

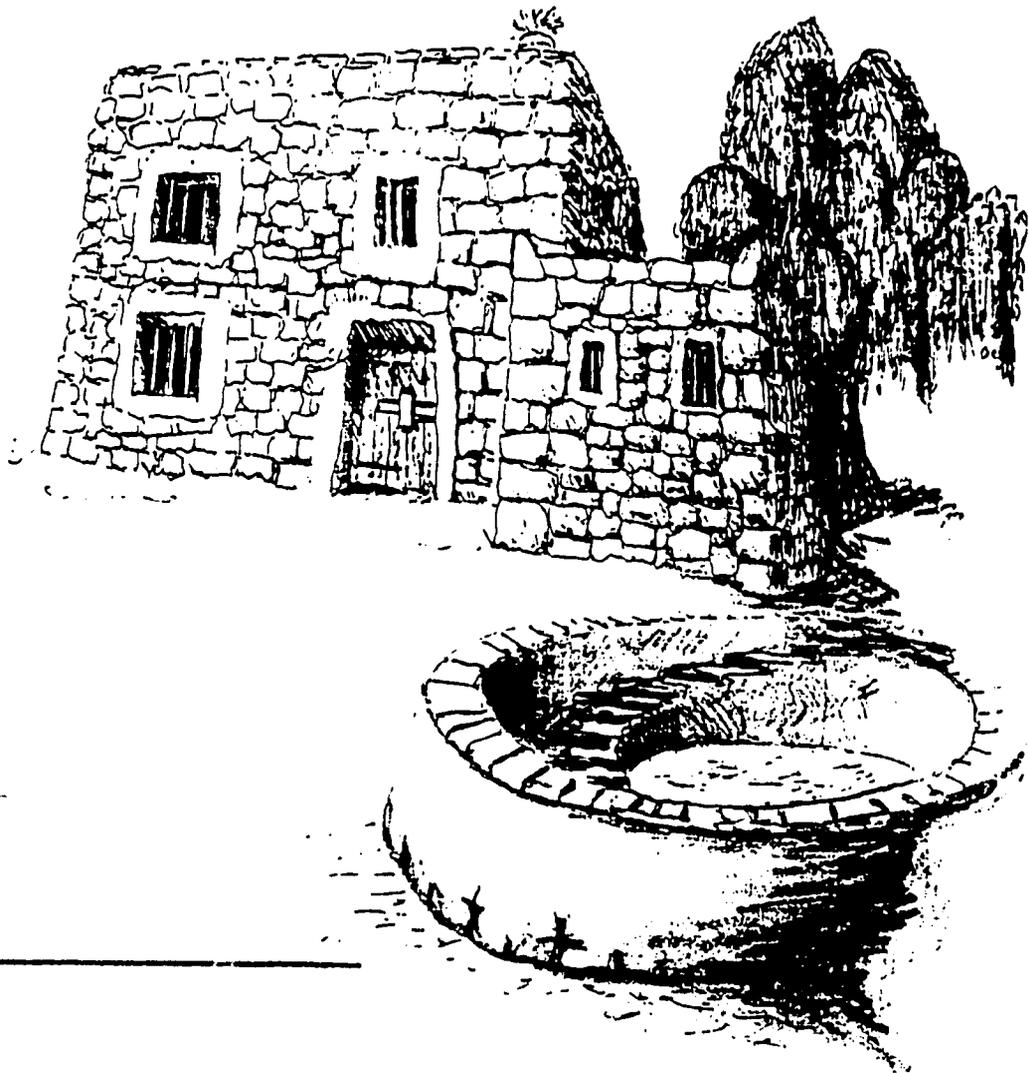
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NEW TRANSCENTURY FOUNDATION

An Unsolicited Proposal for the
Extension of TransCentury's
Cooperative Agreement # AID/NE-CA-1647
for the Execution of Yemen Rural Water
Project #279-0044



1 June 1984

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WARREN W. WIGGINS, PRESIDENT

4 June, 1984

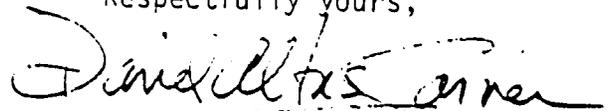
Dear Mr. Nathanielsz,

New TransCentury Foundation is pleased to send you fifty (50) copies of an unsolicited proposal for the extension of Cooperative Agreement AID/NE-CA-1647, proposing a five year extension of Yemen Rural Water Project #279-0044. The proposed extension is for a total of \$12.5 million. Fifty copies of a budget on this project are also being sent to your office under separate cover.

Earlier drafts of this proposal and budget were previously submitted to USAID/Yemen. The USAID's suggestions and comments have been incorporated into the present draft.

We would be pleased to answer any questions you might have about the form or substance of the enclosed. Please contact me if I can provide additional data.

Respectfully yours,



David Altus Garner
Chief of Operations
New TransCentury Foundation

jrh
enclosure

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GLOSSARY OF TERMS AND ABBREVIATIONS

C.P.O.	Central Planning Organization (Yemen's Ministry of Planning)
CYDA	Confederation of Yemeni Development Associations
Design Population	Also designed systems. Public works projects are designed and constructed to allow for normal population growth over time. They are also designed for a given life time. In Yemen, rural water projects are designed and constructed for a twenty year life time, and are generally designed for a 50 percent increase in population over 20 years.
E.O.P.S	End of Project Status. An AID term adopted from log-frames
F.A.R.	Fixed Amount Reimbursement is a system which the U.S. Government sometimes uses in its assistance programs to reimburse a host government Ministry of Department a predetermined amount of money for successfully executing a particular piece of work. Thus, for example, a rural water system would be surveyed, designed, estimated, contracted, and constructed by or through the RWSD. USAID or its designee would review the designs, approve the cost estimations, and inspect the construction to see what it met the agreed standards and specifications. If it met the specifications, the RWSD would be reimbursed an agreed percentage of the estimated cost of the project.
Gabion	A system of interlinked wire mesh boxes filled with rocks and cobbles, used to build small dams, retaining walls, etc.
Hasaba	A section of Sana'a where USAID and part of the RWSD are located
LDA	Local Development Associations. (A sub-component of CYDA)
MPW	Ministry of Public Works. Parent organization of RWSD
NTF	New TransCentury Foundation
NWSA	National Water and Sewer Authority
OPEX	Operations experts; citizens of a second country who are hired to work inside a first country's government with all the duties and responsibilities of a civil servant. (As opposed to an advisor.)
Oxfam	A British based private and voluntary organization

022	USAID assistance program to the RWSD from 1972 to 1977.
044	USAID assistance to the RWSD from 1980 to 1984. Executed through TransCentury Foundation.
044/I	044/I is the first phase of USAID assistance to RWSD 044/II implemented through TransCentury. It extends from August 1980 to September 30, 1984, and includes the Dhamar-related Amendments to the cooperative agreement. 044/II is the proposed second phase, scheduled to go from October 1, 1984 to September 30, 1989.
040	USAID/Yemen program numbers for participant training programs.
080	040 has been in effect from 1979 to 1984. Project 080, the successor program, would go from 1984 to 1989.
O & M	Operations and maintenance. As used in this paper, the term generally means the o and m of a rural water system.
PSI	Pounds per square inch.
P.V.O.	Private and Voluntary Organization
<u>gat</u>	Also sometimes <u>gat</u> . Latin: <u>catha Edulis</u> . A small evergreen shrub that grows from 2 to 4 meters high. Classed as a psychotropic. The tender green leaves are chewed for a mildly stimulating effect.
R.W.A.	Rural Water Authority. (A proposed successor agency to RWSD)
<u>servicio</u>	Literally: Spanish for 'service'. As used in this paper, the term refers to a concept used to describe a development process, where a foreign agency works with a department or Ministry using partly its own systems and partly the department's systems to introduce improved management practices.
TCN	Third country national. A citizen of a third country who is not a citizen of the United States or the host country
UNICEF	United Nations Children's Educational Fund
UNCDF	United Nations Capital Development Program
UNDP	United Nations Development Program
USAID	United States Agency for International Development

- wadi An arabic term for the bed of an intermittant river
- W.H.O. World Health Organization
- Y.A.R. Yemen Arab Republic
- Y.A.R.G. Yemen Arab Republic Government
- Zakat A traditional Islamic tithe, the giving of which is mandated for Muslims. In Yemen this is an agricultural and herd tax used to finance a variety of community self help projects through the Local Development Associations.

EXECUTIVE SUMMARY

TransCentury proposes a five-year extension to Cooperative Agreement AID/NE-CA-1647 for the Yemen Rural Water Project Number 279-0044. The proposal focuses on two principal activities which are inter-related:

- (1) The strengthening of the Rural Water Supply Department;
- (2) The construction of 100 rural water systems.

Four End of Project Status (EOPs) achievements are projected. Taken together, these EOPs will assist the Rural Water Supply Department to:

- (1) plan, survey, budget, and design rural water projects.
- (2) implement the construction of rural water projects in conjunction with the Local Development Associations and private sector contractors.
- (3) train rural communities in the operations and maintenance of rural water systems and advise them on ways to deal with the public health consequences of operating such systems.
- (4) share its financial burden by developing effective ways of increasing village contribution and foreign donor support.

The proposal calls for 34 person-years of resident expatriate technical assistance. Initially in the first years of the extension, the long term technical assistance team which is in place increases from 6 advisors to 9 advisors. Of the three new advisors, one is an electro-mechanical engineer. The other two additional staff are proposed for the new Office of Planning and Management.

The Office of Planning and Management is a new venture for USAID and Project 044, and a key component of the institution-building strategy. The office will be advisory to The Director General of the RWSD. As such it would be slightly removed from the day to day exigencies of both Project 044 and the RWSD. The institution building strategy--including the role of the new Office of Planning and Management--is described in this proposal on pages to .

After year three of the extension the nine staff are cut in half, and in the fifth year of the extension, the expatriate technical assistance team is reduced to three persons. At the same time, the number of RWSD staff will be increased from 11 staff to 30 construction technicians over 5 years. Further, RWSD will recruit 10 new professional staff, of whom 7 would be civil engineers and three would be administrator/planners.

Part II of this proposal contains an analysis of the present staffing, structure, and capabilities of the Rural Water Supply Department. It also contains a description and analysis of Project 044 to date, including the special activities which have been undertaken in response to the earthquake in Dhamar.

Part III of this proposal contains a summary project description including the project goal and purpose, together with the necessary inputs and outputs

Part IV of this proposal is a detailed project description. This includes an extended discussion of the four End of Project Status achievements. Part IV also describes the inter-relationship between institution building and the construction of 100 rural water systems. It describes the three categories under which subprojects will be constructed. These include 50 projects which will be constructed jointly by the Rural Water Supply Department and Project 044 staff working together; 36 subprojects which will be constructed jointly with other donors providing most of the commodities; and 14 projects which the RWSD and Local Development Associations will be responsible for constructing under a Fixed Amount Reimbursement system. Under this proposal, by the fifth year of the project the RWSD will functionally responsible for constructing or supervising the construction of 20 projects each year.

These 100 projects would be designed to serve approximately 109,000 people. If the beneficiaries for the extension are combined with the beneficiaries for 044/I, including Dhamar rehabilitation activities, it comes to approximately 207,000 beneficiaries when the systems are used at full capacity.

Part V describes some special project concerns, including a discussion of commodities and equipment, vehicles and data collection, and some observations on the possibility that the Rural Water Supply Department may become an autonomous authority.

Part VI looks at the RWSD for the years 1990 to 1994, after the cessation of AID funding.

Part VII of this proposal includes a discussion of how the project will work, and a series of implementation plans. It also includes a procurement plan for commodities, and an evaluation plan.

Part VIII of the proposal includes a series of analyses. A social soundness analysis describes the general context in which development takes place in Yemen, as well as the specific context in which rural water systems are built. The social soundness analysis is supplemented by a case study which describes the construction of a representative village water system in the southern part of the Yemeni highlands. The technical analysis looks at the technical methodology for the construction of rural water systems, as well as the technical feasibility for the institution-building aspects of the extension. An Economic and Financial Benefit Analysis addresses the costs and benefits of the first 50 subprojects.

The proposed budget for this 5 year extension comes to \$ 12.5 mil. The details of the budget are presented under separate cover.

I. INTRODUCTION

The design of this proposed extension to TransCentury's Cooperative Agreement has evolved out of USAID's twelve-year history of working with the Rural Water Supply Department, and TransCentury's experience over the last four years as the contract group implementing Project 044/I.

USAID's first experience in working with the Rural Water Supply Department was Project 022. This Project constructed rural water systems, and as a spin-off legacy, it also created two new sections of the RWSD: the Drilling Section and the Mechanical Section. TransCentury's present project in Yemen (Project 044/I) was designed primarily to build rural water systems and train construction technicians. As a by-product, it has also taken significant steps to strengthen the RWSD institutionally by building a field construction capability, with the necessary administrative systems to support field construction.

In 1980, when Project 044 began, it was necessary to place most of the emphasis on field construction, with the institution building component being given a secondary priority. By 1984, those priorities have reversed themselves. Today the Yemen Arab Republic Government (YARG) wants to see more emphasis placed on training and institution building, and USAID, TransCentury, Project 044 staff, and the Rural Water Supply Department have re-established the necessary rapport for this to be a reasonable and viable goal for the extension.

It is in this spirit, therefore, that this proposal is offered. Further, the proposal builds on the recommendations of the USAID evaluation conducted in the Fall of 1983 and on a series of extended discussions which were held in Sana'a during the fall and winter of 1983 involving the senior staff of the Rural Water Supply Department and the USAID.



A. NEAC CABLE

17 Feb. 83

FM Secstate WashDC
To Amembassy Sanaa Immediate 7738

Unclas section 01 of 02 State
049633

Tags:

Subject: 279-0044, Small Rural Water
Systems NEAC Review of Evaluation

REFS: A. Sanaa 0673
B. Sanaa 0389
C. State 368404
D. Small Rural Water Systems
Evaluation Dated October 1983
E. PRC Issues Paper to NEAC
Dated January 26, 1984

1. Summary. On January 31, 1984, NEAC reviewed subject evaluation. The NEAC Chairman focused the NEAC meeting in observations and issues for considerations or resolution by Mission and New TransCentury Foundation (NTF) in the design of any follow-on project.

2. The NEAC concluded that the project should have an institutional development focus and project design must be predicated on Yemeni eventual assumption of responsibility for the project. AID and NTF must gradually disengage from operational roles. The timing of this transition is an important project design issue and should have major influence on project length. Mission should make sure that reasonable targets for transition are developed and plan for Yemeni assumption of subproject project activity including their financing.

The NEAC is mindful that building good water systems is a necessity for Yemen. Our project goal must be to help develop their managerial, technical, and financial capacity to build these needed systems. A hands on quote doing unquote is defensible if it is an essential stage in the institutional development process.

Response:

1. Item 1 and 2 of the NEAC cable address the issue of building the Rural Water Supply Department as an institution. The designers of this proposal share this concern and the issues that govern institutionalization are extensively addressed on pages 38 to 50

3. The other issues which followed the above discussion are:

A. Institutionalization -- The current process of administration, sub-project development and execution (i.e. site selection, survey, design, estimation of quantities, materials procurement -- BID process and award -- construction, inspection, and maintenance) and the extent to which institutionalization is occurring should be analysed to determine whether a capacity should be created in the YARG (MPW, RWSD or elsewhere) to do each of these tasks (in-house capability), or whether the private sector ought to be developed so it could perform one or more of these tasks. In the latter case, an oversight capability would be needed somewhere in the YARG to approve, supervise and monitor the activities contracted to the private sector. Mission/NTF review of this issue must be done in the Yemeni context taking into account local strengths and weaknesses. TA and training to create an in-house capacity to perform a particular function will probably be different from that required to create an oversight capability. In this context, both a viable managerial accounting system and a cost accounting system should be developed.

Response:

2. Item 2A of the NEAC cable addresses institutionalization in more detail. In particular it asks what part of Project 044's work should be undertaken directly and what could be undertaken by the private sector. The present staffing and structure of the RWSD are important background for this issue. These matters are analyzed on pages 13 to 20. The future focus of work of RWSD is discussed on pages 37 to 86. The need for a managerial and cost accounting system for the RWSD is discussed on page 139.

B. Independence of project organization -- The issue arose as to whether RWSD should second trainees or technicians to the 044 project. The NEAC would have no objection to this-as long as there is a plan for the reabsorption of the personnel. The issue must be addressed in terms of how best to infuse needed skills into the appropriate YARG institution.

Response:

3. Item 2B raises the issue of secondment of technicians to project 044. The role of RWSD technicians working with Project 044 is discussed on pages 44 and 45.

C. Salary Topping -- The NEAC had no objection to salary topping per se. However, whatever is done must foster an independent Yemeni long term capacity, not continued dependence on outside assistance. The concept of bonuses in lieu of fixed salary topping might be examined with this in mind.

Response:

4. Item 3C: Salary topping. This item is a complex conceptual issue for the design of 044/I and for 044/II. The issue of salary topping is discussed on page 54. This issue is related closely to the possible change of status of the RWSD to become an autonomous authority. This change of status is discussed on pages 82 and 83.

D. Cost recovery -- Capital costs must be shifted to the Yemenis, preferably to the benefitting villages, over time. The NEAC recognizes this will not happen overnight, but the project designers must deal with how to increase RWSD revenues overtime so it can become self-sufficient. It was also recognized that subsidies by YARG may continue to be justified in very poor villages. Perhaps some combination of loans, discounts or water charges can be used to provide greater cost coverage. Unless there is eventual Yemeni cost recovery, complete Yemeni responsibility for project activity is unlikely. (See issue a re the necessity for the development of sound managerial accounting and cost accounting systems.)

Response:

5. Item D of the NEAC cable is cost recovery. This item is addressed at some length under the 4th End of Project Status Indicator on pages 73i, to 77 . Cost recovery is also discussed in greater detail under the Economic and Financial Benefit Analysis on pages 116 to 127.

E. Continuous Monitoring and Data Collection -- The NEAC favored periodic inspection of sub-projects. It also recognized that, under current conditions, it is not feasible to collect health impact data. The NEAC did not want the project over loaded with extraneous tasks. However, it recognized that it is important that some basic monitoring information be collected, primarily focused on O and M (Recurrent cost coverage and maintenance and repair activities), which could be done in conjunction with periodic inspections.

Response:

6. Item E of the NEAC cable raises issues of monitoring and data collection. This is addressed in this paper on pages 80 to 81 .

F. Health Activity -- AID should assure the project is designed so that AID funded activities do not create health hazards. The NEAC concurred in the evaluation recommendation that a public health advisor qualified in water and sanitation be added to the NTF staff. Planning and design of village water systems must include planning and design of appropriate drainage and waste water disposal. The impact of in-house water connections needs to be examined for possible impact of waste water on health. Any potential health hazards should be identified and methods for adequate disposal should be addressed to the degree that serious hazards are perceived.

Response:

7. Item F raises issues of health, and recommends that a public health advisor be added to the TransCentury staff. This option was considered, and it was decided to use public health advisors on a consultancy basis for approximately 6 months in 1985 and 6 months in 1986, as the project begins to design a more comprehensive health education component. This is discussed on pages 69 and 72 . Item F also stressed that more emphasis should be given to drainage and sanitation. This is discussed on pages 66, 70, and 71.

- II. BACKGROUND

A. DEVELOPMENT ISSUES AND THE NEED FOR VILLAGE WATER SYSTEMS

1. General

The Yemen Arab Republic has begun to emerge as a nation state only since the end of the civil war in 1970. In the last decade it has made massive strides and has constructed a significant portion of the physical infrastructure necessary to link the country together. The major towns are connected by a good primary road system. The major cities are provided with a reliable water supply system. There is electricity in most of the towns and many of the villages.

At the same time that the government has been trying to put into place the necessary physical infrastructure to unify the country, it is also trying to create the political, social and managerial institutions to develop the country. However, it labors under severe constraints: Yemen is classed as one of the 10 least developed countries in the world. Within the Yemen Arab Republic at the present time:

- Trained manpower is very limited.
- The tax base of the government is very narrow.
- Inflation is substantial and could well increase.
- Remittances, which have fueled much of the development of the last decade, have diminished from their peak in 1977/78, and may diminish further.
- Employment opportunities for unskilled Yemeni labor in nearby Gulf countries appear to be increasing only slightly, with a growth rate of about 1.2 percent per year.
- The growth rate in the Gross Domestic Product is expected to slow substantially over the next five years.
- As oil revenues for the nearby Arab states stagnate, Arab assistance to Yemen appears to be diminishing in net terms.
- Foreign donor grants peaked in 1982 and have declined since then.
- Population is growing at a rate of approximately 3 percent per year.
- The population of the Yemen Arab Republic is expected to reach 10 to 12 million people by the year 2000.

At the same time that there are growing constraints on the government, there are also growing expectations from the local people for the delivery of goods and services.

In the midst of all the problems facing the government, there is one bright spot on the horizon. Trained manpower resources within Yemen are beginning to grow substantially. In 1962, for example, there were only 6000 students enrolled in primary schools throughout the country. Twenty years later, the figure had risen to 589,000. Ten years ago, the entire enrollment of Sana'a University was 25 students. In 1984 the figure was more than 8,000. Many of the students who were sent abroad in the late 1970s and early 1980s for their university education are beginning to trickle back to Yemen, and this number should increase significantly over the remaining years of this decade. This new trained manpower begins to open the door for significant institutional changes within the ministries and departments throughout the government. It also creates opportunities for advances in the private sector.

2. Village Water

The population of Yemen is overwhelmingly rural. According to the census of 1975, less than 10 percent of the population lives in settlements of more than 2,000 people.*

The people of Yemen have a strong attachment to their village. There are fewer employment opportunities in the rural areas as agricultural production levels off and the country imports more agricultural produce from abroad. One consequence of the limited employment opportunities in the countryside is a shift of the population to the urban centers. There are no hard population figures available for urban growth, and this is a phenomenon which is not yet well understood in Yemen. However, anecdotal observations suggest that the population of the major towns has grown several-fold over the last decade, and in all likelihood this trend will continue over the next two decades until the end of the century.

While the urban centers have been growing precipitously, the people of Yemen have been investing large parts of their income earned abroad into various kinds of village-level infrastructure. One study of the priorities of Local Development Associations (LDA) revealed the following investment patterns:

* Social and Institutional Profile of Rural Yemen, p. 67.

LDA Accomplishments (1973-1981)

<u>Sector</u>	<u>Accomplishment</u>	<u>Cost YR</u>	<u>Percent</u>
Roads	19,505 kilometers	810,085,227	63.0
Road Maintenance	6,000 kilometers	48,000,000	3.7
Education	4,800 classrooms	244,934,789	19.0
Water	1,713 projects	157,662,953	12.2
Health	111 projects	22,278,997	1.7
Miscellaneous	343 projects	71,182	0.005
			<u>99.6</u>

This report goes on to say that, "after initial concentration on roads subsided, water projects increased from 5 percent to 20 percent of the LDA budgets. Health, electricity, agriculture, mosques, and so on accounted for only a small fraction of the budget."*

These priorities seem to be generally true throughout rural Yemen. People want roads first, and after that they want water projects, and schools. Because of the limited ability of the Government to provide these goods or services directly, and because of the monumental number of small villages that dot the countryside, the people have often gone ahead and put in their own infrastructure.

Typically, for a village water system this investment has consisted of the villagers buying a pump and a motor, and hooking it up to a traditional water source. Sometimes the villagers have turned to private sector drilling contractors and have also had a well drilled. Often they have invested money in a village generator to provide electricity at night. In the late 1970s, some villages bought Caterpillar bulldozers and tried to put in their own roads.

In all cases, whether it was roads, water, electricity, schools, health centers, or mosques, the people of rural Yemen were demonstrating their initiative and entrepreneurial spirit. However, some of these activities were more successful than others.

* Ibid., p. 40

Rural roads were often not surveyed and were constructed without adequate drainage; therefore, they frequently washed out. With respect to power supply, the generators which were installed were a fairly simple piece of turn-key technology, and therefore community power supply projects were usually relatively successful. The record of pumps and diesel motors was somewhat mixed. Villagers often bought equipment that was bigger than they needed, and they could not always maintain it. Still, travelers in the countryside are often struck by the sight of old wells that have been updated with the addition of diesel powered pumps and motors.

In many villages today, this means that the women no longer have to haul the water from the bottom of the well. Instead, the pump brings it to the surface and the girls and women are left to carry it to their homes. Generally however, the provision of a public distribution system around a village has been beyond the technical capabilities of all but the most sophisticated villages. In fact, this statement could be made for most aspects of village investment in rural infrastructure. The money was there. The intent was there. But the engineering capability to survey, design, and implement the project was lacking.

In 1975 only 4.7 percent of the rural population had access to a water supply system. By 1983, this figure had increased to 14 percent. This percentage means that approximately 4,300 out of an estimated 5,000 villages still require assistance in achieving a reliable potable water supply. To date, 30 percent of the investment in rural water supply has been provided by the government. The balance has come from the villagers themselves, their LDAs, and foreign donors whose assistance has been channeled through RWSD and CYDA.*

YARG and foreign donors are currently able to upgrade, improve, or construct 150 to 200 local water systems annually. At this rate, it will take at least until the year 2000 until the entire rural population is served by a reliable system of potable water. To suggest the magnitude of the task remaining, some projected targets to the end of the century might look like this:

Years	Newly Completed Projects	Projects Completed Since 1983	Remaining Projects	Percentage of Systems Completed
1983	700		4,300	14%
1984-1989	1,000	1,700	3,300	34%
1990-1994	1,400	3,100	1,900	62%
1995-2000	1,900	5,000	0	100%

* World Bank, "Yemen Arab Republic Water Supply and Sanitation," March 1983.

The need for improved village water systems that deliver potable water is very clear. According to the Social and Institutional Profile of Rural Yemen, commissioned by the Mission, "The most frequently reported communicable diseases are, in declining order, enteritis, malaria, bilharzia, and amoebic dysentary. Enteritis and dysentary, taken together, are reported twice as often as the next most common cause of death in young children, most of whose deaths occur before the age of two years."

The SIP goes on to say, "The combination of poor nutrition and frequent gastro-enteritis or diarrheal disease results in nearly half of all children dying before the age of 15. Life expectancy at birth was measured in the 1975 census at 35.7 years for males and 38.3 years for females. At present, the average is estimated at 42 years."* Infant mortality is 170 per 1,000. The crude death rate is 23 per 1,000.

The public health statistics, however rudimentary they may be, demonstrate a strong need for improved quality of water. At the same time, on social and economic grounds, there is an equally strong need for villages to have easier access to water. The women and children of Yemen should not spend the remaining years of this century as hewers of wood and drawers of water. There are better and more productive things for them to do with their lives.

Ibid, p. 169.

B. HISTORY OF THE RURAL WATER SUPPLY PROJECT

The Rural Water Supply Department was carved out of the Municipalities Department in the Ministry of Public Works in 1972, about the same time that the United States Agency for International Development (USAID) was returning to Yemen. The new department apparently was given land on the USAID compound, and USAID designed Project 022 to help launch the Rural Water Supply Department (RWSD) into the world. Project 022 seems to have had the following four priorities:

- The creation of the well drilling division of RWSD in collaboration with the Government of Abu Dhabi.
- Creation of the mechanical section of RWSD and the training of approximately 40 Yemeni technicians in Cairo in carpentry, mechanics, welding, etc.
- Construction of the workshop and warehouse complex located next door to USAID, behind the RWSD offices.
- Provision of materials: cement, steel, pumps, etc., for construction of small water projects. The field construction was supervised by American Peace Corps Volunteers.

There were good points and bad points with Project 022, but on balance it seems to have resulted in a considerable strengthening of several RWSD activities. Today, perhaps half of what constitutes the RWSD has grown out of Project 022.

Project 022 was run directly by USAID and in the folk history of the Mission, it is reported that villagers used to haunt the halls of USAID demanding water projects for their villages. The project was scheduled to end in 1978. In the autumn of 1977, USAID was eager to continue to support RWSD activities. However, it felt unable to provide that support directly. Therefore, it contacted various private and voluntary organizations (PVOs) and asked two groups to send representatives to Yemen. In 1978 one of the two groups, New TransCentury Foundation, submitted a project proposal which after some modifications was accepted by USAID/Yemen and AID/Washington.

Unfortunately, prior to this submission, relations between USAID, the Rural Water Supply Department, and the Ministry of Public Works had cooled significantly. USAID/Yemen personnel in 1977/78 were not able to maintain the rapport that their predecessors had had with several key Ministry officials.

At this time a controversy also arose over the role of Peace Corps Volunteers working in Yemen. Volunteers had been included in the design of both Project 022 and Project 044. The controversy which developed was not limited to American Peace Corps Volunteers, but extended to all volunteers working in Yemen and concerned the kind of contribution that young, inexperienced professionals could make in a developing country. This controversy proved to be a major obstacle to getting all the necessary agreements signed to start the project. Further, project-related issues occasionally were raised to the highest levels of government, where they became a focus for East-West rivalries. The end result of these difficulties was that Project 044's gestation period lasted from autumn 1977 until late summer 1980. During this period, to prevent a hiatus, USAID/Yemen designed a Limited Scope Grant Agreement for US\$ 144,000 and put a former Peace Corps Volunteer, who had excellent relations with the Ministry, in charge. This was a successful holding action until Project 044 formally started in August 1980.

Since the project began, there have been two USAID evaluations. The first evaluation in February 1982, concluded that: 1) "The project is making satisfactory progress towards its goals, and 2) construction of small rural water projects is a good vehicle for training RWSD technicians in improved methods of construction and supervision. It is this training aspect which ultimately justifies continuing the project...since in the long run it will enable the RWSD/MPW to supervise the implementation of...projects and up grade their quality."*

The second USAID evaluation in the Fall of 1983 determined that:

- TransCentury had established excellent relations with the Ministry and the RWSD
- management of the survey, design, and construction of sub-projects was excellent
- Project 044 had constructed 29 small water projects of good to excellent quality by October 1, 1983
- It had conducted on-the-job and classroom training for 28 trainees or technicians
- Villagers with completed projects had created adequate procedures to operate and maintain the completed rural water systems
- The quality of life of rural Yemenis resulting from increased availability of water had been improved

*Ponasik, Diane, and Gephart, "Evaluation Small Rural Water Systems in Yemen," March 9, 1982, p. 1

The second evaluation concluded, "In Summary, the team feels that the project is going well, is producing appreciated tangible evidence of U.S. involvement in Yemen's development, and conforms to AID policy."* It recommended that the project be continued for five years to allow more emphasis on institution building.

As of April 1984, Project 044 had completed 43 subprojects. An additional seven subprojects were under construction. Under 044 sponsorship, nine members of the RWSD were enrolled in formal training courses, including two candidates who were studying English prior to beginning engineering studies. Both USAID/Yemen and Project 044 staff have re-established excellent relations with the RWSD and the Ministry of Public Works. Ministry staff and USAID are happy with the progress to date. Project 044 has built a substantial reservoir of credibility with the YARG. A strong foundation has now been laid for sustained collaboration and a serious joint effort to strengthen and professionalize the operations of the RWSD. This effort will be simplified if RWSD can fulfill its ambition--supported by both the President and Prime Minister of the YARG--of converting the RWSD into an autonomous authority, which could compete successfully for skilled Yemeni manpower. In line with this, agreement has been reached in principle with senior Ministry staff to recruit up to 10 Yemeni engineers and planners to work with the RWSD.

The RWSD has made great progress in 12 years. However, much remains to be done in order for it to fulfill its mandate and meet the needs of rural Yemen.

**Leonard, Dichter, and Aburthnot, "Small Rural Water Systems Project Evaluation," October 1983, p. 3.

C. STRUCTURE AND STAFFING OF THE RURAL WATER SUPPLY DEPARTMENT

The RWS D is a department within the Ministry of Public Works. The Ministry is a combination of departments and autonomous authorities. Figure 1 shows the structure of the Ministry and the position of the RWS D within the Ministry.

As of 1984 three of the five departments of the Ministry of Public Works were autonomous authorities. These included: (1) The Ports Authority, (2) The Survey Authority for Mapping, and (3) The Highway Authority. Although nominally autonomous, these three authorities were still under the overall direction of the Minister of Public Works. Two departments remained within the Ministry: (1) the Technical Department for Construction of Government Buildings and (2) the Rural Water Supply Department.

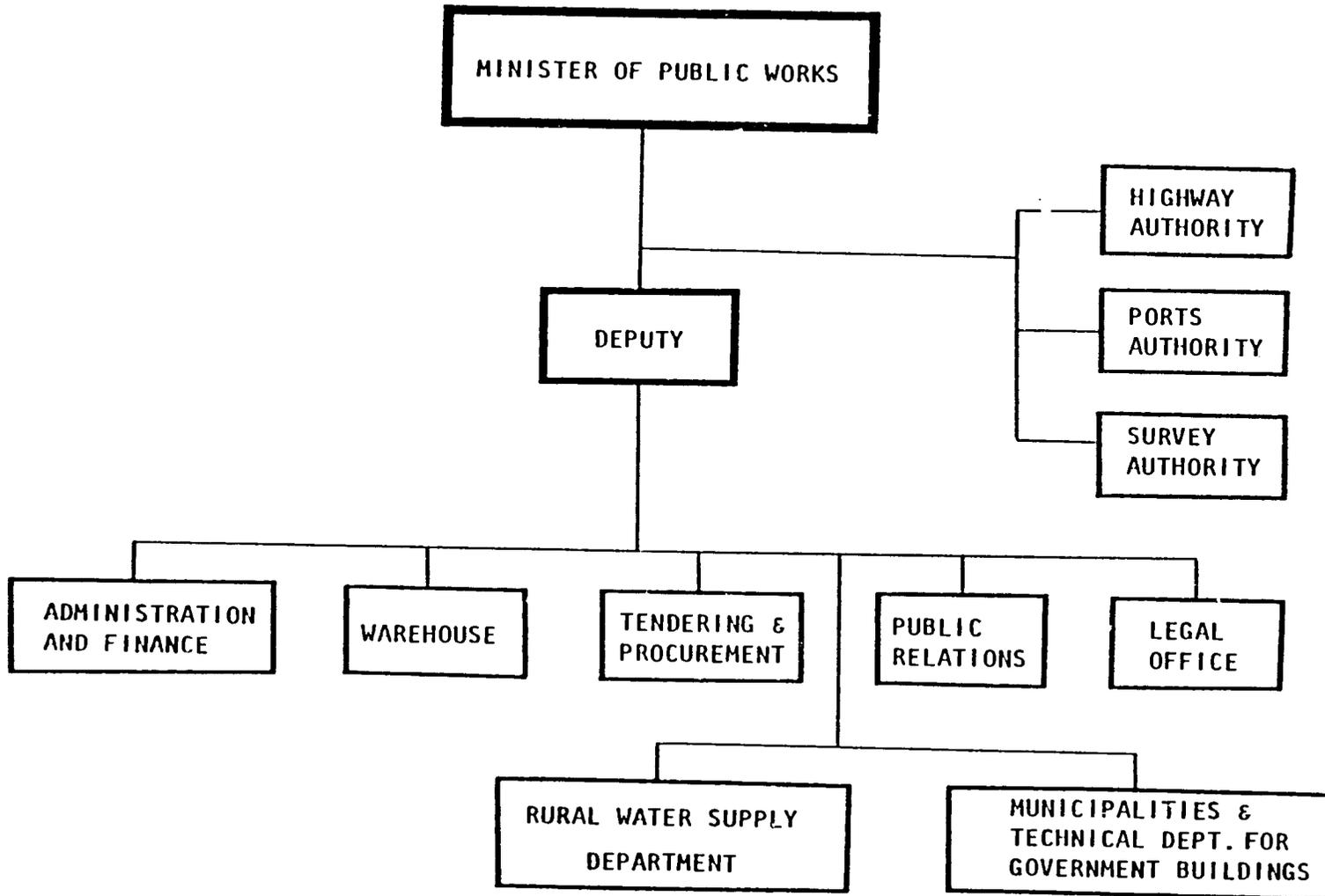
As of March 1984, the RWS D itself is organized into five sections, which are under the Director-General for Rural Water Supply.

These sections are:

- Projects Office
- Drilling Section
- Mechanical Section
- Directorate for Administration
- Office for Bilateral Affairs

At this time, the RWS D is still an integral part of the Ministry of Public Works. Some components of the Department are physically located within the Ministry. The Director-General's office, the RWS D Projects Office, and part of the administrative offices, for example, are located in the Ministry of Public Works. The RWS D also draws upon several related Ministry offices for administrative and technical support.

FIGURE 1 STRUCTURE OF THE MINISTRY OF PUBLIC WORKS - YARG



These include:

- MPW Directorate General for Administration and Finance
- Purchasing and Procurement Department
- Warehousing Section
- Water Laboratory
- Public Relations, Statistics, and Planning
- Accounting

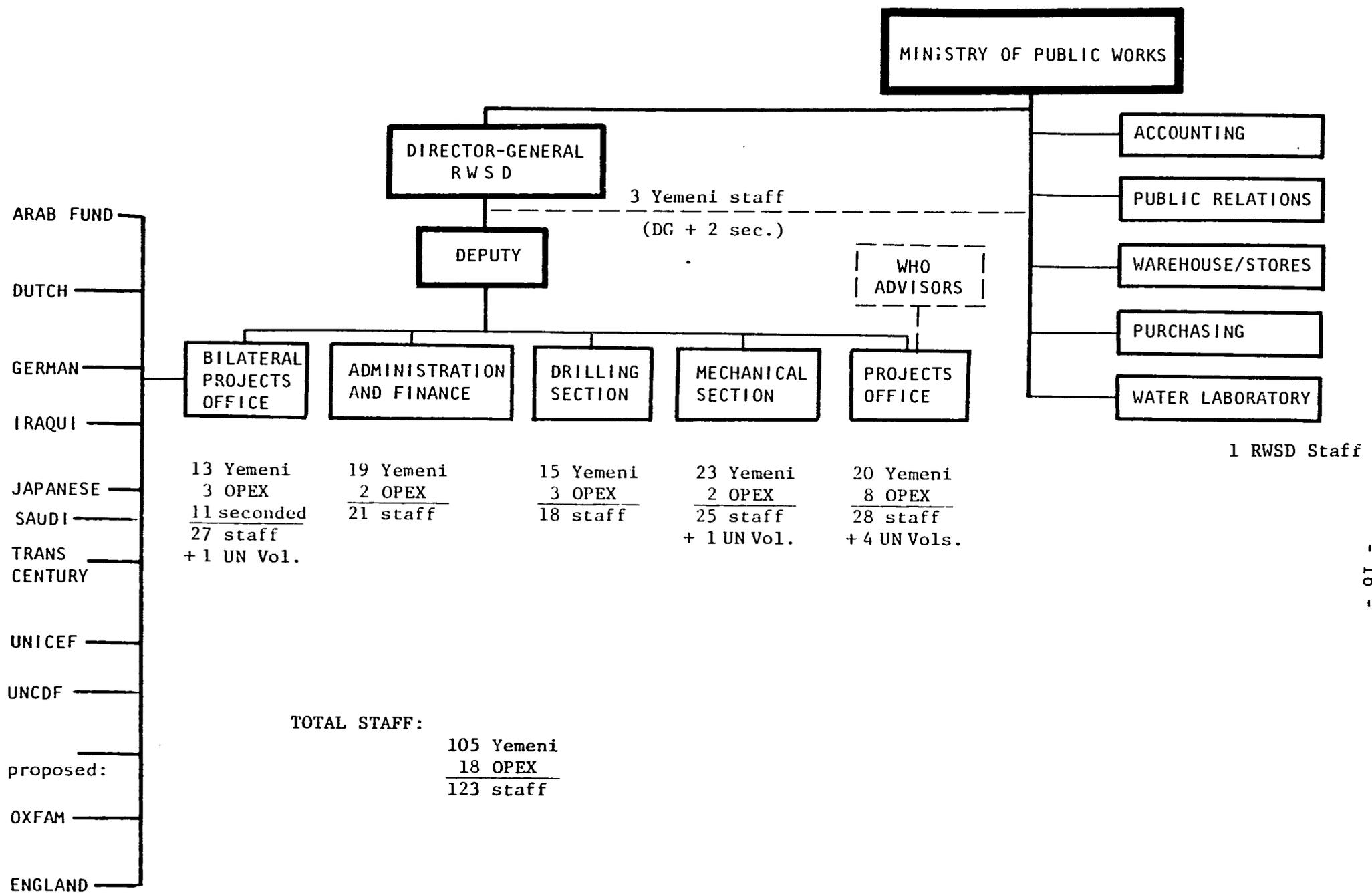
In addition to the offices located at the Ministry, the RWSD has other offices located several miles across Sana'a, next door to the USAID offices at Hasaba. These offices were partially set up to coordinate foreign donor activities. To that end, they include the Office of Bilateral Affairs. They also include the Drilling and Mechanical Sections, a small administrative support unit, and offices for several of the principal donors. The TransCentury Project 044 office is located at Hasaba, as are offices for:

- the Japanese project
- UNICEF/UNCDF
- Iraqi Project
- Dutch Project

The Rural Water Supply Department also has two small regional offices: one in Dhamar Province, and one in Hodeidah. A schematic organization chart for the Rural Water Supply Department as it presently exists is given in Figure 2. Detailed organizational tables with specific staffing breakdowns for the five sub-sections of the Department are given in Tables 1 through 6 in the Appendix.

The Rural Water Supply Department exists to provide potable water systems to the rural sectors of Yemen. It is basically divided into two functional units: 1) an office of Bilateral Affairs, which coordinates foreign donor activities, most of which are turn-key; and 2) departmental activities which include drilling wells, surveying and designing projects, and supervising Yemeni contractors who construct rural water systems on contract to the Department. This second function of the Department is carried out by the Projects office, supported by the Drilling section and Mechanical section. In addition, there is a small Administrative section within the Department. A brief discussion of each of the principal sections within the RWSD is given below:

FIGURE 2 RURAL WATER SUPPLY DEPARTMENT - YARG Spring 1984



1. The Projects Office as it is presently constituted contains 28 staff, of whom 20 are Yemeni and eight are third-country OPEX staff recruited and paid directly by the RWSD. The Projects Office is primarily a legacy of WHO's 10 year involvement with the rural Water Supply Department. It appears to have been set up following normal UN models to create a capability to survey and design prospective possible subprojects. It is currently not staffed with adequate manpower to handle significant levels of field construction. Most of the OPEX staff are former World Health Organization (W.H.O.) staff or former UN Volunteers who have recently been hired by the Ministry as World Health Organization assistance to the Department is phased out. Many of the nine Yemeni surveyors and three construction supervisors have been partially trained either formally or on-the-job by W.H.O. and OPEX advisors. The Project Office is also assisted by four U.N. Volunteers. The composition of the Projects Office is shown in Table 6 in Appendix I.

2. The Drilling Section is a legacy of earlier USAID assistance under Project 022. Originally the Drilling Section had six Ingersoll Rand T-4 percussion rotary drilling rigs and one rotary cable rig which were provided by Abu Dhabi in 1972/73. The staff to run these rigs was trained by USAID both in Yemen and in Egypt. One of the seven rigs was not operable upon arrival. Two of the rigs were given to NWSA after it became an autonomous authority in 1973/74. Today, only one of the RWSD's four remaining rigs is still in semi-operable condition. The remaining three are down owing to lack of spare parts. Currently the Drilling Section has a staff of 15 Yemenis, together with three OPEX engineers or geologists from Egypt. When the Drilling Section was originally set up in the early 1970s there was very little private sector activity in Yemen and virtually no drilling capability. This has changed dramatically over the last decade, and today a substantial private sector capability to drill wells exists. Some of the earlier staff trained by USAID have left the RWSD to go to work with the private sector. The present composition of the Drilling Section is shown in Table 4 in Appendix I.

3. The Mechanical Section is also a legacy of Project 022. It was set up by USAID and is still housed in an AID-built workshop behind the USAID compound and the main offices of the RWSD. The Mechanical Section was primarily established to serve the Drilling Section and the RWSD vehicles. It presently has a staff of 23 Yemenis and two OPEX counterparts. Most of this staff are in the workshop section.

With the growth of the private sector in Yemen, both the Drilling and Mechanical Sections have been overtaken by events. Both are a legacy of the past, and under the direction of the senior leadership of the Department some of the staff of these two departments have been re-deployed on a defacto basis to work with Project 044 and other foreign donor groups.

4. Administration and Finance. The RWSD has a very small administrative wing, with 10 Yemeni staff, seven of whom are clerks, messengers, or office boys. Each section of the RWSD also has its own administrative functionaries, but these are essentially limited to the subprofessional level. On balance, although the RWSD is weak on the technical side, it is even weaker when it comes to routine matters of public administration like typing, filing and planning. In addition to the basic 10 people who provide administrative support for the Department, the RWSD also has 10 drivers assigned to it. With the exception of two Egyptian women who serve as Arabic typists, there are no third-country OPEX staff working to improve the administrative functions of the RWSD.

5. The Bilateral Affairs Office is the newest of the five offices within the RWSD. It was set up in 1982 to coordinate the activities of the eight foreign donor groups working in the rural water sector in the YAR. The Bilateral Affairs Office has a staff of 13 Yemenis and three OPEX administrators. One Sudanese OPEX staff serves as the counterpart aide to the director of the section. The second Sudanese OPEX staff person is in charge of Project 044's warehouse. The third OPEX staff is an Egyptian civil engineer. The Bilateral Affairs Office nominally has 11 additional MPW/RWSD construction technicians assigned to it. These men, however, are formally seconded to Project 044 or other bilateral projects. The Bilateral Affairs Office coordinates the activities of eight bilateral or multilateral aid programs. These include:

- the Arab Fund
- the Dutch Program for Dhamar
- the German Program for Dhamar
- the Iraqi Program
- Japanese Assistance
- Saudi Aid
- USAID/TransCentury (Project 044)
- UNICEF/UNCDF

Further, they will coordinate the proposed British and OXFAM assistance if these come to pass. An analysis of the present donor assistance to the Rural Water Supply Department is presented in tabular form in Table 1.

Although there is an element of adding apples and oranges to the exercise, the design team for 044/II has added the current and proposed assistance from the present eight donors working with the Department and

COUNTRY OR ORGANIZATION	COST	COMPONENTS	ESTIMATED DURATION	IMPLEMENTING AGENCY	STATUS
1. Saudi Project	US\$26.3 million	50 complete systems, including wells, tanks, pumps, generators, pump houses, transmission and distribution lines for towns of 1,500 to 12,000.	Phase I (drilling) 22 Nov. 83 to August 1985, to be followed by Phase II - civil works - and Phase III - pump installation. Project expected to last about five years.	Saudi Projects Office with Al-Watari (Yemeni Construction Company)	Drilling phase expected to last 15-17 months, till spring 1985. 4 wells have been drilled to date.
2. Iraqi Assistance	US\$4	30 deep wells and sometimes the provision of pumps and generators.	March 1982 to May 1984	Iraqi contractors with 3 drilling rigs, 15 technical staff, and 1 Chief of Party.	About 28 wells drilled, 2 remaining.
3. UN Assistance					
UNICEF	US\$1,984,000	50 water resource development projects, including tanks, pipelines, pumps & generators.	30 May 1982 to 31 December 1984		15 projects completed
UNCDF	US\$2,487,000	45 projects - resource improvements, including tanks, pipelines, pumps and generators.	30 May 1982 to 30 October 1984. Agreement will probably be extended.		52 projects surveyed, no construction started. All commodities required for projects have been imported and are at RWSD warehouses.
4. Japanese Assistance					
Phase I (grant aid)	US\$1,980,000	5 complete systems in Sanaa, Hajjah and Taiz.	10 August 1982 - 15 March 1984.	Nisshoikai Corp. Nissako Corp.	Work supposed to be completed, but some drilling rigs appropriated by tribes. Extended to September 1984.
Phase II (grant aid)	US\$2,009,000	2 complete systems for 17 villages.	7 March 1983 - 15 March 1984		
Phase III (loan)	US\$2,678,000	3 projects for 16 villages	Consulting agreement signed 31 July 1983. Duration not known.		Entering negotiations for tendering. Will be followed by contractor selection. Project work expected to last about 2 years, till March 1985.
	US\$6,667,000				Under negotiation.
5. Arab Fund for Economic & Social Development	US\$2,396,439 (700,000 Kuwaiti donor)	10 projects, including pumps and fittings, pipelines, extensions, civil works, technical services and establishment of regional offices.			
6. Dutch Projects	US\$2,787,456	14 projects, including civil works for wells previously drilled by Dutch Project in Rada and Damar.	4 October 1983 - August 1985		4 staff in country. After civil works completed, 5 proposed staff will assist the RWSD as experts.
7. German Assistance for Damar Earthquake Rehabilitation	US\$2,192,982	45 sites to be provided with tanks, pumps and distribution systems.	12 March 1983	KPS Corp. has been selected as contractor.	Under negotiation.
8. American Government USAID					
Phase I	US\$6,900,000	55 projects.			
Damar 1	500,000	18 projects	28 July 1980 to	TransCentury Foundation	Proposed extension for 5 years, from October 1984 to September 30 1989. Emphasis to shift to institution building.
Damar 2	1,358,000		30 September 1984		
	US\$8,758,000	73 projects			
GRAND TOTALS:	US\$47,576,000	327 sites/projects			

TABLE 1. Foreign Donor Assistance to RWSD

calculated their contribution as a percentage of this total. Ranked in this fashion, the various donor's contributions look like this:

	<u>Total</u>	<u>Percent</u>
1. Saudi Arabia	\$ 26.3 million	45.7
2. USAID	8.758 million	15.2
3. Japanese	6.667 million	11.6
4. UNDP TOTAL	4.471 million	7.8
	(UNICEF 1.984 million)	(3.4)
	(UNCDF 2.487 million)	(4.3)
5. Iraq	4.0 million	6.9
6. Dutch	2.787 million	4.8
7. Arab Fund	2.396 million	4.2
8. German/Dhamar	2.193 million	3.8
	<u>\$ 57.576 million</u>	<u>99.9</u>

D. PROJECT 044: SUMMARY OF PROGRESS AS OF APRIL 15, 1984

Project 044 has made substantial progress both in terms of building rural water systems and in terms of building the RWS as an institution. Some benchmarks which do not include reconstruction activities in Dhamar* include the following:

- 93 projects have been surveyed
- 73 projects have been designed
- 43 rural water projects have been constructed
- 22 elevated reinforced concrete tanks have been constructed
- 13 fiberglass tanks have been installed
- 5 ferro-cement or shotcrete tanks have been built
- 1 cistern has been improved
- more than 20 well tests have been conducted
- 11 pumps have been installed
- 9 motors or generators have been installed
- 14 pump, motor, or generator houses have been constructed
- 6 pilot sanitation projects have been constructed
- 123 kilometers of pipeline have been laid.

This is all on the bricks and mortar side of the equation. More significant, however, in terms of the long-run benefits to the people of Yemen, is the creation of a field construction capability under the auspices of RWS. This is symbolized by the following:

- 6 construction teams currently are working in the field
- 12 local-hire 044 construction technicians have been trained by the project. Of this number nine are still with the project.
- 14 Ministry technicians have been trained by the project. Of this number 12 are currently working with the Project.
- 9 Yemeni staff from the Ministry of Public Works are currently in formal training. This includes:

* Dhamar is discussed separately beginning on page 29 .

- one studying surveying in Khartoum
- one studying public administration in Cairo
- five receiving technical training in Egypt
- two in English language training in Sana'a.

Further, 19 American Peace Corps Volunteers and two Dutch Volunteers have worked or are working with the project. Twelve volunteers are currently working with the project. The volunteers have also assisted the institution-building component of the project, because they have meant that the local hire and Ministry technicians have almost always had an expatriate counterpart to work with on the job.

The institution building which has taken place so far is significant, because it represents a weaving together of Project 044 staff and RWSD/MPW staff to create a field construction capability which did not previously exist. It means an ability to support field construction by such things as surveying and designs, vehicles, warehousing, bookkeeping, record keeping, and routine project administration. It is done within the context of the Ministry of Public Works, using a partial complement of Ministry staff. It is done under the auspices of the Rural Water Supply Department. Unlike virtually all the foreign donor assistance to the Department (save for WHO) Project 044 is not done on a turn-key basis.

At the present time, the first 50 subprojects completed under Project 044 are currently serving 36,000 beneficiaries. The systems are designed and constructed to last for 20 years. Over a 20-year period, the first 50 subprojects will serve 54,000 beneficiaries. The present average number of beneficiaries per village is 720. The projects are designed to serve an average of 1,075 beneficiaries per village. The cost per beneficiary for the designed systems* based on this first 40 sub projects completed to date is \$46.78.

The local villagers contribute very substantially toward the capital costs of these rural water systems. In addition to the pre-construction costs which are often substantial, and the entire operations and maintenance costs, which average about \$1,900 per year per system, the local villagers have also contributed approximately 36 percent of the capital costs of rural water systems.

For the first 50 subprojects, including both Tihama and mountain projects, direct costs and contributions were:

*Designed systems: public works projects are designed and constructed to allow for normal population growth. They are also designed for a given lifetime. In Yemen, Project 044 rural water projects are designed and constructed for a 20 year lifetime, and generally are designed for a 50 percent increase in population over 20 years.

	<u>Average</u>	<u>Percent</u>
Village contribution	\$18,365	36.44
Project 044 contribution	32,021	63.56
	<hr/>	<hr/>
TOTAL	\$50,385	100.00

In addition to the bricks and mortar and the institution-building, several new techniques or technologies have also been introduced. These include:

- shotcrete or guncrete. This is pneumatically applied concrete often used in the United States for building swimming pools. In Yemen it has been used for constructing cost-effective above-ground water storage units in the Tihama. It was also used to construct a demonstration earthquake resistant structure for Dhamar.
- standardized prefabricated concrete forms have been introduced to the Tihama. Formerly LDAs and Yemeni contractors made individual form for each new elevated water tank. Project 044 now uses the same pre-fabricated form for 10 or more tanks, resulting in a substantial savings in time, money, and materials. Local contractors appear to be adopting aspects of this technique.
- gabion wire baskets have been introduced. This is a cost-effective construction technique using wire mesh and rock to build retaining walls, river protection walls, small dams etc., where interlinked wire baskets are filled with rocks and cobbles. It represents an ideal construction technique for an arid country like Yemen with lots of rocks.
- a hydraulic ram is in Sana'a waiting installation. This represents a very low maintenance, cost-effective technique for pumping water which uses the force of falling water to raise water. In the right condition, it represents a very suitable technique for Yemen.
- Finally, preliminary research has been initiated into possible applications for photo-voltaic solar pumping. This represents another cost effective technique for water management in the right circumstances.

Present Structure and Staffing

The present structure and staffing of Project 044 as of March 1984 is given in Figure 3. The 044 staff (including Dhamar staff) currently consists of 57 people. This is composed as follows:

	<u>Number</u>	<u>Percent</u>
Expatriate Professionals	6 }	14
Expatriate Consultants	2 }	
044 Local-Hire Staff	22	38
Ministry Staff on Secondment	15	27
Peace Corps Volunteers	12	21
	<u>57</u>	<u>100</u>

The detailed composition of Project 044 staffing is given in Appendix III, page 141

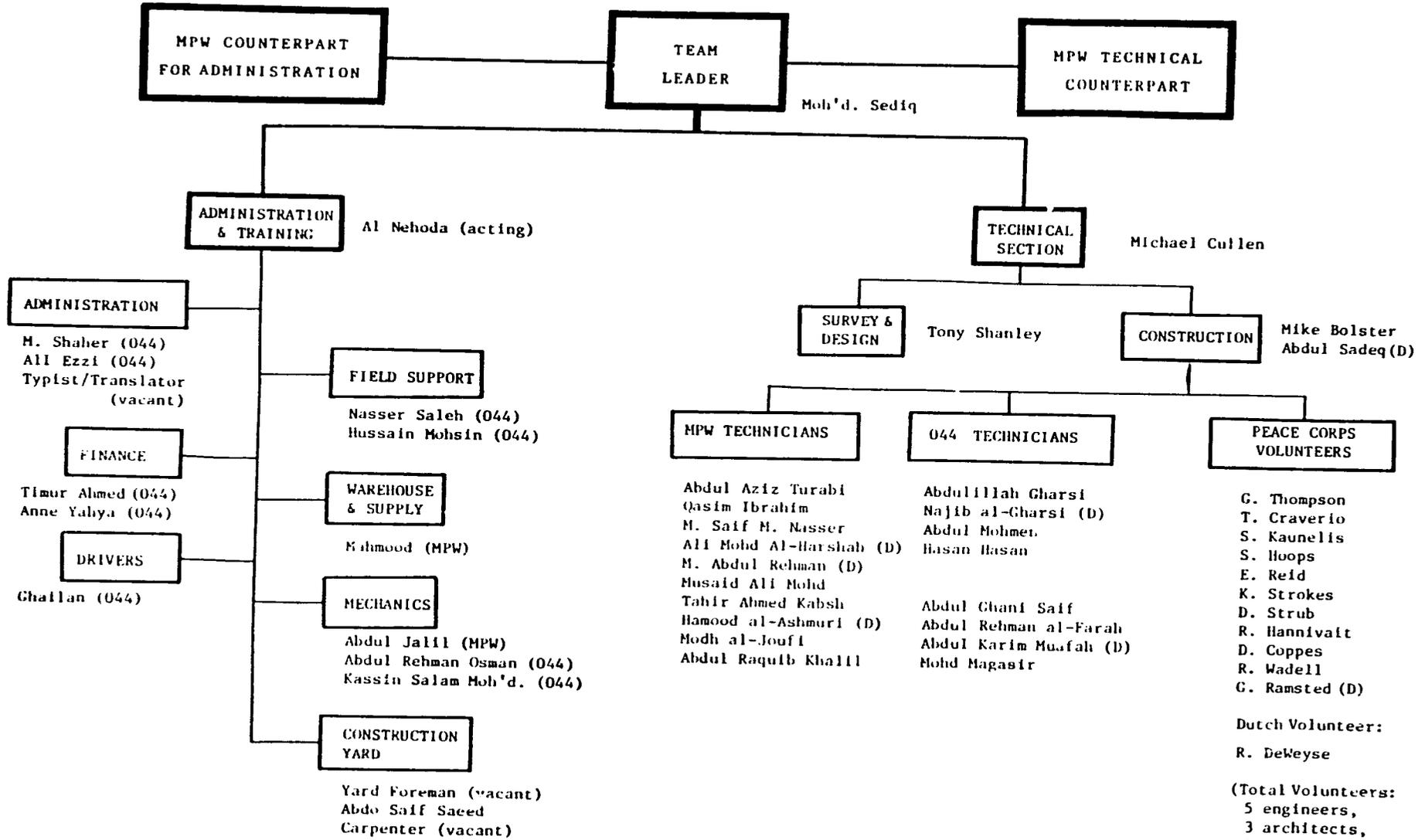
Sub-project costs

Project costs consist of all the expenditures on goods and services required for the various phases of a particular subproject. These include preconstruction analysis, surveys, designs, construction supervision, commodities, equipment and supplies, evaluation, operations, and maintenance. Costs can be calculated in several different ways. Project 044 uses the prescribed method of the Ministry of Public Works which counts only direct costs. This system lumps together under capital costs all the expenditures on physical assets required for the installation and construction of a subproject. The Ministry of Public Works uses this system to evaluate the cost of all donor assistance to the Ministry. Therefore, for the Ministry to have comparable data, it is required that Project 044 use this system also.

Pre-project costs and indirect costs are not counted as part of the subproject costs. Pre-project costs consist of such things as the initial social feasibility study, along with any infrastructural developments that may be required before actual work can begin. The latter may include site preparation, the cost of drilling or deepening a well, casing or sealing a well, or other improvements like access roads that precede the construction of a small water project. These are generally relatively expensive and constitute a major portion of the actual cost to the villages and/or the LDAs. Pre-project costs are totally borne by the local communities, are generally not known in detail, and are not reflected in the Project 044 costs.

Indirect administrative costs, like the team leader's salary when his time is not spent directly working with a sub-project, is not counted in the Ministry's calculations. The time for Project 044 staff which is spent on institution building or other indirect endeavors are not allocated to

FIGURE 3 PROJECT 044 ORGANIZATIONAL CHART - MARCH 1984



(D) = Dhamar Reconstruction

(Total Volunteers:
5 engineers,
3 architects,
4 construction
supervisors)

subproject costs. For the Ministry to more properly assess the actual costs of subprojects, a method for including these costs needs to be built into a managerial accounting system for the Ministry.

Direct costs include the following: (1) Salaries and per diem, (2) Tools and equipment, (3) all commodities used, (4) any sub-contracts, (5) transportation costs, (6) village contributions, (7) any other direct costs. The detailed breakdown of these seven categories are given in Appendix VIII, page 156.

These seven cost categories are consolidated at the time the subproject completion report is filled out, when construction is finished. These reports are extant for the first 40 subprojects. A typical completion form is given in Appendix X. Pre-construction estimation forms are extant for another 10 projects. The data for the first 50 projects have been tabulated, and are given in Table 2 on the following page.

TABLE 2. Components of 50 Rural Water Projects

- 27 -

#	PROJECT NAME	NUMBER	PROVINCE	PROJECT COMPONENTS:						VILLAGE CONTRIB.	O44 CONTRIB.	SUB-PROJECT TOTAL COSTS	COST/ BENEFICIARY	PUMP HOUSE
				POPULATION: PRESENT	POPULATION: DESIGN	ELEVATED TANK	GROUND TANK	PIPELINE (Kms./Hrs.)	OTHER					
1	al-Hillah	81-01	Hodeidah	725	1,088	25m ³	-	1,017		\$18,560	\$65,933	\$84,493	\$116.54	-
2	Muradifah	81-02	Hodeidah	594	891	25m ³	-	970		19,825	43,145	62,970	106.01	-
3	al-Mahd	81-03	Hodeidah	730	1,100	existing tank	-	1,410		17,738	21,499	39,237	53.75	-
4	al-Khadariah	81-04	Hodeidah	645	970	25m ³	-	1,577		19,018	33,977	52,995	82.16	-
5	As-Saadiyah	81-05	Hodeidah	825	1,240	15m ³	-	2,406		26,410	45,552	71,962	87.23	-
6	al-Marwan	81-06	Dhamar	750	1,125	-	spring boxes							
7	Beit a-Hindyah	81-08	Dhamar	150	200	-	50m ³ 15m ³	1,073 1,238		6,310 6,758	22,716 18,546	29,027 25,304	38.55 168.50	
8	Beit al-Ansi	81-07	Dhamar	200	300	-	25m ³	1,342		7,077	18,885	25,962	129.73	
9	As-Sayh	82-07	Dhamar	450	600	-	25m ³	1,320		5,424	11,823	17,259	28.60	
10a	Unayziah Phase I	82-06	Hodeidah	595	895	25m ³	15m ³ shotcrete	install pump/engine	2,300	2,195 19,765	16,196 36,517	38,390 56,281	30.90 94.59	Assisted with pump house
10b	Unayziah Phase II	82-06	Hodeidah	-	-	-	-	-	-	-	-	-	-	
11	Bayt Muftah	82-03	Sanaa	550	825	25m ³	5 springs developed	5,729		12,027	34,917	46,945	85.36	
12	al-Maweer	82-04	Sanaa	495	750	15m ³ tank	roof of 50m ³ cistern	1,728	Install pump and generator					
13	Dar al-Qadhi	82-08	Sanaa	320	480	25m ³	2 fiberglass tanks; ferro-cement	1,020		7,447 6,465	39,706 17,081	47,153 23,546	95.25 73.41	built motor house
14	Hub	82-09	Sanaa	420	630	10m ³		1,146		2,946	12,833	15,799	37.58	
15	Bait Idhuga	82-01	Sanaa	1,140	1,710	50m ³		1,578	Pump, generator	22,913	18,113	41,027	35.98	
16	Bayt al-Faqih	82-05	Sanaa	680	1,020	15m ³	3 fiberglass	3,000	3 fiberglass inst.	\$15,876	\$62,149	\$78,025	\$114.28	
17	Bayt Kahin	82-10	Sanaa	456	684	15m ³ 25m ³		2,220		11,107	16,033	27,140	59.52	built pump house
18	al-Marbak	82-11	Sanaa	1,450	2,175	50m ³		3,170		11,564	20,984	32,548	22.45	
19	Hosayah Ulya	82-12	Hodeidah	770	1,155	25m ³		2,004	Installation pump/motor	23,054	28,696	51,750	67.18	pending
20	Hosayah Sufilah	82-13	Hodeidah	1,250	1,875	25m ³		4,078	25m ³ shotcrete tank	9,761	31,865	41,626	33.25	
21	al-Mahalab	82-14	Hodeidah	900	1,350	25m ³		3,227	Installation pump/motor	8,825	44,059	52,884	58.76	pending
22	As-Sawlah	82-15	Hodeidah	850	1,275	25m ³		2,956		8,824	46,360	55,184	64.97	
23	Ad-Danigh	82-16	Hodeidah	730	1,095			1,566	3 fiberglass tanks	9,374	19,454	28,828	39.49	
24	Dayr-Ahdam	82-17	Hodeidah	1,380	2,070	25m ³ shotcrete		1,435	2 fiberglass tanks installed temporarily	24,930	42,449	67,379	48.82	
25	Majallah	83-01	Hodeidah	870	1,300	25m ³		5,136		19,327	44,660	63,987	64.00	
26	al-Wisabah	82-02	Hodeidah	280	560	25m ³		1,003		15,553	29,580	45,133	161.23	
27	Dannah	83-03	Hodeidah	532	798	25m ³		2,898		16,099	36,561	52,660	99.00	

#	PROJECT NAME	NUMBER	PROVINCE	POPULATION:		PROJECT COMPONENTS:				VILLAGE CONTRIB.	O44 CONTRIB.	SUB-PROJECT TOTAL COSTS	COST/BENEFICIARY	PUMP HOUSE
				PRESENT	DESIGN	ELEVATED TANK	GROUND TANK	PIPELINE (Kms/Ms.)	OTHER					
28	Ilan Ilan	83-16	Taiz	2,000	3,000			6,200		137,555	18,061	155,616	12.83	
29	al-Maeenah	83-06	Sanaa	250	375		25m ³	2,312	install pump	8,333	28,836	37,119	149.00	
30	Rubad	83-11	Sanaa	266	399		25m ³ shotcrete	2,525	shotcrete tank install pump	21,161	31,249	52,410	197.00	
31	At-Turbah	83-07	Hodeidah	620	930		25m ³	2,826	install pump/motor	15,315	33,160	48,476	78.00	
32	Al-Muraban	83-04	Hodeidah	845	1,268		25m ³	5,094		16,806	46,129	62,935	75.00	
33	Kohlan	83-05	Sanaa	310	465		25m ³	1,208	install pump +450m elec.cable	\$13,445	\$28,653	\$42,098	\$135.80	
34	Nibhan	83-17	Taiz	1,000	1,500			7,200		63,215	37,004	100,219	42.95	
35	Tafaa	DRMP83-07	Dhamar	1,800	2,500		60m ³	2,296	install pump/engine	15,246	38,623	53,869	29.92	
36	Beni Suade	DRMP83-29	Dhamar	600	1,000		50m ³	3,776	10 showers 3 latrines	18,640	27,213	45,853	76.42	
37	Saba ⁹	83-08	Hodeidah	750	1,125		25m ³	2,814		24,091	42,092	66,183	88.32	
38	al-Mahwah I	83-09	Hodeidah	630	945		25m ³	1,171	install pump/motor	12,867	28,774	41,641	66.09	
39	al-Mahwah II	83-36	Hodeidah	630	945		25m ³	1,171	"	12,867	28,774	41,641	66.09	
40	al-Qubaa	83-18	Taiz	480	720		3 fiberglass tanks	2,347	3 fiberglass tanks/diesel generator	6,640	17,075	23,715	49.40	
41	al-Dhaef	33-19	Sanaa	1,200	1,800		50m ³	5,109	install elec. pump/generator	21,006	45,371	66,377	55.31	generator house
42	Sethan	83-13	Sanaa	363	545		25m ³	1,830	pump/diesel generator	20,750	39,222	59,972	165.27	generator house
43	Talab	83-34	al-Beidha	989	1,484		60m ³	2,550	pump/motor	22,975	39,119	62,094	62.78	pump house
44	KaShah	83-22	Sanaa	420	630		2 fiberglass tanks	1,361	pump/generator	20,537	26,137	46,674	111.13	pump house
45	Kawkarah	83-38	Hodeidah	860	1,290		25m ³	2,995		17,820	31,681	49,501	57.56	motor house
46	al-Jaruba	83-35	Hodeidah	800	1,200		25m ³	4,303		\$20,191	\$47,112	\$67,303	\$84.13	
47	al-Hisi al-Jadidah	84-02	Hodeidah	450	675		existing tank	1,360		23,726	11,692	35,418	78.71	pump house
48	Bayt al-Hawri East	83-32	Sanaa	580	870		25m ³	1,135		8,751	24,908	33,659	58.03	
49	Bayt al-Hawri West	83-33	Sanaa	660	990		25m ³	668		7,419	22,091	29,510	47.71	
50	Dar al-Hisi East	83-15	Ila Jjah	730	1,095		25m ³	1,214	pump/engine	13,678	27,770	41,448	56.78	motor house
				37,970	53,912			122,012			918,206	\$1,601,035	\$2,519,225	
AVERAGES:				719	1,078			2,440						

TABLE 2 (continued)

Dhamar Earthquake Reconstruction Summary of Progress as of April 15, 1984.

The earthquake of December 14, 1982 was a tragedy for the people of Dhamar. Because of the extent of the damages, it required massive financial resources, and created severe problems for the Yemen Arab Government. The American Government was one of the first Western donors to respond to the earthquake by sending part of the Project 044 staff along with USAID staff and Peace Corps Volunteers to conduct a survey of water systems damaged by the earthquake. Working together with WHO staff and counterparts from the Ministry of Public Works, Project 044 surveyed 888 damaged villages over a three week period. USAID then amended TransCentury's Cooperative Agreement, adding \$500,000 to assist with rehabilitation activities in the earthquake damaged areas. A later project amendment added \$1.38 million for this purpose.

The rehabilitation activities in Dhamar were added to the original project. There is one senior expatriate civil engineer in charge of supervising activities in Dhamar, together with two 044 technicians, three Ministry/RWSD technicians and two Volunteers (1 Dutch engineer and 1 American Peace Corps architect). There is some rotation of staff in and out of Dhamar, so the exact composition of the staff changes from time to time. Generally, however, there are usually three to four construction teams working at any one time in Dhamar, in addition to the basic six teams working with the rest of Project 044.

Some benchmarks for activities in Dhamar which are over and above the benchmarks previously cited for Project 044 include the following:

- 40 projects surveyed of which
- 22 projects surveyed and found suitable, and
- 18 additional projects surveyed, but currently excluded from consideration because the water source was found to be inadequate
- 17 projects designed
- 8 projects constructed
- 5 additional projects under construction for a total of 13 projects as of April 1984
- 4 additional projects surveyed and designed but currently suspended because of village disputes
- 2 additional projects ready for construction
- 8 masonry tanks completed, constructed, or under construction
- 5 fiberglass tanks installed or being installed

- 2 cisterns improved
- 3 pumps installed
- 3 motors installed
- 2 pump and motor houses built or repaired
- 22 kilometers of pipeline laid for the first 11 projects.

Further,

- 4 construction teams are at work in the field
- 5 additional subprojects are scheduled for completion by September 30, 1984 for a total of 18 subprojects.

Several new technologies have also been introduced in Dhamar. These include:

- round masonry storage tanks, which have standardized components, where the storage volume can be varied by extending the height
- round concrete block water storage tanks sprayed or coated with ferro-cement or shotcrete to reduce construction costs and eliminate the need for form work (see section AA, Figure), page .
- prefabricated stand pipe systems, with special provisions for drainage (see page, Figure)
- improved locally made manhole covers that eliminate possible water infiltration and therefore bacteriological contamination (see detail B Figure), page .
- gabion water catchment systems for trapping and storing runoff from springs
- the staff in Dhamar is also exploring the possible use of solar pumps at several project sites.

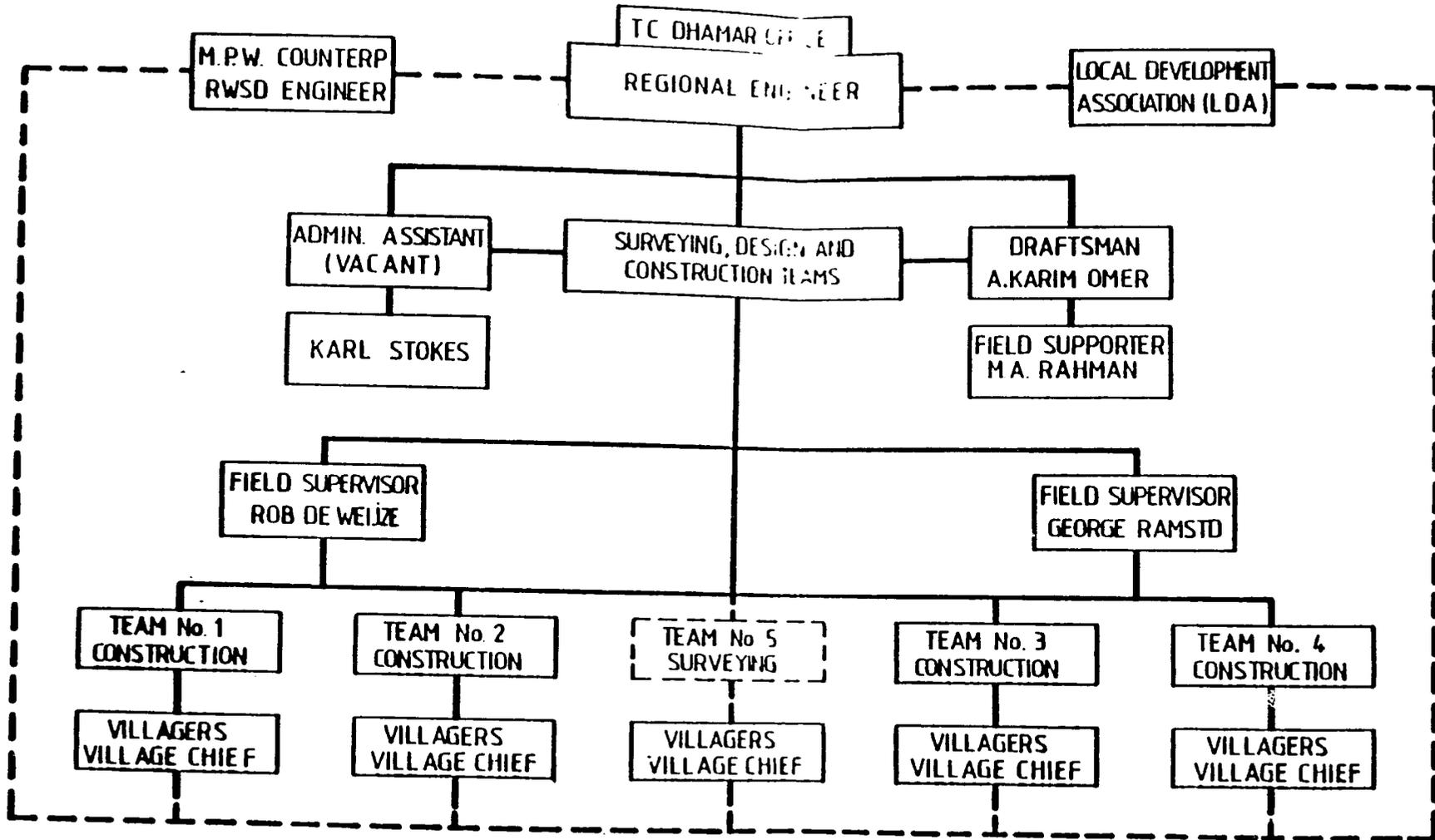
An organizational chart for activities in Dhamar is given in Figure 4. The activities in Dhamar are important as a response to the earthquake, but they are also important because they suggest a precedent for what regional offices of the RWSD might be able to do. The RWSD and O44 offices in Dhamar, for all practical purposes, are the first regional office of the Department.

A status report of Dhamar activities is given as Table 3.

FIGURE 4

T.C DHAMAR ORGANIZATION CHART (1984)

WATERSUPPLY REHABILITATION PROJECT



15 April 1984

#	PROJECT NAME	DRWP NUMBER	POPULATION PRESENT	POPULATION DESIGN	NO. OF VILLAGES SERVED	WATER SOURCE	PROJECT COMPONENTS:		DIRECT PROJECT COSTS:			COST/BENEFICIARY
							TANK	PIPELINE (meters)	VILLAGE CONTRIB.	PROJECT CONTRIB.	TOTAL COSTS	
1.	Dhawan Ans	83-01	± 3,000	4,500	9	borehole	1 fiberglass tank + existing 150m ³	4,584	\$3,061	\$30,328	33,389	\$7.41
2.	al-Lahj	83-02	± 1,200	2,000	4	borehole	existing 100m ³	3,272	1,769	21,452	23,221	11.61
3.	ad-Darb	83-03	± 1,200	1,800	2	borehole	50m ³	1,866	8,283	31,538	39,821	22.12
4.	As-Sayh	83-04	± 2,500	3,500	4	borehole	completed 90m ³	416	7,675	26,454	34,129	9.75
5.	Bani-Shaikh	83-05	± 1,600	2,000	3	spring	25m ³	930	9,528	21,897	31,425	15.71
6.	Bani Sabir	83-06	± 1,100	1,700	2	borehole	25m ³	120	5,121	13,746	18,867	11.09
7.	al-Jabjab	83-09	± 1,200	1,800	2	spring	7.5m ³ fiberglass + existing cistern	1,336 636	13,799	34,958	48,757	27.08
8.	Bayt al-Akwa	84-01	350	500	1	springs	1 fiberglass w/ cistern improvement					

UNDER CONSTRUCTION:												
9.	Al-Khalaqah	84-07	600	900	2	hand dug well	30m ³	1,285				
10.	Rada/Bayt Fara]]	84-06	450	700	2	spring	1 fiberglass	2,070				
11.	Asherwess	84-05	1,000	1,600	2	spring	1 fiberglass 60m ³	2,685				
12.	Afq		1,400	2,100	3	borehole	50m ³	2,704				
13.	Bayt al-Umais		1,500	2,250	4	borehole	60m ³ + fiberglass					

READY FOR CONSTRUCTION:												
14.	Sunaah		2,500	3,750	3	borehole	elevated 50m ³					
15.	Burhan		600	800	2	spring	2 - 30m ³					

SUSPENDED (SURVEYED & DESIGNED):												
16.	Al-Qa'dah											
17.	Hamam All											
18.	Bani Esa al Fatimah	84-02										
19.	Mankadah											

TABLE 3. Components of Dhamar Subprojects

Project 044 and Dhamar Activities Summarized

A summary of Project 044 accomplishments including Dhamar Reconstruction Component includes:

- 133 projects surveyed
- 90 projects designed
- 12 additional projects under construction
- 22 elevated tanks constructed
- 28 masonry tanks constructed or under construction
- 18 fiberglass storage tanks installed or being installed
- 3 cisterns improved
- 14 pumps installed
- 12 motors or generators installed
- 16 pump, motor or generator houses built or repaired
- 144 kilometers of pipeline laid in 62 villages.

Further in addition to these quantifiable physical accomplishments, the institutional systems have been created using a mixture of RWSO/Ministry resources, TransCentury/044 resources, and Peace Corps Volunteers to field approximately 10 construction teams of two men each at any one time. Because one construction team can sometimes supervise more than one subproject, approximately 12 subprojects are under construction at any one time. The necessary administrative support and backstopping from Sana'a, -- ranging from vehicles, to workshops, to warehousing, to cashiers, to bookkeepers, to secretaries, to survey and design capability--is in place to support 10 construction teams. In the context of Yemen, this represents monumental progress.

III. SUMMARY PROJECT DESCRIPTION

PHASE I: 1984-1989

A. PROJECT GOAL

The broad program objective to which this project will contribute is to improve the rural population's access to potable water and therefore improve their health status and their quality of life. By 1989 over 70,000 rural persons will have improved access to potable water because of this project, and by 2004 an estimated 109,000 persons will be beneficiaries.

	<u>Current Population Served</u>	<u>Design Pop- ulation (after 20 years)</u>
50 Tihama projects @750 people per village, increasing to 1,125 after 20 years	37,500	56,250
50 mountain projects @700 people per village, increasing to 1,050 after 20 years	35,000	52,500
	<hr/>	<hr/>
	72,500	108,750

B. PROJECT PURPOSE

The purpose of the project is to strengthen the managerial, technical and financial capabilities of RWSD, so that they can effectively respond to the need for improved village water systems.

Project 044 built on the experience of Project 022, and has made significant progress toward the creation of a field construction capability under Departmental auspices. Based on the work of the two earlier projects, Project 044/II now plans to address more fully the institutional weaknesses within the RWSD. The end of project status (EOPS) will include the following:

The Rural Water Supply Department should be able to:

- 1) Plan, survey, budget, and design rural water projects.
- 2) Implement the construction of rural water projects in conjunction with Local Development Associations, rural villages, and the private sector.
- 3) Train communities in the operations and maintenance of rural water systems and advise them on ways to deal with the public health benefits of improved water systems and the consequences of operating such systems.
- 4) Share its financial burden by developing effective ways of increasing village contributions and foreign donor support.

C. OUTPUTS

To achieve the project purpose, nine institutionally-related and three physical construction activities will be undertaken as follows:

Institutional Achievements

1. An Office for Planning and Management will be created and staffed initially with expatriate advisors who will be replaced by trained Yemenis by the end of the project.
2. The RWSD will be helped to reorganize and restructure itself.
3. Five staff will be recruited or reassigned from other RWSD offices to assist with Departmental administration, planning and training. (Initially these will probably have to be OPEX staff.)
4. Thirty Yemeni technicians could be in place as RWSD construction supervisors; 10 new Yemeni engineers and administrator/planners will become part of RWSD management; 24 private sector contractors will be in place to carry out construction activities; and 100 village communities will be trained to perform operations and maintenance functions on completed projects.
5. A modified Fixed Amount Reimbursement (FAR) system will be employed to reimburse RWSD for the construction of 16 subprojects.
6. A rural water hydraulics laboratory will be established to train RWSD technicians.
7. Three regional offices of the RWSD will be established or expanded at Dhamar, Hodeidah, and Taiz.
8. Four in-depth village studies will be completed analyzing water usage patterns and community health practices.
9. The RWSD may be reconstituted as an autonomous authority.

Physical Construction

1. 100 rural water systems will be completed.
2. 22 sanitation projects will be completed.
3. Five small gabion check dams will be constructed as part of a pilot conservation and erosion control program. (These will count as part of the 100 subprojects.)

D. INPUTS

Inputs required to achieve these outputs include technical assistance, training, and commodities according to the following schedule:

Technical Assistance: 34 expatriate person years, and 83 local hire person years.

Training:

1. Regional training:

- 12 fellowships for technical training for 6 person years
- 10 fellowships for public administration and related disciplines for 10 person years

2. Short-term training:

- 450 person weeks of short-term technical training
- 120 person weeks of short-term administrative training
- 100 person weeks of short-term training in health
- 96 person weeks of training for private sector contractors
- 800 person weeks of training for villagers in operations and maintenance of rural water systems

Total: 1,566 weeks of short-term training

3. Training allowances for RWSD technicians for 30 person years

Commodities and Materials: \$1.8 mil

Equipment: 850,000

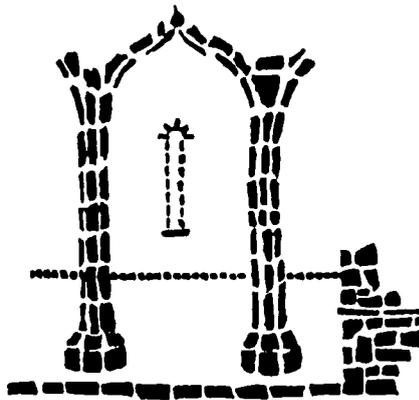
For details, see budget under separate cover.

IV. DETAILED PROJECT DESCRIPTION

There are four principal End of Project Status (EOPS) objectives which are proposed for Project 044/II. These four EOPS are given below. The Rural Water Supply Department should be able to:

- 1) plan, budget, survey, and design rural water projects;
- 2) implement the construction of rural water projects in conjunction with LDAs, rural villages, and private sector contractors;
- 3) train rural communities in the operations and maintenance of rural water systems and advise them on ways to deal with related public health issues;
- 4) and share its financial burden by developing effective ways of increasing village contributions and foreign donor support.

These four EOPS are described in appropriate detail below. In addition, following the first EOPS and related to it, there is an extended discussion of the staffing which will be necessary to implement this proposal.



EOPS #1. The Rural Water Supply Department should be able to plan, budget, survey and design rural water projects.

There are six sub-components of this EOPS, and all of them help to strengthen the RWSD. Taken together, they constitute the principal institution-building strategy for Project 044/II. Institution-building happens in bits and pieces, and there is no grand design which will miraculously transform the RWSD. Instead, there are a series of discrete but inter-related interventions which are proposed for 044/II. In a very broad sense, most of these subcomponents relate to training or manpower development. The six sub-components are as follows:

- 1) An Office of Planning and Management will be created.
- 2) The RWSD will be helped to restructure itself
- 3) Five additional staff will be recruited or reassigned from other offices of the RWSD to assist the Department with administration and planning. (Initially most of these staff will be OPEX.)
- 4) Four levels of training will be initiated or expanded.
- 5) A rural water hydraulics laboratory will be established to train RWSD technicians, and the RWSD Training Center will be expanded.
- 6) Three Regional Offices of the RWSD will be established or expanded.

1. The first component of the institution building strategy will be to create an Office for Planning and Management.

This office will be advisory to the Director-General of the RWSD. It will initially be staffed by two expatriate engineer/planners who can advise on general operations of the Department. This advisory role will be separate from but coordinated with the day-to-day field operations of Project 044/II. In 1985, one Yemeni technician and one Yemeni administrator/planner will be recruited to serve as formal counterparts to the expatriate advisors. One expatriate will be replaced in 1987, and the second senior expatriate will be replaced in 1989. In 1986 one or two Yemeni engineers will be recruited to serve as technical counterparts.

The Office of Planning and Management will assist senior departmental staff with clarifying the purpose and optimizing the structure of the RWSD. It will assist with the recruitment or redeployment of third-country OPEX staff who will be necessary to staff the strengthened department. It will assist with establishing necessary relationships with supportive institutions around the Middle East like:

- the Wadi Magboul Institute in Khartoum, which is a training academy for rural water.
- the National Water Authority in Jordan
- the Alexandria Water Authority in Egypt

The Office of Planning and Management will undertake special tasks from time to time. For example, there are several policy issues that the RWSD needs to clarify. It appears that the RWSD would be more responsive to the rural water sector if it were set up to be primarily a service center to provide technical designs and construction supervision capability to LDAs and rural villages. During the first year of the extension, the Office of Planning and Management needs to carefully review these functions and determine what activities are best done by the private sector, and what is best done in-house by the RWSD using its own staff. This exercise needs to carefully define the medium-term staffing implications for RWSD, building on the work that has already been done by the design team for this proposal and the materials presented in Appendices I and II which detail the present staff and suggest an illustrative possible reorganization of the RWSD.

The RWSD and Project 044/II needs to carefully review and monitor completed rural water projects on a systematic basis -- perhaps every six months -- to see that they are operating properly. Eventually an office would need to be added to the RWSD to permit this kind of detailed follow-up. Initially, however, this function should be performed or coordinated by the Office of Planning and Management to see that the right kinds of questions are asked.

The Office of Planning and Management will help to set the agenda for an expanded training center and a new hydraulics laboratory for RWSD. It will identify training needs for the departmental staff and propose candidates for training. It will help the Director-General prepare annual budgets. It will help to initiate within the department both a managerial and a cost accounting system.

The Office of Planning and Management will also help to establish a consolidated procurement, warehousing, and inventory control system for all RWSD commodities and supplies. It will assist the RWSD to prepare and package proposals suitable for funding by other donors. And if the RWSD moves to become an autonomous authority, it will assist with this transition.

In essence, Project 044/II will follow a rolling design methodology, adjusting the day to day decisions to serve the longer-term requirements of institution-building. It will be a major responsibility of the Office of Planning and Management to see that this rolling design approach rolls in the right direction.

2. A second component of an institution-building strategy will be to help the RWSD reorganize and restructure itself.

At the present time the RWSD is not organized in a linear fashion to function smoothly or efficiently. It is physically bifurcated into two parts: one half is located at Hasaba, between NWSA and USAID. The other half is located at the Ministry of Public Works. Further, there is duplication within the present organization. If the principal staff were to be consolidated in one place, this would provide some opportunity for increased efficiency. There is some duplication in the staff structure for the RWSD Projects Office, which does survey, design and construction work, and the staff of Project 044, which is also organized to do surveys, designs and construction. There would be considerable savings in effort if the RWSD Projects Office and the present components of Project 044 were consolidated into one technical office. Further, the legacy of Project 022 in the form of the mechanical section and the drilling section could also be consolidated into an expanded technical section.

The function of the existing Drilling and Hydrology Section needs to be revised. At the time of Project 022, there was negligible private sector capability to drill wells in rural Yemen. Today this has changed. Therefore, it is proposed that this section be privatized. Three of the four remaining drilling rigs would be cannibalized. The fourth rig would be kept for the Government to perform necessary hydrological test bores. The remaining staff of this section could be converted to well testing crews, or redeployed elsewhere within the restructured organization depending on their skills.

The Mechanical Section and the Workshop could also be reorganized. If the drilling functions are privatized, the labor requirements to maintain one rig instead of four would be substantially reduced. The Mechanical Section, therefore, could be restructured to reflect this reduced workload. Also, to the extent it was compatible with Yemeni Government law, the Rural Water Authority could investigate the feasibility of turning to the private sector for some maintenance of project vehicles and equipment.

This possible restructuring or redeployment of RWSD will not happen in one monumental reorganization. Instead, it will be done gradually in bits and pieces as the senior leadership of the RWSD feels this is appropriate. The restructuring will be assisted by the new Office of Planning and Management. An illustrative possible reorganization of the RWSD is described in Appendix II, on page 137 of this proposal.

3. A third component of the institution building strategy will be to assist the RWSD to recruit or redeploy staff to assist with Departmental administration and planning. (Initially these will probably be OPEX staff from the Middle East.)

USAID, W.H.O., and the Department have all put emphasis upon building the technical skills of the RWSD staff. Yemenis have been trained in engineering, surveying, hydrology, drilling, mechanics, welding, carpentry, and various aspects of construction supervision. However, very little emphasis has been placed on directly training people in the fields of planning, management, or public administration. One step to improve departmental operations, therefore, would be to increase the number and quality of Middle Eastern OPEX counterparts available to work with the Yemeni staff who are now in place, or who will be returning to work with the Department after they finish their formal education.

OPEX staff will be important to the operations of the RWSD staff for the next eight to 10 years. The Department will have to draw upon the manpower resources of other Arab countries until sufficient Yemenis are trained to cover all the necessary staff positions. The OPEX staff will assist this process by:

- 1) upgrading the current operations of the Department;
- 2) serving as role models for decision-makers through on-the-job training;
- 3) freeing some Yemeni staff for in-service or regional training.

At the present time, the RWSD has 18 OPEX positions out of a total of 123 staff, or 15 percent of the total. The 18 OPEX who presently work for the Department are allocated as follows:

<u>Office</u>	<u>Number</u>	<u>Skills</u>
1. Bilateral Affairs	1	Administrator/Planner
2. Administration & Finance	2	Arabic typists
3. Drilling Section	2	Engineers
4. Mechanical Section	2	Mechanical engineers
5. Project Office	9	8 Engineers, 1 Draftsman
6. Warehouse & Stores	1	Warehouse supervisor
7. Water Laboratory	1	Lab technician

Many of these OPEX staff are former UN Volunteers. Others are Third Country Nationals (TCNs) who have found their way to Yemen seeking employment. Most of these staff are paid somewhere between 4,500 YR and 8,000 YR per month (U.S. \$900-1,600). Fifteen of the present 18 OPEX staff work on technical matters. While the RWSD is weak on the technical side, it is even weaker in the administrative areas of management and planning. Therefore the focus of any additional OPEX staff should be on administration and planning.

The additional offices or sections within the RWSD which appear to need the temporary help of OPEX staff at this time are the following:

- 1) One OPEX counterpart is needed for the Director of Administration;
- 2) One OPEX staff person is needed in the Accounts Section;
- 3) One OPEX person is needed to assist with the Planning and Coordination functions of the Department;
- 4) One OPEX staff is needed to assist with Budget and Finance functions;
- 5) One OPEX staff is needed to head the technical training component of the Rural Water Training Academy and Hydraulics Laboratory.

The Yemeni staff or offices which would be assigned OPEX staff are summarized in the table below:

<u>RWSD Office</u>	<u>Status</u>	<u>OPEX Counterpart</u>	<u>Proposed Duration of Assignment</u>
Director of Administration	staff in place	proposed	3 years
Office for Planning & Coordination	modification of Bilateral Affairs Office	proposed	3 years
Office of Budget & Finance	proposed	proposed	3 years
Accounts Office	proposed	proposed	3 years
Training Academy & Hydraulics lab	existing proposed	proposed proposed	3 years 3 years

Within the RWSD, the Director of Administration is currently in place. One OPEX staff would work with him. For the remaining four offices, two could be filled by assigning existing RWSD staff to head the new offices. The RWSD Office for Planning and Coordination evolves fairly easily out of the Office of Bilateral Affairs, and an existing staff person could be assigned to head up the Training Academy. The Yemeni office directors for the Budget and Finance Office and the Accounts Office would have to be recruited and probably would come from among the undergraduates who are currently studying in the United States or would be hired locally by the RWSD.

The present OPEX staff are paid by RWSD directly. For the extension, it is proposed that RWSD continue to fund these or any additional OPEX positions from their own budget. These five positions should be filled over the next 12 to 18 months, either by redeploying existing OPEX staff or by recruiting new or additional OPEX counterparts. This recruitment exercise should be initiated by the RWSD with the assistance of the Project 044/II Office for Planning and Management. The best source of suitable OPEX manpower appears to be the Sudan. An alternative source could be Egypt. TransCentury offices or staff in Cairo, Khartoum, or Washington would be available to assist this exercise.*

Project 044/II will not directly fund or augment the funding of these OPEX staff at this time. However, it is proposed that Project 044/II establish a field per diem fund so that Ministry and OPEX staff who were not formally seconded to Project 044/II could be sent off on brief assignments to assist with project-related activities. This would permit the Project to assist with the deployment of OPEX staff to increase the efficiency of Departmental operations.

On balance, the OPEX staff represent an important transitional augmentation of the RWSD staff. They serve to upgrade departmental skills and make it somewhat easier to attract qualified Yemenis to work for the Department when they come back from overseas training.

An estimated ratio of OPEX staff to Yemeni staff over the next ten years is given in the table below:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
# of OPEX	18	21	23	25	23	20	18	16	14	12	10
Total RWSD	120	125	130	140	145	145	145	150	155	160	160
Percentage of OPEX to RWSD	15	17	18	18	16	14	12	11	9	8	6

*TransCentury has recruited more than 300 long-term OPEX staff to work in 14 countries in Africa. Further, it has initiated discussion with AID/Khartoum to explore the feasibility of partially funding Sudanese OPEX staff to work in Yemen using surplus Government-owned Sudanese pounds.

4. A fourth component of the institution-building strategy will be training.

Four levels of training are proposed:

- diploma-level training in the region or Sanaa
- in-service training in Sanaa
- on-the-job training for counterparts
- village-level training

For degree training it is proposed that RWSD rely primarily on the manpower pool that is being developed under USAID's participant training programs 040 and 080.

Under this program there are 101 Yemenis currently studying engineering and 50 studying administration, social science or public affairs. Over the life of the project it is proposed that RWSD try to recruit two additional professional staff per year for a total of ten. Of these new staff, it is recommended that approximately seven should be engineers and three should be administrator/planners. It appears to be more cost effective for Project 044/II to rely on this USAID-funded activity than it would be for the project to fund directly undergraduate training in the USA.

Going beyond the recruitment of new trained staff, there are two principal areas where training for existing staff would focus: technical and administrative. The technical training would be primarily oriented to strengthen the technical section of the RWSD. At the present time, under the auspices of Project 044 there are 22 construction technicians. Of these men, 11 are locally hired by Project 044, and 11 are seconded by RWSD to the project. The technicians are divided as follows:

	<u>RWSD/MPW Technicians on Secondment</u>	<u>Project 044 Local Hire Technicians</u>	<u>Total RWSD & 044 Technicians</u>
Construction Technicians	2 senior 8 junior <hr/> 10	4 senior 4 junior <hr/> 8	6 senior 12 junior <hr/> 18
Mechanical Technicians	1 senior 0 junior <hr/> 1	1 senior 1 junior <hr/> 2	2 senior 1 junior <hr/> 3
Carpenters	0	1 senior	1 senior

To strengthen the construction supervision capability of the RWSD, it is proposed to increase the number of technicians to 30, according to the following schedule:

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
RWSD	11(+1)	= 12(+6)	= 18(+3)	= 21 (+4)	= 25 (+5)	= 30
044/II	11(+0)	= 11(+0)	= 11(-2)	= 9 (-4)	= 5 (-5)	= 0
	22	23	29	30	30	30

There is a one technician currently in training in Khartoum at the Wadi Magboul Institute who will return in 1984, and join Project 044/II. There are five mechanical technicians currently studying in Cairo. These men will return and rejoin the Department in 1985. The overall technician cadre should stay at approximately 30. From this number, two to three nominees per year will be sent to Cairo, Khartoum, or the Sana'a vocational Training Center for six to nine month's formal training in various aspects of construction and construction management. These men will return and rejoin the Department, usually as junior technicians. They will serve as junior technicians for two years, during which time they will be given a series of in-service training courses at the Rural Water Training Academy. After two years they will be tested, and if they pass, they will be promoted to senior technicians. The in-service training courses for technicians will focus on the theory and practice of construction management, and typically will last for two to three weeks per session. There will be two to three such sessions per year.

There is a clear intent to shift more responsibility for field construction supervision over to the RWSD. For this reason the number of local hire technicians is phased down beginning in 1986 and phased out by the fifth year of the extension. These men who are now directly hired by Project 044 might be asked to join the RWSD at the time it converts to being an autonomous authority. Alternatively, they might join another government department, LDA, or CYDA Coordinating Council (provincial level technical office). In addition, they could find employment in the private sector.

The other major focus of training for the RWSD staff would be in the areas of planning and administration. Over the five years, up to ten candidates would be identified and nominated for formal academic training in various aspects of planning and administration. This training typically would last from 6 to 18 months in Cairo, Khartoum, or Jordan.

However, it may prove difficult to find motivated candidates who have mastered the necessary prerequisites and are qualified for training outside of Yemen. Accordingly, the Rural Water Training Academy will be designed and equipped to conduct short in-service courses in administration and planning. These would typically last one to two weeks. Three to four such in-service courses normally would be conducted each year. Sometimes, the technical cadre and the administrator/planners would be asked to undergo this training together when it focused on things like cost accounting, documentation for field expenses, bidding, contractor selection, etc.

In addition to the primary areas of training, there would be additional areas of emphasis like health and sanitation, renewable energy, and appropriate technology and technical training for RWSD and LDA contractors. The technical cadre of RWSD/O44-II would be given short one to two week courses on water as it relates to health and sanitation. From time to time during the technical training sessions, specific materials on appropriate technology and/or renewable energy like windmills or photo-voltaic solar pumps would be covered. To strengthen the private sector capability to respond to the needs of the RWSD, short training sessions would be held each year for contractors nominated by the LDAs and RWSD. These training sessions would last four to six weeks and would cover such topics as cost estimation and bid preparation, as well as technical aspects of field construction like proper mixing and placement of concrete, proper layout of piping distribution systems, installation of pumps and motors, proper care of tools and equipment, etc. An illustrative schedule for contractor training is given below:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTALs</u>
Private Sector						
Contractor Trainees	4	4	5	5	6	24

Finally, for villagers, Project 044/II would continue to run a short course in pump and motor operations. This course was established by WHO and Project 044 working together. Courses currently last four weeks or 24 days. Pump and motor maintenance courses will be held twice a year in Sana'a or Hodeidah. Approximately 20 candidates will be trained per session. Ten candidates will be nominated by Project 044/II and ten candidates from other villages will be nominated by RWSD and LDAs. There will be 200 trainees over the five year extension as follows:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTALs</u>
044/II	20	20	20	20	20	100
RWSD/LDA Nominees	20	20	20	20	20	100
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	40	40	40	40	40	200

Fellowships Summarized:

- Twelve fellowships would be granted for technical training in the region in places like Khartoum, Cairo, or Jordan. If each fellowship is assumed to be six months, this represents six person years of technical training.
- Ten fellowships would be granted for training in public administration or related disciplines in the region. At one year per fellowship, this would represent ten person years.

Short-term Training Summarized:

- Technical
3 sessions per year for 3 weeks per session
10 trainees per session
90 person-weeks of training x 5 years = 450
person-weeks
- Administrative
2 sessions per year at 2 weeks per session
5 trainees per session
24 person-weeks per year x 5 = 120
person-weeks
- Health and Sanitation
2 sessions per year at 1 week per session
10 trainees per session
20 person-weeks per year x 5 = 100
person-weeks
- Private Sector
Contractors
1 session per year at 4 weeks per session
24 trainees x 4 weeks = 96 person-weeks
- Pump and Motor
Maintenance
2 sessions per year at 4 weeks per course
20 trainees per session
160 person-weeks per year x 5 years = 800
person-weeks of training
- Water and
Sanitation Seminars
(International)
2 persons for 2 weeks per year x 5 years =
20 person weeks plus travel

Total: 1,566 person-weeks of short-term training.

5. A fifth component of the institution-building strategy involves the creation of a rural water hydraulics laboratory. The RWSD Training Center would also be expanded.

At present, the RWSD has a small training center behind their offices in Hasaba. The training center is housed in a warehouse build by Project 022, which has been converted to use as classrooms. Currently it is used approximately twice a year to conduct training courses for villagers in pump and motor operations and maintenance. Under Project 044/II as part of the institutional-building component, it is proposed that the in-country training capabilities of the RWSD be substantially expanded.

Because of the limited number of high school graduates available in Yemen, it is hard to find qualified candidates to send outside for training. Therefore, the RWSD has decided that a substantial amount of training must be done in Yemen. For this reason, it is proposed to add one OPEX/TCN technical trainer to the staff of RWSD. The OPEX/TCN staff person would head up the RWSD training center until a suitable Yemeni was found. The OPEX staff person would probably be recruited from an institution in the Middle East which specializes in training people to work in the water sector of developing countries.

As head of the training academy he would be responsible for conducting several training programs each year to address the technical deficiencies of the RWSD staff, private contractors, and LDAs.

The principal candidates for training would be the technical and administrative staff of the RWSD. A typical training session would last for two or three weeks. Construction technicians might be given intensive applied courses in math to give them further background in the technical aspects of rural water systems. They could be given training in public health and drainage. The administrators within the RWSD could be given training in cost accounting, financial management, report writing or other areas where experience showed that they needed additional training.

Other candidates for training could include staff from the LDAs who would be necessary to implement an FAR system, private sector contractors, or candidates from affiliated development institutions on a space available basis.

The Hydraulics Laboratory - Technical trainees would have access to a hydraulics laboratory equipped to teach the principals of proper rural water system design and construction. The laboratory would include such things as a centralized flow system utilizing clear plastic piping and colored fluids to teach things like friction loss and fluid mechanics. It would include demonstration flow meters to measure turbulence and laminar flow, pressure valves, and other kinds of technical instrumentation to teach students how to measure fluids. The hydraulics laboratory would be equipped to demonstrate visibly what happens when a three inch diameter pipe full of water branches off and enters a one inch pipe. The laboratory would have various kinds of water purification and filtration equipment.

The lab would include a sealed dry well to teach students how to conduct well tests. It would have demonstration solar pumping stations, windmills, and other renewable energy technologies. It would have a small concrete laboratory to teach the properties required to mix good quality concrete. It would demonstrate various relevant construction practices like the proper use of concrete formwork. A small Arabic film library would be attached to the training academy, teaching subjects related to health and water.

6. A sixth component of institution-building involves the expansion or establishment of three branch offices for the Rural Water Supply Department.

The purpose of these branch offices will be 1) to improve access of villagers to RWSD staff, and 2) to increase the ability of RWSD to respond to local needs. At the present time as part of its effort to respond to the needs of rural Yemen, the RWSD has opened two regional offices. One of these is in Dhamar and was established in response to the earthquake of December 1982. The other is located in Hodeidah. Both of these offices exist at least in part to make it easier for villagers to secure access to the Rural Water Supply Department. As such, these offices can be seen as part of the nation building process, as the central government attempts to extend goods and services to the people of the countryside. They also represent at least a first step towards planning for development from the bottom up rather than always initiating things from the center.

It is proposed under the extension to augment these first tentative steps which the RWSD has taken by formally assigning some of the project staff to these nascent regional offices. Such assignments increase the efficiency of the 044 staff. In essence, Project 044 currently has two regional offices: one in Dhamar and one in Bayt al-Faqih. The Project office in Dhamar is set up to be both an office and living quarters. In addition to the 044 office, the RWSD has its own office and counterpart in Dhamar. The staff in Dhamar include one senior expatriate construction engineer and his RWSD counterpart, 3 RWSD technicians, two 044 technicians, and two Volunteers (one from the Dutch Government and one from the American Peace Corps.) The existence of this field office substantially increases the efficiency with which things can be done in Dhamar. Drafting, design, and storerooms are all consolidated at the provincial level. The existence of this office creates a base for operations that is much closer to work in the field.

A similar model would be used for expanding the office in Hodeidah, and creating a third office in Taiz. Currently in the Tihama, Project 044 has activities in Bayt al-Faqih and in Abs. One of these towns is an hour south of Hodeidah; the other is almost two hours to the north. Construction activities in the Tihama will become increasingly spread out over time. Under the extension, therefore, it is proposed to assign one of the Project 044/II construction engineers to Hodeidah in order to centralize field support for activities in the Tihama. Following the model of Dhamar, the Project would rent a house which was big enough to serve as an office and where surplus construction materials could be stored and project vehicles could be parked.

In 1985/86 a third office would be established in Taiz to serve as a central point for field activities in Taiz and Ibb provinces, and the southern Tihama. All of these offices would have one Project 044/II engineer assigned to them. These assignments would generally continue to be on a rotational basis, because of the seasonal nature of the construction schedule followed in Yemen. Each office would also have one or more regional mechanical technician and one draftsman assigned to it. This will facilitate support for field operations as well as improve maintenance of project vehicles and equipment. These mechanical technicians would be equipped to conduct well tests, and assist with the installation of project-related pumps and motors.

During the course of subproject construction, field technicians would be assigned on a rotational basis to these regional offices, where they would work under the overall direction of the regional engineer. This is the way both Dhamar and Tihama activities work at the present time. Creating the new offices is merely a way of formalizing and expanding what is already happening.

For reporting purposes, the regional offices--which will initially be primarily 044/II offices--will report primarily to the 044 Chief of Party, and through him to the Director-General of the RWSD. Over time, as the concept of decentralization extends further into the day-to-day operations of the RWSD, and as more RWSD staff are directly assigned to the field, they will report back to the restructured Technical Office of the RWSD.

STAFFING

The staffing proposed for Project 044/II will take place within the context of converting the Department to becoming an autonomous authority and also within the framework of trying to place as much responsibility onto Yemeni staff as possible. Conceptually this could still be described as following the servicio model described originally in the Project Proposal for Project 044. As we continue to use the term servicio, it means that Project 044/II will have the resources and staff to directly execute field activities in conjunction with RWSD staff and through this to influence various operational aspects of running the Department. While there is a measure of autonomy in project operations, there is also a substantial measure of integration with on-going activities of the RWSD. Project 044/II activities will continue to be executed under the direction of the senior leadership of the Department, with an increasing involvement of all relevant RWSD offices and staff.

Viewed impressionistically, this dichotomy of autonomy verses integration can be seen as a continuum over time. The ratio of autonomy from and integration with the activities of the Department is illustrated in the following table.

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Autonomy from RWSD	95%	85%	75%	65%	55%	45%	35%	25%	15%	5%
Integration with RWSD	5%	15%	25%	35%	45%	55%	65%	75%	85%	95%

Based on this subjective analysis, project 044/II is approaching the crossover point on the continuum, where project activities become more integrated with (rather than autonomous from) the Department. It is in this context that the following discussion about staffing needs to be viewed.

Project 044/II proposes five levels of staffing:

- (a) expatriate professional staff
- (b) Yemeni technical staff
- (c) volunteers
- (d) local-hire administrative staff
- (e) consultants

(a) Expatriate Staff. For the expatriate staff, it is proposed that nine staff would be required at the beginning of the project, including the staff for continuing Project 044-type activities, staff for Dhamar Rehabilitation activities, and staff needed to create a new Office for Planning and Management. In effect, all this staff exists within the framework of Project 044/II:

	<u>No. of Staff</u>
Project 044/II (1985)	
Chief of party	1
Executive Officer	1
Senior Design Engineer	1
Field Construction Engineers	2
Electromechanical Engineer	1
Total	6
Dhamar Reconstruction	
Civil Engineer	1
Total	1
Office of Planning and Management	
Senior Engineer/Planner	1
Engineer Planner/Trainer	1
Total	2
	<hr style="width: 10%; margin-left: auto; margin-right: 0;"/> 9

This staff would be phased down over time as more Yemeni technical staff and administrator/planners are trained. The biggest change comes in mid-project in 1987, when the expatriate staff would be cut by more than 50% from nine persons to four persons. The staffing proposed is based on the currently known variables. These levels should be reviewed and confirmed or adjusted following the normal AID evaluations scheduled for 1986 and 1988. A projected schedule for staffing is given below.

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>Person Years</u>
<u>Project 044/II</u>						
1. Chief of Party	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					5
2. Exec. Officer	XXXXXXXXXXXXXXXXXXXX					3
3. Senior Design Engineer	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					4
4. Construction Engineer #1	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					5
5. Construction Engineer #2	XXXXXXXXXXXXXXXXXXXX					3
6. Electromechanical Engineer	XXXXXXXXXXXXXXXXXXXX					3.5
<u>Dhamar Reconstruction</u>						
7. Civil Engineer	XXXXXXXXXXXX					2.5
<u>Office of Planning and Management</u>						
8. Senior Management Engineer	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					5
9. Administrative Planner/Trainer	XXXXXXXXXXXX					<u>3</u>
TOTALS	9	9	8.5	4.5	3	34

Six of these staff positions are a continuation of current positions. The new positions include the electromechanical engineer and the two staff proposed for the Office of Planning and Management. The electromechanical engineer would be responsible for such things as supervising well tests and the installation of pumps and motors; supervising the workshop for maintenance of vehicles and project equipment; and designing and executing a training program twice a year for villagers in pump and engine operations and maintenance.

In 1985, these staff would continue to be internationally-hired expatriates. However, in the interests of augmenting the capability of the RWSD, a serious and sustained effort would be made to Yemenize this staff. Therefore, Yemeni junior professional staff would be recruited on an ad hoc basis when they became available. Some of these junior professional cadre probably would be recruited from among the Yemeni under-graduates currently studying engineering in the United States.

An illustrative schedule for replacing the international professional staff with Yemeni junior professionals is given below. The figures below the calendar year are expressed as a ratio of expatriates to Yemeni professional staff:

<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
9:0	8:1	7:2	5:4	4:5

It is planned that the expatriate staff will phase down, particularly in the third year of the extension. It is also expected that the Department will become an autonomous authority with an augmented budget in 1986/87. Any Yemeni professional staff who join the Project in 1987 or thereafter would be hired by the Department and seconded or assigned to work with Project 044/II. Any who join the Department before 1987 would be hired jointly by Project 044/II and RWSD. Yemeni professional staff are hard to find. If two or three engineers were to become available in 1985 or 1986, it is recommended that they be hired by the RWSD according to its present salary scale. Project 044/II would agree to pay the difference between this salary level and those salaries which would be authorized when RWSD becomes an autonomous authority. For the time being, the NWSA compensation policies would be adopted for calculating these salaries.

(b) Yemeni Technical Staff. The core of the Rural Water Department's present field construction capability comes from the 22 Yemeni construction technicians who have been trained under Project 044 and the twelve local staff who support field activities. This includes the field support office, warehouse and supply office, mechanics, carpenters, and the administrative and finance group. Of the 22 construction technicians, 11 are hired directly by TransCentury and 11 are on secondment from the RWSD/MPW.

Under 044/II, it is proposed that this number of RWSD technicians be increased to 30, according to the following schedule:

	<u>1984</u>		<u>1985</u>		<u>1986</u>		<u>1987</u>		<u>1988</u>		<u>1989</u>
RWSD Technicians (Direct-hire)	11	(+1) =	12	(+6) =	18	(+3) =	21	(+4) =	25	(+5) =	30
044/II Tech. (Local-hire)	11		11		11	(-2) =	9	(-4) =	5	(-5) =	0
Totals	22		23		29		30		30		30

These technicians are generalists. They work with almost all phases of construction, including survey and design, drafting, village liaison and negotiations, contractor selection, construction supervision, and training villagers in the operations of rural water systems. There are also mechanical technicians who are included within this group of 30 men. Mechanical technicians currently are responsible for such things as assisting with well tests, and assisting with the installation of pumps and motors, as well as being responsible for the maintenance of project vehicles and equipment such as concrete mixers, aggregate shakers, generators, and compressors.

The construction technicians are becoming somewhat specialized, and this process will continue over the life of the project. For now, however, most technicians serve several functions. When the complement of technicians reaches 30, they would be constituted approximately as follows:

- 4 surveyors
- 4 draftsmen
- 3 regional officers (Taiz, Dhamar, Hodeidah)
- 5 mechanical technicians
- 14 construction supervisors
- 30

(c) Local-Hire Administrative Staff. To support the field construction of 20 water systems a year, or seven construction teams per quarter, Project 044 currently requires 17 field support staff, allocated as follows:

	<u>Staff</u>	
1. Administration		
Director of Administration	1	(044)
Clearances Officer	1	(044)
Secretary/Translator	1	(044)
Typist (vacant)	1	(044)
2. Finance		
Accountant/Bookkeeper	1	(044)
Cashier	1	(044)
3. Field Support Office		
Field Coordinator	1	(044)
Assistant Field Coordinator	1	(044)
4. Warehouse & Supply		
Warehouse Supervisor	1	(MPW)(OPEX)
5. Construction Yard		
Senior Carpenter	1	(044)
Junior Carpenter (vacant)	1	(044)
Mason (vacant)	1	(044)
6. Mechanics		
Senior Mechanic	1	(MPW/RWSD)
Senior Mechanic	1	(044)
Apprentice	1	(044)
7. Drivers		
Truck No. 1	1	(044)
Truck No. 2	<u>1</u>	(044)
	17	

Project 044 currently has 14 of these 17 positions with three vacancies. Of the current 17 staff, 15 positions are locally hired by Project 044, and two staff are currently seconded by RWSD. An illustrative turn-over schedule showing the RWSD assuming increasing responsibility for supporting field construction activities is given below:

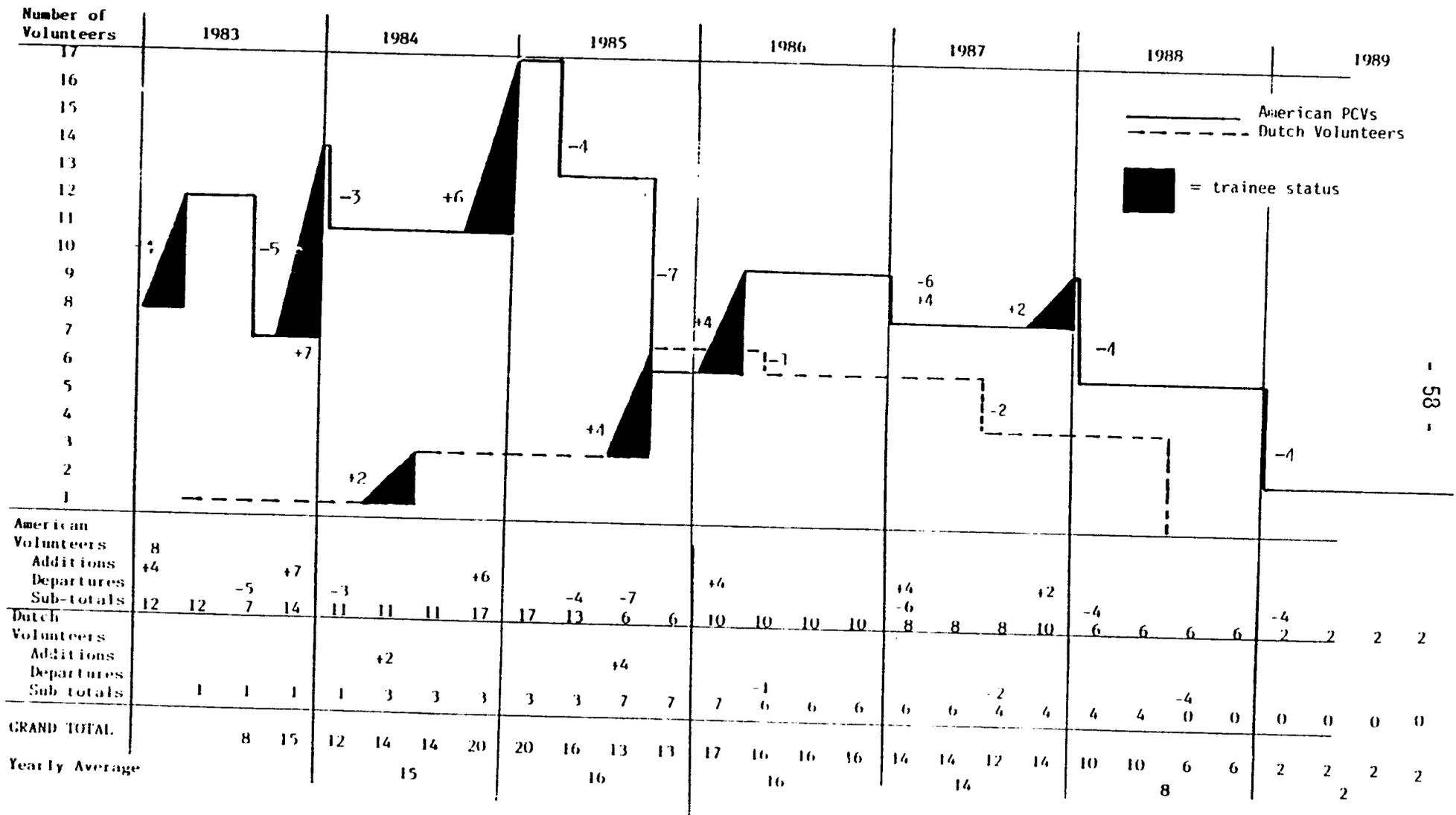
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Project 044/II Field Support Staff	15	14	11	8	5	0
RWSD Field Support Staff	2	3	6	9	12	17

During the years 1985-1987, most of the additional RWSD staff seconded or assigned to work with Project 044/II would be on the technical/mechanical side and would include mechanics, carpenters, drivers, warehouse and supply officers. Until 1987/88, Project 044/II would remain largely autonomous in the areas of administration and finance, while the Office of Planning and Management, the OPEX staff, and others work to strengthen the RWSD's own capabilities in these areas. After 1987, when it is expected that the Department will become autonomous, the RWSD will assume greater direct responsibilities for the administration and financial management of field construction.

(d) Volunteers. Volunteer technical staff--including both American Peace Corps Volunteers and Dutch Volunteers--have made a major contribution to the success of Project 044 to date. Under the extension the continued use of Volunteers is proposed, but in diminishing numbers as the Yemeni technicians become better able to undertake project construction supervision.

The exact number of volunteers who are in Yemen at any one time is hard to predict because of the vagaries of recruitment, training cycles, and possible early terminations of volunteers. Project 044 has been extremely fortunate in the consistently high quality of volunteers who have been recruited to work with the Rural Water Supply Department. It is hoped that such volunteers will continue to be available in the future. To increase the likelihood of maintaining the needed level of technically qualified volunteers, it is proposed under the extension to add additional Dutch Volunteers to work along side the American Volunteers. This supports the general trend of increased collaboration among the foreign donors working within the RWSD.

During the years 1984 through 1987, there will be an average of approximately 15 volunteers working with Project 044/II. (See chart on the following page for details.) During Phase I from 1980 to 1984, Project 044 has aimed at an approximately equal mix of engineers, architects and construction supervisors. This strategy will continue through most of 1985 and 1986, but as more trained Yemeni construction supervisors become available as counterparts, it will be necessary to increase the number of trained engineers and architects among the volunteers. By the end of 1987, and for the duration of the project, the volunteers should be



predominately civil or mechanical engineers. This need for increasing the number of engineers represents another reason for mixing Dutch and American Volunteers together. Because of specializations within the Dutch labor market, the Dutch volunteer program appears to have a better chance of recruiting engineers trained to work in the water sector. The projected ratio of American to Dutch Volunteers on a yearly basis is given below:

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Ratio of American to Dutch Volunteers	13:3	11:5	10:6	9:5	6:2	2:0
Totals	16	16	16	14	8	2

On balance, over the five years in which Volunteers from both programs are represented within Project 044/II, the Dutch Volunteers represent a cumulative average of 30% and the American Volunteers represent 70% of the volunteer presence.

(e) Consultants. Consultants would continue to be used to augment the work of the direct-hire staff. The description of prospective roles for consultants at this time is illustrative and not exhaustive. However, consultants would be used for such things as:

- public health analysis
- sanitation and drainage
- health education
- training
- audits and evaluation
- financial management
- appropriate technology
- OPEX recruitment
- human resource development
- dam design engineering

In Yemen it is difficult to find good qualified expatriate staff who are able to work and function inside a Middle Eastern bureaucracy. Therefore, Project 044/I has often sent prospective staff out to Yemen on a consultancy basis for one to three months to see if a proposed long-term candidate was suitable. Also, when Peace Corps Volunteers have completed their service, they have generally been hired for one to three months as consultants to augment the activities of the regular staff. This strategy will continue under 044/II. Based on the past three years, Project 044 has averaged about 16 person months of consultancy services per year. Extrapolating from this data base, seventy-two person-months of consultancy services are proposed for 044/II, according to the following schedule:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>Total</u>
Person-months of consultancy time	18	18	14	12	10	72

EOPS #2: The Rural Water Supply should be able to implement the construction of rural water and sanitation projects in conjunction with Local Development Associations and the private sector.

This End of Project Status represents a substantial evolution of the Department's capabilities over the next five years. Currently most of the rural water systems which are constructed around Yemen are done on an entirely turn-key basis by foreign donors,* or by private contractors and/or Local Development Associations. To date, only Project 044 has attempted to work within RWSD, and at the same time reach out and work with the Local Development Associations and with private sector contractors.

Under 044/II, it is proposed to continue with this strategy, but expand and extend it, and try to institutionalize the process, so that by the end of five years the RWSD has adopted this strategy as its own.

We assume that the Government will not have the resources to significantly expand the staff of the Ministry of Public Works or the Rural Water Department, so the Department will be required to structure itself to be a survey, design and contracting organization. It will not have the human or financial resources to directly implement significant numbers of rural water projects. However, to gain credibility and experience, it will need to have staff who have had direct hands-on experience constructing rural water systems. And it needs to have a corporate familiarity with the logistical and administrative problems inherent in supporting the construction of rural water systems.

At the same time that the RWSD needs to develop more than a vicarious familiarity with field construction, project 044/II needs to have some legitimate reason to work with various offices of the Department. The best and most inclusive reason is field construction. This is the principal

*Saudi Arabia, Japan, Iraq, UNICEF and UNCDF are turn-key projects. With the exception of USAID under projects 022 and 044, only W.H.O. (supported by a grant from the Dutch Government) has attempted to play an institution-building role with the RWSD. It appears that the Dutch now plan when their activities in Dhamar are finished after two years, that their five person technical assistance team will shift over to play an advisory role helping with the operations of the RWSD.

reason why the Department exists. Therefore, it is proposed that Project 044/II, working with various offices and staff of the RWS, be responsible for the construction of 100 small water projects over a five year period. These projects would be constructed using three overlapping systems:

- (1) As currently done using Ministry staff, local hire staff, the Local Development Association, and the Peace Corps Volunteers. (50 projects)
- (2) In collaboration with other donors, where the other donors provide the commodities, the technical designs, or a related component of a project like a drilled well. (36 projects)
- (3) Through FAR systems, where the RWS and the LDAs are responsible for the actual execution, and Project 044/II is responsible for designing the management systems and inspecting the work to see that it was done according to agreed standards and specifications. (14 projects)

Annual targets would look like this:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>Totals</u>
RWS-044/II:	20	15	10	5	0	50
With Other Donors:	0	4	7	11	14	36
RWS/LDAs(FAR):	0	1	3	4	6	14
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	20	20	20	20	20	100

The number of projects constructed directly by RWS and 044/II working together remains at the current level through 1985, and then adjusts itself fairly substantially as more of an identity is achieved between RWS and 044/II, following the servicio model described on page 51. By the end of the third year the 044/II staff is cut in half, and the number of RWS technicians will have increased to 21 out of 30 (70%). By the fourth and fifth years, the 044/II local hire staff phases out, and the expatriate advisors are reduced to three. The number of RWS technicians has increased to 30. This changing relationship of Project 044/II with the RWS and growing capability of the Department is summarized in the chart below:

	1984	1985	1986	1987	1988	1989
044/II (degree of integration with RWS)	45%	55%	65%	75%	85%	95%
044 Expatriate Staff	6	9	9	8.5	4.5	3
044 Local Hire Staff	11	11	11	9	5	0
RWS Technicians	11	12	18	21	25	30

It is anticipated that the RWSD staff in 1989 will still be responsible for coordinating the work of six to eight foreign donors. A significant part of this work will probably continue to be turn-key activities, where the RWSD's coordination job will be minor. However, other donor activities and the issues of village liaison and fielding requests from villages, sheikhs and tribal leaders will continue to require a significant amount of the Department's time. In view of the present staff capabilities that exist within the RWSD and the present and projected workloads, it seems reasonable to aim for a total of 14 subprojects which would be unilaterally supervised by the RWSD under FAR systems.

It also seems that the FAR systems on a pilot basis represent a reasonable system to introduce to Yemen, as a possible way to link the RWSD, the Local Development Associations and the private sector contractors more closely together.

The role of collaboration among the various foreign donors is something which also needs to be encouraged. There is no sure way at present to guarantee collaboration, but the USAID Mission and TransCentury staff have been holding discussions with the German aid program (KFW) about collaborative assistance for Dhamar, where the Germans would provide commodities and equipment and the Americans would be responsible for construction supervision. There have been some similar preliminary conversations with UNICEF. It seems reasonable, therefore, over the five year life of the project to estimate that 36 projects out of 100 could be executed collaboratively.

Based on the experience of Project 044, it is suggested that the extension aim for 50 mountain projects and 50 Tihama projects. Calculated at current prices, direct costs for 100 projects would be as follows:

50 Tihama Projects	Village Contribution	\$ 17,060 x 50 = \$	853,000
	Project 044/II	38,272 x 50 =	1,913,600
		<u>\$ 55,332 x 50 =</u>	<u>\$ 2,766,600</u>
50 Mountain Projects	Village Contribution	\$ 20,007 x 50 = \$	1,000,350
	Project 044/II	26,025 x 50 =	1,301,250
		<u>\$ 46,032 x 50 =</u>	<u>\$ 2,301,600</u>

For collaborative subprojects, the design team has assumed that other donors would contribute commodities for 18 Tihama projects and 18 mountain projects, and that commodities and equipment represent 50% of the direct foreign donor costs.

18 Tihama Projects (Other Donors):	\$ 38,272 x 50% x 18 =	\$ 344,448
18 Mountain Projects (Other Donors):	\$ 26,025 x 50% x 18 =	\$ 234,225
Total		<u>\$ 578,673</u>

The cost to Project 044/II for 100 subprojects would look like this:

50 Tihama projects at	\$ 38,272 =	\$ 1,913,600
50 Mountain projects at	\$ 26,025 =	\$ 1,301,250
Subtotal		<u>\$ 3,214,850</u>
Subtract Other Donor Contributions	-	-(578,673)
Total		<u>\$ 2,636,177</u>

Fixed Amount Reimbursement (FAR).*

A modified FAR system will be employed on a trial basis to reimburse the construction of up to 14 subprojects.

As part of the institution-building strategy for working with the RWSD and helping it to assume increasing responsibility for project implementation, a small FAR component is proposed. This would be phased in gradually, so that there would be time to design the administrative systems and train RWSD staff in their operations. A suggested schedule for FAR subprojects to be jointly constructed under departmental and LDA auspices is given below:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTALs</u>
RWSD/LDA (FAR)	0	1	3	4	6	14

These 14 subprojects represent 14 percent of the total of 100 subprojects proposed for construction under Project 044/II. However, for 1989, the following schedule of construction activity is proposed:

* Fixed Amount Reimbursement (FAR) is a system which the U.S. Government sometimes uses in its USAID assistance program to reimburse a host government Ministry or Department a predetermined amount of money for successfully executing a particular piece of work. Thus, for example, a rural water system would be surveyed, designed, estimated, contracted, and constructed by or through the RWSD. USAID or its designee would review the designs, approve the cost estimations, and inspect the construction to see that it met the agreed standards and specifications. If it met the specifications, the RWSD would be reimbursed an agreed percentage of the estimated cost of the project.

	<u>1989</u>	<u>Percent</u>
RWSD-0044/II:	0	0
With other donors:	14	70
RWSD/LDA(FAR):	6	30
	<u>20</u>	<u>100</u>

From this schedule, by the fifth year of the project, the RWSD/LDAs would be unilaterally constructing 30 percent of the projects proposed for construction, as well as supervising any remaining projects being constructed. At the same time the RWSD and Project 044/II are gradually achieving an identity so that by 1989 Project 044/II is essentially subsumed within RWSD.

The FAR component is designed to serve as a project management tool to facilitate the institutional development of the RWSD. The FAR component would be used to reimburse the construction of water storage and distribution systems. This activity is based upon creating a sustained symbiotic linkage between the RWSD, the Local Development Associations, and private sector Yemeni contractors. The RWSD or even a revised RWA is not expected to have the resources to undertake significant direct field construction. Instead it will have to work through various intermediaries. The Local Development Associations represent one such intermediary, and private sector contractors are another. Other intermediaries who could serve to multiply the range and effectiveness of the RWSD might emerge during the course of project implementation. The use of the FAR mechanism provides a useful vehicle to help explore with the RWSD/RWA the issues of privatization and the implications of working through the LDAs and the contractors. Under the model currently envisioned, the RWSD would do the survey and design work, and supervise the construction, while the LDA was responsible for the actual work. Under an FAR system, each party would be reimbursed for the work they actually did, according to closely calculated estimates.

If this mechanism is shown to be a cost effective technique for producing rural water systems, then it could be extended or expanded after 1989 under other donor sponsorship.

DISCUSSION: Project 044 to date has had good experience in working with the Local Development Association in the Bayt al-Faqih area in the Tihama. The LDAs are an important institution of government in Yemen, helping to link the Central Government and the rural villages together. LDAs also select and supervise contractors and contribute directly or indirectly towards the financing of village projects through the zakat tax. The zakat tax is a traditional Islamic tithe collected at the District level, and 75 percent of this is returned to the LDAs to finance rural development endeavors. (See Social Soundness Analysis for further details.)

The project has also had good experience working with local contractors. Project 044 has trained six contractors in the construction of rural water systems. Some of these contractors have reached the point where they are now directly contracting with the Bayt al-Faqih LDA to build rural water systems on their own. Formerly the quality of these contractor-constructed systems was very poor. However, recently some contractors have adopted several improved techniques, including the use of plywood formwork for concrete, the proper mixture of concrete, and proper vibration. The Project 044 standard designs for elevated reinforced concrete tanks have been at least partially adopted by one LDA and local contractors in the Tihama (as well as by the German project in Amran and the Dutch project in Radaa.)

At the present time, among the LDAs with which Project 044 has worked only the Bayt al-Faqih Local Development Association appears to be strong enough to undertake an implementation relationship with the RWSD. However, there are also private Yemeni contractors in Taiz, Ibb and Sanaa provinces, who could construct subprojects directly for the RWSD. Over time other LDAs and other contractors in other provinces might be found or trained.

Under Project 044/II it is proposed that up to 24 small private sector contractors be trained in proper construction techniques. These training courses would be open to prospective Ministry contractors. Trainees would be nominated by the Ministry, LDAs, and Project staff, and would be given a small stipend to cover their living costs for the length of the training. Training courses would range from four to six weeks, and would cover such things as: job setup, tools and equipment, masonry, concrete work, job costing and estimation, bid submissions, pipe fitting and sanitary water distribution. Training would be conducted under the auspices of the Rural Water Training Center at Hasaba. A schedule for trainees is given below:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTALs</u>
Trainees	4	4	5	5	6	24

Additional considerations: Subprojects

(1) Gabion Check Dams. The Ministry of Public Works has stated that it is a high priority to develop alternative water supply systems which do not deplete the ground water. Accordingly, to the extent that it proves feasible, Project 044/II will experiment with three to five small gabion check dams as a technique for catching and storing runoff water which might be useful for village water supply systems. Project 044, working in Dhamar under the earthquake reconstruction component has experimented successfully with a series of small gabion structures across a wadi to trap spring runoff. It is proposed to expand this kind of experimentation under the extension.

A typical gabion catchment structure might be 10 to 15 feet high and perhaps 25 to 50 feet across. They would be made only of gabion wire cages and rocks. They would not be earthfilled structures. They would be designed to permit water to overtop them in the event of floods, and would not require substantial spillways. They would be designed to be small, low-risk, low-maintenance structures, whose purpose was to slow flash flood runoff, impound small amounts of flood water, and assist with the recharge of springs and the ground water aquifer. To this end, a series of several smaller gabion structures would be more effective than one larger storage dam. Such mini-dams would store only a small fraction of the runoff from a flood, and would not create problems for downstream water users. Typically, they would be "owned" by a nearby village in the same way that villagers now "own" their water systems. During the prefeasibility and design phase it would be necessary to look closely at public health issues like malaria and bilharzia to insure that no environmental hazards were created. A typical gabion structure is estimated to cost no more than US\$20,000. These five gabion check dams would be counted as part of the 100 proposed subprojects.

Using these check dams as a first step, Project 044/II will explore the feasibility of adding a water conservation and erosion control component to field activities. This experimentation would have to be compatible with the mandate of the RWSA or the proposed Rural Water Authority. In addition to the check dams, further work could include such things as experimentation to improve water infiltration back into the aquifers to increase spring flows and general water recharge, as well as appropriate afforestation and reforestation activities to slow water runoff.

(2) Drainage. All future subprojects under Project 044/II will have an appropriate drainage component. It is proposed that Project 044/II put in standardized drainage systems around all stand pipes where standing water could collect and experiment with additional provisions for the disposal of excess waste water as required by the terrain and conditions of particular villages. The mountainous terrain of most villages in the central highlands and the high porosity of the soil in the Tihama seem to lend themselves to simple cost-effective solutions to the disposal of waste water. Sometimes, for example, this waste water can be used for irrigating fruit trees or vegetable gardens. It would also appear beneficial to introduce the idea of soakage pits in a few demonstration households, so that people learn how to deal with the issues of waste water at the family level.

(3) Household Connections. Project 044 has generally installed community stand pipes in villages at the same time it has also put in "tees" in the distribution line to facilitate villagers completing their own household connections. Often over time the community stand pipes have virtually gone out of use as the villagers completed the connections to their houses. Under Project 044/II it is proposed to continue with the same policy. Systems will be designed with enough flexibility to permit the villagers to adapt them to their needs.

All systems will be built with tees, to facilitate modifications. The number of stand pipes will be minimized if it appears that the villagers will go ahead and put in household connections shortly after the completion of construction.

(4) Water Meters. Project 044/II will experiment with and supervise the installation of water meters in those villages where the village leaders believe this will be an acceptable practice. Meters will be potentially helpful in determining what happens to water consumption over time. They will also provide a more accurate assessment of individual household costs and therefore allow more accurate billings. They may serve as an effective conservation measure. Therefore on a pilot basis, Project 044/II will bear the cost for metering up to five village systems. The project staff will also attempt to monitor the results of installing water meters. The village leaders will be responsible for using the meters in ways that are compatible with the social practices of the community. There are villages in the southern part of North Yemen and near Radaa which reportedly have already put in their own meters. The utilization of these new meters will be left up to the community in the same way that they are now responsible for the operations and maintenance of the systems. When money is collected, it will be collected by the same people who collect money now. If someone needs to be trained in how to read the meters, one candidate could be the person who is already trained in the operations and maintenance of the pump and engine which powers the water system. This training could easily be added to the pump and engine maintenance course presently being conducted under RWSD/044 auspices.

EOPS #3: The Rural Water Supply Department should be able to train communities in the operations and maintenance of rural water systems, and advise them on ways to deal with the public health consequences of operating such systems.

The RWSD already trains villagers in the operations and maintenance of rural water systems. Three or four years ago, the WHO staff working with RWSD put together a three week syllabus in pump and engine repair and maintenance. This course, now conducted under the joint auspices of the RWSD and Project 044/I, is held twice a year in the RWSD Training Center in Hasaba. Approximately 20 trainees per session attend the course. Typically, half of the trainees are from villages where 044 has built a project, and half are from other villages.

Villagers are also trained on-the-job during the course of construction of a rural water system in things like pipe threading, the placement and operation of valves, air-lock release mechanisms, and the general operation of the water system. In all villages, before a water system is ever built, there is a water source, and often the rudiments of a water system are also in place. Typically in the Tihama this will include a pump and engine. In some cases these will have been in place for several years, and the village will have established a system for maintaining this equipment. Project 044 builds on this pre-existing system or capability, modifying it as necessary to fit the demands of the new system.

The water systems generally already are an integral part of the community's social systems. The village leadership has taken responsibility for putting in the traditional system--whether it's a well, or a spring, or a cistern--and they have also taken responsibility for soliciting the assistance of the RWSD to improve it. Improved community water systems are popular with the villagers, and they contribute substantially toward the capital costs. On average, for the first 50 projects, villagers contribute 36.5 percent of the capital costs. They also cover the operations and maintenance costs after a system is completed. Typically this runs nearly \$2,000 a year.

Currently Project 044 staff--of which 25 percent is Ministry staff on secondment--works closely with the village to design an appropriate community water system. The Project staff then lives in the village for two or three months during the course of construction. During this time project staff usually becomes very familiar with the personalities and leadership style of the community as a subproject is being built.

Further, to minimize the problems of operation and maintenance, the systems are designed to be as simple as practical. If a gravity feed system is possible, for example, this will be used in preference to a system requiring a pump and motor, because of the reduced operations cost, and the lower maintenance which would be required.

Further, there is a high standard of quality control which goes into the construction of 044 rural water systems. Valves are usually American made, because of their higher quality. Piping, when it will come under significant pressures, is American pipe. The concrete in elevated tanks is made to no less than 3500 PSI standards. The water systems are designed and constructed to have a 20-year life, requiring only normal and routine maintenance.

It is proposed under the extension to continue with the same emphasis on solid simple structures and close involvement with the community during the course of construction, so that these standards are assimilated into the operating style of the RWSD. Under the servicio system, with the kinds of staffing turn-over proposed on pages 45 to 47, it is expected that the Rural Water Supply Department will continue to train rural communities in the operations and maintenance of completed systems. Thus addressing the first part of EOPS number three is relatively easy.

However, advising villages on the public health consequences of completed systems is an issue of somewhat greater complexity. The problems here are well-known: standing water, malarial mosquitoes, bilharzia, improper sanitary practices--but adapting the appropriate Western technical solution to the cultural context of rural Yemen involves a complex series of social changes that are not currently well understood. Therefore under Project 044/II, a careful program of action research is proposed. A series of village studies will be undertaken, to try to understand in a more comprehensive fashion what people believe about water and sanitation. Simultaneously, the project will continue working with the drainage of waste water in the villages as an entry point to working with sanitation.

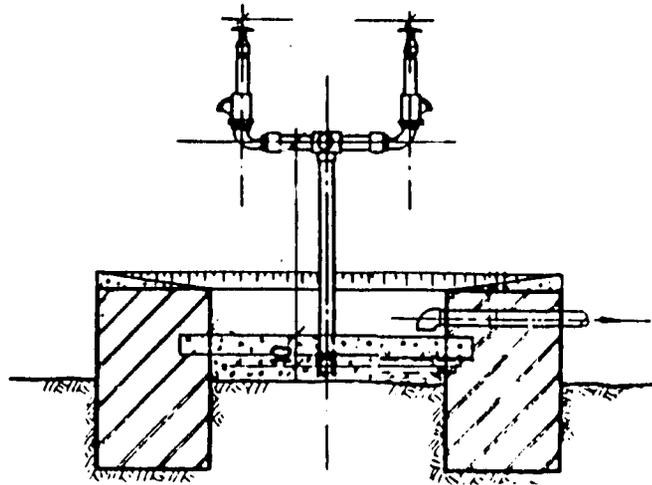
HEALTH AND SANITATION

When new rural water systems bring water into a village, this initiates the first step in a complex process of change. A second step, which is almost as important as the first, is to insure that there is adequate provisions for the safe disposal of waste water in the village. A third and even more complex step involves possible changes within households over how they use the water once it is inside their homes.

For the first two years of the extension under Project 044/II, it is proposed that project staff direct more resources at the issue of village drainage. This is potentially the most serious health issue directly related to Project 044. And it is easy to establish a connection in the villagers' minds between water coming into a village from a new system, and the need to make provisions for the disposal of waste water from the system.

At the present time, when a water project is built in a village, Project 044 initially installs stand pipes or public taps. Usually, over the following several months, the villagers modify the system to provide individual household connections. The provision of a village water system should be viewed as a dynamic process which changes over time as the new system is assimilated into the community's social structure.

To date Project 044 has experimented with several different designs for public taps, and has come up with a number of good models. Perhaps the best model is the one being used in Dhamar, which calls for locally prefabricated steel pipes and tapes, which stand above a concrete platform. Beneath the taps themselves, contained by a low concrete wall, there is a layer of crushed rock. The waste water from these public taps drains through this crushed rock and is carried through a pipe to a nearby trough where it is used for animals. It is also sometimes used to irrigate fruit trees. The siting of these public taps is carefully done, usually putting them on a slight rise, so there is natural provision for drainage. This kind of a system appears to represent a good, safe, prudent solution to the initial problem of waste water. With some modifications, such solutions often would be replicable in private homes.



Therefore, under the extension, it is proposed that more emphasis should be placed initially on educating villagers about the importance of this kind of public drainage activity. Examples should include things like soakage pits filled with crushed stones, drinking troughs for animals, or provisions to use the waste water to irrigate fruit trees. Some or all of these techniques should be introduced to each village. Educational work in these areas would be working with something which is new to the village. It would not be trying to change old established cultural practices like, for example, how people use and store water in the privacy of their homes, or how often they wash their children. It is something which is physically outside, and public, but it can also serve as an example for private homes to adapt and modify.

At the pilot level, Project 044 has also worked with other aspects of village sanitation. It has put in showers, washing facilities at mosques, or latrines into seven villages. Four of these villages were in the Tihama and three were in the mountains.

The results of these pilot experiments have been mixed, and it is not clear why one system works in one village and does not work in another similar nearby village. The socio-cultural variables in the areas of public health and sanitation are not well understood at this time. Relatively little is known about traditional water use practices, so a priority for 044/II will be to collect information to lay the groundwork for an appropriate future village health education component. This research will be conducted by project staff and consultants during 1985 and 1986.

To assist with generating a data base for future health activities, the extension will continue to construct improved sanitary facilities, but at a modest level until more is known about the cultural variables that affect their acceptability. Some provisional targets are given below:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTAL</u>
Sanitation Projects	3	4	5	5	5	22

This schedule will permit continuing experimentation and thorough evaluation. Project 044/II staff will be able to visit all subprojects on a routine schedule to identify and analyze problems that could perhaps be overcome by the design and construction of a different kind of system. These projects will be constructed in villages which want them, and which indicate their interest by a willingness to provide labor and local materials. The village contribution for sanitation projects will be comparable to their contribution towards the initial primary water system.

Other possible interventions in the health sector include the following:

(1) Construction supervisors now receive a short training module in drainage, sanitation, and communication skills. This will be followed up throughout their employment with O/A with short courses to supplement their knowledge and improve their ability to communicate it. Construction supervisors could then work with village leaders, school teachers, and village laborers on health related topics.

(2) One female PCV sanitation engineer is permanently assigned to sanitation. Unlike other 044 (male) staff, she has access to village women and can work with them on water use and disposal. Her volunteer service is completed in March 1985. Project 044/II will attempt to replace her with another female engineer. Other volunteers can work with village elders and school teachers on these topics. They will probably require some special training to do this. Volunteers can also help train technicians on these topics.

(3) Visual aids (poster/brochures) could be developed to illustrate simple points about washing hands, mosquitos, storing water safely, standing water, etc. These should be complete visual since the illiteracy rate is nearly 100% for village women and very high for the men. Experimentation will need

to be done to determine what materials will work with men and what will work with women. It may also be necessary to develop different materials for the Tihama and for mountain villages. Large posters or brochures or both could be carried by technicians and staff and posted in schools or distributed in the villages. It may be possible to use health education materials which other projects plan to develop.

(4) In mountain sanitation projects, 044 could experiment with solar water heaters to make bathing in the colder months more possible.

(5) Project 044 could experiment with water-related health education during construction of a water project and after a water project is in operation to determine when villagers are more receptive to this information.

(6) Water systems will be visited at set intervals after completion. (For example: 6 months, 18 months, 30 months and 48 months). During these visits water use problems could be evaluated and some help provided to the village to solve them.

(7) The pump and motor maintenance course for village water system operators could include training in water use and disposal.

Finally, Project 044/II staff will explore with the USAID-funded Tihama Primary Health Care project (TPHC) the possibilities of collaboration. It may be possible in one or two cases to construct water projects in villages where there is a primary health care worker who could undertake some health education activities. Collaboration in the field of water use education might also be possible with British health workers working to improve the health care system in Abs district.

EOPS #4: The Rural Water Supply Department should be able to share its financial burden by developing effective ways of increasing village contributions and foreign donor support.

This section begins with a brief discussion of the financing of the Rural Water Supply Department itself. The RWSD already reportedly receives most of its financial assistance directly from the YARG. According to published reports* The YARG's contribution to the Budget of the RWSD has generally doubled or tripled each year over the last six years from 1976 to 1982. In 1976/77, the YARG budget for the Rural Water Supply was only \$660,044. In 1981/82 this had increased to \$15,758,241, an increase of more than 2,000 percent. At the same time, the YARG's contribution to the RWSD as a percentage of the total amount of money for which the department was responsible (including all reported donor assistance to the department) increased from 8 percent in 1976/77 to 71 percent in 1981/82. The details of these costs are presented in the table below:

	YARG Budget for RWSD (US\$)	Total Financing for RWSD Including all Donors (US\$)	YARG Contribution as % of Total
1976/77	660,044	8,067,297	8
1977/78	1,952,308	7,831,428	25
1978/79	1,098,901	8,978,022	12
1979/80	2,783,736	5,115,604	54
1980/81	7,780,220	13,604,395	57
1981/82	15,758,241	22,087,912	71

Therefore, at a national level, the RWSD is already drawing a substantial amount of budgetary support from the rural villages of Yemen to the extent that the central government's budget is paid through taxes from the rural areas and customs duties.

At the village level, the RWSD also receives significant direct contributions toward the capital cost of the community water supply projects. For the first 50 projects, the average village contribution has been 36.5 percent toward the direct costs of the project. This does not include preconstruction investments which the village may have made to permit the project to be built. These include such things as access roads, drilling or deepening wells, casing or lining wells, and often pumps and engines. These costs are often difficult to calculate precisely, because they may have been accrued several years earlier and records may not have been kept. However, if representative and typical pre-construction costs are derived, the villages' contribution toward the total direct capital costs for a project increase from 36.5 percent to 67.7 percent. This represents a very respectable contribution from relatively poor villages, who clearly are paying significant amounts of money for a water system which they really want.

*Ministry of Public Works, Twenty Year Review, p. 355.

Going beyond capital costs to recurring costs, the villagers are totally responsible for covering these costs. In the Tihama projects, and in those mountain projects which have pumps and motors, the villages typically pay 800 rials a month to cover operations and maintenance costs. Projects which are fortunate enough to have gravity fed systems have virtually no operating or maintenance costs. The 800 Rial running costs consists of 400 Rials per month for oil and diesel fuel, and 400 Rials a month for the operator's salary. Translated into dollar amounts, this comes to more than \$1,900 per year per village to operate and maintain a village water system.

It is a measure of the seriousness with which Yemeni villagers regard their village water system that on average they will have spent \$69,614 toward the capital costs of the system, and they will spend another \$1,900 per year to operate and maintain the system over its 20 year life.

	<u>Village</u>	<u>YARG/Project</u>	<u>Total</u>
Preconstruction costs:	\$53,250	\$2,150	
Construction costs:	16,364	34,021	
Preconstruction and construction costs:	<u>69,614</u>	<u>36,171</u>	\$105,785
Operations and Maintenance @ 1,900 per year* for twenty years:			
Subtotal:	38,000	0	38,000
Total:	<u>107,614</u> (75%)	<u>36,171</u> (25%)	<u>143,785</u> (100%)

Over the twenty year designed life of the project, the village would pay \$107,000 or 75 percent of the cost of the project. Foreign donors and the YARG together would pay the remaining \$36,000 or 25 percent of the costs.

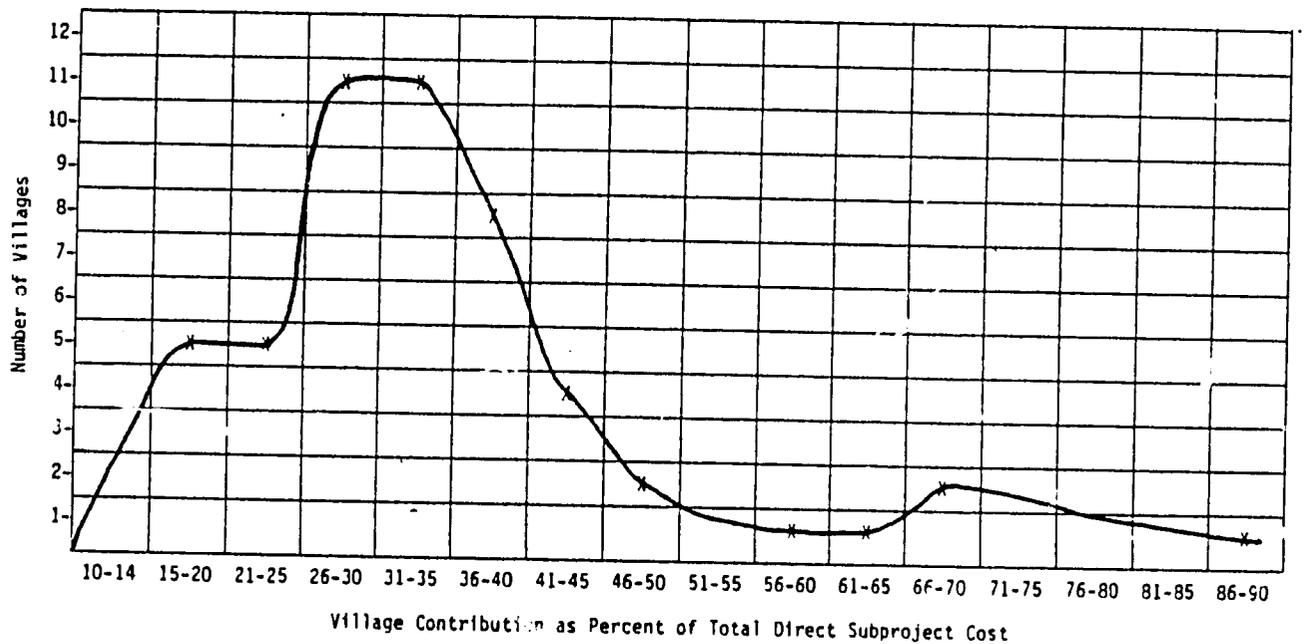
This money is paid in two ways. If there is a major purchase required --like a pump or engine, or drilling a new well,--a special assessments is made per household. These assessments are equitable and progressive and are based on a family's ability to pay. Very poor families are exempted from paying, and wealthy families pay far more than their per capita share. For operations and maintenance costs, these are usually covered by a monthly charge per household, which ranges from \$3 to \$5 per month. Again this charge is progressive, based on ability to pay. Poor families are exempted from payment, but are still given water according to Islamic

*Current present value.

strictures. Wealthy families pay more than the normal monthly fees. In almost no cases have the villagers established a capital fund to set aside money in advance for future major repairs or replacement of a pump and engine. Nor should they in economic terms, because of the inflation rate in most sectors of the economy in Yemen. No bank or other institution would pay villagers interest that would equal or exceed the inflation rate, so it is more prudent to continue to handle major costs with special assessments. The costs of rural water systems based on the first fifty completed to date range from a low of \$15,799 for a small mountain project to a high of \$155,000. The total direct project costs follow a normal curve as follows:

<u>Projects costing from:</u>	<u>Number of Projects</u>	<u>Percent</u>
0 - 15,000	0	0
\$15,000-20,000	1	2
\$20,001-25,000	3	6
\$25,001-30,000	6	12
\$30,001-35,000	1	2
\$35,001-40,000	4	8
\$40,001-45,000	6	12
\$45,001-50,000	8	16
\$50,001-55,000	5	10
\$55,001-60,000	2	4
\$60,001-65,000	4	8
\$65,001-70,000	4	8
\$70,001-75,000	1	2
\$75,001-80,000	2	4
\$80,001-85,000	1	2
\$100,000-105,000	1	2
\$155,000-160,000	<u>1</u>	<u>2</u>
	50	100

As one would expect, the village contributions to these totals also follow a standard curve. The lowest village contributions fall between 16 and 19 percent. In these communities, the villagers already had contributed substantially towards the preconstruction costs of the subprojects through the provision of various infrastructure like pumps, motors, drilled wells and casings. For accounting and programatic reasons, these preconstruction contributions are not counted as part of the village contribution. The highest overall village contributions were in the most expensive projects. Here the village contributions ranged as high as 38 percent of the total cost. The average village contribution for the first 50 projects was 36.5 percent. The percentage of village contributions toward total project costs is given graphically below:



This then is the context in which the RWSD works, as it attempts to share its financial burden with the participating villagers and foreign donors. The villagers already contribute very significantly toward the cost of the subprojects, both directly to their own subprojects and indirectly via the YARG budget through an agricultural and herd tax. The central government's financial resources will remain weak. The design group for project 044/II has reviewed this situation with the mission and the RWSD. Based on these discussions it is proposed that a series of experiments be tried through the first three years of the extension to increase village contributions to subprojects.

One model might be to give preferential treatment to villages which pledge to contribute a higher amount toward subproject construction costs. Under this system, such villagers would be moved to the head of the list, and construction would start sooner on their project. The problem with this approach, however, is that it would skew project selection over time toward wealthier villagers, and begin to add a regressive cast to subproject selection.

A second model might be to negotiate a commitment with various LDAs, so that the LDAs agreed to cover a minimum amount of the capital costs, or agreed to match the village contribution.

A third and perhaps more serious medium term solution is to explore some kind of revolving rural credit mechanism. The systems for this would have to be carefully designed and field tested, but it might be possible to establish some kind of a revolving loan fund, where villages could borrow a percentage of the capital costs for rural infrastructure projects against future zakat taxes, or against some kind of collateral like revenue from qat.

All these options, and others which might evolve during the extension, are weighted heavily with political consequences for the central government. Therefore, anything which was actually attempted would have to be very carefully explored with the senior leadership of the RWSD, the Ministry, USAID, and perhaps other parts of the YARG, such as the Central Planning Organization.

The second part of this End of Project Status indicator--increasing foreign donor support to the RWSD--is mainly a function of institution building. As RWSD becomes a stronger and more self reliant institution, it will be better able to approach foreign donors, and better able to prepare the necessary documentation which would be suitable for foreign donor funding. At the same time, a stronger RWSD would be more attractive for foreign donors to invest resources in, because they would be more sure that their money would do what they wanted it to do. The issues related to institution building have been exhaustively discussed under the previous End of Project Status Indicators for this paper.

V. SPECIAL PROJECT CONCERNS

This part of the proposal deals with a number of miscellaneous items of concern to the project. These include the following:

- research and development
- private sector initiatives
- co-financing
- equipment, commodities and supplies
- vehicles
- monitoring and data collection
- and the possibility that the RWSO may become an autonomous authority.

RESEARCH AND DEVELOPMENT: RENEWABLE ENERGY TECHNOLOGIES

Project 044/II staff and consultants will actively explore new technologies to utilize water more efficiently, and reduce field construction costs. There will be a small research and development component to field test the utility of these new technologies. Examples of such technologies could include prefabricated water storage units, new water purification technologies, as well as such things as solar pumps, hydraulic rams, and windmills.

PRIVATE SECTOR INITIATIVES

Project 044/II will continue to work through the private sector to the fullest extent possible. It will continue to work with Yemeni contractors and subcontractors to develop their capacities, and minimize the logistical support pressures on the RWSO. It will work with private sector importers to develop markets for appropriate American-made products like solar panels, pumps and windmills, and pneumatically applied concrete equipment.

CO-FINANCING AND COORDINATION WITH OTHER DONORS

At the present time, the RWSO receives assistance from 10 foreign donor groups: (1) the American Government, (2) the Arab Fund, (3) the Dutch Government, (4) the German Government, (5) the Iraqi Government, (6) the Japanese Government, (7) the Saudi Government, (8) UNICEF, (9) UNCDF, and (10) WHO. In addition to these groups, additional assistance is under negotiation with England. Project 044/II will continue to

coordinate as closely as practical with these projects, and will actively seek ways to collaborate to reduce administrative costs or increase the efficiency of departmental operations. At the same time, it will explore opportunities for co-financing or parallel financing of rural water projects.

EQUIPMENT, COMMODITIES AND SUPPLIES

A detailed list of the equipment, commodities and supplies needed to continue this project is given in Appendix IX. The total bid, ex factory price for the equipment, commodities and supplies is estimated to come to \$745,000. The estimated cost for inland transportation from factories to TransCentury's warehouse, and port of exit is \$12,400. Warehousing and inspection, receiving, export boxing, issuing of packing lists, etc. is estimated to come to \$17,025. Ocean freight from Port of New York to Hodeidah, Yemen including bunker and port congestion surcharges based on present tariffs is estimated at \$78,500. Marine insurance from warehouse to warehouse is estimated at \$4,369. The total cost, CIF Hodeidah, is \$857,400.

VEHICLES

The present ceiling for the Project 044 vehicle fleet is set at 22 vehicles. This includes nine pickups, ten hard-top jeeps, one motorcycle, and two large seven or eight ton trucks. The vehicle fleet as of 1 March 1984 had a cumulative total of more than one million kilometers on it. The average vehicle in the fleet showed 52,000 kilometers on the odometer. The Project 044 vehicles are all numbered, and their mileage odometer figure is given in Appendix V.

The limiting variable for field activities is mobility. This is as true for Project 044 as it is for the Ministry. Project 044/II proposes to maintain the total level of field activities at 20 subprojects per year. Therefore, it is also proposed to maintain the vehicle fleet at 22 vehicles.

Based on the experience to date, it is recommended that Project 044/II continue to standardize around small Daihatsus and Toyota pickups for field construction. These are the most serviceable vehicles for use in rural Yemen. A replacement schedule for the individual project vehicles is given below:

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Replacement for 044 vehicle number...	4	1	3		
	6	2	9		
	13	7	17		
	16	8	20		
	<u>19</u>	<u>18</u>	<u>21</u>		
Totals	5	5	5	0	0

Replacement by type of vehicle:

<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988/89</u>	<u>Totals</u>
2 pickups	3 pickups	3 pickups	--	8 pickups
2 jeeps	2 jeeps	2 jeeps	--	6 jeeps
1 truck			--	1 truck
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
5 vehicles	5 vehicles	5 vehicles	0	15 vehicles

MONITORING AND DATA COLLECTION

Closely related to the issues of public health and sanitation are the issues of monitoring and data gathering. Most developing countries place little value on research. Their priorities are on tangible projects which demonstrate an immediate return to their constituents. At the same time, policy makers for donor agencies feel a strong need for research data to rationalize and justify the expenditure of money, so they can assure their constituency that resources are not being misallocated. The priorities of both sets of policy makers are valid. For the extension of Project 044/II, a low-key, low-level monitoring and data collection component is proposed. To date Project 044 has done some good, quiet research using its own staff and affiliated consultants. Some of the best writing on rural water usage patterns in Yemen has been done by consultants working for TransCentury.

The USAID evaluation of November 1983 recommends that, "whatever future intervention the project decides to undertake in the health and sanitation should be gone about slowly, experimentally, and cautiously." It further states, "we would recommend more research along the lines of the excellent work done by (Christine) Ansell and Najwa Adra--one or two persons in one or two villages over two or three months."*

Project 044/II plans to continue to use its own staff and Peace Corps Volunteers to continue to conduct routine in-house technical evaluations. In-house evaluations are good useful tools to chart progress, and systematically integrate the results of past experience into present and future activities. At the same time the 044/II staff will need some outside assistance in the form of public health and community impact studies. To this end, short consultancy assignments are proposed. An illustrative schedule for 1985 and 1986 would be for one consultant to come for six months per year to carry out a series of village studies and other activities. The emphasis on this data gathering would continue to be the collection of information which had direct utility for the Rural Water Supply Department and which supported its mandate to provide potable water to rural villages.

An illustrative schedule for six months of one consultant's time would look like this:

*Evaluation Recommendation, p. 33.

(a) Four Weeks: Collect background information and materials, visit relevant possible project sites, choose relevant sites for further study, determine what kind of information needs to be collected, and write research proposal.

(b) 16 weeks: Analyse and write up four village studies as follows:

(1) Mountain Projects: 5-week visit to one completed mountain project like Marbek or Han Han, which will be one year old in 1985 together with a three-week visit to a representative village subproject under construction. Total 8 weeks.

(2) Tihama Projects: 5-week visit to one completed project like Sadiyah or Unaziah which will be 3 years old in 1985, together with a 3-week visit to a Tihama project under construction.

(c) Miscellaneous Activities: 6 weeks

(1) Review baseline survey questionnaires and other in-house data collection documents.

(2) Make suggestions to O44 staff on the collection of relevant social and technical information.

(3) Assist with the development of sanitation education materials.

(4) Share information from village studies with O44/II and RWSD staff and make recommendations for subproject improvements.

The strategy for 1986 would be similar: to continue to generate relevant data on village water usage patterns and to evaluate the social impact of water systems under construction and completed systems. As time moves on, it is hoped that this quiet ad hoc strategy will generate the necessary information to permit a modest expansion of the health education and sanitation component in the later years of the extension. This strategy will also be done in collaboration with the Tihama Primary Health Care program, and the British Volunteers working in Abs, to minimize duplication and learn from the experience of other groups working in the health field.

Further monitoring and data gathering that could not be done in-house would come from the pool of unallocated consultancy services.

THE RWSD MAY BECOME AN AUTONOMOUS AUTHORITY.

This component of the proposal is stated as an assumption or a possibility rather than as an explicit End of Project Status. However, the process of changing the Department to become an Authority appears to be already underway. A charter has been drafted, and is currently under review by the Prime Minister's Office. This change in status is reportedly supported by both the President of the YARG, and the Prime Minister. The World Bank also appears to support this change.

There are many tradeoffs in the decision to make a Department an autonomous Authority. The YARG generally does not encourage the further spread of authorities, and exceptions are made only in rare cases, where the direct returns to the Government outweigh the potential for increased costs. Generally, also, autonomous authorities are required to cover their salary and operating costs from their own revenues.

The World Bank in their Sector Memorandum, "Yemen Arab Republic Water Supply and Sanitation," recommended that, "Government consideration should ... be given to the proposal that RWSD be replaced by a Rural Water Supply Development Agency (more closely focused on the LDAs) which could frame conditions of service designed to attract and retain local staff. The Agency would require financial support from Government as it will not be in a position to generate self-supporting funds in the manner of NWSA. Its expenses could, however, be partly offset by its charging agency fees for project preparation work which it undertakes on behalf of CYDA, LDAs, and other sector development agencies."*

The principal rationale for converting the RWSD to become an autonomous authority is the opportunity it represents to professionalize the staff. To create a professional organization to work in the rural sector which can attract qualified Yemenis, it is necessary to pay salaries comparable to the private sector or to other autonomous authorities like NWSA. Under YARG law, only an autonomous authority is allowed to exceed salaries set by civil service regulations.

The following steps will have to be taken to convert the Department to autonomous status. After the Prime Minister and the legal advisors in his office and the President's office have reviewed the draft charter, they will send it to the Cabinet. After approval by the Assembly, it is sent to the President for his signature. Tacit approval is expressed when the Prime Minister's office forwards the charter to the Cabinet. The entire process is expected by the senior leadership of the RWSD to take 18 to 24 months.

* World Bank, Sector Memorandum Number 3939YAR, March 25, 1983. P. 25. The emphasis is ours.

The change in status from a Department to an autonomous authority would open many opportunities for institution building. It would mean a chance to recruit technically trained junior professional staff. It would also create an opportunity for revising the operational mandate of the RWSO.

With the present tax base available to the YARG, the limited human resources, and the high salary costs both in the public and private sector, it is clear that neither the Ministry of Public Works nor the RWSO will be able to follow a traditional developing country model for staffing. The RWSO cannot expect to hire several hundred technicians and administrators and fifty to one hundred engineers and attempt to meet directly the needs of rural water throughout the Yemeni countryside.

An alternative model is required. One such model--applicable both to the RWSO or a Rural Water Authority-- would be to establish the Department as a service institution organized to survey and design rural water systems, and supervise their construction. However, the actual construction would be undertaken either by Local Development Associations, village leaders, private sector contractors, or by some combination of all three.

The possible change to autonomous status would represent an ideal opportunity to reposition the RWSO to take advantage of the growing private sector capabilities that are beginning to exist throughout Yemen. Aspects of this repositioning are discussed throughout this proposal. Specifically, see the discussion under Fixed Amount Reimbursement (FAR) beginning on page 63 .

In the event that the RWSO does not become autonomous, it will still be possible to make significant progress to improve the operations of the institution: (1) an Office for Planning and Management can still be created; (2) the RWSO could still restructure itself to make better use of its existing resources; (3) additional OPEX staff could be recruited, or existing OPEX staff could be redeployed; (4) training of the present staff could continue; (5) the Fixed Amount Reimbursement mechanism could still be employed to create stronger links with the LDAs and private contractors; (6) the Hydraulics Laboratory could still be created, and the Training Center could still be expanded; and (7) regional offices could still be established or strengthened in Hodeidah, Taiz, and Dhamar.

VI. PROJECT DESCRIPTION - PHASE II

This project is divided into two phases: Phase I from 1984 to 1989 and Phase II lasting until 1994. The NEAC Review indicated that while USAID funding would extend for five years, the designers should try to design the project for ten years. This is a good and wise strategy for institution building projects. To fully develop the RWS will take till the year 2000 and beyond.

At the same time, working in a microcosm like Yemen, where changes are sometimes slow, sometimes rapid and almost always unpredictable, the further one goes into the future in trying to design something, the more the exercise is like catching a handful of smoke. In response to this problem, the Project Proposal designers have broken the ten year time period into phases, and built in a series of evaluations using the standard USAID evaluation methodology which allows for adjusting targets or repositioning a project if circumstances warrant during the course of project implementation. A somewhat similar corrective mechanism will need to be built in after the cessation of USAID funding in 1989, to allow for changes of course and changing circumstances.

Still, it appears that a few useful things can be said about the period 1990 to 1994. The project designers have assumed that other donor assistance will start to phase down circa 1987. At the same time, the Department should be growing stronger and better able to manage its own internal affairs. The designers have suggested a World Bank Appraisal Mission come to Yemen to review activities in the water sector in 1988, and that a loan could be negotiated in 1989 for five years for \$20 to \$25 million. In effect, this begins to place the World Bank and the IDA as the putative successors to USAID after 1989 as the support for further institutional building. This use of the Bank's name in this case is purely illustrative to suggest a possible role which might evolve, using the Bank as an example of such funding.

To continue to keep matters on track, we have assumed routine external evaluations of project and/or Departmental operations every two years. We have projected the number of OPEX staff to rise to a maximum of 25 in 1987, and then to decline to 14 by the tenth year as they are replaced by trained Yemeni staff. This represents an average of 19 OPEX staff per year over the ten year period. The number of engineers and planners working with the project goes up by five in 1987 and to ten by 1989 when USAID funding is scheduled to stop. Because there are more undergraduates in Sana'a University studying engineering and other disciplines we are projecting the number of trained engineers and planners to increase to 20 in 1992 and to 30 in 1994.

We have described some experimental work with the Local Development Associations using the Fixed Amount Reimbursement system as a tool to facilitate this marriage of convenience. This starts in 1986/87. For the

duration of the USAID funding, we have assumed that the RWSD will work with only two LDAs; however, in 1990 this increases to three, in 1992 it becomes four, and by the end of the ten year period, we have assumed that this will have increased to five LDAs. In the same vein, also prompted by the FAR system, we have suggested that the RWSD will be working with four local contractors in 1989. This increases to eight contractors by 1994.

We have assumed that the RWSD budget will go from \$18 million in 1984 to \$23 million by 1989, as the Department develops stronger technical skills and administrative capability to handle government revenues and that it will increase further to \$28 million by 1994. This represents a rate of increase of less than 5% per year, but seems reasonable given the present and estimated future absorptive capacity of the Department.

The direct-hire staff is estimated to go from approximately 120 staff in 1984 to 145 staff in 1989, an increase of 21 percent. It will then increase further to 160 by 1994. This represents a total staff increase of 33 percent over ten years or 3 percent per year. Given the budgetary constraints within the YARG, and the limited tax base, these figures seem reasonable.

1984-1994 BENCHMARKS - RWSD PROGRAM

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1. RWSD becomes an autonomous authority.			X								
2. RWSD restructured to assimilate additional technical staff.				X							
3. Additional Engineers & Planners (E&P) recruited.		2	3	5	7	10			20		30
4. Donor assistance phases down. (No. of donors)		8		6							
5. World Bank Appraisal					X						
6. IDA loan to RWSD negotiated for \$20 million.						X					
7. External evaluations or appraisals.			X		X		X		X		X
8. OPEX staff by total number.	18	21	23	25	23	20	18	16	14	12	10
9. FAR system tried.				X	X	X					
10. RWSD working with LDAs.				3			3		4		5
11. RWSD working with Yemeni contractors.				4			5		6		8
12. Number of complete rural water systems constructed counting all donor assistance under RWSD auspices.	40	45	50	55	62	70	75	82	90	100	110
13. RWSD/YARG Budget (\$mil)	18	19	20	21	22	23	24	25	26	27	28
14. RWSD Direct-Hire Staff	120	125	130	140	145	145	145	150	155	160	160

VII. IMPLEMENTATION PLAN

A. HOW WILL THIS PROJECT WORK?

Project 044/II will continue to function in much the same manner that Project 044 has worked. Many of the same staff, at least initially, will continue to work in much the same positions. The Project 044 Chief of Party, for example, is expected to stay for an additional two years. Many of the Peace Corps Volunteers, as they complete their service, are hired either as consultants or as direct hire staff to continue working with the project.

The management style will continue to be much the same. Project 044/II will continue to be a synthesis of western management techniques grafted onto a Middle Eastern framework. It will continue to be run inside the Ministry of Public Works, as if it were an integral part of the Ministry. As necessary it will continue to invoke western management practices to insure the necessary quality control over field construction. At the same time there will be an increasing blurring of the distinction between 044/II and the RWSD.

There are two main strands to the implementation of 044/II, and both are interrelated:

- o field construction of subprojects
- o institution-building, coordinated through the proposed new Office for Planning and Management

Both components support each other in a symbiotic relationship. The field construction lends legitimacy, leverage, and credibility to the Project. The institution-building helps to integrate the departmental involvement with field construction. The creation of the new Office of Planning and Management creates the possibility for rationalizing the deployment of departmental resources.

The specific components necessary to implement this extension are described in detail in Part IV of this Paper: Detailed Project Description. These components emphasize things like a restructuring of the Department and the recruitment of additional staff. It is important to emphasize that all of these components -- no matter how neatly or precisely they may be spelled out in a paper like this one -- will probably happen in ad hoc, seemingly unplanned, and incremental fashion. Although this paper describes a possible restructuring of the Department, for example, and suggests an illustrative reassignment of staff, the reality is that this change will happen slowly and gradually, as the leadership for the Department feels that this is appropriate. It will not happen in the form of one monumental reorganization that would happen overnight, or in a week, or a month.

It is in this context that the following year by year implementation plans must be viewed.

B. IMPLEMENTATION SCHEDULE

See following page...

C. PROCUREMENT

Procurement will be done according to the commodities, equipment, and supplies list given in Appendix IX of this proposal. Procurement under Project 044/II will continue to be done as most of it was done under 044/I. TransCentury has a procurement office in Waldwick, New Jersey, which is equipped to handle all procurement necessary under this extension. The bulk of this procurement would be done in 1985, to avoid future inflation and optimize the use of the equipment and supplies.

To this end, a representative of TransCentury's procurement office in New Jersey would be sent to Sana'a for approximately two weeks in December 1984 or January 1985 to review the proposed procurement list, and assist with preparing the necessary detailed specifications to permit the procurement to proceed in an orderly and efficient manner. In the past Project 044 staff when they were on leave in the USA have routinely stopped in New Jersey to compare notes on the operations or procurement of field equipment and materials.

By sending a representative from New Jersey to Yemen, we will acquaint the procurement office better with the constraints and conditions that affect equipment operations in Yemen and permit even better service in the future.

A cost comparison of vehicles will be made. UNICEF in Sana'a is prepared to procure vehicles for cooperating agencies. Other vehicles are available from Saudi Arabia. Comparative bids will be solicited and the most responsive bidder will be awarded a contract. Vehicles to be purchased must have service and parts dealers in Yemen to support after sales warranty.

Most pipe and reinforcing steel for subprojects will continue to be American made and purchased from the USA. Most engineering tools and equipment will be American made. A blanket waiver will be requested to permit the purchase of 15 non-American made vehicles for \$225,000. A further waiver will be requested to purchase 12 generators (\$144,000) and 18 pumps which are not available from American manufacturers (\$216,000). The balance of the equipment, commodities and supplies necessary for the implementation will either be purchased in the USA (Code 000) or they will be purchased off-shelf in Yemen (Code 941) in accordance with AID regulations.

TransCentury Procurement Office will be responsible for:

1. The preparation or refinement of specifications;
2. Preparation of "RFP"s and "IFB"s;
3. Placing Bid advertisements with Small Business Opportunities Office and Commerce Business Daily;

NEW TRANSCENTURY FOUNDATION
RURAL WATER SUPPLY DEPARTMENT
MINISTRY OF PUBLIC WORKS

IMPLEMENTATION PLAN
FISCAL YEARS 1985-1989

DESCRIPTION	YEAR I	YEAR II	YEAR III	YEAR IV	YEAR V	REMARKS
I. SUBPROJECT IDENTIFICATION, SURVEY, DESIGN, ESTIMATION, AGREEMENT						
1-Assignment, Reconnaissance Survey	50 pr	50 pr	50 pr	40 pr	30 pr	pr = projects
2-Survey, Design, Estimation, Agreement	35 pr	30 pr	25 pr	20 pr	--	
II. SUBPROJECT CONSTRUCTION						
1-Tihama Construction Starts	9 pr	10 pr	10 pr	12 pr	14 pr	
1-Tihama Construction Completions	7 pr	9 pr	9 pr	10 pr	12 pr	
2-Mountain Construction Starts	15 pr	15 pr	15 pr	15 pr	15 pr	
2-Mountain Construction Completions	13 pr	11 pr	11 pr	10 pr	8 pr	
III. SANITATION, HEALTH & WASTE WATER DISPOSAL						
1-Study-Design	7 pr	8 pr	10 pr	10 pr	10 pr	
2-Design-Construction	3 pr	4 pr	5 pr	5 pr	5 pr	
IV. FIXED AMOUNT REIMBURSEMENT						
1-Study	1 pr	2 pr	6 pr	10 pr	14 pr	
2-Implementation	--	1 pr	3 pr	5 pr	7 pr	
V. GABION STRUCTURES	1	1	1	1	1	
VI. WATER METERS	1	1	1	1	1	
VII. RENEWABLE ENERGY (SOLAR)						
1-Survey and Design	1	1	1	1	1	
2-Installation & Experimentation	1	1	1	1	1	
VIII. PROJECT INSPECTION	20 pr	20 pr	20 pr	20 pr	20 pr	
IX. PERSONNEL						
1-Professional Staff	7 people	7 people	6.5 people	3.5 people	2 people	Total 34 person years 0 in 1990 17 in 1990 For details refer to annual implementation plan
2-volunteers	11 people	10 people	9 people	6 people	2 people	
3-TC Technicians	11 people	11 people	9 people	5 people	3	
4-MPW Technicians	12 people	18 people	21 people	25 people	30 people	
5-Planning & Budget	2 people	2 people	2 people	1 person	1 person	
6-Admin Support (TC)	15 people	14 people	11 people	6 people	5 people	
7-Admin Support (MPW)	2 people	3 people	6 people	9 people	12 people	
8-OPEX/TCN	5 people	5 people	3 people	0	7	
9-Consultants	18 people	18 people	14 people	12 people	10 people	
10-Dutch Volunteers	5 people	6 people	5 people	2 people	1	
X. TRAINING, INSTITUTIONAL DEVELOPMENT						
1-On the Job		CARRIED ON THROUGHOUT THE LIFE OF THE PROJECT				
2-Collaborative Training	2 sessions	2 sessions	2 sessions	2 sessions	2 sessions	
3-Regional Training	3 people	4 people	4 people	1 person	0	
4-Long-Term U.S. Training	2 people	2 people	1 person	3 people	2 people	
5-In-Service Training	3 wks -- 3 wks	3 wks -- 3 wks	3 wks -- 3 wks	3 wks -- 3 wks	3 wks -- 3 wks	
6-Seminars - Water and Sanitation	2 persons/2 weeks	2 for 2 weeks	2 for 2 weeks	2 for 2 weeks	2 for 2 weeks	
7-Home Office Visits	4 visits	4 visits	4 visits	3 visits	2 visits	
XI. PROJECT REVIEW, EVALUATION & PLANNING						
1-Annual Implementation Plan	1 plan	1 plan	1 plan	1 plan	1 plan	
2-Annual Budget & Submission	1 budget	1 budget	1 budget	1 budget	1 budget	
3-Evaluation	--	--	1 team evaluation	--	1 team evaluation	
XII. PROCUREMENT						
1-U.S. Procurement	1st U.S. Procurement		2nd U.S. Procurement		Last U.S. Procurement	
2-Local Procurement	Cement, pipe, fitting 5 vehicles	Cement, pipe, fitting 5 vehicles	Cement, pipe, fitting 5 vehicles	--	--	
3-Vehicle Replacement						
XIII. REPORTING						
1-Accounting	24 reports	24 reports	24 reports	24 reports	24 reports	
2-Quarterly	4 reports	4 reports	4 reports	4 reports	4 reports	

4. Analyzing and recommending to project staff for approvals;
5. Providing cost summaries and time schedules;
6. Purchasing approved commodities;
7. Advertising notices of Awards through AID Office of Business Relations;
8. Issuing letters of credit, if required;
9. Following up on delivery to our warehouses;
10. Arranging warehousing, freight forwarding, and negotiating Project freight rate with steamship lines;
11. Third party inspection of cargos, if required;
12. Providing monthly status reports, and warehouse computer printouts;
13. Arranging for host country customs clearance with Yemen clearing agent;
14. Shipping of cargos to Hodeidah, clearing cargo through customs, and delivering to job site.

D. EVALUATIONS

Two formal external USAID program evaluations are proposed for Project 044/II. There have been two evaluations under Project 044/I and both have served a useful purpose, either to permit a re-structuring of project activities, or to inform the Mission, the Ministry and USAID/Washington about what was happening to the project.

It is proposed that similar evaluations be conducted during the extension. The first evaluation would be conducted in the spring or summer of 1986. It would consist of three to four outside evaluators who would review the technical aspects of field construction, the social impact of completed projects, and the institution building component of the project. The evaluation team would consist of a civil engineer, a public administration advisor, a public health specialist, and an economist/anthropologist/social scientist. The 1986 evaluation team would review the proposed activities for the following three years, and suggest changes or alternatives as necessary. The team would review the proposed staffing, and confirm or adjust this to suit the institution building goals of the project.

A second evaluation would be scheduled for 1988. Its role, scope and purpose would be similar to the 1986 evaluation, but it would be designed to facilitate the orderly cessation of USAID assistance to the Department.

To this extent, it would look more closely at the RWSD, and its staffing, structure, and ability to assume the functions of Project 044/II. It would review closely the proposed activities of other donors working with the Department at the time of the evaluation. It would review Departmental finances, and made recommendations on the staffing implications after 1989. If appropriate it would review and make recommendations about alternative funding opportunities that might be available to the Department after the cessation of USAID funding support in 1989.

VIII. PROJECT ANALYSIS

A. SOCIAL SOUNDNESS ANALYSIS

The Yemeni Context

Geographic Setting

Within a small geographic area, the Yemen Arab Republic contains a number of ecological zones that vary widely in environmental and cultural features. The country can be divided roughly into three distinct zones: the Tihama or coastal plain, the Highlands and the Eastern Plateau.

The coastal plain extends 65 km. inland and covers 16% of the land area of the YAR. Its population in 1975 was about 730,000. It is a region of farmers, herders and fishermen. About 55% of its land area is range-land.^{1/} Rainfall is sparse, although lands near the foothills are watered by seasonal floods that flow down the seven major wadis. The crops grown on these flood watered lands include sorghum, millet, sesame and cotton. Rainfed lands were traditionally planted in sorghum and millet, crops that require little water. With the increase in the number of tubewells for irrigation in the last 5-10 years, crops planted now include tobacco, cotton, fruit, and vegetables.

The Highlands can be further divided into two regions: the Western highlands, covering 30% of the country's area, and the central highland plain, covering 40% of the land area. Rainfall varies, with the greatest amounts falling in the south around Ibb and Taiz. Total population is around 3.5 million, with the greatest density occurring where there is the most rain. Agriculture is characterized by narrow, steeply terraced fields with larger fields on the plain. Major crops are sorghum, wheat, barley, maize and legumes. In areas where rainfall is high or where there is irrigation from springs, tubewells or seasonal floods, cash crops such as vegetables, qat and grapes are grown. Qat has become an increasingly important and profitable crop, but it is one which has no export potential and which takes up land which could be used to meet Yemen's food needs.

The Eastern Plateau, which eventually becomes desert, is very arid and has a small population of around 200,000. Agriculture, which is based mainly in the western portion, is not an important activity and is heavily dependent on seasonal floods and tubewell irrigation. Cereals are the main crop. Much of the population of the eastern section is nomadic.

^{1/} Social and Institutional Profile, 1983, p. 16

Historical Background

Socio-Cultural Context

Yemen's people show as much diversity as her geography and have traditionally been divided along overlapping tribal, ethnic, religious, regional, and occupational status lines. Tribal and religious divisions have been particularly important politically and have resulted in considerable internal conflict which has retarded Yemen's development and made it very difficult at times for the central government to bring all parts of the country under control. Tribes have been a particularly important feature of the central and northern highlands. Tribes have also been important in the Tihama, where tribal leaders have played a more authoritarian role than their counterparts in the highlands. They have been least significant in the south, where people tend to think of themselves as tribesmen but where tribal leaders exercise authority not because they head some tribal unit but because they are powerful landlords.^{2/} Southerners have had long contact with the outside world owing to their proximity to the part of Aden. They have tended to be better educated than people elsewhere in Yemen and have played an important role particularly in commercial affairs.^{3/}

Yemenis in the northern and central highlands and the east belong to the Zaidi sect of Islam. Although Zaidis are sometimes characterized as Shia, their theology, law and practice differ little from the Sunni Muslims who live in the southern highland and the Tihama. The Sunnis belong to the Shafi'i school of law, one of the four schools in Orthodox Islam, while the Zaidis are sometimes spoken of as a fifth school of law. The differences between Zaidis and Shafi'is, each of whom constitutes roughly half of the population, are less religious in nature than they are regional, socio-cultural and political. A more significant religious division these days occurs between supporters of the growing fundamentalist movement in the Islamic world and those who are interested in liberalizing Yemeni society.

Recent History

Power in Yemen has been fragmented for centuries, and many regions have known considerable, if not complete, autonomy. The Ottoman Turks were the last foreign rulers of Yemen. Their control was sporadic and limited to certain areas but they were an important force from the 1870's through the second decade of this century. They favored the Shafi'is, but met with fierce resistance from much of the population. After their overthrow in Yemen during World War I, the Zaidi religious and political leader, the Imam Yahya, was able to begin to extend the power of his theocratic government over various parts of the country where he had once had no control. The Shafi'is were not happy with his rule, in part because he restricted their economic influence but also because taxes and conscription were considered onerous. Government administration was rudimentary and handled almost

^{2/} Social and Institutional Profile, pp. 45-46

^{3/} Ibid. p. 19

entirely by the Imam himself. The government's ability to control events and to organize the daily work of public administration was severely limited. Services were almost non-existent. Western ideas and technology, which were imitated and adapted with considerable enthusiasm elsewhere in the Arab world, were generally fiercely resisted in Yemen and by Imam Yahya in particular. The Imam's power grew and, by the late 1930s, he had brought some stability to a turbulent and anarchic land. In the 1940s resistance to his rule began to grow not only from those who were motivated by traditional ambitions and resentments but also from those who had gained some exposure to new ways of thinking outside Yemen. In 1948 the Imam was assassinated during the course of a general revolt against the government. A new Imam was named, but various northern tribes supported Imam Yahya's son, Ahmad who had been named by his father, in a very controversial move, as successor to the Imamate. Sana'a was sacked in the fighting; thereafter, Ahmad was able to establish his title to the Imamate and his rule over much of the country. Another revolt, which this time turned into a devastating civil war, began in 1962. This war was both fuelled and prolonged by funds from Saudi Arabia on the side of the Imam and the northern tribes and funds and soldiers from Egypt in support of the Republicans. Destruction was widespread. Although the new Republican government developed the beginnings of a Ministerial system and was genuinely interested in bettering the lot of the Yemeni people, the war took much of its attention and most of its money. It was only with the end of the civil war in 1970 that the process of development could truly begin.

Socio-cultural Feasibility of the Project

The Political Framework

Challenges to the Republican government were posed from time to time in the 1970s but generally diminished and allowed officials to begin the difficult process of nation building. Defense and public security expenditures remained high and are still significant. In 1982 they formed 50% of the current expenditures and 20% of the capital expenditures.^{4/} Parts of the country periodically demonstrated their independence. Various tribes were occasionally troublesome. And, for a time in the late 1970s and early 1980s, National Democratic Front activity, which was funded in part by Marxist South Yemen, posed a serious threat in government eyes.

During the 1970s the government began to create a physical and administrative infrastructure. Roads linking the major towns and cities were built. The number of government employees went from 4000 in 1962 to 31,300 in 1975.^{5/} However only 16% of these employees in 1975 had a primary

^{4/} World Bank, Yemen Arab Republic - Second Five year Plan: Public Investment Program Review," December 1983, p. 8

^{5/} World Bank, YAR: "Urban Sector Report," March, 81, p. 17

school education or better. The lack of trained manpower remains a serious problem and is a great hinderance to development. Government administration is further hampered by the fact that civil service salaries have not kept pace with private sector salaries, so it is difficult to hire and keep well educated Yemenis in government employment. Another serious problem is that the government's tax base is narrow and natural resources are almost non-existent, so it has few funds to devote to development. Considerable development work has been funded by foreign donors and will continue to be so funded. Unfortunately, foreign grants reached a peak in 1982 and have since declined.

Rural Yemen

Introduction

Around 90% of the population is rural. Most Yemenis live in very small villages. The 1975 census recorded that 78% of the population lived in settlements with fewer than 500 people while 34% counted less than 100 individuals as their neighbors. Although housing in the countryside is usually adequate, living conditions often are poor. Life expectancy at birth is 47 years. Infant mortality stands at around 170 per 1,000 live births. The fertility and illiteracy rates are among the highest in the world. No more than 12 to 14% of the rural population has access to a potable water system. The government is working hard to provide rural areas with health workers, teachers, extension workers and the like, but progress is slow because of the large number of settlements to accommodate and the enormity of what remains to be done.

The Rural Economy

Yemen's economy has long been dependent on agriculture, which now employs three-quarters of the labor force and produces one-third of the GDP.^{6/} In many parts of the country, agriculture is still a subsistence activity with productivity dependent on uncertain rainfall. Seventy-five to eighty percent of all cultivated land is rainfed. Drought is a recurring problem. One occurring over a span of several years in the 1960s and 1970s spurred migration and caused the abandonment of many marginal fields. One estimate suggests that the total area planted may have decreased ten percent since 1970.^{7/} This decrease, however, is at least partly because of the shortage of rural labor and the increase in rural incomes which makes possible the purchase of imported food. The rains in 1983 and thus far in 1984 have been very poor and have had a serious effect on agricultural productivity. As one indicator, wheat production fell from 67,400 tons in 1982 to 27,700 tons in 1983. If the summer 1984 rains fail, The YARG could be in an awkward position. The summer rains are usually the heaviest ones in the highlands, and agriculture in the Tihama is dependant on the run off from these rains. The country is currently facing a serious shortage in foreign exchange reserves and could have difficulty funding sufficient food imports.

^{6/} World Bank. "Second Five Year Plan: Public Investment Program Review" December, 1983. p. 23.

^{7/} Redding, David A. Yemen's Economy. Unpublished paper, November, 1982 n 8

Farmers are increasingly turning from traditional drought-resistant crops to cash crops such as fruit, vegetables and qat. Remittance money has allowed farmers to invest in the irrigation required to grow many new crops and has also increased rural demand for these foods and for qat.

Land ownership is fragmented, with sharecropping a significant feature of Tihama agriculture.^{8/} Ninety-two percent of all holdings are smaller than five hectares.^{9/} This fragmentation, combined with the ruggedness of the terrain, makes mechanization, which is desirable given the labor shortage, difficult.

Productivity in the sector is low and has not kept pace with the increase demand for food. In the early 1970s, Yemen produced 90% of all the cereals which people consumed; by the end of the decade, production had dropped to 70%. Yemen has relied on worker remittances to fund necessary food imports.

Women have always played a vital role in farming and have traditionally performed tasks which have ranged from sowing, weeding and thinning to threshing. They have also been responsible for most livestock care, a time consuming activity in those parts of the country where cows must be handfed. Migration has resulted in an increase in agricultural work for women in many areas of Yemen. One exception to this has occurred in areas where qat has replaced grain crops. Men look after qat trees so women's work has decreased.^{10/} Families with remittance money can often afford to pay agricultural laborers but the latter are in short supply. Even when hired by a family, farmhands must be fed and, sometimes, supervised by the women. In areas where land is rainfed, male migration has been especially high and women have had to assume even greater responsibility for farming. They have had to oversee or carry out themselves such traditional male tasks as terrace repair, plowing and marketing of produce.^{11/} Tihama women whose families own land that is spate or tubewell irrigated have also seen an increase in their workload. Women have taken over male tasks such as irrigation during seasonal floods, and threshing sorghum.^{12/} Although burdensome, such work does give women freedom to move outside the home and also increases their decision making power within the family.^{13/}

^{8/} SIP, p. 15

^{9/} IMF. YAR, "Recent Economic Developments," July 1982, p. 3

^{10/} Adra, Najwa, "The Impact of Male Migration on Women's Roles in Agriculture in the YAR," October 1983, p. 29

^{11/} Ibid. p. 32

^{12/} Ibid. pp. 33-34

^{13/} Ibid. pp. 38-39

Migration and Its Impact

Remittances from migrants working abroad have brought increased wealth to rural Yemen. The economic benefits brought by migration have been widespread and have been shared by almost all categories and classes of people. Many families have, in this way, earned the money to pay exorbitant brideprice fees, build houses, purchase land, buy Toyotas and drill irrigation wells. Increased spending in rural areas has even benefitted those who stayed home. Wages for agricultural labor, stone masons and construction workers are high. A stonemason can earn around \$70 a day, a considerable sum given the average per capita income of \$430 in 1980-81. Investment opportunities are limited, so much of the remittance money has been spent on consumer goods. To some extent, the recent decline in remittances has meant that, once a migrant has paid the brideprice, he can only afford consumer goods and not the larger investments in land and housing.^{14/}

An estimated 400,000 Yemenis, or 8-14% of the total population, are short term migrants outside Yemen.^{15/} This adds up to one-third of the potential male labor force. In some areas, emigration is particularly high; for example, perhaps as much as three-quarters of the Tihama's labor force work abroad.^{16/}

Remittances climbed to an estimated USD 1 billion in 1977-78 and have since fallen as a result of the stagnation in international oil prices and increased competition from South and East Asian workers. During this time, YAR's importation of foreign skilled labor has increased. The last year that remittances exceeded the cost of imports was 1977-78, when remittances peaked. In 1982, remittances covered less than 40% of the cost of imports.^{17/} This has contributed to a serious drop in foreign reserves and a growing debt. Remittances are not likely to increase in the next few years. The World Bank predicts that after 1986 oil prices will rise again and that this will bring about a concurrent rise in remittances.^{18/} However, cheaper and more docile Asian workers may be increasingly preferred by the oil producing states.

^{14/} Jon Swanson. "Rural Society and Participatory Development: Case Studies of two villages in the YAR," Cornell University, 1981, pp. 51-51.

^{15/} World Bank, "YAR: Urban Sector Report," March 1981, p. 10.

^{16/} Najwa Adras "The Impact of Male Migration on Women's Roles in Agriculture in the YAR" October 1983, p. 9.

^{17/} World Bank, "YAR - Second Five Year Plan: Public Investment Program Review," p. 88.

^{18/} Ibid. p. 96.

Rural Yemen

Water Use

Water is taken from three main sources: wells, cisterns and springs. Drinking water may be taken from any source by any individual. Women are the main carriers and distributors of water. Cisterns catch runoff during the rainy seasons and do not provide water all year around. Many villages have cisterns but often they are not kept clean. They may be full of garbage and can serve as a breeding ground for insects and, in some parts of the country, bilharzia. There are regional differences in the use and storage of water. In many areas, people will not drink cistern water, but will reserve it for animals, washing clothes, and sometimes personal washing.^{19/} In other regions, perhaps owing to the paucity of water from other, purer sources, people will drink cistern water. For example, in the village of al-Ghuwla, north of Arman town, women take drinking water from a polluted cistern. They believe that straining the water through a thin veil makes it clean enough to drink.^{20/} The purity of water and its clearness to the eye are generally thought to be identical. However, the only other alternate source for al-Ghuwla is a spring, where women used to go for water twice a day before the cistern was built, that is a 1 1/2 hour round trip from the village.^{21/}

Water is stored inside the house or compound in a variety of containers: the plastic jerry cans or tin ghee cans in which it is carried, large clay jugs, metal barrels, sheet metal tanks, or some combination of the above. Coolness in drinking water is very important, so the preferred container for such water is made of clay, which permits evaporation. Animals are watered from courtyard containers or if feasible they are sometime driven to a nearby source. Yemenis prefer to give animals water that has not been used before but, if there is not enough water, animals will be given rinse water from the kitchen.^{22/}

^{19/} Richard Tutwiler, "Social Aspects of Water Distribution and Consumption in a Subdistrict of Mahweet province," American Save the Children/Yemen Report No. 1, February 1980, p. 8.

^{20/} Christine Ansell, "The Benefit of Rural Water Projects: An Impact Survey of Five Villages, NTF paper," October 1981, p. 15.

^{21/} Ibid. p. 15.

^{22/} Ibid. p. 5.

Kitchen and bathroom facilities vary greatly from one region or even from one village to another. A traditional highland kitchen would have a hole at the ground level to carry water outside the house. If women make dung cakes for fuel, the wastewater is channeled to the dung soaking pit.^{23/} Women who do not have a proper kitchen will collect wastewater in a large pan and throw it into the street or give it to the animals. In the Tihama, where the sun is strong and the ground absorbant, women will throw wastewater on the ground of the compound as the water is used.^{24/} In houses with bathrooms, wastewater from washing, urine and feces are channeled outside the house, with the feces separate from the liquids. Dried feces may then be carried out to the fields. Sometimes there is so much wastewater on the floors of Yemeni bathrooms that flies breed and cockroaches thrive.^{25/} Tihama compounds often include bathroom facilities in an enclosed corner. Children do not use toilets; rather, in a practice which encourages the spread of disease, they defecate outside the house, which is also where they play. In many areas, adults use the fields for urination and defecation. And there is some suspicion that women may limit their fluid intake owing to the problem of finding privacy in the fields during the day. With the influx of remittance money, many Yemenis are adding bathrooms to their houses.

Although people wash themselves and their healthy children frequently, they do not understand the value of soap and water in preventing disease. Some practices make it difficult to keep children healthy. For example, young children are often left grubby in order to ward off envy and the "evil eye". More problematic is the belief that infants and children should not be bathed when they are ill.^{26/}

Political Organization in Rural Areas

Rural areas as noted earlier, have long histories of independence and autonomy and have not always been amenable to control by a central government. The contemporary process of integrating disparate parts of Yemen and making all segments of the population feel some sense of shared

^{23/} Ibid. p. 8

^{24/} Ibid. p. 9

^{25/} Ibid. p. 10

^{26/} Christine Ansell and Robert Burrowes, "Communicating Hygiene/Sanitation Messages to Villagers: An experiment in Wadi Ayyan," ASTC/Yemen, June 1981, p. 21.

nationhood is a slow and continuing one. The Government is making steady progress in its effort. Rural people, for example, have come to see that the central government can provide them with valued services and therefore, they actively seek schools, clinics, and water projects from government ministries. Their expectations of the central government have grown as the government has tried hard to provide rural areas with a physical infrastructure and services. Unfortunately, the Government has always had too few resources to meet rural demand by itself, and so it has relied heavily on the Local Development Associations (LDAs) to organize and fund development projects. The creation and growth of the LDA system has also given the government a way to get the Yemenis to devote some of their incomes to improving rural life.

The LDAs are usually district-level organizations that vary greatly in funding, administrative organization, energy and influence. They have helped make Yemenis aware of the possibilities of change and have given them a means of pursuing it. In many districts, they reflect the traditional power structure. For example, in one Tihama district, the paramount sheikh was elected head of the LDA without opposition and was soon given complete responsibility for all LDA activities. Community participation was no more lively or enthusiastic than it had been earlier.^{27/} The President, as paramount sheikh, has so many other demands on his time that the LDA is not very active. Other LDAs, however, are energetic and well-organized and accomplish a lot. Still others reflect the level of conflict prevailing in a particular area. LDA work can then become hampered by the fact that this new organization has become a focus for old suspicions.

LDAs receive 75% of the "zakat" tax on agricultural production and livestock, and can call on CYDA contributions and a few other less important taxes. Because the LDA's income is dependent on agriculture, it is possible to find a poor LDA in a community rich in remittance money.

Village leadership varies as much as does LDA leadership. Some villages are blessed with leaders who are farsighted and ambitious for their village's development. If such villages are also blessed with reasonable wealth, be it from remittance money, qat or commerce, then much can be accomplished. For one example, see the case study which follows this section.

Rural Development Priorities

Rural development has been carried out mainly by the LDAs and villagers themselves, with support from the central government and foreign donors. Emphasis has been on infrastructure. Roads have been a major interest; now that many areas have acquired a reasonably adequate network of roads, attention has turned chiefly to water projects, schools, and mosques. Many communities have organized themselves without LDA assistance to build a

^{27/} World Bank, "YAR - Local Development Associations: A New Approach to Rural Development," March 1981, p. 5 and also Mary Herbert, "Community Structure and Participation: Yemen's LDAs", Working Paper No. 15, Cornell University, March 1983, p. 5.

mosque or school. Improvements in health care are often given a low priority. In 1983 the Abs LDA, which already has a good road system decided to allocate only 20% of its funds to improve the very low level of health services.^{28/} Remaining funds were to be denoted to schools, water, and other miscellaneous projects. Many Tihama villages in which 044 has built a water project say that their next goal is to construct a school.

Discussion of Project Components

Introduction

Everything that is written in the sections above suggest that Project 044/II is one which fits neatly into the Yemeni cultural, political, and economic context. The project relies on and hopes to strengthen existing organizations involved in the supply of water. The project also demands--as does YARG generally--that villagers devote some of their own resources to improving the quality of their lives. It is only by relying on village interest and cooperation that a financially overstretched government can hope to develop rural areas. The project is careful in determining the village contribution through consultation and negotiation with village leaders. Project 044 constructs simple, easy to operate, and easy to maintain water systems. Successful experimentation with various devices may cheapen and simplify future systems. The project's criterion for minimum population may seem low at 250 but it takes proper cognizance of the very small size of most Yemeni villages. In fact, the village population average for those projects completed under Project 044/I was around 750 at the time of construction with an increase to about 1,000 over 20 years. The training provided to village systems' operators generally ensures that these systems will be in operation for their 20-year design life.

Those interventions which are designed to strengthen RWSD may be the most lasting benefit of Project 044/II. Training is one of the most significant features of this institution-building. All government ministries and departments are short of well educated personnel with good administrative and technical skills. In 1981, at least 8,000 civil service positions remained vacant, and most of these vacancies were in the technical departments.^{29/} Many of RWSD's technical staff are non-Yemeni, some of whom do not even speak Arabic. The Rural Water Supply Department will not be able to function effectively in its new guise as an autonomous authority without a full complement of adequately trained personnel. The change to being an autonomous authority will create a greater opportunity for an administrative restructuring in the name of greater effectiveness and efficiency. As RWSD's reputation improves, along with the ability to establish and meet goals, it will find it easier to attract employees from among the growing number of young, well-trained Yemeni

^{28/} Elizabeth Gascoigne, "A Baseline Health Survey of Abs District," March 1983, p. 19

^{29/} World Bank, "YAR: Urban Sector Report," March 1981, p. 17

technocrats, who will in turn boost the Department's ability and reputation. Regardless of how capable RWSO becomes, however, it will never be able to fully execute all aspects of field construction of rural water projects, from the initial survey to the final painting of the tank, owing to budgetary and staff limitations and the sheer number of villages which require water systems. The emphasis which O44/II places on fostering cooperation between the private sector, the LDAs, and RWSO is an appropriate one for this environment. The private sector is already active in the water sector; O04/II will build on this activity by encouraging contractors to improve their management and construction techniques. A strengthened private sector will be able to work hand in hand to meet the demands of a strengthened RWSO.

The health/sanitation component and the data-gathering on which this component's activity will be partly based are low-key and recognize the limited amount of information presently available on which to base such a large scale endeavor. It also acknowledges the ignorance about such matters in the countryside and the sensitivities of collecting the information necessary to design most activities. Improving public and perhaps eventually private drainage of waste water may be the easiest place to start. It is a new issue and is one which is clearly connected with the water system. It also may interfere least with prevailing cultural practices relating to water use. Because there is some resistance to foreigners working in the more sensitive areas of personal sanitation, it is best to construct showers, latrines, and ablution chambers only where there is public enthusiasm for such structures and to build them in a number which is consistent with close followup. The data gathering component under O44/II is modest, cautious and appropriate since research by outsiders, particularly in the countryside, rouses suspicions about the researcher's purpose and the benefit to be derived from this research. Working with women may be particularly sensitive and could become more so if more Yemenis begin to accept more conservative religious views. There is some evidence to suggest that husbands returning from Saudi Arabia to Abs district in the Tihama are beginning to restrict the mobility of their wives and older daughters in an attempt to emulate the Saudi pattern.^{29/} Foreigners and Yemenis not native to a particular subproject area may find their opportunities to collect data and do health education very few, since villagers are not likely to understand why the builders of a water project would want to branch off into such seemingly unrelated areas.

Project Beneficiaries and Benefits

Direct beneficiaries are all the villagers, including the very poor, who reside in subproject villages. Typically, households are assessed for the construction of a water project according to their ability to pay, and poor households may pay nothing at all. Monthly operation and maintenance charges for the system are similarly set. No family is excluded from obtaining their water from the new system owing to an inability to pay assessment or operating fees. This allows all villagers to enjoy what are in their eyes, the chief benefits from a water project: convenience and reliability.

^{29/} Gascoigne, "A Baseline Health Study of Abs District," March 1983, p. 22

Health benefits can also be expected from an improved supply of clean water. Owing to ignorance, such benefits may not be noticed by villagers, and are impossible to quantify by outsiders because of the lack of baseline data and the difficulties of carrying out research in rural areas. Information provided by villagers who were interviewed during the 1983 evaluation suggests that villagers were bathing more often and drinking more water. The relative cleanliness of the clothing seen by team members in Project 044/I villages also suggested that clothes were being washed more often. It can be assumed that more household cleaning and washing of cooking equipment, utensils and dishes is being done in subproject villages. Small gardens have been planted in some project villages and fruit trees in others. As these are imitated and villagers become used to new items in their diet, village nutrition may benefit. Further health benefit might result from sparing women and particularly children the necessity of carrying 20 litre or 44 lb containers of water on their heads two or three times per day. (Children usually carry 10 liters of water per trip.) Many adult women complain of back pains, a not unsurprising consequence.

One of the important benefits of water systems in Yemen is the time water carriers save. This is particularly true in the highlands where a village water source may be far away and over rough terrain. Girls and women are the main carriers of water. In places where donkeys are available for the transport of water (as, for example in many parts of the Tihama), boys and men may participate in fetching water. The amount of time saved varies from perhaps an hour per day to several hours. Women seem to divide that newly available time between their other customary tasks. It was noted previously that female agricultural responsibilities have increased in many parts of Yemen. Other tasks have also grown more burdensome. For example, Yemenis own more clothing than they did 20 years ago. That factor, combined with the availability of water which allows higher standards of cleanliness to prevail, means that women must wash clothes more often.^{30/} Women used to tell the age of a dress by the number of times they had washed it; this is becoming increasingly difficult to do.

The October 1983 evaluation team felt that women in the Tihama were washing their children more often. Women may also be devoting additional time to making traditional handicrafts, such as baskets and clay jugs which may either be for household use or for sale. Women in one Tihama village make braid in their spare time and then sell this to sewers of traditional Tihama dresses. These women may choose to spend more time at this activity, which, however is one that generates very little income. Poor women work as paid agricultural laborers. Time save on household tasks could be allocated to earning additional money in the fields. Saved time may also be spent resting and/or visiting friends. These are good and healthful activities, especially considering the very heavy workload of rural women. Women, in fact, are so burdened that it would be a mistake to assume that releasing them from any one responsibility will lead to the assumption of new productive activities. In some areas, there is a trend toward establishing nuclear family households. The women in such a household can be in an awkward position if her children are young and her husband is working in Saudi Arabia.

^{30/} Najwa Adra, "The Impact of Migration on Women's Roles in Agriculture in the YAR." October 1983. n. 31

Unlike the women in extended family households, she has no one with whom to share the family's workload and so may be extraordinarily burdened.

Children who are freed from the task of carrying water a number of times a day may be able to attend school, perform other chores, or spend more time playing. Families are increasingly willing to send their daughters to primary school. Decreasing the amount of time various household and agricultural tasks take could well provide the hours needed to allow a daughter to attend school.

Those Ministry personnel who are trained under the extension can also be thought of as beneficiaries. Their technical and/or administrative training will fit them to hold more responsible jobs---at higher salaries---than they would have qualified for initially. The same thing may be written of the small private contractors who work with O44/II, although in a slightly different sense. The 24 contractors who are scheduled to participate in short formal courses, and others who receive on-the-job training will improve in technical and managerial skills. They will be able to do better cost estimates, submit more accurate bids, and build better water systems in less time and with less waste. By doing higher quality work, their reputations will improve and they will be in a position to win more contracts.

LDAs often contribute to and play a role in the construction of rural water projects. Whether they are beneficiaries of FAR reimbursement or are involved with O44 in a more direct tutorial fashion, the LDAs will gain more experience in helping villages meet goals for village improvement. They will gain the increased respect of their constituents. Their staff may also have an opportunity to receive special training from O44/II. For example, one technician now working with O44/II is on secondment from the Bayt al-Faqih LDA. Once his training is completed, he will be used by the LDA to ensure that private contractors on contract to the Bayt al-Faqih LDA do acceptable work.

The primary institutional beneficiary of Project O44/II is, of course, the RWSD. At the end of the project period, the RWSD will be a more efficient bureaucracy and one which is better able to fulfill its mandate of providing rural Yemen with water. In turn, this will provide one more link between the central government and the rural citizenry. It is in part by meeting rural needs and expectations that the government will succeed in its nation-building exercise.

Participation

The attainment of a convenient and reliable source of water is such a high priority in rural Yemen--most of whose inhabitants have suffered at one time or another from shortages in water--that motivation to secure a water system and later to operate it properly is very high. The halls of the RWSD are literally crowded with village leaders who come attempting to get their village listed for a water project. They use whatever influence they have to bring to bear on the RWSD.

There are so many villages without water systems and so few resources available to the RWS that juggling the claims and demands of various villagers is a difficult, time-consuming and occasionally noisy task, demanding much patience and considerable skill at negotiating.

Villagers are most interested in obtaining a reliable, convenient and increased supply of water. The connection between water and health is not one which is always made by Yemeni villages. While they recognize that water is essential to life and while they have established their own ideas of what is clean and what is dirty (i.e. water stored in the house for longer than one day is not fit to drink), their knowledge is incomplete and inaccurate. This is why the disposal of waste water and the household storage of water are project concerns. Owing to Islamic dictates, washing is particularly important in this culture. Household taps, mosque ablution chambers and public showers are all appreciated by Yemenis for the ease with which they allow them to fulfill a requirement of their religion.

All villages contribute substantially to the cost of putting in a water system (see page 116 for past percentage and village contributions) although some prove to be more cooperative during the construction than others. The degree of cooperation seems to be primarily a function of how well organized, interested, and respected the village leader is. Villages normally provide housing, food for the O44 crew, labor, local materials and sometimes cash payments for the stonemason, the rental of a backhoe for pipe trenches, or bulldozing an access road to the tank site. Villagers sometimes also pay for the pump and/or motor and drilling the well. Often the LDA or the Ministry helps with these expenses.

Impact of Project 044/I and 044/II

Water projects are in such great demand that through some combination of village, LDA, Ministry and foreign donor resources, they already dot the countryside. As long as remittances do not decline sharply, rural Yemenis will continue to have some money with which to fund water and other development projects. However, they will continue to need outside help. What is most difficult to ensure is the spread of competent survey and design work and good construction techniques. There is some indication that some of the techniques used by Project 044/I in the Tihama have begun to be imitated in Bayt al-Faqih district. For example, elevated tanks showing the use of plywood forms for concrete have appeared within the past year. In addition, the concrete mixture used in some recent tanks appears to be of a much better quality than that of most earlier projects. In training private contractors, Project 044 is attempting to promote the diffusion of good construction practices. This will have an effect not only in future water projects but in other kinds of construction. One Bayt al-Faqih contractor who has worked with Project 044 is applying his new knowledge and the improved capabilities of his crew to building a large hotel in Bayt al-Faqih Town. As Yemenis are provided with examples of good construction, they will be better able to evaluate the work of contractors and will be more demanding that work done in their villages be of a higher caliber. However, there will always be contractors whose practices are less than optimum. Project 044 trained

technicians from RWSD and the LDAs will be able to act as quality controllers and ensure that project recipients receive a good and functioning product.

Another potential effect is that villagers are learning how to work with the central and local government in implementing village goals. They are learning how to get the government to contribute to their development ambitions. Techniques learned in acquiring a water project may be just as easily applied to requests for a school or clinic. As the case study on the following pages points out, one village may learn from a more experienced one how to get a development project. Work on a water project also gives villagers experience in working together and may serve as a spur to further development. Again, the case study suggest how this can happen. Within a village, innovations in the use of water will spread but may take considerable time and may depend on factors such as: (1) the continuing need to conserve water and, (2) the amount of labor time an innovation consumes. For example, small vegetable gardens, which have been started by some households in project villages, may not spread very rapidly owing to the amount of water required for irrigation and the amount of time heavily burdened women need to spend tending the garden and then cooking the vegetables.^{31/} There are already signs that household showers have spread and there is considerable interest in fruit trees. In one village, most of the Project 044 fruit trees died. However, interest was so high that villagers drove to the nursery and purchased replacements. As these trees grow and begin to produce fruit, neighboring villages may see the desirability of trees and purchase their own.

Small rural water systems do not generate additional employment, except for part time work for system operators, but they do help make villages more attractive places to live, perhaps decreasing the lure of the city. A water system will not improve rural income by itself. It does, however, improve the rural environment, and thereby improves rural well being.

One important way of replicating water projects is found in 044's effort to strengthen the RWSD's and LDA's capabilities to cooperate with one another and with villagers in constructing projects. As the government becomes increasingly responsive to the needs of isolated and often fiercely independent rural areas, it ties those inhabitants more closely to it, thereby introducing greater stability to the area.

CONCLUSION:

The case study which follows this analysis demonstrates the kind of progress that it is possible to achieve in a village. Rural people have seen remarkable changes in the past 15 years. Improvements that were unimaginable at the end of the civil war, such as water piped to the house, power mills to take over the arduous task of grinding grain, and free education for their children have happened and have led rural Yemenis to expect changes that will enhance rural life. This project is aimed at strengthening the various parties involved in the rural water sector. By improving their ability to work together, it not only increases the chances for replicating water

^{31/} Najwa Adra, The Impact of Migration on Women's Roles in Agriculture in the YAR. October 1983. p. 91

projects in the thousands of villages without water supply, but it also lays a foundation for cooperation on other projects. Within memory of most adult Yemenis, neighboring villages fought one another. Sometimes there was fighting within a village over land or water. Now Yemenis within a village are learning to work together to benefit all inhabitants. In the same way, villages may be learning to cooperate with one another through the LDAs. People are beginning to feel a common identity as Yemenis and may increasingly feel less divided by other factors, such as region or tribe. To the extent that this project increases the ability of the RWSD to respond to rural demands and facilitates cooperation between villagers and their government, it strengthens the trend towards national stability and helps to build Yemen as a nation.

B. CASE STUDY

Water and Development in the Village of al-Ka'dhera

The 1980s began as a decade of great expectations and rapid modernization in the southern uplands of Yemen. The village of al-Ka'dhera is typical of others in the region with its fairly sophisticated population which was able to capitalize on the opportunities offered by the period. This chapter will describe the major changes in the quality of life in al-Ka'dhera, using the village water project as an example of the forces at work in village affairs.

Al-Ka'dhera is an imaginary, but illustrative village based on the experience of Project 044 in the southern highlands during the summer and fall of 1983. Its location on the border with Aden gives it a unique position in the national setting. A long and close association with the British in Aden and trade based in this port gave a number of villagers an opportunity to gain an education and develop experience in commerce. Other communities in Yemen, particularly in the Tihama coastal plain, are poorer. Still, the southern highlands share many features in common with other parts of the country.

Since the end of the civil war, Yemen has made massive progress in the improvement of rural life. It has also seen a great rise in expectations. In the spring of 1984, some women from a village near al-Ka'dhera were talking about the changes which had come to their area since the access road opened in the summer of 1980. They decided the first thing they wanted in their village was a water project and the second, a telephone. If their village were to see the same substantial progress as others in the southern uplands, they might come to see a new school, a clinic, electricity, and an expanded agricultural extension service over the next five to ten years. At the same time, the future is hard to predict and the sources of the present prosperity are far beyond the control of the village. The funding for most development is derived from the remittance money earned abroad and sent home. Villagers have heard that the health of the international economy and the position of Yemeni workers abroad are threatened. Despite these predictions of a grimmer economic future, the expectations of most people in al-Ka'dhera remain high. Their capacity to absorb changes seems to be expanding as old and new institutions adjust to changing conditions in the world.

A Profile of al-Ka'dhera

The local combination of geography, demographics and climate has produced opportunities and obstacles for the people of al-Ka'dhera. The village is located on the southern rim of the Yemen highlands, where the terrain drops sharply 1,800 meters to the Aden plain below. Aden is less than 70 kilometers away. A number of villagers were educated in Adeni schools, worked in factories there, or owned shops long before such opportunities existed in the North. Presently, the houses in al-Ka'dhera number about 120. They are large stone structures grouped in family hamlets. Most of the houses have been built during the prosperity of the past 40 years. Only 30% date from before the turn of the century. Stone is still the preferred building material for houses. It is beautiful, easily available, and has excellent thermal qualities. The houses are still quite similar in plan, and no matter how modest an initial structure, the foundations are always laid for a large house that will accommodate 6-20 people. Nowadays, it is common for sons to be working abroad while their father watches over the family's wives and children in one big house. In all, the village population totals about 800, although at any one time perhaps only 700 people may be present.

The village is surrounded on three sides by barren, rocky mountains, with one side open to the coastal plain below. The mountain slopes concentrate the rain runoff in a series of terraced fields about 4 kilometers square.

Ka'dhera has always been an agricultural community and the relatively abundant rainfall has rewarded the tremendous effort of building terraces and irrigation channels. The year is divided into wet and dry seasons. The major rains come with the Monsoon off the Gulf of Aden in July, August, and September. Year round the temperatures are mild, although the sun is tropical.

Sorghum has been the staple grain for a number of years. Millet is also grown. Coffee was a popular cash crop until the last Imam imposed a high tax on coffee trees which drove the growers to uproot them. Some coffee is still grown for private use, but the protected places near the mountains where the trees once stood are now given over to qat. Qat (catha Edulis) is an evergreen shrub that grows to two meters high in this region. The tender new leaves are chewed for a mildly stimulating effect. The villagers say it makes them strong so they can work hard and think clearly.

Past Development of Water Resources

Water was the key to settlement in al-Ka'dhera. Local storytellers claim that 300 years ago three men and their families walked into the mountains from the Aden plain following a riverbed to its source. They settled in a small basin and named it al-Ka'dhera: 'the flat place'. They dug a strong well, developed irrigation channels and built terraced fields.

The well was dug where watercourses converge in the center of the basin. Water now flows on the surface of the wadi six months out of the year and drops to five or six meters below the surface during the dry season. Before the TransCentury water project, women would come to the well in the mornings and late afternoons. Some would draw water while others washed clothes. Water was collected with ropes and buckets, women pulling them up hand-over-hand. They carried the full vessels themselves or loaded them on donkeys for the trip back to their houses one or two kilometers away. A family of ten used 300-400 liters per day for drinking, cooking, washing and watering animals.

As more people came to settle in the region, the well at al-Ka'dhera earned a reputation for being the most reliable water source during years of drought. People would come from villages four to five kilometers away when their wells ran dry. Islamic law is quite clear that those who have more than enough water for themselves must offer the surplus to others so that they and their animals may drink. It states that people who develop a well are given priority access to it, but they do not own the water in it. The water, in fact, cannot be owned by any individual or group. The Prophet is supposed to have said, "mankind are co-owners in three things; water, fire and pasture." He also said, "when two thirsty men come to a well he who is most thirsty must drink first, then their animals by lot." Although there is a clear and universal right to drink from any well, there is at the same time a customary law that villagers rely on their own water sources and do not impose on their neighbors. As a limited resource, water is in fact closely guarded. In the past year, Project 044 staff have seen women in neighboring villages laboriously scooping water from the dregs of their own well rather than go to the well at al-Ka'dhera.

Other water sources in the area depend on regular rainfall. One is a seasonal spring reached by a steep path up the mountainside. A cave has been dug there to expose a spring between two big rocks. Women remove their shoes before descending to the pool in back. Six cisterns have been built to catch runoff from the mountains. This water is used mostly for animals and washing, or occasionally for irrigation. Two or three cisterns are quite large, being 50 to 60 cubic meters. Smaller ones are covered like those used for ablutions at the mosque.

Rainfall provides water for agriculture. The average annual rainfall is 600 millimeters (or 23.6 inches). This water is carefully controlled by custom and law as it moves through a series of channels and terraces. It is allocated according to common sense and the priority rights of landowners. The principle is that water should flow down a predetermined series of terraces filling each with an adequate amount for the crop which is planted there and serve as many fields as possible. During a typical one-hour downpour, the runoff cascades off the mountainsides and is captured in small stone channels that lead to larger canals and the terraces. The fields are protected from the watercourses by thick stone walls, each with a gate. When the runoff comes, the owner of the land opens his gate in turn. Water may flow from one field to adjoining ones if they have similar priority. The sorghum fields are usually flooded ankle deep. Marginal fields rely solely on the rain which falls directly onto them.

The well-established conventions which govern the use of irrigation water are based on a situation of intense competition. Water disputes are a very serious event in the village. Generally, water rights are spelled out in land deeds and the law provides that water rights cannot be separated from the land. A deed specifies the volume of water a parcel is entitled to and specifies its place in the sequence of irrigated fields. Nowadays, pumps are making rented water from private wells more common. Since the water project in al-Ka'dhera was built, some farmers are claiming rights to the water in the old public wells. In one case, a family which developed a well generations ago and donated it to the public is now trying to re-establish their claim. They have built a locked door over the old well and installed a pump and pumpline which they use to irrigate fields or to fill tank trucks at 20YR per 1,000 liters. The shiekh has locked the remaining public wells before someone claims them too.

The New Village Water System

In the summer of 1982, village leaders began to plan for a domestic water supply project. A well drilling contractor was scheduled to bore new wells in the area, and this provided the opportunity for a new well at al-Ka'dhera that would be the starting point for a water project. A major difficulty was getting the large drilling rig to the well site. The main access road which had been constructed three years earlier was adequate as far as it went, but a new road had to be cut to the old al-Ka'dhera well at a cost of 10,000YR. The new well was drilled 50 meters from the old one. Near the surface a water-laden stream bed of sand and gravel fed the original well. At a depth of 60 meters a substantial aquifer was reached but the well was extended to 150 meters in case there was an eventual drop in the water table. The well cost about 250,000YR. The money was collected by the village headman at a rate of about 1,000YR from each household. The pharmacist paid for the roadwork himself. The area shiekh and two wealthy families each contributed about 30,000YR towards the total cost.

Once this preliminary work was done, the villagers looked for help with their water project. First they approached the Southern Uplands Regional Development Project (SURDP). SURDP provides tanks and pumps at no cost to the villages. Pursuing a SURDP project proved time-consuming and complicated so the villagers looked elsewhere. The Local Development Association (LDA) agreed to pay 50% of the cost of a water project at al-Ka'dhera. One of the local men who worked in a government office in Sana'a approached TransCentury directly to see if they could help. He was referred back to the Rural Water Supply Department and eventually al-Ka'dhera appeared on a list of villages to be surveyed as potential TransCentury projects. When the Project 044 surveyors arrived, they determined that the project was feasible and measured elevations and distances. They talked with the village men about plans for the project. Sizes and locations of tanks and pipes were discussed. It was decided to install a pipe network for house connections rather than public taps. There would be washing taps in the two mosques. The villagers agreed to provide labor and local materials (about 30% of project costs), of which the LDA would pay half.

Four weeks later the al-Ka'dhera water system had been designed and a delegation from the village arrived at the Rural Water Supply Department in Sana'a to sign the contract. The agreement specified that there would be two 25 cubic meter concrete tanks, one for houses at a high elevation and another for those lower. There would be four kilometers of pipe, a pump, generator and pumphouse. The cost was estimated at 270,000YR or 400YR per capita. The delegation, along with a TransCentury engineer and his counterpart, returned to the village where the agreement was reviewed at the shiekh's house. The contract was accepted by consensus and the headman and the president of the LDA signed the document. The process of listing the village, executing the survey, completing the design and negotiating the construction contract had taken three months.

Six weeks later, a Peace Corps construction supervisor and his Ministry counterpart arrived in al-Ka'dhera with a pickup truck full of tools and pipe fittings. The villagers gave them a room in the school to live in and an old stable to store their equipment. The next day a large truck made the first of three trips to deliver pipes, cement, and form-work. The villagers unloaded the trucks and carried the materials to the site. Only two men were paid by the village. They received 100YR, lunch and qat each day for joining pipe working along side the Ministry and TransCentury counterpart. They all worked eight hours per day.

While the pipe was being laid, the tank construction was also initiated. One tank was located high on the mountainside, the other a bit lower. It took a bulldozer 21 days to cut the road to the tank sites and cost 58,000YR. The tanks were made of reinforced concrete rather than stone because the villagers insisted that that was what they wanted. They also wanted larger tanks but finally accepted tanks of 25 cubic meters. This gave the villagers a consumption capacity designed for 50 liters per day which was sufficient to accomodate a future population of 1,000.

Each day the focus of work shifted between pipe laying and building the tank. One morning, half a dozen men carried pipe for a line to a distant hamlet. When they grew tired their women helped. As the pipe joiners connected pipe, they came to a field whose owner would not allow the pipeline to cross her land. She was quite adamant. The villagers would not accept an alternative route which they considered too long so they brought in the shiekh to impose a decision. He decided the line must follow the edge of her field and his decision was quickly accepted.

On days when concrete was poured for the tanks, more than a dozen men were present to carry materials and mix concrete. The headman made sure that there were always sufficient voluntary laborers and that a different household provided lunch each day for the Ministry and TransCentury crew.

The pump and generator were the last components of the project. Villagers wanted the biggest generator they could persuade the project to buy so it could be used to illuminate their houses at night. Finally, after much discussion they agreed to pay the difference between the cost of the larger generator they wanted and the cost of the generator required by the pump.

Everything was in place four months after construction started. The tanks and pipelines were filled and checked for leaks. Since no one had made connections to their houses yet, the women came to the mosque taps to fill their jerrycans. The excitement was contagious in those first days while the women filled every container they owned and children danced around their mothers. For two or three days the water system was used in this unregulated way until the sheikh decided to establish order. He locked the pump for two weeks until everyone installed house connections. Then he collected 20YR from each household to cover operating costs for the first month. The headman's cousin, who had just attended the Transcentury pump operator's course in Sana'a, was given the money and the key to the pump. He started running it every morning for five hours. In the afternoons he opened the lines from the tanks for two hours and each house filled its storage tank. Eventually, operating costs were established at 400YR per month for the operator's salary and 400YR for diesel and oil. Each month the operator collected 15-30YR from each family depending on the family's size and ability to pay. Consumption rates stabilized at 40 liters per person per day.

Momentum for Change in Al-Ka'Dhera

The water project in al-Kadhera is part of a larger effort for improving rural life all over Yemen. The village was able to achieve its goal of a safe, reliable and convenient water supply by using outside resources (the Ministry of Public Works) and local resources (the Local Development Association and village labor). Clearly, new institutions such as the MPW and the LDA are making a useful contribution in rural areas. Still water projects are only one small step. The access road into al-Ka'dhera for example has clearly encouraged a number of related developments. It is also no coincidence that the school was built only months after the road was complete.

Now a clinic is under construction. The villagers hope that the other recent improvements in the village will help them with the difficult task of attracting medical staff.

Large projects in al-Ka'dhera have been accomplished with major support from ministries and foreign donors. At the same time a number of important changes are also occurring on a more modest scale. One man has returned from Saudi Arabia trained as a welder. He has set up a shop where he makes metal doors and small water tanks. Another man operates a diesel-powered flour mill which at night runs a generator. He sells electricity to his neighbors for 20YR per fluorescent fixture. Scattered among the houses are two or three shops that sell processed foods and clothes. Perhaps the most important non-agricultural activity in al-Ka'dhera at the present time is house building. As more money becomes available more people are finding ways to have it pass through their hands as it circulates through the village.

Nowadays, a typical family in al-Ka'dhera has incorporated a number of new ways of doing things into their lives. Their children go to school regularly each morning. The women have water piped to their houses. The grain harvest is ground mechanically. Pharmaceutical supplies and processed foods from abroad are common. At night television shows enter the houses and bring pictures of a new way of life that is rapidly becoming real. Most Yemenis have a great fondness for their village--even if they live in the city. They associate a healthy climate and fresh food with the countryside. The people of al-Ka'dhera are also beginning to say, "Now that we have the same conveniences as the city, village life is even better."



C. TECHNICAL ANALYSIS

This section of the proposal looks at the technical feasibility of the two principal components of the project: 1) the construction of rural water systems, and 2) the institutional development strategy for the extension over the next five years.

The current technical methodology for the design and construction of rural water systems involves a crew of engineers and technicians who visit a site, conduct the necessary social and technical analyses, and prepare a design. From here the project moves to construction. The construction in the Tihama usually involves an elevated tank; in the mountains for gravity fed systems, stone masonry ground tanks are generally used.

On balance, the technical methodology used by Project 044/I for the construction of these systems has been shown to be effective, appropriate, and produces good quality water systems. These observations have been repeatedly confirmed by a series of formal and informal USAID evaluations. The evaluation of October, 1983 states, "with regard to general project operations, the mangement of the survey, design, and construction of subprojects is excellent...."* The engineer's report in the same evaluation confirmed this general statement. He concluded that, "Engineering activities of the village surveys, cost estimating, construction and construction supervision including supervision of contractors, appears well done.**"

There are several factors which contribute to the technical feasibility of the sub-project construction cycle. First, Project 044/I uses a standard hierarchy of supervisors, and there are routine inspections throughout the construction cycle. Contractors and villagers are supervised by RWSD technicians and Peace Corps Volunteers. RWSD technicians almost always have a Peace Corps counterpart. The technicians and Volunteers, in turn, are supervised by the technical staff and Chief of Party in Sana'a. This pyramid of supervision ensures good quality control throughout the construction process.

Further, the villagers are closely involved throughout the construction process. Systems are usually partially extant before construction of an improved water system is ever undertaken. The pre-existing components are incorporated into the improved system. The villagers also participate directly in the construction process. Through these various techniques, the villagers' concerns are incorporated into the design and construction of the system, and they are familiar with the technical aspects of construction, so

*Leonard, Dichter, and Arbuthnot, "Evaluations of the Small Rural Water Systems Projects," p. 1.

**Ibid., p. 22.

that after completion they are able to properly operate and maintain the system.

Finally, the technical construction of these rural water systems often utilizes local contractors or subcontractors, particularly in the Tihama. The use of contractors with appropriate supervision as detailed above has been found to be technically feasible, cost effective, and a good way to transfer technologies beyond the immediate confines of Project 044, into the larger community.

A second part of the technical feasibility concerns the institution building component of this project. Project 044/II will be constructing rural water systems, but it will also be strengthening the RWSD as an institution. It will be doing this in the context of a rolling design. Although the goals of the project will remain fixed, the day-to-day and month-to-month components will shift because of the personalities within the Department, and the normal exigencies of working in Yemen. The over-riding objective will remain the improvement of the capabilities of the RWSD.

The priorities for institutional development will continue to be to transfer the necessary skills into the RWSD to help it function more professionally and efficiently. This will be accomplished through a variety of direct and indirect training and management methodologies.

Under Project 022 -- the precursor USAID project to Project 044 -- USAID added two units to the operations of the RWSD: 1) the Drilling Section and 2) the Mechanical Section. Both of these offices were set up initially entirely by USAID. AID hired the staff and paid the laborers. At the end of Project 022, with negligible structured transition, these two offices were turned over completely to the RWSD.

Under Project 044/I, a similar but more complex model has been followed. Here there is a deliberate blurring of the distinction between the Project and RWSD. RWSD staff are assigned on secondment to work with the Project for field construction activities. And Project staff, in turn, works with various other parts of the Department on administrative and planning issues. Through these mechanisms (repeatedly characterized in this paper as following the servicio model) there is a consistent commingling of staff, and a transference of skills from the Project to the Department. To date, this strategy has resulted in the creation of one additional proto-section of the RWSD. There is now an emerging field construction capability, which has been created under Departmental auspices. This unit is now in the process of being turned over to the RWSD, or assimilated into the structure of the Department.

Project 044/II will continue to use the same sort of institution-building strategy which 044/I used, doing institution-building in a staged fashion, to ensure that the various individual steps are appropriate for a given state of the RWSD's development. Institutional development takes place over time. The evidence in Yemen consistently has been that people

generally learn best by doing things in a "hands-on" fashion. Therefore, while there is some regional training proposed, the bulk of the training under Project 044/II is based on short in-service training courses that will be interspersed with normal on-going work and informal on-the-job training. Project 044/II will continue to create an institutional context where the administrative and management systems work. Through this, the Yemeni staff will be exposed to a positive environment for on-the-job training, as well as carefully structured relevant short in-service training courses.

In addition to this, there will be a small number of OPEX staff added to the Department to help RWSD's operational systems become fully functional. The RWSD will hold these OPEX slots open while Yemeni staff are being trained to fill these positions.

Through these strategies (which are copiously detailed under the first EOPS of this proposal) it is expected that Project 044/II will substantially strengthen the RWSD.

This type of management development strategy has been shown to be feasible under Project 022 and 044. It should be significantly more feasible under Project 044/II because of the foundations which have been laid, and the resources which are being proposed under this extension.

D. ECONOMIC AND FINANCIAL BENEFIT ANALYSIS

An analysis of the benefits realized to date through Project 044 does not lend itself well to the use of standard quantitative techniques such as Internal Rate of Return Analysis and Cost-Benefit Ratio Analysis. The reasons for this have been highlighted in other sections of this report, but are again summarized below:

- a. The baseline data necessary to complete the above analyses are not readily available;
- b. The costs, in terms of manpower and financial resource requirements necessary to collect the above data, are prohibitively high vis a vis the existing resource base.

Because of this, the analysis discusses the benefits realized through Project 044 in a qualitative rather than quantitative manner.

The primary benefit of the project to date is the improved access to water supplies for the following rural villagers throughout Yemen:

<u>Province</u>	<u>Number of Projects</u>	<u>Total Current Beneficiaries*</u>	<u>Total Beneficiaries after 20 years*</u>
Sana'a	16	9,560	14,348
Hodeidah	23	17,261	26,040
Dhamar	6	3,950	5,725
Taiz	3	3,480	5,220
al-Beidha	1	989	1,484
Hajjah	1	730	1,095
	<u>50</u>	<u>35,970</u>	<u>53,912</u>

This improved access has in turn produced the following direct benefits: Health and Hygiene. Although no reliable quantitative data is readily available, reports from villagers gathered during the USAID Evaluation of the Fall of 1983 indicate that, as a result of improved access to water supplies, rural villagers:

- a. have increased per capita drinking water consumption;
- b. have improved sanitation practices, including the washing of clothing and cooking utensils;
- c. have improved personal hygiene, particularly for children, as a result of more frequent bathing.

*The projects are designed and constructed to allow for normal population growth over a 20 year period. The current beneficiaries are the present population; the total beneficiaries represent the systems at full capacity.

The above changes have resulted in an improvement in the general health and well being of recipient villagers as well as a decrease in the number of work days lost to diseases caused by shortages of potable water. (For example through diarrhea and other intestinal disorders.)

Labor Savings. Prior to Project 044, water was collected several times a day by women and children. This often involved carrying 44 lb. containers of water on their heads over a distance of several miles. This work was done in addition to the agricultural and household tasks completed by the same group.

As a result of the project, women and children have realized a savings in the amount of time required for collecting water of one to three hours per day. This time appears to be spent on other customary tasks and on increased time spent caring for families. The project also has helped alleviate the physically arduous tasks of collecting water, thus, providing an additional benefit for the health of the women and children.

The magnitude of this labor savings is quite high. This is shown in the calculations presented in the two tables on the following pages. The first table calculates labor savings that have already been realized from Project 044 as well as potential savings that would be realized if the other components of Project 044 and the proposed extension were completed. As can be seen, labor savings from the 50 projects already completed amount to over 2,000 person years per annum, or over 40,000 person years during the life of the project. This savings amounts to over 8,000 person years per annum when the additional components of Project 044 and the proposed extension are included, or over 160,000 person years over the life of the project.

These labor savings increase again when the same calculations are done for the water systems at full capacity. For projects already completed, labor savings amount to about 3,150 person years per annum, or about 63,000 person years over the course of the project. When the additional components and proposed extension savings are added in, these totals rise to, respectively, about 12,200 person years per annum and over 245,000 person years over the twenty year project period.

Because a large portion of the YAR labor force is employed outside the country, and significant parts of the economy suffer from a serious labor shortage, this labor savings represents a significant gain to the Yemen economy.

Another significant group of benefits produced by Project 044 are public and private sector institution buildings at both the national and local levels.

Projected Labor Savings - Current Beneficiaries

<u>Project Group</u>	<u>Hours Saved/Day/ Household</u>	<u>Number of Households</u>	<u>Hours Saved Per Year</u>	<u>Person Weeks Saved Per Year</u>	<u>Person Years Saved Per Year</u>
044 Projects Completed to date (50)	2 hours	$\frac{35,970 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 5,995 \text{ hh}$	$2 \text{ hours} \times 5,995 \text{ hh} \times 365 \text{ days} = 4,376,350 \text{ hours}$	$\frac{4,376,350 \text{ hours}}{40 \text{ hours/workweek}} = 109,409 \text{ work weeks}$	$\frac{109,409 \text{ work weeks}}{52 \text{ weeks/year}} = 2,104 \text{ person years/year}$
044 Projects to be Completed by Sept., 1984 (5)	2 hours	$\frac{3,500 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 177 \text{ hh}$	$2 \text{ hours} \times 177 \text{ hh} \times 365 \text{ days} = 425,590 \text{ hrs}$	$\frac{425,590 \text{ hours}}{40 \text{ hours/workweek}} = 10,640 \text{ work weeks}$	$\frac{10,640 \text{ work weeks}}{52 \text{ weeks/year}} = 205 \text{ person years/year}$
Dhamar Projects to be Completed (18)	2 hours	$\frac{30,348 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 5,058 \text{ hh}$	$2 \text{ hours} \times 5,058 \text{ hh} \times 365 \text{ days} = 3,692,340 \text{ hrs}$	$\frac{3,692,340 \text{ hours}}{40 \text{ hours/work week}} = 92,309 \text{ work weeks}$	$\frac{92,309 \text{ work weeks}}{52 \text{ weeks/year}} = 1,775 \text{ person years/year}$
Proposed Extension: 50 Tihama Projects	2 hours	$\frac{37,500 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 6,250 \text{ hh}$	$2 \text{ hours} \times 6,250 \text{ hh} \times 365 \text{ days} = 4,562,500 \text{ hours}$	$\frac{4,562,500 \text{ hours}}{40 \text{ hours/work week}} = 114,063 \text{ work weeks}$	$\frac{114,063 \text{ work weeks}}{52 \text{ weeks/year}} = 2,193 \text{ person years/year}$
Mountain Projects	2 hours	$\frac{35,000 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 5,833 \text{ hh}$	$2 \text{ hours} \times 5,833 \text{ hh} \times 365 \text{ days} = 4,258,090 \text{ hours}$	$\frac{4,258,090 \text{ hours}}{40 \text{ hours/work week}} = 106,452 \text{ work weeks}$	$\frac{106,452 \text{ work weeks}}{52 \text{ weeks/year}} = 2,047 \text{ person years/year}$

hh = households

Projected Labor Savings - Designed Beneficiaries (Over 20 Years)

<u>Project Group</u>	<u>Hours Saved/Day/ Household</u>	<u>Number of Households</u>	<u>Hours Saved Per Year</u>	<u>Person Weeks Saved Per Year</u>	<u>Person Years Saved Per Year</u>
044 Projects Completed to Date (50)	2 hours	$\frac{53,912 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 8,985 \text{ hh}$	$2 \text{ hours} \times 8,985 \text{ hh} \times 365 \text{ days} = 6,559,050 \text{ hours}$	$\frac{6,559,050 \text{ hours}}{40 \text{ hours/work week}} = 163,976 \text{ work weeks}$	$\frac{163,976 \text{ work weeks}}{52 \text{ weeks/year}} = 3,153 \text{ person years/year}$
044 Projects to be Completed (5)	2 hours	$\frac{5,250 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 875 \text{ hh}$	$2 \text{ hours} \times 875 \text{ hh} \times 365 \text{ days} = 638,750 \text{ hours}$	$\frac{638,750 \text{ hours}}{40 \text{ hours/work week}} = 15,969 \text{ work weeks}$	$\frac{15,969 \text{ work weeks}}{52 \text{ weeks/year}} = 307 \text{ person years/year}$
Dhamar Projects (18)	2 hours	$\frac{41,922 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 6,987 \text{ hh}$	$2 \text{ hours} \times 6,987 \text{ hh} \times 365 \text{ days} = 5,100,510 \text{ hours}$	$\frac{5,100,510 \text{ hours}}{40 \text{ hours/work week}} = 127,513 \text{ work weeks}$	$\frac{127,513 \text{ work weeks}}{52 \text{ weeks/year}} = 2,452 \text{ person years/year}$
Proposed Extension: 50 Tihama Projects	2 hours	$\frac{56,250 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 9,375 \text{ hh}$	$2 \text{ hours} \times 9,375 \text{ hh} \times 365 \text{ days} = 6,843,750 \text{ hours}$	$\frac{6,843,750 \text{ hours}}{40 \text{ hours/work week}} = 171,094 \text{ work weeks}$	$\frac{171,094 \text{ work weeks}}{52 \text{ weeks/year}} = 3,290 \text{ person years/year}$
50 Mountain Projects	2 hours	$\frac{52,500 \text{ beneficiaries}}{6 \text{ beneficiaries/hh}} = 8,750 \text{ hh}$	$2 \text{ hours} \times 8,750 \text{ hh} \times 365 \text{ days} = 6,387,500 \text{ hours}$	$\frac{6,387,500 \text{ hours}}{40 \text{ hours/work week}} = 159,688 \text{ work weeks}$	$\frac{159,688 \text{ work weeks}}{52 \text{ weeks/year}} = 3,071 \text{ person years/year}$

hh = households

Assumptions on Number of Beneficiaries

	<u>Beneficiaries</u>		
	<u>Current</u>	<u>Designed</u>	<u>Note</u>
044 Completed Projects	35,970	53,912	Current based on actual totals. Designed based on 50 percent increase in village size over 20 years
044 Projects to be Completed (assumed as Mountain Projects)	700/project	1050/project	Based on report calculations of average project size
Dhamar	30,348	41,922	As estimated in report
Proposed Extension:			
50 Tahima Projects	750/project	1185/project	Based on report calculations of aver- age project size
50 Mountain Projects	700/project	1050/project	

Public Sector. The RWS of the Ministry of Public Works is the main YARG institution involved with Project 044 at the national level. Under the project, a total of eleven RWS staff have been seconded to Project 044 as counterpart technicians to expatriate staff working on Project 044. An additional eleven technicians have also been hired locally by Project 044. These staff are from the following technical skill groups:

<u>Skill Group</u>	<u>RWS Seconded Staff</u>	<u>Local Hire Technicians</u>	<u>Total Staff</u>
Construction	2 senior	4 senior	6 senior
	8 senior	4 junior	12 junior
Mechanical	1 senior	1 senior	2 senior
		1 junior	1 junior
Carpenters	-	1 senior	1 senior
	<u>11 total</u>	<u>11 total</u>	<u>22 total</u>

These staff have by now received extensive on the job training and represent a significant increase in RWS technical staff available for work on water supply projects.

In addition to these technicians, the RWS has gained significant experience in the areas of program design, contract management, and administration. At the local level the LDAs have often been involved with various aspects of Project 044. In particular, the LDAs are involved with project identification and selection activities. LDA staff have also received training under Project 044. This will help improve the overall project and program design and planning skills of the LDAs.

Private Sector. A total of 6 contractors have been involved with constructing water supply systems under Project 044. Under the extension an additional 24 contractors are expected to be involved. Staff from these contractors have received informal training in such things as contract and bid preparation, preparation of cost estimates, and project management. In addition, these contractors have now had practical experience in the construction of water systems.

Public-Private Sector Linkages. A third institutional benefit of Project 044 is that a stronger linkage has been developed between the RWS and these contractors. This linkage is in keeping with current USAID and YARG policy objectives. Through this construction work, the Yemeni private sector contractors have also improved their capabilities to carry out public works projects.

Project Cost Analysis

To date a total of \$2,519,241 has been spent on the first 50 sub-projects. Within this total, the village contribution ranges from 30 percent to 74 percent. It averages 36.4 percent. Project 044 and the Ministry's contribution averages 63.5 percent. Details on per project and per beneficiary costs are shown in the table below:

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>	<u>% VILLAGE CONTRIBUTION</u>
Sanaa	16	211,747	468,283	680,030	31.1
Hodeidah	23	402,941	855,917	1,258,858	32.0
Dhamar	6	59,455	137,806	197,261	30.1
Taiz	3	207,410	72,140	279,550	74.2
Al-Beidha	1	22,975	39,119	62,094	37.0
Hajjah	<u>1</u>	<u>13,678</u>	<u>27,770</u>	<u>41,448</u>	<u>33.0</u>
Totals	50	919,206	1,601,035	2,519,241	36.4

Average Cost/Project (US\$)

Sanaa	16	13,234	29,268	42,502
Hodeidah	23	17,519	37,213	54,733
Dhamar	6	9,909	22,968	32,877
Taiz	3	69,137	24,047	93,184
Al-Beidha	1	22,975	39,119	62,094
Hajjah	1	13,678	27,770	41,448
Total Average		18,365	32,021	50,385

Average Cost/Beneficiary (US\$)

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>NUMBER OF BENEFICIARIES</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>
Sanaa	16	9,560	22.15	48.98	71.13
Hodeidah	23	17,261	23.34	49.59	72.90
Dhamar	6	3,950	15.05	34.89	49.94
Taiz	3	7,480	59.52	20.73	80.25
Al-Beidha	1	989	23.23	34.55	62.78
Hajjah	1	730	18.74	38.04	56.78
Total Average			25.52	44.51	71.03

Based on a sample of 50 subprojects, an average subproject, costs \$50,385 dollars in direct costs. This is divided into two primary categories: village contributions and Project 044/Ministry contributions. Based on 50 projects, the village typically contributes \$18,364 dollars or 36.5 percent of the direct capital costs. The project with some assistance from RWSD/MPW contributes \$32,021 or 63.5 percent of the direct capital costs.

For planning and budgeting purposes, subprojects can also be broken up into two major categories: mountain projects and Tihama projects. Among the first 40 projects, half were built in the Tihama and half were built in the mountains. The average cost for 20 mountain projects was \$46,032 and the average cost for Tihama projects, -- which are slightly bigger and usually require an elevated tank and pumps and engineers--was \$55,332. The villager's contributions to the capital costs for mountain projects was \$20,000, or 43.5 percent. The villagers contributions to the capital costs of Tihama projects was \$17,000, or 31 percent.

The cost details for Tihama projects and mountain projects are given in tabular form below:

Total Capital Costs/Mountain Projects (US\$)

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>	<u>% VILLAGE CONTRIBUTION</u>
Dhamar	6	59,455	137,806	197,261	30.1
Sanaa	11	133,284	310,554	443,838	30.0
Taiz	3	207,410	72,140	279,550	74.2
Total	20	400,149	520,500	920,649	43.5

Capital Costs Per Village/Mountain Projects (US\$)

<u>PROVINCE</u>	<u>PROJECTS</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>
Dhamar	6	9,909	22,968	32,877
Sanaa	11	12,117	28,232	40,349
Taiz	3	69,137	24,047	93,184
Total Average	20	20,007	26,025	46,032

Capital Costs/Beneficiary/Mountain Projects

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>NUMBER OF BENEFICIARIES</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>
Dhamar	6	3,950	15.05	34.89	49.94
Sanaa	11	6,337	21.03	49.01	70.04
Taiz	3	3,480	59.52	20.73	80.25
Total Average	20	13,767	29.07	37.81	66.88

Total Capital Costs/Tihama Projects (US\$)

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>	<u>% OF VILLAGE CONTRIBUTION</u>
Hodeidah	20	341,204	765,432	1,106,636	

Capital Costs Per Village/Tihama Projects (US\$)

<u>PROVINCE</u>	<u>NUMBER OF PROJECTS</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>
Hodeidah	20	17,060	38,272	55,332

Capital Costs Per Beneficiary/Tahima Projects (US\$)

<u>PROVINCE</u>	<u>PROJECTS</u>	<u>BENEFICIARIES</u>	<u>VILLAGE</u>	<u>RWSD/044</u>	<u>TOTAL</u>
Hodeidah	20	15,151	22.52	50.52	73.04

The villagers contributions towards direct capital costs,--whether it is 31%, 36.5% or 43.5 percent--represents only a part of the total cost of the project. There are numerous other project related costs which are not included in the above costs. These include such things as:

Project Identification and Approval. This involves the villagers presenting a project to an LDA; the LDA's approving and presenting the project to RWSD (MPW); then the preliminary RWSD technical survey and project approval by RWSD.Pre-Project Infrastructure Development. This can include construction of an access road, site preparation and grading, and the initial well drilling, or deepening, casing, lining, pumps, and engines.

Project Inspection Trips. These include field site inspections during and after project construction.

Training. This involves training of villagers in the operations and maintenance of the new water supply water systems.

Additional costs. Additional project related expenditures can include a sanitation component and the operations and maintenance expenses associated with the water supply systems. This latter expenditure is borne 100% by the recipient villages. On average, the operations and maintenance costs for a village water system is estimated to run approximately \$1,900 per year per system.

Of these categories of costs, preproject costs which precede the actual construction of a project are the most important. Project 044 works only on a project when there is an existing water source. There also has to be an access road, to permit trucks, vehicles, and equipment to get to the site. Often the villagers will have invested thousands of dollars in a water source before they ever contact the Ministry of Public Works. These preproject construction costs will vary significantly from subproject to subproject, depending on the specific location, geography, and particular needs of a particular village. However it is possible to estimate some approximate additional costs per project, including both village and YARG contributions.

The results of this analysis are shown in the table below:

	<u>Additional costs (US\$)</u>		
	Village	YARG	Total
Project identification and approval	2,020	140	2,160
Infrastructure development - 1 km @ \$6,000	6,000	--	6,000
well	45,000	--	45,000
Project inspection	15	285	300
Training	200	1,800	2,000
Evaluation	15	285	300
Total/Project	<u>53,250</u>	<u>2,510</u>	<u>55,760</u>

When these additional costs are included in the project cost analysis, the village contribution to total costs rises from 36.4% to 67.7%, or almost two thirds of total project costs. Details of this analysis are shown in the table below:

<u>Village Cost Contributions (US\$)</u>				
	<u>Village Contribution</u>	<u>YARG Contribution</u>	<u>Total Cost</u>	<u>%Village Contribution</u>
Capital cost Village	18,364	32,021	50,385	36.4
Additional Costs/ Village	53,250	2,150	55,400	96.1
Total	71,614	34,171	105,785	67.7

These increases in village cost contributions also increase the per beneficiary contributions to total project costs. For capital costs, the per beneficiary contribution amounts to US\$ 25.52 beneficiary. However, the inclusion of the additional costs increases this contribution to US\$ 99.54 per beneficiary. Details of this analysis are shown in the table below:

Project Cost Contributions per Beneficiary (Current Beneficiary)
US\$

Beneficiaries/Village	35,970 beneficiaries
	<u>50 villages = 719.4 ben/village</u>
Capital Cost-Village Contribution/Beneficiary	18,364
	<u>719.4 beneficiary = \$25.52/beneficiary</u>
Additional costs- Village Contribution/ Beneficiary	\$53,250
	<u>719.4 beneficiary = \$74.02/beneficiary</u>
Per Beneficiary Project Input	\$25.52/ben. + \$74.02/ben = \$99.54/beneficiary

This per beneficiary contribution decreases when the same calculations are done for the design population rather than the current population, as shown in the table below. As can be seen, the contribution per beneficiary decreases from \$99.54 to \$66.42.

Project Cost Contribution per Beneficiary - Design Beneficiaries
US\$

Beneficiaries/Village	53,192 ben.
	<hr/> 50 villages = 1,078.2 beneficiaries/village
Capital Cost-Village Contribution/Beneficiary	18,364
	<hr/> 1,078.2 beneficiary = \$17.03/beneficiaries
Additional costs- Village Contribution/ Beneficiary	\$53,250
	<hr/> 1,078.2 beneficiary = \$49.39/beneficiaries
Per Beneficiary Project Input	\$15.18/ben. + \$49.39/ben = \$66.42/beneficiaries

One note of caution must be mentioned with regard to the data used to calculate the additional project costs. These data are approximations, and therefore there may be a degree of variance within the data. It is expected that this variance is between 10-20%. Therefore, this analysis is presented as an indication of the degree and trend in village (and beneficiary) contributions.

Log-Frame

NARRATIVE SUMMARY

OBJECTIVELY VERIFIABLE INDICATORS

SPECIFIC TARGETS

MEANS OF VERIFICATION

IMPORTANT ASSUMPTIONS

Goal

To expand the rural populations access to potable water with consequent improvement in their health status and their quality of life.

Conditions that will indicate goal has been achieved:

1. Expanding numbers of rural persons with improved access to potable water.
2. Measurable changes in adequate and safe disposal of waste water.
3. Organized findings, helpful to determine training content of future programs on how households use water.
4. Women and children freed for other activities besides water-hauling; handicrafts; work in fields; leisure, schooling.

- 1989 - 70,000 persons.
2004 - 109,000 persons.
- 1989 - 20% of the 100 Tihama and mountain based projects.
2004 - 50% of the 100 Tihama and mountain based projects.
- 1987 - Completed studies of at least 100 households among seven villages.
- 1989 - Improvement of a significant factor in types of activities and duration pursued by women and children in villages assisted with rural water supplies.

1. Evaluation of 1986.
2. Evaluation of 1988.
3. End-of-Project evaluation.
4. On-site visits. Contractor reports.
5. Monitoring and data collection activities.
6. Special villana studies.

1. Design and implementation will be adequate to serve targeted demand, i.e., number of persons and villages planned.
2. Villagers are motivated to improve water storage usage, and drainage practices associated with expanded domestic water supply.
3. Households are motivated to improve domestic water usage helpful to achieving better health conditions.
4. There is a causal connection between rural water delivery systems and alterations in the tasks and style of living of rural women and children.

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Purpose

1. To provide improved domestic water supply and sanitation in selected rural villages.
2. To improve the managerial, technical, and financial capabilities of the Rural Water Supply Department (RWSD) so that it has the institutional strength essential to developing and sustaining a nationwide rural domestic water supply and sanitation program.

1. Rural water systems completed and sanitation projects installed.
- 2.1. RWSD able to plan budget, survey, and design rural water and sanitation projects.
- 2.2. RWSD implementing the construction of rural water and sanitation projects in conjunction with local development associations and the private sector.
- 2.3. RWSD training communities in the operation and maintainance of rural water systems and advising them on ways to deal with the public health and sanitation aspects of rural water supply.
- 2.4. RWSD developing effective ways to increase village contributions and foreign donor support.

1. 100 rural water supply systems.
22 sanitation projects.
- 2.1. Specific management, training, manpower development and technical design systems installed and operational.
- 2.2. RWSD responsible for construction of 100 small water projects, in collaboration with other participants, over a 5-year period.
- 2.3. RWSD systems developed and installed for villagers on-the-job training, research and related health education.
- 2.4. Models for village contributions developed and improved documentation developed for foreign donor support.

1. Outside inspections. Contract reports. Evaluations of 1986, 1988.
- 2.1. Detailed systems established for:
 - Management
 - Training
 - Staffing
 - Technical Design
- 2.2. Scheduled collaboration plans fixed within RWSD for work with other donors and LDAs.
- 2.3. Training Courses establishment:
 - Public drainage experiments
 - Village studies organized
- 2.4. Average of 50% village contribution towards cost of a project.
 - Documentation submitted to foreign donors for support.

1. Designs adequate, implementable in timely fashion and selection process workable. Other technologies applicable.
2. RWSD is receptive to institutionalizing managerial, technical, and financial capabilities.
3. The reorganization and restructuring of RWSD can be accomplished in appropriate ways, over time.
4. RWSD can locate, recruit, and train staff appropriate to the expanded implementation, training and coordination activities outlined for the proposed institution.
5. Some elements of RWSD operations can be privatized.
6. FAR systems comprise a way to link the RWSD, the local development associations, and private contractors.
7. Villages are motivated to participate in the health aspects of water supply process.
8. Villagers are motivated to expand their contributions to water supply project costs.

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NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	SPECIFIC TARGETS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p><u>Outputs</u></p> <p>1. 100 rural water systems will be completed; 22 sanitation projects will be completed; and 5 oabion check dams will comprise a pilot conservation and erosion control program. All will have the following sub-outputs:</p> <p>1.1. Feasibility surveys with basic economic and social data.</p> <p>1.2. Village sanitation process established/implemented.</p> <p>1.3. Periodic water quality testing.</p> <p>1.4. New technologies to utilize water more efficiently and reduce field construction costs.</p> <p>1.5. Appropriate drainage component for each sub-project.</p> <p>1.6. O & M capability established within all sub-project villages.</p> <p>1.7. All systems built with "Tees" and number of standpipes minimized.</p> <p>1.8. Water meters installed in up to 5 villages.</p> <p>1.9. Village health attitudes canvassed and elementary sanitary hygiene education provided.</p>	<p>1.1. Feasibility studies performed by EOP maintenance.</p> <p>1.2. Criteria established for selection of water, sanitation and check dam projects by RWSO.</p> <p>1.3. Water source tested before, during and after sub-project inventory.</p> <p>1.4. Appropriate technology identified and tested involving gabion check dams.</p> <p>1.5. Standardized drainage systems around all stand pipes; experimental irrigation use of waste water; household soakage pits.</p> <p>1.6. People trained and functioning in each village.</p> <p>1.7. Systems built with flexibility in design on "Tees" and standpipes.</p> <p>1.8. Criteria developed for placement/use of water meters.</p> <p>1.9. Surveys completed and education programs developed.</p>	<p>1.1. 250 studies.</p> <p>1.2. Adaptation of selection system to implementation as follows: RWSO - 50 Other donors - 36 RWSO/LDAs (FAR) - 14</p> <p>1.3. 300 tests.</p> <p>1.4. 2 to 3 appropriate technologies functioning in 5 - 15 villages.</p> <p>1.5. 50 drainage systems. 20 experimental irrigation use of waste water 300 soakage pits</p> <p>1.6. 200 villagers trained</p> <p>1.7. Design criteria established which permits various "mixes" in distribution outlets.</p> <p>1.8. At least 800 water meters installed.</p> <p>1.9. At least 4 villagers and up to 400 households surveyed and educational programs developed.</p>	<p>1.1. On-site inspections -Contract reports. -Peace Corps Volunteer reports. -Studies completed. -Evaluations 1986, 1988.</p> <p>1.2. Selection system installed and schedules for implementation met.</p> <p>1.3. Test Records.</p> <p>1.4. Test Reports.</p> <p>1.5. Reports on installed drainage systems.</p> <p>1.6. Records of training programs.</p> <p>1.7. As built drawings for each installed system.</p> <p>1.8. Reports and evaluations on water meter experience.</p> <p>1.9. Surveys completed and samples of educational programs/materials available.</p>	<p>1. -All Technicians on board, functioning in timely and adequate manner.</p> <p>-Feasibility and designs meet village requirements, construction supervision adequate, and projected construction time table is attainable.</p> <p>-RWSO and contractor has expertise to devise and implement surveys and follow-up.</p> <p>-New technologies can be applied to rural Yemeni conditions.</p> <p>-Villagers can be trained in O & M procedures.</p> <p>-RWSO and contractor can adequately address drainage, distribution, water charges and health education aspects of project.</p>

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	SPECIFIC TARGETS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p><u>Outouts:</u> (continued)</p>				
<p>2. Rural water supply department staffed, financed, and supported by the Ministry of Public Works so that it is capable of:</p>	<p>2.1. Office of planning and management created within RWSO.</p> <p>2.2. RWSO reorganized and restructured.</p>	<p>2.1. Advisory to D.G. of RWSO and staffed initially with 2 expatriate engineers/planners with counterparts assigned in 1985.</p>	<p>2.1. Authorization of office and staffing plan.</p> <p>2.2. Organization chart and modification in same.</p>	<p>2. RWSO leadership and Ministry of Public Works supports institutional development activities including:</p>
<p>2.1. Managing, planning, and designing all aspects of rural water and sanitation projects</p>	<p>2.3. Staff recruited or re-assigned from other RWSO offices to assist departmental administration planning and training.</p>	<p>2.2. Consolidation of technical offices; revision of various sections, e.g. drilling and hydrology, etc.</p>	<p>2.3. Staffing plan and counterpart assignments.</p> <p>2.4. -Training schedules. -Design and staffing of rural water training academy. -contract reports.</p>	<p>-Reorganization and staffing. -Expanded manpower development and training. -Increased involvement with LDAs, rural villages, and private sector. -Regional expansion.</p>
<p>2.2. Coordinating rural water project construction with local development associations, rural villages, and the private sector.</p>	<p>2.4. Training of technicians, engineers, administrators/planners; private sector contractors; and members of village communities.</p>	<p>2.3. 5 OPEX new staff assigned to administration/planning functions with Yemeni counterparts re-assigned to each function performed by OPEX staff.</p>	<p>2.5. FAR systems installed and records showing operation.</p>	<p>-Use of FAR systems for LDA/RWSO construction activities. -Improved monitoring and data collection and village studies. -Diversification and expansion of cost-sharing with villages and foreign donors.</p>
<p>2.3. Training communities in O & M of rural water systems and advising on the public health aspects of such systems.</p>	<p>2.5. Modified fixed amount reimbursement system installed.</p>	<p>2.4. -30 Yemeni technicians trained as RWSO construction supervisors. -22 Yemeni given advanced training in planning and administration (12-6 month; 10-1-year).</p>	<p>2.6. Rural water hydraulics laboratory equipped and accompanied by training programs/schedules.</p>	
<p>2.4. Expanding village and foreign donor support for the construction of rural water supply systems.</p>	<p>2.6. Rural water hydraulics laboratory established.</p> <p>2.7. Regional offices of RWSO established and expanded.</p>	<p>-Rural water training academy designed and staffed to do short-term training in planning and administration. -24 private sector trainees -200 villagers trained in O & M.</p>	<p>2.7. Authorized staffing, financing for of 3 regional offices.</p> <p>2.8. Studies available for review.</p>	
<p>2.5. Operating a monitoring and data collection system.</p>	<p>2.8. In-depth village studies completed analyzing water usage patterns and community health practices.</p> <p>2.9. RWSO systems monitoring and data collection on health practices/conditions.</p>	<p>2.5. FAR operational in up to 14 sub-projects.</p> <p>2.6. Expand the existing RWSO training center and equip it with a rural water hydraulic laboratory.</p>	<p>2.9. Monitoring and data gathering results available for review.</p>	

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- 2.7. 3 regional offices in Dhmar, Hodeidah, Taiz.
- 2.8. 4 village studies completed.
- 2.9. RWSO staff familiarized with monitoring activities.

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INDICATIVE SUMMARY	VERIFIABLE INDICATORS	SPECIFIC TARGETS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS										
<u>Inputs:</u>														
1. <u>Staffing:</u>	1.1. 9 positions filled by contractors.	1.1. 34 person-years over 5 years	1. -Staffing plans and schedules of RPSD and Contractor	1. Personnel can be obtained/retrained by contractor.										
1.1. Expatriates	1.2. Positions: <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1984</td><td>85</td><td>86</td><td>87</td><td>88</td></tr><tr><td>22</td><td>23</td><td>29</td><td>30</td><td>30</td></tr></table>	1984	85	86	87	88	22	23	29	30	30	1.2. 134 person-years over 5 years	-Budget for contractor and RPSD	2. RPSD can attract and retain qualified/trained personnel.
1984	85	86	87	88										
22	23	29	30	30										
1.2. Yemeni technical staff	1.3. Positions: <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>1984</td><td>85</td><td>86</td><td>87</td><td>88</td></tr><tr><td>16</td><td>16</td><td>16</td><td>14</td><td>8</td></tr></table>	1984	85	86	87	88	16	16	16	14	8	1.3. 70 person-years over 5 years	-Volunteer agency staffing schedules	3. Volunteers can be obtained/retained with correct technical qualifications.
1984	85	86	87	88										
16	16	16	14	8										
1.3. Volunteers	1.4. 17 positions	1.4. 105 person-years over 5 years	-Consultant budgets and assignments.											
1.4. Local-hire administrative staff.	1.5. At least 10 types of specialized consultancies.	1.5. 72 person-months over 5 years	2. -Training plans and schedules	4. Waivers can be obtained for local procurement.										
1.5. Consultants	2.1. 12 at 6 months each 10 at 12 months each	2.1. 6 person years 10 person years	-Creation of Rural Water Academy programs	5. Training plans and facilities can be operated on timely basis providing adequate training to highly trainable personnel.										
2. <u>Training</u>	2.2. 3 sessions/year for 3 weeks per session, 10 trainees/session	2.2. 450 person-weeks over 5 years	-Budgets for fellowships, training (short-term) and international seminars.											
2.1. Fellowships (long-term)	2.3. 2 sessions/year at 2 weeks per session, 5 trainees/session	2.3. 120 person-weeks over 5 years	3. Annual budget allocation for commodities and materials; and arrangement for sharing with LDAs rural villages and donors.	6. RPSD budget operations, timely and adequate.										
2.2. Technical (short-term)	2.4. 2 sessions/year at 1 week/session 10 trainees/session	2.4. 100 person-weeks over 5 years	4. Annual budgets and equipment procurement plans.	7. Villagers and foreign donors increasing their participation in program.										
2.3. Administrative (short-term)	2.5. 1 session/year at 4 weeks/session, 24 trainees	2.5. 96 person-weeks over 5 years												
2.4. Health and sanitation (short-term)	2.6. 2 sessions/year at 4 weeks/session, 20 trainees/session	2.6. 300 person-weeks over 5 years												
2.5. Private sector contractors (short-term)	2.7. 2 persons for 2 weeks/year x 5 trips	2.7. 20 person-weeks plus travel over 5 years												
2.6. Pump and motor maintenance (short-term)	3. Budget	3. \$1.7 million												
2.7. Water and sanitation seminars (international)	4. Budget	4. \$750,000												
3. <u>Commodities and materials</u>														
4. <u>Equipment</u>														

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- Appendix II: A possible reorganization of RWSO
- Appendix III: Staff Composition, Project 044
- Appendix IV: Criteria for Sub-project Selection
- Appendix V: Vehicle Mileage List
- Appendix VI: Request for Waivers for Vehicles
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- Appendix IX: Commodities, Equipment, and Supplies
- Appendix X: Selected Standard Forms in Use in Yemen
- Appendix XI: Bibliography

Appendix I: RWSO Staffing

TABLE 1

DIRECTOR-GENERAL'S OFFICE - RWSD

Director General	Abdul Bari Saleh
Secretary	Ali Anisi
Secretary	Anwar Hussain Al-Aswai
Deputy Director-General	Ibrahim al-Shami (Acting)

BILATERAL AFFAIRS OFFICE - RWSO (Hasaba)

1. Ibrahim al-Shami	Director	Counterpart for 044
2. Hamoud Gilan	Survey/Admin	Counterpart for Japanese
3. Thaa Ali Amir	Surveyor/Admin	Counterpart for UNICEF
4. Ali Ali Rizq	Sec./Typist	
5. Zafran Hassen Nagi	English Typist	Yemeni woman
6. Khairia Saad	Arabic Typist	Yemeni woman
7. Muhsen Ali Hamoud	Office Boy	
8. Mohammed Saif Andulla	Translator	Nominated for training under 044
9. Khalid Ibrahim al-Shamy	Surveyor	Nominated for training under 044
10. Ali Hamoud Aborig	Gardener	
11. Gaid Abdalla Awad	Waiter	
12. Abdalla al-Gady	Translator	
13. Ahmed Hassan al-Zufri	Technician	with Dutch Project
Seconded to various projects:		
14. Ali Mohammed al-Harsha	Construction Supervisor	044
15. Hamoud Tahir al-Kabsh	Construction Supervisor	044
16. Abdul Aziz al-Turabi	Construction Supervisor	044
17. Musaid Ali Homanmed	Construction Supervisor	044
18. Mohammed Saif M. Nasir	Construction Supervisor	044
19. Abdul Raquib Khalil		
20. Moh'd Abdul Rahman		
21. Matahar Gasaba		
22. Ali Saleh al-Kumein		
23. Abdu Al Raqib Moh'd Thabet		
24. Abdullah Ali al-Sumei	Mason	
OPEX Staff.		
25. Osman Nouri Saleh	Administrator (functions 044 as administrative Assistant to Dir. for Bilateral Affairs)	
26. Mahmoud Moh'd Mahmoud	Warehouse Keeper	Sudanese OPEX staff, partially paid by 044
27. Magdi Ahmed Moh'd	Civil Engineer	Egyptian OPEX staff
UN Volunteers		
1. Brahala Manendhar	Civil Engineer	Nepali, with UNICEF

ADMINISTRATION AND FINANCE

1. Mohammed Sharafi	Financial and Administrative Officer
2. Jalal Sudqi	Administrative Operations Manager
3. Nabil Hamid Mohsin	Secretary/clerk/typist
4. Mohammed Sultan	File Clerk
5. Mohammed Ahmed Salafi	Secretary/Clerk
6. Ahmed Badir	Messenger
7. Hameed Ali Omar	Coordinator for Public Services
8. Ahmed al-Kibsi	Invoice Clerk
9. Saad Saleh Badir	Receptionist/MPW Office
10. Mohsen al-Yarimi	Office Boy

OPEX Staff

1. Merivat Abdil Majid	Arabic Typist	Egyptian Woman
2. Noor Bint Moh'd Amir	Arabic Typist	Egyptian Woman

Drivers

1. Hasein al-Faqih	MPW Office Driver
2. Moh'd Abdullah al-Dieb	MPW Office Driver
3. Ahmed Ashi	MPW Office Manager's Driver
4. Rashid al-Yourshifi	Deputy Director's Driver
5. Moh'd Saleh Abila	Mahdi's Driver
6. Hussain Shabami	Hasaba Office Driver
7. Yahia Yahia al-Shabami	Hasaba Officer Driver
8. Mohammed Risq	Hasaba Office Driver
9. Abdu Hassein Nagi	Driver

(Allowance paid by UNICEF.)

MECHANICAL DIVISION

1. Abdullah Amir	Director	
2. Ali Mohammed Saif	File Clerk	
3. Saleh al-Radaey	Driver	
Workshop Section of Mechanical Division		
4. Saleh al-Sheyani	Supervisor	
5. Abdulrahman Sharaf	Mechanic	
6. Abdul Galil Moh'd Saif	Mechanic	(on secondment w/044 in Egypt on training)
7. Ali Ahmed Abbad	Mechanic	
8. Ahmed Nasir al-Bakili	Mechanic	
9. Abdulmalik Moh'd Shoshy	Mechanic Assistant	
10. Abdalla Hamoud Tahir	Test Unit (Wells?)	
11. Abdu al-Razzaq al-Ahdal	Welder	
12. Ahmed Lutfy al-Waty	Welder	
13. Abdulmalik al-Matary	Crane Driver	
14. Moh'd Hazam al-Matary	Crane Driver	
15. Abdalla Gahzar	Channel Driver	
16. Abdullah al-Bowab	Pipe Fitter	
17. Abdul Galil Ahmed	Pipe Fitter	
18. Abdul Gabar Manen	Pipe Fitter	
19. Gasim Ibrahim	Pipe Fitter	(on secondment w/004)
20. Ali Saleh al-Arasy	Pipe Fitter	
21. Ali Hussein Aliy	Pipe Fitter	
22. Moh'd Ali al-Khawlany	Construction Technician	
23. Yahia Gais	Mechanical Assistant	
OPEX Staff		
23. Thomas Correan	Mechanical Engineer	Indian
25. Tartour al-Mohra	Mechanical Engineer	Sudanese
UN Volunteers		
1. Moh'd Abdul Ghaffar	Diesel Mechanic	Egyptian

DRILLING DEPARTMENT (Hasaba RWSD)

1. Abdullah Abdulmalik Badr	Director	Masters in Hydrology
2. Fawzy Abdul Wasey	Deputy Director	Hydrologist
3. Ahmed Abdalla Gahhaf	Engineer	Masters in Hydrology
4. Osman Gasim	Rig Mechanic	
5. Yahia al-Kabary	Compressor Technician	
6. Saad al-Sharafy	Drilling Technician	
7. Hayel Noman	Drilling Technician	
8. Moh'd Saleh al-Joufi	Drilling Technician	(on secondment to 044)
9. Saad Anan	Drilling Technician	
10. Galib Gayed al-Odyni	Drilling Assistant	
11. Moh'd Mahiob al-Gened	Drilling Assistant	
12. Abdalla Ahmed al-Odeyni	Rig Driver	
13. Hamoud al-Ashmory	Rig Driver Assistant	(on secondment to 044)
14. Ali Kupas	Rig Mechanic	
15. Mohammed Mustafa al-Halaby	Clerk Secretary	

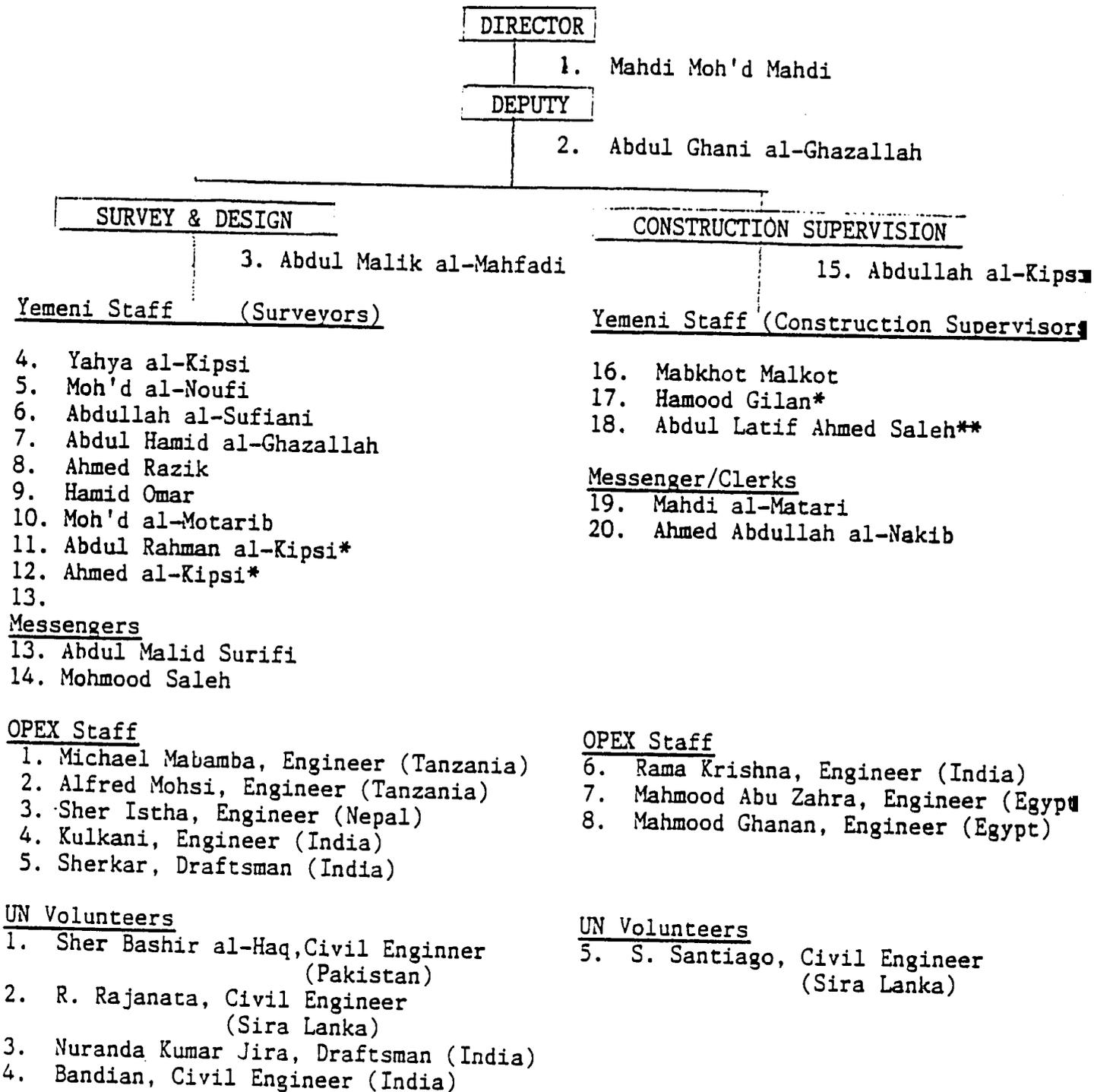
OPEX Staff

16. Ali Abdalla Shaban	Geologist	Egyptian Engineer
17. Abdalla Said Abdalla	Geologist	Egyptian Engineer
18. Magdi Shatlah	Engineer	Egyptian

Laboratory Section

1. Mahammad Abdu al-Maty	Laboratory Analyst	
--------------------------	--------------------	--

RWSO PROJECTS OFFICE (Main building of Ministry of Public Works)



* training status
 ** military service

APPENDIX II

Some suggested staffing requirements for the four major offices within a revised RWA are given below. These include: (a) the Director-General's Office, (b) the Technical Office, (c) the Administrative Section, and (d) the new Office for Planning and Coordination.

(a) The Director-General's Office would continue to function as it presently does. The Director-General has important political tasks which are critical and essential to the work of RWSD. The primary function of this office is to act as a liaison with tribes and village sheikhs who come to the Ministry demanding water projects. The present Director-General also holds a second informal position as a trouble shooter for the President of the Yemen Arab Republic in the event that there are disputes in the rural sector over water rights. These political roles will continue to be important; therefore, the Director-General should continue to be a politically skilled individual. However, he needs the assistance of additional technical staff working under him. The Director-General's office presently has two clerk/secretaries. It needs to be augmented slightly as follows:

- 1 Director-General
- 1 Secretary
- 2 Archivists
- 1 English typist
- 1 Arabic typist

6 total

(b) The Technical Section

Some suggested staffing requirements for the reorganized technical section are given below:

<u>Section Breakdown</u>	<u>Staff</u>
(1) <u>Director</u> for Technical Affairs	1
(2) <u>Assistant</u> to the Director	1
(3) <u>Survey Group</u>	

Four teams of two men each team consisting of one third-country OPEX engineer and one Yemeni technician. There will also need to be one technical storekeeper to maintain the field equipment in good order and one blueprint technician.

10

(4) Design Group

Four design teams of two men each consisting of either two engineers or one engineer and one draftsman.

8

Section Breakdown, (continued)Staff(5) Estimator's Office

One chief engineer estimator plus two specially trained Yemeni technicians as assistants.

3

(6) Construction Office

With a consolidation of the WHO-sponsored Projects Office and Project 044 staff, it should be possible to field up to 8 construction supervision teams of two Yemeni technicians each. These men would work under the general direction of 3 designated regional engineers: one for Ibb and Taiz, one for the Tihama and one for Dhamar.

19

(7) Mechanical Section and Workshop

The Mechanical Section would be reorganized. Three senior Yemeni mechanics would be designated to work with the three regional engineers. These men would be posted in Taiz, Hodeida or Dhamar and they would be circuit riders for mechanical problems under the direction of the regional engineers. In addition to the 3 circuit riders there would be 6 additional mechanics assigned to Sanaa. These men would perform routine maintenance as well as conduct diagnostic analysis on RWA vehicles.

9

(8) Hydrology and Well Testing

(Three teams of three men each.)

9

Total

60

The vehicle requirements for the technical section at a minimum would consist of the following:

No. of Vehicles

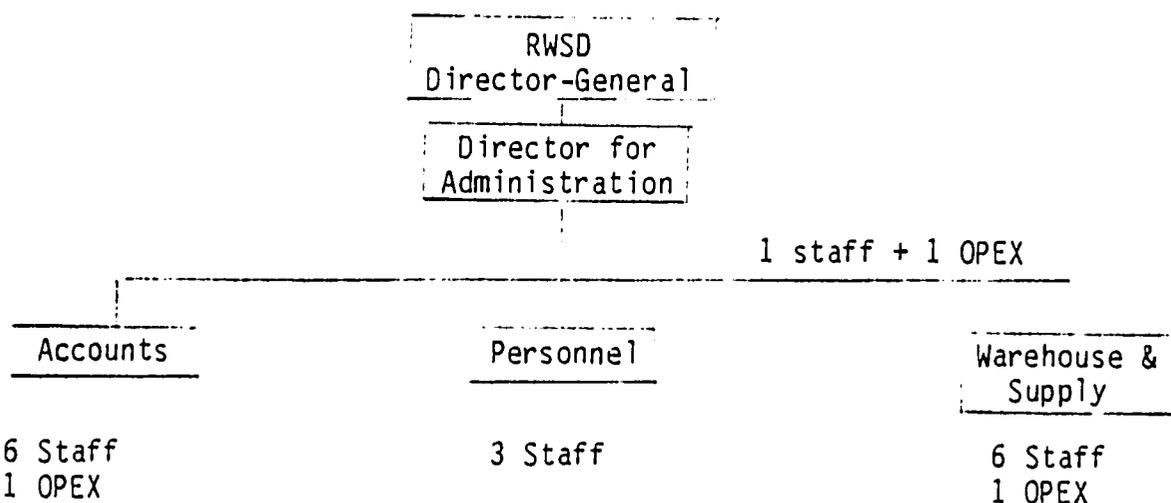
3	for regional engineers
8	for field construction teams
4	for survey teams
1	for the design team
2	for contingencies

18

Total

C. The Administrative Section. The RWSA presently draws heavily on the Ministry of Public Works for administrative support. Currently this means that such functions as accounting, procurement, some warehousing, public relations, and water quality testing are performed in whole or in part by Ministry offices. As the Department moves to become an authority it will need to assume some, but not all, of these functions.*

A suggested structure for the administrative wing of the Rural Water Authority is given below:



The Accounts Section would be headed by one chief accountant (OPEX) and five clerks: one each for: (1) advances, (2) salary and overtime, (3) clearances, (4) travel and per diem, and (5) a petty cashier.

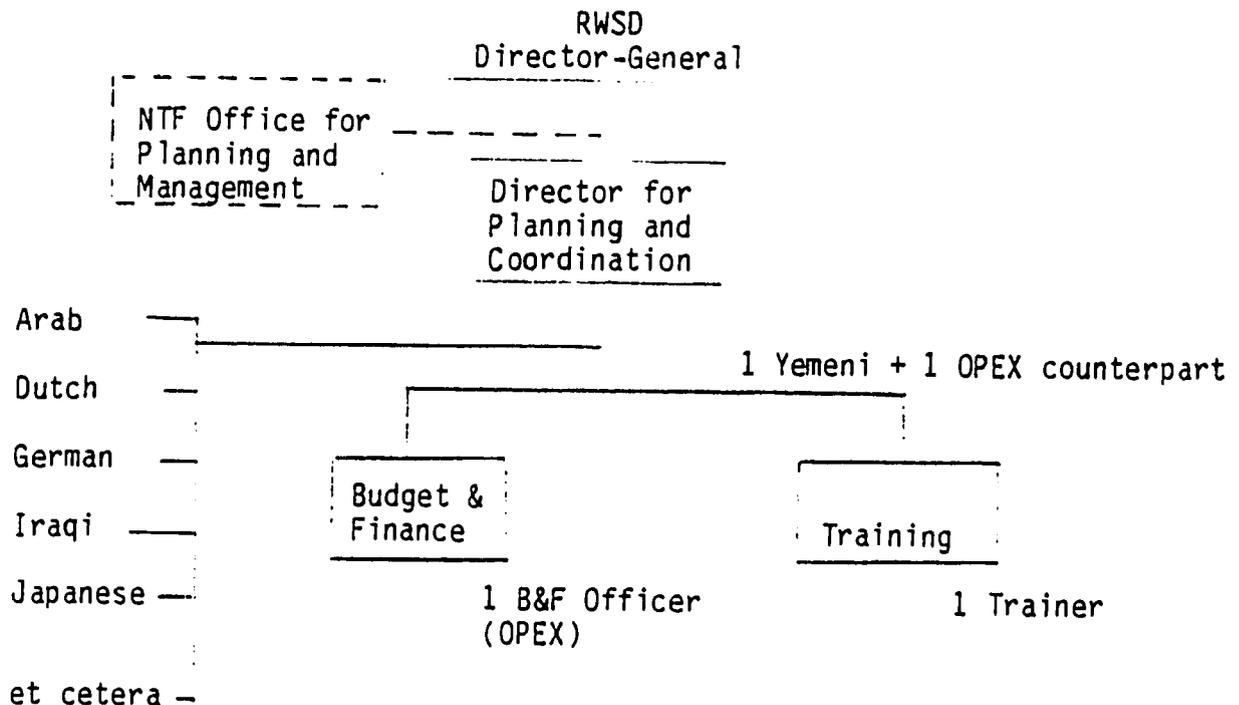
The Personnel Office would be headed by one personnel officer and two clerks: one for records and one for daily attendance.

The Warehouse and Supply Section would be headed by one chief for properties and commodities (OPEX). He would be assisted by: 2 records clerks, 1 storekeeper, and 2 assistant storekeeper.

Total required: 16 staff plus 3 OPEX/TCNs.

* Over the life of this project it is expected that procurement and tendering would continue to be done through the main Ministry offices.

(4) The Office for Planning and Coordination. This is a new office that does not currently exist within the RWS. The closest thing that exists at present would be the Office for Bilateral Affairs. The functions of planning and coordination can be seen as augmentations of the present role of the Office of Bilateral Affairs, which exists to coordinate the activities of the bilateral and multi-lateral donors working with the RWS. A possible structure for the Office for Planning and Coordination is given below:



The staff required to make this office operational would include:

- 1 Director for Planning and Coordination
- 1 OPEX Counterpart
- 1 Budget and Finance Officer (OPEX)
- 1 Trainer (Yemeni)
- 1 Training Coordinator
- 1 English typist
- 1 Arabic typist
- 1 Office boy
- 1 clerk/secretary

APPENDIX III

Project 044/I staff is currently constituted as follows:

	<u>Number of Staff</u>
Expatriates (5)	
1. Chief of Party	1
2. Director of Administration and Training	1
3. Director of Technical Section	1
4. Senior Design Engineer	1
5. Senior Construction Engineer	1
Dhamar:	
1. Senior Engineer	1
Expatriate Consultants (2)	
1. Engineer Supervisor	1
2. Construction Supervisor	1
Project 044 Local-Hire Staff (22)	
1. Senior Construction Technicians	4
2. Construction Technician Trainees	4
3. Administrators	2
4. Typists	1 (vacant)
5. Finance	2
6. Drivers	2
7. Field Support Coordination	2
8. Mechanics	2
9. Construction Yard	1
10. Carpenters	2 (1 vacant)
Ministry Staff on Secondment (14)	
1. Administrative Counterpart to COP	1
2. Technical Counterpart to COP	1
3. Senior Construction Technicians	2
4. Junior Construction Technicians	8
5. Warehouseman (OPEX staff)	1
6. Mechanic	1
7. Asst. to Dir. of Bilateral Affairs Office (OPEX staff)	1
Peace Corps Volunteers (12)	
1. Architects	3
2. Construction Supervisors	4
3. Engineers	5

New TransCentury Foundation
P.O. Box 377
Sanaa, Yemen Arab Republic

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TELEPHONE: 202278, 202250

RURAL WATER SUPPLY PROJECT

ترانس سنشري
٣٧٧
الجمهورية العربية اليمنية
٢٠٢٢٥٠ ر ٢٠٢٢٧
بمع مباء الربيف

Project Criteria

1. Access
Road to village or acceptable walking distance
= 1½ hr.
2. Water
 - a. Quantity: 15 lit/cap/day (mountains) - after allotment made for other needs
30 lit./cap/day (Tihama)
 - b. Quality: Source capable of being adequately protected treated or correctable to W.H.O. standards
3. Village Contribution (Willingness)-(Ability)
 - Availability of Workers
 - Availability of Local Materials

Must be of adequate supply to ensure the completion of the project.
4. Village Maintenance Capability
An adequate maintenance capability must be proven available provided by the villagers themselves (preferably) or by someone outside the project area just so its a dependable source. Provide representatives for appropriate training in maintenance and operation.
5. Ownership - Water Rights
All questions of water use from a particular source must be settled. (ex. shared use of water between villagers or distribution between human consumption and agriculture)
6. Project Cost
Maximum cost of 900 Y.R./person
7. Population Limits
250 - 2000 population per project.

Appendix V: Vehicle Mileage List

NEW TRANSCENTURY FOUNDATION
Mileage of 044 Project Vehicles
as of March 1, 1984

<u>IC/Y VEH.</u> <u>NO.</u>	<u>VEH. TYPE</u>	<u>MILEAGE *</u>
1	Daihatsu	65,258
2	Daihatsu	84,000
3	Daihatsu	70,100
4	Daihatsu	53,457 (at time of loss)
5	Toyota Pickup	57,193
6	GMC Pickup	19,140 miles (31,390 kms)
7	Chevy Pickup	59,822
8	Chevy Pickup	45,050
9	Daihatsu	58,424
10	Daihatsu	44,901
11	Toyota Pickup	45,926
12	8 Ton Chevy Truck	33,890
13	Motorcycle	64,445
14	Toyota Pickup	26,000
15	Toyota LC Salon	19,225
16	Toyota Hardtop	44,839
17	Toyota Hardtop	79,596
18	Toyota Pickup	109,315
19	Toyota Pickup	18,253
20	Toyota Pickup	69,784
21	Toyota Hardtop	55,369
22	7 Ton Isuzu	11,680
Total		1,147,916

* kilometers, unless otherwise indicated

Average kilometers per vehicle: 52,173

150

Appendix VI: Request for Vehicle Waiver

Request for Waiver

TransCentury requests approval of a waiver to procure and operate non-U.S. manufactured vehicles in Yemen. Currently Project 044/I has a vehicle fleet of 22 vehicles. This is composed as follows:

Vehicle	Quantity	Percent
Daihatsus	6	27
Toyotas	10	45
Hardtops	3	13
pick-ups	6	27
salon	1	5
American picks	3	14
Chevy pick-ups	2	
GMC pick-ups	1	
Isuzu 7 ton truck	1	5
Chevrolet truck	1	5
Motorcycle	1	5
	-----	-----
Total	22	100

Based on four years cumulative experience, it is clear that standardization around Daihatsus for administrative and survey work, and Toyotas for field construction work best serves the interest of the project. Project 044, perhaps more than any other USAID project in Yemen, is a rural development project. Rural in this case really means rural. It means driving up wadis, and driving down dirt trails. It means driving across open deserts, and across plowed fields. Toyotas and Daihatsus are designed for this type of off-road use; American made vehicles are designed to be used primarily on paved roads, with occasional periods of off-road use. In the case of Project 044, for most of the vehicles most of the time, they are driven off-road. Even the vehicles used for administrative support in Sana'a are frequently commandeered for field surveys by field staff, and are used for field trips by the administrative staff.

On the basis of utility to the project, therefore, off-road vehicles are required. On the basis of maintenance and spare parts, non-American vehicles are also required. There is virtually no capability extant in Yemen to maintain complex American made vehicles, with electronic ignition systems, and a variety of other sophisticated mechanical equipment. Project 044 has its own workshops, and it runs a systematic preventive maintenance program to optimize the use of project vehicles. This preventive maintenance program is implemented by a mixture of Ministry mechanics on secondment, local hire mechanics, and Peace Corps Volunteers. Experience over the last four years has shown that Daihatsus and Toyotas are the most practical vehicles to maintain in Yemen. This is true in Sana'a, and it is quadruply true in field situations where project staff, counterparts, and volunteers frequently have to jury rig temporary repairs to keep the vehicles functioning.

Spare parts is yet another issue. Project 044 staff can't walk into the sug on Bayt al Faquih and buy a carburator for a General Motors truck at a local parts supply warehouse. However, spare parts for Toyotas and Daihatsus are available all over Yemen. If the projects were to standardize around American made vehicles, there is no practical cost effective way that the Project could stockpile an adequate supply of spare parts in the far corners of the country.

Therefore, it is requested that a blanket waiver for 15 off-road vehicles be granted simultaneous with the approval of this unsolicited proposal.

Appendix VII: Initial Environmental Examination

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Yemen Arab Republic

Project Title: Small Rural Water Project

	<u>USAID FUNDING \$</u>	<u>YARG FUNDING</u>	<u>TOTAL FUNDING</u>
FY 85			
FY 86			
FY 87			
FY 88			
FY 89			

Life of Project:

IEE Prepared BY:

Environmental Action Recommended: Negative Determination

Mission Concurrence:

For the NE Bureau:

Action Recommended: Negative Determination

Approval:

Disapproval:

Clearances:

155

Yemen Rural Water Project: 279-0044/II
Project Description

The basic problem addressed by this project is the lack of reliable and potable water supplies for villages in rural areas in Yemen. Approximately 90 percent of the population of Yemen live in rural villages. YARG statistics estimate that only 14 percent of the population have easy access to water. Typical villages have populations under 1,000 with the majority of villages reliant on subsistence agriculture, and the remainder dependent to some extent on cash crops like grapes, tomatoes, and qat. The entire economy of Yemen is reliant upon labor migration with remittances forming a potential capital base to conduct development projects. However, the resultant shortage of labor within the country is a chronic problem.

Villages are often located on mountain tops for defensive reasons or to conserve agricultural land. Water sources are often distant from the village and a significant amount of time and energy is required for women and children to obtain water for the household. This situation results in minimal quantities of water being used domestically. The objective of this project is to provide improved water supplies to selected rural villages of the country, with emphasis on improved quantity, quality, access, and reliability.

This proposed extension to the existing on-going project will continue to provide a technical assistance team through New TransCentury Foundation, to work with the Rural Water Supply Department (RWSD). TransCentury will have two primary tasks: (1) to strengthen the capabilities of the RWSD, and (2) to assist the RWSD to build rural water systems. In pursuit of the latter goal, TransCentury staff will be directly or indirectly involved in the full range of project activities, including:

1. performing feasibility studies;
2. refining established criteria for project selection and taking part in the selection process;
3. preparing or reviewing final designs for sub-projects;
4. providing various kinds of training for counterpart staff including on-the-job, in-service and regional training;
5. supervising Peace Corps Volunteers in the field;
6. purchasing, keeping records of, and accounting for project commodities;
7. performing water quality monitoring tests;
8. providing training for villagers in the operations and maintenance of completed systems;

9. helping villagers to understand the public health consequences of operating completed rural water systems;
10. conducting research and testing appropriate technologies for improved village water systems;
11. coordinating with existing health teams working in the field to provide water related health and hygiene education, and
12. strengthening RWSD's capability to survey, design, and contract for the construction of rural water systems which will not be constructed under the project.

Subproject designs will vary depending on local conditions. Some villages rely on cisterns; others rely on springs; still others rely on hand-dug wells, and in many cases the only alternative is a deep drilled well. Project 022 worked with several cisterns; Project 044 has worked with practically none. Typically however, a cistern project would involve the cleaning and plastering of an ancient cistern, or excavation and construction of a new one. A hand-dug well project usually involves a well that has been deepened and subsequently tested to prove its yield. The project may involve installing a pump and engine, constructing a pump house, transmission and distribution lines, storage tank(s), and public taps. Drilling wells has not been included under Project 044/I, and will not be included under Project 044/II. However constructing distribution systems for existing drilled wells will often be undertaken.

It is estimated that 20 subprojects can be completed per year for a total of 100 subprojects over the five year life of the extension. Approximately 108,000 rural villagers are expected to benefit from improved water systems. Outputs of this level will involve a technical assistance team of seven members working directly with the RWSD to assist with field construction, as well as two senior engineer planners working with a new office of Planning and Management to advise the RWSD on overall departmental operations. Twelve to fifteen Peace Corps Volunteers, and counterpart RWSD staff and technicians will also be required. Under USAID/RWSD project 022, villages selected for subprojects were primarily in the northern highlands in areas reasonably close to Sana'a. Under 044, there was a significant expansion of project activities particularly into the Tihama. Yemen's rugged terrain and lack of adequate roads has much to do with subproject selection, and there are still many areas where it is not feasible to do a project and have reasonable assurance that it will be adequately supervised. The RWSD had opened offices in Hodeidah and Dhamar, and it plans to open an office in Taiz. It is anticipated under this extension that the RWSD will expand its service area further, as it attempts to meet the water supply needs in rural areas and strengthen the nation building process.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas 1/Impact
Identification
and
Evaluation 2/

A. LAND USE

1. Changing the character of the land through:
 - a. Increasing the population
 - b. Extracting natural resources
 - c. Land clearing
 - d. Changing soil character
2. Altering natural defenses
3. Foreclosing important uses
4. Jeopardizing man or his works
5. Other factors

LLNNNNN

B. WATER QUALITY

1. Physical state of water
2. Chemical and biological states
3. Ecological balance
4. Other factors

NNN

1/ See Explanatory Notes for this form.

2/ Use the following symbols: N - No environmental impact
 L - Little environmental impact
 M - Moderate environmental impact
 H - High environmental impact
 U - Unknown environmental impact

C. POLLUTION

- | | | |
|--------------------|-------|---|
| 1. Air additives | _____ | N |
| 2. Air pollution | _____ | N |
| 3. Noise pollution | _____ | N |
| 4. Other factors | _____ | |
| _____ | _____ | |
| _____ | _____ | |

D. NATURAL RESOURCES

- | | | |
|--|-------|---|
| 1. Diversion, altered use of water | _____ | L |
| 2. Irreversible, inefficient commitments | _____ | N |
| 3. Other factors | _____ | |
| _____ | _____ | |
| _____ | _____ | |

E. CULTURAL

- | | | |
|------------------------------------|-------|---|
| 1. Altering physical symbols | _____ | N |
| 2. Dilution of cultural traditions | _____ | N |
| 3. Other factors | _____ | |
| _____ | _____ | |
| _____ | _____ | |

F. SOCIOECONOMIC

- | | | |
|--|-------|---|
| 1. Changes in economic/employment patterns | _____ | L |
| 2. Changes in population | _____ | N |
| 3. Changes in cultural patterns | _____ | N |
| 4. Other factors | _____ | |
| _____ | _____ | |
| _____ | _____ | |

G. HEALTH

1. Changing a natural environment
2. Eliminating an ecosystem element
3. Other factors

N

N

change in water supply affecting health or population.

L

H. GENERAL

1. International impact
 2. Controversial impact
 3. Larger program impact
 4. Other factors
-
-

N

N

N

I. OTHER POSSIBLE IMPACT (not listed above)

Project Location: Yemen Arab Republic
 Project Title: Yemen Rural Water Projects
 IEE Prepared by:
 Mission Director Concurrence:

See attached Discussion of Impact

DISCUSSION OF IMPACT

Items for which some environmental impact has been identified on the IEE checklist are discussed below:

A. Land Use

1.a. Increasing the Population: Improved quality and increased quantity of village water supplies is expected to have a positive impact on health, in particular on a possible decrease of the infant mortality rate. Establishment of the cause and effect relationship and quantification thereof would be extremely difficult to prove due to the presence of so many other factors. It is not expected that improved water supplies will have any significant effect on increasing the rate of population growth.

1.b. Extracting Natural Resources: The construction of small water projects generally involves the construction of small structures such as water storage tanks, pump houses, and cisterns which are designed to make use of locally available materials including sand, stone, and gravel. These materials are widely available throughout the country and are commonly used in local construction of homes and other structures. The extraction of these resources in the relatively modest amounts required for this project will not have a significant effect on the environment.

The purpose of Project 044/II is to increase domestic water supplies to villages. In many cases this will involve the "extraction" of the water resource. The subprojects planned under this project will increase village water supplies through the following methods: capturing runoff in cisterns, developing springs, and constructing distribution systems for previously dug wells or drilled wells. Cisterns do not "extract" water, rather they conserve it. In the case of springs, possible beneficial environmental impact may occur in the reduction of open standing water and the reduction of phreatophytes in the areas of previously undeveloped springs. Generally, hand-dug wells extract water from shallow alluvial aquifers which readily recharge. Extracting water during the dry season with subsequent replenishment in the wet season has little environmental impact. Many subprojects involve installing a pump and village distribution system for a dug or drilled well. For wells, a pump test is routinely performed as part of the feasibility study of the project to determine the well's safe yield. If the test indicates the well cannot meet the reasonable foreseeable village demands, the project is not considered for funding by the project and recommendations are made for alternative sources of water.

D. Natural Resources

1.a. Diversion, Altered Use of Water: The extension proposes to build 3 to 5 small gabion check dams. These would probably be built in series, and would be designed to slow the runoff, and catch silt in the upper dam(s). To this extent, they should have a limited but positive impact on the environment. The flood runoff will be slowed to permit greater ground

water recharge. Slowing flood runoff may make less water available for agriculture downstream. This effect, however, is minor, and is consonant with traditional practices in Yemen. The RWSR reportedly is already building small dams, apparently in conjunction with cistern recharge.

1.b. Wells: A typical village water project based on ground water may involve village initiative in deepening a hand-dug well or drilling a deep well. In either case water is used for domestic use instead of other uses including possibly agriculture. Considering the water short nature of Yemen, this is a tradeoff which must be made to meet the needs of the population. The YARG has stated this priority on domestic water in the Five-Year Plan.

F. Socioeconomic

1.a. Changes in Economic/Employment Patterns: one impact of the project is to decrease the amount of time and energy required by women and children to obtain domestic water for their households. Several years of USAID experience with completed small water projects has not revealed any significant deleterious effect on village society or economy as a result of completed subprojects. Evaluations have repeatedly concluded that women find alternative uses for their free time, either spending more time with family duties, leisure, or in increased productive activities in agriculture or handicrafts.

1.b. Economic: Some villages rely on water trucked in for dry periods during the year. Providing an improved water system may eliminate some employment for truck drivers, but this is a negligible impact since there are many alternative employment opportunities available in the Yemen economy. More importantly, villagers will no longer have to pay for water, except for the monthly Operations and Maintenance charges. Either money, or time, and frequently both will be saved at the household level.

D. Health

1. Changes in Water Supply Affecting Health: Improving the quantity and often the quality of village water systems is expected to have a beneficial impact on the health of the population. To date this impact has generally been accepted axiomatically in projects worldwide, and has not been quantified. Where studies have been made, the cause and effect relationships have usually been tenuous. Yemen's public health statistics are still rudimentary, and trained personnel are lacking, so that it is questionable if a quantitative study of health impact on improved water supply would be feasible or worthwhile. Given the unreliability of harder statistical data, Project 044/II under the extension proposes to do some impressionistic village level studies on water use patterns and sanitation practices to document the prospective impact of increased water supplies. These studies will be done in 1985 and 1986, and should help prepare the way to add a more comprehensive health and sanitation component to field activities in 1987-1989.

3. Potability: A final environmental issue which should be discussed in this examination is the question of potability and monitoring for bacteriological water quality.

Project 044/II needs to continue to monitor water quality, making use of existing laboratory facilities within Yemen. Potability will be discussed as it affects the types of subprojects considered.

3.a. Cisterns: Field evaluations of rural water projects has repeatedly demonstrated that villagers do not generally regard water from cisterns as potable. Water from a cistern is used for other domestic purposes--like laundry, cooking, bathing, etc., -- while drinking water is obtained from another source, usually a spring. If Project 044/II is able to come up with an appropriate technology -- like a slow sand filter -- for upgrading cistern water to make it potable, the quality of the water should be monitored closely to insure that there are no attendant health problems.

3.b. Springs: Springs, if properly developed and sealed, can be excellent sources of potable water without further treatment. Regular water quality monitoring needs to continue, however.

3.c. Hand-dug wells: Hand-dug wells in Yemen generally are 4 to 6 feet in diameter, masonry lined, with built up sides which prevent pollution by surface runoff. Traditionally these wells are usually not covered, so they are subject to contamination from pollutants entering from above (i.e. people throwing in debris.)

Currently, for dug wells which have been up-graded with a pump and engine, Project 044 constructs a zink and plywood cover to seal the well opening. This is a significant improvement over traditional village practices, but there is a limited possibility of contamination if the pump leaks, water forms on top of the zink sheet and drips through back into the well. At the same time, zink and plywood sheets are a replicable technology, which can be copied by other nearby non-project villages, and they are a big improvement over no cover at all. Therefore, Project 044/II should continue to review alternative designs for well covers. In the hand dug wells built under Project 044, the static water level generally ranges from 20 to 60 feet deep. With wells this deep, the possibility of contamination from infiltration is probably negligible. Repeated evaluations have not found that villagers had health problems which the villagers related to the well. Hand dug wells should be monitored for quality, however, and villagers should be educated regarding the possibilities of contamination.

3.d. Deep Wells: This term refers to drilled wells which are generally sealed with a concrete cover. Sealing prevents contamination from surface runoff and the wells generally reach deep aquifers which are essentially free of biological pollutants. Less frequent monitoring is required with deep wells than with other sources.

The water monitoring program is clearly an essential component of Project 044/II. The project will be providing increased quantities of domestic water, but also water which will be considered by the villagers to be potable. Therefore, water quality should be closely monitored, followed by a disinfectant program like chlorination, if required.

CONCLUSIONS: This examination has attempted to focus on the reasonable foreseeable effects on the human environment of the proposed project. To summarize, no major impacts have been identified in the areas of land use, water quality, atmosphere, natural resources, cultural or socioeconomic effects. A possibly more significant impact was identified in the health field concerning potability of water supplies, particularly in the case of hand dug wells. The project, however, has been designed and implemented to date to minimize any possible adverse impact on health through the design and selection of subprojects and the establishment of a water-quality monitoring program. Under the extension, research is proposed in the area of health and sanitation, and as the results of this research becomes available, a more comprehensive health education component will be added to the project. This examination has not found that the proposed project will have an adverse effect on the human environment and hence a negative determination is recommended.

Appendix VIII: Direct Sub-Project Costs

APPENDIX VIII

Direct Sub-Project Costs
by Category
(As established by MPW)

	Tihama	Mountains
A. <u>Salaries and Perdiems:</u>		
1. Ministry supervisory cost	(\$55,332)	(\$46,032)
2. TC field staff	9%	19%
3. TC field technicians		
4. Volunteer expenses		
5. Training Cost		
B. <u>Tools and Equipment</u>	4.8%	6.5%
1. All tools used		
2. All equipment used (including fuel cost)		
3. Vehicles used in the project area for Construction Team. (This includes only those vehicles assigned to the Team that stay at the site.)		
C. <u>Commodities Used</u>	26.6%	42.3%
1. Pipes		
2. All pipe fittings		
3. Cement		
4. Pump		
5. Steel Bars		
6. Generator or motor		
7. Electrical accessories		
8. Tank (Fiberglass/steel)		
D. <u>Sub-Contract</u>	12.6%	0
E. <u>Transportation Cost:</u>	1.7%	1.2%
1. Project vehicles or vehicles rented for Commodities Transportation		
F. <u>Village Contribution</u>	44.0%	31.0%
1. Labor		
2. Material		
3. Equipment		
4. Local Sub-Contract		
5. Transportation		
6. Room and Board for O44 and Peace Corps staff		
7. Warehousing		
8. Other contributions		
G. <u>Other Costs</u>	1.2%	0
	<hr/>	<hr/>
	99.9%	100.0%

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Appendix IX: Commodities, Equipment, and Supplies

Appendix IX: Commodities, Equipment, and Supplies

These items fall under two budget line items:

1. Equipment and Supplies
2. Commodities

An estimate of funds committed for these items is also noted.

This listing of commodities and equipment is illustrative, and subject to refinement in the field. Commodities listed here are not counted as part of the total cost in this appendix. Commodities are calculated in the budget, according to a unit cost system.

1. Commodities

<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Description</u>	<u>Cost</u>
C001	8000	1½" galvanized steel pipe	mild steel, welded hot dip	_____
C002	1200	1" " " "	galvanized water pipe to (ISO)	_____
C003	16000	2" " " "	R.65 Medium Denes Threaded	_____
C004	800	¾" " " "	to B.S. 21 Thread (15G-RT)	_____
C005	3200	2½" " " "	Docketed free-end protector	_____
C006	5000	3" " " "	6 meter lengths	_____
C007	2000	4" " " "	(Pipe would be American	_____
C008	8250	1½" Fittings and valves for pipe	made. Code 000, or purchased off shelf (code 94))	_____
C009	8550	2" " " " "		_____
C010	4000	2½" " " " "		_____
C011	6000	3" " " " "		_____
C012	2500	Fittings-Reducers (various sizes)		_____
C013	1250	Metal Push Tops ¾-1/2		_____
C014	250	Metal Wire Mesh		_____
C015	150	Air relief valves - 2", 3", 4"		_____
C016	30	fiberglass tanks		<u>45,000</u>
C017	3000	¾ inch fittings and valves		_____
C018	5000	1 inch fittings and valves		_____
C019	2500	1.25 inch fittings and valves		_____
C020	150 gals	waterproof paint		<u>2650</u>
C021	200	check valves 2", 2½", 3", 4"		<u>10000</u>
C022	2000	taps, sturdy		<u>10000</u>

Commodities continued

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Description</u>	<u>Cost</u>
C023	100 Rolls		Wire mesh, hexagonal "chicken wire" 0.75 mm diameter, 20 mm openings, 150 foot rolls, 36" wide	5,000
C024	800 tons		cement (locally manufactured in Yemen, and purchased off shelf.)	112,000
			Reinforcing steel	
C025	40 tons	#3		
C026	80 tons	#4		
C027	150 tons	#5		
C028	400 tons	#6		
C029	16 tons	#2		
C030	1 ton	galvanized		225,000
C031	150 rolls	welded wire mesh, 2", 3", and 4"		----
			Total	_____*

* Commodities listed in this schedule are not counted as part of this total. Commodities are calculated under schedule XVI in the Budget, given under separate cover.

II. SURVEY AND TESTING EQUIPMENT

<u>Quan.</u>	<u>Item</u>	<u>Description</u>	<u>Total</u>
2	Tri-pod stands	Tripods for K&E Transit, lightweight hardwood, durable, extended length 180 cm	370
		Tripod for theodolite, lightweight hardwood, durable, extended length 180 cm	
		Tripod for theodolite, aluminum, durable, extended length of 180 cm	
2	Leveling staffs	Leveling staffs, metric chessboard pattern, 4 meters long, folded, well seasoned timber with laquer seal, caps on end, handles and circular erect numbering.	240
		Leveling staffs, sectional staff, 1 meter aluminum sections, cm graduated erect numbering, transport bag, with base plates and two circular levels, graduated at temperature of 20 degrees centigrade.	
1	Range Pole	Range Pole, 4 meters long, lightweight durable	40
10	Abney Hand levels		210
10	Altimeters		1,400
8	Stopwatches		496
15	Directional compasses		330
2	Engineering levels		200
6	electric water level tapes		300
30	Hach incubators		200
30	thermometers		100

<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
S012	100	Measuring tapes	800
S013	2	PH Measurement Kits	50
S014	2	Total Hardness Kits	500
S015	2	Conductivity meters	760
S016	2	Dri Bath Incubator	450
S017	200	Presumptive test tubes	100
S018	200	Confirmed test tubes	100
S019	200	Fecal coliform test tubes	100
S020	10	Plastic test bottles - 250 ml.	20
S021	2	Millipere filters	30
S022	100	Filter pads	30
S023	10	Rain guages	300
S024	2	Water meters (electronic water level tester)	2,362
S025	6	Barometric Altimeter	960

III. CONSTRUCTION EQUIPMENT (\$200,000)

E001	20	Pipe threader ½ - 2" Manual BSPT 21 #12R	6,480
E002	15	Pipe threader 2 - 4" Manual " " "	12,375
E003	10	2-4" Electric	8,250
E004	130	Pipe wrenches - 18"	3,250
E005	130	Pipe wrenches - 24"	5,070
E006	120	" " - 36"	10,080
E007	115	" " - 48"	14,375
E008	110	Pipe cutters - 2"	7,920
E009	110	Pipe cutters - 3"	13,145
E010	5	" " - 4"	900
E011	20	Cutting blade replacements - 2"	1,360
E012	20	" " " - 3"	2,140
E013	10	" " " - 4"	530
E014	10	Pipe vises 1-6" w/stand	2,240
		Spare parts for guncrete machine	1,000
E015	4	Tires	176
E016	2	Feed wheels	824
E017	200	Felt seal strips	1,106

<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
E018	200	Rubber Pads	2,540
E019	4	Diaphragm Water Pump - Air Oper. Water Booster	3,843
E020	4	Water hose (50' long) 3/4"	523
E021	2	Air Hose (50' long) 1½"	779
E022	2	Air Hose compressors 50 x 3/4"	120
E023	2	Air Hammers BR40 Barkers	1,500
E024	10	3" chisels 1½" x 12"	231
E025	10	Maul points 1½" x 12"	185
E026	2	Portable airline lubricators 1R016F	332
E027	4	Spare tires	200
E028	5	Concrete mixer - Gilson Model 3½ ST-S 7HP gas eng.	9,900
E029	7	Concrete vibrator - stow W/8HD gas engine	7,646
E030	10	Vibrator shaft 21' " " "	3,190
E031	4	Electric tapes (Measuring wells)	600
E032	25	Threading dies ½", 1", 1½", 2"	1,300
E033	15	Threading dies - 2", 2¼", 2½", 3", 4"	1,500
E034	10	Pipe chain wrench	280
E035	4	Pipe racks for trucks	3,100
E036	4	Pump racks for trucks	400
E037	5	U-clamps	150
E038	10	Safety goggles	39
E039	10	Safety helmets glasses	75
E040	10	Respirator mouthpieces	175
E041	500	Filters for respirators	200
E042	15	Masonry line levels	147
E043	2	Hand Auger	7
E044	8	Winch w/tripod - McKinnon Corp. CM Sate1	370
E045	8	Winch electric - Jenks cat. page 359 Model 15,176 SRD-6000-9	15,176
E046	100	Paint primer (100 gal.)	650
E047	50	Sand sieve screens	900

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<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
E048		Well testing equipment	3,000
E049	3	Recorder	1,845
E050	3	Analog flow meter	550
E051	50	Pipe fittings	125
E052	4	Cables	100
E053	10	Charts - 63 ft.	48
E054	3	Magnetic flow sensor	4,260
E055	10	Gate valves	680
E056	5	Poinjar drills	7,500
E057	150	Steel pipe 3" - 2 M. Lengths (150 lengths) (Flange pipe)	3,351
E070		Construction Equipment	
E080		Buckets, shovels, spades, pick axes, wheel barrows, crow-bars, mason's tools, etc. (American made)	25,000
E090		Scaffolding, form wood, and plywood (American made)	50,000
			<hr/>
IV.	<u>MECHANIC TOOLS</u>	(\$10,000)	245,457
M001	10	Hex head wrenches	50
M002	64	Socket tool set S450E	240
M003	24	Offset combination wrenches	170
M004	6	Bench vise - ½" - 3"	708
M005	6	Hand vices	33
M006	14	"C" Clamps	184
M007	5	Screwdrivers with rack (slot head)	110
M008	5	Screwdrivers with rack (cross tip)	132
M009	3	Electronic pliers No. 442	28
M010	2	Electric pliers No. 402	15
M011	2	Micro electric pliers	50
M012	2	Electric cutting pliers	15
M013	2	Universal pliers	18
M014	2	Lock grip pliers	16
M015	2	Hex pliers	17
M016	2	Chain wrenches	28
M017	4	Adjustable wrench No. 0	48

<u>Item#</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
M018	4	Adjustable wrenches No. 4	64
M019	8	Spark plug wrenches	24
M020	2	Torque wrench ½" Drive	79
M021	2	Socket tool set - J450	240
M022	5	Punches, central	14
M023	6	Punches, drift	39
M024		-WD-40 Lubricating Oil	44
M025		-Cum-Along-Winch-It-on	255
M026		Liquid wrench	34
M027	6	Mechanic's hammers	69
M028	4	Ball peen hammers	34
M029	4	Plastic tip hammers	48
M030	19	Feeler gauges	319
M031	1	Sliding caliper	16
M032	1	Inside caliper	9
M033	10	Hack saws	100
M034	200	Hack saw blades	120
M035	10	Tap and die set	1,650
M036	2	Spark plug brush	7
M037	20	Oil cans	90
M038	4	Outside pullers - 90 mm	106
M039	4	Outside pullers - 300mm	136
M040	2	STG file set	50
M041	1	Piston fitting clamp	15
M042	1	Extension light	15
M043	6	Wheel nut spider wrench	87
M044	1	Circlip pliers set	23
			<u>5,549</u>

V. DRAFTING EQUIPMENT (\$10,000)

D001	3	Drafting tables	360
D002	3	Roller bars - drafting arms	768
D003	3	Drafting pen sets	99
D004	10	Drafting paper rolls	200
D005	3	Pen cleaners (sonic)	150
D006	5	Compasses	32
D007	5	Erasing shields	20
D008	60	Pens, drafting	200

<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
D009	5 gals.	Solution pen cleaner	200
D010	5	Adjustable triangles	89
D011	5	Templates (circles)	18
D012	5	Templates (retangles)	18
D013	2	Templates (letter) 2.5mm, 3.5mm, 5 mm, 7mm	7
D014	2	Templates (numeral) " " " "	7
D015	20	Press type lettering (English)	560
D016	20	Press type lettering (Arabic)	
D017	1	Blue print machine	<u>4,500</u>
			7,128

VI. OFFICE EQUIPMENT (\$15,000)

Q001	1	Photocopier	4,000
Q002	3	Photocopers (small)	7,500
Q003	12	Chairs	2,400
Q004	2	Couches	<u>800</u>
			14,700

VII. MISCELLANEOUS (\$35,000)

MS-001	10	"First Aid" Kits for construction teams	550
MS-002	10	Medical Kits for vehicles	190
MS-003	1	Forged steel bench vise	115
MS-004	2	Hand vises	13
MS-005	4	"C" Clamps	50
MS-006	5	Screwdrivers for slot-head screws, w/wall rack	110
MS-007	5	Cross tip screwdrivers w/wall rack	132
MS-008	3	Electronic pliers	
MS-009	3	Electric pliers	
MS-010	3	Micro electric pliers	
MS-011	2	Electronic cutting pliers	15
MS-012	2	Universal pliers	18
MS-013	3	High capacity lock grip pliers	32
MS-014	3	Hex plier	49
MS-015	3	Chain wrench	37

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<u>Item#</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
MS-016	1	Adjustable wrench (10")	9
MS-017	7	Adjustable wrench (4")	42
MS-018	5	Spark plug wrench	15
MS-019	5	Precision torque wrench w/dial	475
MS-020	5	Metric sets (54 tools)	1,725
MS-021	5	Centre punches	14
MS-022	5	Drift punches	22
MS-023	5	Mechanic's hammers	
MS-024	5	Ball peen hammers	
MS-025	5	Feeler gauges	
MS-026	5	Sliding calliper	
MS-027	5	Inside calliper	
MS-028	7	Standard hacksaw frame	
MS-028	7	Hand hacksaw blades (100 per package)	
MS-028	7	Set of tap and dies	1,155
MS-029	5	Filecard spark plug brush	17
MS-030	5	Pump-type oil cans	57
MS-031	1	Outside pullers (large w/long jaws)	29
MS-032	2	STG file set	140
MS-033	1	Piston fitting clamp	11
MS-034	1	Extension light w/siz bulbs	16
MS-035	6	Wheel nut spider wrench	88
MS-036	2	Circlip pliers w/changeable tips	55
MS-037	10	Measuring tapes	281
MS-038	10	Rain guages	300
MS-039	1	Winch with tripod (electric)	3,795
MS-040	8	½" to 4" pipe threaders (metric)	814
MS-041	2	Power drives and accessories, 220v, 50 cycles, single phase	2,187
MS-042	5	Pipe vise , 1" to 6", w/stand	1,120
MS-043	25	Vacuum breaker valves -2"	1,308
MS-044	25	" " " -3"	5,002
MS-045	25	" " " -4"	5,002
MS-046	10	Extra dies for threaders - 2½"	1,180
MS-047	10	" " " - 2½"	1,180
MS-048	10	" " " - 3"	1,250

<u>Item #</u>	<u>Quantity</u>	<u>Item</u>	<u>Total</u>
MS-049	10	Extra dies for threaders - 4"	1,400
MS-050	2	2" to 4" pipe chain wrench	
MS-051	1 roll	Wire mesh	<u>48</u>
			31,116

PUMPS

P-001	6	Submersible pumps, to lift $6\text{m}^3/\text{hr}$ - $15\text{m}^3/\text{hr}$, against 100 m, 150, 200, and 300 m	72,000
P-002	6	surface pumps (electric) to lift $6\text{m}^3/\text{hr}$ - $15\text{m}^3/\text{hr}$ against 100m, 175m, and 250 m, if available	72,000
P-003	6	turbine pumps with motors	72,000
		accessories for pumps: 2" and 2.5" heavy duty steel pipes with straight threads (not tapered)	-----
		<u>GENERATORS</u>	
G-001	12	15-25 kwh diesel generators	<u>144,000</u>

\$360,000

Appendix X: Selected Standard Forms in Use in Yemen

Sub-project Preconstruction Report
Small Rural Water Project, 279-044

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I. Summary

Date prepared : _____

1. Number : _____

2. Name : _____

3. Location: Governorate: _____ Nahiya: _____ Uzla: _____

4. Estimated Current Population: _____

5. Design population: _____

6. Water Source : _____

7. Water Yield : _____

8. Design water consumption: _____

9. Description of Improvements: _____

10. Estimated Cost : _____ Y.R.

Plus 10% Contingency: _____ Y.R.

Total : _____ Y.R.

11. Cost per capita : _____ Y.R.
(current population)

II. Description ;

The village of _____ is in Uzla _____,
nahiya _____. Access to the village is
by

The wa er source is a

III. Proposed Improvements ;

- a. Construction of a _____ m³ _____
_____ tank.
- b. Laying of _____
_____ pipe line as
shown in the drawing
- c. laying of _____
_____ distribution pipe
line as shown in the drawing
- d. Construction of _____ public taps as
shown on the drawing
- e.
- f.

e. Mechanical movers:

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V. Preconstruction Cost Estimates:

1. Tank (_____)
description.

a. cement

b. steel reinforcing

c. miscellaneous(list - fittings,ladders,etc)

d. local material(sand,gravel,stone,block)

e. equipment useage

f. labor

g. other

Sub total: _____ YR

4. TransCentury Support Costs

- a. _____ engineer(S) days
 b. _____ pcv/technician days

Sub total: _____YR

5. local Support. costs(meals, housing, warehouse)

Sub total: _____YR

6. Pumping equipment/facilities

Sub total: _____YR

7. Total _____YR

8. 10% contingencies _____YR

9. Grand total _____YR

10. Contributions _____YR

a. Local contribution

1. labor
 2. materials
 3. support costs

a. Total local contribution _____YR(%)

b. TransCentury (044)

1. Materials
 2. labor
 3. Transportation
 4. support

b. Total TransCentury contribution _____YR(%)

Sub-project Agreement

1. Sub-project Name: _____ 3. District: _____
2. Sub-project Number: _____ 4. Province: _____
5. Description of Work:

6. Date of agreement: _____
7. Proposed date of Implementation: _____
8. Proposed date of completion: _____
9. This agreement is made on: _____ 198__
10. between:

The Ministry of Public Works, Rural Water Department)

and

The Local Development Association representing the
village of :

_____ in _____ Nahya, _____ Prov

Article One:

- a. Ministry of Public Works agrees to contribute
the following:

1. Materials _____ Estimated cost _____

2. Technical Supervision

3. Other

Sub-total

10 % contingency (+)

4. The total estimated Ministry of Public Works contribution is

Article two:

- A. The Ministry of Public Works reserve the right to terminate this agreement and their commitments to it if this project is stopped or delayed for 45 days due to:
1. The lack of cooperation or participation from the local village in providing their agreed upon contribution (Article 3.A)
 2. Problems that arise because of or between the local people.
- B. The Ministry of Public Works will not be held responsible for any physical damage or personal injury resulting from the construction of this sub-project.

Article Three:

- A. The Local Development Association representing this people of _____, and the person responsible from _____ (village) agree to provide the following as their contribution:

Description

Estimated cost

1. Materials

2. Labor3. Other

Sub-total

4. The total estimated local contribution is _____ YR.
+ 10% contingency
- B. The local representatives agree to provide at least one local person to be trained by the Ministry of Public Works field staff during the construction of this project in the operation, maintenance and repair of this sub-project. If necessary this person may also be required to attend training courses in Sana'a.
- C. The representatives of the LDA and village mentioned above agree to protect and maintain all equipment, tools and materials used on this project from damage or theft. In the event of lose or damage the representatives agree to reimburse Ministry of Public Workd for the cost of any materials, equipment or tools.
- D. In the event of termination of this project for whatever reason the LDA and village representatives agree to return all equipment, tools and materials contributed by the other parties within 30 days of receiving notice of the project termination.

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Appendix X: Selected Standard Forms in Use in Yemen

- E. The local people agree to accept all responsibility for maintenance and repair and the costs thereof. 30 days after completion of the project. Thereafter, this project will be totally their responsibility. Neither the Ministry of Public Works nor TransCentury will bare any further responsibility 30 days after the project's completion.

Article Four:

All parties recognize that all the contributions listed under Article One and Three are estimates; and furthermore they agree to provide this contribution whatever the amount or cost in order to satisfactorily complete this project .

Article Five:

This agreement will be (Annex to # 1) to the original agreement between Ministry of Public Works and New TransCentury Foundation signed on _____.

Article Six:

This agreement becomes effective upon the signature of the four parties listed below:

1. Rural Water Department

Name _____

Signature _____

Date _____

2. Governor of _____

Name _____

Signature _____

Date _____

3. Local Development Association

Name _____

Signature _____

Date _____

4. Local village Representative

Name _____

Signature _____

Date _____

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