PD-AAG-095

UNCLASSIFIED

632-0088 00420

LESOTHO

Rural Water Supply/Sanitation
632-0088

August, 1979

UNCLASSIFIED

ACTION MEMORANDUM FOR THE ADMINISTRATOR AUG 21 1979

THRU: ES

THRU: AA/PPC, Alexander Shakow

FROM: AA/AFR, Goler T. Butcher

Problem: Your approval is required to execute a grant of $1,621,000 from the FY 1979 Health appropriation to the Government of Lesotho for the Rural Water Supply/Sanitation project (632-0088) and to authorize a life-of-project funding of $12,142,100.

Discussion: The proposed Lesotho Rural Water Supply/Sanitation project represents AID's response to a critical need for improved water supplies in rural areas of Lesotho. The project will contribute to assisting the GOL in improving the health and basic living standards of Lesotho's rural poor who comprise approximately 94% of the population. The purpose and principal focus of the project is to assist the GOL in developing the institutional capacity of the Ministry of Rural Development's Village Water Supply Section (VWSS) to design, construct and maintain 210 new and existing rural water supply systems which adequately reflect health and sanitary education considerations. The proposed project is expected to directly benefit over 180,000 persons who reside in rural areas of Lesotho, a direct response to the Congressional Mandate to help the small farmer and rural poor population of the less developed countries. It also represents an important element in AID's basic human needs approach to development by providing improved water supplies to a large segment of Lesotho's rural population.

In order to accomplish the purpose and objectives of the project, a total of $1,621,000 is requested for obligation in FY 79. The life-of-project funding is $12,142,100, which will be expended over a nine-year period. The following table illustrates the specific areas in which funds would be required:

	FY 1979			
	FX	L/C	TOTAL	L.O.P.
Technical Assistance	$856.4	-	$ 856.4	$ 2,202.7
Training	-	41.8	41.8	387.2
Commodities	-	35.8	35.8	7,602.2
Construction	-	476.1	476.1	476.1
Other	-	210.9	210.9	1,473.9
TOTALS	$856.4	$764.6	$1,621.0	$12,142.1

The Government of Lesotho will contribute $1.861 million to this project, which will cover support costs for systems maintenance, administrative positions, costs of land and furnishings for senior technician and staff housing and also regional and three district centers, and necessary unskilled village labor. While this amount represents only 14% of the total life-of-project costs, Lesotho is an RLDC and I am, therefore, requesting a waiver of the 25% cost-sharing requirements for this project. The project has been thoroughly analyzed to ascertain its socio-economic feasibility, and as a result of the analysis, criteria for selected village participation in aspects of systems design, construction, and maintenance have been established (See Annex XI). It has also been examined to determine its technical and environmental soundness. The technology for systems construction will emphasize the three simplest types of systems: protected springs without distribution, high-level spring captations with storage and gravity conveyance pipeline and distribution, and sturdy handpumps on boreholes located in villages and centers of usage. A three-tier systems maintenance program, which will not only emphasize preventive maintenance at the village level, but will provide maintenance capability at the district and regional level, has also been designed for use in this project. The health education and sanitation aspects of the project have been carefully examined. As a result of this analysis, a health education coordinator will be part of the technical assistance implementation team to insure that necessary health and sanitation provisions which have been developed are carried out prior to the construction of the systems. The Initial Environmental Examination (IEE) submitted with the PID has been thoroughly reviewed, and, since individual systems and overall project design provide for necessary health education and sanitation facilities either within this project, or within potential follow-on activities, the environmental impact is expected to be minimal, and I have signed the negative determination. (See Attachment 2). Lesotho is a Category III country for Human Rights and there are no present concerns on the human rights situation.

There are two conditions precedent which must be met. They are:

1. Prior to the disbursement of funds under the Grant for any construction activities for the installation or rehabilitation of village water supply systems, or to the issuance of any commitment documents with respect thereto, the Cooperating Country will furnish, in form and substance satisfactory to A.I.D., a detailed project work plan covering installation and rehabilitation activities to be undertaken during the first two years of the project, and a general plan for construction activities to be undertaken during the balance of the project.

Project Implementation Letters ("PILs") will describe more completely the content of these plans, but the two-year plan will include proposed construction scheduling, design standards for each village water system, evidence that village selection criteria have been complied with, description of the procedures used to select villages to participate in the program, personnel and materials requirements, and evidence that participating villages have established a system to fund minor maintenance requirements.

2. Prior to the disbursement of funds under the Grant for each construction activity for housing or for the maintenance centers, or to the issuance of any commitment documents with respect thereto, the Cooperating Country shall furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that a site adequate for the project purposes has been allocated for the particular construction component.

There are eleven covenants based upon those which are described in Section IV.F. of the project paper and the PAF II.

The following waivers and approvals are required:

1. Waiver of the 25 percent cost sharing requirement contained in Section 11C(a) of the Foreign Assistance Act of 1961 as amended;

2. Source and origin waiver from A.I.D. Geographic Code 941 (Selected Free World) to Code 935 (Special Free World) for the procurement of equipment maintenance and repair services;

3. Approval to deviate from the policy expressed in AID Handbook 3, Appendix 3C (AIDTO Circular A-24), which limits the life-of-project to five years, to allow a 9-year life-of-project.

4. Approval for the proprietary procurement of 400 Moyno Hand Pumps at an approximate cost of $200,000.

5. Approval for the proprietary procurement of 27 project vehicles from International Harvester Co. Inc., at an approximate cost of $280,000.

The justification for each waiver and approval requested can be found in Annex VI of the project paper.

The project committee reviewed and recommended approval for this project on July 24, 1979. The Africa Bureau Executive Committee for Project Review (ECPR) met on August 7, 1979 and was chaired by the Deputy Assistant Administrator for Africa. There were no issues. The ECPR also recommended approval of the project and its preparation for authorization. A Notification advising Congress of a program change was forwarded on August 8, 1979 and the 15-day waiting period expires on August 23, 1979.

The responsible AID officer in the field will be the USAID/Lesotho Mission Director or his designate within the mission and the AID/W backstop will be Alfred Harding, AFR/DR/SA. The GOL agency responsible for implementing this project will be the GOL's Ministry of Rural Development. The activities of the Ministry will be supported by a U.S. technical services contract team, funded under this project, which will provide technical assistance, in-service training and overall management to the project.

Recommendation: That you sign the attached PAF II and thereby authorize the proposed project and the requested waivers and approvals.

Attachments:
1. PAF II
2. IEE — a [illegible] summary [illegible] the project and the environment in which it will be carried out.
3. Project Paper

Clearances:
GC:MBall [illegible]
PPC/PDPR:B.Sidman [illegible]
DAA/AFR:WHNorth [illegible]
GC/AFR:AWilliams [illegible]
SER/COM/ALI:BViragh (draft)

AFR/DR/SA:AHarding:bks:08/20/79:X28818

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

COUNTRY : Lesotho

PROJECT : Rural Water and Sanitation

PROJECT NO. : 632-0088

Pursuant to Part I, Chapter 1, Section 104 of the Foreign Assistance Act of 1961, as amended (the "Act"), I hereby authorize a Grant to the Government of the Kingdom of Lesotho (the "Cooperating Country") of not to exceed One Million Six Hundred Twenty-One Thousand United States Dollars ($1,621,000) to assist in financing certain foreign exchange and local currency costs of goods and services required for the project as described in the following paragraph.

The project consists of developing the institutional capacity of the Ministry of Rural Development's Village Water Supply Section to design, construct and maintain new and existing water supply systems which adequately reflect health and sanitary education considerations through the provision of funding for technical advisors, training, commodities and construction (the "Project").

I approve the total level of A.I.D. appropriated funding planned for this Project of not to exceed Twelve Million One Hundred Forty-Two Thousand, One Hundred United States Dollars ($12,142,100), Grant, during the period FY 1979 through FY 1984, including the funding authorized above and further increments during that period of grant funding up to $10,521,000, subject to the availability of funds and in accordance with A.I.D. allotment procedures. In accordance with AIDTO Circular A-24 (Handbook 3, Appendix 3C), I further authorize a nine year life-of-project extending from FY 1979 through FY 1987.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority, subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in the Cooperating Country or in countries included in A.I.D. Geographic Code 941 except as A.I.D. may otherwise agree in writing. Ocean shipping financed under the Grant shall be procured in the U.S. or the Cooperating Country, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent

1. Prior to the disbursement of funds under the Grant for any construction activities for the installation or rehabilitation of village water supply systems, or to the issuance of any commitment documents with respect thereto, the Cooperating Country will furnish, in form and substance satisfactory to A.I.D., a detailed Project work plan covering installation and rehabilitation activities to be undertaken during the first two years of the Project, and a general plan for construction activities to be undertaken during the balance of the Project.

towards establishing positions required by the Project, personnel to be provided for the Project and the repair status of vehicles purchased under the Project.

2. The Cooperating Country agrees to provide qualified personnel to undertake project financed training in accordance with the training schedule included as part of the amplified project description in the Project Agreement, and further agrees that persons undertaking long-term training will be assigned to positions with the VWSS, or such other positions as the Parties may agree, which are commensurate with the nature and level of training received.

3. The Cooperating Country agrees to gazette or otherwise establish, within six months from the date of the Project Agreement or such other date as the Parties may agree to in writing, positions for the chief technical officers to be trained under the Project.

4. The Cooperating Country agrees to gazette or otherwise establish positions for senior technical officers and other personnel in accordance with the schedule included as part of the amplified project description in the Project Agreement.

5. The Cooperating Country agrees to provide on a timely basis all personnel required for the implementation of the Project including but not limited to support and technical staff for the VWSS, community development staff to assist District Community Development Officers, and public health personnel.

6. The Cooperating Country agrees to provide the recurrent budget support for the Project in the amounts and by the dates specified in the amplified project description.

7. The Cooperating Country agrees to provide, in form and content and by a date specified in PILs, a report indicating the procedures to be utilized to monitor the potability of water brought into villages under the Project and to monitor system maintenance needs.

8. The Cooperating Country agrees to utilize the village selection criteria and procedures set out in the amplified project description to determine which villages will participate in the program.

9. The Cooperating Country agrees to submit, within 90 days from the date the Project Agreement is signed, or such later dates as A.I.D. may otherwise agree to in writing, a plan for preventive and corrective maintenance of vehicles acquired by the VWSS.

10. The Cooperating Country agrees to take such steps as may be necessary to ensure that proper health and sanitary measures are employed prior to the design, construction or rehabilitation of water supply systems.

11. The Parties, recognizing that coordination between health and construction components of the Project is essential to the overall success of the Project, agree that periodic discussions among the Ministries of Health and Rural Development and A.I.D. will be held at times mutually agreed upon in PILs to ensure that such coordination is being effected.

d. Waivers

Based upon the justifications contained in Annex VI of the Project Paper, and notwithstanding paragraph a above, I hereby:

1. Waive the cost sharing requirements of Section 110(a) of the Act, as provided by Section 124(d) of the Act, except that the Cooperating Country shall be required to provide financial or "in kind" contributions in the approximate equivalent value of $1,861,400, as provided for in the Financial Analysis and Plan Section of the Project Paper.

2. Approve a waiver of the requirements under Handbook 1, Supplement B that suppliers of services procured with funds granted to an RLDC shall have their nationality in countries included in A.I.D. Geographic Code 941, to permit the procurement of equipment repair and maintenance services from suppliers which have their nationality in A.I.D. Geographic Code 935; and certify that the interests of the United States are best served by permitting the procurement of services from Free World countries other than the Cooperating Country and countries included in Code 941.

3. Authorize the proprietary procurement of 400 Moyno Hand Pumps at an approximate cost of $200,000.

4. Authorize the proprietary procurement of 27 project vehicles from International Harvester at an approximate cost of $280,000.

Date: August 23, 1979

Douglas J. Bennet, Jr.
Administrator

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY ENTITY: LESOTHO

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 632-0088

6. BUREAU/OFFICE: A. SYMBOL: AFR; B. CODE: 06

7. PROJECT TITLE (Maximum 40 characters): RURAL WATER AND SANITATION

8. ESTIMATED FY OF PROJECT COMPLETION: FY 87

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 4; C. FINAL FY 83 (Enter 1, 2, 3, or 4)

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	1120.1	500.9	1,621	9645.6	2496.5	12142.1
(GRANT)	(1120.1)	(500.9)	(1,621)	(9645.6)	(2496.5)	(12142.1)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1						
OTHER U.S. 2						
HOST COUNTRY	0	0	0		1861.4	1861.4
OTHER DONOR(S)						
TOTALS	1120.1	500.9	1,621.0	9,645.6	4,347.9	14,003.5

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	C. 1ST FY 79 E. GRANT	C. 1ST FY 79 F. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY 81 L. GRANT	K. 3RD FY 81 M. LOAN
(1) Health	513	545		1,621.		1200		2500	
(2)									
(3)									
(4)									
TOTALS				1,621.		1200		2500	

A. APPROPRIATION	N. 4TH FY 82 O. GRANT	N. 4TH FY 82 P. LOAN	Q. 5TH FY 83 R. GRANT	Q. 5TH FY 83 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) Health	2600		2342.1		12142.1	
(2)						
(3)						
(4)						
TOTALS	2600		2342.1		12142.1	

12. IN-DEPTH EVALUATION SCHEDULED: MM 10 YY 81

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 17? IF YES, ATTACH CHANGED PID FACESHEET

[1] 1 = NO, 2 = YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Byron Bahl

TITLE: Acting Mission Director

DATE SIGNED: MM 06 DD 22 YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

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(632-0088)

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I. Summary and Recommendations.

A. Recommendations

Authorization of a grant of $12,142,100 for the project subject to the following waivers and approvals: 1/

1. Approval to deviate from the policy expressed in AID Handbook 3, Appendix 3C (AIDTO Circular A-24), which limits the life of a project to five years to allow a 9- year life of project.

2. Waiver of the 25 percent cost sharing requirement contained in Section 110 (a) of the Foreign Assistance Act of 1961 as amended.

3. Procurement source and origin waiver from A.I.D. Geographic Code 941 (Selected Free World) to Code 935 (Special Free World) for the procurement of equipment maintenance and repair services.

4. Approval for proprietary procurement of 27 vehicles from International Harvester at an approximate cost of $280,000.

5. Approval for proprietary procurement of 400 Moyno Hand Pumps at an approximate cost of $200,000.

B. Project Description

The proposed Rural Water Supply Project is directed towards the goal of improving the quality of rural life in Lesotho by improving the health and basic living standards of Lesotho's rural poor. The purpose of the project is to assist the GOL in developing the institutional capacity of the Village Water Supply Section (VWSS) of the Ministry of Rural Development (MORD) to design, construct and maintain new and existing rural water supply systems in Lesotho. It is anticipated that by providing assistance to the GOL in developing this capacity, the VWSS will be more effective in carrying out its responsibilities as they pertain to rural water supply systems, It will have developed the institutional infrastructure necessary to support future rural water supply endeavors.

1/ See Annex VI for justification

In order to achieve its purpose, the project is to generate outputs which include increasing the numbers of trained Basotho personnel to provide VWSS with an enhanced design, construction and maintenance capability, trained village "waterminders" who will be responsible for minor maintenance of the water supply system serving their villages, regional and district maintenance centers which will be responsible for major repair work in rural water supply systems in their respective service areas, and improved coordination between the Ministries of Health and Rural Development-as it pertains to the health and sanitary aspect and implications of bringing increased supplies of water to rural villages. Inputs needed under the project include technical assistance, participant and in-country training, commodities, budgetary support, construction of facilities, and other costs described in Section II.

The project will be implemented within the MORD's Village Water Supply Section under the direction of a chief-of-party (COP) who will serve as the chief technical officer (CTO) within VWSS. As the CTO the COP will report directly to the Senior Engineer (Mosotho) and the Permanent Secretary within the MORD.
Activities will be closely coordinated with those of other donors involved in providing assistance in village water supply systems.

C. Summary Findings

The analyses undertaken in this paper found the project's design to be technically, economically, socially and financially feasible, and concluded that the project is ready for implementation.

The need for developing the institutional capacity of VWSS to design, construct and maintain rural water supply systems is critical and it is felt that the Rural Water Supply project will serve this need, which will help to improve the health and basic living standards of rural Basotho.

The project retains the same range and the general scope of activities described in the PID. The negative determination requested in the PID, regarding environmental impact, therefore remains valid.

The economic aspects of the proposed project have been closely examined and despite the large capital expenditure planned, the project represents the most realistic alternative to accomplish its goals and objectives, taking into consideration the ability of the GOL to meet its financial obligations during and after the life of this project.

The GOL is firmly committed to the project, and the GOL has stated its willingness to fully support the project in terms of personnel and budget. The project technology and operational approach proposed are the most viable among the many alternatives considered.

II. Project Background and Detailed Description

A. Background

1. General

The mountainous Kingdom of Lesotho, which is surrounded by the Republic of South Africa or its satellites, is about 30,350 square kilometers in area, or a little larger than the American state of Maryland. It is listed by the U.N. as one of the world's 25 least developed countries due in part to a comparatively late start in commencing serious development efforts - approximately thirteen years ago. Lesotho has a de jure population of 1.2 million people and a gross domestic product (GDP) per capita of only $115 (1978). Agriculture is the country's most important sector in terms of its contribution to GDP (30%) and employment (51%), although less than 4000 square kilometers (12.7%) of the land is considered to be arable.

While Lesotho does not have many basic resources (such as mineral deposits, fertile land and trained people), Lesotho does have water resources which can be exploited. The mountainous land, the Senqu (Orange) River and its tributaries, and an average precipitation of approximately 700 mm (275 in) combine to provide Lesotho with the potential for developing relatively inexpensive, gravity spring fed water supply systems in several areas of the country, as well as the potential for domestic hydro-electric power production and water exports to South Africa. Despite this abundance of water, the rural people of Lesotho do not have access to improved water supplies.

Five separate studies, all dealing with various aspects of developing Lesotho's water resources have been reviewed and summarized in an AID-funded feasibility study conducted in October, 1977.1/ This study estimates that approximately 94% of the Basotho people reside in areas not served by municipal water systems, which are the responsibility of the GOL's Ministry of Works. Since water-borne and water-related diseases occur mostly in the rural areas of Lesotho with inadequate or non-existent water supply systems, the GOL has placed high priority on the need for improved water supply systems in these areas. The responsibility for developing these systems lies within the Ministry of Rural Development (MORD). In October, 1976, the GOL formally requested AID assistance in developing rural water supply systems after a GOL inspired program, characterized by inputs of labor and money contributed by villages, as well as MORD technical assistance generated such a large response (approximately 700 villages) that the GOL found it did not have the capacity within MORD to meet this demand nor maintain many of the rural water supply systems subsequently constructed. AID, in response to the GOL's request for assistance, commissioned the engineering consultant firm of Metcalf and Eddy International Inc., to conduct the feasibility study mentioned earlier. As a result of that study, a team was assembled to design a project proposal to assist the GOL in its rural water supply endeavors.

1/ Metcalf and Eddy, International, Inc. : Lesotho Village Water Supply Report, October, 1977.

2. Rural Sector

Lesotho, although primarily an agricultural country, with 94% of its population rurally based, differs from most other developing countries in that the rural family is not dependent on farming or herding for subsistence. The major contribution to the family budget (approximately 60%) comes from wages earned from the industrial economy, almost invariably outside the village, and with respect to 90% of the families involved, outside of the country itself. While the general standard of living may be high relative to rural standards in other African countries, it is a result of the external wage economy and not from the development of domestic natural resources, even though 85% of all rural households have access to some arable land.

Land is distributed relatively equitably in accordance with the traditional land tenure system, with an average of 2 hectares per family. The lowest 25 percent of farm families are reported to have one hectare or less, while less than 10 percent of farm families have four hectares or more. Basotho farm sizes are often too small to support the crop production and livestock requirements of the typical farm family, and therefore sharecropping and communal grazing arrangements are often made between farm families. It is estimated that about 60% of the sharecropping arrangements and 68% of the rural households are managed by women, since an average of 60% of the active male population is absent from the family earning the family income.

The greatest desire among both rural men and women is to earn cash from outside the farm, even where this might compete with subsistence domestic responsibilities. There is an innate understanding among the rural Basotho communities that the cash returns to incremental agricultural activity are lower than in other forms of employment. Therefore, the preference is for non-agricultural activities due to the greater risks involved in investing incremental expenditures of energy and resources into agriculture.

The rural communities of Lesotho lack access to basic needs in terms of adequate nutritious food, preventive health services and potable water. Clearly, activities designed in these primary areas would be directly responsive to AID's congressional mandate to utilize its resources to assist the rural poor, which constitute an overwhelming majority of Lesotho's population.

3. Coordination with Other Donor Assistance

The P.P. Design Team found that numerous efforts either have been, or are being undertaken, in cooperation with the GOL, by other donor agencies in the area of village water supply development.

Many of these activities, however, were found to be quite small (under $100,000) and also site specific (i.e. villages to receive water supply systems were identified by the GOL and the donor) and programmed so that the assistance provided, in general, covers only costs of materials and equipment. The limited nature and fitful progress of these activities compared to demand reflect the need for developing the comprehensive effort (including not only materials and equipment, but technical assistance personnel, training and facilities) proposed in this project.

Currently the major donors in the area of village water supply development are the British Government (U.K.), the European Economic Community (EEC) and UNICEF. The nature of the assistance being provided and or contemplated by each of these donors is summarized as follows:

British Government. The British Government's assistance in the development of village water supplies in Lesotho dates back to the late 1960's. More recently, in November 1977, the British Government agreed to provide approximately $420,000 to the GOL to assist in developing village water supplies. These funds were provided to cover the costs of constructing 30 village water supply systems primarily in the British-funded areas of the Basic Agricultural Services Program (BASP). The villages which have or will receive water supplies are in the districts of Butha-Buthe, Leribe, Berea Mafeteng, Mohale's Hoek and Maseru (all, except Mohale's Hoek are located in the north or southwest part of Lesotho). Funds can be used to cover costs of construction materials and supplies, vehicles and other capital costs. The British Government is also examining a proposal by the GOL to provide an estimated $770,000 to cover the costs of constructing an additional 20 water supply schemes (plus any village systems not constructed during the initial 1976-79 period) over the 1979-82 period. It is anticipated that these funds will be authorized for use in primarily the same manner as in the initial project. Both of these projects require self-help village labor and a 10% GOL contribution.

European Economic Community (EEC). The EEC's European Development Fund (EDF) agreed to provide the GOL with approximately $170,000 to cover the costs of constructing 12 gravity water systems over a 1 year period (Phase 1) beginning mid-1978. In addition, the EEC, during the second and third phases of its project(which will consist of 8 gravity and 20 borehole systems), has tentatively indicated that it will provide $630,000 over the 1980-82 period, if funds are available and phase 1 is successful. The EEC projects will cover the costs of materials, workshop tools, simple survey equipment and some transport costs. These projects also require that the GOL ensure that self-help village labor will be made available.

UNICEF. The UNICEF assistance to village water supplies in Lesotho began in 1978. Through an agreement with the GOL, UNICEF is providing approximately $103,000 which is being used to cover the costs of training approximately 50 village waterminders (who would perform minor maintenance on the system serving his/her village) and providing them with repair kits. Funds will also be used to cover some transport costs. The funds provided by UNICEF (which have almost been completely expended) can be utilized by the GOL through 1980.

UNDP. The United Nations Development Program, as part of the Water Supply and Sanitation decade which begins in 1980, has indicated to the Mission and the GOL its interest in assisting in the implementation of AID's proposed rural water supply project in Lesotho. UNDP has proposed to provide technical assistance in the construction of latrines in selected villages being provided with water supply systems. The Mission has indicated its desire to work cooperatively with UNDP, and UNDP is in the process of preparing documentation on the nature and level of assistance being proposed.

As stated earlier, the assistance provided by other donors in developing village water supplies does not represent a comprehensive effort such as proposed under the AID sponsored project. However, the assistance being provided by other donors would be coordinated with AID's assistance, since the Chief-of-Party for the American technical assistance group (an engineer) would serve as Chief Technical Advisor for all of the activities involvirg village water supplies in Lesotho. Thus coordination with other donors is assured.

4. Coordination with Other Mission Projects. The proposed Rural Water Supply project, which will assist the GOL in developing its institutional capacity to design, construct and maintain village water supply systems, will be the first project of its kind funded by AID in Lesotho. However, this project will need to be coordinated with the implementation of the Rural Health Development project (632-0058), also funded by AID. The Health project features, among other outputs, training for village health workers, who will be able to instruct other members of the village in such things as proper washing and storing of food and food utensils, body and hand washing, and in general, proper care and use of water. Since the training of village health workers is well behind the original schedule due to delays in project authorization and implementation, a health education specialist, who would serve as a coordinator between the Ministries of Health and Rural Development for the rural water supply project, will be necessary to ensure that the villages selected to receive water supply systems have been instructed in the proper care and use of water prior to construction (See Health Component contained in Section III A of this project paper).

B. Detailed Project Description

1. Goal

The goal of this project is to assist the GOL in improving the health and basic living standards of Lesotho's rural poor who comprise approximately 94% of the population. Goal achievement can be monitored by analyzing such indicators as the percentage reduction in the occurence of water-borne and water related diseases among rural Basotho, and reductions in morbidity in rural villages, particularly among young children. The Rural Health Development project will be directed at, among other things, training health workers for duty in rural health centers and clinics, who will be keeping records from which data conerning these and other health indicators can be extrapolated.

2. Purpose

The purpose and principal focus of this project is to assist the GOL in developing the institutional capacity of the VWSS to design, construct and maintain new and existing rural water supply systems which adequately reflect health and sanitary education considerations. At the end of this project, it is expected that the VWSS will have increased its capacity with trained Basotho personnel capable of maintaining (with the necessary minor maintenance to be provided by village "waterminders") all existing systems. The VWSS will also have the capability to design and construct approximately 20-25 new systems a year. Organizational and operational procedures employed by the VWSS will be significantly improved and institutionalized as a result of the assistance provided under this project. Major weaknesses of past efforts by the GOL, with the assistance provided by other donors, as it pertains to rural water supplies, were:

a) the lack of (in terms of both quantity and quality) personnel within VWSS to cary out the design and construction activities;

b) the virtual non-existance of a maintenance unit to service the rural water supply systems constructed, and;

c) inadequate organization, planning and management capability within VWSS.

This project has been designed to place emphasis on improving these areas while progress is also being made in reducing the backlog of requests from villages for water supply systems.

3. Outputs

The outputs of this project which will be produced to achieve the project purpose are the following:

a. Trained Basotho Personnel

By the end of the project, 3 long-term participants trained to the B.S. level in Engineering in the U.S. and 20 long-term participants trained in various technical skills at Lesotho technical institutions, will have been assigned to positions within the VWSS. The 3 long-term (U.S.) trainees will be assigned to counterpart positions within the VWSS, upon training completion. The 20 long-term graduates from Lesotho's technical schools will be primarily assigned to various supervisory positions to be established for the existing technical units within VWSS. Training will also be provided for present VWSS personnel which will be geared to improving their on-the-job skills. This training will generally be of 1 to 2 weeks duration per person each year, and will be provided by the training engineer, as supplemented by the other technical assistance engineers. Finally, training will be provided to 547 village representatives called "waterminders" (ralipompo). This training will also be from 1 to 2 weeks duration and will provide the "waterminders" with the knowledge, skills and tools necessary to perform minor maintenance functions on various types of rural water supply systems.1/

b. New and Reconstructed Rural Water Supply Systems

By the end of the project, 142 new rural water supply systems and 68 completely reconstructed systems will be installed. The schedule for installing systems over the 7-year life-of-project has been developed taking into consideration equipment and material delays, availability of trained personnel, absorptive capacity, and recurrent costs. Thus, the majority of the systems to be newly constructed or reconstructed will be installed in the latter years of the project, while the systems requiring less trained labor and equipment will be installed in the early years. Temporary labor will be employed to install all systems, as well as latrines, with the self-help labor input of the villages.

c. Regional and District Maintenance Centers

The VWSS will have 1 additional regional center and three additional district centers, greatly enhancing its capacity to maintain village water supply systems. With these additional facilities and necessary equipment, the VWSS will be able to perform major maintenance work that may be required in each of Lesotho's 10 districts.

1/ The question of pay for waterminders is being left open to decision during project implementation. The Government of Lesotho position is that the question of pay should be decided by the village committees and that any pay should be funded by the village.

d. Improved Organizational and Operational Procedures.

The VWSS organizational, management and operational procedures used for identifying villages in which systems will be constructed, and designing and maintaining systems will be significantly improved by the end of the project. VWSS will have the capability to administer its capital equipment and human resources in such a manner that the work of each unit can be planned effectively, enabling the VWSS to operate much better and monitor its activities. Support activities such as transport management, financial record-keeping, and equipment and material inventory management will be strengthened so that the VWSS will be able to account for the resources being utilized in systems installation and maintenance.

e. Improved Coordination between MOH and MORD.

The provision of water supply systems in rural areas of Lesotho has health and sanitary implications which must be addressed if this project is to be successful in helping to reduce the incidence of water-borne and water-related diseases. Therefore, it is essential to have effective coordination of rural water supply construction between the Ministries of Health and Rural Development. By providing a health education specialist, who will serve to coordinate and monitor health and sanitary education aspects of village water supply activities until village health workers have been trained in sufficient numbers under the Rural Health project, it is expected that the VWSS staff will become more sensitive to the health and sanitary implications of their work. This specialist, a full member of the MOH Health Education Unit, would work with MOH in determining health and sanitary measures most appropriate for rural areas of Lesotho. This specialist will also work with MORD/VWSS to ensure that these measures have been employed prior to actual construction of water supply systems and sanitation facilities (which will be provided only to selected villages). In this manner, it is anticipated that effective communications and coordination between ministries will be established and the provision of improved rural water supplies and sanitary facilities, which will help to reduce the occurence of water-borne and water-related diseases, can be realized.

4. Inputs

The required inputs sufficient to produce the outputs described above are indicated in the following discussion:

		($000's)
a. AID	Total	$12,142.1
1. Technical Assistance		$ 2,202.7

The project will provide 22 person-years of long-term technical expertise and 3 person-years of consultancies. The long term technicinas comprise a Civil Engineer (team leader, 7 p.y.'s), Construction Engineer (5 p.y.'s), Maintenance Engineer (4 p.y.'s), Civil Engineer (training, 2 p.y.'s), Health Education Specialist (2 p.y.'s) and Financial Manager (Accounting,2 p.y.'s). Consultancies will be provided in the following areas (and possibly others if deemed necessary): Well Drilling (for Rotary Drilling Rig), Hydrogeology, Sanitary Engineering and Public Health.

2. Training $ 387.2

Training will include 12 study years of long-term participants at the B.S. level in the U.S., 60 study years of long-term training at Lesotho technical schools. Three individuals will be trained to the B.S. in Engineering level and 20 persons will be trained to the technical diploma level (three year program) at Lerotholi Polytechnic. Use may also be made of the Leloaleng Technical School.

The long-term project training schedule has been planned to allow time for appropriate individuals to be identified, given Lesotho's critical shortage of trained personnel.

Short-term in-service training (1 to 2 weeks) will be provided periodically each year for employees of VWSS to upgrade their on-the-job skills. Short-term training (1 to 2 weeks) will also be provided for waterminders, which will enable the waterminder to perform minor maintenance on the water supply system serving his/her village. Waterminders will be trained at the rate of up to 10 persons each month.

Below is a training schedule which shows the numbers of persons starting long term training:

New Starts	FY1980	FY 1981	FY 1982	FY 1983	Total Trainees
Long-term U.S.	-	1	2	-	3
Long term Lesotho	5	5	5	5	20

3. Commodities.* $7,602.2

The commodities to be financed by this project include well drilling equipment (including special trucks, supplies and casing), hand pumps, diesel engines, windmill parts and power water pumps, vehicles, tools and power equipment (for waterminders and maintenance centers), water testing equipment, pipes, fittings (and other supplies such as valves, joints, etc) cement, steel storage tanks and re-bar (reinforcing steel).

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* See Annex V for detailed commodity list and cost estimates.

4. Construction $ 476.1

The construction component consists of the following elements:

-	Senior Technician Housing	(1)	$ 45.0
-	Senior Technician Housing	(5)	$200.0
-	Field Staff Housing	(3)	75.0
-	Regional Maintenance Center		55.1
-	District Centers	(3)	28.3
-	Contingency/Inflation		72.7

All construction is scheduled to begin in the first year of the Project. The housing will be the standard "Pitso IV" type, of which 19 are now under construction for other A.I.D. Technicians. Still others have already been constructed and occuped by A.I.D. Technicians.

5. Other Costs $1,473.9

This category includes funds to assist the Government of Lesotho in the systems maintenance support program, of which the USAID contribution represents approximately 25% of the total amount required.* Also included in this funding category are costs for temporary wage labor (required to install systems) and vehicle operation and maintenance (which includes petrol, oil and lubrication costs).

b. GOL $1,861.4

1. Maintenance Program Support* $ 884.8

The Government of Lesotho will provide funding, on an increasing percentage scale, to cover the salary and materials costs for the systems maintenance support program. The percentage of costs funded by the Government of Lesotho would be relatively small (20%) in the initial year of the project and increase by 15% each year until the sixth year of the project, when the Government would be responsible for all costs of this program.

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*/ The AID contribution to this program provides funding on a declining percentage scale in years 1 through 5 of the project. The GOL contribution to this program will be increasing up to year 6, when the GOL will start assuming all costs for this program. This cost-sharing arrangement will facilitate the GOL's capability to handle the costs of the maintenance program.

2. Administrative Support $429.2

The Government of Lesotho will be required to provide funding for administrative support costs for the life of the project. These funds would be used to cover salaries of the following Government of Lesotho support personnel:

1 Personnel Officer

1 Assistant Executive Officer

2 Copy Typists

1 Clerical Assistant

7 Office Assistants (messengers and night watchmen) and a transport officer. Also included would be funds for field allowances and field equipment.

3. Land and Furnishings $119.2

(a) The Government of Lesotho will provide land for the construction of 6 senior technician houses, three staff houses, and 1 regional and 3 district centers. They will also provide all utility connections, access roads (if necessary), site preparations, etc. This cost has been estimated at $81,700 (in-kind).

(b) In addition, the Government of Lesotho will provide basic furnishings for all constructed facilities (including stoves but not refrigerators or heaters for senior technician's houses). This has been estimated at $37,500.

4. Village Self-Help Labor $428.2

The villages where water supply systems are to be constructed, as an integral part of the criteria for selecting them, will be required to volunteer labor to dig trenches, carry piping and other needed equipment, and carry rocks which will be used to construct reserviors.

5. Important Assumptions

There are important assumptions related to the achievement of the objectives of this project. The logical framework matrix, Annex II of this paper, presents assumptions at each level of activity achievement. The following represent those assumptions which are critical to project success:

a. MOH and MORD Coordination.

During project design, it was learned that in the village water supply projects funded by other sources, there was little coordination between the

Ministries of Health and Rural Development concerning the health and sanitary aspects of these projects. It will be important to establish a coordinated effort between the MOH (which can assist in proper health education and supervising sanitary facilities construction) and MORD (which will be performing the design and construction work for the village water supply systems). It is important to coordinate between these two Ministries from the outset of this project, and both Ministries have indicated they will, indeed, work cooperatively in this endeavor.

b. Communications at the District and Village Levels.

It is important to have effective communications between GOL officials at the district level and villages interested in water supply systems in these districts. Through effective communications, villages will understand what is required of them (i.e., maintenance of the system, selecting a waterminder, unskilled labor, etc) in order to be considered for a water supply project and district officials will be in a position to explain how the government will assist them. If this communications linkage is not functional, many misunderstandings can arise between the two parties, which would be most unfortunate with regard to achieving project objectives. Further, in order the District Community Development Officers (DCDO's) to do their job effectively, they must have adequate staff and transport to reach the villages. The GOL has indicated it plans to take action to strengthen the staffing and transport available to each district.

c. Recurrent Costs

Meeting recurrent costs is a problem throughout the GOL and is of special concern in a project as large as this one. The problem has been reviewed thoroughly with all concerned officials of the GOL. GOL representatives say that because of the intense, widespread demand for water systems and the consequent intense interest in this project at the highest levels of the GOL, recurrent costs will be met even if it means cuts in other areas. The Ministry of Finance is including the GOL share of recurrent costs for this project in its long term projections.

III. PROJECT ANALYSES

A. Technical Analysis

1. Technical/Engineering Analysis

General Description

The engineering and construction phase of the project will entail routine planning, design and construction of some 142 new community water supply systems to serve minimum domestic needs for villages ranging from less than 100 to as many as 2,000 persons. Also included in the project is provision for rehabilitation of some 68 existing systems which have failed because of poor construction or lack of maintenance. The project is countrywide in scope and will be centrally directed from Maseru. However, construction, rehabilitation and maintenance activities will be carried out from 3 regional/district and 7 district centers.

Technical and professional guidance for planning, design, procurement, construction rehabilitation and operation will be furnished by the Ministry of Rural Development (MINRUDEV)1/ through its Village Water Supply Section (VWSS) as the implementing agency for the grant. The VWSS will be assisted in these activities by expatriate advisors as well as U.S. technical assistance personnel assigned to the project. The VWSS has performed similar work in its past and current programs, although on a smaller scale than proposed under this project. The present VWSS cadre includes engineering technicians, a hydrologist, surveyor draftsmen, well-driller and office personnel, all under the general guidance of an expatriate engineer advisor. The VWSS also operates a limited number of percussion well-drilling rigs and other equipment used in construction and maintenance activities, and maintains a small inventory of supplies and materials. Skilled artisans such as pipe fitters, bricklayers, masons and carpenters are usually employed on a job basis. The expanded construction and maintenance activities foreseen under the project will require a substantial interim increase in the VWSS cadre of personnel over the term of the project, and then a decrease to an equilibrium level.

Description of Selected Technology:

Virtually all existing village water systems, as well as those proposed in this project, are based on the protection and development of naturally potable water sources from springs and boreholes. Frequent breakdowns and lack of maintenance of existing systems based on diesel, electric and wind-powered

1/ Listed in other sections of the paper as MORD.

pumping from low level springs and boreholes point, in the long run to a lower level of appropriate technology, which can be handled at the village level, and which can be managed under the constraints imposed on MORD. Therefore, emphasis in new construction in the project will be placed on three types of systems: simple protected springs without distribution; high level spring captations with storage and gravity conveyance pipeline and distribution; and sturdy hand pumps on boreholes located in villages in and near centers of usage. No new wind powered systems, and only a limited number of diesel and/or electric powered systems will be installed. Provision, however, for the rehabilitation and maintenance of some existing systems of all types will be made over the term of the project. All of these systems will comprise some combination of the following components:

(a) a source, either a spring or borehole. Springs will be protected by a captation box and silt trap. Boreholes (with an average depth of 55m) will generally be cased, 6 inch diameter from the surface to a depth of about 10m with open hole below. A concrete plinth will be poured around the casing to exclude surface contaminants.

(b) A pumping facility, generally hand pumps on boreholes, but also a limited number of diesel or electric pumps on low level springs or boreholes.

(c) A conveyance pipeline (supply main) and a distribution network.

(d) One or more storage reservoirs for pressure control and balancing of distribution.

Design Standards:

(a) A supply of 30 to 40 liters per capita per day (l/c/d). Relative per capita supply will depend on the yield of the source.

(b) Sufficient storage capacity in spring-fed gravity systems to fully utilize the low flows of the dry seasons. The design of these systems will be based on minimum seasonal flow.

(c) A minimum distribution pressure of 10 lbs./in^2.

(d) Distribution taps (standpipes) located so that no house is more than 150m distant.

(e) Provision of one hand pump and borehole for each 100 persons (about 20 families).

(f) Construction of new boreholes for hand pump installations will generally be carried out with a straight rotary drilling rig to be procured for the project.

(g) The VWSS will establish a capability for routine monitoring to ensure continuing potability as well as to respond to temporary loss of potability resulting from system breakdowns.

(h) A 10 year population growth design period for major components.

Virtually all efforts will be concentrated in the development and protection of naturally potable water sources to minimize contamination hazards and reliance on treatment measures. In all cases, however, systems will be disinfected prior to their being placed in use, and provision will be made for routine monitoring of water quality to ensure continuing potability. Powered pumping installations will be housed for protection against vandalism and the weather; however, the number of such installations will be minimal. For the most part, new pumped systems will be based on unhoused hand pumps set directly over protected boreholes. (No large diameter dug wells are to be constructed in the project.)

The "least-cost", technically acceptable system will be selected, appropriate to local village requirements. In each case, a decision on whether to proceed with construction will be based on an assessment of the village's willingness to support the costs of maintenance and depreciation.

For those systems involving delivery by conveyance pipelines, the source will be developed as close as practicable to the usage center thus minimizing the length of the conveyance pipeline. This pipeline, together with the distribution network, will generally consist of either polyvinyl chloride (PVC), galvanized steel, or both. The type of pipe to be used will be selected on the basis of

cost but also on local physical conditions. Wherever possible the pipes will be buried in a trench both as a protection against vandalism as well as against freezing. Experience has shown that in existing systems, with operating pressures of less than 60 lbs./in^2 PVC performs well. However, galvanized steel pipes will also be required, particularly where exposed on rocky ground or at the crossing of 'dongas'.

The distribution network will be based on communal water taps (standpipes), each with two faucets, a concrete splash block under each faucet, and a drainage pit or properly sloped drainway.

To reduce costs for steel or brick storage and distribution tanks which have been used in existing systems, it is proposed to consider usage of covered hewn and/or rubble rock masonry tanks, and where topography permits, a ground level masonry platform or possibly reinforced concrete.

Some of the smaller populated centers, in the range of 50 to 400 persons, may not warrant construction of conveyance systems with storage and distribution. Under such conditions two options can be considered. If springs exist near centers of usage, they can be protected by closed captation boxes with silt traps and with one or more outlets from which water can be drawn. Technologically, this is the simplest and most inexpensive system. Alternatively, where local geologic conditions permit, boreholes can be drilled at a spacing of 150m or more and each equipped with a hand pump so as to be available to users within a radius of 100m. Appropriate drainage for spillage around hand pumps will be provided and all boreholes will be sealed to prevent entrance of surface seepage and other contaminants.

Engineering and Construction:

The implementation of the engineering planning and design, construction and operation phases of the village water supply systems will be based on the procedures established in previous village supply activities of the VWSS. These have been reviewed in considerable detail in recent studies by consulting engineering firms and have been found adequate.

A reconnaissance survey by Metcalf and Eddy, International Inc., during 1976/77 developed preliminary feasibility data on which project design modes and other criteria are based. More recently, Binnie and Partners have developed detailed

design and costs for some 49 actual systems on which average costs presented in this report are based. The VWSS has prepared a list of some 258 systems of which some 110 are designated for new construction and the remainder for rehabilitation. Design documentation for these systems is presently lacking; however, it is expected that before the grant-financed equipment is delivered, some 50 system designs will have been completed. The remainder will be designed at a rate of about 30 per year during the 7 year life of the project. This design capability is not presently available in the VWSS. However, the MINRUDEV is committed to supplementing the present staff to reach these goals. Furthermore, the grant provides for technical assistance as well as related equipment and supplies so that VWSS capabilities will be commensurate with the tasks that are to be undertaken during the life of the project.

Prior to commencing the project, the VWSS will prepare and submit to USAID, for its review and approval, a detailed project work plan for the first two years and a more general plan for the remaining 5 year planning, rehabilitation and construction program. This plan will include proposed project scheduling, personnel staffing and a list of quantities for all required materials and equipment identified as to source of origin and finance.

Thereafter, a quarterly summary report will be prepared and submitted to USAID which will include village project agreements, construction plans, listing of materials and cost estimates, together with appropriate bar progress charts and sufficient description to identify accomplishment during the reporting period and that projected for the coming quarter. It is foreseen that construction of a typical new system will proceed in general accordance with existing schedules along the following lines: after the target villages have been identified, scheduled in the work plan, and administrative formalities completed, the approximate water systems will be surveyed and designed. Rehabilitation of existing systems would follow a similar but modified schedule depending on the amount of work required:

(a) As soon as the pertinent conditions prec dent have been fulfilled, the VWSS, through its construction subsection, will begin construction of spring captation, covered masonry storage and distribution tanks, and trenching necessary for the conveyance pipelines and distribution network for village systems, which have passed

the selection process and been rank ordered. The bulk of the materials required for the above work are readily available and will be purchased locally. All unskilled labor and local materials will be furnished by the villages. Most masonry, pipe fitting and carpentry work related to an installation will be contracted by the VWSS.

(b) Once the grant-financed equipment (rotary drilling rig, hand pumps, ancillaries and vehicles) and materials (PVC and steel pipe and well casing) are procured and delivered, the spring-fed gravity systems will be completed. Also, work will be started on the drilling of boreholes and the installation of hand pumps.

The expected division of work is as follows:

(a) Manual labor and local materials to be provided by villagers.

(b) Skilled labor for masonry, pipe fitting, carpentry and other trades to be provided by VWSS through contract and staff personnel.

(c) Drilling of boreholes and setting of hand pumps or motor pumps and testing of purification of the system to be done by the VWSS, using VWSS equipment.

(d) Supply and transport of other than local materials by the VWSS.

(e) Regular supervision of all work by VWSS personnel.

Equipment Maintenance:

The VWSS at present has only limited equipment maintenance capability. However, it operates and maintains 4 trailer mounted percussion drilling rigs, procured in the early 1970's, at about a 40 percent efficiency level. Servicing vehicles, presently in its possession, includes one large flat-bed truck, 3 Toyota ½ ton pickups, and 3 ½ ton Land Rovers.

These vehicles of fairly recent vintage are maintained in VWSS workshops. However, the VWSS has no organized preventive maintenance program, although it does have some in-house corrective maintenance capability.

As some 14 service vehicles will be procured initially for the project as well as a rotary drilling rig and ancillary equipment including a water truck, it is essential that the VWSS develop a maintenance program commensurate with the demands that will be placed on it by the project. This will require the VWSS to develop a preventive and corrective maintenance plan for vehicles which it will acquire. Funds for this maintenance will be budgeted and provided by the project initially, to be taken over progressively by GOL by year 6 of the project.

System Maintenance:

The VWSS is very much aware of the importance of a sound maintenance program for the new water systems it proposes to build as well as those defunct systems it proposes to rehabilitate under the project grant. In order to maintain all the systems to be constructed or rehabilitated the following series of actions are planned:

1. During the first years of the grant the VWSS will augment its maintenance subsection to a level commensurate with the needs of the rehabilitation component of the project. Technical assistance for this work will be provided by one of the U.S. engineers assigned to the project.

2. Also during the first 2 years of the project, the maintenance subsection will emphasize strongly training of newly acquired personnel in the practical aspects of preventive and corrective maintenance both on the job as well as by ground in-service instruction. Concurrently, construction of 1 regional/district and 3 district workshops for storage of equipment and supplies and for maintenance will be undertaken by the project through a local contract(s).

3. Maintenance on systems newly constructed under the project will be minimal during the first year and probably during most of the second year; consequently the maintenance subsection will

concentrate its efforts on the work outlined in items 1 and 2 above as well as in the regular program of the VWSS. By the beginning of the third year of the project, however, the maintenance subsection will be directing some of its efforts to maintenance work on new systems, but most of its efforts will be concentrated on rehabilitation.

4. In the procurement of new equipment, a 15 percent factor has been included for an initial spare water system parts stock to be controlled by the VWSS. The question of payment for minor spare parts is to be resolved during project implementation. One approach that will be thoroughly considered is to debit the parts to the villages by the VWSS at cost as required. The village will make payment from a village maintenance fund to be held in escrow for such contingencies. This system would be used for nominal small repairs such as broken valves, pipes, etc., but the MINRUDEV will finance major maintenance out of its recurrent budget.

5. A stock of replacement hand pumps will also be provided to the VWSS under the project to replace those that become defunct or those needing major repairs.

6. The district community development officer (DCDO) routinely visits all villages which have water systems and receives reports from the water minders as to the condition of the system. Further, the water minder is required to report any major difficulties (those which the minder cannot repair immediately) to the DCDO. The DCDO routinely reports his findings to the District Maintenance Technical Officer who schedules the repair and effects it.

Technial Feasibility:

The project is deemed technically feasible as presently designed in the project paper. It is based on previous experience of MINRUDEV, plus certain innovations which have been incorporated in project design and technical considerations which should make the project more cost effective. These include the substitution, to the greatest extent possible, of rock masonry structures for imported steel tanks and bricks. Since there is a demonstrated ability of the Basotho to hew and lay rock, either loose or with mortared joints, this

seems the obvious means for construction reservoirs, etc., when the unlimitless availability of raw material, on site, is considered.

A second, and perhaps as important, innovation to present technical methods, is the introduction and installation of hand pump systems. This can be accomplished at much less cost than the present borehole windmill or diesel pumping systems, and is a much more apppropriate technology in the majority of villages requiring borehole sources of water. The abandonment of new windmill systems has been encouraged since they are not, as presently installed at least, technologically or economically acceptable.

The village water supply section has formulated standard plans for spring boxes, silt chambers and other appurtenant structures for distribution systems. Also it has access to independent local firms for architectural services, and possesses the survey and drafting capabilities required for its present workload. The addition of three engineering technicians should sufficiently augment the activities of the three Swiss engineers presently assigned to VWSS until such time as Basotho can be trained to supplant them.

Procurement Procedures:

In procuring materials and equipment with AID grant funds, AID procurement procedures will be followed. Letters of commitment/credit will be used for all procurement from sources other than Lesotho. Procurement of local materials will be in accordance with local law and practice, insofar as compatible with AID procurement regulations.

Cost data was based on a sample of 49 villages actually planned and detailed for MINRUDEV and British Ministry of Overseas Development by Binnie and Partners, Ltd., a consulting firm with a branch office in Lesotho. From this, an additional cost of 10 percent for U.S. procurement plus a difference in shipping costs of plus 20 percent for U.S. procurement over the landed in Maseru costs for British supplied commodities was added. In addition, line item quantities were inflated for contingencies.

Environmental Analysis:

The initial Environmental Examination (IEE) was adequate, a negative determination was made, and the project retains the proginal character. No environmental analysis (EA) is required.

Hydrogeologic Considerations

Ground water, extracted from springs and boreholes, provides about 70 percent of the total water consumed in Lesotho. Some 69 percent of existing rural water supply systems, which have been constructed by MINRUDEV or its predecessors, are gravity systems based on high level spring captations which feed into storage tanks and then into conveyance pipelines, distribution tanks and pipes (reticulation), and village taps (standpipes). Such systems prevail in all the highland region (about two-thirds of the national territory) as well as in much of the western and southern lowlands. About 31 percent of existing systems, virtually all concentrated in the lowlands, are based on diesel, electric or windmill powered pumps which raise water from boreholes or low-level springs through trunk pipelines (rising mains) to storage tanks. From these, water is distributed by gravity reticulation to village standpipes. Hand pumps, although extensively used on privately owned boreholes for domestic water supply, have only recently been installed by MINRUDEV on two departmentally drilled boreholes. It is proposed to increase substantially the number of such installations, as the most appropriate technology available for villages of less than 400 people. Rooftop catchments feeding cisterns are also widely used by private householders as principal sources of domestic water in wetter areas, or as a supplemental source for inadequate public supplies. There is considerable scope for more extensive use of rock catchment sources that feed covered cisterns, particularly in hill top villages which cannot be freely served by springs or boreholes.

A hydrogeologic assessment during the preparation of this paper has led to the conclusion that boreholes yielding 0.1 to 0.2 l/s or more can generally be located in most villages in the western and southern lowlands at distances of no more than 150m from centers of usage. The requisite depths of such boreholes would generally range from 40 to 80m with an average of 55m. The depths to water, below land surface, are generally in the range of 3 to 44m and average about 12m. These depths are well within the feasible limits of hand pumping. One hand pump with borehole has been designed for each 100 persons (20 families) with a maximum economic limited of about 4 hand pumps and boreholes for a village of 400. It is proposed to equip each borehole with a Moyno-type hand pump, each with a pumping capacity of 12 l/min or 5,760 liters per 8 hours of continuous use. Withdrawal at this rate would provide 150 persons/pump with 38 l/c/d. Pumps used for 4 hours continuously would provide 100 persons/pump with 29 l/c/d.

In order to speed up the rate of village borehole construction, a rotary drilling rig with ancillary equipment will be procured under the project. When operating at maximum efficiency this rig can drill a 55m borehole within a 16 hour work shift. Operating at reasonable efficiency, the rig will probably bore about 2 holes per week. One or more drilling crews from the present cadre of the drilling subsection would be trained to operate the rotary rig by a TDY (6 months) U.S. well-drilling advisor to be provided under the project. During construction of the village boreholes operations of the Hydrogeology Subsection would also be upgraded through improved methodology introduced by a U.S. hydrogeologist in 2-3 month TDY's during the 7 year life of the project.

The design of the village boreholes is quite simple, as minimal quantities of water are to be extracted from each. Also, the design follows that used in existing boreholes from which considerably larger quantities of water are extracted. As the geologic terrain in which the village boreholes are to be drilled is predominantly compact sandstones and shales, only the uppermost 10m or so of the borehole will be cased with 6 inch steel casing and the rest will be "open hole". The casing will be scaled near the surface and a concrete plinth poured around it. The hand pump will be mounted directly over the borehole. The total number of boreholes to be drilled under the project has yet to be determined, but will probably lie in the range of 250 to 300.

For spring captations to be constructed under the project, it is essential that measurements or at least valid estimates of low flows of the target springs be available for realistic design of the systems. Many springs, particularly in the drier western and southern lowlands of the country, are reported to have dry season flows less than a third as great as those of the wet season.

Consequently, springs for larger captation systems will be selected carefully, and sufficient storage will be provided so that the minimal flows of dry periods are conserved and utilized fully.

A full discussion of hydrogeologic consideration in the project is presented in Annex VII.

Least Cost Method:

The VWSS will have all the information necessary to ensure that a modified least cost solution will be chosen. As used in this paper, the term "least cost" refers to installation

cost as maintenance costs are similar for all the systems. Least cost methodology, to the greatest extent possible, has been incorporated in this project. Substitution of locally available stone masonry structure for steel tanks will result in a 50 percent saving on these structures. Use of handpumps for smaller villages in place of more costly and difficult to maintain windmills and diesel pumps is another example of least cost technology.

Water Resources Utilization:

Attention has been directed to assuring that the water resources to be utilized for village supplies do not detract from other possible uses of these resources. Ground water, extracted from springs and boreholes, will provide the source of water for virtually all the systems to be constructed or rehabilitated under the project. Normal recharge to the aquifers, from which the ground water is to be extracted, vastly exceed the relatively small quantities which will be withdrawn for village water supplies. Since the majority of the sources are free-flowing springs, which are presently being used as a water source for the villages, no diversion of resources is involved.

Technical Planning:

The technical planning for this project is based on three studies; namely, the report by Richard Feachem and others, the SWECO report, and the Metcalf and Eddy report, all released in 1977. The SWECO report considers village water supplies as a part of an overall comprehensive study of the water resources of Lesotho. The Feachem report emphasizes the health and sociological aspects of village water supplies, and the Metcalf and Eddy report concentrates on the engineering aspects. Thus, the two latter studies tend to complement each other. More recently (1978), Binnie and Partners have developed designs and costs for some 49 typical systems on which average costs in this report are based. The cost data represent valid present (early 1979) costs in Lesotho.

Village Sanitation:

Sanitation will be incorporated into the water supply scheme to the extent possible. MINRUDEV, through project funds, will supply cement for the construction of privy slabs of the direct drop type. They will also provide one person and simple forms to instruct and assist villagers in constructing slabs. The villagers themselves will be responsible for digging the pit and providing the shelter building for the privy. The Ministry of Health and the health coordinator provided in the project will be responsible for encouraging and educating villagers to the need and desirability of this type of facility and will coordinate their health education efforts with MINRUDEV's construction schedule in order to ensure that a maximum effort is obtained.

Cost of materials per privy is estimated to be:

Cement : 15Kg.	at	R.070
Rebar : 2Kg.	at	R.080
Total material cost per slab		R1,50

Costs of local effort are borne on an indivudual family/household basis and are not computed as part of local contributions.

In addition MINRUDEV will provide, on an experimental basis, a minimum of one clothes washing slab per village. This will be located adjacent to (within 10 meters but no closer than 3 meters) a handpump or street hydrant (standpipe). Ministry of Health village health workers will encourage use of these slabs for clothes washing and will report on their acceptance and any requirements for additional slabs. Costs of these are as follows:

4-5 50Kg. bags cement ...	at	R12.00
5 M.H. cement mason labor .	at	R 5.00
Total cost for labor and materials		R17.00

Sand and rock are to be furnished by the village and costs shall be credited in the totals for the entire water system.

611 (a)(1) Statement:

A thorough analysis of costs, designs and typical plans has been made and this section of the FAA is deemed to have been satisfied. While sites have not been identified for either structures or water systems to be installed under this project, those existing systems observed by the design team engineer and an analysis of costs and design criteria and specifications indicate that they are sound and reasonable. Sites for construction of buildings, have not yet been identified and an AID engineer will inspect and certify such sites upon identification prior to contracting and disbursement of funds.

Summary:

The effect of both the rehabilitation and construction of village water supply systems will be to enhance local village health standards. Even though it is anticipated that the washing of clothes and personal bathing patterns of the villagers will not change markedly by making clean water more accessible, it is expected that within a relatively short time villagers will use more water for personal hygiene and cleanliness. Use of latrines is already well established in many villages of the western and southern lowlands. Thus the introduction of potable water in such villages can do much to raise the essential base for higher standards of public health. Justification for this is not based on the provision of clean water alone. The project proposes to include the introduction of privies in those villages where use of these is unknown, as well as clothes washing slabs on an experimental basis. Considering this threefold approach, the improvement in public health should be significant, even though the bulk of the project concentrates on clean water. This is the necessary base upon which other health programs must be built.

2. Health Education Considerations

Adequacy of Existing Health Education Program to Water-Borne Disease

The need for, and importance of, a comprehensive health education program in Lesotho as it relates to water-borne and water-related diseases is fully recognized and understood by the various departments and personnel of the Ministry of Health and the Ministry of Rural Development, but the actual implementation of any active, ongoing programs has been slow due to a lack of enough adequately trained personnel.

The present health delivery system in Lesotho is characterized by a wide variation in the quality and quantity of services in the urban and rural areas. Emphasis has been placed on curative community health services in the major towns, at the expense of preventive services in the countryside. Health resources are concentrated in the urban areas of the lowlands and are predominantly hospital based. Over 90 percent of all health resources are directed towards episodic curative care, primarily at hospitals. In both Lesotho's First and Second Five-Year National Development Plans, emphasis was placed on improving and upgrading health services to the rural areas and strengthening preventive medical services. During the First Five-Year Plan steps were taken to improve rural health

services and reduce the imbalance between rural and urban facilities. The Second Plan places greater emphasis on rural services, and calls for the provision of basic integrated health services to the rural population through a Rural Health Development Program (with AID assistance being provided through the Lesotho Rural Health Development Project, 632-0058, September 1977).

This major AID sponsored project has been designed:

1. to upgrade the planning, administration and management competence of the Ministry of Health to the level required to develop and maintain a national health delivery service, and

2. to establish and institutionalize new health cadres required for the rural component of a national health services delivery system.

In the Ministry of Health, plans are also underway to functionally divide the geographic areas covered by Lesotho's nine Government and eight non-government hospitals so that each of these hospitals will become the "hub" of a regional Health Service Areas (HSA). These seventeen hospitals each provides health services for a coverage area of 50,000 to 100,000 people. The Government of Lesotho plans to develop and integrate a three-tiered health delivery structure composed of:

1. The Health Service Area Hospital - This will be the focal point for management of all health facilities within the coverage area. It will be staffed by a doctor, nurse clinicians, nurses, nurse assistants and support staff.

2. The Rural Health Clinic (RHC) - There will likely be from two to fifteen clinics peripheral to and operated from the HSA hospital, with each clinic serving a population of 5,000 to 10,000 people. The Rural Health Clinic will be staffed by a nurse clinician and a nurse assistant, and will be the link between the HSA hospital and the more peripheral Village Health Worker.

3. The Village Health Worker (VHW) - The VHW will be under the supervision of the nurse clinician at the Rural Health Clinic and it is anticipated that each Village Health Worker will serve an enumeration area (5-10 villages) of 1,000 people or less, though this will vary depending on the area, size and composition. The Village Health Worker is the individual who will bring the simplest elements of preventive and curative medical system to the village level.

It is expected that all units will be established, functioning and providing services to Lesotho's rural population by October 1981. The implementation of this regional concept will do much to strengthen the health care delivery systems, especially in the area of primary health services. Once the new cadres are in place and at work it will be possible to develop effective health education/environmental sanitation and personal hygiene campaigns which should yield positive health and environmental effects.

The three new cadres of health workers to be developed or expanded under the Rural Health Development Plan are:

1. Nurse Clincians - In addition to being able to diagnose and treat the problems of 90 percent of the patients seeking care at the rural clincs, they will provide direction and supervise the preventive and promotive activities of the nurse assistants and the Village Health Workers.

2. Nurse Assistants - They will be able to carry out basic nursing procedures and some curative services and perform health preventive and promotive activities.

3. Village Health Workers - These workers will be residents in villages within the enumeration areas they will servie. The VHW's will be selected by their villages and will serve as extensions of the rural health clinic staff at village level. The 3 month period of training will take place at the RHC and will be carried out by nurse clinicians, who will also supervise the VHW's when they return to work in the village. The VHW's will provide some curative health services but the major emphasis of VHW work will be on preventive health care.

It is estimated that 125 nurse clinicians, 165 nurse assistants and 1,000 village health workers are required to give adequate health care coverage to Lesotho's rural population. Promotion of good health will take many forms. Active programs at the village level will be initiated and supervised by the Public Health Staff in the HSA Unit and carried out by the nurse clinicians and village health workers, working in coordination with the Public Health Inspectors, Health Assistants and other key personnel in the HSA Unit. Since village health workers' training will have illness prevention and the promotion of positive health (safe water supply, safe food storage, etc.) as its major component, the village health workers will provide most of the preventive health care/

health education in the system. Virtually all of the village health worker positions will be filled by the rural residents, the majority of whom will be women. They will be part of the village social life and, with relatively simple skills, the village health workers will be able to translate their knowledge into language understood by the villagers, helping to bridge the social and knowledge gap between the health system and the village social system. The village health worker will be technically supervised by the nurse clinician at the rural health clinic, but will ultimately be answerable to the community in which he or she lives.

The development of the curriculum and other preparatory activities, which would lead to the commencement of the first VHW course in June 1980, was scheduled to start in March 1980. (Lesotho Rural Health Development Project Paper, p. 34). However, the implementation of this project is approximately a year and a half behind schedule, so that the first group of village health workers trained under this program will not be available until early in 1982, too late to have much input into the Rural Water Supply Project. There are to date about 125 village health workers in scattered villages who have been trained under 12 presently existing training programs, but these have been pilot programs. They are not coordinated, and offer only a one or two week period of training before the VHW returns to his village.

So although the potential for effective health education dealing with hygiene and sanitation on the village level is hopeful, some other means of providing the health education component of this project must be found.

A Health Education Unit was established in the Ministry of Health in 1972. It became fully institutionalized in FY 75-76, and now has a Health Educator who completed his stufies in the U.S. and returned in December 1978.

The Health Education Unit (HEU) has developed health education classes for student nurses and midwives, for agricultural college students, health assistants and home economic assistants, as well as nationwide in-service education courses for personnel in and outside MOH. On-going health activities at the village level are accomplished through the public health and clinic staff in the field and in cooperation with other Ministries and members of the public. HEU supports them with organizational skills and teaching aids. Leaflets already produced include one on safe water and one on the building of pit latrines. The HEU has the capability of providing many of the Water Supply Program's health educational needs, but has a very limited staff.

Health teaching of any kind is minimal in the schools at present. Health education is in the curriculum of the National Teachers Training College, and health textbooks are being developed for students in the primary schools, so the potential for effective teaching of basic hygiene and sanitation concepts to accompany the installation of water supply systems in the villages is real.

The Distance Teaching Center was set up to expand the use of distance teaching methods in Lesotho. These methods include radio programs, instructional booklets and leaflets, correspondence courses and communication support, such as visual aids, pamphlets and training courses for field workers. The Center provides background information, develops written materials as well as simplifying and making these materials attractive, pretests materials and evaluates progress. It also advises organisations on their overall educational work and designs materials to help them.

Health Education Programs Coincident with Provision of Improved Water Supplies

Unsanitary conditions - the lack of protected water supplies and latrine facilities - combined with a lack of information and knowledge concerning proper hygiene are responsible for much of the disease in Lesotho. "Water-related disease accounts for 11 percent of hospital reportings overall, and 20 percent of reportings in the under 5 age group" (Feachem : p.24). The most prevalent water-related health problems are gastroenteritis, typhoid fever, infectious skin diseases and infectious eye diseases. Although individuals with skin and eye conditions are more likely to go directly to the hospital, many people with symptons of water-related disease such as stomach pain or diarrhoea are likely to treat their complaint at home or take it to a village practitioner. Only the serious cases reach the hospitals. Consequently, available statistics do not necessarily give an accurate picture of the actual incidence of water-related gastro-intestinal complaints.

Reduction of water-borne diseases is normally one of the prime justifications for improved water supply projects. However, Richard Feachem's study found that "there is no difference in the prevalence of reported water-related disease in villages with or without improved water supply, and there is no difference in the epidemiology and seasonality of water-related disease in villages with or without improved supplies". Some of the reasons cited in his study were:

1. that even with improved water systems, hygiene habits remained the same in the villages;

2. that because infectious skin and infectious eye conditions fall into "water-washed" category of diseases, they were not influenced by the provision of improved water alone;

3. that diarrhoeal diseases and typhoid fever may be either water-borne or water-washed (or, more probably, both), and could be due to factors othern than fecal contamination, such as poor village hygiene practices, presence of flies, etc.

Diarrhoeal diseases, especially in children under age 5, and typhoid fever, which is most prevalent in teenagers and young adults, both peak sharply during the wet season both in villages with and without a protected water system. Feachem postulated that possibly this was due to:

1. the better survival of pathogens in the moist, warm conditions of the wet season than in the cold, dry winters of Lesotho.

2. The significantly less hygienic village environment in the wet season which exposed the people to a greater risk of infection.

3. The lowered nutritional status of the population due to the shortage of home grown grains in the wet season. Not every family can afford to buy all the food it needs from a store, and there is a correlation between malnutrition and diarrhoea in young children.

4. The increase in the fly population in the summer causing some diarrhoeal disease transmission via fly-borne fecal material.

The problem is that clean water supplies provide a necessary but not sufficient condition to improved health. That is, they provide the means to break the disease cycle, but the villagers allow the cycle to be completed in other ways through such unsanitary practices as making contact with contaminated water, not sufficiently cleaned utensils, and so forth. Thus, a health education program leading to improved sanitation and hygiene, carried out in conjunction with the installation of clean water supplies, would lead to health benefits unachieveable by either activity alone.

The health education programs should primarily be directed toward an improved village environment and toward the instillation of better personal habits of hygiene on the part of the village population. This would include:

1. a change in defecation habits so that there would be no pollution of the water system (including the building of latrines). If alternate sources of water continue to be used for bathing and washing clothes, these should also be free of fecal contamination.

2. Handwashing before eating and preparing food, and after defecation.

3. Frequent body bathing and clothes washing.

4. Protecting food from flies.

5. Washing fruits and vegetables before eating them.

6. Proper washing and storing of all dishes and utensils used for food and water transport, storage and serving.

7. Elimination of fly breeding areas by burying or disposal of garbage by other methods.

The effect of providing a safe water supply on community health depends on the extent to which the community makes use of the supply. This, in turn, depends on social customs, an understanding of health implications, and on the level of service provided. If water has to be carried from distant wells or public standpipes, the quantity fetched is usually small. Use of this safe water for drinking and cooking reduces water-borne diseases, but the supply may be insufficient for proper personal hygiene, so that "water-washed" diseases (for example, trachoma and some skin diseases) cannot be effectively controlled. There is also the risk that the safe water obtained from the source can be contaminated in transit or while being stored prior to use.

An effective village water supply program should provide for education in basic public health both during preparation to stimulate village interest, and during implementation, to ensure that full benefits are obtained from the new system. Major health education efforts using printed materials and direct contact by extension personnel should be timed to coincide

with water system construction and maintenance, and should be followed by careful evaluation of resulting changes in attitudes and practices. Health education programs need to be established on a continuing basis, beginning early and, ideally, extending over several years after the project is completed.

Professional leadership is essential to the establishment and effective functioning of any health education program, and to esnure that the educational aspects are carefully planned for the best utilization of time, personnel and resources to achieve the desired changes in health practices. Coordination with the Ministry of Rural Development's installation and maintenance of water supply systems is crucial to the success of the health education component of this project.

In view of the present health infrastructure in Lesotho, the delays in the training of health cadres under the Rural Health Development Program, the shortage of all categories of health personnel and the intracacies of the inter-departmental coordination required for a successful health education effort, the assignment of a health education coordinator to the project seems highly desirable, if not essential.

This health education coordinator should be assigned to the HEU in the Ministry of Health and would be responsible for the coordination of water-related health education activities with the installation of water supply systems in the selected villages. (See Job Description, Annex IV.)

Working with the Chief Health Educator and his staff, the health educator would devlop schedules coincident with the installation of water supply stsems in the villages. The HEU would prepare/compile relevant audio-visual materials and develop curriculi for the various categories of personnel who would be involved in the implementation of the health education component of the project. The HEU would orient the key officials in each Ministry to the needs of the program and the desired objectives for their personnel, and schedule training programs.

The next step would be the orientation and preparation of the on-site "health educators", using various resource people - Public Health Nurses, P.H. Inspectors, etc., as well as HEU personnel for their training.

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and capital constraints found in the rural areas. However, time gained be it used for leisure, household activities, social or family gatherings, or agricultural productivity is worthy of a high social benefit rating.

b. Health Benefits. One of the most important direct benefits from improving the quality and quantity of water available is better public health. This aspect may be realized in terms of supplying uncontaminated water to a village site, or in developing sanitary watering facilities or both. The effect of water on health depends on many factors, especially the prevalence of disease and the extent in which villages use water. It is therefore necessary to identify the vectors of disease in order to break the chain of transmission. Previous studies concerning this problem in Lesotho indicate that the main vector of disease transmission lies in unsanitary water conveyance from source to usage site. The World Bank Paper on Village Water Supplies1/ suggests that there is a direct proportionality between distance from water source to usage site and incidence of water transmitted disease. What one deduces from these reports is that public health benefits will be maximized from both conveniently sited, uncontaminated water and improved sanitary conditions, not only at the watering site but also in the conveyance from water point to home. To this end the project endeavors not only to construct village water systems, but to include a rural health education component to instruct villages on water usage sanitation practices, and management of human waste.

An additional benefit within the area of health is implied in the concept of convenience. What is meant here is that less energy is required per day to supply water for domestic and personal use. In areas of marginal nutrition, this could prove to be a major benefit in reducing energy expenditure or cash amounts spent on food. In areas in which the nutritional plane is not as critical, nonetheless, the convenience factor could play a key role in overall physical well being of rural Basotho.

c. Self-Help Benefits. The villages are to make a cash contribution for water system maintenance, but also to contribute labor for construction and ditch digging. This idea of self-help and community cooperation may be an incremental step in rural sectoral development.

2. Cost Effectiveness.

The cost effective part of the economic analysis will analyze three outputs resulting from the project.

1/ World Bank Paper: Village Water Supply. March 1976.

a. Institution Building - Training.

Probably the single most important phase of the project is the institution building. Without this component it would be impossible to establish an ongoing program of water development. Investigation into the present MORD/VWSS program clearly shows that the major constraint is lack of technically trained personnel. Unfortunately, adequate numbers of trained personnel needed not only for this project but for ongoing VWSS development simply do not exist within the country. Therefore, key individuals for these positions must be trained either locally in technical schools or in foreign institutions depending on the competency level required. The organization/training part of this report has shown that it will take a period of seven years to train and educate sufficient personnel at all levels to run an expanded program.

The cost effectiveness of the institution building component is evident. Given this as a major objective there is no other alternative but to train and educate for the prescribed period of time. Reduction in training time and personnel will seriously constrain self-sufficiency in ongoing VWSS development.

b. System Construction.

There will be an estimated 142 new systems built over the life of the project and 83 reconstructed. Appendix 7D shows the yearly construction schedule and costing breakdown.

Total cost for all new and reconstructed systems is estimated at $6,485,206.1/ These systems are aimed at serving an average village size of 400 persons. This breaks down to 225 villages or 90,000 persons served. Average cost per capita comes to $72. As an average cost this figure might be misleading since in practice systems constructed might vary enormously from the average.

In reality a more efficient determination based on cost as a function of village size, geographic location, proximity to water source, and water source itself will be applied. The following table shows a current cost of the three recommended systems per various village sizes.

1/ Calculated on the basis of present materials costs, excluding all inflation and contingencies, plus labor directly attributable to system installation, again excluding all inflation and contingencies.

The constraints on Systems 1 and 2 are dependent on spring flow. It is not recommended that a simple spring protection serve more than 400 people, villages larger than this should have a distribution and storage system or borehole/hand pump system where appropriate. Likewise only on rare occasions should a System type 2 be recommended for villages of over 2,000 people (village size of 1,500 was used in this analysis, as an optimum) since it is questionable that a spring or closely linked springs can supply a stable, adequate supply for populations over 2,000. System 2 is also constrained by length of pipe distribution. A general rule of thumb used in MORD/VWSS is that pipe distribution system of over 2km is cost prohibitive.

System 3 is constrained more by location than the other systems. Boreholes are recommended for the lowland areas where springs are not prevalent.

c. Maintenance.

Next to the institution building component of the project the next in terms of importance, at least economically speaking, is maintenance.

The basic tenet here is: if the cost of maintenance is less than the cost of not having maintenance, then maintenance is justified

Maintenance Cost Analysis.

Project engineers have estimated that a major breakdown in any of the three recommended systems has a 20% occurrence rate. This means that at any given time one out of five systems can be inoperable Experience in developing countries has shown that an inoperable system usually has deteriorated to the point where major replacement of parts is needed. However, since low maintenance systems are recommended for this project, with the highest cost items being pipe, which are not likely to have a high replacement factor, a replacement and repair factor of 100% for System 1, 25% for System 2 and 35% for System 3, should maintenance not take place, is used for this analysis.

Assuming that ten (10) units of System 1, fifteen (15) units of System 2 and thirty (30) units of System 3 are produced at the beginning of year 1, total cost based on project data for these 55 systems comes to $910,570. If maintenance is applied to the systems, they would all be assumed to be operating at the end of five years; total maintenance costs for maintaining these systems for 5 years is $49,235 (future value discounted at 11% for 5 years). However, if the systemss are not maintained it would be assumed, based on a 20% breakdown rate, that only 18 of the systems would be operable at the end of five years. Replacement costs of these systems using the

CURRENT COST OF THREE RECOMMENDED SYSTEMS PER VILLAGE SIZE

	Systems 1/			
Population	1	2	3	
100	511	N.A.	N.A.	Present value using
200	1,022	N.A.	9,410	average construction
400	2,044	23,260	18,684	cost and maintenance
700	N.A.	25,260	32,937	discounted at 11%
1,000	N.A.	34.890	47,053	for 7 years.
1,500		46.520	70,575	

1/ System 1 = Simple protected spring
System 2 = Gravity spring fed system with reticulation
System 3 = Boreholes with handpumps

COST PER CAPITA

	Systems 1/		
Population	1	2	3
100	$5.11	$ -	$N.A.
200	5.11	-	47.05
400	5.11	58.15	47.05
700	N.A.	36.08	47.05
1,000	N.A.	34.85	47.05
1,500	N.A.	31.01	47.05

Systems Analysis

Systems 1 and 3 show a straight line increase as population increases. They have fixed amounts of materials and labor for every 100 people served. System 2 is elastic in its pricing and can take advantage of economies of scale as shown by decreasing per capita costs. The pricing shown for illustrative purposes on System 2 is based on an average (see Appendix 7B for average price of gravity system). Increases in System 2 costs resulted in additions to storage facilities and some distribution. However, it may have been equally justifiable to suggest an agglomerated system serving a number of villages and having an extensive distribution system; costing for this type of system could go as high as $68,000.

above cited maintenance and repair factors on future values is figured to be $306.984. Thus it can be seen that maintenance has saved $257,749 in expenses and has shown a cost efficiency ratio of 524%.

The following details the above analysis:

Number of systems: 50

No. 1 10
No. 2 15
No. 3 30

Total maintenance costs for 5 years discounted @ 11% $49,235.

Number of systems to be replaced at the end of five (5) years given a 20% p.a. breakdown with no maintenance:

System	Future Cost	Replacement Cost
1	7 x $2,982 x 100%	$ 20,874
2	10 x $35,131 x 15%	87,828
3	20 x $28,326 x 35%	198,282
	TOTAL	$306,984

Summary: Cost Effectiveness

1. Institution building is shown to be cost effective, given it is the major objective of the project, and that the scale of production determines the period of training needed.

2. It has been shown that System 1 is a low cost system that should be used where appropriate in villages of under 400 persons. System 2 can be designed to serve villages from 400 persons on up to a realistic constraint of 1,500-2,000. It is the only system that can reduce cost per capita down by economies of scale. It, however, can become a very costly undertaking for large agglomerated village systems. System 3 is best suited to lowland areas where springs are not abundant. It should not be installed in village sizes of under 200 because of high exploration and transport costs. System 3 has an advantage over the other systems in that should one handpump break down the village would still have other pumps to ensure a water supply.

3. Maintenance is shown to be highly cost effective component to the entire aspect of institution building and cost saving. It is a necessary component for any VWSS program, and cannot be over emphasized or promoted enough.

III. E. Managerial and Institutional Analysis

Introduction

The ability to develop the capability of the Village Water Supply Section (VWSS) to plan, install, and maintain rural water supplies is a function of at least five major managerial and institutional factors. They are:

1. Staffing
2. Training
3. Logistical Systems and Procedures
4. Organizational Structures and Functions
5. Administrative Processes

This analysis concludes that with the inputs supplied by the Government of Lesotho and the USAID, this project will be able to accomplish the stated purpose. While the public service system in Lesotho has many problems in common with other African countries, it does not have some of the critically disabling difficulties which others possess. For instance, the GOL is not plagued with the tribalism or rampant corruption which undercut development efforts in more manpower rich states. Rather, there are the more normal problems of skilled manpower shortages, high turnover, insufficient training, partial dependence on expatriate staff, inefficient procurement and supplies procedures, inadequate recurrent revenues, and only minimal salary incentives.

Not all these problems can be dealt with in a project in this nature, as many of them have their bases in structural rigidities which only time and slowly accruing experience can change. However, the general design and specific structuring of this project attempts to address each of these difficulties. Activities have been evolved which try to mitigate their negative influences and effects.

1. Staffing

a. Existing Institutional Capacity

There are 71 GOL nationals and 6 expatriates presently on the Village Water Supply Section's technical personnel roster. These personnel work in the following divisions:

	GOL	Exp.
Survey	5	1
Hydrogeology	4	
Drilling	21	
Maintenance	11	1
Construction	23	3
Workshops	7	
Prin. Tech. Officer		1
	71	6

At present these staff are divided into seven broad position/categories, and are paid from three distinct sources of funds. Fifty (50) of the seventy one (71) GOL/MORD staff, or 70%, are employed on a daily basis. This situation and the average salaries of each rank are shown below in Table 1.

Table 1. VWSS Staff Compensation Pattern

Positions	Existing No. of Staff	Salaries	Daily Paid Wages	Daily Paid on Donor Proj Funds	Monthly Average Salaries
Principal Tech Officer	-	-	-	-	-
Chief Tech Officer	-	-	-	-	414
Sr. Tech Officer Officer	4	4	-	-	255
Technical Officer	3	3	-	-	179
Technical Ass't Officer	35	11	12	12	152-114-112
Laborers	24	-	4	20	48-49
Drivers	5	3	2	-	71-69
	71	21	18	32	

At the present moment, these 71 staff are fully occupied working on water supply systems funded by other donors. As will be indicated in another section, these staff have a capacity to

*Source: MORD, Accounts Office, Salary Records, December, 1978.

construct about 19 gravity systems per year on average.

b. Additional MORD Staff Required to Implement AID Funded Project

With the present personnel's time taken up with other donor projects, the staffing requirements for the AID funded project will be entirely in addition to the GOL's existing staff. Furthermore, as the compensation pattern showed (and the preceding financial analysis demonstrated), the GOL does not have the capacity to absorb many new staff on their recurrent budget. Thus, any additional personnel to implement the AID project water systems will have to be primarily daily paid out of the AID project funds. The only exceptions are the maintenance crews, to be absorbed by the GOL on an ascending scale, and supplemental administrative support staff assigned to the project temporarily by the GOL.

The daily paid approach to compensating personnel is very useful in the Lesotho context for three reasons: first, it is acceptable to the staff hired; secondly, it does not impose an unnecessary burden of unneeded staff on permanent terms and thirdly, it permits replacement of normal turnover losses from a trained pool and for the recurrent account these arrangements provide a significant element of flexibility in personnel matters.

Part of the original motivation of the GOL in requesting assistance was to help reduce its enormous backlog of water supply applications. The MORD envisioned that the USAID project would temporarily boost the output of installations. The output would then phase down to a level where the MORD, with its enhanced institutional capacity, could carry on adequately. The numbers of projects which have been developed as desired output levels are noted below. They are the basis upon which staffing requirements have been drawn up.

Table 2. Baseline Objectives for USAID Systems Installations and Maintenance

(1980 - 1986)

	Installation	Maintenance
USAID New Systems	142	142
USAID Reconstructed Systems	68	68
USAID Replacement Systems 1/	-	15
Other Donor Systems	-	90
Existing Systems	-	232
	210	547

1/ Replacement systems will not require additional installation staff as these are done on contract with a Lesotho company.

Table 3 and 4 depict the numbers and levels of personnel required to implement the above numbers of installations and maintenance operations. The figures for installations were derived by a systematic process of person day work-loading for each activity phase in the construction of each system type. The maintenance personnel computations were relatively simpler, as shown below, based on the needs of a decentralized organizational structure. However, a cross check was done to insure that the probable person days required for maintenance was not exceeded by the number of system breakdowns to be expected. These computations are shown in Appendix VII-E, Tables 1 through 5. The estimates made in all of these calculations were supplied by the professional engineering staff of the VWSS.

Table 3. Installation Personnel Required for AID Funded Systems at Height of Demand 1/

	Numbers
Chief Technical Officers	4
Senior Technical Officers	5
Technical Officers	7
Technical Assistant Officers	22
Laborers	33
Drivers	8
TOTAL	79

Table 4. Maintenance Personnel Required for All VWSS Systems (1980 - 1986)

Positions	Districts	Crew Staffing	Total
Technical Assistant Officers	10	1 per District	10
Laborers	10	2 per District	20
TOTAL			30

1/ Maximum demand will occur primarily in the last four years of the project.

About thirteen (13) administrative support staff will be needed to back up these additional technical installation and maintenance personnel over the life of the project. They include: 1 Personnel Officer, 1 Assistant Executive Officer (Registry), 2 Copy Typists, 1 Clerical Assistant, 7 Office Assistants, 1 Transport Officer.

The field allowances and field equipment costs for the technical personnel will also be covered by the GOL.

c. Availability of Additional GOL Staff to Implement AID Funded Project

Of all the institutional issues outstanding, staffing considerations are the most important. It has been found that shortages of potential senior and intermediate staff are the most severe constraint on achievement of project purposes.

Table 5 shows the numbers of personnel needed at each level, and the size of the personnel pool from which candidates could be drawn. The senior officer numbers (for CTO and STO) have been increased beyond the numbers shown for just AID funded projects, because the USAID training responsibilities encompass all staff at the VWSS. Thus, localization of the expatriate posts (7) and expected additions to establishment (4) are also reflected in these figures, making the total numbers required for each category 10 each.

Table 5. Numbers of Technical Personnel Required for System Installation and Maintenance

(1980 - 1986)

Positions	Number Required	Qualification Level Required	Numbers and Sources of Personnel in 1979
Chief Tech Of	10	B. Sc. Eng.	13 Nat'l Univ., Part 1, 2nd year, B. Sc. Science program
Senior Tech Of.	10	Dipl. Eng.	91 Secondary School graduates with "O" level passes in math and science.

1/ See Appendix VII-E, Tables 1 through 5, for method of computation.

Table 5 (continued)

Positions	Number Required	Qualification Level Required	Numbers and Sources of Personnel in 1979
Technical Ass't Off.	22(Inst) 10(Maint)	Technical School of Trade Cert.	- 270 Technical School graduates

As the Table above indicates, the pools from which people would be drawn are quite small. There are inadequate numbers of technical school graduates, secondary school graduates with "O" levels in math and science, and university students in science/engineering programs.

In addition, there are other problems which restrict the availability and likelihood of retaining the needed persons. They are:

1. Low GOL salary levels relative to the private sector and employment opportunities in the Republic of South Africa (RSA).

2. Unharmonized schemes of service under which some competing ministries can offer appointments at higher levels to persons with the same training.

3. A degree of inflexible position classification requirements which sometimes prevents persons without paper qualifications from b eing promoted to their true level of competency.

4. Lack of a systematic training plan, including localization schedule.

5. High turnover of staff at each level. Two conclusions have been drawn from the data and these situational factors:

- There is no chance of achieving a "self-sustaining" institutional capability in the VWSS during the life of the project. Only when the top ranks could be filled with B. Sc. graduates, and reliance on expatriates terminated, could that be possible. A second phase would thus be needed.

- A seven year time frame is necessary for the project. This will insure that the required numbers of personnel will be available; that the 225 scheduled projects can be produced, and that the skill transfer so essential to institutional development can be received and passed on.

While there are few short term remedies for the constraints mentioned, there are ways of coping with these real world problems. Basically, the project has been structured with achievable objectives, an active staff recruitment effort, and a practical training plan. In addition, there are other positive signs on the horizons:

- An enlarged enrollments effort at technical schools is being supported by a World Bank Education Loan,

- Reduced migrancy opportunities are expected in the immediate years ahead as the RSA attempts to employ more nationals to help with their own unemployment problem. This could raise the numbers of technically qualified personnel available.

- Harmonization and adjustment of schemes of service is a good possibility in the next couple of years. A Canadian team has submitted a report which is likely to be acted upon in the future.

2. Technical Assistance Staffing Implications

Technical assistance staffing in the project is shown in Table 6. It is designed to accomplish the following:

a. To allow sufficient time for new technical assistant staff to be housed, settle-in, integrated within the existing organization, and become acquainted with the rural water supply lessons of experience through working on on-going projects. This will also allow for possible delay in the arrival of drilling and installation materials, supplies, and equipment.

b. To concentrate on training the 70 or so existing technical staff in construction, drilling, survey, and hydrogeology areas, as well as the training of the 30 maintenance personnel will be stationed in the 10 regional and district centers.

c. To train those GOL and other technical assistance staff who will be the trainers of newer staff in subsequent years.

d. To set up work planning, control, monitoring and procurement and supply management systems before the heavy pressures of

installation building start.

e. To forge coordination linkages among the Ministries of Health, Agriculture, and Rural Development in the delivery of health education, sanitary facilities, home economics, nutrition, community development, adult education, and water systems constructions.

Experience indicates that providing early and adequate amounts of time for the performance of these institution building activities will yield the best chance for future successful operations.

Table 6. Technical Assistance Staffing Pattern (1980 - 1986)

Position	80	81	82	83	84	85	86	Total PY's
Team Leader, Engineer	X	X	X	X	X	X	X	7
Construction Engineer	X	X	X	X	X			5
Maintenance Engineer	X	X	X	X				4
Training Officer/ Construction Engineer	X	X						2
Health/Education Coordinator	X	X						2
Financial Management Specialist	X	X						2
Short Term Consultants								
- Drilling Engineer		X						3/4
- Hydrogeologist		X	X					1/2
- Miscellaneous								1 3/4
								25

With the above phasing of staff, the training and skill transfer functions will be accomplished before the pressure for production of new and reconstructed systems becomes especially heavy in the last five years. In this way both the institutional development as well as the construction, maintenance, and rural health outputs will be achievable. (See job descriptions in Appendix IV).

With regard to the possible contributions of Peace Corps personnel in the project a firm determination has been reached. The VWSS and Ministry of Rural Development are clear in desiring only experienced technical personnel in construction and maintenance. They indicate they would prefer to rely on other voluntary organizations for supplementary staff with technical backgrounds, if Peace

Corps cannot guarantee personnel with the required qualifications. Peace Corps has indicated that it is not likely to be able to fulfill these specifications.

There is more likely to be a role for AB generalist Peace Corps volunteers with the Ministry of Health to assist with health education and sanitary facilities installations.

4. VWSS Staffing and Productivity

A good deal of concern has been expressed by both donors and the GOL about the seemingly low number of system installations which have been done in the past few years. For this reason, a careful "productive capacity" analysis was undertaken. This analysis utilized the person days per installation type data originally compiled to estimate installation personnel requirements, together with computations of the actual work days each year for VWSS staff. It was found that when the total number of staff work days per year were divided by the number of work days needed to construct one average sized gravity system, the resultant annual VWSS capacity is 19 systems. (See Annex VII-E, Tables 6 and 7). The historical record of system installations has been: 16 in 1976; 15 in 1977; and 8 in 1978.

With maximum productive capacity at about 19, the present output of 7 is especially disconcerting. Two questions arose: First, what explains the below-capacity production of the VWSS; and second, would the larger scale of AID funded projects be affected by the constraints of the past?

The explanation of the discrepancy between theoretical and actual productive capacity involved four key factors:

- Inadequate training of employees in all fields causing greater frequency for breakdowns and lower standards of performance.

- Insufficient transport for personnel in all fields due to maintenance and repair down times.

- Lack of careful planning, programming and monitoring with proper coordination and communication.

- Inadequate logistical programming in which piping, fittings, pumps, tanks, etc, were not ordered and delivered on a timely basis.

These problems were especially prevalent in 1978, particularly the logistical programming issue. Each of these matters is addressed in the subsequent sections of this analysis, with a description of the activities programmed to deal with them.

The question of whether or not the AID project would be affected by the same productive capacity limitations of staff numbers remains. There are two reasons why the same problems should not arise. First, the aforementioned difficulties will have been largely dealt with. Second, when examining the numbers and types of projects to be carried out, it is found that the AID funded projects will benefit from two characteristics:

a. a highly productive and labor saving rotary drilling rig will be used to assist in producing 85 of the 142 new systems, or 60%. In addition, only 32 new gravity systems will be installed over the 7 years; while 68 existing systems will be improved through reconstructions. The latter are far easier and shorter to do. Other labor saving aspects of the installation schedule are that very few diesel and no windmill installations will be done. Each of these technologies normally take over 800 person days of work. By contrast, a number of spring protection systems will be carried out, and they take on average only 90 days per unit; (See Annex VII-F, Table 8);

b. especially careful person day estimates were drawn up with adequate flexibility for each of the types of systems to be installed. Neither of these approaches have been utilized in the past activities of the VWSS.

2. Training

Skill transfer in the planning, implementation, and up-keep of rural water supplies is one of the four principal outputs of the project along with systems installation and maintenance, and health and sanitary education. To accomplish this there are four major kinds of training which the USAID Training Specialist and Ministry Training Officer will set up.

a. Chief Technical Officer Positions

Three (3) Bachelor of Science in Engineering degrees have been programmed to address the need for professional technologist level staff. It would be desirable to program more persons at this level, but as noted earlier, there is a grave shortage of qualified

candidates to enter such programs. In addition, it is expected to be very difficult to retain B. Sc. Engineering personnel given present GOL salary scales. Because of the high cost of U.S. training, it is suggested that the USAID Team Leader may wish to identify appropriate training sites with lower unit costs, especially on the African continent or elsewhere in the developing world. This would permit more persons to be trained than just the 3 scheduled here.

b. Senior Technical Officer Positions

Twenty (20) Diplomas in Engineering have been programmed in order to secure at least 10 STO's. Expected turnover and drop out rates underlie the requirement for the high number of training starts. These persons will be trained at the newly established Lerotholi Polytechnic in Maseru. This institution has considerable multi-donor funding and staff, led principally by the United Kingdom. Out of a maximum of perhaps 25 places available per year, the Ministry of Rural Development should be able to secure about 5 places per year for four years. The course is directly relevant to engineering conditions and technologies in Lesotho, and includes one out of three years spent in practical internships.

It is planned to recruit, sponsor, and pay the fees and living expenses of 5 persons per year. They would do their practical internship with the VWSS in order to receive hand-on experience and contribute to installations and maintenance.

While some turnover will undoubtedly be experienced, it is the opinion of civil servants and educational officials that retention rates will be better than if reliance were placed on foreign institutions.

Candidates for diploma level training will be drawn from two sources; internally from present TA/TO staff as well as directly from secondary schools. This arrangement would provide a mobility path for present staff. For those individuals who lack sufficient math and science in their backgrounds, supplementary tutoring will be arranged where necessary. Those diploma graduates who demonstrate exceptional capabilities could be considered for B. Sc. level training after a year or two of work experience.

c. In-Service Training and On-the-Job Training

In general, one week per year of in-service training will be given to each level of staff, from STO down. A part of this should be an orientation to community development approaches. The bulk of training, of course, will be provided on-the-job in the field, as

installations are constructed and maintained. The USAID Training Specialist has been phased in to establish these training systems when the project is initiated.

1) Technical Assistant Officer Positions

The greatest numbers of personnel to be trained will be the TAO's. To the present complement of 35 will be added 33 more to accomplish both AID and other donor funded projects. Active recruitment of technical school graduates will be pursued to fill these slots. The technical schools produce craftsman level personnel who will fill construction crews of masons, plumbers, and carpenters, as well as maintenance crew leaders.

Their training will be of two types, on-the-job and in-service classroom. The USAID Training Specialist will be responsible for structuring learning experiences for them, developing materials and methods, conducting initial programs, and training other staff to do the same in the future.

2) Laborers

On-the-job and in-service training will be conducted, especially for 16 drillers and 20 maintenance crew personnel. A special effort will be made to identify talented laborers who could take trade tests and possibly qualify for entrance into TAO ranks.

d. Water Minder Training

There are estimated to be about 315 rural water supply systems at present, with 142 USAID and 90 other donor projects to be added. A total of 547 water minders will therefore need to be trained over the seven year period. While Basotho staff are needed to teach in the Sesotho language, the USAID Training Specialist will assist in the facilitation of scheduling, curriculum, sequencing, methods, materials, and evaluation.

e. Training PLans and Training Officers

A full time Training Officer for the Ministry of Rural Development as a whole has now been appointed and has begun functioning. He will work with the USAID Training Specialist. (A full job description for the Training Specialist is found in Appendix IV). Below is a summary Table 7 which depicts the training plan for the USAID project.

Table 7. Summary of Training Plan (1980 - 1986)

Type of Training	Positions	No.	Subject & Level	80	81	82	83	84	85	86
Participant Training	Chief Tech. Off.	3	B. Sc. Eng.	X	X	X	X	X	X	
	Senior Tech. Off.	20	Dipl. Eng.	X	X	X	X	X	X	
In-Service Training	Technical Officer	7	In-Service & on-the-Job	- 1 week per year - in the field						
	Technical Assistant Officers	68	In-Service & on-the-Job	- 1 week per year - in the field						
	Laborers	81	On-the-Job	- in the field						
	Water Minders	547	Power & Gravity Systems	70	75	90	90	85	80	57

3. Logistical Systems and Procedures

a. Transport

Vehicles provided under the project will be fully adequate for both Technical Assistance personnel and the 10 regional and district construction and maintenance centers. Furthermore, they fit the standardization efforts of the GOL with regard to equipment, can be serviced properly by the workshops, and spare parts are readily available. Costs have been kept to a minimum by targeting 4-wheel drive vehicles only for those mountain areas and assignments which require them. Cheaper half-trucks have specified as suitable for the lowlands and foothills.

As there has been considerable difficulty with vehicles maintained and repaired by the GOL's centralized government garage, it is planned that the VWSS workshops will service these new vehicles. Closer control, accountability, and turn-around time is expected. There are sufficient engineers and mechanics to insure this.

Replacement vehicles have been included because of the seven year length of the project. These are considered absolutely essential to successful completion of the installation and maintenance outputs of the

project. The heaviest workloads occur in the last four years of the project.

b. Procurement and Supply

As mentioned earlier the apparent low levels of systems installations and the productive capacity analysis led to an investigation of causes. Procurement and Supply arrangements have been identified as the principal problem. Donor country requirements lay behind a good part of the issue. Other delays are due to paperwork bottlenecks in the GOL with regard to locally supplied items.

In the past the major donors of water supply systems have required that ordering of materials and supplies can not take place until the following steps have been completed: preliminary surveys, detailed designs and costings, formal approval by donor agency, and physical release of funds. This process might easily take a year to complete. Subsequently, the preparation of purchase specifications, submittal to the Central Tender Board, tendering procedures, awards, shipment and inland transportation had to occur. The process has often been known to take up to two years to complete; and along the way, the prices of the specified materials have often changed, requiring some modifications.

In this project the sequence of steps as outlined above for donor projects has been reversed in such a way that materials and supplies will be available as soon as a water system site has been properly surveyed and approved. Instead of waiting for a one-by-one site-specific detailed survey to be carried out, this project would, in principle, fund 210 water systems. Capital supplies have been programmed to arrive in time to keep up with the installation program, which in turn is based on prior training efforts and availability of technical staff. The VWSS and particularly the USAID supplied technical assistance team leader, will then participate in the decision-making process for each specific water supply system to be funded by the project. Proper standards and controls can thus be insured, without incurring costly delays.

There are two important elements in this process. The first will be the ordering of commodities as soon as possible after the project agreement is signed, and before the technical assistance personnel arrive. The second is that the USAID team leader and the Financial Management Specialist shall function in part as the procurement and supplies personnel for at least USAID funded activities.

Delays in the local procurement of items through the GOL Central Tenders Board is not an easily resolved item. In the short term, the existing procedures must be accepted and work must proceed within that framework. The Financial Management Specialist will bear some of the burden of handling supplies expedition in the beginning. He will help to establish an improved supplies management system and train a GOL colleague to gradually assume the responsibility.

It is encouraging to note that other donors have recently come to understand the procurement problem; and that they are beginning to provide up to 80% advance funding to deal with it. There is considerable likelihood, then, that the low 1978 level of systems installations will not be repeated again.

4. Organizational Structures and Functions

Three dimensions of organizational structures and functions require discussion. The first relates to the internal coordination of Ministry of Rural Development and the VWSS; the second concerns inter-ministerial cocordination of efforts related to water supplies and health; and the third anticipates the type of inter-donor and GOL joint effort which will be required.

a. Internal Coordination

1. Central Administration and VWSS Technical Division

Charts I, II, and III depict the organization structure of the Ministry, the VWSS, and the field administration level of work. Since the Swedish Consulting Group's organization study on the VWSS and the Feachem Report, knowledge of and sensitivity to a wide range of organizational and administrative issues has been heightened and spread. A number of changes were made in the organizational structure of the Ministry and the VWSS, which have improved the functioning of all units. The outstanding issues are only the perennial difficulties that a technical division and a headquarters administration have in coordinating their work. Misunderstandings and lapses in careful communication do occur on personnel, supplies, planning, transport and accounts issues. There is, however, good will on all sides to meet regularly and improve coordination of effort. To assist this process, a Rural Development Coordinator has been appointed and is located in the VWSS physical facility.

2. Field Administration

(i) Decentralization. The major innovation to take place at the time of this project is the decentralization of many maintenance and construction activities to the 10 regional and district centers. Three of the district centers will be located together with the regional offices. Each regional office will supervise and support the activities of its constituent districts. The regional offices will undertake major drilling and construction equipment maintenance, as well as be prepared to correct serious breakdowns in water systems. District centers will be able to take care of routine and minor maintenance problems that occur; and especially to give technical support and additional training to village water minders as needed. Together with the USAID support, this structure should considerably enhance proper maintenance throughout the country.

Each regional and district center will also serve as a store for various types of supplies used in equipment and system construction and maintenance. Supplies will thus be closer to those who need them; and lessen the dependence on headquarters linkages and the consequent delays.

(ii) District Committees and Selection Criteria. The DCDO in each district is the head coordinating officer for the Ministry. The officer sits on the District Development Committee (DDC), and participates in the water supply system selection process. The DDC is composed of all district ministry heads, chiefs from the area, members nominated by the Prime Minister, and coopted prominent citizens who the District Administrator (DA) and committee thinks could make useful contributions. The DDC debates and draws up its suggested priority lists, based on the selection criteria suggested in the Feachem and Metcalf Eddy Reports. Thanks to a considerable adult education effort with DDC members these criteria are now widely known and accepted as the relevant ones. The weighting given to various factors will naturally differ from place to place according to local circumstances.

(iii) Community Development

The coordination between the DCDO and VWSS field staff is generally good. In the future coordination must become more intense and more sophisticated as the pace of project implementation picks up. It is expected that 20 additional Community Development Assistants (CDA's) will be hired to assist the DCDO in preparing the way for better system introductions in the villages. It is planned to coordinate the community development aspects of installing a water system far more closely in the future. This coordination will encompass the representatives of other Ministries such as the Ministry of Health which has sanitary inspectors, health assistants, and village health workers in the areas. All of these personnel will be attempting to

dovetail their efforts more closely.

(iv) Rural Resource Planners. These more integrated efforts will be supported by other innovations taking place at the district level more generally. It is planned for 10 United Nations volunteers to come serve as Rural Resource Planners in each district in the future. GOL is considering assignment of these former District Development Secretaries toward levels in order to be in closer contact with principal chiefs and citizens in the villages.

(v) National Rural Development Coordination. All of these factors in field administration are taking place against a background of the Wilmot Report. The Wilmot Report advocates utilizing the Ministry of Rural Development in part as an inter-ministerial clearing house and coordinating body for national rural development efforts at the Maseru top management level. The matter is under discussion at Cabinet level.

3. VWSS Issues

(i) Structure. There are no major structural issues at present within the Section. Most have been adequately resolved in the past. Functional units to deal with surveying, hydrogeological examination, drilling, construction, maintenance, transport, and stores have been established and appear to coordinate reasonably well. The only concern one has is that as the Section grows larger over the course of the USAID project, that it will be necessary to enforce a team spirit among divisions. Otherwise, the natural tendency to become overly "departmental" could lessen coordination.

(ii) Integration of USAID Technical Assistance Personnel

An area where there is always the possibility of unnecessary friction is in the integration of a new group of technical assistance personnel. The policy of the Ministry, the thinking of the USAID Mission, and the findings of this analysis are that the USAID personnel and resources should be fully integrated into the normal on-going operations of the VWSS. This will mean that in the first two or three years that US personnel will function for all practical purposes as GOL advisors in the performance of their technical functions. Although categorized as advisors, they will fill operational positions as Chief Technical Officers in charge of maintenance and construction in all regions or as assigned. They will be available to work on other donor projects as necessary, and will not restrict themselves solely to USAID funded projects. In the last four to five years as USAID funded projects begin to be implemented in considerable numbers, it is only natural that they will tend to work more on them.

The USAID Team Leader will function as a Chief Technical Officer and professional engineer staff advisor to the Senior Engineer (a newly established position for which a Mosotho is being recruited). He will have special responsibilities for procurement and supply, work planning and control, and administrative leadership for the other USAID funded personnel. Technical direction, however, will come through a unified chain of command from the Senior Engineer. This unified chain of command is based on agreed upon objectives, roles, and program of the USAID funded personnel envisioned in this project. Basic departures from these agreements would normally be the only cause of significant potential conflict.

b. Inter-Donor and GOL Coordination

The major issue which arises here is that of the termination and initiation of donor funded efforts. The ability of the USAID funded project to achieve its purpose is premised in part on the presence of other donors' capital and personnel contributions to the VWSS operations. Terminations of other donor personnel, especially, would place too great a burden on the remaining USAID staff. They would be unable to implement the volume of both other donor water supply systems and those funded by the U.S. similarly, new initiatives for water supply systems from other donors should naturally be carefully coordinated to ensure that they are within the VWSS's productive capacity. An inappropriately phased contribution could overburden the organization in the same way that an abruptly terminated assistance effort would. Proper advance planning and coordination is naturally called for from all parties. All indications are that there will be continuity in donor contributions, and close collaboration among them.

c. Inter-Ministerial Coordination

Inter-ministerial coordination is required at two levels. The first is in the capital among the professional staffs of the VWWS, Community Development Section, the Ministry of Health, the Ministry of Agriculture, the Ministry of Education, and the private health and school associations. These staffs will normally have to meet at least quarterly so that each can keep the other informed of their efforts in health education, sanitary facilities, home economics, nutrition, school health science education, and so on as related to the water system installation and maintenance programs. Those cooperating organizations who have personnel in areas where water projects are being established can then make quarterly plans for joint action based on the VWSS schedule. The VWSS work plan will tend to be the dominant factor, as drilling and construction activities must necessarily be located with due regard to seasonality and other technical and economic factors.

Coordinating meetings will allow mobilization of available resources to achieve the health education output envisioned in the project.

The second level of coordination required is in the field. This can only occur if the results of the headquarters meetings of professionals are well and fully communicated to their district field administrators. At this point the district representatives will form their own informal coordinating groups to plan their activities ward by ward and village by village.

The USAID funded Rural Health Coordinator will provide the impetus through which this interministerial consultation and practical planning can take place.

d. Administrative Processes

The two most significant administrative processes involved in the VWSS (in addition to logistics management) concern the application of selection criteria and the overall planning-programming-monitoring system. As indicated in the preceding section on project selection criteria at the district development committee level, there is no outstanding problem in this area. The technical and professional criteria which have been evolved are widely understood and utilized both in the field and at headquarters. The USAID team will be able to participate in and monitor each selection.

With regard to planning and programming, there is a great deal that can and will be done with the assistance of the USAID Team Leader and Financial Management Specialist. The present Principal Technical Officer has initiated various systems of proper record keeping which are appropriate. The additional personnel provided under the USAID project will enable full implementation of these essential paperwork processes.

CHART I: MINISTRY OF RURAL DEVELOPMENT - ORGANIZATIONAL SCHEME

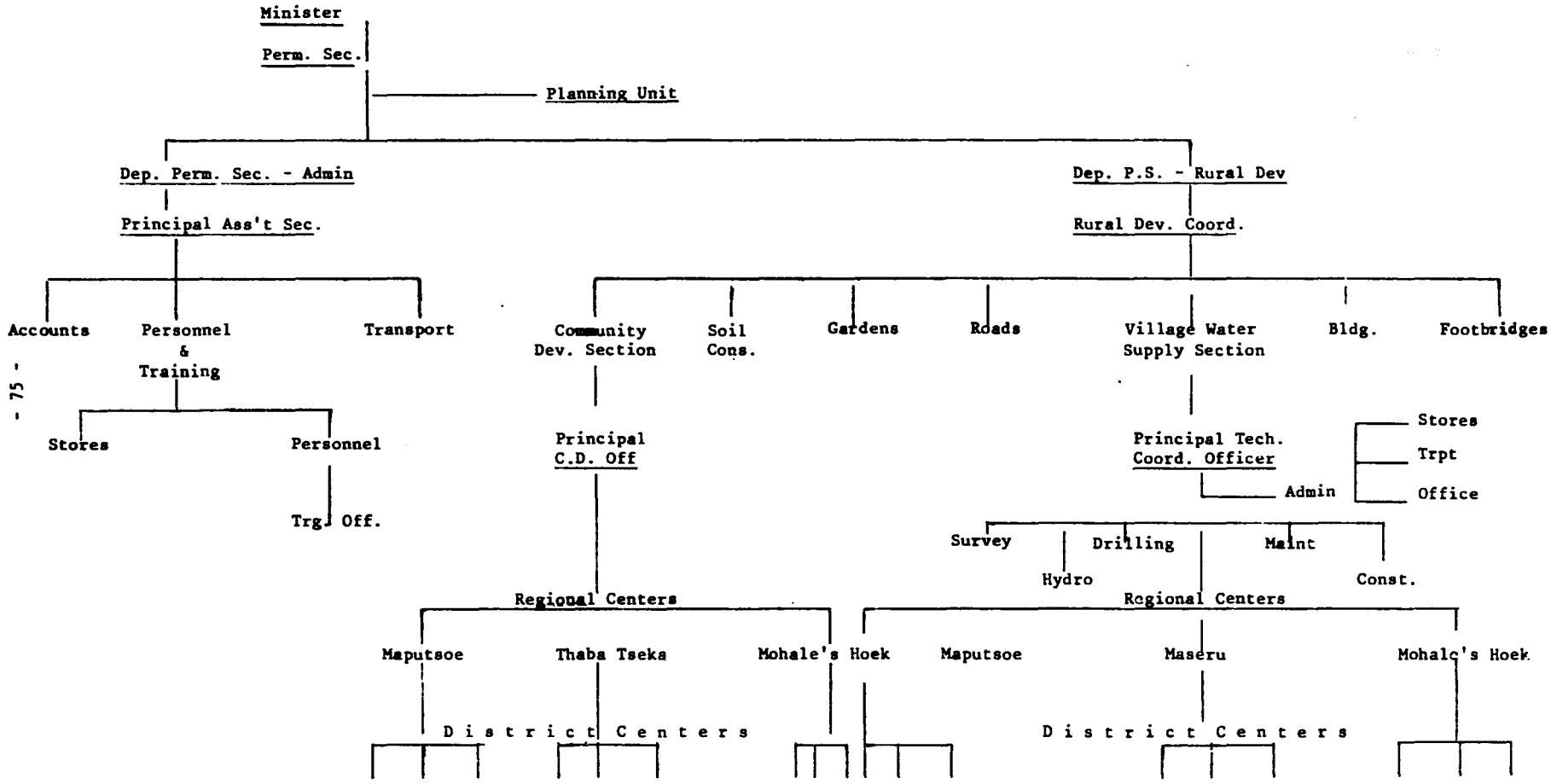


Chart II: Village Water Supply Section of the Ministry of Rural Development

PTCO	
PTCO/a	A. HARTMANN

AID 7 — Coordinating link — — — — — — — — AID 1, 2, 3

ADMINISTRATION

AS	K. MAPHELEPE

OFFICE

Ty	A. MATSIPA
Tel O	D.M. LAZARUS
Cler A	
Mes 1	A.L. SEBOTA
- 2	M. MONYAMA
Cl 1	M. LEBOKO
- 2	P. TSOLIHANE
- 3	M. MAKOANYANE

STORES MASERU

Sk	J. LETNONO
A Sk 1	N. MOHALE
- 2	N. MAKAE
S Ca	J.C. MOLOMO
Wat.	T. LEKENA
Lab 1	T. MAMASHAMOLE
- 2	K. KANETANE
- 3	T. MAMELE
- 4	L. MALAKIA

STORES QUTHING

Sk	
A Sk 1	
- 2	
Wat.	
Lab 1	
- 2	
- 3	
- 4	

TRANSPORT

Dr. 1	N. MONAPI
- 2	L. MCHERE
- 3	T. LIBOTI
- 4	MORAME
- 5	MOTOLO
- 6	R. MOTLOMELA
- 7	
- 8	
- 9	
- 10	

STORES MAPUTSOE

Sk	
A Sk 1	
- 2	
Wat.	
Lab 1	
- 2	
- 3	
- 4	

DRILLING — AID 6

STO	T. NTEPE
TO	S.T. MAKOANYANE
TAO 1	P. MALAKENI
- 2	M. SETUMO
- 3	S. ROJANE
- 4	
Lab 1	N. MAFIKA
- 2	M. RATHEBE
- 3	S. RAFONO
- 4	T. MOTLALETSI
- 5	K. NTLALO
- 6	N. MANLOMANOLO
- 7	R. MOSOKA
- 8	T. MOTNAE
- 9	P. BENLE
- 10	T. RANTSANE
- 11	S. MABOKO
- 12	L. LEMPHANE
- 13	D. MONAESA
- 14	T. MATSOAPO
- 15	L. MAFOMEKOANE
- 16	M. MATOASELE
- 17	
- 18	
- 19	
- 20	

MAINTENANCE

STO	AID-A
STO/a	S. BALLE
TAO 1	S. MOLEMANE
- 2	T. TAU
- 3	M. MATORO
- 4	P. LIETO
- 5	L. LEBOELA
- 6	S. MAKHABANE
- 7	E. LIANOLO
- 8	
- 9	
- 10	
Lab 1	M. MPOPO
- 2	T. TSIAME
- 3	T. LERATA
- 4	
- 5	
- 6	
- 7	
- 8	
- 9	
- 10	
- 11	
- 12	
- 13	
- 14	
- 15	
- 16	
- 17	
- 18	
- 19	
- 20	

CONSTRUCTION

CTO 1	— AID 5
- 2	
- 3	
CTO/a 1	A. MASSOT
- 2	K. BGLI
- 3	G. ROTH
STO	
TO 1	S. NTOI
- 2	
- 3	
TAO 1	P. MOSOABOLI
- 2	P. MAKARA
- 3	M. PETJE
- 4	R. MAPESHOANE
- 5	B. MAEKISO
- 6	A. RAMAKOSI
- 7	M. MAKHALANYANE
- 8	T.V. KHOMARI
- 9	N.J. MPOLI
- 10	M.R. MOHAPOLA
- 11	P. SEKHESA
- 12	S. THAKHOLI
Mes 1	S. KABI
- 2	R. MAKHOTE
- 3	L.P. SEKHESA
- 4	R.A. MAKHOINE
- 5	L.B. TJABANE
- 6	
Car 7	R.L. HOOHLO
- 8	S. PANYANE

SURVEY — AID 6

STO 1	T. HLABANA
- 2	K. KANETSI
- 3	
STO/a	J. VAZ
TAO 1	S. LEUTA
- 2	
- 3	
Ch 1	M. MOETI
- 2	
- 3	
Dra 1	
- 2	

HYDROGEOLOGY — AID 7

STO	K. MAKAMWA
TAO	S. FAKO
Lab 1	K. TOEPE
- 2	T. NTSASA

WORKSHOPS MASERU

TO	GM SETILO
TAO 1	A.N. TSANYANE
- 2	P. LIPHIMO
- 3	R.J. MAITI
Com	N. RAMMAI

MAPUTSOE

TAO 1	
- 2	

MOHALE'S HOEK

TAO 1	
- 2	

- 76 -

ABBREVIATIONS

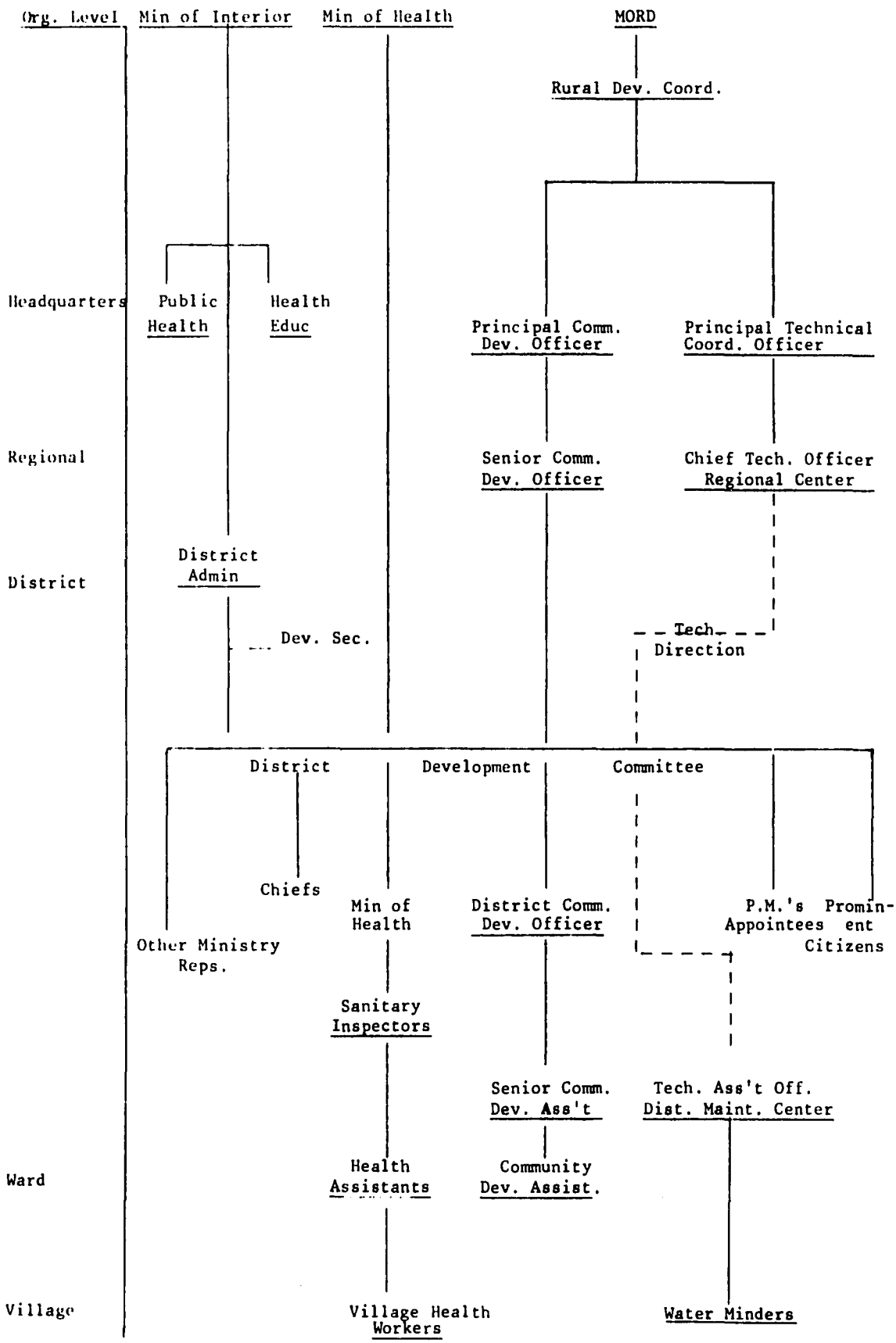
-/a	advisor
AS	Assistant Secretary
A Sk	Assistant Storekeeper
Car	Carpenter
Ch	Chainman
Cl	Cleaner
Cler A	Clerical Assistant
Com	Compressor Operator
CTO	Chief Technical Officer
Dr	Driver
Dra	Draughtsman
Lab	Labourer
Mas	Mason
Mes	Messenger
PTCO	Principal Technical Coordinating Officer
S Ca	Store Caretaker
Sk	Storekeeper
STO	Senior Technical Officer
TAO	Technical Assistant Officer
Tel O	Telephone Operator/Filing Clerk
TO	Technical Officer
Ty	Typist
Wat	Watchman

AID T.A. Personnel

1. Engineer, Team Leader
2. Training Specialist
3. Fin. Mngt. Spec.
4. Maint. Eng.
5. Const. Eng.
6. Short Term Cons.
7. Health Ed. Coord.

4.1.79

CHART III: FIELD ADMINISTRATION SCHEME



IV. Implementation Arrangements

A. Recipient Project Administration

The GOL's Ministry of Rural Development has responsibility for designing and implementing programs and projects in community development and rural development (with the exception of those which fit more comfortably within one of the other Ministries such as Health and Agriculture). The Village Water Supply Section of the MORD will be the unit responsible for working in a collaborative manner with technical assistance personnel provided under this project. The technical assistance engineers will be serving in an advisory capacity to Basotho counterparts concerned with the maintenance, construction and design of village water supply systems. The team leader (a civil engineer) would report directly to the Permanent Secretary of the MORD, and the PTO. The other technical assistance personnel will be under the general direction of the team leader, but would be expected to work with Basotho counterparts in their respective fields of expertise on a day-to-day basis.

B. AID Project Administration

AID management of the activities planned under this project will be the responsibility of USAID/Lesotho. Day-to-day monitoring of the project will be responsibility of the Director, USAID/Maseru or his designee who would serve as the project manager. The Director or his designee would serve as the primary point of contact for the team leader, and will be responsible for assisting in the identification and resolution of any problems concerning project implementation. It is anticipated that in matters concerning commodity procurement, contractual and/or legal matters, the assistance of the REDSO/EA or AID/W support staff will be solicited.

Upon signature of the Project Agreement prepared by REDSO/EA legal staff, steps will be taken to initiate the required construction contracts and services, procure commodities initially needed, and begin the identification and selection of the first class of trainees to start technical school training in Engineering in Lesotho. The necessary Project Implementation Order's for commodities, technical services and training will be prepared by USAID/Maseru with assistance from REDSO/EA or AID/W as needed.

AID will disburse funds for recurrent costs on a reimbursable cost basis. As plans for constructing systems and accompanying cost estimates are developed, AID will review these to determine their adherence to systems design criteria. AID will also review the selection of individual villages for installation of water systems in terms of the standard criteria for selection of villages, and

the constraints and needs listed in the social analysis section. It is anticipated that funds for the housing and maintenance facilities construction will be disbursed on a fixed amount reimbursement basis. If advances are necessary for construction or recurrent project costs, as it is anticipated they may be, procedures for advances will be outlined in Project Implementation Letters.

C. Implementation Arrangements

As mentioned earlier, this project will be implemented by a team of technical assistance advisors. It is anticipated that these individuals would be contracted through an institutional contract. PIO/C's to procure commodities should be issued well in advance (at least 6 months, preferably one year) of when these commodities will be needed to construct village water supply systems, since most of these commodities will be procured from the U.S. (with the exception of vehicles, diesel engines, windmill parts and cement, rebar and steel tanks which will be purchased locally from Code 935 countries). Participants for long-term training in the U.S. should be identified as soon as possible in recognition of the problems which are anticipated in this regard (see Institutional Analysis).

Implementation Schedule

Month	Action	Responsible Organization(s)
D 1/	P.P. completed and submitted	Mission
D + 1	P.P. approved	AID/W
D + 2	Pro-Ag approved and signed	GOL/Mission
D + 2	PIO's for commodities, technicians issued	Mission/REDSO/EA
D + 5	Local contracts for construction of facilities issued	Mission
D + 10	10 L.T. (Lesotho) candidates identified and selected	GOL/Mission
D + 15	First class of 10 L.T. (Lesotho) participants begin technical training	GOL
D + 6	Vehicles purchased	Mission
D + 12	Technical assist. team leader arrives, two-year work plan developed	GOL/Mission
D + 14	Other technical assist. personnel arrive	GOL/Mission
D + 17	U.S. procured commodities arrive; local materials, supplies purchased	Team leader/GOL, Mission

1/ D now estimated at June, 1979

Month	Action	Responsible Organization(s)
D + 9	L.T. (U.S.) participant(s) identified and selected	GOL/Mission
D + 19	U.S. commodities procured (PIO's C's issued)	GOL/Mission
D + 15	First class begins training	GOL
D + 19	Annual evaluation conducted	Mission/GOL
D + 21	U.S. procured commodities arrive; L.T. (U.S.) participants identified and selected; local materials purchased	GOL/Team Leader/ Mission
D + 24	Second class of (5) L.T. (Lesotho participants identified and selected; PIO/P's for L.T. (U.S.) issued	GOL/Team Leader/ Mission
D + 25	PIO/C's for U.S. commodities issued	Mission/GOL
D + 27	Second class L.T. (Lesotho) participants and L.T. (U.S.) participants begin training	GOL
D + 31	External evaluation conducted; new work plans developed	Mission
D + 33	U.S. commodities arrive	GOL/Team Leader
D + 36	Third class of L.T. (Lesotho) participants identified and selected	GOL/Mission
D + 37	PIO/C's for U.S. commodities issued	Mission/GOL/Team Leader
D + 49	First class of L.T. (Lesotho) participants return and placed	Mission/GOL/Team Leader
D + 43	Replacement vehicles ordered; annual evaluation conducted	Mission
D + 45	U.S. commodities arrive	GOL/Team Leader
D + 49	PIO/C's for U.S. commodities	Mission
D + 55	External evaluation held	Mission

D. Contracts

Local contracts will be issued for the construction of physical facilities required for this project.

E. Evaluation Arrangements

Project evaluation will be an ongoing critical component of this activitiy. Continuous internal evaluations, annual evaluations and three external evaluations are scheduled to insure that project objectives and commitments are met:

1. Internal Evaluations

Internal evaluations are "in-house" appraisals on the part of the project manager, technical assistance personnel, and appropriate MORD

staff to insure that project activities are being directed toward the achievement of project purpose and outputs. These reviews will be scheduled periodically each year at the discretion of the project manager.

2. Annual Evaluations

The Mission will be responsible for preparing project evaluation summaries (PES's) which will evaluate performance towards outputs and objectives stated in the work plan. Through this process, problems can be identified and corrective action taken as appropriate.

3. External Evaluations

Three external in-depth evaluations are scheduled during the 9-year life of this project. The first two evaluations will be held at the end of the second and fourth years of the project. These evaluations will examine:

a) progress toward achieving output and project purpose, which will include numbers of systems constructed, and reconstructed, interaction between MOH and MORD, training of Basotho counterparts and waterminders, village participation in construction and maintenance activities and benefits being derived from employing health and sanitary measures;

b) insure that technology being applied is most appropriate among those recommended; and

c) changes or modifications in the work plan or project design which may need to be made to insure the success of the project in achieving its objectives.*

The final external evaluation will take place at the end of year six to determine the project's effectiveness and impact on the institutional structure of VWSS and the villages which have received improved water supplies, health education and sanitary facilities. This evaluation will also analyze the need for a post project evaluation - and if one is needed, when and by whom.

These evaluations will be undertaken with the assistance of AID-funded experts from outside the Agency in such areas as engineering, (village water systems) health education, sanitary engineering, sociology and management planning and administration. Scopes of work for these evaluations will be developed jointly by the Mission and MORD. Team personnel selected will receive the concurrence of both the Mission and the GOL/MORD and may include staff from AID/W and REDSO/EA if appropriate.

*Note: The fifth year evaluation will closely examine progress in both institutional development and the physical construction of systems, and, on the basis of funding availabilities at that time, readjust as necessary the overall output projections for systems construction such that the institutionalization of this program is ensured over the life-of-project.

F. Conditions, Covenants and Negotiating Status

The following conditions and covenants, which may be subject to modification, have been tentatively identified:

Conditions Precedent

1. Prior to the issuance of any commitment documents or any disbursement under the Project Agreement to finance construction of housing or maintenance centers, the Grantee will furnish in form and substance satisfactory to AID, (a) final plans and specifications for the units to be constructed, and (b) evidence that sites have been allocated for the construction component of the project and these sites are adequate for project purposes. This condition may be satisfied separately for each unit of construction.

2. Prior to the initiation of construction activities for the installation or rehabilitation of village water supply systems, the Grantee will furnish in form and substance satisfactory to AID, a detailed project work plan covering installation and rehabilitation activities to be undertaken during the first two years of the project, and a general plan for construction activities to be undertaken during the balance of the project.

Project Implementation Letters (PILs) will describe more completely the content of these plans, but the two-year plan should include, unless AID otherwise agrees in writing, proposed construction scheduling, design standards for each village water system, evidence that village selection criteria have been complied with, description of the procedures used to select villages to participate in the program, personnel and materials requirements, and evidence that participating villages have established a system to fund minor maintenance requirements. Additionally, these plans will be updated on a periodic basis; the timing and content of these updates will be the subject of PILs.

Covenants

The Grantee will covenant, substantially, as follows:

1. To provide qualified personnel to undertake project financed training in accordance with the training schedule included as part of the amplified project description of the project agreement. The Grantee will also covenant that persons undertaking long-term training will be assigned to positions with the VWSS, or such other positions as the Parties may agree, which are commensurate with the nature and level of training received.

2. To gazette or otherwise establish, within six months from date of the project agreement or such other date as the Parties may agree to in writing, positions for the chief technical officers to be trained under the project. Additionally, the Grantee will covenant to gazette or otherwise establish positions for senior technical officers and other personnel in accordance with the schedule included as part of the amplified project description of the project agreement. The periodic reports referred to in c.2. above will address, in part, progress towards establishing required positions.

3. To provide on a timely basis all personnel required for the implementation of the project. Such personnel, more completely listed in the amplified project description, include: support and technical staff for the VWSS, community development staff to assist District Community Development Officers, and public health personnel. The report cited in c.2. above will address, in part, progress towards fulfilling these requirements.

4. The Parties, recognizing that coordination between health and construction components of the project is essential to the overall success of the project, agree that periodic discussions among the Ministries of Health and Rural Development and AID will be held at times mutually agreed upon in PILs to ensure that such coordination is being effected.

5. To provide the recurrent budget support for the project in the amounts and by the dates specified in the amplified project description.

6. To provide, in form and content and by a date specified in PILs, a report indicating the procedures to be utilized to monitor the potability of water brought into villages under the project and to monitor system maintenance needs.

7. To utilize the village selection criteria and procedures set out in the amplified project description to determine which villages will participate in the program.

8. To submit, within 90 days from the date the project agreement is signed, or such later dates as AID may otherwise agree to in writing, a plan for preventive and corrective maintenance of vehicles acquired by the VWSS. The periodic reports cited in c.2. above will address the repair status of such vehicles.

9. To take such steps as may be necessary to ensure that proper health and sanitary measures are employed prior to the design, construction or rehabilitation of water supply systems.

ANNEX I

AID/W PID Approval Message

CLASSIFIED

EDU	
CON	
EXO	
AGR/S	
GSO	
EDU/TRG	
TRG	

R 292136Z MAR 78
FM SECSTATE WASHDC
TO RUEHMB/AMEMBASSY MBABANE 6596
INFO RUEHMU/AMEMBASSY MASERU 0252
RUEHOR/AMEMBASSY GABORONE 3908
RUVQC/AMEMBASSY NAIROBI 8342
BT
UNCLAS STATE 080912

AIDAC, NAIROBI FOR REDSO

E.O. 11652: N/A

TAGS:

SUBJECT: (LESOTHO) RURAL WATER SUPPLY (632-0088)

1. SUBJECT PID IS APPROVED.

2. PROJECT COMMITTEE, WITH AOO MASERU PARTICIPATING, REVIEWED PID ON MARCH 9TH, RECOMMENDING FOLLOWING GUIDANCE FOR OSARAC AND DESIGN TEAM IN DEVELOPMENT OF PP:

A. SINCE INTENT OF PROJECT IS TO LEAVE DURABLE INSTITUTIONAL CAPABILITY IN PLACE UPON TERMINATION OF PROJECT ACTIVITY, CARE SHOULD BE TAKEN TO SEE THAT EXCESSIVE TECHNICAL ASSISTANCE IS NOT PROVIDED AS A SUBSTITUTE FOR TRAINING. TO THIS END, EXTENSIVE DETAIL SHOULD BE DEVELOPED ON TRAINING--ITS SUBSTANCE AND ITS LOCALE--WITH PARTICULAR EMPHASIS ON THE AFRICAN CONTEXT (E.G., USE OF THE PAN AFRICAN INSTITUTE FOR DEVELOPMENT). HEAVIEST STRESS IN THE TRAINING DESIGN SHOULD BE GIVEN TO FOCUSING UPON ON-THE-JOB TRAINING OF VILLAGERS SO THAT UP-KEEP AND MAINTENANCE DO NOT BECOME DEPENDENT UPON INDEFINITE TECHNICAL ASSISTANCE. IF THE FIVE-YEAR FUNDING PERIOD AND SIX-YEAR PROJECT LIFE IS MORE DIRECTLY RELATED TO AID GUIDELINES THAN TO A REALISTIC APPRAISAL OF TIME REQUIRED FOR THE GOL RURAL WATER SUPPLY AND SANITATION FUNCTIONS TO MATURE AND STABILIZE, OSARAC SHOULD PROPOSE A MORE APPROPRIATE PROJECT LIFE EVEN IF SUCH INVOLVES DEVIATION FROM THE NORM.

B. SUGGEST EMPHASIS UPON HEALTH EDUCATION AND EXCRETA DISPOSAL ASPECTS OF PROJECT BE UNDERSCORED BY CHANGING PROJECT TITLE TO QUOTE RURAL WATER SUPPLY AND SANITATION UNQUOTE.

C. SECOND SENTENCE OF PAGE 10 OF PID IMPLIES THAT DIARRHEA AND TYPHOID ARE NOT WATER-BORNE DISEASES, WHEREAS, CONCLUSION OF FEACHAM REPORT WAS THAT CONTAMINATION OF WATER WAS TAKING PLACE AWAY FROM ITS SOURCE. THIS POINT SHOULD BE CLARIFIED IN PP.

UNCLASSIFIED

D. TO SUBSTANTIATE IEE, ENVIRONMENTAL SOUNDNESS OF INSTALLATIONS AT VARIOUS SOURCES OF WATER, PARTICULARLY AT RIVER SOURCES, SHOULD BE SPECIFICALLLY DESCRIBED. SIMILARLY, FOR PURPOSES OF 611(A) DETERMINATION, DETAILED EXAMINATION OF QUOTE TYPICAL PROJECTS UNQUOTE MUST BE MADE. FACTORS SUCH AS TRANSPORTATION COSTS, DRILLING COSTS AND TIME IN VARYING FORMATIONS, LOCAL LABOR COSTS (COMPETING AGAINST RSA WAGES) MUST ALL BE CONSIDERED IN ANY BLANKET DETERMINATION. UNRELATED CONSTRUCTION, SUCH AS TRAINING DORMITORIES, MUST BE CERTIFIED INDEPENDENTLY RATHER THAN BEING INCLUDED IN THE PROPOSED BLANKET DETERMINATION.

E. WHILE EMPHASIS IN WATER SUPPLY PORTION OF P ROJECT WILL BE ON RECONDITIONING EXISTING SUPPLY SYSTEMS AND IN PROTECTING AND UTILIZING SPRINGS WITH GRAVITY FEED, THERE WILL BE SOME WELL DRILLING INVOLVED. IF THE VILLAGE WATER SUPPLY SECTION OF THE MINISTRY OF RURAL DEVELOPMENT DOES NOT HAVE THE REQUIRED EQUIPMENT AND PERSONNEL CAPACITY, BOTH EQUIPMENT AND TRAINING FOR WELL DRILLING CREWS NEED TO BE INCLUDED, SUBSTANTIALLY RAISING COST ESTIMATES PROVIDED IN PID.

F. EXISTING SUPPLY SYSTEMS AND THOSE INITIATED IN THE FIRST TWO YEARS OF PROJECT WILL HAVE A FIVE OR MORE YEAR OPERATIONAL HISTORY, SUGGESTING THAT THEREFORE SOME CAPITAL EQUIPMENT (E.G., PUMPS AND WINDMILLS) MAY BE NEARING END OF USEFUL LIFE AT EOP. PP AND PROAG SHOULD INDICATE CONSIDERATION OF GOL'S CAPABILITY TO SUSTAIN THE INCREASED INVESTMENT AND MAINTENANCE REQUIREMENTS SUBSEQUENT TO LOP.

G. PP TEAM SHOULD INCLUDE TRAINING CONSULTANT. USE OF AFRICAN EXPERTISE (SEE MASERU 0692) IS ENCOURAGED. TEAM

SHOULD REVIEW ATAC EVALUATION OF SIMILAR CARE PROJECT IN KENYA.

H. IMPLEMENTATION BY A PVO SUCH AS CARE, AFRICARE, OR OTHERS SHOULD BE CONSIDERED.

I. INDIRECT AS WELL AS DIRECT SOCIO-ECONOMIC BENEFITS SHOULD BE SPECIFIED IN PP.

J. COSTS SHOULD INCLUDE PROBABLE INFLATION FIGURES. COOPER

ANNEX II

PROJECT TITLE: RURAL WATER SUPPLY, LESOTHO

PROJECT NO.: 632-0088

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

FROM: FY79 to FY84

DATE PREPARED: February, 1979

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Goal: To assist the GOL in improving the health and basic living conditions of Lesotho's rural poor.	1. Reduction of water-borne and water-related diseases in rural villages in Lesotho. 2. Reduction in morbidity in rural villages, particularly among young children.	1. MOH records from hospital rural health centers and clinics, etc. 2. Rural Health project appraisal and evaluation reports.	1. That the GOL and MOH will continue to support a program of providing improved health and services to rural areas of Lesotho. 2. That a positive corelation exists between the overall health status of rural people and the provision of clean water supplies.
Purpose: To assist the GOL in developing the institutional capacity of a MORD/VWSS in designing, constructing and maintaining new and existing rural water supply systems which reflect health and sanitary education considerations.	EOPS: 1. VWSS maintenance unit will be fully staffed by trained Basotho personnel. 2. Organizational and operational procedures within VWSS will be significantly improved and institutionalized. 3. There will be effective coordination between MOH and MORD as it concerns health and sanitary measures utilized in rural areas with	1. GOL personnel records. 2. Project evaluations. 3. MOH and MORD records; Rural Health project evaluations. 4. MORD records.	1. That GOL will be able to absorb personnel trained for staffing VWSS. 2. That MORD/VWSS will be receptive to changes in organizational/operational procedures. 3. That MOH and MORD are willing to coordinate and work cooperatively.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	water supply systems. 4. MCRD/VWSS will be able to assume all recruitment costs.		4. That GOL will be able to budget funds to cover recurrent costs.
Outputs: 1. Increased numbers of trainee Basotho personnel to staff Regional and District Maintenance Centers. 2. Increased numbers of rural water systems newly constructed or completely reconstructed. 3. Increased numbers of village representatives (waterminders) trained to perform minor maintenance on their respective village water supply systems. 4. One Regional and three district maintenance centers constructed and operating. 5. Improved coordination between MOH and MCRD on health and sanitary aspects of installing and maintaining rural water supply systems.	1. 23 Basotho trained and assigned to positions within VWSS by the end of the project. 2. Approximately 142 new systems and 68 reconstructed systems installed by the end of the project. 3. Approximately 547 village waterminders trained and provided with basic tool kits by the end of the project. 4. 1 Regional and 3 District constructed by the end of the first year of the project. 5. 1 Health Education Coordinator function within MOH, in cooperation with MCRD by the end of year 1 of the project.	1. GOL and MCRD personnel records. 2. VWSS records, Mission project evaluation and monitoring records. 3. VWSS records, Mission project evaluation and monitoring records. 4. Mission and GOL records. 5. Mission project monitoring and GOL records.	1. That GOL can identify, attract and retain qualified Basotho for training and can budget funds to pay them. 2. That GOL can attract individuals needed to construct and reconstruct systems. 3. That villages can select appropriate individuals for waterminder training. 4. That the GOL will develop site plans and specifications for all physical facilities prior to project implementation. 5. That the MOH and MCRD are willing to cooperate and work in a collaborative manner.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs: (A.I.D.) ($000's)			
Technical Assistance $2,202.7 1 Civil Engineer (team leader) (7 p.y.'s) 1 Construction Engineer (5 p.y.'s) 1 Maintenance Engineer (4 p.y.'s) 1 Training Engineer (2 p.y.'s) 1 Health Education Coordinator (2 p.y.'s) 1 Financial Management (2 p.y.'s) Consultants 1 Well Drilling Spec. (¾ p.y.) 1 Hydrologist (½ p.y.) Other Consultants (1¾ p.y.'s)	Files, records, and field observation.	1. Daily project management. 2. Annual evaluation.	That funds will be available.
Training $387.2 3 L.T. Training, U.S. (4 p.y.'s) 20 L.T. Training, Lesotho. (3 p.y.'s each) In-Service Training 547 Waterminders			
Construction: $476.1 Senior Technician Housing (6) Field Staff Housing (3) Regional Maintenance Center (1) District Centers (3)			That GCL will develop site plans and specifications and allocate land for these facilities

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Commodities $7,602.2 1. Well Drilling Equipment 2. Hand Pumps 3. Diesel Engines 4. Windmill Parts 5. Power Water Pumps 6. Vehicles 7. Tools and Power Equipment 8. Pipes, Fittings, Other Systems Supplies Other Costs $1,473.9 1. Maintenance Program Support			
GOL $1,861.4 1. Maintenance Program Support $ 884.8 2. Administrative Support $ 429.2 3. Land & Furnishings $ 119.2 4. Village Self-Help Labor $ 428.2			

GRANTEE'S APPLICATION FOR ASSISTANCE ANNEX III

P.15

In reply please quote: CPO/56/03
Your Reference: MJPW/AMM/lm

Cable address: PLANNOFF
Telephone: 3811 Maseru

CENTRAL PLANNING AND
DEVELOPMENT OFFICE
P.O. BOX MS 630
MASERU
LESOTHO

22nd March, 1979.

F. Campbell Esq.,
Acting Director,
USAID,
P.O. Box 333,
Maseru 100

Dear Mr. Campbell,

Rural Water Supply Project (632-0038)

I am pleased to enclose our comments on the Design Paper for the above project, submitted under cover of your letter of 26th February, 1979. These have been revised on the basis of the meeting of 9th March 1979, the minutes of which are also enclosed.

With the appropriate modifications the Design Paper can now be submitted to USAID Washington. I look forward to rapid clearance and signing of the Project Agreement.

Yours sincerely,

A. M. MONYAKE.
PERMANENT SECRETARY, PLANNING & STATISTICS.

Done 6-21-1979
Byron Bahl
acting Director

Annex IV -Position Descriptions

Job Description-Lesotho Rural Water Supply Project

Title: Chief of Project-Civil/Sanitary Engineer

Duties and Responsibilites: As Chief of Project, incumbent will be responsible for all activities required to carry out the goals and objectives of the project. Particularily this includes general overall management of the project within the Ministry of Rural Development of Lesotho including but not limited to the following; specific village water supply design criteria; modification of project design as befits the exigencies of project development; supervision of other technical personnel assigned to the project; logistic management of materials, supplies and other commodities; both technical and especially managerial day-to-day operational monitoring of project activities; negotiation of contractural requirements for the project as needed; prepare and submit progress and other such required reports; and such other duties as may be required to ensure that the goals and objectives of the project are met. Candidate must be willing to sign a minimum 2-year contract with AID and would be posted in Maseru, Lesotho. Renewal of contract for a total work period of up to seven years total service is contemplated, depending on performance.

Required Qualifications: Candidates must have a minimum educational requirement of a B.S. degree in Civil or, preferably Civil/Sanitary Engineering with at least ten years experience in the area of water supply design and/or project management of water supply systems. A general knowledge of rural type systems along with rural waste disposal and small town/village sanitation is also required. Management of overall programs of this type is an essential component of qualification requirements. Specific knowledge and background in well drilling techniques, both rotary and percussion is also a prerequisite for employment.

Candidate must demonstrate that he/she has had overseas experience and preference will be given to those with specialized overseas experience in the general areas outlined above. Sub-Saharan Africa experience would be preferable in all candidates. Foreign language capability is not required but the ability to learn languages should be demonstrable.

Job Description-Lesotho Rural Water Supply Project

Title: Civil/Construction Engineer

Duties and Responsibilities; Incumbent shall be responsible for all construction activities of the Ministry of Rural Development, Rural Water Supply Section (RWSS), of the Government of Lesotho. He/she shall design and make cost estimates on those structures such as reservoirs, spring boxes, pressure reducing devises and pipe distribution systems. He/she shall also be required to do site survey (including topographical details) work on villages in the project, prepare plans and other such activities of an engineering nature connected with small water system development. He/she shall also be employed in training employees of the RWSS in surveying, cartography, records management, simple concrete and rock/brick masonary design, and pipe network analysis. Incumbent shall be required to submit periodic reports of progress to and through the project chief.

Candidate will be required to accept a minimum two year contract in Lesotho with the option of renewal for two year periods up a maximum of six years, depending on performance.

Required Qualifications: Candidate shall be required to have a minimum of a B.S. degree in civil and/or structural engineering. He/she must have had considerable experience in small masonry structures and actual experience as a mason or apprentice mason is desirable. He/she must have demonstrable experience in pipe network design and layout and must also have a background and/or training as a land surveyor with licensure as such being given preference. Experience in well-drilling, both percussion and rotary, would be helpful but not required. Candidate must be able to write well since legible and understandable reports must be prepared. Teaching and/or instructional experience is also desirable. Foreign language capability is not required but candidates must show an ability to learn foreign languages. Overseas experience of at least two years, preferably in Africa, is required.

Job Description-Lesotho Rural Water Supply Project

Title: Maintenance/Equipment Engineer

Duties and Responsibilites: Incumbent shall be responsible for all maintenance activities of the Ministry of Rural Development, Rural Water Supply Section (RWSS) of the Government of Lesotho. As such he/she will be required to establish maintenance and repair facilities for RWSS equipment, vehicles and other mechanical equipment as well as maintenance of equipment installed in small water systems installed by RWSS. He/she shall establish preventive maintenance programs and schedules at the three major and seven minor centers located or to be located throughout Lesotho. He/she shall be required to teach employees of the RWSS in all phases of equipment maintenance ranging from planning and record keeping down to actual mechanical shop training in the use of tools and engine/pump repair. Establishment of a maintenance logistics, (spare parts requirements, etc) operation and inventory system will be required.

Required Qualificationns: Candidates must have a B.S. degree in Mechanical Engineering with at least four years experience in heavy equipment and light vehicle maintenance. Candidates must demonstrate practical experience in maintenance management, engine (both diesel and gasoline) mechanics and repair. Some machine shop experience would be helpful but not required as long as candidate has demonstrable ability to prepare shop drawings for a machine shop.

Candidate should have overseas experience, preferably in Africa, but this is not mandatory. Foreign langua ge capability is not required but candidate must demonstrate a capacity for learning foreign languages.

Candidate will be on contract for a period of two years in Lesotho with an option to renew for a second 2-year contract if proven satisfactory.

Job Description-Lesotho Rural Water Supply Project.

Title: Training Specialist (Engineering)

Duties and Responsibility: The training specialist is to serve as the head of all technical training operations at the Village Water Supply Section of the Ministry of Rural Development. He would report to the Principal Technical Officer of the VWSS. His post would be in the capital city, Maseru, with fequent but not long trips to the rual water supply sites. The appointment would be for a two year period. The Specialist would be expected to function both in the training area and as a Chief Technical Officer in construction operations, as required. The specific objectives would be:

1. To design and institutionalize a technical training plan and process as a normal part of the on-going operations of the VWSS.

2. To skill transfer the duties of a training officer to a GOL colleague.

3. To design, prepare, organize and supervise technical training on both an in-service and on-the-job basis for the laborers, craftsmen and technicians. of the VWSS. The main fields would be practical work in stone masonry, brick work, concrete, plumbing, mechanics, and so forth.

4. To create, reproduce, and circulate tested and effective training materials in the fields required.

5. To train the other senior engineering staff in the proper methods and approaches to use in classroom and field training.

6. To be in charge of organizing and evaluating all water minder courses.

7. To serve as a Chief Technical Officer in the construction area when not involved in training matters.

Qualifications: The training specialist should have both practical and theoretical experience in construction engineering. A B.Sc. in Engineering is desirable, considerable hands-on experience is considered essential. Broad overall technical knowledge is preferred, with at least five to ten years of technical educational experience being necessary. Acquaintanceship with rural water supply systems, installation and maintenance in developing countries would be of considerable benefit.

Appendix

JOB DESCRIPTION OF HEALTH EDUCATION COORDINATOR

Duty Station: Health Education Unit (HEU), Ministry of Health and Social Welfare, Kingdom of Lesotho

Responsibility

To ensure that health education activities specifically directed at water-related health problems are coordinated with the installation of water supply systems in villages selected for the Rural Water Supply Program.

Duties

A. In cooperation with HEU staff, plan, develop, organize and supervise the implementation of a multi-disciplinary educational program directed at water related health problems which will coincide with the provision of improved water supply systems in villages selected under the Rural Water Supply Project.

1) Plan and prepare health educational materials related to water-borne diseases (leaflets, posters, flip charts, etc.) as needed for effective coverage of the target population.

2) Assist in the planning and conducting of seminars, working conferences, short-term training courses, meetings and discussions for Government of Lesotho officials and other appropriate Government personnel in order to enlist their participation in the water supply systems/health education program.

3) Assist in the strengthening of units taught on water (more emphasis on improving health through better use of water) in the GOL training programs for Health Assistants, Agricultural Extension Workers, Nurse Assistants, Home Economics Assistants, etc.

4) Assist in planning and conducting multi-disciplinary In-Service training programs for all of the above personnel already in the field to orient them to their own - and to each others - health educational role.

5) Assist in planning and conducting seminars and workshops for Health Inspectors to improve motivational and educational skills needed for the latrine construction and environmental sanitation program coincident with water supply installation.

6) Orient clinic nurses to their educational role as part of the preventive health team as pertaining to water related illnesses.

B. To act as the liaison between the Health Education Unit and the various Ministries that are involved in, or that can make a contribution to, the Rural Water Supply Program, and to identify opportunities for water-related

health education activities through other government agencies, professional associations, voluntary groups and others.

1) Ministry of Rural Development

a. Become thoroughly familiar with their schedule for village installations so that prior to, or at the time of, water supply installation, the relevant contributing ministries or persons can be activated to provide the health education component that is required.

2) Ministry of Education

a. Inform relevant school officials re schedule for installation of water supply systems in village(s) where school children live and, with them and HEU, plan a health education program that will acquaint the children with the benefits of a good water supply and introduce them to the need for good personal hygiene and a healthy environment. This could include:

1. In-service training of teachers by health and other resource personnel.

2. Provision of learning materials developed by HEU or the Distance Learning Center.

3) Ministry of the Interior

a. Work with the District Administrators to organize health education training programs re sanitation for appropriate personnel.

b. Orient Chieftains to the goals and objectives of the water supply program for their villages.

4) Ministry of Agriculture

a. Ensure that Agricultural Extension workers coordinate their teaching with the Water Supply Program; emphasizing the use of water for home gardens, animal husbandry, etc. (more food for better nutrition can reduce the incidence of malnutrition/ diarrhea syndrome in children.)

b. Ensure that Home Economics Assistants direct their teaching toward the proper preparation of foods with clean water, storage of foods to avoid fly contamination, cleanliness of kitchen equipment, and advice on foods to eat for good nutrition.

C. To act in an advisory role in the planning and conducting of research activities. (There are many opportunities for research inherent in this project.)

D. To ensure that evaluation of the health education aspects is incorporated into the Water Supply Program and that community and staff are involved in the evaluative process both during the planning and in the conduct of the project; and to continually evaluate and revise educational methods and techniques employed and determine which combination of educational methods can be most effective.

Job Description-Lesotho Rural Water Supply Project.

Title: Financial Management Specialist

Duties and Responsibility: The financial management specialist is to serve as an advisor to the Ministry of Rural Development with regard to the development of an accounting system for USAID supplied commodities to the Village Water Supply Section. His post would be in the capital city, Maseru, and would be for an initial two year period. The specific objectives would be:

1. To design a financial management system to account for commodities, and to enable timely reports to be made for reimbursements.

2 To train MORD accounting and bookkeeping personnel in the proper utilization of the system.

3. To design a procurement and supplies management system which will allow proper logistical programming of overseas and local commodities. This would include preparation and expedition of purchase orders and tender documents; scheduling of transport and storage; warehousing and inventory control; and moitoring of and use of U.S. commodities.

4. To train MORD supplies personnel in the utilization of the system.

5. To assist the USAID Team Leader with other required administrative support operations for the team's personnel.

Qualifications: The specialist should possess a Bachelors of Science Degree in Financial Management and/or Accountancy. He should have a minimum of 10 years experience at the senior financial management level, preferably in the construction engineering field. He will be expected to relate well at senior management and professional/technical levels. His temperment should be appropriate for a person in an advisory role, who also may be asked to carry some operational responsibilities. Patience and skills in training colleagues are essential. Prior overseas experience in Africa is very desirable, but not absolutely necessary.

Job Description-Lesotho Rural Water Supply Project

Title: Well Drilling Advisor.

Duties and Responsibilities: The short-term services of a competent U.S. well drilling advisor will be needed (1) to upgrade the technical standards and work performance of the Drilling Subsection of the VWSS in its regular program of percussion drilled boreholes and (2) to introduce the new methodology required for operation of rotary drilling equipment to be procured for construction of boreholes equipped with hand pumps.

Timing: A 9-month TDY for a U.S. well-drilling advisor should be scheduled so that he arrives at the time the rotary drill and ancillary equipment arrives in Lesotho. The well drilling advisor's TDY could be tentatively scheduled to start at the beginning of the second year of the project. A need can also be anticipated for short follow-up visits to trouble-shoot specific problems during the third and fourth years of the project.

Required Qualifications: The well-drilling advisor should be a mature, competent individual with at least 5 to 10 years of practical experience in well construction using both percussion and rotary drilling techniques. As the boreholes to be drilled are of simple, open-hole design with the minimal yields required for hand pumps or small motor pumps, there is no need for experience in advanced techniques of well construction. Preferably, the well-drilling advisor should have had some past experience in working in the developing countries, particularly in Africa. He would be expected to select and train one or more drilling crews from the cadre of the Drilling Subsection in the operation and maintenance of the rotary drilling equipment and in the construction of boreholes using the equipment; to develop an appropriate system for the accounting and storage of drilling equipment and supplies; and to establish standards for the maintenance of drilling rigs and ancillary equipment.

Job Description-Lesotho Rural Water Supply Project

Title: Hydrogeologist

Duties and Responsibilities: The short-term services of a competent U.S. hydrogeologist will be needed to upgrade the technical standards and work performance of the Hydrogeology Subsection of the VWSS twice during the 7 year life of the project.

Timing: The first 3-month TDY should be timed so that the U.S. hydrogeologist arrives about 1 to 2 months after the arrival of the U.S. well drilling advisor, when the operations of the rotary drilling rig are underway. This TDY could be tentatively scheduled in the early part of the second year of the project. The second 3-month TDY should be scheduled in the middle or latter part of the third year of the project to follow up on work performance and standards developed during the first TDY.

Required Qualifications: The hydrogeologist should be a mature, competent individual with at least 10 years of education and experience in applied hydrogeology. Preferably, he should have had some past experience in working in the developing countries, particularly in Africa. His recent experience should include work in areal as well as site-specific hydrogeology; lithologic logging and interpretation of samples from boreholes, both from percussion and mud rotary drilling; simple aquifer and pumping tests; and preparation of areal as well as site-specific hydrogeologic reports. He would be expected to work closely with one or more Basotho counterparts in the VWSS, providing on-the-job training in the methodology of collecting, recording and interpreting hydrogeologic data from boreholes under construction as well as from existing and operating VWSS boreholes; in the performance and interpretation of data from pumping tests; and the preparation of areal as well as site-specific hydrogeologic reports.

Suggested Scope of Work for the Interim Evaluator (Sociologist)

Objective

To carry out an interim evaluation and prepare a progress report on selected social aspects of the Rural Water Supply Project in Lesotho.

Tentative Programme

The evaluation needs to be done once there is evidence that the Ministry of Rural Development has implemented the recommendations contained in the PP on the formation and establishment of village committees, and on the training and payment of village water minders. Too long a break before evaluation may make it impossible to alter less successful practicies. A gap of a year between the submission of the PP and the interim evaluation would seem adequate. By this time at least 130 village water minders ought to have received training in basic maintenance on a number of types of water system, and Government ought to have moved closer to a coherent policy on village committees.

If the evaluator has experience in Lesotho 30 working days would probably be s sufficient time in which to undertake the evaluation. It is tentatively envisaged that at least 14 days of this period be spent in the villages interviewing village water minders and other committee members, and examining the problems still faced at the district level. The remaining days would be spent in discussion with Ministry of Rural Development central office personnel and in preparing the report.

Responsibilities

The social evaluator will be required to undertake the following :

- Monitor and analyse progress since the PP on the establishment and functioning of village committees.
- In the light of the recommendations contained in the PP examine the progress and problems in the district administration of the programme.
- Examine the implementation of the village water minder concept, determine what has been learnt since the proposals contained in the PP, and make recommendations on their training, payment and functioning within the context of village management.

Qualifications

- Graduate degree in sociology or social anthropology.
- Working knowledge of Sesotho and research experience in rural Lesotho.
- Experience in village-level management of development programmes.

ANNEX V - Financial Annexes

COST ESTIMATE

Lesotho Rural Water Supply Project
FY 1979 - FY 1986

(000 U.S.$)

	Foreign Exchange	Local Currency	Total
I. GRAND TOTAL	$11,078.8	2,924.7	$14,003.5
A. USAID	9,645.6	2,496.5	12,142.1
B. GOL		1,861 .4	1,861.4
II. USAID	$9,645.6	$2,496.5	$12,142.1
A. Technical Assistance	2,202.7	-	2,202.7
1. Chief Engineer (7 P.Y.'s @ 80.0)	560.0	-	560.0
2. Maintenance Engineer (4 P.Y.'s @ 70.0)	280.0	-	280.0
3. Construction Engineer (5 P.Y.'s @ 70.0)	350.0	-	350.0
4. Civil Engineer (Training) (2 P.Y.'s @ 80.0)	160.0	-	160.0
5. Health Ed. Coordinator (2 P.Y.'s @ 60.0)	120.0	-	120.0
6. Financial Manager (2 P.Y.'s @ 70.0)	140.0	-	140.0
7. Consultants (3 P.Y.'s @ 6.0)	216.0	-	216.0
8. Inflation Factor (IF): FY 1980-86, 10% p.a. US.	376.7	-	376.7
B. Training	$289.2	98.0	$387.2
1. Participant Training (3 for 4 years, U.S.)	186.0	-	186.0
2, In-Country Training (20 for 3 years, Lesotho)	-	40.0	40.0
3. In-Service Training	-	15.1	15.1

	Foreign Exchange	Local Currency	Total
4. "Waterminder" Training	-	19.2	19.2
5. Inflation Factor: 10% P.A. US.	66.0	23.7	89.7
6. Contingency (Item 1 = 20% p.a.)			
C. Commodities*	7,433.7	168.5	$7,602.2
1. Well Drilling Equipment and Support	637.2	-	637.2
2. Well Drilling Supplies and Casing	109.0	-	109.0
3. Handpumps	200.0	-	200.0
4. Diesel Engines, Windmill Parts and Water Pumps	-	68.0	68.0
5. Vehicles	280.0	--	280.0
6. Tools and Power Equipment	68.3	-	68.3
7. Water Testing Equipment	2.9	-	2.9
8. Pipes, Fittings, & Supplies	2,648.0	-	2,648.0
9. Cement, Rebar, & Steel Tanks	-	108.0	108.0
10. Shipping and Transport Costs (Items 1,2,3,6,7,8-40%)	1,466.1	-	1,466.1
11. Inflation Factor: 10% p.a. US., 15% p.a. Lesotho)	590.4	98.1	688.5
12. Contingency: 20% p.a.	1,431.8	-	1,431.8
D. Construction*	-	$476.1	$476.1
1. Senior Staff Housing	-	245.0	245.1

* See Detailed Commodity List in Annex V-E.

	Foreign Exchange	Local Currency	Total
2. Field Staff Housing	-	75.0	75.0
3. Regional Maintenance Center	-	55.1	55.1
4. District Centers		28.3	28.3
5. Contingency: 20% p.a.	-	72.7	72.7
E. Other Costs	-	$1,473.9	$1,473.9
1. Maintenance Program Support	-	287.7	287.7
2. Temporary Wage Labor (for systems installation only)	-	879.5	879.5
3. Vehicle Operation and Maintenance	-	170.0	170.0
4. Inflation (@ 10% p.a.)	-	85.6	85.6
5. Contingency (@ 20% p.a. for POL only)	-	51.1	51.1

	DIRECT	IN-KIND	TOTAL
GOL	$1,433.2	$428.2	$1,861.4
A. Maintenance Program Support	884.8	-	884.8
B. Administrative Support	429.2	-	429.2
C. Land, site prep, all util. connect. for all constructed facilities (incl. refrig, stove, heaters for sen. tech. houses)	119.2	-	119.2
D. Village Self-Help Labor	-	428.2	428.2

USAID OBLIGATION SCHEDULE
FY 1979 - FY 1983
(000 U.S.$)

	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	TOTAL
TOTAL	1,621.0	1,200.0	2,500.0	2,600.0	2,343.1	1,878.0		12,142.1
A. Technical Assistance	856.4	-	403.5	364.7	578.1	-		2,202.7
B. Training	41.8	-	87.6	89.5	168.3	-		387.2
C. Commodities	35.8	1,200.0	1,797.9	1,839.6	850.9	1,878.0		7,602.2
D. Construction	476.1	-	-	-	-	-		476.1
E. Other Costs	210.9	-	211.0	306.2	745.8	-		1,473.9

Expenditure Schedule - GOL
FY 1979-FY 1986 (Based on U.S. Fiscal Year)
(in Rand 000's)

	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	TOTAL
TOTAL		R113.0	R 85.5	R145.5	R205.0	R283.1	R365.3	R375.9	R 1,573.3
A. Maintenance Program Support	-	13.8	29.7	53.9	88.0	138.5	210.6	226.4	760.9
B. Administrative Support	-	28.4	37.4	54.8	54.4	59.9	66.3	72.4	373.6
1. Personnel Officer	-	2.7	2.7	2.7	2.7	2.7	2.7	2.7	18.9
2. Assistant Executive Officer	-	1.7	1.7	1.7	1.7	1.7	1.7	1.7	11.9
3. Copy Typists (2)	-	2.5	2.5	2.5	2.5	2.5	2.5	2.5	17.5
4. Clerical Assistant	-	.8	.8	.8	.8	.8	.8	.8	5.6
5. Office Assistants (7)	-	4.2	4.2	4.2	4.2	4.2	4.2	4.2	29.4
6. Transport Officer	-	3.8	3.8	3.8	3.8	3.8	3.8	3.8	26.6
7. Field Allowances	-	9.0	17.0	30.5	33.5	36.9	40.6	44.6	212.1
8. Field Equipment	-	3.7	3.1	5.3	-	-	-	-	12.1
9. Inflation Allowance	-	-	1.6	3.3	5.2	7.3	10.0	12.1	39.5
C. Land, Utility Installation, Access Roads, Etc.		(70.8)	-	-	-	-	-	-	(70.8)
1. Senior Technician Houses (6)		(31.0)	-	-	-	-	-	-	(31.0)
2. Field Staff Houses (3)		(13.9)	-	-	-	-	-	-	(13.9)
3. Regional Maintenance Center		(7.7)	-	-	-	-	-	-	(7.7)
4. District Maintenance Centers (3)		(18.2)	-	-	-	-	-	-	(18.2)
D. Furnishings, Senior Staff Housing and Req. Center		24.1	-	-	-	-	-	-	24.1
E. Village Self-Help Labor			(18.4)	(36.8)	(62.6)	(84.7)	(88.4)	(77.1)	(368.0)

Expenditure Schedule - USAID
Lesotho Rural Water Supply Project
FY 1979-1987
(000 U.S. $)

	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	TOTAL
TOTAL	-0-	2,391.5	3,527.0	2,555.7	1,982.6	780.3	576.8	308.2	20.0	12,142.1
Technical Assistance	-	324.0	532.4	403.5	364.7	262.6	153.8	141.7	20.0	2,202.7
1. Chief Engineer	-	60.0	80.0	80.0	80.0	80.0	80.0	80.0	20.0	560.0
2. Maintenance Engineer	-	45.0	70.0	70.0	70.0	25.0	-	-	-	280.0
3. Construction Engineer	-	45.0	70.0	70.0	70.0	70.0	25.0	-	-	350.0
4. Civil Engineer (Training)	-	53.0	80.0	27.0	-	-	-	-	-	160.0
5. Health Education Coordinator	-	40.0	60.0	20.0	-	-	-	-	-	120.0
6. Financial Manager	-	45.0	70.0	25.0	-	-	-	-	-	140.0
7. Consultants	-	36.0	54.0	54.0	54.0	18.0	-	-	-	216.0
8. Inflation Allowance	-	-	48.4	57.5	90.7	69.6	48.8	61.7	-	376.7
Training	-	7.3	34.5	87.6	89.5	92.5	68.0	7.8	-	387.2
1. Participant Training	-	-	17.0	49.0	45.0	45.0	30.0	-	-	186.0
2. In-Country Training	-	3.3	6.7	10.0	10.0	6.7	3.3	-	-	40.0
3. In-Service Training	-	1.5	1.8	2.1	2.3	2.4	2.5	2.5	-	15.1
4. Training for "Waterminders"	-	2.5	2.7	3.2	3.2	3.0	2.7	1.9	-	19.2
5. Inflation Allowance:										
U.S.	-	-	1.7	10.3	14.9	20.8	18.3	-	-	66.0
Lesotho	-	-	1.2	3.2	5.1	5.6	5.2	3.4	-	23.7
6. Contingency	-	-	3.4	9.8	9.0	9.0	6.0	-	-	37.2
Commodities	-	1,497.1	2,785.6	1,853.6	1,272.8	128.0	65.1	-	-	7,602.2
1. Well Drilling Equip. and Support	-	-	637.2	-	-	-	-	-	-	637.2
2. Well Drilling Supplies and Casing	-	-	109.0	-	-	-	-	-	-	109.0
3. Handpumps	-	50.0	50.0	100.0	-	-	-	-	-	200.0

	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY87	TOTAL
4. Diesel Engines, Windmill Parts and Pumps	-	-	46.4	5.4	5.4	5.4	5.4	-	-	68.0
5. Vehicles	-	33.8	59.5	-	21.6	59.5	-	-	-	174.4
6. Tools and Power Equipment	-	68.3	-	-	-	-	-	-	-	68.3
7. Water Testing Equipment	-	2.9	-	-	-	-	-	-	-	2.9
8. Pipes, Fittings and Supplies	-	794.4	529.6	794.4	529.6	-	-	-	-	2,648.0
9. Cement, Rebar, and Steel Tanks	-	10.8	16.2	16.2	21.6	21.6	21.6	-	-	108.0
10. Shipping and Transport Costs	-	264.7	631.8	357.8	211.8	-	-	-	-	1,466.1
11. Inflation Allowance:										
U.S.	-	-	81.1	263.9	254.4	-	-	-	-	590.4
Lesotho	-	-	18.3	7.0	25.3	20.2	27.3	-	-	98.1
12. Contingency	-	272.2	606.5	308.9	212.1	21.3	10.8	-	-	1,431.8
D. Construction	-	476.1	-	-	-	-	-	-	-	476.1
1. Senior Staff Housing	-	245.0	-	-	-	-	-	-	-	245.0
2. Field Staff Housing	-	75.0	-	-	-	-	-	-	-	75.0
3. Regional Maintenance Center	-	55.1	-	-	-	-	-	-	-	55.1
4. District Centers	-	28.3	-	-	-	-	-	-	-	28.3
5. Contingency	-	72.7	-	-	-	-	-	-	-	72.7
E. Other Costs	-	87.0	174.5	211.0	[illegible].6	297.2	289.9	158.7	-	1,473.9
1. Vehicle Operation and Maintenance	-	16.0	16.0	10.0	10.0	8.0	8.0	6.0	-	74.0
2. POL (Systems Construction)	-	-	19.2	19.2	19.2	19.2	19.2	-	-	96.0
3. Inflation @ 10%	-	-	5.3	9.4	15.2	20.3	27.5	7.9	-	85.6
4. Contingency	-	3.2	8.1	7.7	8.9	9.5	10.9	2.8	-	51.1
1. Budgetary Support 1/ (Maintenance)		64.5	65.0	62.7	55.3	40.2	0	0	-	287.7
2. Temporary Labor 2/ (Construction)		3.3	60.9	102.0	147.0	200.0	224.3	142.0	-	879.5

1/ Inflated at 15% Materials
10% Labor

2/ Inflated @ 10%

DETAILED COMMODITY LIST

Summary of Costs for Materials, Supplies, Construction and Equipment

A.	Well Drilling Equipment and Support	$ 637,200
B.	Well Drilling Supplies and Casing	109,025
C.	Pumps and Engines:	
	a. Moyno Pumps - Hand	200,000
	b. Diesel engineers, Repair Parts, etc. (*)	67,955
D.	Light Vehicles (Pickups) (*)	174,500
E.	Buildings, Houses and Construction	283,314
F.	Tools and Power Equipment	58,260
G.	Water Testing Equipment	2,850
H.	Pipes, Fittings and Supplies for System Installation	2,648,000
I.	Cement, Rebar and Steel Tanks (*)	108,000

(*) Denotes local purchase - Source/Origin waivers required.

Total Procurement (current prices, no contingency, shipping, insurance or inflation) $4,289,104

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION

	COSTS	
	AID	GOL
A. Well Drilling Equipment	$	
1. 1 each. Failing Mud Rotary Drilling Rig, mounted on 2050 IHC, 4 W.D. right hand drive, chassis with interlock equipped w 5x6 Gardner-Denver mud pump; 400 ft. of 2 7/8" 1F drill pipe in 20' lengths; necessary subs for swivel and end rod as well as rig truck, portable mud pit to be included. @ U.S.$100,000. F.O.B.	$ 100,000.	
2. 1 each. Miller 180 AMP "Rough-neck" welder plus necessary accessories, to be installed on drilling rig (Item 1 above) @ U.S. $3,000.	3,000.	
3. 1 each. IHC 2050 diesel truck, 4 w.d., right hand steering, with interlock, equipped with 1,200 U.S. gallon water tank. Tank to be equipped with vacuum GED transfer pump and interchangeable suction hoses with strainers. Truck to be equipped with front-mounted Ramsey PTO winch. @ U.S.$35,000.	35,000.	
4. 1 each. D5A Caterpillar bulldozer equipped with 55 DSDD winch. Bulldozer to be equipped with standard width tracks. @U.S.$80,000.	80,000.	
5. 1 each. Cyclone F-40 pump hoist mounted on IHC, 4 w.d. diesel truck.	43,000.	
6. 1 each. Airco oxy-acetylene welding/cutting set-equipped with necessary tips for heating brazing, welding and cutting; 30 ft. of dual hose adaptors for fitting metric oxygen/acetylene tanks, plus valves, eye goggles. Regulators to be 2-stage calibrated in both lbs/sq. inches and kg/sq. cm.	500.	
7. 1 each. IMCO Tri-axle Lowboy trailer with IHC Diesel tractor, right hand drive.	55,000.	

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION (continued -2)

	COSTS	
	AID	GOL
8. 1 set. Camping equipment to include: 1 each - 5 man tent, 5 cots, sleeping bags, cooking gear, and stove, lanterns, etc.	$ 700.	
9. 1 each. Tranceiver, single side band, compatable with present radio equipment, portable.	500.	
10. 300 each. Rotary drill shoes; @ U.S.$60.per shoe	18,000.	
11. 450 each. Rotary drill bits, 6 7/8" diameter @ U.S.$440./bit.	198,000.	
12. Tires, batteries, spare parts for well-drilling equipment @ 20% of total	103,500.	
Total for Equipment	$ 637,200.	
B. Well Drilling Supplies		
1. Drilling Mud, quik-gel @ 3 bags/hole and 300 holes = 900 bags @ $5.00/bag.	4,500.	
2. Mud-Cleaning agent, "Barafos", @ 1 bag/hole = 300 bags @ $50.00/bag.	15,000.	
3. Well-casing, steel, 6" diameter, @13 m./hole for total of 3,900 m. = 12,742 feet = 609 21 ft. joints, (Black iron 0.250 in. wall thickness; T and C API threads w. couplings) @ U.S. $7.00/ft.	89,525.	
Total for Well Drilling Supplies	$ 109,025.	
C. Pumps and Engines		
1. "Moyno" hand pumps, Model, 2V2.6, for 300 wells plus 100 replacements over 5 year program. @U.S. $500. complete with drop pipe and shaft. 400 x $500. = $200,000.	200,000.	
2. Diesel Engines, "Lister" Model Sr-1, for replacements of non-working engines and windmills plus new installation; 25 each @R877. = $1,060.(*)	26,500.	

(*) Source/origin waivers required (South Africa)

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION (continued - 3)

	COSTS	
	AID	GOL
	$	
3. "MONO" pumps, model ES-15, complete with head, shaft, drop piping, frame, pulleys, etc. @R933. 10 each @R933. = R9,330 = $11,240. (*)	11,240.	
4. Windmills, "Southern Cross", heads and fans only, for replacement of existing broken mills only. Estimated @R1,200 x 15 = R18,000. = U.S.$21,690. (*)	21,690.	
5. Miscellaneous windmill parts, for repair of existing windmills only: foot-valves, air chambers, check valves, pump cylinders, [illegible]ings and mill rods @R283/set. 25 sets @R283/set = R7075 = U.S. $8,525. (*)	8,525.	
Sub-total	267,955.	
D. Vehicles (other than those listed for drilling)		
1. 17 each. International Harvester "Scout), ½ton, pickup trucks, equipped w/H.D. suspension and 4 speed transmission @ $10,000 ea.	170,000	
2. 10 each. International Harvester 4 w.d., 1885 kg. pickup trucks equipped w/H.D. suspension, diesel engines. 4 to be equipped /PTO front mounted winches. 6 trucks @ $11,000 ea.	66,000	
4 trucks @ $11,000 ea.	44,000	
1 truck at each Regional/District Center financed by the project and 1 truck for Rotary Drilling rig.		
rounded Sub-total for Vehicles	280,000	
E. Buildings, Houses and Construction		
1. 5 each. Technicians houses, Standard Plan "Pitso Mark IV" or equivalent, including A & E services for site planning, contracting and construction supervisor, to be constructed in Maseru. @$40,000/each.	200,000	

(*) Source/origin waivers required (South Africa)

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION (continued - 4)

	COSTS	
	AID	GOL
2. 1 each. Technicians Housing - same detail as item E.1 above, but to be contructed in Mohales Hoek @$45,000.	$ 45,000.	
3. Furnishing site, site preparation, all utility connections, full household furnishings including all kitchen appliances (refrigerator, stove) and electric heaters, for items E.1 and 2, above. Estimated @$10,000/unit.		$ 60,000
4. 3 each. District Maintenance Centers, consisting of storeroom, office, workshop, pipe store, and working concrete foundation & slab, concrete block walls and galvanized iron roof; 52 sq.m @R140/sq. m. = R7,280 plus cement slab of 28 sq.m @R30/sq. m. = R840. plus site fencing. Total cost/ structure = R8,120 = $9,420 X 3	28,260	
5. Furnishing site, site preparation, and connection to utilities for three District workshops = $7,065.		7,065
6. 1 each. Regional/District Workshop-store consisting of office building, storage warehouse, workshop, pipe racks (open), guard shack, and two small rondavals for District workers. All structures to be concrete slab floor, concrete block walls and galvanized iron roof on steel trusses. Only office building to be finished interior.		
a) 1 each office building @45.5 sq.m. @R140/sq m = R6,370. = 4,389	7,390	
b) 1 each warehouse of 243 sq. m. @R110./sq.m. = R26,730.	32,200	
c) 1 each workshop of 68.0 sq. m @R110./sq. m. = R7,480. = $9,012. + 28 m. sq. concrete work slab @R30/sq. m. = R840. = $1,012. Total cost = $10,024.	10,024.	
d) 29 each pipe racks, external @R30/rack =	1,048.	

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION (continued - 5)

	COSTS	
	AID	GOL
	$	$
e) 170 m. fencing for compound, 5' chain link topped by 4 strands barbed-wire on steel posts spaced 3.0 m. ø., @R12./m. = R2,040. = $2,458.	2,458.	
f) 24 m. steel shelving for fittings, 36 bins/ 6 m. section = total 144 bins @R400./6 m. section = R1500. = $1,930..	1,930.	
g) Furnishing site, site preparation, access and internal roads, all utilities and furniture, etc., @ estimated R 10,790		13,000.
7. 3 each Junior houses, Morija type, bedroom, bath kitchen, living room (for Senior techical officers 2 in Maseru, 1 in Mohale's Hoek, Cost to include A&E, contracting and construction supervisor. @$25,000 each plus site preparation and utilities connections, furniture, access roads by GOL @$6,000.	75,000.	18,000.
Sub-total for Buildings, Housing, construction.	403,310	98,065
. Tools and Power Equipment (Regional/District Workshops) (Note: Unless otherwise specified, all electrical tools, etc. to be 220 v., 50HZ).		
1. 300 each. Tool kits for Village water minders; consisting of: 1-12" pipe wrench @$9.00, 1-16" pipe wrech @12.00, 1-hacksaw w/blades @$7.50, 1-adjustable wrench "Crescent", 10" @$8.00, 1-vice grip plyers, 10" @$9.00, and 3 screwdrivers, straight tip, 8", 10", 12" @$3.00/each = $9.00, 1 toolbox @$7.50. Total cost/kit = $62.00 x 300 = $18,600.	18,600.	
2. 7 each. Oxy-acetylene welding set, w/2 sets of bottles, 2-stage regulators calibrated in lb/sq. in. and kg/sq. cm., w/20' of twin hose, welding, cutting, brazing and heating tips, goggles, etc. @$500. = $3,500.	3,500.	

EQUIPMENT AND SUPPLIES - ITEM AND DESCRIPTION (continued - 6)

Tools and Power Equipment (continued)	COSTS AID	COSTS COL
3. 7 each. Arc-welding machines, GED, portable, "Miller" or equal, 220 AMP welding, plus 220 v. 50 cycle output for tool operation, Estimated @$800. x 7 = $5,600.	$ 5,600.	
4. 1 each. Air compressor, stationary, electric driven, 7.5 cfm delivery to 150 psi., with 50' hose air chucks, cleaning nozzle and impact wrench $1,500.	1,500.	
5. 6 each. Air compressor, stationary, electric, 2.5 cfm to 100 psi., w/chucks and air cleaning nozzle. @$350.	2,100.	
6. 7 each. Bench grinder, 2 wheel, 8", w/spare grinding wheels @$200.	1,400.	
7. 1 each. Battery charger/starter, 220 v to 6-12v 100 amp @$250.	250.	
8. 6 each. Battery charger, 220v to 6-12v, 10 amp @$40.	240.	
9. 8 each. Vices, bench, 6" jaws, @$60.	480.	
10. 8 each. Drill set, high speed, 1/16" to 1/2" by 16ths. @$60.	480.	
11. 8 each. Drill set, high speed, 1mm-12mm by 1mm. @$60.	480.	
12. 1 each. Tool box, master mechanics, to include socket wrenches metric and English, end wrenches metric and English, screw drivers and assorted other wrenches adjustable, etc. @$600.	600.	
13. 6 each. Tool boxes, mechanics, metric and English wrenches etc. @$300.	1,800.	
14. 8 each. Pipe wrench sets, 12", 16", 24" 2 each. @$110.	880.	
15. 8 each. Electric drills, 220v, 50HZ, 1/2", reversible double insulated, variable speed, heavy duty @$90.	720.	

Tools and Power Equipment (continued)	COSTS AID	COSTS COL
	$	
16. 8 each. Electric drills, 200v, 50HZ, 3/8", reversible, double insulated, variable speed, H.D. @$50.	400.	
17. 1 each. Plug Cleaner and tester, "Champion Model 800"	300.	
18. Valve grinding machine, variable angle, with valve seat grinder, @$1500.	1,500.	
19. 1 each. Drill press, floor model, w/chuck to 13 mm., electric 220v, 50cycles. @$600.	600.	
20. 1 each. Press, hydraulic, to 10 ton capacity @$650.	650.	
21. 1 each. Testing set, compression, for diesel engines, @$170.	170.	
22. 1 each. Tester, diesel injectors, @$275.	275.	
23. 1 set. Wheel/gear/pulley pullers, 8",12", 16", spread, inside-outside type. @$120.	120.	
24. 16 each. Jack stands, H.D. to 8,000 kg. @$35.	560.	
25. 1 each. Overhead rail chain hoist - 5 ton. @$600.	600.	
26. 8 each. Jack, hydraulic, 5 ton @$45.	360.	
27. 8 each. Block and tackle sets - 3 ton. @$320.	2,560.	
28. 1 each. Ring compressor, to 6½ bore pistons. @$20.	20.	
29. 8 each. Tire repair/patching kits, @$30.	240.	
30. 2 each. Pump, trash type, "Homelite", GED, 1½" suction w/20' of suction hose. @$400.	800.	
31. 1 each. Lubricator, grease gun, hand operated for grease drums, on castors, @$175.	175.	
32. 6 each. Grease gun, hand operated @$25.	150.	
33. 2 each. Drum pumps, all purpose, for oils, gear oil @$35.	70.	
34. 1 each. Suction gun for emptying and filling transmissions and differentials @$25.	25.	
35. 1 each. Compression tester for gasoline engines @$50.	50	

Tools and Power Equipment (continued)	COSTS AID	COSTS GOL
36. 1 lot. Miscellaneous small tools:battery cell testers, hammers, tire tools, etc. @$300.	$ 300.	
37. 3 each. Pipe threading machines, electric, complete w/9 sets of dies for each of the following sizes: 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3" pipe ips (British) threads. @$2,000.	6,000.	
38. 5 each. Pipe threading set, including chuck, handles, and dies, ips (British threads), plus 2 extra sets of dies for 3/4", 1", 1 1/4", 1 1/2", 2", dia. pipes @$250.	1,250.	
39. 5 each. Pipe vises, on tripod, chain type, @$70.	350.	
40. Miscellaneous supplies:	1,000.	
41. Miscellaneous equipment for hydrogeologist	1,055.	
Sub-total	58,260.	
G. Water Testing Equipment		
1. 3 each. Milipore field test kits, bacteriological w/spare filters, media and sterile sampling tubes for 3000 tests @$650.	1,950.	
2. 1 each. Hack DREL, chemical test kit, spectrophotometric, w/spare batteries and reagents for 1000 tests per ion. @$900.	900.	
Sub- Total for water test equipment	2,850.	
H. Pipes, Fittings and Supplies for System Installation.		
1. 9,000 - 3/4" galvanized steel pipe, unthreaded @R150/100m =R4,500. =	15,525	
2. 7,500 - 1" galvanized steel pipe, unthreaded, (Note: 1" pipe for hand pumps included in est. for pumps) @R200/100m = R 15,000 =	17,250	
3. 45,000 - 1 1/4" galvanized steel pipe, unthreaded @R270/100m	140,400	

Pipes, Fittings and Supplies for System Installation (continued)	COSTS AID	COSTS COL
	$	
4. 45,000m- 1½" galvanized steel pipe, unthreaded @R320/100m	165,600.	
5. 67,500m- 2" galvanized steel pipe, unthreaded @R400/100m	310,500.	
6. 67,500m-- 2½" galvanized steel pipe, unthreaded @R480/100	372,600.	
7. 11,250m- 3" galvanized steel pipe, threaded and coupled, ips threads @R700/100m	98,350.	
8. 11,250m- 4" galvanized steel pipe, threaded and coupled, ips threads @R1,000/100m	129,360.	
9. 60,000m - 1"PVC pipe, w/couplings, Class 80, @R85/100m	58,650.	
10. 30,000m - 1 1/4" PVC pipe, w/couplings, Class 80 @R110/100	37,950.	
11. 54,000m - 1½ PVC pipe, w/couplings, Class 80 @R170/100m	105,510.	
12. 67,500m - 2" PVC pipe, w/couplings, Class 80 @R250/100m	194,070.	
13. 67,500m - 2½" PVC pipe, w/couplings, Class 80 @R320/100m	248,400.	
14. 11,250m- 3" PVC pipe, w/couplings, Class 80 @R500/100m	64,680.	
15. 11,250m- 4" PVC pipe, w/couplings, Class 80 @R700/100m	90,570.	
16. 1,500 each. 3/4" spigots/hos bibs, brass or bronze, ips threads, @$3.50/each.	5,250.	
17. 660 each. 1" valves, gate, C.I. body, ips threads @$6.00	3,960.	
18. 450 each. 1 1/4" gate valves, C.I.body, ips threads @$7.50 each	3,375.	
19. 600 each. 1½" Gate valves, C.I. body, ips threads, @$9.50 each	5,700.	

Pipes, Fittings and Supplies for System Installation (continued)	COSTS AID	COSTS GOL
	$	
20. 750 each. 2" Gate valves, C.I. body, ips threads @$14.50	10,875	
21. 240 each. 2½" Gate valves, C.I. body, ips threads @$26.	6,240	
22. 135 each. 3" Gate valves, C.I. body, ips threads @$38.	5,130	
23. 60 each. 4" Gate valves, C.I. body, ips threads @$49.	2,940	
24. 450 each. 1" Gate valves, C.I. body, for coupling to PVC pipe @$4.	1,800	
25. 300 each. 1 1/4" Gate valves, C.I. body, for PVC coupling @$7.50	2,250	
26. 450 each. 1½" Gate valves, C.I. body, for PVC coupling @$9.50	4,275	
27. 450 each. 2" Gate valves, C.I. body, for PVC coupling @$15.	6,750	
28. 120 each. 2½" Gate valves, C.I. body, for PVC coupling @$26.	3,120	
29. 60 each. 3" Gate valves, C.I. body, for PVC coupling @$38.	2,280	
30. 30 each. 4" Gate valves, C.I. body, for PVC coupling @$50.	1,500	
31. 1 Lot - Pipe unions, ips threads in following quantities and sizes: 10,500 - 1" 1 1/4" 3,900 - 1½" 7,500 - 2" 1,200 - 2½" 450 - 3" 300 - 4"	234,900	
32. 1 Lot - Check valves, swing type, brass or bronze, ips threaded in following quantities and sizes: 150 - 1" 450 - 2" 30 - 2½" 30 - 3" 30 - 4"	20,550	
33. 1 Lot - Pipe Tees, galvanized iron, ips threaded quantities and sizes as follows: 1,300 - 1" 600 - 1 1/4" 600 - 1½" 900 - 2" 600 - 2½" 300 - 3" 150 - 4"	44,025	

Pipes, Fittings and Supplies for System Installation (continued)	COSTS AID	COSTS GOL
	$	
34. 1 Lot. Reducers, galvanized iron, ips threads, as follows:		
90 - 4 x 3"		
120 - 4 x 2"		
60 - 4 x 1½"		
90 - 3 x 2"		
120 - 3 x 1½"		
60 - 3 x 1 1/4"		
90 - 2½ x 1½"		
150 - 2½ x 1"		
150 - 2 x 1"		
300 - 1½ x 1"		
300 - 1 1/4 x 1"	13,950	
35. 1 Lot. Reducers, female to female threaded, ips threads, galvanized iron: Same sizes, prices and quantities as in Item H.34, above.	13,950	
36. 1 Lot. Pipe nipples, galvanized iron, ips threads in sizes and quantities: 3/4" - 1,200 1" - 900 1 1/4" - 600 1½" - 600 2" - 300 2½" - 300 3" - 300 4" - 150	4,725	
37. 1 Lot. Elbows, 90°, galvanized iron, ips threads in sizes and quantities - 3/4" - 1,200 1" - 1,200 1 1/4" - 1,200 1½" - 1,500 2" - 1,500 2½" - 900 3" - 300 4" - 300	24,150	
38. 1 Lot. Elbows, 45°, galvanized iron, ips threads in sizes and ½ the quantity shown in H.37, above.	12,000	
39. 1 Lot. Float valves, copper float, ips threaded, as follows: 1" - 240 1 1/4" - 60 1½" - 60 2" - 60 3" - 45	85,575	
40. 1 Lot. Miscellaneous fittings: air release valves, cross-overs, collars, pipe dope, etc.	21,000	
41. 1 Lot. Tees, PVC, sleeve type for cement welding, Class 80 in the following: 1" - 900 1 1/4" - 600 1½" - 600 2" - 900 2½" - 300 3" - 150	21,000	

Pipes, Fittings and Supplies for System Installation (continued)	COSTS FID	COSTS COL
	$	
42. 1 Lot. Reducers, PVC sleeve type for cement welding, Class 80 in following: 4 x 3" - 60 4 x 2½" - 60 4 x 2" - 150 4 x 1½" - 90 3 x 2"- 60 3 x 1½" - 120 3 x 1 1/4" - 60 2½ x 2" - 30 2½ x 1½" - 60 2½ x 1 1/4" - 90 2½ x 1" - 300	9,300	
43. 1 Lot. Elbows, 90°, PVC sleeve type for cement welding, Class 80, as follows: 1" - 600 1 1/4"- 600 1½" - 900 2" - 900 2½" - 300 3" - 300 4" - 150	11,400	
44. 1 Lot. Elbows 45°, PVC sleeve type for cement welding, Class 80; same size and one-half quantity as in item H. 43, above.	7,500	
45. 1 Lot. Crossovers, PVC, sleeve type for cement welding, Class 80, in 4 x 3"; 4 x 2½"; 3 x 2½"; 3 x 2"; 3 x 1½"; 3 x 1 1/4"; 3 x 1"; 2 x 1 1/4"; 2 x 1"; total of 1,500	9,000	
46. 900 quarts. PVC Cement, in 1 quart cans @$6.50/qt.	3,150	
Sub-total for pipes/fittings	$ 2,647,935	
• Cement, Rebar and Steel Tanks,		
1. 1 lot. Rebar, 3/8" and ½", deformed, 100 tons. (*) @$250/ton.	25,000	
2. 10,000 bags - cement for spring boxes/reservoirs, 50 kg bags (*)	29,000	
3. Steel Tanks, 4.5cm, and 45cm. (*)	54,000	
Sub-Total	$108,000	

ANNEX VI WAIVERS AND APPROVALS

I. Waivers and Approvals Required.

1. Approval to deviate from the policy expressed in AID Handbook 3, Appendix 3C (AIDTO Circular A-24), which limits the life of a project to six years to allow a nine year life of project.

2. Waiver of the 25 percent cost sharing requirement contained in Section 110 (a) of the Foreign Assistance Act of 1961 as amended.

3. Procurement source and origin waiver from AID Geographic Code 941 (Selected Free World) to Code 935 (Special Free World) for the procurement of equipment maintenance and repair services.

4. Approval for proprietary procurement of 27 project vehicles from International Harvester at an approximate cost of $280,000.

5. Approval for proprietary procurement of 400 Moyno hand pumps at an approximate cost of $200,000.

II. Waiver of the policy contained in Handbook 3, Appendix 3C, which limits the life of a project to six years to permit a nine year project life.

Handbook 3, Appendix 3C, notes that the length of a project should not normally exceed six years but that a somewhat longer period, if required by the implementation plan, may be justified. Project requirements as described below necessitate an extension to nine years, it being unfeasible to divide the project, as suggested in the handbook guidance, into phases.

The project calls for considerable training of certain key personnel. Given the staff limitations of the implementing agency, the VWSS, this training of necessity must be staggered so as to allow construction and maintenance/monitoring activities to be undertaken. Training will be of a long-term nature both in the U.S. and Lesotho, with several trainees not scheduled to complete training until the proposed last year of the project, FY 1986. Experience has shown that the benefits accruing from training can be increased if there is time allowed for overlap with technical assistance personnel upon the trainees' completion of training. An extension to seven years will allow the project to provide such overlap for several key Lesotho participants.

The project has justified a program to construct and rehabilitate approximately 210 village water supply systems. Given prior experience and VWSS personnel limitations, the design team has determined to phase construction over a seven-year period, but allow the bulk of these activities to occur during the latter half of the project

to permit time for some local staff to be recruited, trained, and slowly brought into newly devised installation and maintenance systems. By doing so, physical and human resources of VWSS will not be overburdened. The design team feels that a nine year project will permit construction to take place at a pace which is most compatible with the capability of the VWSS.

III. Waiver of the 25 percent cost sharing requirement contained in Section 110 (a) of the Foreign Assistance Act.

Lesotho is on the United Nations Conference on Trade and Development list of relatively least developed countries. Lesotho will be contributing $1,861,400 or nearly 14 percent of the project total. The great majority of this contribution will be incremental budget expenditures rather than contributions in kind. These increased expenditures will mean an increase of nearly 18 percent annually in the Village Water Supply Section's budget over the life of the project. The waiver is thus requested in view of Lesotho's position as an RLDC and its sizable contribution toward project costs.

IV. Justification for waiver of policy set forth in AID Handbook II to permit procurement of services from Free World firms.

The need for this waiver is based on the following:

Since the amount of construction will be small, U.S. construction firms are not expected to be interested in this work.

A sufficient number of qualified firms operating in Lesotho are available to perform the required construction and permit competitive procurement. Possibly a number of firms may be qualified as "local firms" under Section 2(d) of Handbook II, Chapter 2, on the grounds that they are integral parts of the local economy. However, since some of the firms operating locally may not be incorporated in or may not have their primary place of business in Lesotho, this waiver is considered necessary to assure adequate competition and availability of services.

In addition, it is anticipated that some maintenance and repair services will have to be provided by local firms, many of which may also be owned by South African or other Free World interests.

No U.S. firms providing the required services are known to exist in Lesotho.

V. Justification for Proprietary Procurement of 27 International Harvester Company (IHC) Vehicles

The need for proprietary procurement of International Harvester (IHC) vehicles for this project is based upon the following:

A. IHC is the only U.S. vehicle manufacturer with a distributorship located in Maseru, Lesotho.

B. IHC has indicated that its Lesotho distributor is willing and capable of servicing their complete line of right-hand drive trucks, and will maintain an inventory of fast moving spare parts. If for some reason, a part is not readily available at this location, IHC has indicated that parts can be obtained from a branch office in Bloemfontein, S.A.

C. IHC has indicated its willingness to conduct a maintenance training program in Lesotho for Basotho mechanics.

D. IHC is willing to post a performance bond to insure that its Lesotho distributor will offer adequate service and parts support for project vehicles. The performance bond would remain in effect for a period of one year after delivery of the vehicles.

These vehicles will be manufactured, according to desired specification, in the U.S. and shipped to Lesotho. IHC indicates they will be able to manufacture and ship these project vehicles in a timely manner.

For the above reasons, we believe it would be most appropriate to procure the necessary vehicles for this project from IHC.

VI. Justification for Proprietary Procurement of Moyno Hand Pumps

The project will feature the drilling of 320 holes which will be equipped with a pump for drawing water. A successful pump is critical if villagers are to be able to take advantage of the improved water supply provided by the new wells. Any piece of equipment with moving parts will eventually break down if proper maintenance is not undertaken. It is precisely on the issue of pump maintenance that proprietary procurement is justifiable.

It is recommended that the Moyno hand pump for rural water systems be used exclusively as the project pump. The Moyno pump is manufactured by Robbins and Myers, Inc. of Springfield, Ohio. The 1979 cost per pump is estimated at $500 (including discharge head and gear box, 2 stage stator-rotor assembly, pipe, and shaft with bearing). 400 pumps at this price, which includes 20% spare pumps, gives a total of $200,000 (inflation, transport and contingency costs are not included in purchase price, but provisions have been made for these as shown in the financial annexes of this paper).

The Moyno pump uses a screw-like rotor which turns within a helical stator to form progressing cavities which easily and evenly move the water to the pump discharge located above ground. Flow rate is directly proportional to rotation speed of the rotor. Since total dynamic head (the total distance the water is lifted described in feet of lift) is relatively independent of speed, the Moyno pump can handle high total dynamic heads with a minimum of effort. For example, the Moyno 2-stage stator-rotor assembly can move from a well 3 gallons per minute with only 7 pounds of force, an easy task even for a child. This pump is a positive displacement pump which means the turning of the rotor, no matter how slow or fast, will move water out of the well.

The down-the-hole stator-rotor assembly of the Moyno pump has no valves, gaskets, or leathers to wear out, thus greatly reducing the necessity of pulling the pump for maintenance or repair. The rotor has been constructed from a high grade stainless steel and is chrome-plated for protection against any abrasive materials. The stator is constructed with a heavy duty high grade steel outer shell and with an interior of specially compounded rubber, molded to form the helical design for constant use when submersed in water. The stator is suspended in the well to a depth which puts the suction hand below the expected pumping water level on 10 ft. lengths of $1\frac{1}{4}$" galv. pipe. The rotor is suspended on 7/16" solid steel drive shaft with a centralizer bearing each 10 ft. The upper end of the drive shaft is supported by two tapered roller bearings to assure proper positioning at all times of the rotor within the stator and to insure non-binding while in operation.

Above the support bearing, a 20 tooth beveled gear is positively attached to the rotor drive shaft. This gear is driven by a 40 tooth beveled gear

mounted on a drive shaft at right angles to the stator shaft. The shaft which has the 40 tooth gear is mounted by use of two tapered roller bearings, one for each end, mounted in a steel casting for support. Both gears are packed in homogenized hi-temp. grease. Two operating handles 1 ft. long are mounted 180° from each other, one on each end of the shaft. This gear box arrangement is known as a right angle gear box. It uses the same principle, except on a smaller scale, that has been used unsuccessfully on larger supply wells for municipal, industrial and irrigation application for over 85 years.

Other pumps

Over 12 standard reciprocating pumps were studied by use of available reports and literature along with actual field observation of most of the 12 types utilized in other African countries.

The names of the reciprocating pumps considered were Monarch, Sholapur, ABI, Godwin, UST, Thysen, Monitor, Beatty, Dempster, AID/BAttelle, Lucky, Uganda, and the Brian.

All the above pumps require pulling the pumping cylinder completely out of the well for changing the plunger bucket leathers or for repair of the check valves. This must be done on a regular schedule of 6 to 12 months to keep the pump in operation. All the above pumps have hole cylinder and plunger parts which are known to break without previous indications because of the strain and stressing caused from the reciprocating motion which is necessary for their operation.

The grade handles and attached parts for the above pumps are also subject to the same strain and stressing plus the friction at all pivot points and are subject to many failures. Many of the grade assembly designs for the above pumps have been greatly improved, but even the best, which appears to be the Monarch, still has trouble with broken fulcrum castings and handles.

Also, studied and field inspected were the Vergnet food pump which still is in the development stage with many maintenance requirements (although it is still a very promising concept). The final pump was the Mono which is the English concept of the Moyno Pump. It is a good pump and the only problem has been with the right angle gear box which has sleeve bearings of oilite bronze. The lubrification is 90 SAE gear oil which leaks out through the bronze bearing shaft openings.

Annex VII - Technical Addendums

Annex VII A

Lesotho-Rural Water Supply and Sanitation Project

February 1979

US AID (632-088) FY 79

Hydrogeologic Considerations in Rural Water Supply Development in Lesotho

Prepared by:

George C. Taylor, Jr., Hydrogeologist

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Hydrogeologic Considerations in Rural Water Supply Development in Lesotho

Conclusions and Recommendations:

1. A base of technical data and information pertaining to hydrogeology, hydrology, geology and cartography now exists in Lesotho and is adequate for the purposes of ground-water exploration and development proposed under the present project. Hydrogeology as well as ground-water data collection and analysis were given strong expatriate support during 1973-1975 in the Department of Mines and Geology but are now languishing for lack of appropriately trained personnel in this discipline and adequate GOL and/or donor financial support. Consequently, on-going monitoring as well as data collection and analysis activities pertaining to ground-water development and extraction in the DMG are now essentially inactive. The Hydrogeology Subsection of the VWSS, as presently organized, is essentially a service group directed to the selection of sites for new boreholes, collection and description of borehole samples, and the carrying out of yield tests on new and existing VWSS boreholes. A review by the writer of existing VWSS borehole records indicates a strong need for upgrading both the quality and coverage of these records as well as in the methodology used in hydrogeologic data collection. These are essential to maintaining the viability of existing borehole systems as well as those proposed under the present project. In view of the foregoing the writer recommends that two 3-month TDY's for a U.S. hydrogeologist be programmed during the life of the present project. These TDY's should be timed, if possible, to overlap with those of the drilling advisor (see below). The U.S. hydrogeologist would be expected to train VWSS personnel in the methodology of collecting and recording hydrogeologic data from boreholes under construction as well as from existing and operating VWSS boreholes. The writer recommends upgrading the capabilities of personnel of the Hydrogeology Subsection by on-the-job training and local training seminars.

2. The borehole construction operations of the Drilling Subsection of the VWSS are now carried out entirely with four active and two standby percussion drilling rigs. The drilling crews operate these rigs and carry out borehole construction with an acceptable degree of efficiency. Under the present project, however, it is proposed to introduce a direct rotary drilling rig principally for putting down those boreholes required for the hand-pump systems. The operation and maintenance of such a rig with ancillary equipment require technical skills somewhat more advanced than those pertaining to percussion drilling. Consequently, the writer recommends that a 6-months' TDY for a U.S. well drilling advisor to be programmed in the project, the arrival of the advisor to be timed to coincide

with the arrival of the drilling equipment in Maseru. A second TDY of 3 to 6 months duration could be programmed later in the project life for a driller to evaluate the progress in drilling operations and trouble shoot any problems that might have developed during the course of operations. The well drilling advisor would be expected (1) to select and train one or more drilling crews from the cadre of the VWSS Drilling Subsection, (2) to develop an appropriate system for the accounting and storage of drilling equipment and supplies, (3) to establish standards for the maintenance and repair of the drilling rigs and ancillary equipment. The writer recommends upgrading the capabilities of personnel of the Drilling Subsection by on-the-job training and local training seminars rather than by training outside of Lesotho.

3. One of the early needs of the present project will be on-the-ground studies of target villages to select appropriate sites for new borehole-cum hand pump installations and/or springs which could be captated for gravity supplies or for simple protection. A brief report on each village could be prepared with a sketch map showing the location and altitude of captable springs with respect to the location and altitudes of storage reservoir sites and standpipe sites in or near the target village. Sites for borehole-cum-hand pump installations could be selected with due consideration to the needs of schools, clinics, hospitals, missions or community centres. The report would contain estimates of spring discharge and its seasonal variability as well as the amounts of storage, pipelines, and reticulation system needed to provide a 30 to 40 liter capita supply to the village or alternatively the numbers of hand pumps and boreholes needed to serve the same purpose. These studies could be coordinated with the inventory of existing village water supplies now being made by the VWSS. The writer recommends that these on-the-ground studies be undertaken by <u>Peace Corps (PC) volunteers</u> each with a Basotho assistant on a district by district basis. Each PC volunteer, preferably with engineering and/or geologic training, would be responsible for collecting information on each target village in each of 2 adjoining districts. As Lesotho has 10 districts, 5 PC volunteers each working about one year would be required. It is further recommended that all the PC volunteers work under the direction of one of the <u>U. S. water engineers</u> to be attached to the VWSS as part of long-term technical assistance to the project.

4. Once on-the-ground studies of target villages have been completed (probably in the second year of the project) the energies of the <u>5 PC volunteers</u> and their Basotho assistants (5) could be directed to construction and/or maintenance of new or existing rural water supply systems, always under the general direction of a U. S. water engineer. For example, they could participate in the

setting of hand pumps on completed boreholes; in the construction of spring boxes at protected springs; in the construction of spring captations, erection of storage tanks and laying of pipelines to village standpipes (taps). They could also participate in the maintenance of existing systems and in the instruction of village water minders in the care and preventive maintenance of such systems. Additionally, they could assist in up-grading the accounting and storage of spare parts and in repair of pumps and other equipment at regional and district repair and maintenance centres. Finally the PC volunteers might assist in a training program for Basotho personnel of the Hydrogeology and Drilling Subsections to be conducted jointly by the U. S. drilling advisor and the U. S. hydrogeologist during their TDY's in Lesotho.

5. Having reviewed the operations and needs of the VWSS the writer concludes that there would be only limited use for either a conventional aerial photography (scale 1:50,000 or 1:60,000) or Landsat imagery (scale 1:1,000,000) library. In any case, such a library would duplicate facilities already existing in the Dept. of Mines and Geology.

6. Having studied the relative costs of (1) protected springs, (2) high-level spring captation + storage tanks + conveyance pipeline + distribution, (3) hand pumps with boreholes, (4) low-level spring captation + windmill and pump + conveyance pipeline + storage tanks + distribution, (5) low-level spring captation + diesel engine and pump + conveyance pipeline + storage tanks, (6) borehole + windmill and pump + conveyance pipeline + storage tanks + distribution system, and (7) borehole + diesel engine and pump + conveyance pipeline + storage tanks for a given population, the writer concludes that new construction in the present project should give high priority to systems nos. 1, 2, and 3. No new systems of types nos. 4 and 6 should be constructed under the project. New construction of systems nos. 5 and 7 could be considered where village populations exceed 400. However, the prevailing lack of maintenance of existing systems similar to nos. 5 and 7 points, in the long run, to a low level of technology, namely systems nos. 1, 2 and 3, which could be managed at village level and which could be handled by the constraints imposed on Minrudev.

7. A hydrogeologic assessment during the present Project Preparation (PP) Mission has led to the conclusion that boreholes yielding 0.2 l/s or more can generally be located in most villages in the western and southern lowlands at distances of no more than 150 m from centers of usage. The requisite depths of such boreholes would generally range from 40 to 80 m with an average of 55 m. The depths to water, below land surface, are generally in the range of 3 to 44 m and average about 12 m. These depths are well

within the feasible limits of hand pumping. One hand pump with borehole is recommended for each 100 persons (20 families) with a maximum economic limit of about 4 hand pumps and boreholes for a village of 400. It is recommended to equip each borehole with a Moyno-type hand pump each with a pumping capacity of 12 l/min or 5,760 liters per 8 hrs. of continuous use. Withdrawals at this rate would provide 150 persons per pump with 38 l/c/d. Or pumped for 4 hrs. continuously would provide 100 persons per pump with 29 l/d/c/.

8. In order to speed up the rate and efficiency of village borehole construction, it is recommended that a rotary drilling rig with ancillary equipment be procured for the project. When operating at maximum efficiency this rig can drill a 55 m borehole within a 16-hour work shift. Operating at expectable efficiency this rig will probably put down about 2 boreholes per week. It is recommended that one or more drilling crews from the present cadre of the VWSS Drilling Subsection be trained to operate the rotary rig by a TDY (6 months) U.S. well-drilling advisor to be provided under the project. It is also recommended that the operations of the VWSS Hydrogeology Subsection be upgraded during village borehole construction operations through improved methodology introduced by a U.S. hydrogeologist in two 3-month TDYs during the life of the project.

9. The recommended design for the village boreholes is quite simple, as minimal quantities of water are to be extracted from each. Also the design follows that used in existing boreholes from which considerably larger quantities of water are extracted (that is 0.1 to 0.3 l/s versus 0.5 to 2.0 l/s). As the geologic terrain in which the village boreholes are to be drilled is predominantly compact sandstones and shales, only the uppermost 10 m or so of the borehole will be cased and the rest will be "open hole." The casing will be sealed at the surface and a concrete plinth with a surface sloping away from the casing poured around it. A hand pump will be mounted directly over the borehole. The total number of boreholes to be drilled under the project has yet to be determined but will probably be in the range of 250 to 300.

10. For spring captations to be constructed under the project, it is essential that measurements or at least valid estimates of low flows of the target springs be available for realistic designs of the systems. Many springs, particularly in the drier western and southern lowlands, of the country are reported to have dry season flows less than a third as great as those of the wet season. Consequently, springs for larger captation systems must be selected carefully, and sufficient storage must be provided so that the minimal flows of dry periods are conserved and utilized fully.

Introduction: Ground water, extracted from springs and boreholes, provides about 70% (reference 6) of the total water consumed in Lesotho. Water supplies from boreholes and springs furnish virtually all requirements for drinking, cooking and bathing as well as much of the water needed for the washing of clothes in rural areas. Although surface-water systems drawing from the larger rivers are increasingly used for town water supplies, boreholes and spring captations also continue to provide important supplies in suburban areas. Some 69% of existing rural water supply projects, which have been constructed by the Minrudev (Ministry of Rural Development) or its predecessors, are gravity systems based on high-level spring captations which feed into storage tanks and thence into trunk pipelines, distribution pipelines (reticulation), and faucets at village standpipes (taps). Such systems prevail in virtually all the highland region (about two-thirds of the national territory) as well as in much of the western and southern lowlands. Some 31% of existing systems, virtually all concentrated in the lowlands, are based on diesel, electric or wind-powered pumps which raise water from boreholes or low-level springs through trunk pipelines (rising mains) to storage tanks. From these water is distributed by gravity regiculation to village standpipes. Hand pumps, although used on privately owned boreholes for domestic water supply, have only recently been installed by Minrudev on a few departmentally drilled boreholes. Roof-top catchments feeding cisterns are also used by some private householders as principal sources of domestic water in the wetter areas or as supplemental sources for inadequate public supplies.

Hydrogeologic Setting: The ultimate source of the ground water which sustains boreholes and springs in Lesotho, is precipitation. Infiltrating water from precipitation or streams percolates down to permeable water-bearing zones in the rocks which lie at or below the water table. These water-bearing zones, where they intersect the land surface, give rise to springs or are tapped by boreholes, generally within 100 m (meters) of the land surface. The yields of both boreholes and springs are dependent, in the long term, on recharge to the water-bearing zones which sustain them. Thus water levels in the boreholes rise seasonally with recharge of wet periods and then decline with natural depletion of storage during dry periods (Table 4). Concurrently, the flows of springs increase during wet periods and then decrease during subsequent dry periods. It is well recognized that some springs in the drier lowlands or valleys have dry-period flows which may be only a third as great as wet-period flows. Consequently, only those springs which are known to have reliable and sustained dry-period base flows should be selected for captation and development. Springs in the highlands, because of greater precipitation and recharge, tend to have higher sustained

base flows and thus can be developed and utilized with a somewhat higher degree of confidence than those of the lowlands.

There are 5 groups of stratified rocks which yield ground water to boreholes and springs in Lesotho. In addition ground water is commonly found in shattered and fractured zones in and near intrusive dolerite dikes which cross cut the stratified rocks. The most complete discussion of the occurrence and behaviour of ground water in the rocks of Lesotho is contained in reports by Bonney (references 5 through 10) and much of the following discussion is excerpted from these. From the outset, however, it should be recognized that virtually nowhere in Lesotho are there highly productive aquifers (water-bearing zones) in the rocks from which large quantities of ground water can be extracted. However, small to moderate quantities of water can be obtained from boreholes or developed from springs in many places. The hydrogeologic characteristics of each of the 5 rock groups from oldest to youngest are summarized below:

Beaufort Formation: Comprises red, purple and green mudstones and some buff very fine-grained sandstone. Crops out mainly in the lower valleys of the Jammerberg, Tsa Kholo, Tsoaing, Southern Phuthiatsana, Hlotse, Mohobelong, Mofogoi and Butha Buthe Rivers, all of which are left bank tributaries of the Mohokare (Caledon) River. Some 47 boreholes of record (Table 1) have been drilled in Beaufort rocks mostly near or in dolerite dikes. The mean yield of 11 boreholes after 24 hours pumping was 1.16 l/s with a mean specific capacity of 0.12 l/s/m.

Molento Formation: Made up of interbedded medium to coarse-grained feldspathic sandstones and grits with thin gray silty shales. Crops out between Maseru and Mohale's Hoek in a platform about 5 km (kilometers) wide particularly in the upper Tsoaing, lower Tlumethu and Southern Phuthiatsana River valleys. The formation thickens from only 15 m in the north to 350 m in the extreme southeast of Lesotho. Important spring lines occur both within and at the base of the formation. Several strong springs may occur along 1 km of outcrop with individual dry-season discharges of as much as 0.5 l/s. Some 79 boreholes of record (Table 1) have been drilled in the Molento Formation, chiefly in the vicinity of Mafeteng, Mazenod, Maputsoe, Hlatsoe and Butha Buthe. The yields from the boreholes range from nil to 1.6 l/s even where dikes are not present. The variability in yield is attributed to variations in the degree of cementation of the sandstones.

Elliot Formation (formerly known as the Red Beds): Chiefly red, yellow, blue and gray mudstones with some fine-grained sandstones. About 15 m thick in the north, the formation thickens southward

Table 1.--Distribution of boreholes by geologic formations and catchment areas.

(Bonney, Report MGH GB6)

Catchment Number	Stream	Super-ficial	Beaufort	Molteno	(Red) (Beds) Elliot	(Cave) Clarens	Drakensberg
1 000	Senqu				15	2	3
1 003	Sabapala				1		
1 010	Makhaleng				23		5
1 013	Kolo-la-pere			6	5		
1 014	Qhoqhoane				6		
1 016	Makhalaneng						1
1 030	Tele	1					
1 130	Semena-Mali						1
1 131	Malibamatso						2
1 [illegible]	Matsoku						4
1 300	Caledon		6	26	79	2	
1 301	Tlametlu		1	4			
1 302	Tsoaning		5	5	5		3
1 303	[illegible]khoio		13	3			
1 304	Jammerberg		6	7			
1 [illegible]	Caledon		3	1	21		7
1 [illegible]	Caledon		1	5	7	5	12
1 [illegible]	Hlotse			3			
1 330	Phuthiatsana				1		
1 331	Phuthiatsana				34	1	
1 332	Teja-tejane				7	7	
1 340	Thupa Khuba		8	10	1		
1 341	Thupa Khuba			3	6	1	2
1 34[illegible]	Lehobos	1	4	6	96		1
	Total	3	47	79	307	18	41 = 495

to 110 m at Roma and to 250 m in the southeast. The formation lies near the surface in most of the western and southern lowlands and also in the Senqu (Orange) River valley between Qacha's Nek and Sekakes. Small non-flowing springs and seeps are common in shallow swales in the lowlands. Occasional live springs generally produce flows of about 0.005 l/s. Because it is widespread, the Elliot Formation is the principal source of borehole supplies in Lesotho, in spite of the fact that it contains the poorest aquifers. There are some 307 boreholes of record (Table 1) tapping ground water in this formation, particularly near the towns of Maseru, Mohale's Hoek and Roma. Randomly sited boreholes generally can yield about 0.15 to 0.30 l/s with specific capacities of about 0.05 l/s/m after 60 minutes of pumping and 0.02 l/s/m after 24 hours. However, boreholes sited near dikes may yield as much as 1 to 4 l/s with specific capacities ranging from 0.2 to 0.3 l/s/m after a few hours pumping.

Clarens Formation (formerly known as the Cave Sandstone): This formation is composed of massive fine-grained sandstone which forms prominent cliffs overlooking the softer slope-forming beds of the Elliot. The Clarens, made up of consolidated ancient wind-blown sands, shows the cross-bedded structures typical of such deposits. Two spring lines occur in the Clarens. One of these is near the base above the more impermeable beds of the Elliot. The other is near the top of the Clarens particularly where there is a cover of basalt or a cap of unconsolidated sand. There are 18 boreholes of record (Table 1) most of which are located in or near the towns of Quthing, Mapoteng and Teyateyaneng. The borehole yield characteristics of the Clarens appear to be equal to or slightly better than the Elliot.

Drakensburg Formation: Virtually all the highland region of Lesotho is formed of a succession of basaltic lava flows with occasional ash beds. Some thin sandstones are interbedded in the lower 100 m of the formation. The maximum thickness of the volcanic succession is about 2,000 m. Extensive outlying plateaux and buttes of the Clarens Formation capped by a few tens of meters of the Drakensburg lavas are also common in the western and southern lowlands. Springs may occur at all levels in the Drakensburg lavas chiefly from the scoriaceous and fragmental zones between flows. There are some 41 boreholes of record (Table 1) in the lavas. The average yield for 6 of them was 0.7 l/s with a specific capacity for one of them of 0.04 l/s/m.

Intrusive dikes: Cross-cutting all the stratified rock groups of Lesotho are intrusive dikes which range from a few meters to as much as 150 m wide. Shattered and fractured zones along the dikes give rise to perennial springs particularly at points of intersection with surface drainage lines. Flows may range from 0.03 to

as much as 1.0 l/s but most are in the range of about 0.3 to 0.5 l/s. Larger yields are also generally obtained from boreholes drilled adjacent to dikes than from those drilled at random sites in the stratified rocks at some distance away from the dikes.

Borehole Yields, Depths and Water Levels: Many boreholes have been drilled for the public supplies of towns and villages and for private use during the past 20 years or more. Beginning in 1972 the Hydrogeology Section of the Department of Mines and Geology (DG , set about the task of compiling records on all boreholes put down in the country. As of the end of 1975 records had been collected for some 495 boreholes (Table 1) which are identified by catchment areas. The locations of the boreholes identified by the Hydrogeology Section are shown schematically in Figure 1. The average yield of the boreholes within each catchment area are shown in Table 2. Also shown are the maximum and minimum yields, the yields exceeded in 25 and 75% of the boreholes, and the number of dry holes. As noted in Table 2 the largest percentage of dry holes (56%) has been registered in 1311 Upper Caledon. Elsewhere the percentage ranges from 5 to 50% with an average failure rate of about 36%. Apparently any borehole yielding less than about 0.2 l/s is generally considered a failure. Nevertheless, a borehole yielding 0.2 l/s would provide sufficient water for a hand pump serving a population of 100. The average minimum borehole yield for all the catchments shown in Table 2 is 0.22 l/s and the average maximum is 2.24 l/s. The overall average yield per borehole is 1.10 l/s.

Readily available data on typical borehole supplies, drilled and maintained by the Minrudev Village Water Supply Section in the western and central lowland districts of Lesotho, are shown in Table 3. These data are summarized below:

District	Range in borehole depth(m)			Range in borehole yield (l/s)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Mohales Hoek	86	44	65	5.4	0.51	2.28
Berea	78	24	50	1.35	0.12	0.76
Mafeteng	106	7	56	4.15	0.27	1.24
Butha Buthe	89	27	60	1.39	0.375	0.89
Leribe	60	42	51	2.50	0.375	1.39
Maseru	90	27	54	1.45	0.22	0.71

Table 2.--Summary of borehole yields.

(Bonney, Report MGH GB6)

Catchment Name/No.	Number of holes				Yield per hole (l/s)				
					Ave	Max	25%	75%	Min
1	2	3	4	5	6	7	8	9	10
1000 Lower Senqu	20	6	5	1	0.6	1.3	0.8	0.6	0.1
1003 Sebapala	1	1	1		0.2				
1010 Lower Makhaleng	28	20	10	10	1.0	1.8	1.2	0.8	0.3
1013 Kolo-la-Pere	11	8	3	5	0.2	0.3			0.1
1014 Qhoqhoane	6	3	3		1.3	1.9			0.8
1016 Makhaleng	1	1	1		0.5				
1300 Lower Caledon	113	68	51	17	1.1	4.2	1.5	0.5	0.1
1301 Tlametlu	5	5	4	1	0.5	1.1			0.2
1302 Tsoaning	18	13	8	5	1.3	4.4	1.9	0.3	0.2
1303 Tsakholo	29	20	19	1	0.9	3.2	1.1	0.2	0.1
1307 Sommerberg	13	7	6	1	1.3	1.9	1.9	0.6	0.4
1310 Mid Caledon	32	15	15		1.0	2.5	1.2	0.6	0.1
1311 Upp. Caledon	30	9	3	6	0.6	1.1			0.3
1320 Lower Hlotse	3	2	2		1.6	5.1			0.8
1330 Lower Phutiats	1	1	1		2.5				
1331 Upp. Phutiats	35	16	9	7	0.8	1.8	1.3	0.3	0.1
1332 Teja-Tejane	15	10	8	2	1.1	2.5	1.5	0.2	0.1
1340 Thupa Khuba	19	18	14	4	0.6	2.5	0.9	0.0	0.0
1341 Upp. Thupa Khuba	12	10	6	4	0.5	1.3	0.6	0.1	0.0
1342 Lehobos	108	20	20		1.2	2.5	1.6	0.8	0.0

2 = Number of identified holes
3 = Number of holes with information on yield
4 = Yielding holes
5 = Dry holes

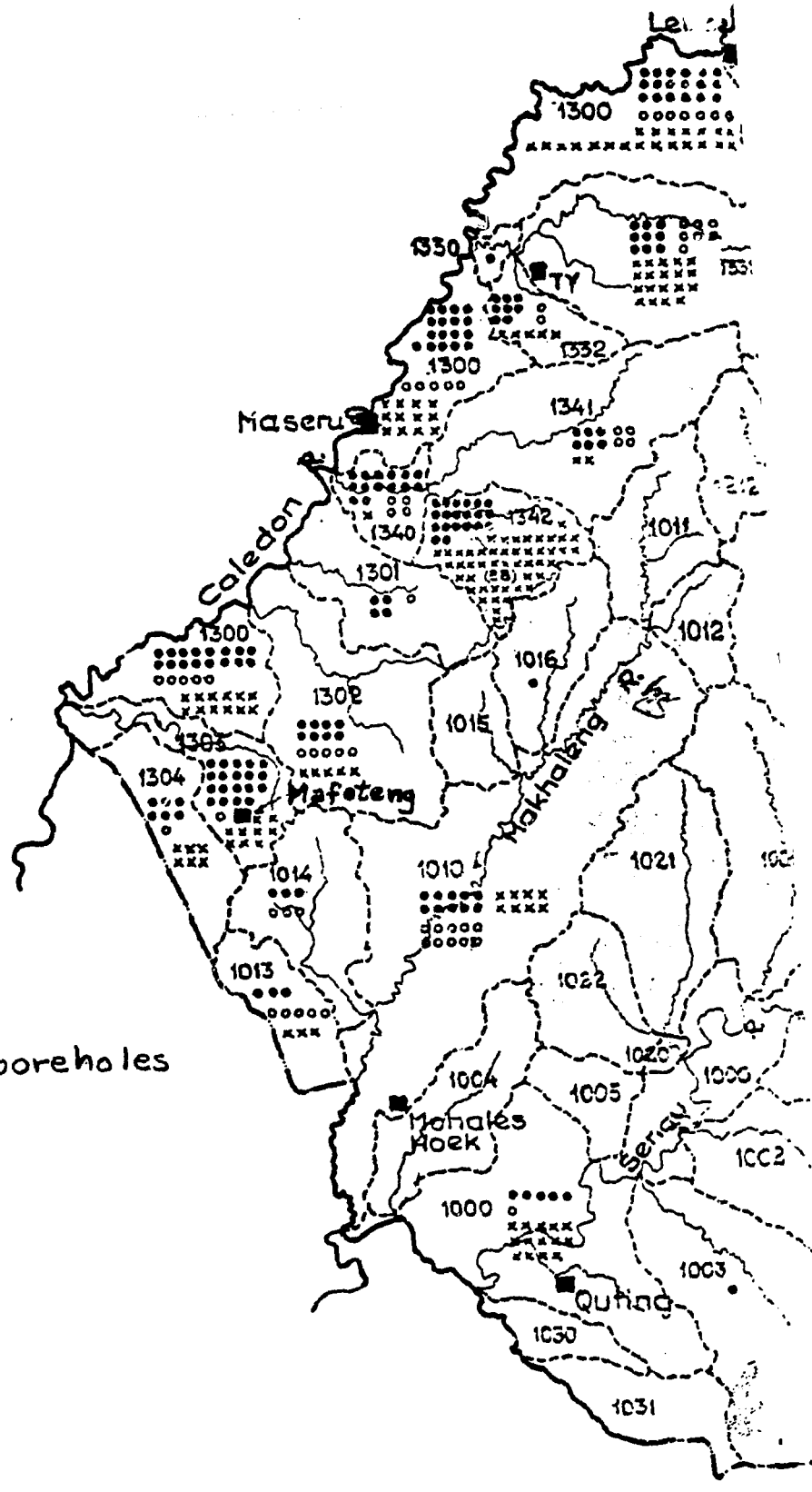

Fig. 1.--Distribution of boreholes

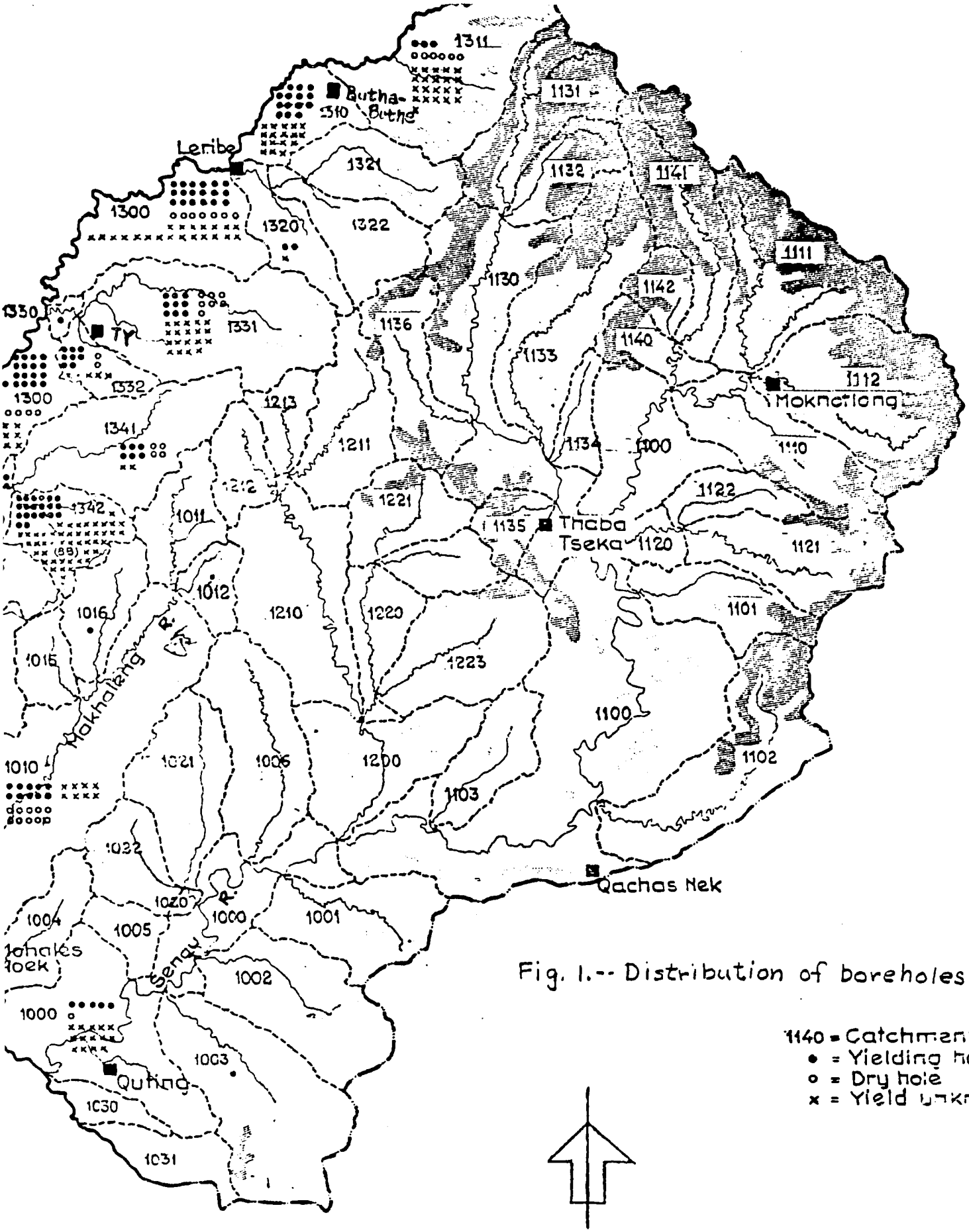

Fig. 1.-- Distribution of boreholes

1140 = Catchment No
• = Yielding hole
o = Dry hole
x = Yield unknown

Table 3.--Records of typical boreholes maintained by the Minrudev Village Water Supply Section in the western and southern lowlands of Lesotho.
(From Minrudev, VWSS files.)

Name of village	Proj. No.	Depth (m)	Yield (l/s)	Remarks
Mohales Hoek District				
Liphiring	10	44	0.51	WM. Cylinder set at 16.76 m.
Siloe	61	44	5.4	
Ha Bokoro	9	86	0.925	Lister ST1. Mono ES10 1500 RPM.
Ha Nkaus Clinic	15	NR	NR	Lister ST1, 1900 RPM. Mono D30ES15 800 RPM.
Mohalinyane	17	NR	NR	Southern Cross Mark RH WM.
Lifateng	16	NR	NR	Lister LRI 2200 RPM. National D6 pump.
Berea District				
Maghaka	13	76.9	0.12*	Seneschal WM. *30 hr test in 1973.
Lipeleseng	14	91	0.62	WM. Cylinder set at 30.48 m.
Mesanela--Th.	26	39.6	1.35*	D/W 12/19 m. *5 hr test in 1967.
Matooane	50	39.9	0.5*	*5 hr test in 1972.
Ha Fusi	86	78	0.79*	*48 hr test.
Ha Ts'ekelo	89	41	1.06*	*42 hr test in 1972.
Phoofolo	90	24	0.94	

NR = No Record or Information available.

Table 3 (continued)

Mafeteng District

Name of Village	Proj. No.	Depth (m)	Yield (l/s)	Remarks
Ha Patsa	20	37	1.05*	*8 hr. test in 1976.
Ha Tlaitlai	25	44	1.10*	*12 hr test in 1976.
Malimong	38			WM.on spring.
Bolumatou I	50	44+	0.51	WM. Cylinder set at 44 m.
Lit'soeneng	70	NR	NR	WM.
T'supane Police Post	75	25	0.85	
Sekantsing	89	NR	NR	
Tsakholo	97	7.21	0.563*	*47 hr test. Seneschal RH WM with 16.5 m tower. Cylinder set at 5.90 m.
Lepolesa	98	21	0.625	Southern Cross WM Mark RH.
Sekoati	99	69.8	1.375*	*36 hr test. Seneschal RF WM 5.2m.
Ha Kuili	101	80	0.876*	*Tested in 1978.
Matlapaneng	103	61.4	1.48	
Daemane	111	60	4.15(?)	
Makintane/Molise	113	106	2.08	Hand pump.
Kapanong	900	104	0.27*	*Tested in 1976.

Butha Buthe District

Khukune	4	NR	NR	WM.
Mamaziboko	11	27	0.938*	WM Mark RH. *Tested in 1973.
Qalo	18	24+	0.88*	WM. Cylinder set at 24.38 m. *Tested in 1972.
Khapung (Mr. Metlakhola)	1370-19	15+	0.56*	*Tested in 1973. WM. Cylinder set at 15.24 m.
Liphofung	25	NR	0.375	Spring.
Serutle	44	64.6	1.17*	*Tested in 1972.
Moroeroe Nqabeni	49	42+	0.94*	WM. Cylinder set at 42 m. *Tested in 1973.
St. Paul Mission	50	NR	NR	
Tlokoeng	51	88.7	1.39*	*Tested in 1973. WM. Cylinder set at 40 m

Table 3 (continued)

Leribe District

Name of Village	Proj. No.	Depth (m)	Yield (l/s)	Remarks
Leberu	7	NR	NR	
Rakolo's A (1)	8	50	1.50*	*Tested in 1973. Electric motor 2.2 kw. Mono ES 15 1250 RMP pump.
Rakolo's B (3)	8	42	1.25	Listev SR II. Mono ES 15 1250 RPM pump.
Rakolo's B (4)			0.375*	*Tested in 1972. Electric motor. Mono pump.
P.M.'s house				
Rakolo's B (2)	8	NR	2.50*	*Tested in 1969. Seneschal WM.
Moharane	31	NR	1.44	
Liteboho	42	NR	NR	
T'sifadi Mali	76	NR	NR	
Hloahloeng	77	NR	NR	
Mathokoane	82	60	1.25	

NR = No record or Information available.

Table 3 (continued)

Maseru District

Name of Village	Proj. No.	Depth (m)	Yield (l/s)	Remarks
R.T. Station		44	0.22*	*Tested in 1976. Electric motor 220 V./1.5 kw. Mono ES 4 1000 RPM pump.
Mphoto	154	38+	2.0*	*Tested in 1977. WM. Cylinder set at 38 m.
Ramahajane	151	44+	1.3*	*Tested in 1977. WM. Cylinder set at 44 m.
Ratjomose	144	NR	1.14*	*Tested in 1978.
Ha Luka	135	NR	0.6*	*Tested in 1972.
Tikoe	123	NR	NR	Southern Cross Mark 12-E WM.
Ha Boshofo	122	NR	0.6*	*Tested in 1977.
Motoko	117	NR	0.25*	*Tested in 1971-72. Electric 3-phase 4 HP motor. Pump.
Ha Jimisi	110	90	0.3*	*Tested in 1976.
Ha Katu	57	47+	1.45*	*Tested in 1977. WM. Cylinder set at 47 m.
Mapatong	26	NR	NR	Lister SR 170 B 2000 RPM 6.5HP engine. Blacks pump.
Lithabaneng	25	51.1	0.194*	*Tested in 1978.
Khoabane	14	NR	NR	Lister LT 2600 RPM 10 HP engine. Mono ES 10 pump.
Makhalanyane B	10	27	0.30	Electric 380 v 1.5 kw motor. Mono ES 4 1350 RPM pump.
Makhalanyane A	10	57	0.35	Electric 380 v 1.5 kw motor. Mono ES 4 1540 RPM pump.
Masianokene	8	36+	0.6	Electric 380 v 3 HP motor. Mono ES 10 pump. Cylinder set at 36 m.

NR = No Record or Information available.

The range of depth in Minrudev boreholes located in the western and southern lowland districts are summarized in the table above. As shown here the deepest borehole of record is 106 m in Mafeteng District. (It is reported, however, that some Minrudev boreholes have reached depths of 120 m.) The average maximum depth among the 6 districts indicated is 85 m, the average minimum is 28 m, and the overall average for the 6 districts is 56 m. The average maximum yield among the 6 districts is 2.70 l/s, the average minimum is 0.31 l/s and the overall average for the 6 districts is 1.21 l/s.

Available data on the depth to water level (rest level) below the land surface in the boreholes put down in Lesotho appear to be quite sparse. Data on 11 boreholes scattered through the western and southern lowlands indicate a range of 3 to 44 m and an average of 12 m. These data are based on water-level measurements made by the Hydrogeology Section, Dept. of Mines and Geology during 1973--75 (reference 6). The data are summarized in Table 4. It should be noted here that systematic recording of both static and pumping water levels is of the highest importance in the routine operation and maintenance of any borehole-cum-pump project. The writer has observed that no provision has been in existing VWSS pump installations for routine depth-to-water measurements. To make such measurements a threaded hole with a removable plug can be tapped in the pump base so a tape or water-level measuring device can be inserted into the borehole. Alternatively a one-inch pipe with a cap can be laid in the concrete base so that a tape can be inserted into the casing for a water-level measurement.

Borehole construction: The Village Water Supply Section (VWSS) operates and maintains 6 percussion drilling rigs, all of the same make. Four of these drilling rigs are normally in operation and 2 rigs are in standby in case of breakdowns. All the rigs were manufactured by the Dreyer's Engineering Co. of Bloemfontein. The rigs were all purchased in the early 1970s. Transport of the rigs from one site to another frequently entails delays, because the trucks on which the 4 operating rigs are mounted suffer frequent breakdowns owing to old age and unavailability of spare parts. The VWSS is now drilling about 30 boreholes per year with its operable rigs. On the average a rig can put down about one borehole per month, if no breakdowns or other work stoppage occurs. A drilling crew generally includes 4 labourers plus a drilling foreman working one shift of 8 hours per day. The capacity of the rigs is about 120 m, but most boreholes range from 30 to 85 m deep with an average depth of 55 m. When in good operating condition, a rig can drill 6 to 7 m/day.

Table 4.--Depths to water, in meters below land surface in 11 observation boreholes in the western and southern lowlands of Lesotho.

(after Bonney, MHG GB 2, 1975)

Town and (District)	Catchment Area (Fig. 1)	Aquifer	Depth of borehole (m)	Depth to water (m) during 1973-75*	
				Maximum	Minimum
Maputsoe (Leribe)	1300-86	Molento	55	11.335	8.235
Mpharane (Leribe)	1300-86	Molento	NR**	5.856	4.485
Mazenod (Maseru)	1342-35	Molento	19	13.578	12.485
Lipeleseng (Berea)	1300-55	Molento	91	11.258	9.670
Liphiring (Mohales Hoek)	1013-07	Elliot	44	10.102	7.300
Takalimane (Maseru)	1342-21	Superficial	15	3.339	2.405
Mafeteng (Mafeteng)	1303-15	Molento	NR	6.583	2.754
Butha Buthe (Butha Buthe)	1310-13	Elliot	NR	7.730	5.470
Kolonyama (Leribe)	1331-23	Elliot	38	25.486	18.775
Mapoteng (Teyateyaneng)	1331-33	Clarens	55	44.485	36.483
Roma (Maseru	1342-56	Elliot	58	15.320	12.500

* Below land-surface datum.
** NR = No Record.

The VWSS boreholes are usually drilled in a 6½-inch (165 mm) diameter open hole in which 3 10-ft (3.05 m) lengths of 6-inch (152 mm) steel casings are driven. The boreholes are developed by surging, backwashing and bailing. Below the 30 ft (10.1 m) of surface casing, the boreholes are simply left open as no lining is generally required. Traditionally boreholes have been sited adjacent to dolerite dikes where somewhat larger yields can generally be expected than from boreholes randomly sited at points some distance away from dikes. Boreholes yielding less than 0.2 l/s are generally considered "unsuccessful." It should be recognized, however, that a borehole yielding as little as 0.2 l/s, where fitted with a hand pump, can provide an adequate water supply for 100 people. The VWSS, however, has traditionally sought to find sites for boreholes that would yield 0.4 l/s or more and adequate for installation of an electric, diesel or wind-powered pump. Although fewer boreholes may be needed to supply a given population, conveyance pipelines and storage reservoirs are required to serve villages not conveniently located near dikes. Such installations are vulnerable to frequent mechanical breakdowns as well as to lack of fuel or wind to drive the pumps. An alternative to the now existing installations is the siting of boreholes at or as near as possible to the point of use and the installation of a sturdy hand pump on each borehole. Although lower yields might be obtained from individual boreholes they would, nevertheless, generally be sufficient to sustain a population of 100 to 150 people per hand-pump-cum-borehole. Such installations would eliminate the need for conveyance pipelines and storage reservoirs. Also sturdy hand pumps are less vulnerable to breakdown and more easily repaired than electric, diesel or wind-powered pumps. For larger villages two or more hand pumps-cum-boreholes could be installed so that if one should fail the others can still be used until repairs are made.

The smaller capacity boreholes constructed by the VWSS and private contractors and located at random sites and allowing for a 33% failure rate and 10 m of 6-inch surface casing can now be costed at *R48 per meter or R2,645 for a borehole of an average depth of 55 m. For a larger capacity borehole located in or near a dike a somewhat higher failure rate of 50% can be anticipated. Thus the rate per meter for a successful borehole increases to R64 per meter or R 3,518 for a borehole with an average depth of 55 m.

*1 Rand = $US 1.15 in Feb. 1979.

Hydrogeologic Data Collection and Analysis in the VWSS:
The Hydrogeologic Subsection of the VWSS is presently charged with responsibility for (1) the selection of sites for new boreholes based on geologic criteria; (2) the examination of formation samples taken from boreholes during drilling operations and the description of the physical characteristics of these samples; (3) the measurements of static and pumping water levels as well as borehole yields at the time of borehole completion; (4) borehole depth and settings of pump intakes or cylinders; and (5) preparation of graphic logs or strata charts for each new borehole . These data together with the engineering details of the borehole construction and water-delivery system are placed together in the general project file for each village system at the VWSS "bottom" office. The writer's review of these records indicates that the hydrogeologist's current logging of boreholes is being done accurately and competently. The quality of the pumping tests is good for the purpose intended, namely to give a rough measure of the static water levels, and drawdown versus yield during pumping tests ranging from 8 to 48 hrs duration. Apparently, there is no routine sampling of the water from boreholes for chemical or bacteriological analysis either at the time of completion or later. Also following completion, there is no routine monitoring of water levels or yields of operating boreholes to evaluate their continuing performance and to anticipate any potential problems in declining yields or possible failure. The quality of initial pumping tests could also be upgraded through provision of adequate equipment for measurement of water levels together with some training of staff in the more sophisticated aspects of data collection and analysis for determination of aquifer characteristics. For the older operating boreholes there is a distressing lack of data in the VWSS files for such basic borehole parameters as depth, static and pumping water levels and yields. Given the proper equipment, some instruction in methodology, this type of data could be readily collected by the staff of the Hydrogeology Subsection. These data could then be evaluated routinely to determine the on-going performance of borehole-based village water-supply systems. For spring-supplied systems there is a need for an on-going monitoring of spring discharges to determine whether adequate flows are available to sustain village requirements. Such measurements could be made on a seasonal basis perhaps two or three times a year.

A recommended list of hydrogeologic equipment for VWSS is attached.

Comparative Costs for Construction and Maintenance of Rural Water-Supply Systems: There are some 7 types of rural water systems which can be identified in the rural water-supply development and maintenance program in Lesotho. If the needs of an average village of 400 people receiving a range of 30 to 40 liters per capita per day are assumed, 7 prototype systems can be costed using the standards developed in references 11 and 15. These costs are solely for materials and supplies needed in the construction of the systems and do not include labor costs.*

Construction:

(1) Four protected springs without conveyance storage or distribution (an "in situ" system)

	R
4 Spring captations @ R 175 each	700

The cost per capita would then be R 1.75

(2) High-level spring captation + storage tanks + conveyance pipeline + distribution (a gravity system)

	R
Spring captation	175
2 Storage tanks @ R 1,800 each	3,600
Conveyance pipeline, 1,500 m @ R 308/m	4,620
Distribution system	500
	8,895

The cost per capita would then be R 22.

(3) Four hand pumps and four boreholes (a pump system) without conveyance or storage

	R
4 Boreholes 55 m deep @ R 2,090 each	8,360
4 Hand pumps, Moyno type @ R 435 each	1,740
4 Concrete plinths @ R 15 each	60
	10,160

The cost per capita would then be R 25.

*The costs given in references 11 and 15 are for early to mid-1977 and should be multiplied by a factor of 1.25 to bring them up to date (February 1979).

(4) Low-level spring captation + windmill and pump + conveyance pipeline + storage tanks + distribution (a pump system)

	R
Spring captation	175
Windmill and pump	3,830
Conveyance pipelines, 1,500 m @ R 3.08/m	4,620
2 Storage tanks @ R 1,800 each	3,600
Distribution system	500
	12,725

The cost per capita would then be R 32.

(5) Low-level spring captation + diesel engine and pump + conveyance pipeline + storage tank + distribution system (a pump system)

	R
Spring captation	175
Diesel engine and pump	1,390
Conveyance pipeline, 1,500 m @ R 3.08/m	4,620
2 Storage tank @ R 1800 each	3,600
Distribution system	500
	10,285

The cost per capita would then be R 26.

(6) Borehole + windmill and pump + conveyance pipeline + storage tanks + distribution system (a pump system)

	R
Borehole 55 m deep in dike	2,780
Windmill and pump	3,830
Conveyance pipeline, 1,500 m @ R 3.08/m	4,620
2 Storage tanks @ R 1,800 each	3,600
Distribution system	500
	15,330

The cost per capita would then be R 38.

(7) Borehole + diesel engine and pump + conveyance pipeline + storage tank + distribution system (a pump system)

	R
Borehole 55 m deep in dike	2,780
Diesel engine and pump	1,520
Conveyance pipeline 1,500 m @ R 3.08/m	4,620
Storage tank (1)	1,800
Distribution system	500
	11,220

The cost per capita would then be R 28

The relative annual maintenance, operation and depreciation costs of the 7 prototype systems, excluding labor, would be as follows:

Maintenance, operation and depreciation:

(1)

System	R
Minor repairs	10
Preventive maintenance	30
No operation or depreciation costs	40

The cost per capita would then be R 0.10.

(2)

System	R
Minor repairs	10
Major breakdown, in gravity system	50
Preventive maintenance	30
Depreciation on tanks, 2 X r 120/yr over 15 years	240
No operation costs	330

The cost per dapita would then be R 0.82.

(3)

System	R
Minor repairs, 4 X R 10	40
Preventive maintenance	30
Deprec. ion on pumps, 4 X R 43.50/yr over 10 years	175
No operation costs	245

The cost per capita would then be R 0.61.

(4)

System	R
Minor repairs	10
Windmill and pump repairs	20
Major breakdown, as in gravity system	50
Preventive maintenance	60
Depreciation on tanks, 2 X R 120/yr over 15 years	240
Depreciation on windmill and pump over 30 years @ R 130/yr	130
	510

The cost per capita would then be R 1.28.

(5)

System	R
Minor repairs	10
Diesel engine and pump repairs	20
Major breakdown, as in gravity system	50
Preventive maintenance	90
Depreciation on tank 1 X R 120/yr over 15 yrs	120
Depreciation on diesel engine and pump @ R 140/yr over 10 years	140
Fuel @ 10 liters per week (operation)	200
	630

The cost per capita would then be R 1.56.

(6)

System	R
Minor repairs	10
Windmill and pump repairs	20
Major breakdown, as in gravity system	50
Preventive maintenance	60
Depreciation on tanks, 2 X R 120/yr over 15 years	240
Depreciation on windmill and pump over 30 years @ R 130/yr	130
No operation costs	510

The cost per capita would then be R 1.28.

(7)

System	R
Minor repairs	10
Diesel engine and pump repairs	20
Major breakdown, as in gravity system	50
Preventive maintenance	90
Depreciation on tank 1 X R 120/yr over 15 yrs	120
Depreciation on diesel engine and pump @ R 150/yr over 10 yrs	150
Fuel @ 10 liters per week (operation)	200
	640

The cost per capita would then be R 1.60.

The comparative capital, maintenance, depreciation and operation costs are summarized below:

System No.	Capital cost (R)	Per capita capital cost (R)	Maint., depr. and oper. cost (R/yr)	Per capita maint., depr., and oper. cost (R/yr)
1	700	1.75	40	0.10
2	8,895	22	330	0.82
3	10,145	25	245	0.61
4	12,725	32	510	1.28
5	10,285	26	630	1.56
6	15,330	38	510	1.28
7	11,220	28	630	1.60

From the above analysis it is concluded that for a village of 400 people, which may be close to a median size in Lesotho, simple protected springs (no. 1) are the cheapest source of potable water both in unit and per capita costs. A high-level spring gravity system (no. 2) compares closely in capital cost with a low-level spring and diesel pump system (no. 5) but the annual maintenance, depreciation and operation cost of the latter are 2.1 times as

great as the former. The hand-pump borehole system (no. 3) while exceeding the capital cost of systems nos. 2 and 5 has the lowest annual maintenance, depreciation and operation cost, excluding system no. 1. Windmill pumped systems nos. 4 and 6 have the highest capital costs among the 7 systems, but diesel pumped systems nos. 5 and 7 have the highest annual maintenance, depreciation and operation costs.

In view of the above analysis the writer believes that new construction in the Lesotho Rural Water Supply Project should give high priority to systems nos. 1, 2 and 3. No new systems of types nos. 4 and 6 should be constructed under the project. New construction of systems nos. 5 and 7 could be considered where village populations exceed 400. However, lack of maintenance of existing systems similar to nos. 5 and 7 points, in the long run, to a lower level of technology (systems 1, 2 and 3) which could be managed at the village level and which could be handled by the constraints imposed on Minrudev.

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Hydrogeological Equipment for VWSS:

2 Brunton Compass w/ case @ $75 each	$ 150
2 Locke Hand Levels w/ case @ $20 each	40
2 30-meter steel tapes w/ reel @ $75 each	150
1 100-meter steel tape w/ reel	150
1 150-meter steel tape w/reel	175
2 M-scopes with 150 m of cable @ $125 each	250
4 Probes for M-scope @ $15 each	60
1 Repair kit for M-scope	100
	$1,075

Unit Borehole Costs--Rotary Hole for Hand Pump
Assuming 55m hole

		R
Labor:		
	Survey, construction, construction education, testing, strata chart preparation, siting, and drilling	1,054
		1,054
Supplies:		
U.S. Origin	Casing, 6-inch, 10 m steel @ R 20/m	200
	Drilling mud ± 3 bags/hole @ R 4.35/bag	13
	Mud cleaning agent ± 1 bag/hole @ R 43.50/bag. . . .	43
	Rotary drill shoe 1/hole @ R52 each.	52
	Drill bits, 1/ hole @ R 380 each	380
		678
Operation:		
	Fuel (diesel):	
	Rotary Rig--16 hrs/day @ 26.5 l/hr x 16 is 424 l/d @ R 0.32/l	136
	Water Truck- 8 hrs/day @ 26.5 l/hr x 8 is 212 l/d @ R 0.32/l	68
	Support vehicles (1) - 4 hrs/day @ 19 l/hr x 4 is 76 l/d @ R 0.32/l.	24
	Test pump and engine - 12 hrs/day @ 19 l/hr x 12 is 228 l/d @ R 0.32/l	73
	Spare parts and repairs for equipment and support vehicles @ R 500/hole	500
		801
	Total R	2,533
	Assuming 33% failure rate 1 successful borehole . . . . . R	3,369

Unit Borehole Costs--Percussion Hole for Hand Pump
Assuming 55 m hole

		R
Labor:		
	Survey, construction, construction education, education, testing, strata chart preparation siting and drilling	1,380
		1,380
Supplies:		
U.S.	(Casing, 6-inch 10 m steel @ R 20/m	200
	--(Drive shoes 1/hole @ R 52 each	52
Origin	(Drill bits 1/4 bit/hole @ R 782 each	195
		447
Operation:		
	Fuel (diesel):	
	Percussion rig - 8 hrs/day for 11 days is 88 hrs @ 19 l/hr is 1672 l @ R 0.32/l . . .	535
	Water truck - 4 hrs/day for 11 days, 44 hrs @ R26.5 l/hr is 1166 l @ R 0.32/l	373
	Support vehicles (1) @ 4 hrs/day for 11 days, 44 hrs @ 19 l/hr 836 l @ R 0.32/l	267
	Test pump and engine	73
	Spare parts and repairs for equipment and support vehicles @ R500/hole	500
		1,748
	Total R	3,575
	Assuming 33% failure rate 1 successful borehole . . . . . R	4,755

Annex VII B

Engineering Analysis:

Table of Contents:

Section 1 : Introduction
Section 2 : Construction Techniques, Materials, etc.
Section 3 : Cost Estimates
Section 4 : Maintenance of Water Systems
Section 5 : Priority of System Types
Section 6 : Buildings, Housing and Construction
Section 7 : Sanitation

Section 1 : Introduction

This engineering analysis concerns itself primarily with describing techniques and methods presently being used by the Ministry of Rural Development, Rural Water Supply Section of the GOL in providing water supplies to villages throughout the country. Hydrogeology and well drilling techniques are described in the annex pertaining to that subject.

Section 2 : Construction Techniques, Materials, etc.

Presently, the Rural Water Section of the Ministry of Rural Development (Minrudev) is constructing two basic types of systems. These are:

(1) Spring protection (captation) with and without distribution. Most of these are gravity flow but a very few are pumped; and

(2) Wells (boreholes) with pumping, either diesel or windmill powered.

Both types of systems, especially in a larger villages, generally require storage and/pressure equalizing reserviors in the system as well as a fairly extensive distribution piping system. No systems are being designed to serve house or yard connections and all customers are being served with street hydrants (stand pipes).

(1) Spring systems: Presently, once a spring or springs of sufficient dry-weather flow is located within 2000 meters of the village to be served and which is elevated above the village, the "rule of thumb" is that this is the least cost method of providing water to the village. A distance greater than 2000 meters indicates that a well is the "least cost" choice. This rule of thumb parameter does not, however, include the added maintenance and operational costs required for mechanical pumping devices.

Assuming a survey finds that a spring meets the basic requirements for gravity flow, the following constructions are required:

(a) The spring box or protective captation - These are small masonry (generally brick bat sometimes local stone) boxes of sufficient size to cover and protect the spring from surface contamination;

(b) A sedimentation chamber/feeder reservoir - This is again a brick or stone masonry structure placed at such an elevation below the spring box to allow for gravity flow. It is composed of a small stilling/sedimentation tank for sand and silt removal which overflows to a small feeder reservoir chamber. In smaller villages, this may serve as the only storage reservoir in the system.

(c) Pressure regulating reservoirs or chambers - These are located in the distribution system, as elevations dictate in order to reduce excessive pressure in the system. They may be a small masonry tank equipped with an inlet float valve or, more often, a 4.5 or 45 cubic meter reservoir which also serve as storage reservoirs.

(d) Storage reservoirs/tanks - These are almost always 4.5 and 45 cubic meter tanks, installed

singly and in multiples to provide sufficient storage for a 24 hour demand based on 30 liters per person per day. Recently this has been expanded to 40 L/p/d at the insistance of the BMOD donor.

(e) Distribution systems - All pipe sizes are presently being selected to deliver 30 L/p/d. Present sizing does not take into consideration the possibilities of population growth or demand growth. Pipe materials are galvanized steel primarily, with some polyethylene pipe being used. Unfortunately, results with polyethylene have not been satisfactory, primarily due to the fact that they are not buried deeply enough to prevent herd boys and others from vandalizing them since they are fairly easily perferated. Another factor is that they are not bedded properly prior to backfill of the trenches.

(2) Borehole Systems - (Note this also includes low level spring systems which must be pumped).

Where spring systems (gravity) are not feasible due to distance or lack of water quantity, this becomes the preferred system.

Presently, all such systems have been installed using either a windmill or a diesel engine driven down-the-well pump. Both of these are quite expensive to install and have a remarkably poor performance record. Maintenance is costly and requires frequent visits from the maintenance personnel of the Minrudev. In addition, windmill systems are poorly planned. Since the boreholes are at the dike area which is almost always in a low area, the windmills are somewhat sheltered from the wind and are unable to pump water for long periods of time. This creates the need for large storage capacity (7 to 30 days demand) in order to provide water over the windless days. The pumping capacity of these devices is, however, insufficient to meet the daily demand and to pump enough extra water to fill the large

reservoirs.

The Minrudev has only installed two handpumps in the country and those only very recently.

The same materials, distribution systems, reservoirs etc, as discussed in gravity-fed systems, applies to these systems.

Recommendations: In order to establish cost methods for both construction and in order to minimize maintenance to the greatest extent possible, the following procedures, etc. are recommended, and have been incorporated into this project design:

1. That, to the greatest extent possible the use of steel tanks for storage, etc, and the use of imported bricks (SA) be discontinued and replaced with stone masonry reservoirs, spring boxes, etc. The only real need for a steel tank is in those few instances where it must be placed on some kind of elevated platform. It appears that the Basotho have a great ability for doing hewn stone masonry, even building their rondavelles in this manner. Hewn stone, however, is not even necessary since reservoirs and spring boxes could be built from rubble rock. Both forms of construction would require much less expenditure by Minrudev and allow for more village participation/contribution in labor.

2. That all pipes in distribution systems be hydraulically designed to deliver a minimum of 40 liters/person/day, even if dry-weather flow from the source may not match this. This would allow for watering of small kitchen gardens (not community gardens which have been fairly unsuccessful ventures to date) thus supplementing the diets of the villagers, an important public health benefit from a water system.

3. That the use of polyethylene pipe for transmission mains and lines be discontinued due to its high

vulnerability to crushing and vandalism. Small diameters for very short distances (i.e. connecting a street hydrant to a main) would be acceptable.

4. That the use of polyvinyl chloride (PVC) pipe be substituted for steel wherever possible. At present, purchase costs of PVC are about 60% of steel pipe prices.

   Transport costs are lower due to less weight and it is more easily handled and layed. Since it is rigid and of higher density and thickness than polyethylene, the problems of crushing and vandalism are minimized, especially since class 80 pipe (heaviest wall thickness) has been specified. It should not be used wherever it must be exposed, as in donga crossings or where pipe must be laid on the surface due to excavation impossibilities, however.

5. That, to the extent possible, the use of hand-pumps on boreholes be substituted for windmills and diesel driven pumps on boreholes. This is the least cost method for villages up to about 400 population where borehole systems must be used. The use of "Moyno" handpumps is recommended since these are the sturdiest and most maintenance-free hand pumps available. Such maintenance as is required is quite simple and easy to accomplish. This appropriate technology alternative would require one well for each 100 population requiring 4 wells for the average village of 400 people in lieu of the one bore-hole and pumping device used at present. With the provision of a high-speed rotary drilling rig, this 4 : 1 ratio also becomes a least cost method since the rotary rig can drill four wells in about one-half the

time required for the presently used percussion rigs to dig one well. A further advantage is that if one pump breaks down, the village still has water from the other three until repairs can be effected whereas with the single well with mechanical pumping a breakdown means the village is completely without water.

Section 3 : Cost Estimates

Cost estimates for materials, construction, equipment and vehicles are contained in Annex 5E. Cost estimates are based on a detailed cost analysis performed by Binnie and Partners, a British A & E firm operating in Lesotho which has been contracted to do A & E work for those projects funded by the British Ministry of Overseas Development. The sample comprised some 49 systems of which 41 systems were of the spring-fed gravity type. The balance was a borehole or a combination of gravity-pumped systems. Complete designs and detailed, itemized commodity lists were available. From this, we extrapolated to the number of systems envisaged in the project, using a factor of a 10% shipping cost for all commodities. Annex 5E is based on current prices otherwise and does not factor increases due to inflation. These costs are contained in the financial analysis section of the project paper.

Engineering Analysis

Section 4 : Maintenance of Water Systems

Undoubtedly the problem of maintaining both the existing and proposed water supply systems is critical if not crucial to the success of the project. With the possible exception of gravity flow spring systems, the overall maintenance picture is a dismal one. Windmill and diesel driven pumping systems show as high as a 200% per year failure rate with failures ranging, in the case of diesel units causes ranging from simple lack of fuel to the need of complet replacement of the engines.

At present, major maintenance and repair services are furnished by two teams operating out of Maseru. It is obvious from the maintenance records and reports of breakdowns that this is not sufficient organization, even for maintenance of the existing systems. Minor maintenance is supposed to be provided by the "village water minder" system; whereby each village to receive a system shall appoint one of their members as the person responsible for the operation and maintenance of the system. If a problem is minor and one which can be taken care of by the water-minder, he/she does it. If the problem is greater than the capabilities of the water-minder, he/she reports the problem to the District FTA (Field Technical Assistant) who, in turn, reports the problem to MORD in Maseru. Theoretically, this is a reasonably practical system under present conditions. Actually, the water-minder concept is so loosely organized that they have no training and are not equipped with even the simplest tools, so that in practice almost any breakdown becomes a "major" one which is referred to the FTA.

In order to better undertake the maintenance and repair of existing systems as well as those proposed in this and other projects, a series of regional and district repair depots is suggested.

Minrudev (MORD) has planned the following pattern of Regional and District Maintenance Depots -

Regional Workshops	District Workshops
	1. Mokhotlong (planned)
Maputsoe (Leribe) North	2. Butha-Buthe (planned)
	3. Berea north
	4. Berea south
Maseru (Maseru District)	5. Mafeteng
Central	6. Thaba Tseka
Mohale's Hoek	7. Quthing
South	8. Qacha's Nek

The Regional facilities at both Maseru (central) and Maputsoe (north) have been constructed and are operating. The district center at Thaba Tseka is built but not equipped. In addition, the district center at Mokhotlong, Butha-Buthe and Qacha's Nek are being funded by the EEC. However they will not be equipped. It is proposed that under this project the Regional center at Mohale's Hoek and the District Centers at Berea north, Mafeteng and Quthing be constructed and equipped and that the project also equip the other unequipped district centers. Costs and equipment lists are presented in Annex V-E, Detailed Commodity List. It is also proposed that each district center be staffed with a minimum of one trained technical person and two laborers.

The water minder concept for minimal maintenance and reporting must be strengthened. In any case, the water minders must be given minimum training, a basic set of tools, and must be paid at least a small stipend. This stipend would vary according to the complexity and size of the system, but a suggested rate is as follows:

1. Small spring box gravity system	- Gratis
2. Larger spring-gravity system with distribution and street hydrants	- R3.00/mo.
3. Borehole hand pump system	- Gratis
4. Multiple (3 or more) borehole and hand pump system	- R2.00/mo.
5. Borehole with windmill system	- R4.00/mo.
6. Borehole with diesel pump system	- R4.00 - 6.00/mo. depending on size etc.

It is suggested that (see social analysis section) the village be responsible for any remuneration to water minders on the smaller, most maintenance free systems, but that Minrudev be responsible for payments to water minders on the

more complex (diesel-windmill) systems.

Funding for maintenance and repairs, other than personnel, has also been a serious problem. At present, there is not maintenance vote in the budget of Minrudev. This, of course is a necessity if installed systems are to be in any way maintained. In addition, each village applying for a water system is presently required to put up some "front money" to indicate the seriousness of their request. The amount varies considerably, but the important point is that, in the past, these funds have gone into government coffers and is not retrievable excepting as a credit toward capital costs once Minrudev actually builds the system. Recent policy changes dictate that Minrudev will no longer accept these payments and the villages are now advised to deposit their "earnest money" in a bank account and simply present evidence to Minrudev, along with their application, that this has been done.

A more pertinent policy could and should be adopted. Villages which desire a water system should be required to contribute a minimum amount per household which is meaningful. The amount of R5.00 per household would be adequate. These funds, once collected, should be deposited in an interest-bearing trust or escrow account in the national bank. These funds should not be used to defray any of the capital costs of the project, but should be held as a maintenance fund which the village could draw on for minor maintenance costs once the system has been installed. Major maintenance and total capital costs would be the responsibility of Minrudev. Since the time-log between collection of funds and the need for using them may be as much as four years (two years to construction plus two years before serious local maintenance costs are accrued) the interest earnings should be considerable. In this way and in conjuction with the trained water-minders program perhaps at least the greater portion of the maintenance problem could be rectified.

Section 5 : Priority of System Types

There appears to be a definite need to prioritize, on an engineering and logistics basis, the installation of water

systems in Lesotho. This section will attempt to outline such a system based on the relative simplicity and costs of the various supply schemes presently being employed by the Ministry of Rural Development.

Priorities, in descending order of desirability, are as follows:

1. Protected springs only - Simply protecting the springs being used, especially in the case of smaller villages, with provision for later addition of distribution lines to the village in the case where gravity feed is possible or a pumping device where springs lie below the village. This would be a visible first step, where possible, in beginning to alleviate the backlog of requests for systems.

2. Gravity fed spring system - This is, by any measurement, the most desirable system by far in that it costs little to install and is practically maintenance free. The present formula used by the MORD is that this is preferred over a well (borehole) whenever a spring with adequate perennial flow and elevation can be located within two kilometers of the village(s) to be served. It is suggested that a better system than this "rule of thumb" must be employed. Even a rough engineering cost estimate, comparing the costs (installation and at least ten (10) years of estimated maintenance and operating costs) of the two alternatives, would indicate which of the two was least expensive, even though the spring source was more than the two kilometers distant.

3. Well (Borehole) equipped with a hand pump - This possible alternative has not been used as frequently as it might have in Lesotho. It is one which must be considered and used in light of the backlog of requests for water systems that presently exists. This alternative is especially adaptable to small villages (100 -

500 population) where wells (boreholes) are the most economical solution for a water source. This actually could be adapted to almost all villages where wells are the most viable alternative. On this respect, it is recommended that a small rotary drilling rig be purchased in order to speed up these installations. Additionally, it is recommended that the "Moyno" statorrotor variable cavity type pump be adopted as the standard hand pump for the country. While somewhat more initially expensive than some other pump types, the heavier and simpler construction should make them less prone to breakdown and maintenance problems, thus making them less expensive over the long run.

4. Electrically driven pumps in wells (boreholes) - Equipped with a mono pump, these have proved fairly maintenance free. Of course they can only be used where there is an adequate electrical supply.

5. Well (Borehole) equipped with a diesel driven pump: This alternative should not be considered at all in villages less than 400 population. In any case, other preferable alternative must be carefully considered and cost (including maintenance over the expected life of the system) analysis/comparison must be made. It appears from data analysis that this type of system is preferable to windmills both from a maintenance cost basis and from a dependability basis. Operational costs are, of course, higher and must be bourne by the village.

6. Well (Borehole) equipped with a windmill: This is probably the least desirable of all alternatives. Initial cost is higher than diesel pumping when required storage capacity (estimated between 7 and 30 days with my emphasis more on the high end of this range) is included. Maintenance (breakdowns) seem to be almost equal and while repair parts for these systems are lesss costly than for diesel driven units, the real costs (time and travel for repair

crews) is the same or more.

Several other methods of providing improved drinking water have not been included in this priority listing since they are not presently being used by the MORD. However, they should be considered and tried since there are undoubtedly some situations where they would be less costly and perhaps a supply solution for which there is no viable alternative. These are (not in order of priority):

1. Infiltration galleries - may be installed in stream beds, along stream banks, in the bed of a reservoir, or at the toe of earthfill dams where it also serves to dewater the area below the toe and contribute to the stability of the dam.

2. Infiltration boxes - These are loose rock-walled boxes with a perforated drain pipe in the bottom which are filled with fine sand. The entire structure will be submerged in a stream, generally directly behind a small dam or weir which acts to form a pool of sufficient depth to keep the box submerged.

3. Small simplified slow sand filters - These can be built for approximately R .20 per capita served in sizes from 700 liters per hour up to 80,000 L/hr. They are automatic and require very little attention or maintenance other than occasional cleaning of the top 2 - 3 cm. of sand and will operate entirely by gravity under proper slope conditions. These can be built of almost any material (reinforced concrete, brick, cement block, stone) and would provide a viable alternative where conditions dictate.

Section 6 : Buildings, Housing and Construction

(a) Technicians Housing - houses will be provided for a total of 6 technicians programmed for this project. These houses will be of a standard design as prepared by the Ministry of Works, known as the "Pitso Mark IV" model or "Pitso Mark V" which are equal but different for different types of sites. They contain living, dining rooms, kitchen, bath and 3 bedrooms. They

are the models the government builds for senior officials. Cost is estimated at $40,000 plus $10,000 for site, site planning, preparation, utility connections, furniture including kitchen appliances and electric heaters bourne by the GOL. Four of these will be constructed in Maseru and one at Mohale's Hoek. Construction will be contracted by USAID/Lesotho and paid for through FAR accounting procedures.

(b) Counterpart Housing - Houses will be provided in the project for 3 counterpart technicians of the RWSS. These are to counterpart the three engineering technicians in the project. These are known as "Junior Houses", "Morija Type" for senior technical officers and contain living room, bedroom, bath and kitchen at a cost of $25,000 each plus $6,000 for site preparation, utility connections and furnishings, this latter cost to be bourne by GOL. These will be contracted by USAID/Lesotho and payment made on a FAR basis.

3. One Regional/District Maintenance Center to be constructed at Mohale's Hoek. This center will serve as a maintenance, repair and storage depot for the Mohale's Hoek, Quthing and Qacha's Nek districts. This center will consist of a site of approximately 2 - 3 Hm and will include the following structures:

(a)	One office building, 45.5 sq. m.	@	$ 7,390
(b)	One warehouse, 243 sq. m.	@	$32,200
(c)	One workshop, 68 sq. m.	@	$10,025
(d)	29 External Pipe racks	@	$ 1,050
(e)	Chain link fencing for compound	@	$ 2,458
(f)	Steel bins for pipe fittings	@	$ 1,930
	TOTAL construction costs ($US)		$55,053

In addition, the GOL will be required to furnish the site, prepare site, access and internal roads, all utility connections and furniture at an estimated cost of $13,000.

All building will be of concrete block on a reinforced concrete slab/and foundation. Roofs will be sheet metal over wood or steel trusses. All walls to be left unfinished except for the office building where walls will be painted and ceilings installed. Construction will be contracted by USAID/Lesotho and payment made on a FAR basis.

4. 3 each district Maintenance Centers to be located at Berea north, Mafeteng and Qacha's Nek will be constructed. These will be small (52 sq. m. plus an uncovered 28 sq. m. concrete working slab) concrete block structures with sheet metal roofs on concrete slab floors and reinforced concrete foundations. They will contain an office for the district senior technical officer, storeroom, workshop and external pipe racks. Cost per unit is estimated at $9,420 per center plus a GOL contribution of $2,370 for site, site preparation, access road, utility connections and furnishings. These units will be unfinished except for painted walls and finished ceiling in the office. They will be contracted by USAID/Lesotho and reimbursement will be made on a FAR basis.

Section 7 : Sanitation

Village sanitation facilities will include providing one clothes - washing slab per village, located adjacent to a water point (hand pumped well or street hydrant). This ratio is set as a pilot or experimental input to ascertain if village women will use such a facility in preference to those presently used such as streams, etc. Each slab or stand will be of concrete, approximately 4 x 4 meters square, be curbed and drained to a sump or natural drainage way. They will be placed about 5 meters away from the watering point and down slope from them.

A latrine or privy building program will be initiated through Minrudev in coordination with the Ministry of Health's health education programs. This, initially at least, will provide the cement and rebar (approximately 15 - 18 kg. cement and 4 m rebar) to construct a simple straight drop privy slab, provision of simple forms of casting and a person to instruct the villagers on techniques of construction. This will begin at the time water supply construction begins and be carried on by the village health workers once construction is completed. Digging the pit and construction of a

shelter will be the responsibility of the recipient. Shelters can usually be built of loosely stached (unmortared) rock in most of Lesotho.

SOCIAL ANALYSIS

1. BENEFICIARIES

   (a) Rural Women
   (b) Entire Villages

2. SOCIAL BENEFITS

   (a) Water Collection
   (b) Benefits of Self-Help
   (c) The Distribution of Benefits
   (d) The Spread Effect

3. BASIC SOCIAL CHARACTERISTICS OF THE RURAL POPULATION

   (a) The People
   (b) The Population
   (c) Sotho Culture
   (d) Village Social Organization
   (e) The Village Economy
   (f) The Position of Women

4. SOCIAL AND CULTURAL CONSTRAINTS TO THE SELF-HELP VILLAGE WATER SUPPLY PROGRAM

   (a) Cultural Constraints:

      (i) Do Villagers Want Improved Supplies?
      (ii) Are Improved Supplies Culturally Acceptable?

   (b) Social Constraint:

      (i) The Social Implications of Choices of Technology
      (ii) Inadequate Village-Level Management of Self-Help
      (iii) The Delay

5. THE VILLAGE MANAGEMENT OF VILLAGE WATER SUPPLIES

   (a) Village Committees:

      (i) What Village Institutional Structure is best suited to be Management of Village Water Supplies?

(ii) How should Village Committees be Constituted?

(A) Elelected or Appointed Committees;
(B) General Village Development Committees or Single Purpose Water Associations;
(C) Sources of Power: Legal Status or DCDO support;
(D) The Management of "Agglomerate Supplies".

(b) Village Committee Procedures:

(i) Village Committee Constitutions
(ii) The Cash Contribution
(iii) What is the Purpose of the Initial Cash Contribution?
(v) The Labor Contribution
(vi) Maintenance
(vii) Are Village Water Minders Acceptable?
(viii) Who should the Water Minders be?
(ix) Should Village Water Minders be Paid?

(c) District Level Support

6. CONCLUSION AND PRINCIPAL RECOMMENDATIONS.

7. BIBLIOGRAPHY.

APPENDIX D1 A SUGGESTED CONSTITUTION FOR A WATER SUPPLY COMMITTEE.

APPENDIX D2 SUGGESTED SCOPE OF WORK FOR INTERIM SOCIOLOGIST EVALUATOR.

PIERS CROSS FEBRUARY, 1979

Lesotho Rural Water Supply, and Sanitation Project Paper

The social assessment considers the implications and feasibility of the Lesotho Village Water Supply programme in two ways. On the one hand the programme's social soundness is examined in terms of existing cultural practices and social constraints; and on the other it considers the implications of administering the programme by means of a 'self-help' philosophy. Discussion of these issues is preceded by an outline of the project beneficiaries, the potential social benefits and an outline of the basic social characteristics of the rural population.

1. The Beneficiaries

(a) Rural Women

The initial and chief beneficiaries of the Lesotho Village Water Supply Scheme are the rural women of the country. In Lesotho, women have virtually sole responsibility for the collection of water and are prime water users. The onerous position of women in rural Lesotho is discussed in Section 3 (f) and the precise benefits extended by the programme to them in Section 2 below.

(b) Entire Village

All the rural population in the villages under the project's consideration may be considered potential beneficiaries of the programme for two reasons. Firstly the provision of an improved water supply may enhance the health and wealth of the entire village receiving the supply. The potential benefits are discussed in sections and of the Project Paper. Secondly, implementation by means of self-help strategy potentially provides a number of other social benefits which are discussed below.

2. The Social Benefits

(a) Water Collection

The immediate social benefit to be gained from the implementation of an improved village water supply is a saving in time and energy expended on water collection. Most households make between 2 and 6 water collection journeys a day to a water source as well as carry out several water-related tasks at a water source. On average every adult woman in the lowlands (the area in which approximately two thirds of the population are based) spends 41 minutes per day on water collection, though the average figure for the mountains, 25 minutes per day, is considerably less (Feachem et al 1977: Annex E). The actual savings in time spent by the average adult woman drawing water from an improved source is 30 minutes per day in the lowlands and 18 minutes per day in the mountain areas. This appears a relatively small time saving, but the study from which these figures are taken states that in a third of the sample taken from the lowlands (the most densely populated region of the country) the saving in time spent by the average adult women in water collection from improved sources was over one hour per day.

2. SOCIAL BENEFITS

(a) Water Collection: The significance of this benefit is open to various interpretations. Two observations stand out as crucial. Firstly and most importantly for many women in Lesotho, domestic life is arduous and without much comfort and for them a reduction in the time that must be spent on one of the most strenuous of the day's activities is a real benefit and one that must be recognized as such. The importance of this benefit should not be under-valued and should be seen in the context of the problems of the migrant labor economy. Rural Lesotho is in practice largely a society of women and any project which improves their lot, whether or not the improvement is demonstratable in economic terms, is worthy of a high priority.

Secondly, in economic terms, the opportunity value of the time saved to agricultural or other productive activity is very small. This conclusion must however be considered against the fact that agriculture and other local productive activities are marginal activities in the migrant labor economy.

The implementation of village water supplies has little effect on the pattern of water use in the villages other than saving time and energy. Water is primarily used for cooking, drinking, personal washing and the washing of food, utensils and clothes. Other uses are in brewing beer, plastering dwellings and garden and animal watering. The implementation of an improved village supply does not appear to have a marked effect on either the place of water use since villagers will often continue to draw water from several sources.

(b) The Benefits of Self-Help:

Why are village water supplies implemented by means of a self-help strategy? One reason is simply that in an underdeveloped country with limited economic resources village contributions in labor and and cash enable projects to be installed with the minium of Government contribution. If water supplies were the sole responsibility of a Government water authority the tax on government resources would be so much greater. As it is the village contribution amounts

to an initial cash contribution of, on average, 7 percent of the total cost of materials; all the maintenance costs, estimated as being R150 per supply per year; and the cost of initial labor input. Feachem (1977: Annex B) compared the costs of Self-Help and Government employed labor and concluded that the use of self-help labor does significantly reduce the cost of implementation.

A further reason is that self-help promotes popular participation in development, retains villagers control over their environment, and often provides a source of training for villagers. To date villagers have received little formal training as a result of the project. But if the recommendations in the PP are implemented each village committee should contain a village water minder, chairman/chairwoman. secretary and treasurer all of whom will have received some instruction. The principal beneficiaries of the training will be women, since women in the main, serve on village committees.

Yet implementation by means of a self-help strategy also implies social benefits. The social benefits follow from two sociological tenets implicit in the strategy. These are:

(i) The experience of a successful project will promote a spirit of communcal responsibility, self-reliance and confidence among villages, and thus a positive attitude towards future development initiatives.

(ii) The establishment of appropriate institutional structures in villages will provide a base from which further projects may be tackled.

The evidence from Lesotho suggests that to date the social benefits of self-help have not always been realized. There are two sets of reasons why this is the case. The first concerns the logic of the strategy itself, and the second the current means of implementation. The latter is reviewed in section 5 which also discusses improvements on current policies.

The logic that the 'pump-priming' activity of Government will set in motion an ongoing process of self-improvement often fails since, rather than learn the value of self-sufficiency, villages often learn that for a relatively small contribution they can get Government to commit itself to helping the village.

A second logical problem of the strategy of self-help is that the experience of an unsuccessful project may equally well have a detrimental effect upon the ideals of self-improvement. Despondency and disillisionment may follow an unsuccessful projecy, and confusion, resulting from the improper establishment of village committees, is likely to be a positive hazard to further development initiatives.

These two problems can only be overcome by careful monitoring of developments in the villages by the Ministry of Rural Development's district staff. This implies both sufficient community development staff and adequate transport to provide a clear and supportive explanation of the project's aims to villagers; and sufficient technical staff and an efficient maintenance policy to ensure that supplies have the greatest chance of technical success.

(c) The Distribution of Benefits:

The distribution of benefits which follow the improvement of village water sources is remarkably uniform both within villages and between villages. The provision of water to communal standpipes does not generally benefit any particular identifiable group within villages to the exclusion of others. There are instances in which certain influential villagers have managed to have taps placed particularly conveniently for them, and there are instances of wealthier villagers being able to make use of the water by means of private connections or hosepipes. But, in general, the Ministry of Rural Development has been very successful in implementing a policy whereby the benefits of the improved supplies are distributed with a marked egalitariansim within villages.

The same is true of the distribution of improved supplies amongst villages. The geographical distribution, regional distribution and, to our knowledge, political distribution of supplies is remarkably uniform. The selection of villages appears to be random in effect, and does not reflect any particular bias or even clear rural development strategy on the part of the Ministry. The pattern of distribution probably reflects both a rational assessment of the per capita cost of the various technologies in use, as well as the self-help orientation of the program. Self-help has implied that the Government has in part relinquished the ability to determine investment priorities, since they are pre-empted by the decision of certain villagers to collect their own contributions. Both these factors explain why the distribution of village water supply projects has been so wide and has not concentrated on the areas of greatest water shortage.

(d) The Spread Effect:

Lesotho's small size and cultural and social homogeneity allow easy communication between the sectors of the population. Furthermore, a consequence of the high level of migrancy is that Basotho travel a good deal around Lesotho and Southern Africa. The main channels of communication occur along roads and bridle paths and along the course of river valleys in the mountains. Ease of communication and the wide spread distribution of supplies mean that the idea of piped water supplies has been widely communicated across the country in a short space of time.

The large number of water supply applications indicate that the knowledge that a piped water supply might be obtained from Government is undoubtedly widespread. Yet it is more difficult to assess how this has affected the success of the dispersion of the ideas implicit in community development. Villages neighboring a well-organized enthusiastic village may well wish to emulate it, but so often the success or failure of a project is determined by the institutional arrangements and the nature of village disputes, in particular villages rather than simply by the communication of the initial idea.

3. BASIC SOCIAL CHARACTERISTICS OF THE RURAL POPULATION

(a) The People:

In comparison with other African countries, Lesotho's population is remarkably homogeneous. Historically the Basotho Nation comprises a number of Sotho clans and San and Nguni groups which were united well over a century ago. Other national minority groups - mainly Asians and Europeans, form under 2 percent of the population.

(b) The Population:

The 1976 census records a de jure population of approximately 1,213,960 and a resident population of approximately 1,059,000. The absent population of 154,000 consists mainly of male migrant laborers. The absence of so many adult men, together with the earlier death rate of the male population, means that women and children comprise the largest section of the resident population. Roughly two-thirds of the population between 16 and 60 are women.

According to the 1970 Agricultural census over 95 percent of the population live in the rural areas, mainly in the western lowlands. Roughly two-thirds of the population live in one-third of the country, the lowland and foothill refions. 1974 estimates for population density are 76 people per square kilometer in the lowlands, 63 per square kilometer in the foothills, and 14 per sequare kilometer in the mountains.

The rural population lives in villages. Villages in Lesotho usually consist of a compact cluster of households with a distinctive social and geographical identity. Village populations vary from 40 to over 1000.

(c) Sotho Culture:

Sotho culture dominates the region in a uniform manner. Sesotho, a branch of the Sotho language group which also contains Setswana, is spoken throughout the country. In social anthropological terms the culture is distinguished by its pattern of concentrated settlements, patrilineal descent and custom of preferred viviloval, endogamus cross-cousin marriage.

The Basotho are traditionally cattle-owning agriculturists, who, prior to the twentieth century, were renowned for their smelting of iron, copper and tin. Over a century and a half of influence and a century of wage labor has totally altered the basis of their economy and fundamentally altered many aspects of Sotho culture. Family relations and marriage practices have been subject to the effects of migrant labor and inflation; christianity has long gained a firm foothold; the position of the chieftancy and the nature of chiefly power has altered, and the position of women has become increasingly onerous. The distortion of Sotho culture are made all the more complex as the majority of Basotho have both experienced the working class life in South Africa's mines and been made to remain within the skeleton of a more 'traditional' way of life in the impoverished rural areas of Lesotho. As an extreme example of a migrant labor economy Lesotho well exemplifies the culture of 'the men in between'.

(d) Village Social Organization:

The basic social and geographical unit in a village is the household. The mean household size in the mountains is over 3 while that in the lowlands is just over 4. The actual composition of households is far from the ideal complement of close kin. The absence of migrant laborers

and the higher male death and desertion rates, mean that women head a significantly high percentage (60) of households. Migrant laborers are put in the ironic situation whereby the viability of their households as independent units depends upon man and wife living apart for long periods. The average length of time migrants spend away from their Lesotho homes is between 13 and 16 years. Such long periods of separation and/or unfulfilled marriage payments results in a high level of conjugal instability.

Migrancy also has important effects uprn corporate village organization. The loss of manpower implies a loss of enthusiasm for communal labor, splinters the group of male household heads and undermines communal organization in villages by introducing alternative values and sources of power and wealth. There are three forms of corporate organization in villages today - interhousehold cooperation, the chieftainship and village committees. Each will be discussed in turn below.

Economic hardship, a strong tradition of interhousehold cooperation and reciprocity, and the effect of migrant labor which saps so much strength from the household mean that a great many village activities are only achieved through interhousehold cooperation. Share-cropping exists in a number of forms; households arrange to plough and work communally together on each others fields; often village women contribute to a revolving fund from which each in turn may draw to provide capital for fund-raising 'parties'; and some villagers form burial insurance societies. With just whom one agrees to cooperate in any of these activities is determined by a number of factors including kinship, age, status and political affiliation. Household feuds, village factionalism and political rivalry are as prevelent in Lesothr as they are in any other impoverished rural community lacking centralized leadership.

Villages are the basic political and administrative unit and traditionally fall under the jurisdiction of a local chief. The chieftainship is determined by descent, although the chief is traditionally responsible to the villagers under his authority. The well known Sotho idiom "a chief is a chief by the people" captures the traditional democratic nature of the institution. As a result villagers expect to participate in the decisions affecting

village affairs. The institution of the pitso, traditional meeting between a chief and his people, and the village khotla or village court, remain important, though not unmodified, institutions in which commoners can express their views.

However, the status of the chieftainship has declined markedly in the twentieth century, principally because of the establishment of a central national government. Chiefs still have sufficient power to affect the course of events but they no longer represent commoners in the traditional democratic style. To take just one example of this, in Chief Jingoes's autobiography he laments that a chief is no longer "a chief by the people" but "a chief by the government". (Jingoes 1975:183.)

The limits on interhousehold cooperation and the decision of the chieftainship have left a gap in the representation of village opinions. The Government has attempted to fill this gap by establishing village committees.

Informal groups of advisors have always assisted the chieftainship and provide an informal way of sounding out village opinion before making decisions on the village's behalf. In the last decade more formal committees have been established at the village level. Their establishment has caused some problems in terms of the political nature of the early committees, but there has been little cultural resistance to the introduction of this style of administration. Indeed one of the problems has been the over abundance of committees that have been formed and the confusion as to their areas of jurisdiction. The formation and functioning of village committees is discussed in Section 5.

(e) The Village Economy:

Villagers have four sources of income, migrant labor, local salaried employment, farming and other local activities.

Income from migrant labor remittances is by far the largest source of rural income. It accounted for 59 percent of the average household income in 1973/4, and its importance has probably increased since then. The average yearly household income was R486 in that fiscal year. However, remittances are irregularly sent and this often prevents them being efficiently invested. The chance of migrancy is open to almost any young male, with the rrsult that rural Lesotho is characterized by a widespread equality of income. The poorest households in the country are those which consist only of women, children and old men. The

general equality of poverty in the country is also a result of the system of communal land tenure which has maintained an equitable distribution of land and limited the numbers of landless.

Local income-generating activities in the rural ares are of much less importance, particularly following the rise in South African mine wages in 1974. In general, the opportunities for salaried employment are very limited, Government and local traders being the only rural employers. Although agriculture is often states as being crucial to the national economy, its importance has declined dramatically since the 1920's to the extent that effective agriculture is in practice reliant upon migrant labor earnings. A recent report on agriculture in Lesotho concludes that the pattern of agriculture in Lesotho:

> "is precisely the pattern we would expect from consumers and homemakers, and is not the pattern we would expect from serious farmers. Serious farming is prevented by the poor distribution of fields around the village, by lack of tools and plowing power, by the lack of such modern inputs as good seeds and fertilizers, and by the erratic climate. It may well be simply the necessity to plow the fields in order to maintain rights over them is all that leads the rural resident to do crop farming at all." FAO (1977:18)

Other income-generating activities are the brewing of local beer or the buying and selling of imported liquor, an activity sociologically well suited to the demands of a migrant labour economy, and the occasional sale of fresh produce, milk and handicrafts. Participation is 'Food for Work' projects is commonly restricted to those without any other source of income.

(f) <u>The Position of Women</u>:

Customarily, and an ideal conception in Sotho culture, women are treated as jural minors. Their area of jurisdiction is limited to domestic control from birth. On the birth of a daughter water is poured over the child's (or in some versions the father's head), water symbolizing one of the many arduous domestic tasks which fall under a woman's jurisdiction. Girls are traditionally weaned before boys, and are quickly socialized into their future roles as mothers and wife by learning to bear the burden of the

household's domestic chores. Included among the customary duties delegated to women are care for the children, the housekeeping, all domestic chores and most of the agricultural labor. In her position as mother and housekeeper, a woman may exercise a great deal of autonomy and responsibility. In ideal terms her position is secure and her areas of responsibility clearly defined.

In practice, adaptation to a society dominated by migrant labor has meant that the position of women in rural Lesotho is somewhat different, more contradictory and more arduous than the ideal. Firstly, women are generally better educated than men. This is explained by several factors but largely by the fact that the loss of young men on migrant labor contracts has meant that the responsibility of herding now falls solely to herdboys, so restricting their schooling opportunities. Furthermore many men leave for their first mine contract at the age of 18 while women remain on at school and have a better chance of achieving higher grades. Despite their better education, fewer women have salaried jobs in the country, and women remain formally subservient to men in matters of household management.

Secondly the absence of men has meant that women have had to adopt new responsibilities with little formal recognition of their altered position. Women are now in practice very often the resident heads of households and resident farm managers and, while often better to manage household affairs, given their superior education are not able to command the resources necessary to carry out the responsibilities of these positions. Resources here refer not only to income and labor, but also to the benefits derived from control of the mystical plain. Murray (1976 : Chapter 8) has argued that the fact that women are more susceptible to mystical affliction is indicative of the fact that the moral responsibility for an equitable relation with the shades (balimo) is vested in men, and the fact that women are more exposed to the vicissitudes of household management. The stress resulting from the contradictions in this position must be added to the other burdens of the position of women in rural esotho. The insecurity which results from conjugal instability, lack of control of the mystical realm, intermittent income and yet increased household responsibilities may well be as important a factor as poverty and the breakdown of corporate village organization in explaining village inertia.

Women are the chief beneficiaries of this project. How the project hopes to affect the position of rural women is principally by saving time and energy in water collection and providing training in basic supply maintenance and committee procedures, is discussed in section 2(a), (b) and 5(b).

4. SOCIAL AND CULTURAL CONSTRAINTS TO THE SELF-HELP VILLAGE WATER SUPPLY PROGRAM

(a) Cultural Constraints:

(i) Do Villagers want Improved Supplies? Villagers clearly want better water supplies. This conclusion is based on the frustration expressed by individuals at having to draw water from traditional sources, and the persistant efforts villagers have made to obtain improved water supplies.

Yet why is the demand for water so high in a country in which water is relatively widely distributed and in good supply? Two factors explain the paradox. Firstly the open-ended nature of the Government of Lesotho's procedure for establishing the village water supply program in the early 1970's stimulated a tremendous demand for supplies. Villages could commit the Ministry of Rural Development to providing a water supply to their village for a relatively small capital outlay. Secondly village water supplies constituted an important part of the community development strategy adopted by the Government in a period in which the Government was keen to establish projects in rural areas. The decision to select water as the first development program to reach out to the isolated rural areas was facilitated by the use of a relatively cheap and appropriate technology. To the best of our knowledge, villagers had no real choice of development projects. No research seems to have been carried out in order to determine what villagers felt their needs to be, the first rule of community development or what their priorities are, given the government's limited resources. A recent review of rural development strategy, the Wilmot Report, reporting in late 1978 after Community Development had been the adopted rural development strategy for 16 years, states that "the basic problems and true objectives of the rural communities need identifying". (Wilmot (1978:1)).

In the light of history of the program and the lack of choice of alternative development priorities, the demand for water may simply reflect a demand for 'development' or government assistance rather than a preference for a water project. Although it is formally beyond the scope of this project, it is recommended that the Ministry of Rural Development institute research to determine villagers priorities in rural development, or alter its community development structure such that it is able to identify and respond to villagers perceived needs. The Wilmot report makes recommendations in this regard.

In conclusion it must be reiterated that although the provision of water may not be the villagers most important need, either in terms of their own priorities or in terms of development planners analyses, it is undeniable that the collection of water by hand from traditional sources is an arduous task which the grandmothers, wives and daughters of the migrant laborers of Lesotho would gladly be without.

(ii) Are Improved Supplies Culturally Acceptable? The improvement of VWS has no significant effect upon the cultural symbols and traditions of the Basotho.

Water is not a prominent element of Basotho cosmology though it may, in various ritual and cultural contexts represent the transition in phases of the life cycle; spiritual cleansing; a medium through which both good and evil forces may work; prosperity; fertility and womanhood. Its cultural significance is in no way impaired by the improvement of the source. There are no cultural practices which specifically require water to be drawn from traditional sources.

Domestic water sources are a customary meeting ground for the women of a village. The meeting is normally exclusive to women and provides an opportunity for lighthearted discussion. Change from a traditional source to a communal standpipe does not alter the sociability of the occasion, although improved sources often do not allow the privacy characteristic of meetings at traditional sources.

But when this consideration is put against the felt need for improved water sources, it becomes of little consequence. The women whose task it is to draw the water want improved supplies and value the saving in energy and time more highly than they do the possible loss of privacy.

In customary law, water is regarded as a 'free commodity' which may generally be used without restriction though it is subject to the control of the chieftainship in times of drought. Water rights come with citizenship and residence in a particular chieftainancy. The change to improved supply has brought about some changes in this regard. Village committees controlling improved supplies have, in different instances, both elected to allow all village residents access, or have restricted access, to paidup contributors to a private water association. Recommendations on this issue are discussed in Section 5(a), but the potential change in the concept of water rights has not proved to be a significant obstacle to the improvement of the supply, since at present there are generally sufficient water sources to allow water to be drawn from both reticulated water supplies and traditional source in the same village.

(b) Social Constraints:

(i) The Social Implications of Choices of Technology. The concept of 'social appropriateness' has generally been accepted by development technologists to be an important consideration in the choice of technology for use in village water supply programs. Section of the PP indicates that seven levels of technology are under consideration for the Lesotho program, and in addition there is the question raised by Metcalf and Eddy (1977:203) of whether further sanitary facilities might be attached to, or be implemented, in coordination with the village water supply program. In this section we comment on the social appropriateness of the prominent technologies being considered.

Simple spring captation is not generally perceived by villagers to be an adequate form of water source improvement. In most instances, though not all, village women perceive the greatest benefit of an improved supply to be a saving of the time and energy expended in water collection. Simple spring capation may well be the most costleffective and simplest technical solution to the problems of water provision in the mountains, but their provision will not satisfy all applicant villages, particularly since supplies with reticulation have for some years constituted the basic design. Villages who have contributed on the understanding that they will be assisted to build a supply like the reticulated supply, which first prompted their application, will feel hard done by when they only receive a spring captation. These problems are not insoluble. However the solution will be the responsibility of the DCDO and his office, which must be equipped to carry out the task when required to do so.

At the other end of the scale it is now clear that the use of more complex technologies, within the constraints of a self-help policy, have lead to enormous problems at the village level. Previous evaluations of village water supplies in Lesotho, most particularly Feachem (1977:Annex F), have stressed that the breakdown rate for the more complex technologies is far higher than the simpler levels. We are here referring specifically to the use of diesel pumps and windmills. The lack of effective corporate social organization in villages, the unreliability of migrant labor remittances, a shortage of permanent village personnel with technical expertise and the lack of support from an already over-extended Ministry, lead to the conclusion that villagers cannot reasonably be expected to maintain complex water systems in the long term.

The use of 'gravity feed systems' and handpumps fitted to boreholes conveniently sited within villages are the most socially appropriate technologies under consideration, since they most adequately fulfill villagers felt needs, and require a level of technical expertise more within the villagers grasp and grasp and necessitates less regular cash contributions and maintenance.

Three sanitary facilities are being considered as complementary inputs to the improvement of village water supplies. These are Pit Latrines, Communal Showers and Communal Clothese Washing facilities.

The social constraints to the provision of pit latrines are considerably less important than the problem of cost, and technical and sanitary effectiveness. Villagers will use pit latrines if they are properly constructed, if they can afford them and if their promotion and maintenance is efficiently managed at the village level. Pit latrines are to be found in all district centers and in most large villages. They are not a great innovation and are a socially feasible technology in Lesotho.

The introduction of communal showers would constitute a much greater innovation and we do recommend that they are implemented at this stage of the village water supply program. There are three reasons for this; firstly, the attachment of communal showers to a village water supply increases the technical complexity of the construction and maintenance and strains the limited resources of the slef-help program. Secondly, while the idea is exciting in that it increases the chance of achieving a significant health benefit, it is thus far an idea suggested by expatriate advisors and is not necessarily a felt need. If the construction of communal showers is to form part of a self-help program villagers would have to be consulted before including the showers in part of the village water supply design. Thirdly, it is open to debate (and hence is an area for research) whether communal showers are culturally acceptable. The concern for personal cleanliness is a more sensitive area than in that of defecation habits in the modern fabric of village culture, since it touches on one of the means by which village women cope with the intrusion of 'moderness' and the threat of consumerism. Even in the remotest villages most women take great pride in their appearance and dress on occasions of public display. They wash mostly in tubs in the privacy of their own homes, and dress immaculately for occasions

such as church attendance or a visit to the district center. Furthermore, it is possible that washing of the whole body is more closely motivated by status than hygiene. If this is the case then the introduction of communal showers undermines and is contrary to the essential individualism in the public display of 'smartness'. Clearly this last issue requires more research before a program can be designed. All three of these problems are not unsurmountable. However, to rectify them would over extend the Ministry, and we recommend that a communal showers program be accorded a low priority.

Communal clothes washing facilities are perhaps the easiest additional sanitary facility to implement. Their cost would not seem to be prohibitive, they would require little technical expertise to construct and maintain, and they may have the effect of cutting out an important source of disease transmission. The great majority of Lesotho's village women carry their washing once a week on an average to a nearby river to wash it. One hypothesis regarding disease transmission in the villages is that a number of infections are picked up in the course of these regular trips to nearby rivers, since in the absence of any other shelter, river gullies are favourite defecation sites. The construction of communal clothes washing facilities, which would prevent women from spending their regular two to six hours a week in the river gullies, might achieve a significant health benefit.

The innovation would also seem to be socially appropriate since it would involve little change from current practices. As it is, a good many village women carry out their weekly scrubbing in a tub near a communal standpipe or near a village spring. The meeting at a communal spot in order to wash clothes is a sociable occasion similar to the customary queue at the village spring. Changing the venue from the river to a site in the middle of the village would not alter the sociability of the occasion, and would probably add to the saving in time and energy effected by the water supply. We recommend that the idea of communal clothes washing facilities be suggested to a few functioning village committees. If they find the idea acceptable the Ministry should initiate and monitor three or four pilot projects.

(ii) Inadequate Village-Level Management of Self-Help. Village committees do not in general function efficiently as presently constituted. A number of constraints can be identified. Section 5 contains further discussion on these issues and makes recommendations to improve the situation. Here we simply lay out the problems.

Firstly, village level management has been particularly prone to village disputes and faction fighting, sometimes even leading to incidents of sabotage. Disputes are to be expected in any participatory institution, though the problem seems to have been especially acute in this case. The primary reason for this appears to be that the division of national politics have been reproduced at the village level.

The village water supply programme reached its peak of activity at a time of political uncertainty in the country, and the success of projects has suffered as a result. An earlier policy which attempted to ensure that village water supplies were managed by committees appointed by the ruling party structure has had a detrimental effect upon the community development aspects of the program. The unelected leadership if often distrusted, the project is regarded as wholly a government project rather than a self-help project, and village factionalism, a characteristic of village life at any time, is reinforced by national political divisions.

The village management of village water supplies can only succeed if the village institutions are depoliticised, and committees are established with a view to lessening destructive conflict. The fact that the tensions of the early 1970's are subsiding bodes well for the future of the village water supply program. Yet it remains necessary to ensure that village committees are allowed to operate as freely elected representatives of village opinion. Further discussion and recommendations on this issue are presented in Section 5.

A second constraint on the efficiency of village committees is the lack of power on the part of committees to enforce their decisions. The problems of non-contributors undermines the committees' authority and works against the spirit of the self-help program. Yet granting legal powers to committee members may usher in a further period of pronounced intra-village conflict.

Thirdly, procedures and responsibilities of the committees and committee members are generally poorly understood. Lack of appropriate village procedures results in confusion, misuse of village funds and poor management. There is a need to establish an appropriate means of operating village committees, and to ensure that committees stick to these basic ground rules. The structuring of committees is also affected by the creation of supplies linking several villages.

Fourthly, the smooth functioning of many committees is impaired by lack of training. Most committees, as currently constituted, contain a chairman, treasurer, secretary and perhaps two further members. The standards of record-keeping and minute taking are generally very low. Of more importance is the lack of technical expertise available to the Committee for maintenance. This has been discussed at length in both the Feachem and the Metcalf and Eddy reports, and is one of the most crucial questions in the whole program. (See Section 5.)

Finally an issue which affects all the foregoing constraints if the lack of support from the district community development office for village committees. The weakness of the district offices is a major problem in the administrative structure of the Ministry, one which several previous reports on community development in Lesotho have drawn attention to, and one which is further discussed in Section 5.

(iii) The Delay. The creation of the backlog of applications is an additional social constraint on the projects to be constructed for the next 6 years or so. A great many villagers have now been waiting for several years for Government to fulfill their part of the self-help contract. Villagers fired by an initial enthusiasm for their project have contributed cash donations and have occasionally even begun digging pipe trenches only to see them silt up as they wait for government's response.

Implementation by means of self-help relies on a relationship of trust betwen government and the villagers and on village enthusiasm for the project. It will be difficult for government to revive village enthusiasm after so great a delay. For this reason it is absolutely essential that district officers be equipped to cope with the task of reestablishing the ethos of self-help in villages about to receive supplies. Village committees will have to be contacted, revived and in some cases reestablished, and the causes of the delay, and the basis of the self-help program clearly explained. To this end the District Development Office requires manpower and transport.

5. THE VILLAGE MANAGEMENT OF VILLAGE WATER SUPPLIES

This section of the social analysis discusses the establishment and functioning of village-level management of village water supplies. It draws on all previous sections, particularly the social constraints established in Section 4. and lays out the problems and decisions that have to be made and makes recommendations.

(a) Village Committees:

(i) What Village Institutional Structure is Best Suited to the Management of Village Water Supplies? In the discussion on village social organization it has been established that village water supplies are being instituted at a time when the source of authority in the villages is in considerable flux. The principal source of authority in the past has been chieftainship. In recent years new structures have emerged with the result that village leadership is today plural and competitive. Village chiefs and headmen find that their area of authority is increasingly confined to residual administrative and law and order functions as village committees representing the interests of political parties and development programs establish themselves in the villages. Village chiefs may adopt one of several strategies to attempt to maintain credence, and it is clear that chieftainship is a very different institution today from what it has been in the past. As an authority structure it is characterized by its inflexibility to new demands and it would be inappropriate, as well as impractical at this stage, to consider administering the program through the chieftaincy.

Village committees provide a suitable alternative. They are culturally acceptable, have been in existence for some two decades already, have the potential to continue the tradition of popular participation in the decision-making process, and seem suitable vehicles for the management of self-help programs.

(ii) How should Village Committees be Constituted? One of the weakest links in the whole administration of the village water supply program exists at the village level. The inappropriate establishment of committees and their intermittent functioning has

been a major cause of the self-help program's lack of success. Malfunctioning committees may deny villagers any benefit at all from the substantial government, donor and village effort that has been put into the construction of supplies. The benefits of instituting the supply by means of a self-help program are especially dependent on the establishment of successful village committees.

If the problem cannot be solved, one solution is for Government seriously to consider administering the rural water supply program by means of regional water authorities, rather than through a self-help program. We do not consider this the correct approach since the village level problems faced by the village water supply scheme are indicative of the problems, and the challenge of rural development as a whole in Lesotho at this time. The discussion that follows on village committees has been influenced by issues and proposals discussed in recent reports on rural development in Lesotho. We refer specifically here to the UN ACC Task Force Mission (1977), the Wilmot Report on Integrated Rural Development (1978), and the prposed Integrated Rural Development Project at Thabana Morena (1978). We feel that many of the problems identified in these reports also shed light on crucial issues in the administration of village water supplies.

In the light of the importance of efficient village-level management, and the immensity of the bottleneck poor management is making, it is recommended that the Ministry review the whole question of the establishment of village committees in self-help programs. A great range of different committees exist at present, indicative of the lack of policy on village level management and the inadequacy of such policy as does exist. This recommendation parallels the recommendation in the Wilmot Report (1978:Annex 5) which aims to encourage government's rapport with villagers, and obtain 'the peoples' views regarding rural development. We understand that a paper on the formation of village level committees has been prepared by the Ministry for discussion, though we have not seen the paper. The comments made here on the village level management of village water supplies should be seen as a contribution to that discussion. While we understand that the primary intention of the Ministry's paper is to link village committees to the District

Development Committees by means of Ward Committees, here we concentrate on the crucial question of appropriate establishment of village committees.

There are a number of choices that have to be made un the forumlation of a policy on the establishment of village committees:

(A) Should committees be freely elected or contain appointed members?

(B) Should water supplies be managed by a committee representing a single-purpose water association or a general purpose water association?

(C) How should committees enforce their decisions - by means of their own legal powers, or by means of support from the district office?

(D) What is the appropriate village structure in supplies which link a series of villages, i.e. 'agglomerate' supplies?

Our recommendations on these issues follow two premises. The first is that if the committees are to manage self-help projects, villagers should be entitled and encouraged to full participation in village affairs. Secondly, our approach is grounded in the belief that, while a necessary and desirable goal, village participation is not always the harmonious awakening of latent energy and community spirit that it is often portrayed to be. Conflict in any form of participatory organization is inevitable and we make our recommendations in order to establish the most felicitous management of that conflict.

(A) Elected or Appointed Committees:

We conclude that centralised control of village committees, in other words, the use of committees tied to a political party or appointed by a Ministry, are not appropriate to the management of rural self-help programs.

Our conclusion is based on the following evidence. Firstly, the nomination of members is contrary to the spirit of voluntarism on which the whole concept of self-help relies. Central appointment also encourages the view that management of supplies are government's responsibility, a view already prevalent in the country, and one that has not been helped where committees have been centrally

appointed. Secondly, villages may not be aware of the appointment, and the unelected leadership may be distrusted. Thirdly, the association of the committee with national poltics reinforces village factionalism.

On the other hand, freely elected committees do not initially provoke political factionalism and natural leaders, who can act in the village's best interests are allowed to emerge. Freely elected committees are, in our view, a necessary condition for the success of the self-help aspects of the program. It goes without saying that this is not a sufficient condition since conflicts are bound to arise in any form of organization, and village committees, however constituted, will require continual district support throughout their existence.

(B) General Village Development Committees or Single-Purpose Water Associations:

It is current practice in the Ministry to manage self-help projects such as village water supplies through general pirpose village development committees. These committees may then decide to establish special purpose committees for specific projects such as water supplies, although this option is more rarely adopted. This policy may well be over ambitious when set against the minimal social benefits that have been achieved in the program, and we recommend that the priorities be reversed. Single purpose committees should first be established and, where applicable, general purpose village development committees be established at a later stage in order to direct new initiatives once the initial project has successfully been established.

The logic behind having a general purpose village development committee is that community development planners envisage that the successful implementation of one project will stimulate other projects, and the general purpose committee will be used to direct and coordinate the later developments. We find this strategy to be over optimistic and impractical at this stage. The first priority is that the specific project, in this case the water supply, is adequately managed by the village. Only once this has been achieved, and an enthusiasm and confidence has been generated, might it be possible for a general village development committee or further special project committee to be established. Thus far there is little evidence that general purpose committees have provided a springboard for further projects, and some evidence to illustrate that the opposite is the case. Poor management of a water project results in disillusionment with the committee and a reluctance to undertake further projects.

There are two further reasons why we fell that single purpose committees are more suitable for the management of the village water supplies program. Firstly, there is considerable confusion in villages as to the differing responsibilities of the various village committees that have been established. This confusion is not helped by the reduplication of the name 'Village Development Committee' since the committees responsible for land allocation have the same name, nor by the vagueness of the functions of so broad based a committee. On the other hand, a committee responsible for a water supply has a clear function visible to both villagers and committee members. This leads on to the second point which is that management of projects by separate water committees would tend to remove water from the mainstream of village dispute, as committees would see their function to lie primarily in matters related to the water supply rather than as guardians of public morality.

(C) Source of Power : Legal Status or DCDO Support:

Lack of authority to enforce decisions is a problem faced by many village committees. They might support their calls for voluntary contributions of labor and cash with appeals in the name of self-help, but they also require the power sanction to maintain credence.

There are two clear options on this issue, both of which have sociological implications. The first option is that village committees have legal authority to levy subscriptions or labor when necessary. The advantage here is that the committee can legally enforce non-contributors to contribute. Yet there are severe disadvantages to this proposal. Firstly, such an enforcement cuts against the grain of self-help. If the committee did prosecute non-contributors it would undo much of the community development spirit which the DCDO's are attempting to foster. Secondly, legal powers would be a potent weapon in the hands of a village faction and would probably reinforce factionalism.

The second option is that non-contributors are simply prevented from using the supply, and when the committee is not able to enforce this ruling, calls in the DCDO or one of his assistants to settle the matter. The advantage of this option lies in its sensitivity to the spirit and aims of community development and in its implicit management of village disputes. If one faction takes control of the committee, then the other faction can opt out of the struggle and need neither contribute to the project nor receive the project benefits. In the short term, since it is likely that all villagers will want to benefit, and so contribute in the long term, this raises the problem that aid donors and government may be paying over 90 percent of the total cost of the supply to which only a

limited number of villagers have access. We consequently recommend that the percentage of contributors be one of the project selection criteria. At least 60 percent of households need contribute before a village be considered for selection. Furthermore, in order to prevent the water users from becoming an exclusive group, we recommend that the village water committee be elected by all villagers, including both contributors and non-contributors, although only contributors may stand for election.

(D) The Management of 'Agglomerate' Supplies:

The village is a clearly identifiable social unit in Lesotho. Basotho hold a close attachment to their home villages and local chieftainship. The considerable amount of village rivalry, the competition between villages for grazing land, and in a more modern idiom, the spirited concern shown at inter village football matches, is symptomatic of this attachment. In terms of village management it is clear that the ideal situation would be one supply per village. In terms of cost, however, it appears that it may be necessary in many instances to have a single supply serve a number of villages. A compromise of this nature in a self-help program may also mean limited self-help benefits. The village management of agglomerate supplies poses great problems for village management, and it should be emphasized that agglomerate supplies should only be built where absolutely necessary and where there is excellent support from a district community development office.

One basic principle should be kept in mind when planning agglomerate supplies. Reduce village interdependence as much as possible. This principle has relevance to technical design as well as management structure. Where possible, supply systems should follow the 'fan' pattern, whereby separate villages receive their water directly from storage. The alternative, the 'ribbon' pattern, which connects villages by reticulation, means that if a village closer to the storage tank does not carry out repairs promptly, all the further villages are affected.

Two Types of Fan Reticulation

Ribbon Reticulation

With respect to management structure, the system currently employed by the Ministry is that each village contains its own committee which is responsible for their own section of the supply. An alternate model would be that only one committee should be responsible for each supply. Both systems have advantages and disadvantages, but the current system minimises village interdependence and for that reason is the recommended form of management. The disadvantages of having several committees per supply are that the full functioning of the whole supply depends upon a greater number of people, and establishes who is responsible for maintenance and repairs of the source, storage and pipes in between villages may prove to be a problem. One committee per supply makes it clear who is responsible for the supply, but has the serious disadvantage of having the single committee spread throughout the villages concerned. Smooth functioning of the committee would require a good deal of communication between the members in different villages. There is also the problem that some villages might be better represented on the committee or have their supply better maintained than others, particularly if their village contained the trained village water minder. For these reasons we recommend that, in theory, agglomerate supplies are managed in the manner currently employed by the Ministry, a committee per village with regular meetings of all committee members concerned.

In practice however, different situations may require different solutions, and the DCDO should be close at hand and be able to alter the system if it does not appear to be suitable, or if the villagers prefer an alternative. Regular visits to agglomerate supplies and meetings with the committees are essential.

(b) Village Committee Procedures:

Current policy is that this payment is accepted as a village contribution to the capital cost of the supply. Villagers often presume that they are matching government funds (or in reality donor funds) on a 50-50 basis. The real state of affairs was considerably different since it appears that on average villagers cash contribution only amounts to 7 percent of the total cost of the average supply.

Using suggestions from both previous studies which have commented on this issue, we recommend that the initial payment be viewed in a different light. Firstly, following Feachem (1977:Annex B), we recommend that the purpose of the initial contribution be taken as a measure of a village's eagerness to receive water and an indication of the potential for community

development in the village. In order to offset the bias that a policy dependent on the size of the contribution might have against those households too poor to afford a higher payment, the contribution should be judged both on the amount contributed and the proportion of households contributing. It is accepted practice for committees to allow the destitute to pay a lower contribution. This would only apply to a few households.

Secondly, following Metcalf and Eddy (1977:227) we recommend that rather than view the cash contribution as a contribution towards the capital costs, that it be seen as a contribution towards the maintenance of supplies.

What we envisage happening is that the funds raised by the village committee be placed in a bank savings account in the village's name. The account should have at least two signatories, normally the treasurer and chairman of the committee, and should cover the costs of maintenance, minor repairs and the payment of the village water minder where villagers elect to do so. Maintenance is discussed in Sections (v) and (vi) below.

In our view, use of the initial cash contribution in this manner holds out a number of advantages. Firstly, it has the advantage of clarity. It should assist in conveying the principle of self-help to villagers. Villagers chief area of responsibility and contribution to the supply is maintenance, and the DCDO should ensure that villages clearly understand the division of labor. Government will largely be responsible for construction, and the villagers will largely be responsible for maintenance. Secondly, the system reinforces a basic principle of self-help; villagers should be able to exercise real control over their resources within a supportive environment. If the scheme is implemented in this manner, and supported by other measures to ensure solid maintenance policy, (viz. an appropriate technology, technical training for villagers, technical support to undertake those projects beyond the scope of the village water minder, and support from the district community development office) it both provides the training experience implicit in the aims of self-help, and yet does not ask too much of villagers in terms of payment or social organization. Thirdly, the scheme makes sense in terms of the structural problems of the Lesotho economy. Villagers resources are directed at the recurrent costs of the project rather than at the initial capital costs.

We do not envisage any major problems in the implementation of this scheme in the case of new applicants, but in the case of villages which have long since made their contributions the change of policy will have to be explained very clearly. This implies further responsibilities for the district office. Government will also have to reimburse villages whose funds have not yet been transferred to village bank accounts.

(iv) How much should Villagers Contribute? The average initial contribution at present is between R1 and R2 per household, though in the course of maintenance further contributions may be made. The Ministry has for some while held R2 per household be the required initial contribution. How much villagers should pay for water can be computed in a number of different ways:

(A) As a flat rate based on the total capital cost of all supplies.

(B) As a flat rate based on the total maintenance cost of all supplies.

(C) As a percentage of the capital costs of partuclar supplies.

(D) As a percentage of the maintenance costs of particular supplies.

(E) As a percentage of average household income.

(F) As an assessment of what villagers will pay for water.

In the previous section we have argued that the village contribution should be considered part of the maintenance, as opposed to capital costs of the project, so we do not consider options (A) and (C). The total maintenance cost of the 547 systems under consideration over a 7 year period has been estimated to be R175,000. Assuming 80 households per system, this works out at a total average maintenance cost of R16 per household over a 7 year period. In other words, if villages were to pay the total maintenance cost of all systems on the basis of a flat rate (B) each household would have to pay R16 for the first 5 years.

Computation according to option (D) overleaf is presented in Table D1.

TABLE D1

SEVEN YEARS MAINTENANCE COSTS PER SYSTEM IN RANDS

System	Total Maintenance Cost per System for 7 years	Average Cost per Household in a Village of 80 Households	Number of Systems Completed after 7 years
1	580	7.25	
2	1245	15.56	
3	825	10.31	
4			0
5	2025	25.31	
6	1785	23.31	
7	2025	25.31	
Average		TOTAL	

According to Table D1 the maintenance costs per system for 7 years range from an average of R7. 25 to R25.31 per household in a village of 80 households. The range of costs make it clear that, however desirable a policy, a flat rate would mean that average sized villages would over-collect by 100 percent if they received system 1, snd under-collect by approximately 60 percent if they received systems 5, 6 or 7. Smaller villages will under-collect for all systems except System 1. The three types of systems qhich fall above the average R16 contribution, systems 5, 6 and 7 refer only to more complex systems, or percent of the total number of systems to be implemented over the entire 7 year period.

Metcalf and Eddy (1977:222-228) have pursued option (E) and have examined data on household income in Lesotho. They conclude that one percent of gross household income for low income households does not exceed R5 per household per year (R35 over a period of 7 years).

The same study also concludes that households will be willing to pay one percent of household income, a figure which for middle income households equals approximately R30 ro R40 per year, "if effective programs of education, project implementation and rate collection are established" (1977:227). Feachem et al (1977:B6-7) also examines what villagers will pay for water. From an examination of what villagers will and will not pay for water they conclude that "R5 per household would not be an unreasonable sum to collect in future years" (1977:37). No time period is stated here, but clearly this figure is presumed to cover a period of between 3 and 5 years since they further conclude that "without legislation, which would in any case be difficult to enforce, the collection from villagers of regular payments for village water supplies is not practical in Lesotho" (1977:B9) i.e. the one time payment of R5 should cover a number of years.

From all the foregoing we conclude the following:

(1) Villagers should be asked to pay a reasonably high initial payment for water (in their terms) since this provides one indicator of a village's eagerness for a project. This figure should, however, not be completely out of reach of the lowest income group. The high initial payment also solves the problem of the need for regular payments, which are clearly shown to be unsatisfactory in the Feachem report. R5 per household would mean an increase of over 200 percent on the current initial contribution, and yet would fall within the grasp of low income households.

(2) Villagers should have control over their own funds and they should be used as a contribution towards the maintenance costs of supplies. The average maintenance cost for all supplies is R16 per household over a five year period. We recommend that, in general terms the percentage split between government and villagers be two-thirds government to one third from villagers. The average household would then pay a little over R5 and the government a subsidy of just under R11 per average household, per avaerage system, for the average population, over the course of the next 7 years. We envisage that this split will conform to that between minor maintenance, which should be under the control of a village water minder and funded from village funds, and major repairs which would be undertaken by the district technical officer and funded by government.

(3) Yet pricing per system is also important given the range of maintenance costs. We recommend that villages receiving system 1 only be asked to contribute R2 per household per 5 year period, since their supplies will provide an inferior service to the other systems and will not come up to expectations. This split roughly conforms to the one-third/two-thirds ratio. In the case of systems 5, 6 and 7 we recommend that these supplies (in the country in 7 years) be built to serve large villages. A population pf 130 households, for example, contributing R5 per household would be sufficient to cover one-third of the total maintenance costs of either systems 5, 6 or 7 for 7 years. Where it is not possible to construct supplies on this scale, we recommend that government provide a further subsidy and reduce the village contribution for the average population to 20 percent so maintaining the village contribution at R5 per household. We recommend that government does not expect villagers to contribute more than R5 for 7 years of maintenance, and in particular cases, where small sized villages require further contribution, government be prepared to cover the additional cost.

(4) Almost all systems in the next 7 years will be implemented in villages which have already contributed small sums as a percentage of the initial capital cost of the supplies. In order to implement a viable maintenance policy, the government will have to carry out the following: firstly, ensure that all village contributions are paid back into savings bank accounts in villages' names; secondly, the DCDO will have to meet with every committee and explain the new policy regarding maintenance; thirdly, once the government is absolutely certain a village is going to receive a supply, the DCDO will have to call for the smaller initial contribution to be topped off by villagers to meet the new levels. These tasks will be extremely demanding on district office resources.

(iv) The Labour Contribution. Villagers not only contribute cash towards the cost of supplies, but are also responsible for providing the labor required in implementation and maintenance. The provision of labor is in general the least problematic component of the self-help contribution. There is a strong tradition of communal labor in Sotho culture and, given the constraints of the migrant labor economy, the response has in the past generally been good. Furthermore, Feachem has shown (1977:B15-19) that self-help labor is less costly than hired labor. For these reasons we recommend that the self-help labor contribution be maintained. The DCDO should be on hand to support the village committee in dealing with non-contributors

during implementation. One of the effects of the delay may well be to lead to a higher level of non-contributors. Villagers who do not contribute labor should have to pay financial penalties if they wish to draw water at a later stage, whether or not they have joined the initial cash contribution. The village water minder should be employed by government on a daily basis during the course of the implementation or when carrying out major repairs. This will help provide training and will provide additional remuneration for his/her efforts.

(vi) Maintenance. Prior to 1976 there was no maintenance policy for village water supplies. Maintenance was entirely the responsibility of the villagers and they received little support from government. It has now been recognized that government should take over some responsibility for the maintenance and repair of village supplies. Procedures for maintenance are discussed under the organizational and technical sections of the PP. This section examines maintenance at the village level.

In section (ii) and (iii) above we recommended that villagers initial cash payment become a contribution to cover the cost of village maintenance for a 5 year period, whereupon a further payment will have to be forthcoming. The percentage villages pay for maintenance as opposed to government's contribution (one-third to two-thirds) reflects villagers responsibility to carry out minor maintenance, while government is responsible for major repairs. The distinction between major and minor repairs will have to be established in particular cases by the district technical officer in conjunction with the DCDO. In general terms what we envisage is that the village be responsible for the replacement of taps, fixing leaks and preventative maintenance such as greasing hand pumps etc., while the government is responsible for replacing tanks, rebuilding spring captations, etc.

In order to carry out minor maintenance, villages will require the necssary technical expertise. The Ministry has accepted that one means of doing this is to train village water minders, or "barefott water mechanics", who will be responsible for the minor repairs in the village. The first group of 11 water minders have recently completed

their first course of instruction. We have been able to monitor the first course and have visited several of the water minders in their villages. We strongly support the concept of water minders and feel that if the scheme is properly implemented it could greatly improve the level of village maintenance. Interviews with the first water minders revealed that the scheme has great potential, but needs evaluation once the program is fully underway.

(vii) Are Village Water Minders Acceptable? We do not envisage any cultural or social problems in the acceptability of water minders. The majority of the little maintenance that has been carried out has been done by villagers who have, by some means, learnt basic plumbing techniques. Such villagers have either offered their services voluntarily, or they have been paid some small remuneration for undertaking the job. The system envisaged simply formalizes what is already happening in many of the supplies that are being maintained.

(viii) Who should the Water Minders be? The water minders should always be freely elected members of the village receiving the supply. They should be paid-up members of the village water association where applicable. The principle of free election is crucial to the success of the scheme. The DCDO, who should attend the meeting to elect the committee and the water minder, should however point out the following guidelines: firstly, water minders should be villagers who are likely to remain in the village for some time. For thia reason, water minders will in all likelihood either be women or older men. The latter have the possible advantage of experience working with pipes in the mines. Furthermore, in formal cultural terms men would be expected to carry out such work. On the other hand, women as the drawers of water, have the advantage that they know when the supply is not working adequately and have a direct interest in maintaining it. Secondly, before election, water minders should realize what they will be expected to do, and should have a potential skill for working with their hands, and be prrpared to liaise with the community, get their hands dirty, etc. The committee constitution should detail exact responsibilities (see Appendix D1).

These guidelines are not being followed at present. Of the 11 participants in the first course 2 were women, 1 a young man in his thirties, and the rest were older men. The young man was particularly impressive when interviewed but intends returning to the mines in the near future. Some members were appointed by committees and only three or four were elected to attend by all the villagers; some already held posts on the committee and some did not. One area that the interim evaluation would examine is the problems in village choice of water minders.

(ix) Should Village Water Minders be Paid? There are three alternatives:

(A) Water minders should be paid by government.

(B) Water minders should be regularly paid by villagers.

(C) Water minders should not receive regular pay,but should receive a yearly stipend from the villagers.

(D) Water minders, as members of a voluntary committee, should give of their services freely.

The choice between these four options is a difficult one, and strong arguments can be put for and against all four. Both Metcalf and Eddy and Feachem et al discuss the question, each giving different recommendations. Metcalf and Eddy suggest "...The position (of the village water minder) will be an important one, and the person adequately filling the position should be rewarded. It is suggested that the rate of compensation vary from R1 per month for simple systems, to as much as R5 per month or possibly more for complex duties involving specific duties as fixed times. Funds for payment should be generated locally. If the water minder is not paid, she/he should not work and the villagers should be made aware of the fact that it is their system and their water supply which will suffer as a result" (1977:169-170).

Feachem et al, by contrast, points out that "if the minder were paid, villagers would certainly be unwilling to contribute labor free when it was required for maintenance" (1977:C20). Furthermore, the difficulty with payment from the government is that the water minder would "not be answerable to the committee". The chief difficulty with payment from the village is that regular payments are very rarely forthcoming from villagers. The report concludes that government should not be asked to pay any of the committee members but that "if committees have obtained additional funds and wish to use these as an added incentive for villagers services they should be free to do so" (1977:C21).

Clearly the simplest solution in terms of ensuring that the supply is maintained is for the Lesotho Government to employ one village water minder per system (option (A)). If the minders were paid R5 per month on average, by year 5 of the program this would incur an additional recurrent cost of R32,820 for 547 systems. Even if it were possible for government to cover this recurrent cost, which is additional to the other maintenance costs, (see section III.6. of the PP) there remain some additional probrlms. Village water minders would not be responsible to village committees; other committee members might also request payment; villagers might require payment for self-help labor on maintenance; would government cover the additional expense of training and paying 6 water minders in an agglomerate supply containing 6 villages and 6 committees? (see section 5(ii)); and most importantly such government payment would further undermine the principle of self-help. If government were to pay, villagers would regard the supply as wholly government's responsibility.

In the face of these problems, we recommend that government only pay village water minders regularly for maintenance of diesel pumps and windmills. In these instances, villagers are generally quite unable to maintain the supply themselves as the supply requires considerable and regular maintenance, the lack of which could be very costly to government.

Turning to option (B), it is recommended that water minders are not paid by the month by villages. The constraints of the village economy and the general social milieu in the villages is not conducive to regular cash collections. The Feachem report clearly shows that this is simply not a realistic policy in the long term given the unsettled standing of village committees, the disillusionment generated by non-contribution, and the amount of support from the Ministry that such a policy would require to be fully enforced.

The real choice to be faced by the Ministry is whether it should pursue option (C) or option (D) above, in order to have the water minder maintain spring captations, gravity feed systems and hand pumps. Both options could work or fail in different situations. The major problem with option (D) is that it allows neither the same committee, nor the government, to have any control or assurance that the supplies will be maintained. Voluntarism may be sufficient motivation for short term projects, but in the long term something more is required. It is interesting to note, however, that none of the village water minders interviewed felt that they should be paid. The pride generated by their new status seemed to be sufficient, although it must be remembered that this view was recorded only a week after the completion of the course. Accordingly it is recommended that only village water minders receiving system 1, spring captations, be expected to work without any form of stipend. In this case, equipping the minder with tools, a wall-plaque certifying that he has finished the training course, employment by the government in the course of construction, the water minder's status on the committee, and support and encouragement from the DCDO should be sufficient encouragement for him/her to carry out the minimal maintenance that is required for upkeeping system 1.

It is recommended that it be suggested to villages receiving systems 2 and 3 that the village water minder be given a yearly honorarium for his/her efforts. The sum should be in the region of R50 to R80 depending on the size of the supply and village. The average system with the average number of households would pay a maximum of R1 per household per

year to the committee treasurer, who would pay the water minder once a year, possibly at Christmas when the men are home. The political dangers incurred with any cash payment still apply in this option, but it has the advantage of not demanding regular payments; the stipend would not have to be mixed in with the other maintenance payment; it provides water minders with an incentive, though one that is possibly not too great to warrant too much inter-committee jealousy; and it enables the committee to sanction a water minder'a poor performance. The size of the honorarium should be established before the water minder takes the job.

The recommendations outlined here are suggested as possible guidelines to the most appropriate course of action DCDO's might follow. DCDO's should put options (C) and (D) to villagers in particular cases in order to ascertain which is the preferred solution. Given the flexibility of this arrangement, the pilot nature of the early water minder training programs and theoretical state of our knowledge at the moment, it is recommended that an interim evaluation be carried out to determine which of the approaches discussed above is the least prolematic, and what has been learnt from the experiment. The evaluation should be carried out by a social scientist, who would liaise with both the technical section and the DCDO's to establish what progress had been made once usfficient water minders had been trained by earlt 1980, by which time it should be possible to evaluate the success of the proposed guidelines. Although the DCDO's and the technical section responsible for training the minders should themselves be monitoring their progress, it may be very useful to have an outside opinion on what has been achieved. Appendix D2 presents a suggested scope of work for the interim evaluator.

(c) <u>District Level Support</u>:

The most critical area in the management of self-help is the level of communication, nature of the support between the village committees and the district center. However, much effort is put into a self-help

program at higher levels, the program will not prove successful until people are allowed to make real decisions within a supportive environment. Throughout the recommendations we have alluded to the importance of district support. We present a list of the functions that we think that the district office has to undertake:

- Training for the Village Water Minders: A week's course instructing water minders in the basics of maintenance, how and when to apply for technical help, how to purchase spare parts and how to organize village labor if needed. Courses would probably be run by the district technical staff at the regional or district maintenance centres.

- Training for Chairman, Secretary and Treasurer: A two-day course of instruction on committee procedures should be given to villagers elected to fill each of these three roles. Each member should be instructed in the duties accorded to each position in the village constitution. The treasurer, for example, would receive instruction in simple accounting procedures, the chairman instruction in how to chair meetings and liaise with both villagers and government, and the secretary in record-keeping. Copies of an agreed committee constitution should be given to each committee member.

- Moral and Legal Support for Committees: The DCDO or one of the ACDO's should supervise committee elections, be in contact with each committee at least twice a year to sort out any problems that have arisen, arrange for the training of new members, help to solve disputes and act as a source of sanction where necessary. The district community development office should be able to react firmly and quickly to initiatives made by the committee, and even initiate suggestions where necessary+ Regular visits, and clear support for the committees is especially important in agglomerate supplies and in villages which have been waiting for several years for their supplies to arrive.

- Introduction of the New Maintenance Policy: It is likely that the new maintenance policy will have teaching problems when first introduced, and it falls to the district office to sort out the problems. Many villagers are not aware of the government's problems regarding construction and are understandably

concerned about their apparent loss of money and the great delay in implementation. The introduction of the new maintenance policy, particularly where this involves asking for further contributions, may require diplomacy and understanding, and the district officers must ensure that villagers and committees clearly understand the implications of the new system, and the basis of the self-help policy. A further aspect to this policy is the initiation of the village water minder concept, particularly the person. The DCDO would be advised to visit the village at the time the minder is due to receive the payment to ensure that both the committee and the villagers are following the agreed code.

At present the district offices are incapable of carrying out these duties for existing supplies, let alone increased supplies which should follow this project. The two greatest factors retarding the effectiveness of the district offices are:

(A) shortage of manpower, particularly ACDO's/ SCDA's and CDA's;

(B) Shortage of transport.

- (A) The Wilmot report has recommended the creation of 60 CDA's (Community Development Assistants) to improve the effectiveness of rural development at the district level. We recommend the approval of those posts and view their creation as essential for successful self-help village water supply projects. We also recommend that the number of ACDO's be increased to two per district. The ACDO's should receive training in community work and be based at the district center. CDA's on the other hand require less training and should be based out in the villages. By early 1981 district offices should be staffed by at least 1 DCDO, 2 ACDO's and 4 CDA's.

- (B) District offices are in chronic need of transport. Current policy is that DCDO's and their staff should use public transport, taxis or buses, or they may requisition transport from the technical section when it is available. The use of public transport is quite unsatisfactory, firstly because only the lowland districts have suitable public transport - there are no buses or taxis in Mokhotlong for example - and secondly because such public transport that does exist is erratic

and only operates on the main roads. Requisitioning transport is equally unsatisfactory. An estimate for for the Maseru district, the district with more access to transport than any other district in the country, illustrates that the DCDO and her staff only receive transport 9 days a month on average. In 1976 it was estimated in Mokhotlong that the DCO was unable to make approximately 60 percent of his monthly meetings, largely as a result of having no transport whatsoever.

Ideally each district should control a vehicle. Where it is not possible to use a 2-wheel drive vehicle, and we refer specifically to the mountain districts, district offices should have a 4-wheel drive vehicle. It is recommended that government put the purchase of these vehicles at a high priority since the success of the whole community development effort in the country depends to a large extent upon the contact between the district offices and the villagers. In addition to a vehicle per district for use primarily by the DCDO, the ACDO's and CDA's also require transport. In the mountain districts horses would be the best form of transport, while in the lowlands, ACDO's might use motorcycles where appropriate, and the CDA's horses. It is essential that by 1981 each district office, staffed as above, be equipped with a vehicle and either 6 horses, or 4 horses and two motorcycles. Livestock division might be asked to care for the horses, or alternatively, a horse allowance could be paid to the CDA's. Where necessary the Ministry should assist CDA's to raise bank loans to purchase horses if the Ministry is averse to owning its own stock.

Action on both these points (A) and (B) above are critical to the success of the village water supply program, and all community development activities in the country. Successive evaluations of community development in Lesotho have pointed to the disparity between what government is saying in committing themselves to a policy of community development, and the administrative realities of the program (see for example the Burke report (1969)). The district offices are often bypassed in the decision making process (see Feachem (1977:D5), and their administrative and logistical support is consistently inferior to that extended to the technical sections of the Ministry of Rural Development. The recommendations outlined above go a small way to help redress the balance between the technical and community development sections of the Ministry.

6. CONCLUSION AND SUMMARY OF PRINCIPLE RECOMMENDATIONS

The implementation of village water supplies fulfills a felt need and there are no cultural constraints which impede the program. The success of the self-help program relies on effective village management.

Sound village management depends on the following:

(a) the use of a socially appropriate technology;

(b) the formation of village level institutions suited to the task of village management of water supplies;

(c) clarification of the procedures used by village committees;

(d) an effective maintenance policy;

(e) effective support and training for village committees from the district offices.

To this end we have recommended the following:

(i) The use of Gravity-Feed water systems and hand-pumps are the most socially appropriate technology available and should be used wherever possible. The number of 'agglomerate' supplies should be kept at an absolute minimum. When constructed they should follow a pattern of 'fan reticulation' rather than 'ribbon reticulation'. The Ministry should initiate and monitor three or four pilot projects in which communal washing facilities are attached to a water supply.

(ii) Village committees ate the most appropriate institution for the management of supplies. Village committees must be freely elected bodies. They should be formed as single-purpose water committees without legal powers, but with powers of sanction to exclude non-contributors. Agglomerate supplies should be managed by a committee per village. An interim evaluation should examine what progress has been made regarding the establishment and functioning of village committees.

(iii) The Ministry should approve and translate into Sesotho guidelines for a committee constitution which should be issued to every committee. The district office should run training courses for members of committees. Village funds should be kept in a double signatory savings bank account.

(iv) The initial cash contribution which was formerly viewed as a contribution to the capital costs of supplies, should become the villagers contributions towards minor maintenance. It should be placed in a bank account controlled by the village committee. Villagers should be required to pay slightly more for water, though the precise amount should vary according to the system implemented. Table D2 summarizes the recommendation of how much villagers should pay.

The creation of village water minders is strongly endorsed. Water minders should be freely elected members of villages receiving supplies, although this would inevitably mean older men and women. Water minders' servicing diesel pumps and windmills should be paid by government, and minders maintaining gravity systems and handpumps would most often receive a yearly stipend from villages. Minders maintaining spring captations would not normally be paid. The choice as to precisely how water minders maintaining the latter two categories of technology might be remunerated for their service is a matter for village committees under the supervision of the DCDO to decide. An interim evaluation should be undertaken by a sociologist to assess the soundness of the hypothesis on which this policy is based, and to advise on alterations in the procedures for training and paying village water minders where necessary. Table D2 summarizes policy on the payment of village water minders.

TABLE D2

SUMMARY OF RECOMMENDATIONS ON MAINTENANCE POLICY PER SYSTEM

System	Recommended Maintenance Payment Policy	Recommended Village Water Minder (VWM) Policy
1	R2 per household per 80 households = 1/3 of total average maintenance cost	No government payment nor village stipend
2) 3)	R5 per household per 80 households = 1/3 total average maintenance cost per system	VWM receives stipend of R50-80 from villagers
4	-	-
5) 6) 7)	R5 per household per 130 households = 1/3 of total average per system	VWM paid by government at R5 per month

(v) Support from the Ministry's district offices is crucial to the success of the program. The key areas of support are in training village water minders and committee members, providing moral and legal support to committees, and implementing the new maintenance policy. The staff should have access to one vehicle and either six horses or four horses and two motorcycles per district.

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A SUGGESTED CONSTITUTION FOR A WATER SUPPLY COMMITTEE

The outline constitution below is intended primarily as a tool for DCDO's to employ on their instruction courses to show village water supply committees the broad content and intent of a constitution. Essentially, it sets out the duties and obligations of committee members and villagers, and defines the purpose for which the committee is in existence. Nonetheless it can be used as the working basis on which a committee can tailor a constitution appropriate to its particular needs.

In framing the draft constitution we bear in mind the recommendation that the committee responsible for managing the water supply should be responsible for that task exclusively.

1. The name of this Association is

2. The aim of the Association will be to make arrangements for the installation and maintenance of a water supply. If for any reason a supply cannot be built, the members may agree at a general meeting to support some other project.

3. All households which live in the village or villages which are to benefit from the water supply must be members.

4. The right of any member to draw from the supply will be determined by the following:

   (a) they should pay their full subscriptions, unless the committee is satisfied that they are destitute.

   (b) When the supply has been installed, or if major repair work has been carried out, the committee will agree on the number of days for which each member should have worked, Each member should then pay an amount set by the committee for any of these days when he did not work without good reason.

(c) Households newly moving to the village after the supply has been installed need only pay the subscription (a).

5. General meetings of all members will be called by the chief at the request of the committee or of at least six members, giving several days clear notice; the chief and committee must be told in writing who has called the meeting and for what reason. All resolutions of a general meeting must be passed by a majority of those present. Each adult present shall have one vote.

6. Once a year a general meeting will elect a committee which will serve for one year and consist of a chairman, a water minder, a secretary, a treasurer, a vice-chairman, an assistant water minder and an assistant secretary, who will be elected one by one in that order. The old committee members shall show their successors how to carry out their duties, and help whenever necessary. Only fully paid-up members can be elected.

7. At any time during his office, any committee member may be removed from office and replaced by a general meeting, if

   (a) he is prevented from work by illness or absence;

   (b) he fails to attend three consecutive committee meetings without good reason;

   (c) he resigns;

   (d) the members are not satisfied with him, and give good reason for his removal.

8. The committee will meet at least once every three months, when the appropriate committee members will report on the state of the association's funds, records and water supply.

9. The committee members can call a committee meeting, but must give 7 (seven) days notice, except for urgent matters. All committee resolutions must be carried by a majority of those committee members present. Each committee member present shall have one vote and half the committee will constitute a quorum.

10. The chairman will have the following powers and duties:

    (a) to direct all committee meetings and any general meetings not attended by the chief;

    (b) to arrange for the members to help build or repair the supply as the committee may decide;

    (c) to prosecute anyone found wilfully damaging the water supply or interfering with the committee's work;

    (d) to pass on any requests of the committee to the chief;

    (e) to report to the district office any disagreements with the chief or the people which the committee are unable to resolve.

11. The water minder will have the following powers and duties:

(a) to look after the tool kit and spares for the water supply;

(b) to maintain the supply in good working order;

(c) to carry out any necessary repairs if able to do so;

(d) if not, to report the trouble to the DCDO and help them to repair the supply;

(e) to report any cases of wilful damage of the supply to the committee.

12. The secretary will have the following powers and duties:

(a) to keep a book of all resolutions of the committee and of general meetings, which will be signed by the person running the meeting;

(b) to keep all letters received and advise the committee when they arrive;

(c) to write letters and sign them on behalf of the association;

(d) to call committee meetings;

(e) to keep a book of the names of members and record which have paid their subscriptions and gow many days they work when the supply is built or repaired.

13. The treasurer will have the following powers and duties:

(a) to keep all money received from the members, give them receipts for it, and take it to the bank;

(b) to keep receipts for any expenses incurred or money taken to the government, and the association's bank book;

(c) to keep a record of the money received from each member and the date he received it, and of the total amount received and spent.

14. Any of these committee members may delegate any of his powers to his assistant or, if necessary, to another committee member.

15. The secretary and treasurer must show their records to any member who asks to see them.

16. In time of drought, the committee may impose restrictions on water use, which they will announce at a general meeting.

17. Changes and additions to this constitution can only be made by resolution of a general meeting.

ANNEX VIID

VILLAGE WATER SYSTEMS MAINTENANCE COSTS

The following table analyzes the maintenance cost breakdown per system over the life of the project. In the Village Water Systems Cost Table A Sheet systems are listed 1 through 7 representing the various types (see Annex VIIA) and are shown to be either U.S. produced, other donor or existing. An adjustment is made on yearly totals to take into account anticipated increase in petrol and diesel costs and contingencies.

Other tables were prepared, but not included in this Annex, for analytical and background purposes showing annual maintenance costs. The tables use the person day requirements listed in Annex VII-E, standard GOL salary levels, and project materials amounts and values.

A. VILLAGE WATER SYSTEMS COST SHEET (RAND)
MAINTENANCE

		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	TOTAL UNITS
U.S.	1.	2 x 90 = 180	4 x 101 = 404	6 x 114 = 684	8 x 128 = 1,024	10 x 145 = 1,450	12 x 163 = 1,956	15 x 184 = 2,760	15 n
	2.				4 x 277 = 1,108	12 x 313 = 3,756	24 x 353 = 8,472	3 x 400 = 12,800	32 n
	3.		13 x 143 = 1,859	31 x 163 = 5,053	49 x 185 = 9,065	67 x 208 = 13,936	85 x 238 = 20,230		85 n
	5.					1 x 515 = 515	2 x 585 = 1,170	3 x 664 = 1,992	3
	7.				1 x 444 = 444	3 x 515 = 1,545	5 x 585 = 2,925	7 x 664 = 4,648	7
OTHER DONORS	1.								
	2.	12 x 193 = 2,316	24 x 218 = 5,232	36 x 246 = 8,856	48 x 277 = 13,296	60 x 313 = 18,780	60 x 353 = 21,180	60 x 400 = 24,000	60
	3.								
	4.								
	5.								
	6.	3 x 275 = 825	6 x 311 = 1,866	9 x 352 = 3,168	12 x 398 = 4,776	15 x 450 = 6,750	15 x 510 = 7,650	15 x 578 = 8,670	15
	7.	3 x 311 = 933	6 x 353 = 2,118	9 x 400 = 3,600	12 x 444 = 5,328	15 x 515 = 7,725	15 x 585 = 8,775	15 x 664 = 9,960	15
EXISTING	1.								
	2.	258 x 193 = 49,794	258 x 218 = 56,244	258 x 246 = 63,468	258 x 277 = 71,466	258 x 313 = 80,754	258 x 353 = 91,074	258 x 400 = 103,200	
	3.								
	4.								
	5.								
	6.	45 x 275 = 12,375	45 x 311 = 13,995	45 x 352 = 15,840	45 x 398 = 17,910	45 x 450 = 20,250	45 x 510 = 22,950	45 x 578 = 26,010	45
	7.	12 x 311 = 3,732	12 x 353 = 4,236	12 x 400 = 4,800	12 x 444 = 5,328	12 x 515 = 6,180	12 x 585 = 7,020	12 x 664 = 7,968	12
		R 70,155	R 85,954	R 105,469	R 129,745	R 161,641	R 193,402	R 202,008	547
ADJUSTMENT[1]			1,090	3,690	7,756	13,459	19,415	27,200	
TOTAL		70,155	87,044	109,159	137,501	175,100	212,817	229,208	

Petrol, diesel increases, plus contingencies

ANNEX VII E.

for

MANAGEMENT AND INSTITUTIONAL ANALYSIS

Table I: Person Day Requirements for Systems Installation by Activity Phase, Position Classification, and Technology Type.

Table II: Calculation of Personnel Costs for Systems Installations, 1980-1986 by Technology Type and Position Classifications.

Table III. Calculation of Person Year Requirements for Systems Installation, 1980-1986, by Technology Type and Position Classification.

Table IV: Summary of Personnel Numbers Required 1980-1984

Table V: Calculation of Person Year Requirements for Systems Maintenance.

Table VI: Work Day Computations for VWSS Technical Staff

Table VII: Productive Capacity Analysis For VWSS Staff

Table VIII: Schedule of System Installations, 1980-1986 by Technology Type.

TABLE 1: PERSON DAY REQUIREMENTS FOR SYSTEMS INSTALLATION BY ACTIVITY PHASE, POSITION CLASSIFICATION, AND TECHNOLOGY TYPE

Activity Phase and Personnel Classification	Type of System	(1) Spring Protection	(2) Spring and Gravity Reticulation	(3) Rotary Low Percussion Borehole Handpump [2]	(4) Low Level Borehole Handpump [2]	(5) Low Level Spring Windmill [3]	(6) Low Level Spring Diesel [3]	(7) Percussion Borehole Windmill [3]	(7) Percussion Borehole Diesel
1. Preliminary Reconnaissance	CTO	2	2	2	2	2	2	2	2
	STO	2	2	2	2	2	2	2	2
	DRV	2	2	2	2	2	2	2	2
2. Siting (Hyrogeology)	CTO	-	-	1	1	-	-	1	1
	STO	-	1	2	2	1	1	2	2
	DRV	-	1	2	2	1	1	2	2
3. Drilling [5]	CTO	-	-	1	1	-	-	2	2
	STO	-	-	3	2	-	-	5	5
	TO	-	-	5	2	-	-	5	5
	TAO	-	-	20	10	-	-	25	25
	LAB	-	-	80	40	-	-	80	80
	DRV	-	-	12	5	-	-	15	15
4. Strata Checking (Hydro) [4]	STO	-	-	3	2	-	-	4	4
	DRV	-	-	3	2	-	-	4	4
5. Testing (Hydro)	CTO	-	-	1	1	-	-	1	1
	STO	-	-	8	3	-	-	6	6
	TO	-	-	6	1	-	-	6	6
	TAO	-	-	6	3	-	-	6	6
	LAB	-	-	16	6	-	-	16	16
	DRV	-	-	3	2	-	-	3	3
6. Survey Design	CTO	1	2	1	1	2	2	2	2
	STO	.3	7	2	2	7	7	7	7
	LAB	1	3	1	1	3	3	3	3
	DRV	1	3	1	1	3	3	3	3
7. Construction	CTO	2	12	2	2	12	12	20	20
	STO	-	12	2	2	12	12	20	20
	TO	2	40	2	2	40	40	70	70
	TAO	30	120	10	20	120	120	200	200
	LAB	30	120	10	20	120	120	200	200
	DRV	5	30	3	5	30	30	40	40
8. Construction Education	CTO	1	1	1	1	1	1	2	2
	STO	-	1	-	-	1	1	2	2
	TO	1	4	1	1	4	4	7	7
	TAO	3	12	1	1	12	12	20	20
	LAB	3	12	1	1	12	12	20	20
	DRV	1	3	1	1	3	3	4	4

* See following page for NOTES

NOTES:

1. Requirement estimates by professional engineering staff, Village Water Supply Section, Ministry of Rural Development. Estimates are limited to the eight major activities of a system's installation.

2. System type 3 demonstrates 2 technologies of drilling, and the comparative person day requirements. The average rotary system workload is 4 holes drilled, with 3 being successful.

3. System types 4 and 5 are estimated to have the same person days as system 2, the spring gravity reticulation system. However, it should be noted that the emplacement of the diesel or windmill is not included in these estimates. It is planned to have these done on contract. It is estimated that 20 person days are required for a contract specialist to place a diesel pump; 30 days for a windmill pump system.

4. Testing of rotary drill boreholes requires one day for each of 3 in an average size village of 400 persons.

5. Percussion drilling person day estimates are based on a 40 meter hole, taking about which is conservative. Travel and shifting of drilling rigs are included in the estimates.

KEY TO ABBREVIATIONS:

1. CTO = Chief Technical Officer - A.I.D.
2. STO = Senior Technical Officer - GOL
3. DRV = Driver - GOL
4. TO = Technical Officer - GOL
5. TAO = Technical Assistance Officer - GOL
6. LAB = Laborer - GOL

Table II: Derivation of Person Years and Unit Personnel Costs for System Installations

Part I

Derivation Method

Based on Appendix Table I person day calculations, a table was constructed as follows:

(1) System	(2) Positions	(3) Work Time PMs		(4) Employ Time Factor		(5) Employ Time PMs		(6) Months in Year		(7) No.of PYs Reg'd		(8) Av.Cost Per PY		(9) 1979/80 Cost per System
Spring Gravity	CTO	.77	x	1,2322	=	.95	÷	12	=	.0792	x	4968	=	393

A large table as above was constructed for each system and every position in order to derive detailed personnel numbers and unit personnel costs. It is not reproduced here because of its scale, but is available in the project files.

The major element requiring explanation concerns columns 3, 4 and 5. Work time reflects actual installation work days, converted to Person Months from Table I. The work time does not include provision for annual leave, average delay times, sick leave, holidays, training time, and so on. A background analysis of productive work days revealed that laborers actually worked only 57% of the available workdays; while all other staff worked 77% of available work days. Therefore, to derive accurate personnel costs, it became essential to calculate in the full employment time and the associated costs. The conversion factors were 1.464 for all laborers, and 1.2322 for all other staff.

The results of this methodology are shown in the Part 2 summary table which follows. These costs have been utilized in the economic and financial analyses to arrive at full unit costs per system installation.

Part 2

Summary of Person Years and Unit Personnel Costs for Systems Installations 1979/80.

System	1979/80 Unit Personnel Costs per Inst.	Total PYs All Positions
Spring Protection	$1,657	.58
Spring Gravity	2,894	1.92
Borehole-Handpump	1,088	.825
Low level Spring Diesel	3,538	1.93
Borehole Diesel	6,322	4.02

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TABLE III: Calculation of Person Year Requirements for Systems, Installation, by Technology Type and Position Classification

Year + Position	System Type	Spring Protection	Spring with Cravity Raticulation	Borehole Hand pump	Low level Spring Diesel	Borehole Diesel	Totals
CTO	1980	.33	.95	.55	0	0	1.83
	1981	.33	1.74	1.02	0	.14	3.23
	1982	.33	1.74	1.02	.24	.28	3.61
	1983	.33	1.74	1.02	.24	.28	3.61
	1984	.33	1.74	1.02	.24	.28	3.61
STO	1980	.28	1.28	.91	0	0	2.47
	1981	.28	2.35	1.68	0	.14	4.45
	1982	.28	2.35	1.68	.32	.28	4.91
	1983	.28	2.35	1.68	.32	.28	4.91
	1984	.28	2.35	1.68	.32	.28	4.91
TO	1980	.17	2.46	.36	0	0	2.99
	1981	.17	4.51	.66	0	.14	5.48
	1982	.17	4.51	.66	.62	.28	6.24
	1983	.17	4.51	.66	.62	.28	6.24
	1984	.17	4.51	.66	.62	.28	6.24
TAO	1980	1.85	7.39	.91	0	0	10.15
	1981	1.85	13.54	1.68	0	1.17	18.24
	1982	1.85	13.54	1.68	1.85	2.34	21.26
	1983	1.85	13.54	1.68	1.85	2.34	21.26
	1984	1.85	13.54	1.68	1.85	2.34	21.26
LAB	1980	2.15	8.81	4.88	0	0	15.84
	1981	2.15	16.15	8.88	0	1.74	28.92
	1982	2.15	16.15	8.88	2.20	3.47	32.85
	1983	2.15	16.15	8.88	2.20	3.47	32.85
	1984	2.15	16.15	8.88	2.20	3.47	32.85
DRV	1980	.51	2.18	1.22	0	0	3.91
	1981	.51	4.00	2.24	0	.34	7.09
	1982	.51	4.00	2.24	.55	.68	7.98
	1983	.51	4.00	2.24	.55	.68	7.98
	1984	.51	4.00	2.24	.55	.68	7.98

Notes: All figures are from Project Background File, Calculation of Person Years and unit Personnel costs for System Installations.

Key To Abbreviations

CTO=Chief Technical Officer-AID
STO=Senior Technical Officer-GOL
TO=Technical Officer - GOL
TAO=Technical Assistance Off.GOL
LAB= Laborer - GOL
DRV = Driver - GOL

Table IV: Summary of Personnel Numbers Required, 1980-1984

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	80	81	82	83	84
CTO	2	4	4	4	4
STO	2	5	5	5	5
TO	3	6	7	7	7
TAO	10	19	22	22	22
LAB	16	27	33	33	33
DRV	4	7	8	8	8
	37	70	79	79	79

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Table V: Calculation of Person Year Requirements for Systems Maintenance

Part 1 - New Systems

System Type	1	2	3	4	5	6	7	8	Total
No. of New Systems over 5 yrs.	15	100	85		3		7	15	225
No. of Systems per year	2	14	12		.42		1	2	31
Breakdown Frequency	20%	20%	100%	100%	100%	100%	100%	100%	
No. Breakdowns Per Year	1	3	12		1		1	2	20
Person Days Per Breakdown									
No. Repair System-No. Req'd.	2	4	2	5	5	5	5	5	
Total Days Req'd Per Yr. for Maintenance of New Systems	8[1]	12	24		5		5	10	
No. of Persons on Maint. Crew.	3	3	3		3		3	3	
Total No. Person Days Req'd	24	36	72		15		15	30	192

Notes: 1. System Type 1 is a spring protection system composed of 4 spring protection units, each of which serves on average 100 persons. When one system breaks down, it therefore requires four times the person days shown.

2. System Type 8 is the designation for the diesel replacements to be carried out. It is not a system in terms of installations made; but it is a system when maintenance accounting needs to be done.

Part II - Existing Systems

System Type	1	2	3	4	5	6	7	8	Total
No. of Existing Systems		258				45	12		315
No. of Percent Breakdowns Per Yr.		50%				150%	100%		
No. of Breakdowns		129				67	12		208
Person Days Per Breakdown									
No. Repair System-No. Req'd		4				5	5		
Total Days Req'd Per Yr for Maintenance of Old Systems		516				335	60		
No. of Persons on Main. Crew		3				3	3		
Total No. of Person Days Req'd.		1548				1005	180		2733

Part III - Combined Totals for New and Existing Systems

Totla Person Days Required for Maintenance in Average Year 2733 + 192 = 2925

Total No. of Person Days Available

10 TAOs x 211 PDs per annum = 2110
20 LABs x 181 PDs per annum = 3620
Total 5730 5830

Maintenance Days required + Total Maintenance Days Available = 51% of potential Capacity for Maintenar to be utilized in Average Year.

49% of Maintenance Time to be utilized in Equipment Repair and Construction Activities in Each District.

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Table VI: Work Day Computations for Technical VWSS Staff

Days in Year	365
Weekends	- 104
Employment Days	= 261

	Other Employees	Laborers
Annual Vacation	15	15
National Holidays	10	10
Sick Leave	5	5
In-Service Training	3	3
Maintenance and Repair Down Time	5	5
Major Breakdowns Down Time	5	5
Bad Weather	4	4
Miscellaneous	3	3
Time Spent in obtaining Wage Payments	-	19
Time lost in delayed coordination of Self Help Community Labor Contributions	+ -	+12
TOTAL-Non Work Days	49	79
Employment Days Minus Non-Workdays=		
Total Work Days Available Per Year	211	181

Table VII: Productive Capacity Analysis for VWSS Staff

If one takes the work days available and multiplies them by the number of construction and survey personnel presently available, the following results:

	Other Employees	Laborers
Work Days Per annum	211	181
Numbers of Personnel Available	33	3
	6,963	543=Total Work Days Available

If the total available work days figure is then taken and divided by the number of work days needed to construct one average sized gravity water supply system (the most common system), the result is as follows:

7,506 +390 = 19 Maximum Number of Gravity Systems Possible To Construct

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Table VIII: Schedule of System Installations, 1980-1986

by System Type

System Types	1980	1981	1982	1983	1984	1985	1986	Totals
1. Spring Protection	2	2	2	2	2	2	3	15
2. Spring Gravity Fed (Reconstructed)	-	5R	10R	13R	15R	12R	13R	68R
(New)	-	-	-	12N	12N	12N	8N	32N
3. Borehole Handpump (by Rotary Rig)	-	13	18	18	18	18		85
4. Low Level Spring with Windmill	-	-	-	-	-	-	-	-
5. Low Level Spring with Diesel	-	-	-	-	1	1	1	3
6. Borehole with Windmill	-	-	-	-	-	-	-	-
7. Borehole with Diesel	-	-	-	1	2	2	2	7
New & Reconstructed Units-Total	2	20	30	38	46	47	27	210
8. Diesel System Replacement Units	1	2	2	2	2	3	3	15
With Replacements - Total	3	22	32	40	48	50	30	225

STATUTORY CHECKLIST

6C(1) - Country Checklist

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Assistance.

A. General Criteria for Country

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?	a) The project is designed to help rural poor meet their basic human needs. b) No such determination has been made.
2. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotics, drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	No such determination has been made.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	Yes.
4. FAA Sec. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	No.

5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdividions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations towards such citizens or entities?	No.
6. FAA Sec. 620(f); App. Sec. 108. Is recipient country a Communist country? Will assistance be provided to the Democratic Republic of Vietnam (North Vietnam), South Vietnam, Cambodia or Laos?	No.
7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance or (b) the planning of such subversion or aggression?	No.
8. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	Security and protection measures appear to be adequate and reasonable.
9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	No such denial has been considered.
10. FAA Sec. 620(o); Fishermen's Protective Act, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, a. has any deduction required by Fishermen's Protective Act been made? b. has complete denial of assistance been considered by AID Administrator?	No such actions.

11. FAA Sec. 620(q); App. Sec. 504. a) Is the government of the recipient country in default on interest or principal of any AID loan to the country?	No.
b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds, unless debt was earlier disputed, or appropriate steps taken to cure default?	No.
12. FAA Sec. 620(s). What percentage of country budget is for military expenditures? How much of foreign exchange resources spent on military equipment? How much spent for the purchase of sophisticated weapons systems? (Consideration of these points is to be coordinated with the Bureau for Program and Policy Coordination, Regional Coordinators and Military Assistance Staff (PPC/RC)).	Until 1977 Lesotho had no army, only a police force. In 1977 a small army was just being organized. For 1978, police and internal security expenditures represented 3.87% of GOL budget expenditures or of GDP. Less than 1% of foreig exchange resources are spent on military equipment. No money has been spent on sophisticated weapons systems.
13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No, not applicable.
14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?	There is no indication of any arrears.
15. FAA Sec. 620(A). Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?	We have no knowledge of any such action.
16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex to the presence of any officer or employee of the U.S. there to carry out economic development program under the FAA?	No.

17. FAA Sec. 669/670. Has the country delivered or received nuclear reprocessing or enrichment equipment, materials or technology, without specified arrangements or safeguards, etc.? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon state" under the nonproliferation treaty?	We have no knowledge of any such delivery or receipt, or any such detonations.
18. FAA Sec. 901. Has the country denied its citizens the right or opportunity to emigrate?	We are not aware of any case.

B. Funding Criteria for Country

1. Development Assistance Country Criteria

a. FAA Sec. 102(c),(d). Have criteria been established, and taken into account, to assess commitment and progress of country in effectively involving the poor in development, on such indexes as: (1) small-farm labor intensive agriculture, (2) reduce infant mortality, (3) population growth, (4) equality of income distribution, and (5) unemployment.	Yes.
b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) actively designed to build motivation for smaller families in programs such as education in and out of school, nutrition, diseas control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?	N/A

c. FAA Sec. 201(b)(5), (7) & (8); Sec. 208; 211(a)(4), (7). Describe extent to which country is:

(1) Making appropriate efforts to increase food production and improve means for food storage and distribution.	Substantial efforts in these areas are described in Report to Congress on Development Needs and Opportunities for Cooperation in Southern Africa, March 1979, and the FY 1981 Annual Budget Submission.

(2) Creating a favorable climate for foreign and domestic private enterprise and investment.	The Lesotho National Development Corporation, with the personal attention of the Prime Minister, and other organizations are extremely active in promoting foreign and domestic private investment. The government and USAID/Lesotho are designing a project to further promote internal private investment.
(3) Increasing the public's role in the developmental process.	The country encourages community development efforts such as this one with local inputs and control.
(4) (a) Allocating available budgetary resources to development.	See Appendix A to this Annex.
(b) Diverting such resources for unnecessary military expenditure and intervention in affairs of other free and independent nations.	We have no indication of such diversions or interventions.
(5) Making economic, social, and political reforms such as tax collection improvements and changes in land tenure arrangements, and making progress toward respect for the rule of law, freedom of expression and the press, and recognizing the importance of individual freedom, initiative, and private enterprise.	See again March 1979 Report to Congress.
(6) Otherwise responding to the vital economic, political, and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	See again 1979 Report to Congress.
d. FAA Sec. 201(b), 211(a). Is the country among the 20 countries in which development assistance loans may be made in this fiscal year, or among the 40 in which development assistance grants (other than for self-help projects) may be made?	Yes.

e. FAA Sec. 115. Will country be furnished, in same fiscal year, either security supporting assistance, or Middle East peace funds? If so, has Congress specifically authorized such use of funds, or is assistance for population programs, humanitarian aid through international organizations, or regional programs?	No.

6C(2) - Project Checklist

Listed below are, first, statutory criteria applicable generally to projects with FAA funds, and then project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans): and Security Supporting Assistance funds.

A. General Criteria for Project

1. App. Unnumbered; FAA Sec. 653(b); Sec. 671.	
(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;	This project was included in the FY 1979 Congressional Presentation on page 188.
(b) Is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?	No. Appropriate notifications will be made prior to project authorization and allotment of funds.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) Yes. Upon satisfaction of relevant conditions precedent. (b) Yes.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	The GOL Executive Branch will have to establish additional positions for the Village Water Supply Section and include project funding in the GOL budget. These are administrative actions which require no specific legislative actions.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaced Memorandum of May 15, 1962; see Fed. Register, Vol. 38, No. 174, Part III, Sept. 10, 1973)?	This is not a water or water-related land resource construction project.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Yes.
6. FAA Sec. 209, 619. Is project susceptible of execution as part of a regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	No.
7. FAA Sec. 601(a);(and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to:	The project is designed to improve the productivity and living standards of Lesotho's rural poor.
(a) increase the flow of international trade;	N/A
(b) foster private initiative and competition;	N/A
(c) encourage development and use of cooperatives, credit unions, and savings and loan associations;	N/A
(d) discourage monopolistic practices.	N/A
(e) improve technical efficiency of industry, agriculture and commerce; and	N/A
(f) strengthen free labor unions.	N/A

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	The project will fund U.S. source technical assistance, U.S. university training and substantial amounts of U.S. commodities.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	GOL will contribute approximately 14% of the project costs. This is considered reasonable and generous in view of Lesotho's international political climate, its status on the UN's list of "least developed countries," and its limited financial resource.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?	Not an excess foreign currency country.

ANNEX IX

Section 611 (e) Certification

Lesotho Rural Water Supply Project

I, Byron Bahl, Acting Mission Director of USAID/Lesotho, having taken into account, among other things, the maintenace and utilization of projects in Lesotho previously financed or assisted by the United States, commitments of the project to finance maintenance on a decending scale during the life of the project, commitments of the Government of Lesotho to absorb those maintenance costs into its recurring budget in order to provide total maintenance of systems financed under this project at end of project, the likelihood of other donor support towards maintenance of water systems and the present developing capacity for system maintenance, do hereby certify that in my judgment the Government of Lesotho will have and employ both the financial and human resources necessary to maintain and utilize effectively the capital assistance to be extended under the project.

Byron Bahl

Byron Bahl, Acting
Mission Director, USAID/Lesotho

Date: 22 June 1979

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: LESOTHO

Project Title: Lesotho Rural Water Supply (632-0088)

AID Funding:

FY 1979 $1,621,000

Life of Project $12,142,100

IEE Prepared by: John Pielemeier, PDO/OSARAC

Date: 1/18/78

Revised by: Alfred Harding, AFR/DR/SA Date: 7/9/79
based on draft by

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Environmental Action Recommended:

Negative Determination

Concurrence: (Mission Director) Date: 2/16/78

Assistant Director OSARAC: Ted Morse

Assistant Administrator's Decision

Recommendation Approved Date: Aug. 21, 1979

INITIAL ENVIRONMENTAL EXAMINATION
LESOTHO RURAL WATER SUPPLY

1. Examination of Nature, Scope, and Magnitude of Environmental Impacts

A. Description of Project

The purpose of this rural water supply project is to develop the institutional capability of the Government of Lesotho's (GOL) Village Water Supply Section (VWS) to design, construct and maintain village water supply systems.

The project will contribute towards achieving a broader sector goal of improving the health conditions and basic living standards of Lesotho's rural poor.

The project includes 3 coordinated and inter-related efforts: maintenance of existing and proposed water supply systems; a capital improvement program to design and construct new water supply schemes over the next 9 years; and institution-building and training activities for persons involved in system construction and maintenance and in health education which will be necessary if the full potential benefits of improved water supply are to be realized.

By the end of the project:

- the Government's Village Water Supply Section will be fully staffed by trained Basotho personnel.
- approximately 142 new systems will have been constructed and the VWS will have the capacity to effectively survey, design and construct 15-20 new village water supply systems annually; in addition, approximately 68 systems will have been completed or have undergone major reconstruction.
- the VWS will have the capacity and means to effectively maintain all existing village water supply systems with basic maintenance provided by trained village "Water-Minders;"

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- VWS organizational structure and operational procedures for construction and maintenance of water supply systems, including local participation, will have been improved and institutionalized;
- the incidence of water-borne diseases will have been substantially reduced through improved water supply and health education; and
- all VWS recurrent costs for construction and all maintenance costs will be provided from GOL and local resources.

1. The Kingsom of Lesotho

The Kingdom of Lesotho is an independent nation in Southern Africa and is located approximately 560 kilometers (350 miles) north and 800 kilometers (500 miles) east of the Cape of Good Hope. The nation includes an area of approximately 30,350 square kilometers (11,670 square miles) and in 1976 had a "dejure" population of 1,213,960. It is one of the smallest nations in Southern Africa and is completely surrounded by the Republic of South Africa.

2. Lands and Land Use

Lesotho is a very mountainous country and less than 30,350 square kilometers of the total land surface is considered to be arable (less than 13 percent of the total area). Most of the arable land is located in the western lowlands, and a relatively minor portion is along the major inter-montane river valleys. All of the land of the kingdom is located more than 1,400 meters (4,500 feet) above sea level, and the mountain Thabana Ntlenyana, the highest mountain in Southern Africa, is 3,481 meters (11,417 feet above sea level.

The country may be considered to be divided into four principal types of topography:

a. The Lowlands - Areas located along the western border of the Kingdom with elevations less than 1,850 meters (6,000 ft.). Approximately 41 percent of the population resides in this region.

b. The foothills - Land surface is generally between 1,850 and 2,500 meters (6,000 to 8,000 feet) in elevation with 28 percent of the population.

c. The Mountain Areas - Topography above 2,500 meters (8,000 feet) with land use limited to grazing and mineral development. About 21 percent of the population lives in the mountainous areas.

d. The Senqu Valley - Land elevations range from 1,400 to 2,500 meters (4,500 to 8,000 feet) and is located in the eastern part of the Kingdom between the Maluti and Drakensberg Mountains, with only 10 percent of the total population.

Except for a few urban areas land use in Lesotho is agricultural - stock raising and dryland farming. About half of the cultivated areas and a large but unknown proportion of mountain pastures have been affected to some degree by erosion. Overgrazing of uplands and cultivation of marginal lands with a fragile soil types subject to seasonally intense rains are major causes of erosion. The GOL, with AID assistance, has initiated a major effort to stabilize the land resource base and determine economically and technically feasible conservation techniques which are compatible with the social and economic organization of rural Lesotho.

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3. Population

A key factor affecting population numbers in Lesotho is the number of individuals, mostly males, working outside the country. In recent years it has been estimated that over 200,000 Basotho, which is equivalent to over 60 percent of the male labor force, work in the mills or the mines of the Republic of South Africa on temporary contracts. The "de jure" population is the sum of the number of persons in Lesotho on the census day, plus the absentees who had been out of the country for less than five years. The "de jure" population for Lesotho in 1966 was 969,634 and in 1976 was estimated to be 1.213,960. The compounded growth rate for the 10-year period is found to be 2.27 per cent per annum (2,2727). The comparable rate for the period 1956 to 1966 was 2.87 percent per year.

4. Socio-economic Factors

Generally speaking, urban populations may be considered to be limited to the administrative center of each of the nine governmental districts of the Kingdom. Even this concept requires broad interpretation of the term "urban". Only Maseru, the capital city of the Kingdom, has a 1976 population in excess of 6,000, and two of the administrative centers have populations of less than 2,000 persons.

In 1976 only 5.7 percent of the population was "urban" and the remaining 94.3 percent, or 1,144,765 persons live in rural villages, with village populations usually of about 200 persons. It is not unusual, particularly in the lowland and foothill regions to find clusters of villages, usually governed by a single chief, with an agglomerate population of as many as 500-600 persons.

Subsistence agriculture is the principal economic activity of the villages although spinning and weaving, some craft work, and beer making and export agriculture are active in many areas.

The IBRD estimates that Lesotho's Gross Domestic Product (GDP) per capita in 1975/76 was equivalent to US$120 while Gross National Product (GNP) per capita was equivalent to US$180.

Identification and Evaluation of Environmental Impacts

This Village Water Supply project will develop the institutional capability of the GOL's Village Water Supply Section to design, construct and maintain village water systems and will make clean water available to over 150,000 people through 210 water supply systems in Lesotho by 1986.

The project's institution building, training and system maintenance activities will have only positive environmental impacts (improvement of operational procedures, training of VWS staff and village "water minders", health education. maintaining existing water supply systems in good running order, etc).

The project also will assist the GOL in constructing 142 new water supply systems throughout Lesotho. The environmental impact of the construction element of the project is diluted by its great spatial dispersion. Environmental considerations are, as a matter of course, taken into account in the design and installation of new water supply systems in Lesotho and will be continously stressed during project implementation.

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The Impact Identification and Evaluation Form is included at the end of this document for ready reference.

1. Land Use

The project will have very little impact upon the character of land use. Over a period of several decades the availability of improved rural water supplies will undoubtedly result in minor increases in the national population, through reduced death rate, and will increase the already high pressure upon the productive capability of the limited arable land.

The availability of waste water, and some new supplies, for irrigation of private and communal gardens will increase the production of garden crops for home consumption and for sale in the more populated areas.

On balance, the increased productivity of the irrigated lands will more than compensate for the increased pressure on the arable land due to greater longevity. Other efforts to modify the population program greatly over-shadow the influence of the village water supply program.

Approximately 2/3 of the water systems in Lesotho are gravity-fed spring systems. However, in the instances where boreholes are utilized the proposed program may result in some mining, or permanent depletion, of ground water supplies. Since most of the ground water available in fracture areas is apparently trapped surface stream flow the depletion in ground water levels would not be significant and most of the supply at such a location will not be of the mined character.

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Where the subsurface supply is not dependent upon stream flow, but upon infiltration over a very large area, great care must be exercised to assure a permanent source of supply. Although the VWS has a high 70% success ratio on drillings due to the visibility of dolerite dikes, hydrological data is often insufficient to estimate the size and hence, long-term reliability of the aquifers. In the absence of such data the VWS has adopted South African standards for borehole pumping rates (60% of tested yield of borehole) and all pumps are designed to operate at that standard. The hydrogeologist on the PP team has reviewed the most recent hydrogeological study of Lesotho (Binnie and Partners) and VWS procedures for completeness and adequacy for system design purposes and found these to be appropriate.

The village water supply program will have extremely little effect upon the physical state of the surface water resource of the Kingdom. For example, the minimum flow recorded on the Senqu River at Seaka was 2.0 cubic meters per second which is equivalent to 172,800 cubic meters per day. The proposed water supply program at that site will supply domestic water for approximately 60,000 people at the design rate of 40 liters per person per day, which is equivalent to approximately 2,400 cubic meters per day. This is equivalent to 1.4 percent of the minimum recorded flow at Seaka. The actual flow volume at Seaka in 1973 was twenty-eight times the volume that would have accumulated under minimum conditions.

Nascent supplies are not involved.

The village water supply program will have no direct effect upon changes in the character of the soil, in land clearing, or in altering the natural defenses. In most cases, including most subsurface supplies, the water which will be in the proposed program will be water which if unused would be wasted to the sea.

There will be a small increase in the amount of irrigated land if the domestic waste water is used for communal and private gardens as is recommended. Only a very small percentage of the arable land is now irrigated Villagers who have convenient supplies irrigate and hand water their gardens at the present time. When additional water supplies become available there should be additional irrigated gardens. The change in land use, due to available water supplies, will be limited to conversion from field crop to truck crop. There is no land available for conversion from forest to cropland, and there is no significant amount of land available for conversion from pasture to cropland.

The needed change in and use is from cropland to pasture, and from pasture to timber. The GOL is presently considering a proposal to encourage tree nurseries where reliable sources of water are found. The availability of waste water for irrigation may trend in the desired direction, because of increased productivity, but in a nation heavily dependent upon imported foods stuffs the impact will be hardly discernable.

2. Water Quality

The project will have a limited effect on water quality. Waste water will not be returned to the streams. Most of the water is normally tossed lightly from buckets onto gardens or bush after use and quickly transpires or evaporates into the atmosphere.

Application of waste water to truck crops will cause a minor ecologic shift due to the increase in population of crop insects and bird life, but these changes will be very minor.

When surface waters are used as the source of supply there will be a small dimunition in stream erosion due to the construction of weirs and the resultant raising of the stream profile. The sediment laden waters will soon silt in the areas upstream of the weirs and transport of sediments across the weir will be soon re-established.

The GOL does not presently have the capacity to adequately test water quality in rural water supply systems. The PP design team has indicated the need for providing small mobile water-testing kits and training for GOL officials responsible for water quality.

3. Atmospheric Influences

With the exception of very minor increases in humidity and slight reduction in dust level at the garden plots, the project will have no influence on atmospheric conditions.

4. Natural Resources

There will be no effects upon the natural resources of the Kingdom other than those associated with water quality (see 2) and land use (see 1). Impact upon the natural resources will be insignificant.

5. Cultural Effects

There will be no change to the cultural symbols or traditions of the Basotho. Execution of the program will reduce the number of families, and villages dependent upon water carried over substantial distances. While the trip to the spring or well is not viewed as a privilege, observation shows the task is accepted and is an occasion for lighthearted communication with neighbors and friends who are similarly occupied. This comment will apply equally to the more limited time devoted to waiting one's

turn at the new source of supply. Experience in Lesotho and elsewhere shows that cultural patterns are readily and easily adapted to a change in the source of water supply.

6. Socio-economic Aspects

The village water supply program will have substantial impact upon socio-economic aspects of life in the Kingdom:

a. There will be a major reduction in the amount of time devoted to gathering of water. Most of the time saved will apparently be devoted to increased crop production, to caring for the home and rondavel, and to raising the children.

b. There will be some increase in the production of garden goods and this will reduce the dependence upon imported foods. It will increase the actual income where garden crops are marketed in population centers.

c. The development of and participation in village development committees, which will be, inter alia, responsible for maintenance of water supply systems, should be stimulated.

d. Availability of limited water from garden irrigation will increase the time requirement of the garden effort. These gardens will probably be tended by women, utilizing a portion of the time freed up from fetching water.

It is anticipated that increasing the economic conditions at the village level, improving the availability of basic services, such as water supply, and providing use for idle time, will all contribute to a reduction in the rate of migration from the village to the city and thence out of the Kingdom. This effect will not be a major factor, but it will be in the positive direction of holding the labor

force within the Kingdom and in rural areas.

A very significant objective of the village water supply program will be the production of a trained labor force capable of dealing with the construction of wells, storage tanks, and to a lesser extent latrines and wash slabs.

7. Health

A moderate impact upon the health environment is anticipated due to six separate and clear considerations:

a. There will be increased clean water supply available for personal consumption.

b. Greater supplies of water accompanied by health education efforts should bring about a substantial improvement in the level of personal hygiene.

c. In many cases the quality of water will be improved. The higher quality water supply coupled with the improvement in cleanliness of utensils and cooking and food preparation surfaces, should result in a reduction in water-borne, or water associated, disease.

d. Basic concepts in water-related health education will be taught to school teachers, local government officials and village-level health workers and passed on by them to villagers and school children.

e. Diet and nutrition will be improved through consumption of produce from local gardens.

f. The possibility of standing water around village taps will be negated by building concrete aprons and run-off ditches (French drains) at each tap.

8. General

The village water supply program will have positive impact on and will be complementary to, several major development projects which are currently active in Lesotho. These include area development projects such as Khomokhoana and Thaba Tseka, the new Basic Agricultural Services Program (BASP), health clinics, the village health worker program and the health assistant program.

II. Recommendation for Environmental Action

The provision of improved village water supplies will not appreciably alter the present way of life within the villages of the Kingdom of Lesotho. Adequate systems will upgrade the level of public health, will increase the standard of living in the effected rural areas, and will be a convenience to the villagers where systems are installed. The program represents a major step toward satisfying the recommendations of the World Health Organization for water supplies in developing nations.

Negative environmental aspects of the program are quite limited, are dispersed over a very wide area and should not lead to any lasting negative effects.

In the belief that the project will not have a significant effect upon the environment, a Negative Determination is recommended.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-Areas	Impact Identification and Evaluation
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	L
b. Extracting natural resources	N
c. Land clearing	N
d. Changing soil charecter	N
2. Altering natural defenses	N
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
5. Other factors	
Increase irrigated land	L
B. WATER QUALITY	
1. Physical state of water	M
2. Chemical and biological states	L
3. Ecological balance	N
4. Other factors	
Flood flow reduction	L
Reduce stream erosion	L

IMPACT IDENTIFICATION AND EVALUATION FORM

C. ATMOSPHERIC

1.	Air additives	N
2.	Air pollution	N
3.	Noise pollution	N
4.	Other factors	
	None	

D. NATURAL RESOURCES

1.	Diversion, altered use of water	L
2.	Irreversible, inefficient commitments	N
3.	Other factors	
	Conservation of water	L

E. CULTURAL

1.	Altering physical symbols	N
2.	Dilution of cultural traditions	L
3.	Other factors	

F. SOCIOECONOMIC

1.	Changes in economic/employment patterns	M
2.	Changes in population	L
3.	Changes in cultural patterns	[illegible]
4.	Other factors	
	Trained labor force	L

IMPACT IDENTIFICATION AND EVALUATION FORM

G. HEALTH

1. Changing a natural environment _____ M
2. Eliminating an ecosystem element _____ N
3. Other factors

Better standards of hygiene _____ M

Control of water borne diseases _____ M

H. GENERAL

1. International impacts _____ L
2. Controversial impacts _____ N
3. Larger program impacts _____ L
4. Other factors

_____ _____

_____

I. OTHER POSSIBLE IMPACTS (not listed above)

_____

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VILLAGE WATER SUPPLY PROJECT SELECTION CRITERIA

Villages should only make constributions when selected by the DCDO's and invited to do so. No general call for applications or contributions should be made.

(i) the total of cost of materials for the supply, should not exceed R30 per head, and the supply should be feasible without the use of diesel or electric pumps;

(ii) the village should have a committee set up to manage the water supply to the satisfaction of the Minrudev District Office;

(iii) the village must be accessible by vehicle throughout the year;

(iv) all clinics and villages with clinics should have a supply, irrespective of whether they meet the other criteria;

(v) the water sources currently used by the village should be at least 500 meters from most households or highly turbid for most of the year;

(vi) the population to be served by the supply should be at least 400 in the lowlands, or 200 in the mountains; where a school is to be served, the number of school pupils should be included in this population, even if they are not all residents of the village;

(vii) at least 60 percent of households in the village should have contributed a stated nominal sum of at least R2 each and the village should, in the judgment of the DCDO, be willing to contribute labor for construction.

June 21, 1979