17	0	0	0	0	0	17
SUB-TOTAL	27	0	9	0	9	0	46
HESP PROGRAM							
SALARIES - HQ	1	2	4	4	2	1	14
SALARIES-FIELD STFF	13	37	54	56	39	17	216
MATLS & SUPPLIES:							
-VIP DEMO LATRINES	7	17	28	30	33	33	148
-WASHING SLABS	9	17	30	43	52	52	204
-VEHICLES	31	65	109	109	65	22	400
-TOOLS & EQUIP	2	4	4	4	4	3	23
OPERATING COSTS:							
-SUBSISTANCE	2	5	7	9	9	5	37
-FUEL & MAINT	13	15	22	33	33	22	137
-INSERVICE TRAIN	7	9	11	11	11	11	59
SAN RESRCH UNIT:							
-MATLS & SUPPLIES	0	2	3	3	3	3	14
-TOOLS & EQUIP	0	2	3	3	4	3	15
SUB-TOTAL	84	176	273	306	255	172	1267
CONTINGENCIES							
MOWS	11	43	43	43	43	33	217
MOH	2	9	9	9	9	7	43
SUB-TOTAL	13	52	52	52	52	39	261
TOTAL (USAID)	561	1210	1714	1694	1424	826	7429

TABLE 19

RURAL WATER, HEALTH, AND SANITATION COMPONENT
GOM CONTRIBUTIONS BY FISCAL YEAR (IN 1000 US \$)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000 US \$)						LOP TOTAL (US \$)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
MIN OF HEALTH							
SALARIES:							
-HQ	2	3	3	4	5	7	25
-FIELD STAFF	22	41	43	63	84	103	357
OPERATING COSTS							
-SUBSISTENCE	4	8	8	12	15	18	64
IN SERVICE TRAINING	9	13	13	17	24	29	105
SUB-TOTAL (MOH)	36	66	68	97	128	157	552
MIN OF WORKS							
SALARIES:							
-HQ	6	11	13	16	16	17	78
-FIELD STAFF	24	50	52	59	61	61	307
OPERATING COSTS							
-SUBSISTENCE	13	24	25	26	27	27	141
TRAINING	17	26	26	30	30	26	156
WQ MONITORING	13	13	15	15	13	8	77
SPEC FIELD STUDIES	4	0	7	0	4	0	15
COORDINATION	1	3	3	3	3	3	14
SUB-TOTAL (MOWS)	78	127	140	148	154	131	778
TOTAL (GOM)	114	193	208	245	282	288	1330

TABLE 20

RURAL WATER, HEALTH, AND SANITATION COMPONENT
 TOTAL COMMUNITY AND GOM CONTRIBUTIONS (IN 1000 US \$)

PROGRAM OBLIGATIONS	US FISCAL YEAR (IN 1000 US \$)						LOP TOTAL (US \$)
	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	
COMMUNITY SELF-HELP							
-WATER PROJECTS	98	196	207	217	217	191	1126
-HESP PROJECTS	4	10	11	12	14	15	66
SUB-TOTAL (SELF-HELP)	102	205	217	230	231	207	1192
SUB-TOTAL (GOM)	114	193	208	245	282	299	1340
TOTAL (SELF-HELP + GOM)	216	398	426	475	513	505	2533

APPENDIX E

LOGICAL FRAMEWORK

LOGICAL FRAMEWORK
MASH: Rural Water, Sanitation, and Health Component

<u>Sector Goal</u>	<u>Measures of Goal Achievement</u>	<u>Verification</u>	<u>Assumptions</u>
<p>To improve health and basic living conditions of the poor rural populations of Malawi.</p>	<ol style="list-style-type: none"> 1. Improvements in environmental health conditions. 2. Increases in disposable time for rural women and children. 	<ol style="list-style-type: none"> 1. Rural surveys, health impact studies, project records of MOWS and MOH. 2. Social impact studies. 	<ol style="list-style-type: none"> 1. A positive correlation exists between improved health and the availability of safe water, sanitary latrines, and increased knowledge of hygiene practices. 2. Both the MOWS and the MOH are seriously interested in attaining health benefits with the rural water program.
<p><u>Program Purpose</u></p> <p>To strengthen the delivery of primary health care (PHC) services in rural communities through the integrated expansion of the PHC elements of water supplies, hygiene education, and sanitation.</p>	<p><u>Conditions: End-of-Project Status</u></p> <ol style="list-style-type: none"> 1. HESP services to be introduced simultaneously with water in 15 new schemes. 2. HESP services to be expanded to 55 existing water schemes. 3. Up to 245,000 rural villagers to receive piped water. 4. Up to 1,000,000 rural villagers to be reached with HESP services. 	<p><u>Means of Verification</u></p> <ol style="list-style-type: none"> 1. Monthly HESP and MOWS monitoring reports. 2. Periodic inspections of schemes completed and under construction. 3. USAID mid-term and final evaluations. 4. Annual reviews prepared by MOWS and MOH. 5. Health impact study. 	<p><u>Assumptions</u></p> <ol style="list-style-type: none"> 1. Both MOWS and MOH will coordinate their field activities. 2. HESP staffing expands to stay in pace with the MOWS construction program.

LOGICAL FRAMEWORK (cont'd)
Rural Water, Sanitation, and Health Component

<u>Program Outputs</u>	<u>Magnitude of Outputs</u>	<u>Means of Verification</u>	<u>Assumptions</u>
<p>1. Rural piped water schemes completed.</p> <p>2. Staff expansions at both HQ and field levels in the MOWS and MOH.</p> <p>3. Expansion of HESP program to all water schemes in</p> <p>4. Expanded in-service and off-shore training of staff.</p>	<p>1. Up to 15 new schemes completed</p> <p>2. MOWS - HQ: 3 new engineers Field: 10 new monitoring assistants</p> <p>MOH - HQ and regions: up to 4 new professionals Field: up to 125 new field staff</p> <p>3a. HESP activities in all 55 existing water schemes and all new water schemes.</p> <p>3b. Construction of up to 8,000 washing slabs in existing water schemes.</p> <p>3c. Construction of up to 170 demonstration VIP latrines each year.</p> <p>4a. Annual in-service courses in both MOWS and MOH for senior staff, supervisory staff, and field staff.</p> <p>4b. One or more study tours to neighboring countries.</p> <p>4c. MOWS and MOH Personnel attending off-shore training courses.</p>	<p>1. MOWS records and USAID evaluations.</p> <p>2. MOWS and MOH personnel records.</p> <p>3. USAID inspections.</p> <p>4. Annual reviews prepared by MOWS and MOH.</p>	<p>1. Self-help labor will continue to be available for construction and maintenance of water systems.</p> <p>2. Procurement of pipe and other commodities continues without interruption.</p> <p>3. MOWS and MOH expand HQ and field staffs.</p>

LOGICAL FRAMEWORK (cont.)

Rural Water, Sanitation, and Health Component

<u>Project Inputs</u>	<u>Implementation Target (in 1,000's)</u>		<u>Means of Verification</u>	<u>Assumptions</u>	
USAID Inputs:					
<u>Construction Program</u>					
Commodities	K9008	= \$3,900	Project monitoring of GOM expenditures, annual work plans, and field site visits.	1. Necessary funds will be provided in a timely manner.	
Vehicles and Equipment	K1217	= 530			
Tools and Misc.	K 107	= 45			
Operating Costs	K1275	= 550			
Subtotal	K11610	= \$5,045			
<u>Maintenance Program</u>					
Spares and Replacements	K640	= \$280	2. Rate of exchange will remain approximately \$1.00 = K2.30		
Tools and Misc.	K160	= 70			
Vehicles	K 21	= 9			
Operating Costs	K704	= 305			
Training:					
In-Service	K 72	= 30			
Water Quality Monitoring	K264	= 115			
Subtotal	K1860	= \$810			
<u>Information Resources Program</u>					
Special Field Studies	K 60	= \$ 25		+ \$85 (HRID)	
Information Systems	---	---	+ \$15 (HRID)		
Coordination	K 5	= 2			
Computer Assisted Design	K 40	= 15	+ \$25 (HRID)		
Evaluation	---	---	+ \$125 (HRID)		
Off-Shore Training	---	---	+ \$403 (HRID)		
Subtotal	K105	= \$ 45			
<u>HESP Program</u>					
Salaries	K528	= \$230			
Materials and Supplies	K819	= 355			
Vehicles	K921	= 400			
Tools and Equipment	K 52	= 25			
Operating Costs	K400	= 175			
Training:					
--in-service	K135	= 60			
--off shore	---	---	+ \$147 (HRID)		
Sanitary Research Unit	K 68	= 30			
Subtotal	K2913	= \$1270			
<u>Contingencies</u>					
	K600	= \$ 260			
Totals (USAID)	K17086	= \$7500	+ \$800 (HRID)		

LOGICAL FRAMEWORK (cont.)

Rural Water, Sanitation, and Health Component

<u>Project Inputs</u>	<u>Implementation Target (in 1,000's)</u>	
GOM Inputs: MOWS		
Salaries	K 886	= \$ 385
Operating Costs	K 324	= 140
Training	K 358	= 155
Water Quality Monitoring	K 178	= 75
Special Field Studies	K 35	= 15
Coordination	K 33	= 15
Subtotal (MOWS)	K1814	\$ 785
GOM Inputs: MOH (HESP)		
Salaries	K 880	= \$ 385
Operating Costs	K 148	= 65
Training	K 241	= 105
Subtotal (HESP)	K1269	= \$ 550
Community Self-Help:		
Water projects	K2590	= \$1125
HESP projects	K 152	= 65
Subtotal (Self-Help)	K2742	= \$1190
Total (GOM)	K5825	= \$2530

APPENDIX F

RECOMMENDED CONDITIONS PRECEDENT FOR THE WATER AND SANITATION COMPONENT

1. The MOWS and the MOH should carry out a manpower needs assessment of the water and HESP programs in the first year of the MASH program and use the results to prepare a staffing plan for submission with the second Annual Work Plan (1989/90.) (See Appendix A.2 and B.2)
2. The MOWS should carry out a study of the willingness-to-pay for maintenance services during the first year of the MASH program and use the results to prepare a plan for eventual cost recovery of future maintenance costs. This plan should be submitted along with the Annual Work Plan at the start of the second program year (1989/90). (See Appendix A.3)
3. The MOWS should officially adopt temporary guidelines for water quality in rural water supply projects as suggested in the National Water Resources Master Plan (1986). (See Appendix A.6)
4. The MOWS and the MOH should establish within the first MASH program year a joint Program Coordinating Committee to meet at regular intervals, perhaps quarterly, to review progress to date, to discuss existing problems, and to coordinate future activities. (See Appendix C.1)
5. The MOWS and the MOH should prepare a short annual review of the preceding year's work progress, achievements, and problems for submission with each Annual Work Plan. (See Appendix C.2)

REFERENCES

- World Health Organization (1985). Guidelines for Drinking-Water Quality, Vol. 3. Drinking-water quality control in small community supplies, Geneva.
- United Nations, Department of Technical Co-operation for Development (1987). Interregional Symposium on Improved Efficiency in the Management of Water Resources: Follow-up to the Mar del Plata Action Plan (Final Report), New York.
- Government of Malawi and UNDP (1986). National Water Resources Master Plan, Appendix E.
- WASH Field Report No. 186 (1986). Malawi Self-Help Rural Water Supply Program - Final Evaluation, USAID.
- Government of Malawi (1986). Approved Estimates of Expenditures on Revenue Account for the Financial Year 1986/87.
- WASH Field Report No. 105 (1983). Malawi Self-Help Rural Water Supply Program: A Mid-term Evaluation of the USAID - Financed Project, USAID.
- Msukwa, Louis A. H. (1986). Institution Building for the Maintenance of Rural Piped Water Schemes, University of Malawi. Centre for Social Research.
- Department of Water, Ministry of Works and Supplies (1985). Bacteriological Water Quality Evaluation of 6 USAID Funded Rural Piped Water Projects (Part 1) Dry Season Results, Report WQPC, 5/5/(1).
- World Health Organization (1983). Minimum Evaluation Procedure (MEP) for Water Supply and Sanitation Projects, ETS/83.1.