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WATER AND SANITATION FOR HEALTH PROJECT

Operated by
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MIDTERM EVALUATION OF THE USAID/TUNISIA RURAL POTABLE WATER INSTITUTIONS PROJECT

WASH FIELD REPORT NO. 256

JULY 1989

Prepared for
the USAID Mission to Tunisia
WASH Task No. 017

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under WASH Task No. 017

by

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July 1989

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Diana Putman, Project Officer of USAID Tunisia, gave unsparingly of her time during the initial preparation of the team and during the final stages of report writing. Nancy Tumavick, Deputy Director for Projects, demonstrated her personal interest by accompanying Dr. Putman to Kasserine for the CTDA debriefing, and both she and George Carner, Mission Director, demonstrated their interest in the results through their active participation in the initial briefing and debriefing given by the WASH team.

Several high-level officials of the Government of Tunisia (GOT) provided information and encouragement to the team. They included the Minister of Planning, the governors of Kasserine and Kairouan, and senior officials of the Ministry of Agriculture.

Thanks are also given to the numerous district- and local-level GOT officials and to the CTDA field agents who helped to make the field visits productive.

We must also thank the many local Tunisian citizens who responded patiently to our many questions. To them we also wish good health and continued progress in the development of their communities.

Finally, we must acknowledge May Yacoob of the WASH Project, who, together with Diana Putman, was responsible for selecting the team members; Graeme Frelick, of the Training Resources Group, who ably facilitated the team planning meeting; and Hela Rezouga, who provided invaluable help in the final production of this report.

ACRONYMS

A&E	Architectural and Engineering
AIF	Women's Interest Groups, *Association d'Interêt Feminin*
AHA	Water Projects Service, *Aménagement Hydro-Agricole*
AUI	*Architecture, Urbanisme et Ingeneering, S.A.*, Tunisian A&E firm
CTDA	Central Tunisia Development Agency, *Office de Développement de la Tunisie Centrale (ODTC)*
CTRD	Central Tunisia Rural Development Program, *Développement Rural de la Tunisie Centrale (DRTC)*
DAAF	Department of Administrative Affairs and Finance, *Départment des Affaires Administratives et Financières*
DRE	Water Resources Office, *Direction des Ressources en Eau*
GIH	Water Affairs Group, *Groupement d'Interêt Hydraulique*
GIS	Geographic Information System
GOT	Government of Tunisia
GR	Rural Engineering Unit, *Génie Rural (MOA, CRDA)*
IDA	Institute for Development Anthropology
KAP	Knowledge, Attitudes, and Practices
kVA	Kilo-volt ampere
MOA	Ministry of Agriculture, *Ministère de l'Agriculture*
MOH	Ministry of Health, *Ministère de la Santé*
MPH	Ministry of Public Health, *Ministère de Santé Publique (MSP)*
ORS	Oral Rehydration Solution
O&M	Operations and Maintenance
PDR	Rural Development Program, *Programme de Développement Rural*

PDRI	Integrated Rural Development Program, *Programme de Développement Rural Integre*
PVC	Polyvinyl Chloride (plastic pipe)
RADC	Regional Agricultural Development Commission, *Comissariat Regional de Développement Agricole (CRDA)*
RHET	Regional Health Education Team, *Equipe Regionale d'Education Sanitaire (ERES)*
SCF/CDF	Save the Children Foundation/Community Development Foundation
SONEDE	National Society for the Exploitation and Development of Water, *Société Nationale d'Exploitation et de Développement des Eaux*
TD	Tunisian Dinar (in February 1989, 1 TD = US$1.09; US$1 = 0.92 TD)
UAG	Regional WUA Support Unit, *Unite d'Autogestion*
WID	Women In Development
WUA	Water User Association, *Association d'Interêt Collectif (AIC)*

BASIC PROJECT IDENTIFICATION DATA SHEET

1. Country: Tunisia

2. Project Title: Rural Potable Water Institutions

3. Project Number: 664-0337 Grant

4. Project Dates:

   a. First Project Agreement: FY 86

   b. Final Obligation: FY 86

   c. Project Assistance Completion Date (PACD): March 31, 1991

5. Project Funding:

a. AID Bilateral Funding (Grant):	$6,500,000.00
b. Other Major Donors:	0.00
c. Host Country Counterpart Funds:	$3,400,000.00
Total:	$9,900,000.00

6. Mode of Implementation: Mixed: ST and LT Host Country Contracts and ST AID Direct.

7. Project Design: USAID/Tunisia and the Government of Tunisia.

8. Responsible Mission Officials:

   a. Mission Directors: James R. Phippard
   Charles F. Weden
   George Carner

   b. Project Officers: William Egan
   Diana Putman

9. Previous Evaluations: None

10. Cost of Present Evaluation:

	Person Days	Dollar Costs
a. Direct Hire:		
1) AID/w TDY:	0	0
2) USAID/Staff:	8	—
b. Contract: WASH Project	o/a 225	o/a $115,000.00
c. Other:	0	0

EXECUTIVE SUMMARY

This midterm evaluation of the Tunisia Rural Potable Water Institutions Project (No. 664-0337) was conducted from January 23 to February 24, 1989. The evaluation was undertaken by the Water and Sanitation for Health (WASH) Project with a six-person team, including two Tunisian specialists identified by the USAID/Tunisia Mission, which initiated the evaluation (PIO/T 664-0337-3-70117).

The long-term goal of the project is to improve the quality of life of the rural poor in an area of Tunisia where USAID had a major, multisectoral rural development project, Central Tunisia Rural Development (CTRD), from FY 1979 through FY 1989 (CTRD No. 664-0312). The CTRD program encompassed projects in area development, dryland and irrigated agriculture, health, range and pasture improvement, Save the Children, and potable water supply. The idea for the current project was derived from lessons learned while implementing CTRD. Hence, the current project focuses on involving beneficiaries at sites previously financed by USAID as well as at newly constructed ones. The USAID support is provided through the Central Tunisia Development Agency (CTDA), *Office de Développement de la Tunisie Centrale (ODTC)*. The project has three purposes: (1) to establish and refine a coordinated and decentralized institutional approach to rural water operations and maintenance (O&M), with user participation and user fees, as a means of demonstrating a model to the Government of Tunisia (GOT) that may be appropriate for adoption as a nationwide strategy; (2) to maximize water investments by improving site selection for new and improved water systems; and (3) to provide improved access to potable water for underserved rural populations.

The purpose of this midterm evaluation was twofold: (1) to determine the extent to which the project's goal and specific purposes are being met or can be met within the life of the project (PACD March 31, 1991) and (2) to provide the Mission and the GOT/CTDA with guidelines for undertaking any required changes in project design or implementation procedures.

The approach used by the WASH evaluation team was straightforward. During an initial team planning meeting in Tunis, we developed, with the assistance of Mission and CTDA project managers, a common understanding of the evaluation Scope of Work and a work plan that would enable us to respond to the specific questions posed in the Scope of Work. Using a Rapid Rural Assessment approach, we visited a representative sample of project sites in the governorates of Kasserine and Gafsa and an adjacent control area, the governorate of Kairouan. Other techniques and tools used included interviews, questionnaires, documentation review, and meetings with personnel involved in project conceptualization, implementation, or monitoring in both the project area and in Tunis.

The major findings, conclusions, recommendations, and lessons learned are summarized below.

FINDINGS: At the end of the first two years of project implementation, substantial progress has been made toward achieving the three purposes of the project.

(1) A total of 120 Water User Associations (WUAs), *Associations d'Interêt Collectif* (AICs), have been established at potable water points in the Kasserine/Gafsa program area with the assistance of social workers and sociologists of the Regional Support Unit, *Unite d'Autogestion (UAG)*, of the CTDA. Of these, 81 will soon be officially legalized. Of the 120 pump operators, 87 have been partially trained, and all the WUA presidents have received an initial orientation to their roles and responsibilities. Seventeen community health workers have been trained by the new Regional Health Education Team (RHET), *Equipe Regionale d'Education Sanitaire (ERES)*, and have been working for a year in four of the delegations in the project area. Another 20 are currently being selected for an additional four delegations. In February 1989, the President of Tunisia ordered the government to give high priority to the establishment of rural potable water user associations, with user participation and user fees, to ensure rural water operations and maintenance (O&M).

(2) Ten new potable water sites have been selected with community involvement and using project-developed site selection criteria, a hydro-geologic database, and a water resources mapping study (four others were chosen earlier according to the criteria of the earlier USAID project). In addition, using the same new procedure, sites for seven new boreholes, two extensions, and one house connection system have been selected and will soon be proposed to USAID.

(3) Fourteen productive boreholes and three civil works constructions have been completed and are providing improved access to potable water for underserved rural populations. The CTDA is installing pumps, local private contractors are constructing civil works, and one local private contractor is providing O&M services.

CONCLUSIONS:

(1) The project model, per se, may not have been the major factor contributing to the GOT's decision to adopt a nationwide strategy for user participation and user fees to ensure rural potable water O&M. Variations of the model have been developing in other regions of the country for decades, and the approach is now consistent with the GOT's new overall emphasis on decentralization and the disengagement of the state. At the same time, the overall project purpose now has the highest level of political support possible, including an interest in expanding the use of social scientists and social workers to stimulate and sustain community participation and management of resources.

(2) It is premature to conclude that the improved site selection criteria and process and the revised civil works construction plans and procedures for new and improved potable water systems will indeed maximize potable water investments in the CTDA project area and be adopted by the Water Affairs Group, *Groupement d'Interêt Hydraulique (GIH)* for all sites. There are indications that this could be so if the current positive efforts for improved collaboration and coordination of all involved parties are realized.

(3) Due to the higher-than-anticipated costs for the initial boreholes and civil works constructions, the remaining project funds will not be sufficient to achieve the end-of-project verifiable indicator of at least 30 new installations (26 productive boreholes, 4 extensions, and up to 2 pilot house connections).

RECOMMENDATIONS:

(1) The Ministry of Agriculture should, through either the CTDA or its reorganized successor, provide the UAG with adequate resources: three vehicles, personnel, two female agents for training and Women in Development (WID) activities, and institutional authority. These resources are needed to continue the creation, development, and support of the WUAs in the program area and to help ensure the overall management, support, and development of the WUAs at local, regional, and national levels.

(2) USAID and the CTDA should allocate some project training funds for increasing and improving the exchange of information and experiences on the various institutional models currently being tested in Tunisia in order to ensure rural potable water and O&M by local WUAs and to expand health, hygiene, and sanitation education through interagency collaboration and local WUAs.

(3) The Ministry of Health should ensure that the health educator of the Regional Health Education Team receives the training planned for him and that the team receives from the CTDA the minimum logistical (one vehicle) support needed to conduct its work in the program area.

(4) USAID should encourage the Ministry of Agriculture to centralize regional O&M (second-level) services within the context of the reorganization of its services in the region and require that there are work plans for both preventive and corrective O&M programs, using a combination of ministry and private sector resources.

(5) USAID should consider providing additional funding and/or assist the GOT in approaching other potential donors to provide additional resources so that the 30 new installations planned can be completed and that the project approach for developing WUAs using the CTDA model can be adequately studied and compared with other models/approaches being developed in Tunisia (Kasserine and Kairouan).

(6) The CTDA and USAID should agree to finance only one pilot house connection and consider smaller, lower cost technical options for exclusively potable water installations in order to maximize the number of additional new installations before the end of the project.

(7) The GOT should continue to provide only necessary financial subsidies to those WUAs that absolutely need them during their initial stage of development.

LESSONS LEARNED:

(1) USAID/Tunisia and the GOT should, when designing and implementing regional projects, regularly consider the related activities and plans of other donors and the GOT in other regions of the country.

(2) USAID/Tunisia should strengthen its support for GOT efforts to increase the involvement of women in national development activities, particularly in sectors in which women traditionally play a major role.

(3) USAID/Tunisia's historical strategy of concentrating a good portion of its development assistance on the GOT agency responsible for rural development in one of the least developed areas of the country has strengthened the capacity of that agency (CTDA) to ensure adequate financial management, computerized information systems, and sound project design, implementation, monitoring, and evaluation.

Chapter 1

INTRODUCTION

This report constitutes a midterm evaluation of the Rural Potable Water Institutions Project (USAID/Government of Tunisia No. 664-0337). The evaluation took place in Tunisia between January 23 and February 24, 1989. The evaluation was conducted by a six-person team, including two Tunisian specialists identified by the USAID/Tunisia Mission, which initiated the evaluation by the WASH Project (PIO/T 664-0337-3-70117). Team composition was as follows:

Lee Jennings	Team Leader, Training Specialist
Ridha Boukraa	Sociologist
Mohamed Frioui	Economist, Institutional Development Specialist
Richard Swanson	Anthropologist, Information Systems Specialist
Sereen Thaddeus	Medical Anthropologist, Women's Involvement Specialist
Alan Wyatt	Water Supply Engineer, Operations and Maintenance Specialist

1.1 Purpose of the Evaluation

The purpose of this midterm evaluation was twofold: (1) to determine the extent to which the project's goal and specific purposes are being met or can be met within the life of the project (PACD March 31, 1991) and (2) to provide the Mission, the Government of Tunisia (GOT), and the Central Tunisia Development Agency (CTDA), (*Office de Développement de la Tunisie Centrale, ODTC*), with guidelines for undertaking any required changes in project design or implementation procedures.

The major foci of the evaluation were policy changes, important assumptions affecting achievement of project purposes, institution-building strategies, and the general sociopolitical-economic setting. Project components are evaluated against end-of-project conditions and output indicators. Available information on Water User Associations (WUAs) (*Associations d'Intêret Collectif, AIC*), and their social, economic, political, and legal impact is reviewed. The evaluation identifies special or ongoing problems impeding achievement of goals and determines if implementation plans and/or strategies need to be modified. (See Appendix A for the evaluation Scope of Work.) Recommendations pertinent to the role of the CTDA as the primary manager and executor of the project are made. Finally, the range of assistance options available should the GOT wish to continue this type of project and measures for adapting and expanding this model elsewhere in Tunisia are also discussed.

1.2 Political Context

Tunisia has adopted an economic recovery plan that gives greater freedom than before to economic enterprises and undertakes a wider process of liberalization and privatization aiming at a larger participation of the private sector in the economy. The GOT is increasingly disengaged from economic activities, keeping only the so-called strategic sectors.

This new orientation led to a political decentralization that gave the regions a role to play in the economic choices of interest to the population. This led to the establishment of the Regional Development Council (*Conseil Regional de Développement*), which includes all the elected officials of the region (mayors, deputies, and presidents of rural councils) and which discusses the economic policy of the region and follows all development projects in the region.

In regard to potable water, the Water Affairs Group, (*Groupement d'Intéret Hydraulique*, GIH), examines this question from a regional standpoint, but the President of the Republic has given priority to supplying potable water to all rural populations; to that effect, he has provided new budgetary inputs, while emphasizing the need for cooperation with the population and its direct participation in the operational management of water resources.

Aiming at a wider participation of the population in water management, Tunisian authorities took a number of steps to legalize, institutionalize, and promote the establishment of WUAs for the purpose of managing water systems and, more particularly, to accomplish the following:

- relieve the GOT of the direct operating costs of water points (energy and small repairs);
- sensitize the beneficiary population to the importance of the water works, their maintenance, and the continuity of water service;
- involve the population in the various choices related to water policy, in particular the selection of sites;
- develop locally the pricing policy for water;
- provide flexibility of action in the decision-making process;
- encourage the autonomy or the actual independence of the WUAs;
- coordinate WUA activities without infringing on their autonomy;
- develop more effective participation of women, taking into account their primary role in water use; and
- evaluate expected benefits in relation to the overall costs of the WUAs.

These policies are now to be extended to the entire country, taking into account the evolution of a WUA (start-up, maturity, and so on) and some important sociological considerations, in particular participation, collective management, autonomy in decision making, financial equilibrium, overall coordination, institutional viability, continuity of service, and privatization. In fact, during the visit of the evaluation team in Tunisia, the President of the Republic formally announced this new policy for rural water supply, as described in the newspaper article included as Appendix B.

On the whole, political trends aim at consolidating the WUAs and at strengthening community participation in development work. The WUAs should play an increasing role in potable water activities and irrigation and, in the future, in all aspects of community development, in particular in the social and health education fields through the promotion of an increased use of sociologists and social workers.

1.3 Project Context

The CTDA was created by the GOT in 1978 as an autonomous agency under the Ministry of Agriculture and charged with carrying out regional planning and project implementation for Central Tunisia, one of the poorest and most underdeveloped regions in Tunisia. It was the first regional organization in Tunisia to combine both project implementation and planning and was also unique in serving more than a single governorate. Its zone of intervention includes all districts in the governorate of Kasserine, plus two districts each in the governorates of Gafsa and Siliana. (See map in Appendix C.)

During its 11-year history, the CTDA has concentrated particularly on irrigation, agricultural extension, and potable water projects. It has the primary responsibility for coordinating and implementing the planning targets and goals for the GOT's seventh Five-Year Plan (1987-1991) in its zone of intervention.

The USAID/Tunisia Mission began to provide support to and through the CTDA in FY 1979 with the Central Tunisia Rural Development (CTRD), (*Développement Rural de la Tunisie Centrale, DRTC)*, Project (USAID/GOT No. 664-0312). The CTRD was a multisectoral rural development program with the goal of improving the quality of life of approximately 300,000 people in Central Tunisia. The CTRD project encompassed projects in dryland and irrigated agriculture, health, range and pasture improvement, and potable water supply.

USAID's assistance in potable water began in 1980 with the signing of a subproject to the CTRD project entitled Rural Potable Water (USAID No. 664-0312.7). Based on the lessons learned during that initial potable water project, a Project Paper was approved by the Mission in March 1986 for the current Rural Potable Water Institutions Project.

1.4 Project Goals and Objectives

The long-term goal of the project is to improve the quality of life (improved health and increased family productivity) of the rural poor in the CTDA program area. The project has three major purposes:

(1) to establish and refine a coordinated and decentralized institutional approach to rural water operations and maintenance (O&M); with user participation and user fees, demonstrate a model to the GOT that may be appropriate for adoption as a nationwide strategy;

(2) to maximize water investments by improving site selection for new and improved water systems; and

(3) to provide improved access to potable water for underserved rural populations.

Quantifiable measures of the extent to which the project's purposes are achieved were established in the Project Design Summary: Logical Framework (see Appendix D).

1.5 Description of the Project

The project targets include installation of 30 water systems to serve 50,000, at an estimated total project cost of $6.5 million. The project has three major components:

(1) technology transfer: new interventions;

(2) institutional development: WUAs at the local level; and

(3) institutional development: the new Regional WUA Support Unit of the CTDA, the *Unite d'Autogestion* (UAG).

The technology transfer component is directly linked to the project objective of financing the execution of 30 new boreholes (of which 26 are expected to be productive), up to four water point extensions, and up to two pilot house connection installations. It includes the water resources mapping study (Gritzinger, 1987; Gritzinger and Ezzedine, 1987), which was completed during the first year of the project by a U.S. contractor, and a contract with a Tunisian architectural and engineering (A&E) firm, which is responsible for the following:

(1) revision of standard designs, with particular consideration of civil works for water supply (reservoirs, water troughs, engine shelters, etc.), sanitation, and drainage;

(2) adaptation of those designs to site-specific conditions in consultation with local WUAs;

(3) preparation of tender documents to be offered by the CTDA; and

(4) construction monitoring based on a time and materials contract.

The major units or organizations involved or affected by the technology transfer component are as follows:

- the Water Projects Service, *Aménagement Hydro-Agricole* (AHA), and the UAG;
- the Rural Engineering Unit, *Génie Rural* (GR), of the Regional Agricultural Development Commission (RADC), *Commissariat Regional de Développement Agricole (CRDA)*;
- the Water Resources Office, *Direction des Ressources en Eau* (DRE);
- the Rural Development and Integrated Rural Development Programs of the Ministry of Interior, *Programme de Développement Rural* (PDR) and *Programme de Développement Rural Integre* (PDRI); and
- the GIH, which coordinates decisions regarding new water installations for the governorate.

The institutional development component of the project for the local level focuses on developing WUAs around each new and existing public water point in the project area. The WUAs have four principal tasks:

(1) raise money to cover O&M costs, including fuel, salary for the pump operator, basic maintenance, and sanitation improvements;

(2) undertake sanitation activities around the pump site and provide input into certain civil works design features;

(3) undertake health education; and

(4) maintain site discipline, organize labor inputs, and settle conflicts concerned with drawing and hauling potable water.

The regional institutional development component focuses on the development of the UAG which is staffed by social science professionals and is responsible for the organization, support, and training of the local-level WUAs and for

assisting in the coordination at the regional level of all services (technical, construction, O&M, and health and hygiene education) that interact with and assist the local WUAs.

1.6 Methodology of the Evaluation

The methodology employed by the WASH team was straightforward. The scope of work was used as a guide and answers were sought to all the questions included in it. Data were gathered based on field visits by all six members of the evaluation team to a representative sample of 12 WUA sites in the governorates of Kasserine and Gafsa and to an adjacent control area (2 WUAs) in the governorate of Kairouan. These qualitative data were gathered using a Rapid Rural Assessment approach at each site. This included use of standard questionnaires and/or a checklist for the pump operators, the WUA presidents and treasurers, the community health workers (for the two sites where these existed), schoolteachers, health clinic workers, and different users of the water point, including men, women, children, water vendors, irrigators, and so on. Evaluation team members had specific areas of responsibility and usually split up into smaller teams at each site. Upon our arrival at a site, our basic approach was to explain the reason for the visit to the officers of the WUA and then to obtain a general overview of the site in order to interview the different users of water cited above. A Tunisian Arabic speaker, usually a member of the UAG, accompanied each of the subgroups. We were able to visit two WUAs each day; some members of the team spent an additional day following up on special information at several sites, for example, water vendors (Gonna) and women pump operators (Etteraa, El Hachim). Appendix E includes a list of sites visited and the interview instruments and questionnaires used; Appendix F lists the persons and organizations contacted during the evaluation.

Other techniques used included document reviews (see Appendix G) and meetings with key persons involved in project conceptualization, implementation, or monitoring in both the project area and in Tunis. The team also attended the first annual meeting of WUAs in the governorate of Kairouan and administered a questionnaire to the officers of those WUAs in order to compare their experiences with those noted in the WUAs in Kasserine. The meeting was significant in that we observed high government officials (e.g., Minister of Plan, Director General of the Rural Engineering Unit of the Ministry of Agriculture, Governor of Kairouan) listening to several dozen WUA presidents explain their difficulties and hopes for their new associations and then describing the GOT's high expectations that the WUAs will take into their own hands the management and operation of their water resources.

Chapter 2

IMPLEMENTATION PROGRESS

2.1 Summary and Status of Project Activities

All the major activities included in the Project Paper and in the Project Grant Agreement (dated April 31, 1986) have been undertaken, and substantial progress has been made since actual project implementation began in January 1987. These major activities include the following:

- construction activities for new boreholes and civil works;
- the water resources mapping survey;
- the creation and operation of the UAG;
- the creation and initial development of WUAs;
- health and hygiene education;
- O&M activities; and
- improved regional planning and coordination of all of the above through the GIH.

Significant progress has been made regarding nearly all of the planned activities identified in the Project Paper's Logical Framework as objectively verifiable indicators and outputs expected by March 31, 1991. The following examples highlight this progress:

- Fourteen productive boreholes and the civil works for 3 have been completed. The civil works for 6 of the 14 are currently being completed and tender documents are being prepared for the remaining 5.
- The water resources mapping study was completed in August 1987.
- The UAG was staffed and began functioning in March 1987, meeting the requirement of one of the Conditions Precedent in the Project Paper.
- The UAG now receives the wholehearted support of all parts of the regional government, despite having been received with some skepticism at the start of the project.

- WUAs have been created for 120 new and existing rural water points in the project area.

- The new Regional Health Education Team (RHET), *Equipe Regionale d'Education Sanitaire (ERES)*, has trained 17 village-based female health workers in 4 of the 14 delegations of the project area and is currently selecting another 20 for 4 additional delegations.

- Simple O&M is being ensured at most water points by project-trained local pump operators (87 of 120), and more complex repairs and maintenance are being handled by a local O&M contractor and the repair crews of the GR and the Rural Development Program.

- The GIH has been constituted and has designated the UAG as the unit responsible for continuing to help local WUAs develop.

2.2 Problems: Actual and/or Anticipated

Despite the progress made, some problems exist, and others can be anticipated. In regard to the technology transfer component (construction and O&M activities), sufficient funds are not available to complete the planned 30 new installations because of higher-than-expected drilling costs for the first 14 boreholes. It has been necessary to drill to much greater depths--300 to 400 meters, rather than the 150 to 200 meters anticipated. The CTDA justified such drilling by saying that few sites of shallow depth remain that meet the project's criteria. In addition, improvements still need to be made to ensure that the most cost-effective site designs are used and that O&M activities are accomplished in a timely manner. Also, the water resources mapping study, as it was designed, is not amenable to simple updating so it is not used as much as was foreseen.

The UAG has accomplished a great deal in less than two years, but there is a definite need to (1) consolidate, clarify, and prioritize activities, (2) gather and use more socioeconomic data, and (3) increase staff and logistical support if it is to continue to ensure the rational development of the local WUAs for potable water points. The UAG is probably trying to do too much; it must focus its efforts on developing WUA capability to manage specific tasks (basic management, finance, and collective decision making) and at water points that are primarily for potable water.

Eighty-one of the 120 existing WUAs are due to be officially legalized in the immediate future (paperwork has been completed; Minister of Agriculture must sign papers, and WUA's status must be posted in the official GOT journal). They will need considerable guidance and continued assistance from the UAG and the RHET if they are to be able to cover the basic local-level O&M costs of their potable water installations and carry out health, hygiene, and sanitation improvements. The latter activity is beset with problems, particularly regarding interagency cooperation for the logistical needs of the RHET,

continued support for the female community health workers (*animatrices*) until they can be supported by their own WUA, the need to increase women's involvement, and the need to communicate health, hygiene, and education messages more effectively.

All of the institutions, from local to delegation to governorate and to national levels, need to continue to improve their planning and coordination of activities if the ultimate program goals of improved health and increased productivity of family members are to be attained in the future. The project has the definite possibility of contributing to these long-term goals if the immediate problems of institutionalizing effective WUAs for all potable water points in the project area are addressed and resolved over the next two years. The following chapters analyze these problems in detail for each of the major project components and provide specific recommendations for addressing them.

Chapter 3

PROJECT ACTIVITIES: IMPLEMENTATION ISSUES

The project's implementation objectives within the CTDA can be subdivided into two major complementary efforts:

(1) Water point construction, including site selection, well drilling, construction of storage tanks and distribution systems, installation of diesel or electric pumps, and operations and maintenance.

(2) Support in creating and strengthening the UAG within the CTDA to assist in the creation of local WUAs around existing and newly created water points. The major purpose of such WUAs is to place into the hands of the water users themselves the management of the water system, with the ultimate goal of more efficient exploitation, management (of equipment and water point), and conservation of the available water. To do this, local WUAs must raise money through user fees to cover basic operating and low-level maintenance costs, including eventually the pump operator; the GOT is to cover major repairs. Such water points were to include those created in the current project, those created through past USAID assistance in the region, and those existing and being created through other government programs in the region.

USAID project support during the past two years has included the development of a water resources mapping study to be used as a tool in water point site selection, other technical assistance, the drilling and construction of 14 (of 30 planned) water points, and training and materials support for the UAG. The GOT's major financial contribution to the program has been payment of the salaries of the five members of the UAG and the equipping of the wells with motor pumps.

In projects of this type, technical issues (e.g., site selection, water system design) are not all that difficult to resolve. The financial and management issues related to the new WUAs are basically socioeconomic, however, and much more difficult to confront successfully. For this reason, better support, both technically and financially, should be given to resolving issues concerning the UAG and the growing number of WUAs.

3.1 Water Resources Mapping Study

The water resources mapping study (Gritzinger, 1987; Gritzinger and Ezzedine, 1987) was conducted to facilitate a rational well-site selection process for the current project. As pointed out in the Project Paper, "initial base maps with overlays were developed for Kasserine Governorate in Central Tunisia in 1980-1981," which "unfortunately have not been maintained." To maximize investment in this project, up-to-date maps relating water resources to populations were again recommended. Unfortunately, despite the heavy costs incurred, once again the maps are out of date.

3.1.1 Usefulness to Project and the CTDA

The water resources mapping study did help the CTDA staff identify and screen potential sites for new water points based on the three main criteria for site feasibility. Population, infrastructure, and deep aquifer maps were particularly useful in this regard. Use of the overlay maps provides a powerful tool whereby one may rapidly identify the intersection of an area that meets the three criteria--a significant population (>900 people), a lack of water within approximately 3 km, and the existence of an aquifer with acceptable salinity levels (<2.5 g/liter). In all cases, however, field work is still required to confirm population estimates and the nearest water sources. All UAG personnel have photocopies of the population and well-location maps, which they use in the field for orientation (as one would use a road map).

It is not at all clear that such "optimal sites" could not have been selected without such a study. Development personnel in Tunisia have a good understanding of the "zones assoiffées" (thirsty areas) within their regions, as do the various political personnel at the subregional level. Follow-up verification of future water points suggested such knowledgeable personnel, with technical and socioeconomic study, could have probably accomplished the same job for less and still have satisfied the site-selection requirements. It appears that the CTDA does not use the land use, shallow aquifer, or topographic maps created by the study.

Study implementors had hoped that the information contained in the overlay map series would be of use for other endeavors in the region (e.g., agriculture, health/dispensaries, education/school), and by other programs involved in development of water points. Some 25 copies of the study were made available to a variety of other agencies, but there is no indication that they are being used. The last time the maps were used by the UAG was almost a year ago, when a series of proposed sites were evaluated and selected.

Technical and economic studies were performed to accompany the maps. Several of these were quite useful, such as the economic studies by Reeser (1987, 1988). Others, such as that of well statistics (with a file in Lotus 123) are not used and are certainly not being updated. The only agency that might have an active interest in these data (DRE) does not have a computer and uses its own system of storing this information.

3.1.2 Usefulness to DRE

Given the nature of this study, it is surprising that the DRE was not considered a prime beneficiary. Because of the approach taken (personnel coming in from the outside, in the name of the CTDA, to obtain their data and map it), DRE personnel were obviously somewhat put out. They got the impression that "with this information" their assistance could be sidestepped and decisions about site location made without them. That was certainly never the intention, but it is unfortunate that DRE personnel were not directly involved in creating the database and provided with the means to update it. DRE personnel should have been involved in processing those aspects of the study that most concern them so they would develop a proprietary interest in the information.

Aquifer maps were created on base maps at 1:200,000 scale and then enlarged to 1:100,000. This rendered them somewhat imprecise. What the DRE wanted were maps at 1:50,000 scale, basically updating information from topographic sheets at this scale. Apparently the study used outdated maps for the location of wells and aquifers, information that could have been updated with direct DRE interaction. The DRE also possesses significant data sets (e.g., salinity, depth, static level, dynamic level) on every borehole in the region, which are continuously updated (official updates are published every five years). Thus, the office most concerned in terms of the physical criteria for site selection has not found the study of particular significance to its work. DRE personnel did find the infrastructure and population overlays useful when combined with their own knowledge of particular proposed sites of intervention.

3.1.3 Training for Map Use and Updating

The CTDA staff seemed very familiar with the map products (overlays) and knew how to use them. One CTDA staff member has been trained to update maps using PC-Paint software, digitizer, and plotter. However, the CTDA does not have the necessary equipment. Even if it were available, it is doubtful that the task could be accomplished satisfactorily or in a timely manner because it appears that the technical and sociological staff of the UAG has not been trained to use the economic evaluation models related to this information.

The mapping study is essentially a static product of high quality, very difficult to update, and according to the DRE, very incomplete in terms of the hydro-geological data sets included. Given its cost, the study does not appear to have been cost-effective. It would be very difficult to justify funding for subsequent updating of the overlays. Nor would the evaluation team recommend such a system's being developed for any other region of the country.

Given the current national interest in WUAs, and the increased investments in water that are sure to follow, the project probably missed an opportunity in not initiating a computerized geographic information system (GIS) that could have been expanded nationwide. Based on recent experience in designing similar systems (Swanson: Haiti), a computerized information system could have been created with the same data for about one-half the cost of the mapping study, a system that would have provided significantly greater simplicity in updating and creating new hard-copy products. The implementors of the study, Institute for

Development Anthropology (IDA), apparently did consider establishing such a system (Gritzinger, 1987:23), but they opted for what they believed would be a less sophisticated system, more appropriate for Central Tunisia. More emphasis should have been placed, however, on how the information the system would use would be manipulated with other sets of information and presented. The form of the maps and ease of use were given priority over the actual information presented and how it would be updated.

3.1.4 Appropriateness for GOT and USAID Use

The study does not seem to be appropriate for more generalized use by either the GOT or USAID. However, the experience gained from this activity provides some useful lessons:

(1) A system must be simple enough to be updated periodically without major new investments in equipment and supplies.

(2) A system should be designed in-country and with the active participation of intended users.

(3) A system should collect only information the intended users need to perform their duties; their needs must define the development of the system.

(4) A system of this kind implies management of many different kinds of information. Thus, the major intended users should all have a direct stake in the endeavor.

(5) Mapping information must be presented at the highest resolution possible to be useful; 1:50,000 scale topographic maps should have been the base maps for the project.

Because the need for up-to-date geographically referenced information will continue to be vital for future programs of this kind, the project's experience with the water resources mapping study should not discourage future programs from investing in state-of-the-art GIS raster- or vector-based systems. Such microcomputer-based software systems permit storage of any number of layers of information, in much the same manner as one would think of using the mylar overlay maps. The difference, however, is that any layer can be superimposed on one or more other layers to create a new "map," which can then be printed out, if needed, along with statistical information about the variables indicated. It would be a simple task for a GIS, for example, to indicate (by different shading) 0 to 3 km, 3 to 6 km, and 6+ km distances around any specified number of water points or types of water points (only boreholes, only shallow wells, and so on). The GIS works as a flexible information system that can be accessed by different users to perform different tasks. Information can be summarized and displayed using any definable geographic boundary.

With the capability to link with other database programs, raster-based GIS software (CRIES, IDRISI, ERDAS) provide for fairly simple updating of

information. Updating population figures or other socioeconomic data is no more difficult than updating a Lotus-123 file in which the information is stored, followed by hard-copy printing of a map at the desired scale. New point data, such as well sites, can be incorporated by entering their geographic x,y coordinates (the original map would have been digitized directly).

Information management systems using GIS software have important implications for information management in every sector of government because a critical third dimension--space/location--is provided. Location (a water point, a community, a district or department, a type of soil, elevation at 300 meters) provides the common denominator that permits rapid correlation of multiple data sets.

Future programs for potable water in Tunisia should seriously consider initiating a centralized (Tunis-based) information system on all water points in the country. Basic information would be provided by a group like the UAG or GR, which could be trained in applied use of such information for their specific needs and in updating information systems on their region. Several different organizations should be given the hardware/software to manage such a system. The DRE would clearly be a major candidate. If a national-level UAG is created, as proposed with the reorganization of the Ministry of Agriculture, to help coordinate the activities of the regional units, then this kind of system would certainly prove useful for information management. Finally, a computerized information system of this kind can be put to wider and wider use in other government agencies as new geographically defined layers of information are entered into the information systems of each agency.

3.2 Construction Activities

3.2.1 Site Selection

The CTDA has followed a careful procedure to select sites in accordance with the site-selection criteria defined by USAID and based on need. An effort has been made to rank the sites by economic feasibility, but this aspect needs additional strengthening and monitoring by USAID. (Detailed technical and financial data on project sites are given in Appendix H.)

As the first step in site selection, the UAG compiles a long list of underserved areas based on its work in the field, discussions with the rural population, and input from other regional-level institutions and officials. The sites are verified using data from the water resource mapping study to estimate the population, locate the nearest water point, and confirm that no water point exists within 3 km of the proposed site. These preliminary investigations are followed by initial field visits to verify population and water availability. The UAG then compiles another list, ranking sites in terms of need (i.e., distance to water) and population.

The list is then submitted to the GIH for review and verification. The GIH, in turn, commissions a study of the aquifer potential at each site to verify the existence of an acceptable aquifer and to obtain an estimate of the expected

total well depth, yield, and static water level, if possible. This information is added to the list of sites and the candidates are reclassified.

Next, the President-Director General of the CTDA orders a study of each site to determine the costs of the well, civil works, and equipment, and the cost per beneficiary is computed. A water point economic/financial analysis computer program developed by the IDA and the CTDA is used to compute the internal rate of return of the candidate projects.

These results are then presented to the GIH and a final selection is made of a limited number of sites to be proposed to USAID. According to staff of the planning unit at the CTDA, as long as the internal rate of return is above zero, such projects can be considered economically favorable. This minimal value for this criterion is at best unconventional. At the same time, the current model surely underestimates the benefits stemming from the projects, so a higher cut-off point may not be warranted.[1]

During the project to date, 10 sites have been selected using this process (4 others followed the previous project's criteria). They corresponded well to the USAID selection criteria, but it is not clear that these sites are the most attractive economically. It is recommended that the economic model be improved and used to evaluate candidate sites in the future. In addition, detailed economic and financial results for all sites that meet the above-mentioned USAID selection process criteria should be transmitted to USAID, with the proposed selection of sites noted for USAID.

Some additional comments on site selection are in order. In the first USAID potable water project, a maximum depth of 200 m was stipulated. The cost of only the first 200 m of deeper wells was to be reimbursed by USAID for the first four wells under the current project. Thus, the first four wells had depths close to or less than 200 m. Once the depth criterion was lifted, the next five wells were much deeper. This response by the CTDA appears logical, if pure need is paramount as a criterion. However, information on the economic and financial conditions at the sites of these deeper wells was not transmitted to USAID for study. The other result of lifting the depth criterion is that the funds budgeted for well drilling are being used up faster than expected.

A review of the IDA/CTDA economic model revealed an interesting rule of thumb for judging economic feasibility of proposed water points. By coincidence, it appears that for each meter of total depth of a well there must be at least one family to render the project economically feasible. For example, a site with a well 300 m deep requires a minimum of 300 families for a favorable benefit/cost ratio and an interesting value for the internal rate of return.

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[1] The CTDA has acknowledged that an improved economic model is needed. In addition, improvement of the analysis of the financial viability of the prospective WUA is warranted. The UAG has developed alternative models for the assessment of the financial viability of the prospective WUAs, which themselves need improvement. Apparently, the unit's staff is not trained on these IDA/CTDA approaches or does not consider them useful.

While only approximate, this rule of thumb may be useful for screening candidate sites. This relationship should be checked against a revised economic model.

The evaluation team used this rule of thumb to evaluate briefly the 14 water points under the project. Only four sites passed the test. However, the CTDA has also suggested that the population within a 6-km radius be considered as beneficiaries if they are not otherwise served. Using a 6-km radius, 12 of the 14 sites passed the test (see Appendix H).

An approximate economic model (see Appendix H) was created to validate the criterion of a service area within a 3-km radius. The model compared the investment costs, operating costs, and water transport costs for projects with different radii. Since investments will fall as the radius increases, and transport costs will rise as radius increases, an optimal radius can be found. Results for different hypothetical cases showed an optimal radius of from 2.2 to 4.5 km. This very approximate analysis appears to confirm the figure of 3 km.

Once a particular *zone assoiffée* is selected for water point development, planning for the location of the well and civil works can begin. The location of elevated storage tanks depends on local topography. In many cases the availability of an aquifer at a reasonable depth and acceptable water quality will determine the well location. In some cases the best spot for the well is several kilometers from the main concentration of beneficiaries to be served. The practice in these cases has been to extend a pipe from the well to deliver water close to the people.

In general, the locations chosen for the public taps, livestock watering troughs, cistern-filling stations, laundry platforms, and drainage systems are good. Our investigations in the field revealed that for most projects some local people (mostly men) were consulted about the precise location of the water delivery. In addition, a number of sites have extensions to schools, which is a highly beneficial investment.

3.2.2 Standards and Appropriateness of Technologies

Construction Standards

Throughout the project, construction is done by private firms. Overall, the quality of the civil works construction is good. The materials used and the construction methods conform to standard engineering practice and thus also conform well to USAID regulations and expectations. Experienced construction firms have been selected for civil works.

Regular visits (every few days) have been made to the sites by *Architecture, Urbanisme, et Ingeneering* (AUI), the firm that developed the designs, to inspect materials, verify conformity to the plans, monitor construction procedures, and inspect completed components. In addition, CTDA personnel have visited all 14 sites in the course of their field work. (Tables in Appendix H indicate the status of the 14 projects started to date.)

Since March 1988, USAID staff have visited six of the project sites to check on progress. With contractor bids or AUI estimates, USAID staff have established reimbursable amounts for each well and civil works.

A USAID engineer has inspected five sites (September 1988 and January 1989) and confirmed that they are well constructed and conform to USAID regulations. Two of these sites (Dhouaouda, Jadida) are still under construction. Certificates of completion have been prepared by the USAID engineer for three sites (Chabiba, Boulaaba, and Ouled Bouallegue). In addition, the USAID engineer has also reviewed standard designs, tender documents, and contractor bids and found them to be in accordance with expectations.

Overall, this process of USAID staff visits and inspections by the USAID engineer is working well. The CTDA staff confirmed that a visit by the USAID engineer approximately once per quarter was sufficient for inspections and certification of completion.

Standard Designs

With input from the CTDA, AUI has developed standard designs for the following:

- motor shelters
- elevated water storage tanks (25 m^3 and 50 m^3)
- public taps
- livestock watering troughs
- laundry platforms
- drainage systems.

AUI is currently developing plans for fencing around the reservoir (and motor shelters when they are close).

These plans have been used at five sites where civil works construction has begun and will be used for five more of the well sites begun to date. The first four sites developed under this project followed the civil works designs from the previous USAID project so that construction could begin as soon as possible.

In general, AUI's standard designs are good. The drawings are comprehensive and well detailed. This is also the opinion of the USAID engineer. The studies and drawings reviewed reflected careful and precise engineering work. While there is potential for cost reduction, AUI has followed accepted design practice for civil engineering in Tunisia (French norms), with the approval of the CTDA.

The AUI designs are an improvement over the designs used in the previous USAID potable water project. These improvements can be attributed partly to the engineering skill of AUI, but also to the experience gained by the CTDA in the first potable water project. The motor shelters allow for improved ventilation, which is quite critical for good engine operation in the hot summer months. The public taps allow easier access to the faucets and are designed with more

consideration of the ergonomics of users with water jugs. The livestock troughs are wider, allowing easier access to the water. The inclusion of an area for washing clothes should prove to be a valuable addition. All these small structures have wider sloped concrete aprons and are connected to a drainage system (piping and soakaway pit at least 100 m away) in a suitable location.

The cistern-filling stations are more robust and less vulnerable to accidental damage by tractors that haul the cisterns. However, the wasted water at these stations is not collected into the drainage system. This point was reviewed with AUI staff, who explained that no simple solution could be found that would not be susceptible to tractor damage or get clogged with sand. They have agreed to take a second look at this issue to find a way of ensuring proper drainage.

The elevated storage tanks are based on standard reinforced concrete designs. However, no measures have been taken to provide any drainage of water flowing out of the overflow pipe. AUI is thinking of planting some trees, which could be watered with the overflow and the water emptied during tank cleanout. As will be discussed, there is room for considerable cost saving on these reservoirs.

The above components are combined into full system designs with piping. The geographic layout is determined by the well location, which is chosen in consideration of the aquifers and the location of the population. The designer usually simply connects the two. Considerable cost savings may also be possible in the selection of pipe diameters and materials.

Cost Considerations

The standards described above reflect traditional norms in Tunisia, and were approved by USAID and CTDA. The evaluation team feels that more emphasis should be placed on costs associated with these standards. It is important in any potable water project that the least-cost engineering solutions be used. That is, once a site has been selected and a desired level of service defined, the least-cost design should be used to achieve that level of service. The level of service chosen in the project design is to provide 50 liters/person/day to inhabitants within 3 km of the water point.

To address this issue, the cost of wells and civil works was examined in detail. Unit costs for major components and materials were examined. Appendix H shows the total cost of wells and civil works for the 14 sites started to date. The average cost of the 12 wells billed to date is 89,386 TD, and the average cost of the 9 civil works contracts is 43,449 TD, a total of 132,835 TD.[2] There appears to be considerable room for cost reduction, for both wells and civil works.

Since standard designs are used, the variations in civil works costs can be attributed to variations across sites in the size of the population, the length

[2] These figures are invoiced costs for wells and bid totals for civil works. The values for USAID reimbursement purposes will be different.

of piping required, and the characteristics of the site. Appendix H shows details of civil works costs for five systems designed by AUI. The reservoirs and the piping costs are usually the largest cost items, and thus, these two components were examined by the evaluation team in the greatest detail.

The cost of elevated tanks is always high. However, the cost of piping for the reservoirs was typically one-third of the total cost. Large-diameter, cast-iron piping was being used where there is no need for it. Considerable cost savings could be made by reducing the sizes of these pipes and/or switching to galvanized piping, which is readily available locally. These savings would be best used to increase the size of the tanks. The tank sizing is based on storing one-third of the estimated daily peak demand (50 liters/person/day x 1.5 = 75 liters/person/day), or 25 liters/person/day. This is the norm in use by most rural water system designers in Tunisia. However, this leaves little storage in case a motor or pump breaks down, which leads to near panic conditions, especially in summer, when water use and engine operating hours are high. As discussed in section 3.5, the maintenance crews have a difficult time responding to these urgent demands for repairs. A larger tank would provide more of a safety cushion to the population and ease the burden on the maintenance crews. In addition, a larger tank would reduce the required number of starts and stops on the diesel engines, especially in summer, which would also reduce maintenance requirements. AUI originally recommended larger storage tanks than are now being used, but the CTDA desired smaller tanks to keep investment costs down. It is difficult to determine the optimal size for the storage tanks at this time. As outlined in the recommendations below, this issue should be the subject of a study.

The piping used from the wells to the reservoirs and to the actual points of use is almost exclusively 100-mm asbestos-cement. No proper pipe friction calculations appear to have been made, except in a few cases, and those were based on rudimentary guidelines. Cost reductions can be made by correctly sizing the piping and by using lower cost pipe. New software programs are available from the World Bank (Microcomputer Programs for Improved Planning and Design of Water Supply and Waste Disposal Systems) to help minimize pipe network costs, which could be readily used in this project. Those programs will be particularly useful in house-connection systems planned for the project.

Good-quality polyethylene pipe is readily available in Tunisia, in a variety of diameters, at a cost of about two-thirds that of asbestos-cement. Overall cost reduction in pipe networks would not be quite so significant, because the trench/fill costs are fairly significant. AUI and the CTDA have planned to use this pipe in one site (Zannouche) and in the one house-connection system that has been designed to date.

Well costs are quite high--on the order of 300 TD per meter. The cost varies with the depth, the formations encountered, the diameter, and the well driller used. Examination of several well invoices revealed that roughly 40 percent of the cost is for drilling and 40 percent for casing, and that these costs increase greatly with diameter. Most typically, the wells drilled have 12-inch diameters and 9-5/8-inch casings.

Thick-walled polyvinyl chloride (PVC) offers good possibilities for major cost reductions for wells less than 200 m deep. Of the seven sites tentatively selected for a second round of wells, only one or two have total depths less than or equal to 200 m. Casing will not be required in hard-rock formations; however, some of the other sites may still be candidates for PVC casing.

The team held long discussions to see if ways could be found to reduce the diameter of the wells; smaller wells could still produce sufficient potable water. An 8-inch well with 6-inch casing would cost about one-half to two-thirds the cost of typical wells. Staff of the AHA noted that very few pumps are available that will fit into a 6-inch casing.[3] However, in many cases the dynamic pumping level, even on a well 300 m deep is only about 100 m. Thus, 9-5/8-inch casing could be used to just below the pump and a 6-inch casing below that. In many cases the DRE knows the formations well enough to plan for these types of well designs before the well is started, and it can verify the formations with the E-logger equipment purchased under the project. This design appears to be a feasible approach for appreciable cost reduction in many cases.

Selection of Pumping Equipment

Since the start of the project, the CTDA has purchased 15 pumping systems consisting of Perkins/Stamford diesel engine electric generators and Guinard submersible pumps. (Appendix H lists specifications used in the tender documents and technical characteristics.) In general, these are high-quality pieces of equipment.

The pumps were procured early in the project because the order/delivery cycle can take up to one year for such imported equipment. Thus, the specifications (total dynamic head and flow) were developed before the well characteristics were precisely known. An engineer of the AHA wrote the specifications to cover a wide range of conditions, but they were generally oriented toward high pumping heads to give a margin of safety. In one case (Boulaaba), the final pumping head was much less than expected, and a lower cost piece of equipment, procured earlier for another project, was substituted, which produced a better design. In the case of Dhouaouda, however, the overall head was more than expected, which required a second pump and a second motor shelter, thereby adding to the cost of the project.

Calculations also show that the kVa capacity of the engine/generator sets purchased with the pumps was much larger than required to match up with the pumps. This approach gives the maximum flexibility in case of unexpected extra pumping head. However, the engine will be oversized if the head turns out to be as expected, which leads to poor engine loadings, low overall efficiency, and higher operating costs.

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[3] This assertion merits further investigation; personnel from GR offices in other provinces indicated that smaller diameter submersible pumps are available on the market in Tunisia. In addition GR staff in Kairouan are using 7" PVC, which allows the use of many kinds of pumps.

Although it would be better to order the motors and pumps after the well characteristics are known, this approach would mean that the pumps would arrive six months after the civil works are done, thereby delaying the completion of the project. Another approach would be for the CTDA to purchase several high-head pumps and mobile diesel engines that could be used temporarily at the new sites. Then, a carefully chosen pump could be ordered once the well is complete and installed in place of the temporary pump when it arrives. This approach has the disadvantage of requiring two installations, and procurement problems may result from ordering just one unit at a time.

Another important point regarding selection of pumping equipment is that the general order of magnitude of pump output far exceeds that required for potable water uses. Assuming a large site with 2,000 people using 50 liters/person/day, and four hours of operation per day, a pump output of 7 liters/second is required. The smallest pump being procured has an output of 7 liters/second (Appendix H). In fact, the average size was 15 liters/second and four pumps reached 25 liters/second. The pump/engine cost was much higher than necessary as a result.

Some explanation can be found in the fact that once a well test is done, the DRE recommends a pump flow for use in the well. This recommendation is based on a desire to maximize the amount of water pumped from the well, subject to aquifer resource constraints, in order to make the most of the large well investment. This creates, in many cases, "excess" water which can be used for irrigation around the water point. The question must be raised as to whether this is the best approach in a potable water project. Given that the GOT is buying the pumps, it is of less direct concern to USAID, but the deliberate creation of excess has social and economic consequences, which are discussed in sections 3.2.4 and 3.4 below.

It would also be very useful to install water meters to measure pump output. The totalizing type of counter, registering in cubic meters, would be very useful to check technical performance, keep track of water consumption, verify water pumped compared with receipts, and help avoid overfilling the reservoir.

The procurement process for the motors/pumps also merits comment. International tenders are let for the purchase of this equipment. The bid evaluation criteria include unit price, the quality of component materials, the delivery period, "after-sales" service (parts and repair services), and the uniformity of prices. A total score for each bid is tabulated based on a predefined weighting of all criteria. The offer with the best overall score is selected.

The evaluation team feels that equipment standardization is an important consideration in procurement, and should be built into the process. A consideration could be added that would favor those models already in use in Kasserine. Such an emphasis on standardization would facilitate spare parts supply, repair and maintenance activities, and training of maintenance personnel.

The criterion relating to after-sales services was included in the most recent procurement of 15 engine/pump sets, for this project, but not for procurements

in the previous USAID funded water project. CTDA's general experience has been that bidders specify an after-sales arrangement for 5 years. However, most of the problems with the equipment surface after 5 years. They have also had cases where suppliers failed to honor these agreements, even if less than 5 years had elapsed. Unfortunately, under these conditions, CTDA may not be able to force the suppliers to comply. They could refuse to purchase again from these suppliers, but this would deter standardization efforts.

3.2.3 Supervision and Management

To ensure the construction of civil works in an effective and timely manner, the CTDA subcontracted the design and construction supervision aspects of potable water point construction. The CTDA has experienced engineering staff within the AHA, but the extra workload caused by the USAID-funded projects would have overloaded those personnel. This section examines the supervision and management of the construction activities and focuses on the work of AUI, the subcontractor, and its relations with the CTDA.

Through a competitive bid process, AUI was selected as the subcontractor and a fixed-price, two-year host country contract was developed with the CTDA. The tasks assigned to the firm include the following, some of which were discussed above:

- development of standard designs for engine shelters, elevated storage tanks (25 m^3 and 50 m^3), public taps, livestock troughs, laundry platforms, cistern-filling stations, and systems for site drainage;
- preparation of preliminary site studies for approval by the CTDA;
- preparation of detailed designs and tender documents, once approved by the CTDA;
- implementation of the tender process and technical assistance to the CTDA for bid evaluation and contractor selection;
- regular construction supervision and inspection and technical assistance to the CTDA for preliminary and final acceptance of the work performed;
- preparation of monthly activity reports; and
- participation in the preliminary and final acceptance of the civil works.

Some of the final acceptance dates may occur more than two years after the startup of the AUI contract. Thus, AUI's contract may be suspended for a period and then reactivated for the final acceptance procedures.

This is one of the first times in Tunisia that the same firm is performing design work and construction supervision. The fixed-price contract was negotiated for 115,000 TD or (US $145,000), with a start-up date of January 1, 1988. CTDA had already done the design work for 2 sites, Boulaaba and Chabiba. AUI started with the design for Bouibet and Dhouaouda, and has done construction supervision on these 4 sites. In addition, AUI has/is doing design and construction supervision on the other 10 sites already approved by USAID.

Regarding the supervision and management of construction activities, the role of the CTDA has been as follows:

- oversee all work conducted by AUI;
- advise AUI on standard design development (social perspectives);
- select civil works contractors with technical assistance from AUI;
- verify and certify AUI bills and submit them to USAID for direct payment; and
- participate in the preliminary and final acceptance of all civil works.

Since the startup of the contract, AUI has done preliminary engineering designs for 6 sites (Zannouche, Jadida, Ouled Bouallegue, Ouled Zid, Ouled Ahmed, and Karachoun). Contracts have been negotiated for five sites, and tender documents are being prepared for the three additional sites. For two sites (Nadhour and Serg Lahmar), well work is just coming to an end, so work on preliminary acceptance is to begin soon.

AUI makes a strong effort to keep the CTDA informed of work progress by means of written reports, informal visits to the CTDA headquarters, and frequent phone calls. Copies of all construction site inspection reports are sent to the CTDA.

AUI has conducted inspections of site works, but some problems have arisen. AUI carefully verifies that construction conforms to the drawings, but its visits have not been frequent enough at a couple of sites. In some cases, construction work had to be redone. However it is not clear if this is because work was done improperly due to contractor negligence, or because of insufficient construction supervision. In addition, the CTDA was unhappy about the means used for making journal entries. These are relatively minor problems, but AUI should make efforts to correct them.

The CTDA, and in particular the AHA, has performed well in overseeing the work of AUI. CTDA staff verify the construction site log books during their field work on an ad hoc basis. Staff of the AHA have reviewed the design work of the AUI carefully.

3.2.4 Use of Excess Water for Irrigation

The 120 WUAs within the project area can be sorted into the following categories based on their purpose: potable water primarily, irrigation only, and mixed use.

The "potable water primarily" systems typically include wells, reservoirs, and piping to public taps, livestock troughs, and stations to fill tractor-pulled water tanks (potences). These systems are called "potable water only," but point irrigation is achieved by using or hiring a tractor-hauled tank. Still, in our terminology, it is a "potable water only" system.

The "irrigation only" systems usually serve small irrigated perimeters (20 to 100 hectare) with direct piping from a well to a tank on the perimeter. These account for only about 20 of the 120 WUAs.

The "mixed use" systems can be thought of as "potable water only" systems that over time have added the direct connection of individual pipes to deliver water to private fields and gardens. (More precise details about the configurations of the water systems are given in section 3.4.)

An individual who wishes to connect to a potable water point to obtain irrigation water must first request permission of the WUA committee that manages the system. If the WUA committee has no objections, the request is passed to the GIH. The request is reviewed by the technical agencies that are represented on this committee, particularly the GR and the DRE. The former verifies the technical feasibility of the request, and the latter studies the potential impact on the aquifer. The DRE maintains very careful records on the inflow into each aquifer and the utilization of the water resources. For each aquifer, any unused resources are generally programmed for future use, be it municipal water supply, industrial, rural potable water, or direct irrigation. The DRE also maintains detailed records on all water pumped from deep wells; if a request arrives and available resources are already programmed for irrigation, then it will recommend that the request be approved. Requests are returned to the GIH and are approved or disapproved by the governor, in accordance with the technical and water resource recommendations made by the reviewing agencies. Problems arise, however, when the WUA committee, or close family members, are also beneficiaries of the irrigation. This conflict of interest is not lost on anyone, and it undermines the WUA's ability to collect fees. It is the community's perception of such actions that has implications for the future of the WUAs.

From a technical point of view, the use of the aquifers in the region is well controlled. No potential technical or water resource problems should result from the use of excess water at potable water points for irrigation.

As part of the technical assistance provided to the project, the Institute for Development Anthropology conducted an economic evaluation of the use of excess potable water (Reeser, 1988). The study examined the financial and economic viability of irrigation for cereal crops, arboriculture, and mixed cereals and arboriculture. The study calculated internal rates of return at different water

prices and established maximum prices to allow internal rates of return of 10 percent. Arboriculture proved to the most viable option, with a maximum price of 0.250 TD per m^3, which is on the same order of magnitude as current water sale prices for tractor- or animal-hauled cisterns.

Thus, from both a technical and an economic point of view, there appear to be no problems associated with the use of excess water for irrigation. It would appear that its use should be encouraged. However, access to excess water may, in many cases, be limited to a select few who request it first. As discussed in section 3.4, this inequity may lead to social conflicts that may be very difficult for the WUAs to resolve.

3.3 Institutional Development: Regional Support Unit (UAG) for Water User Associations

A first major institutional development effort of the project was the creation of the UAG as a support unit within the CTDA for WUAs within the region. The UAG became operational during the first quarter of 1987 with the recruitment of a director and three of four field technicians. The UAG currently has five male members, including the director, and one woman who has just joined the team.

As described in the Project Grant Agreement, the major responsibilities of the UAG are to "develop associations and strengthen WUA performance once in place" and "to organize, support, and train the Associations." Personnel recruited for the unit are to be individuals with community development, social science/social work and public health experience. The unit is directly responsible to the President-Director General of the CTDA.

In a December 1988 document prepared by the CTDA for its impending reorganization, the UAG is called the Regional Support Service, Service d'Autogestion, with the same position in the overall hierarchy it now possesses (i.e., directly under the President-Director General). In that document the UAG is described as having four principal tasks:

(1) to create associations around water points;

(2) to assist the members of the associations to manage the water points;

(3) to organize field days and workshops for the members of the WUAs; and

(4) to monitor and "animate" the WUAs.

3.3.1 Linkages with the Rest of the GOT

In connection with the establishment, support, and supervision of WUAs, the UAG has developed linkages with various technical agencies at the regional level. These linkages are summarized in Figure 1.

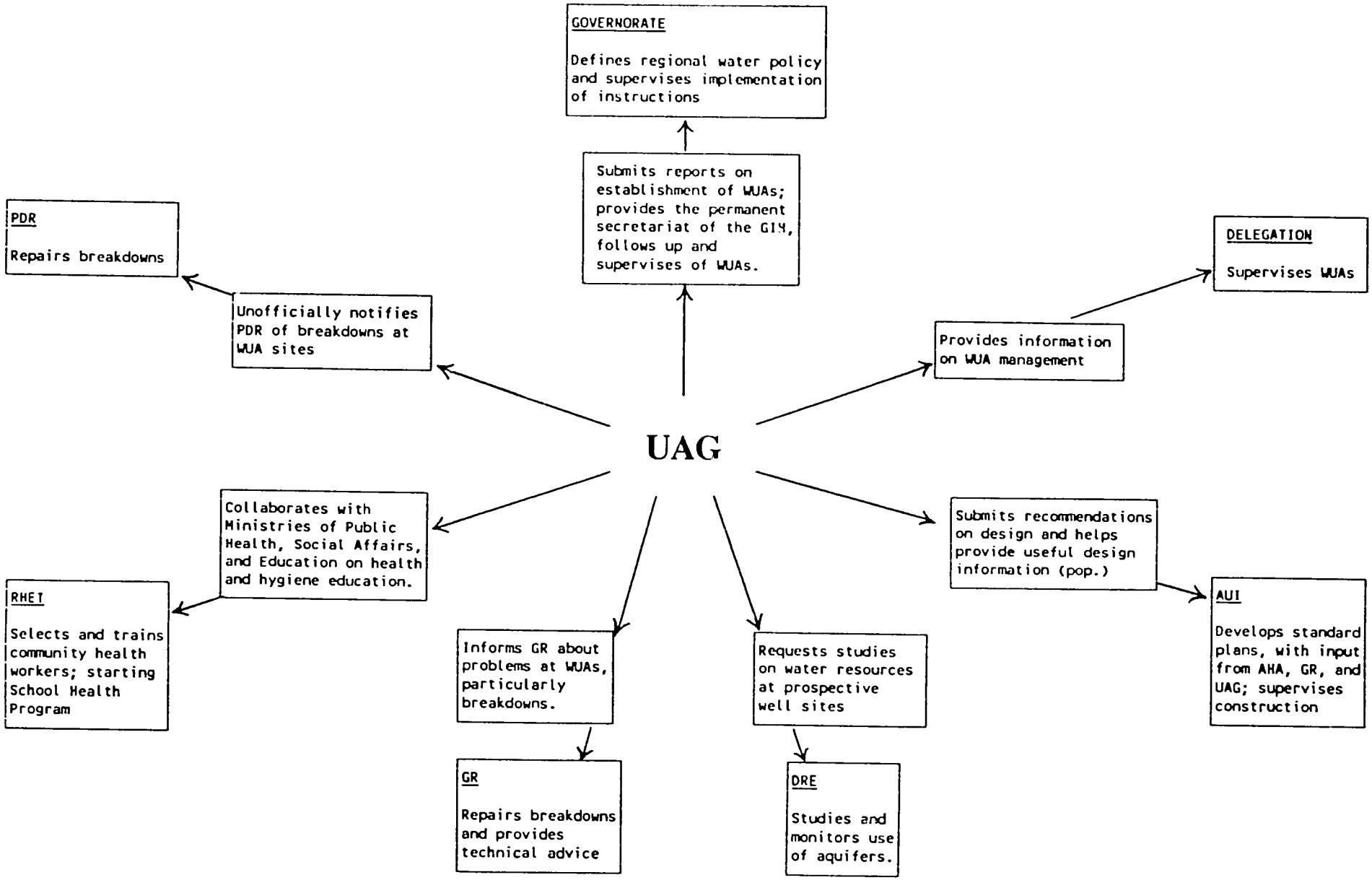

FIGURE 1 - UAG LINKAGES TO OTHER AGENCIES

3.3.2 General Considerations

The UAG has made exceptional progress in a very short time in making itself indispensable to the WUAs as their major advocate with government services. Important in this process was the creation of the GIH, made up of all the major services with interest in water points for the governorate of Kasserine. The GIH has named the UAG as the official administrative contact between these separate services and the subject populations.

The project has in fact initiated a unique experiment in that the UAG has developed a true sense of community participation in its contact with WUAs. The unit is an effective intermediary institution between the associations and two major administrative bodies in the region: the political structure (sector chief, delegate, governor) and the technical/administrative structures of the region (Ministries of Agriculture, Interior, Health, and their subdivisions). The UAG functions as a kind of advocate and facilitator, which greatly reduces what could otherwise develop into administratively and bureaucratically imposed guidelines and implementation of activities. The approach being followed permits the development within local communities of a real sense of autonomy and self-realization in daily management of water resources provided to the community by the GOT.

The installation of expensive wells and equipment, however, is not sufficient to ensure that people in "thirsty regions" have access to water. The installation of such equipment without the consultation of the communities concerned, without prior motivation concerning the necessity of their taking responsibility for management and operation of the water system, without a good prior understanding concerning the ethnic and family diversity of the target community would almost certainly lead, sooner or later, to conflicts within the community, which would compromise the objectives of the entire program. Imposition of rules and management systems, of "outsider" views of what people "should or should not do," without truly listening to what the community members are saying and without realistic involvement of the community can result in apathy or even antagonism in the community, which have marked many programs in the past and led to waste and even destruction of the equipment put in place.

It must be noted that there has been a change of attitude on the part of the various regional agencies and even the rest of the CTDA regarding the need for a unit like the UAG. When this project was being designed, near the end of the previous USAID project, the idea of an office composed of sociologists to assist in the creation and operation of WUAs was met with considerable skepticism on the part of the regional technical and administrative services. However, in just two years the UAG's effective work has completely reversed this sentiment, to the extent that today those same people point out the need for such a service if they are to do their own work more effectively. The President-Director General and key staff at the CTDA clearly recognize that the *animation* work is very important and that a well-staffed, capable unit is essential to the development of WUAs. Other regional offices also recognize that sociologists have an important contribution to make, certainly equal in importance to the technical input of other agencies. The governor of Kasserine, who is also the head of the GIH, is proud of the success of this approach in his region and is

promoting it at a national level during a time when WUAs are receiving a great deal of attention. This change of attitude is a major accomplishment of the project and was achieved in a relatively short period of time.

3.3.3 Role of the UAG: Opportunities and Constraints

Communities will differ in many ways and the UAG has had to develop a realistic means of dealing with such diversity. During the past 18 months the field staff has gained valuable experience in how to approach different communities. Some examples of their experiences are described below:

- Favorable contexts: One can encounter a fairly homogeneous community from an ethnic point of view, with respected and accepted leaders, and with fairly prosperous community members. The WUAs work fairly well, with the UAG providing animation, orientation, and support.

- Unfavorable contexts: One can encounter a community where the WUA leaders are politically opposed, where management is poor, where there is a lack of consensus among the population. In such cases, the UAG must intervene through meetings with the community concerned in order to bring out, through consensus, acceptable leadership that will ensure normal functioning of the WUA.

- Unfavorable contexts: One can also encounter a community that has inherited water installations with technical problems. An example would be creation of a deep borehole and installation of a large engine/generator to "take advantage of all the water that can be pumped out" for irrigation purposes. The technicians have unwittingly imposed "irrigation for a minority" and unequal access to water on a community just learning to manage its own basic needs in terms of potable water and community organization. The resulting cost of operation places an increased burden on the WUA. Another example would be very large water systems with pipes extending to other communities with different clans and families with longstanding internal conflicts. In the best of cases it would be difficult to manage such a system; the social conflicts imposed by the very nature of the infrastructure result in the breakdown of the system as a whole and compromise the entire investment. The UAG plays the role of arbitrator here, attempting to develop compromises between conflicting parties and trying to resolve some of the technical issues.

In sum, the UAG, in the eyes of both community members and regional authorities, has begun to assume the role of trainer/educator, arbitrator/advocate, facilitator/friend to the members of the WUAs. But its efforts at community

animation and its efforts to overcome ethnic/family antagonisms have inevitably encountered obstacles.

Obstacles exist that are often difficult for the UAG to confront directly. For instance, the UAG is in an ambiguous position that, to its advantage, permits it not to be identified directly with the political/administrative hierarchy of the region, a fact that has enabled it to deal so effectively with community development actions. But this reality also implies that its own power is limited, and it is not always perceived for the development institution it really is by local authorities. The UAG also frequently finds itself faced with technical blunders for which no solution seems possible.

With the increasing demands being placed on its time by both WUAs and regional authorities, the UAG is beginning to pay the price of its success by not being able to adequately reach the communities for which it is most responsible--potable water associations. There is no question that the unit is understaffed to do what it would like to do. The real question is what in fact should the unit be doing and with whom (i.e., what kind of associations). One perspective is that the unit should work on development and animation of all WUAs (including strictly irrigation-oriented ones); some would add the possibility that even nonwater-oriented associations could eventually become targets for the unit.

The UAG also does not have the logistic support (vehicles) it needs to perform the tasks before it. At least one additional vehicle is needed in the near future.

Perhaps the single most important factor that limits the UAG's ability to realize its specific objectives fully is the lack of clear definition of the limits of its objectives. To state, as does the Project Grant Agreement, that the UAG is to "train Associations" is to leave the definition of what training is to be performed entirely open. Better definition of the project objectives is needed so that UAG can more clearly establish its role and the scope of work of each of its staff members.

Improved management of time is also called for, which could be greatly facilitated by providing the director with management training. Better definition must be provided of what is to be accomplished when field visits are to be made, what data (technical and socioeconomic) are to be obtained, and who should handle the information flow. In addition, each of the four "social technicians" should be involved on an on-going basis with data entry about their respective areas. And, as has been stated in many consultant reports, one full-time person must be designated to coordinate training for the WUAs.

The evaluation team believes the UAG should see its basic role as one of working with WUAs whose primary objective is "drinking water," with use of water from animal- or tractor-drawn cisterns encouraged for point irrigation (fruit trees, small vegetable gardens). Such water is potentially available to the entire community. However, sites where direct irrigation and potable water are mixed cause considerable problems within the communities, and dealing with those problems takes up a lot of the UAG's time.

It is difficult to find a solution to the problem of mixed water systems. Such systems should not be abandoned by the UAG. In fact, they are the ones that need help. It will be impossible to rescind the right to irrigate, once given. At minimum, the right to perform direct irrigation should be restricted at new USAID sites. Several options have been conceived. First, an additional staff member could be allocated to the UAG to deal with pure irrigation systems, perhaps an existing staff member of the AHA with the requisite technical skills. This would lighten the load of the other UAG staff and provide more time to deal with potable water and mixed systems. Second, a staff member of the AHA who is sensitive to social issues could be seconded to the UAG for a period to help deal with irrigation or mixed-use WUAs. Alternatively, a new person could be added to the UAG staff to focus on the mixed systems.

3.3.4 The UAG as a Team

The UAG staff appears to work very well together. Members are interested in their work and the communities with which they interact; they understand the concept of community development and the encouragement of self-realization. With personal ties to rural communities themselves, and with formal training in rural sociology and community development, they carry out their responsibilities more like community development change agents than civil servants. They are able to communicate to communities in simple ways the information needed for improved management of water points.

The social science members of the UAG are concerned, however, about the long-term security of their positions and tenure within the civil service. This insecurity, which is particularly felt by the director of the unit, could compromise the major investment in knowledge and experience gained over the past two years. The director, who has a master's degree in sociology, has been recruited as a temporary agent. His advancement to the more secure and appropriate grade of "administrator" cannot be achieved without open competition at the national level. Despite the fact that he is the current director (with considerable experience in a domain that has suddenly become a priority theme of the government), nothing guarantees his selection and eventual integration into the civil service. His professional future will remain uncertain, and the CTDA will remain unable, it appears, to give him the kind of guarantee he wishes.

3.4 Institutional Development: Water User Associations

A second major institutional development effort of the project has been to assist rural communities throughout the region in organizing into WUAs around existing or planned water points.

3.4.1 Role of the CTDA and the GOT

In August 1986, the GOT adopted an economic recovery plan that gives greater importance to economic efficiency. As discussed in section 1.2, the plan involves privatization and the gradual disengagement of the GOT from economic activities. The GOT retains control of only the sectors of strategic importance. This liberalization trend was designed to result, in the agricultural sector in general, and in programs to improve rural living conditions in particular, in an increased participation of the target population in the selection and orientation of the programs. This policy was also intended to bring about financial benefits, which would motivate the population, creating an incentive for them to protect public facilities, and thus eliminate the carelessness and wastefulness that are often typical of public service users. The WUAs were thus planned to promote community spirit and to develop a willingness in the communities to assume management of the infrastructure used to meet their requirements.

This orientation resulted in a series of laws. Articles 153, 154, and 155 of the Water Code (Law 87-35 of July 6, 1987) were revised. These articles concern (a) water management and, in particular, the institutions entrusted with this task; (b) the GIH (Article 153); (c) the WUAs (Article 154); and (d) the master bylaws of these associations and the deadline for settling areas. The WUAs were created to oversee the following:

(1) the exploitation of water in the public domain,

(2) the operation, maintenance, and use of public property,

(3) irrigation and rehabilitation of land through drainage or any other methods, and

(4) the operation of a potable water system.

WUAs are established either at the request of users or at the initiative of the administration. They undertake the routine management of water sources and suggest to the government additional uses of water for the benefit of the community.

To standardize procedures and facilitate supervision of the GIH and WUAs by the government, the GOT adopted a series of decrees, in particular:

- Decree No. 87-1261, of October 27, 1987, on the organization, establishment, and operation of WUAs;
- Decree No. 87-1262, of October 27, 1987, on the organization and operation of the GIH;
- Decree No. 88-150, of January 12, 1988, on the approval of master bylaws for WUAs.

Basically, these decrees concern the development of self-management of the various water points installed by the GOT. Users are encouraged to establish a legal entity, with appropriate powers to manage the water points and collect funds necessary for normal operation, including small repairs. Major corrective maintenance and preventive maintenance are to remain the responsibility of the GOT, which must indeed help, establish, support, and develop the WUAs.

Operationally, the CTDA, since early 1987, has had a unit, the UAG, with the following mandate:

- Establish WUAs at existing or planned potable water points in Kasserine.
- Support WUAs by facilitating their establishment and introducing the members of the WUA committee to collective decision-making procedures.
- Develop, among the rural population, a community spirit that will ensure the success of the WUA activities, in particular through training, formal and informal. These efforts are designed to develop a participatory attitude and eliminate a historical tendency to depend on the government.
- Disseminate a standardized method for the establishment and the financial management of the WUAs to guarantee the credibility of the associations in the eyes of their members and to ensure that their image is conducive to success and social progress.

The CTDA has accumulated considerable experience and know-how during its 11-year history. CTDA staff, particularly the AHA, have experience in planning and monitoring financial, management, and technical activities, especially in agricultural endeavors. This capability has and will continue to be helpful in the creation and management of WUAs.

The UAG prepares economic and technical studies on the viability of the WUAs, takes care of administrative matters, establishes the provisional WUA committee, and submits to the GIH the request for the creation of the WUA. By the end of February 1989, 81 WUA files had been reviewed and presented to the Ministry of Agriculture.

In addition, the UAG promotes, supervises, and supports the establishment of a WUA and encourages the beneficiaries to recognize its authority. The beneficiaries can call on the UAG in case of differences or problems, which points out its essential role in the start-up phase. To promote efficiency in the new system, it is important, in the start-up phase, to acknowledge and learn from the occasional difficulties that arise because of the exceptional circumstances of the country, particularly in the political field.

The general thrust of the establishment of WUAs is in the direction of dialogue, concentration, partnership, and cooperation of all those who work for the collective good of the country. The integration of the "living forces" should be the best guarantee of the success of the program, which was undertaken to create awareness among the seminomadic population of the new phenomenon of membership in an association that uses nature to promote life. Indeed, in an area of 3 km, water is a resource that should entice the most reluctant among the population to show their goodwill and do their best so that the WUA can help to improve the way of life of the rural population. This should also enable the WUA to widen its responsibilities beyond the mere use of water to the promotion of development in other fields.

It appears, therefore, that the GOT intends to meet the challenge presented by its disengagement and to encourage the population to take part in decision-making processes related to the creation and management of activities designed to improve their way of life.

3.4.2 Water User Associations

Rather than simply creating a number of new water points, this project has taken on the more difficult objective of creating an institutional base, at both local and regional levels, capable of managing these water systems. The local autonomous and self-supporting institutions at the water point, the WUAs, are essential to the GOT's plan for continued development of rural Tunisia. The rapidly escalating cost of running and maintaining growing numbers of publicly operated and maintained water points has become a serious drain on the national budget and has reduced the GOT's ability to assist in providing water and other services to other underserved regions.

Thus, a high priority of this project has been to assist in creating new nongovernment institutions capable of assuming ownership and responsibility for existing rural water systems. In particular, this has meant communicating to the concerned communities that, by forming into legally recognized WUAs, they can make these water points theirs; the equipment become theirs to care for and exploit for the common good. The project, through the UAG, has followed a bottom-up strategy of getting a concerned community to form a WUA as a precondition for receiving a new borehole and equipment from the GOT. The project has also been involved in creating WUAs around existing water points. Considerable progress has been made, given current staffing levels, with both types of groups.

Information Management for WUAs

UAG personnel have made an effort to develop an information database concerning the various WUAs with which they work. They have done a good job of organizing technical data about the water points and this should be continued. No baseline socioeconomic database has been created for each WUA, however. Hopkins (1987) has suggested that basic socioeconomic information be obtained for each association, but such information needs to be obtained for the actual user

membership of such associations before objective monitoring and evaluation of change can take place.

Some socioeconomic data were obtained by members of the UAG for preparation of the technical and economic studies of WUA viability (*"Etudes technico-economiques"*).[4] In addition, some data have been collected on water usage as a means of helping UAG agents to become better informed about their regions of responsibility. Ten to twenty forms would be filled out in a number of communities until the agent believed he had a good idea of overall water use in the area. The form has been modified four times since its creation, however, and the data have not been obtained systematically.

Without any baseline socioeconomic data, we were not able to evaluate quantitatively some of the socioeconomic indicators about the sites that would have been useful. The observations and recommendations that follow therefore come from informal, qualitative reconnaissance-type information gathered from a small sample (10 percent) of the current WUAs. A sample data sheet provided in Appendix I illustrates the kinds of information that should be obtained for each WUA as quickly as possible to provide an objective baseline for a final project evaluation. Some guidelines are also provided as to the actual implementation of this survey.

Classification of WUAs

The WUAs can be classified in terms of their use of water:

(1) potable water strictly for domestic consumption (human/animal) and point irrigation (water is transported by tractor or animal),

(2) domestic and direct irrigation purposes (hoses, pipes connected at different places to the existing water system), or

(3) direct irrigation (small irrigated perimeters).

WUAs can be further classified based on the nature of the water point itself:

(1) a borehole (usually over 50 m total depth)

(2) a surface well (less than 50 m total depth)

(3) a captured spring.

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[4] These studies are prepared by the UAG for the GIH as a part of the legalization process. They summarize technical site characteristics and estimate operations and maintenance costs.

Figure 2 illustrates the types of WUAs that have been created around water points with the assistance of the UAG. These include 77 WUAs developed strictly for domestic consumption and point irrigation, 22 WUAs that combine domestic consumption and direct irrigation uses, and 7 WUAs for direct irrigation. Fourteen other WUAs have been formed around extensions from these water points, many for mixed and direct irrigation purposes. In 19 cases, an extension was made from the water point to another community and an association sometimes formed around the extension. No WUAs have yet received formal legal status, though for 81 WUAs, all the legal paperwork has been completed.

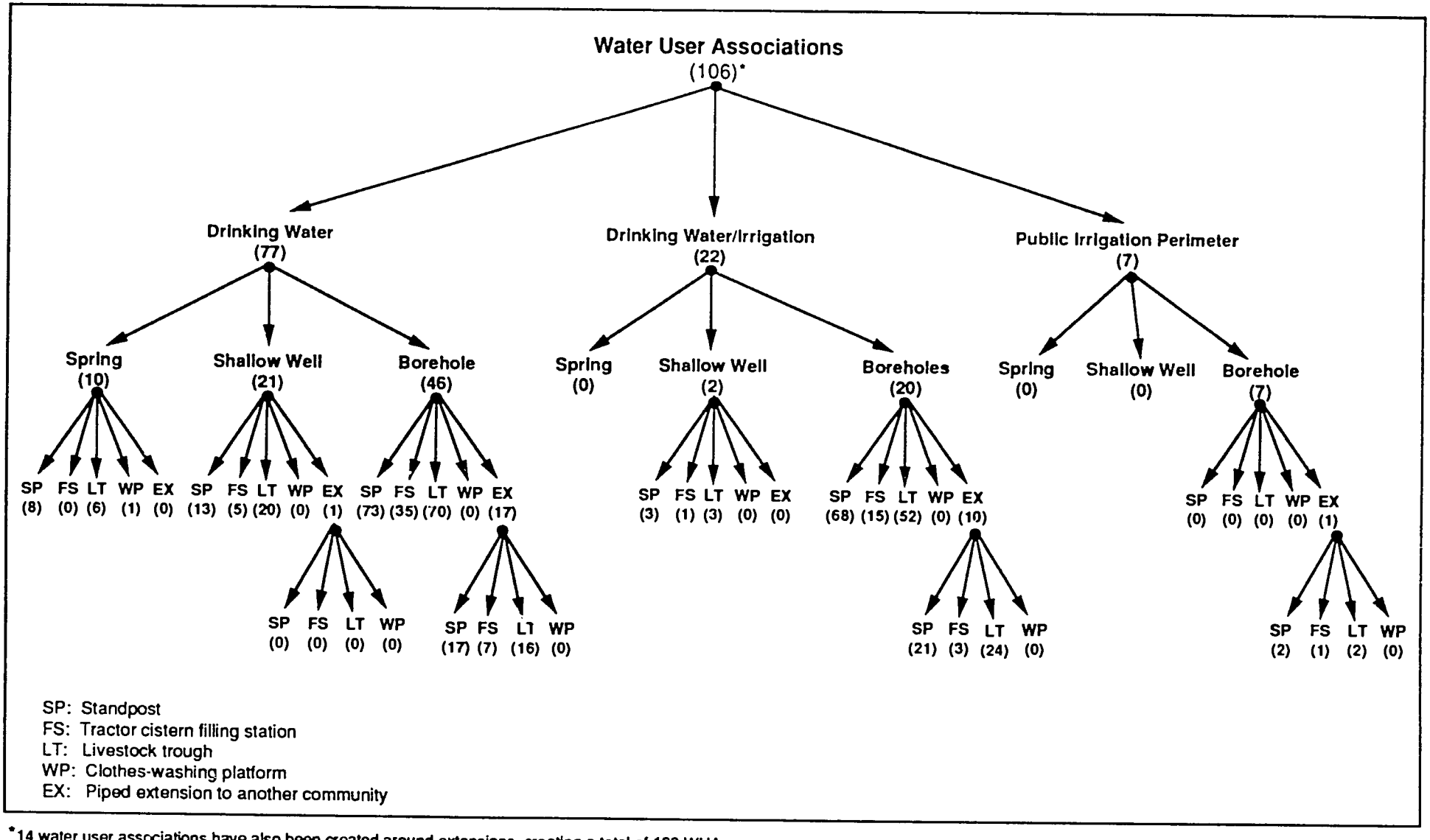
Each water point differs greatly in terms of the actual hardware put into place for the concerned population (132 standposts, 192 animal water troughs, 1 clothes washing platform, 67 tractor cistern-filling points) and to date, the communities' ability to manage each type of water station varies. In some areas more fountains appear necessary or should be more conveniently located for the population clusters, and in other areas fewer are needed (for water use control). Also, in some areas the animal water troughs appear unused (this time of year at least), and most of the animal watering seems to be done at home (even in dry months).

Users' Access to Water

There are three basic ways in which beneficiaries living around a water point collect, transport, and use water. A good understanding of these processes is important to the development of a good system for cost recovery. In addition, the perception of equal access to water by all beneficiaries is essential to the cohesiveness of the WUA and the voluntary payment of user fees. The associations with the least apparent problems and those with the most potential for widespread, diffused benefits to the communities concerned are those created for the purpose of providing water for domestic consumption and point irrigation. In principle, everyone has equal access to the water point, limited only by distance and means of hauling.

The first method for collecting water, mostly used by people living very close to the water point, is carrying pails or jugs. Only those extremely close to the standpost, or the very poor, would do so without the aid of a donkey. It is relatively common to see children heading off to the water point with the donkey and two 20-liter jugs. Such use of water is, of course, limited to basic domestic consumption.

Second, many families have 500-liter tanks mounted on carts pulled by donkeys. The GOT has a major program for advancing credit for purchase of small animal-drawn cisterns. Except for a few households located directly by public standposts, most families in the regions we visited (within a radius of about 3 to 4 kilometers) use water from animal-drawn cisterns for both domestic consumption and for irrigating their small field of fruit trees (apple, apricot, almond, olive), particularly in the dry season. Some families have small household gardens as well. We met one young woman who was hauling water in a donkey-drawn cistern from a water point 7 kilometers away. As distances become greater, however, households rely on purchased water from tractor-drawn cisterns



*14 water user associations have also been created around extensions, creating a total of 120 WUAs.

Figure 2. Types of Water User Associations.

for human consumption and on available "free water" captured in household cisterns below ground level (see below). In some regions visited, considerable assistance could be provided to community members who do not have access to animal-drawn cisterns.

The third means is the purchase of water from vendors. Though not yet formalized, this will play an important role in the success of the water points. Water vendors with a tractor and cistern (3,500 liters) purchase water at the water points and sell it to households in the surrounding areas. The vendors pay 1 TD for 2.5 to 3.5 m^3. They charge based on distance from the water point, reaching up to 10 TD at a distance of about 10 km. They almost always offer a form of no-interest credit to those who cannot pay over a month or two (waiting for cash from family members working elsewhere in Tunisia, a nearby country, or overseas). Every vendor interviewed carried with him a small book for noting these credit transactions. One man interviewed showed us that 292 TD of credit was outstanding for water delivered to 43 families (but for which they themselves had paid 1 TD to obtain). Another showed us that 110 TD was outstanding for 22 persons, each person owing 5 to 6 TD (i.e., one cistern trip). One person stated that he has had as much as 2,000 TD outstanding from community members, with limits set at around 40 to 50 TD per family, for various services he provides to the community. Major repayment periods are when sheep are sold in October and when wheat is harvested and sold in July.

Many outside the WUAs believe the water vendors are profiting enormously from their sales of water at the expense of the people. Based on our rough estimates, however, the vendors actually cover hardly more than their own operating expenses, including repairs and loan repayment on equipment. Rather than saving money against eventual replacement of a new tractor, vendors intend to take out new loans when the need arises. There is no evidence that the local water users resent this service or its cost in any way. It is perceived as a service that they can use if they wish. These locally developing private enterprises should be seen as part of the essential local and private infrastructure at each water point, around which and with whom other economic ventures may be supported. The same vendors use their equipment to plow their neighbors' fields and to transport sand and gravel for construction, for example.

In recent decades, most households in water-scarce regions have adapted as best they could by constructing below-ground, cement-lined cisterns to catch surface water run-off. In some of the areas visited, people use such water for all their domestic water needs, only purchasing water from vendors when their cistern supplies run out in the dry season. Such water is dumped into the cisterns below ground and used as sparingly as possible for human and animal consumption. With decreasing distances to water points and the increasing likelihood that a household could obtain an animal-drawn cistern, new cisterns have been constructed next to the family homestead, into which water (either animal- or tractor-drawn) is dumped. Very rarely did we see systems for capturing water from roof-tops, but much could be done to improve use of water from even these systems.

Providing access to water does not resolve the problem of maintaining its cleanliness until consumed by the household, however. Water delivered to poor families or households with traditional cisterns (catching rain water in sunken cement cisterns) is very frequently dumped into old, open cisterns. Households with such systems will, during the rainy season, often use only trapped rain water for their consumption. Considerable assistance could be provided by the UAG in assisting WUAs to identify such families needing assistance and in upgrading both their means of transporting water and in storing it once it reaches the home.

Operation of WUAs

WUAs currently exist in all the delegations in which the project operates. Nearly all public water points have a WUA. These associations are, in general, operating, that is, fees are being collected, diesel fuel is being purchased, water is being pumped and distributed, and minor repairs are being financed out of WUA revenues. Currently, pump operators are still being paid by the GOT, although all parties state that this subsidy will be phased out in the relatively near future. Despite their fledgling status, the fact that 120 WUAs have been created is a major achievement. Still, there is considerable work to be done regarding legalization, improving operations, and resolving conflicts, as outlined below.

These associations do not exist in the sense of an organized group of all the water users around a given water point. Rather, the UAG has organized a group of community leaders to form a committee, including a named president, treasurer, secretary, and pump operator, who represent the basis of the "association." These leaders draw up a list of all the families they consider to be the "users" of the water, usually those within a radius of a few kilometers. These lists often do not include the names of people who (1) come from considerable distance with either donkey-carried or -drawn water containers, (2) depend on this water through delivery by tractor-drawn cistern or (3) are families of itinerant workers who camp on the land and are charged for water use. The associations have barely begun to explore and find acceptable means of managing their newly given responsibilities. The reason most often given by UAG personnel is that one must wait until they become fully legalized.

Many men within the WUAs believe that the role of the pump operator is privileged, and that the operator is benefiting too much at their expense. The situation is not uniform, however. In some places the pump operator is paid by the government and has a "supplementary" small irrigated place; others are not paid and receive rights to an irrigated parcel as their pay. No formal limits have been set in such cases on how much land the operator can put under irrigation, although the fuel to pump the water is usually supplied by the operator. The function of the pump operator poses a double problem: socially, he is seen as privileged; from a management point of view, he has access to money coming from the sale of water (when cisterns are sold).

The clan affiliation of the pump operator can also have important implications, i.e., people expect him to be partial to his "own people" in terms of water use. The same is true for the president. Where the group is fairly homogeneous, leadership seems to be fairly clear and the WUA can function; where that is not the case, one can expect problems. Priority could be given to homogeneous groups in establishing water points and WUAs, or where that is not possible, a system of rotating power might be worked out. The water points are often found within a conflicting social context, too, and old conflicts can be reactivated around them. Local government will have to play an arbitrating role in these conflicts, with training and assistance provided by the UAG. The three concerned parties (local government representatives, the UAG, and the WUA) should negotiate in a joint meeting who the initial leaders of a WUA should be, rather than initiating an arbitrary "election" certain to stir up conflict in areas of multiple clan segments.

Collection of Water Use Fees

Currently, the fees charged for water from water points fall into two categories, flat monthly fees, and fees by volume used. In most locations there is a flat monthly fee of 1 TD per family. This fee is applied to those families living closest to the water point, who use it regularly. In addition, in most locations people pay additional fees (by volume) for water "purchased" for point irrigation or other uses. Vendors or people living far from the water point can purchase water in the same way. Typically, WUAs charge 1 TD for a tractor-hauled cistern (usually 3,500 liters), and 100 millimes (0.10 TD) for a 500-liter animal-drawn cistern. In general, the UAG has encouraged the WUAs to apply these two cost-recovery methods as suits them best. This has meant in some cases that families with many animals might pay 3 TD per month, and in some cases, a very poor household might pay nothing. Each WUA is encouraged to find its own cost-recovery solution by consensus. This approach has evolved out of a cost-recovery study done under the project (Faouzi, 1988); it has worked reasonably well in some cases, but rather poorly in others. Important issues related to cost recovery are summarized below.

Rural households in Central Tunisia have had to deal with the problem of scarcity of water for centuries. Even the most needy, however, have had to purchase water at times, particularly in the dry months. Because of the financial vulnerability of most families in severely water-scarce areas, however, purchasing water is a last-case solution, which can lead to difficulty in collecting water fees. For such families, all other options have to be explored before they spend hard-earned cash for water.

The WUAs, to date, have not done very well in terms of regularly collecting funds to operate and maintain their sites, though some have been more successful than others. Many manage to pay for their operating costs (fuel), but can pay for minor repairs only as they are needed. In some instances, we noted a healthy growth of community spirit on the part of WUA leaders, to the extent that their duties as leaders have given rise to a feeling of true responsibility for their community's need for water. In such places, a well-off leader will often pay for replacing a needed part or use his own equipment (tractor) to fetch material for the association.

There is every reason to believe that many WUAs will be able to cover their operating costs, including possibly even pump operators, by the end of the project period, a process that will be greatly assisted when such WUAs are legalized and can exercise greater jurisdiction over the water point. This will only be possible, however, if the UAG moves quickly to adopt a standardized and equitable means of sharing the cost of water used.

Problems in collecting fees are often linked to issues in the management of the water point itself. In one case, the village consisted of two clans, each served by its own standpost. One clan was refusing to pay monthly fees because members claimed the pump operator (who was of the other clan, and whose brother was the WUA president) had inequitable access to irrigation water. We visited another WUA where members have managed to collect an excess of funds (leadership is accepted, clan is homogeneous, and people are fairly well-off). Here, most households purchase water from a vendor who buys water by volume at the water point. Good cost recovery is ensured in this way. In fact, there are no monthly fees.

Refusal to pay for water can be explained by perceived inequalities in use, but it can also be for economic reasons. Many families really do not have the cash to pay for the water at certain times (a reason why credit extended by water vendors should be considered important). It seems that where there is relative prosperity, the WUA will function fairly well (at least if the leaders of the WUA are in this category).

Conflicts were observed at all the water points visited where associations were attempting to deal with water for the combined purposes of domestic consumption and direct irrigation. Water points established for the purpose of direct irrigation were not visited, but they appear to be fairly straightforward because members pay directly for their share of the costs/repairs involved in pumping water. Yet, even here, such associations have often been assisted by the GOT in paying for the costs of operations and maintenance.

A mechanism will have to be developed that will permit monitoring of WUA conflicts. Some of the associations noted that once they are legalized they will create formal systems whereby people who can afford it will have to pay, and those who really cannot will be assisted in some way (either pay less or nothing). Traditionally, there have existed mechanisms for conflict resolution through arbitration and for helping those with less. It remains to be seen if such mechanisms can be adapted to resolve the thorny issues certain to be raised if WUAs are to truly take control of the basic operating expenses of their water systems and to maintain sanitary conditions around water points.

Two basic issues seem to dominate discussions of water fees: how much is really needed to meet operating costs at different sites and how can fees be successfully collected, given different means of collecting and using water. The UAG has prepared technical studies of operating costs and advised WUA leaders of the amount of funds that will be needed. The means of collection is a bit harder to work out.

The easiest system to operate and control would be one in which most of the water is dispensed directly into animal- or tractor-drawn cisterns from either a tractor filling station (*potence*) designed for that purpose or from public water fountains using a short hose. Standard rates would be charged, as outlined above. In addition, households within walking distance of standposts and persons using animals to haul water (two 20-liter jugs on their backs) would be expected to pay a monthly fee of 1 TD, plus the usual rates if they fill up their private animal-drawn cisterns.

The UAG and the WUAs could improve cost recovery by developing a system of coupon cards provided by the WUA treasurer to community users, payable in advance or extended in the form of credit when needed, up to a defined limit. A coupon card for 10 TD would be provided to tractor water vendors, good for 10 fill-ups, and punched as each fill-up is made. A coupon card for 1 TD could be provided to animal-drawn cistern operators; again, 10 fill-ups could be authorized and punched per trip. For donkey trips with two 20-liter jugs, 100-millime coupons, good for 10 trips, could be used. A list would be made of families close enough to carry water themselves and they would be charged a flat fee of 1 TD/month, in addition to any charges for other forms of carrying water the household might use. The WUA would have to determine how to charge for the use of water for flocks of animals as well, perhaps again using some type of coupon system. Using coupons would place cash directly into only one person's hands (treasurer), who would be responsible for proper accounting. The pump operator could be monitored by checking the volume of water pumped over a month, based on a water meter, against receipts. Standposts and cistern-filling stations might have to be closed down at set times of the day (depending on demand) to reduce the real danger of unauthorized fill-ups; it is unrealistic to expect the pump operator or a member of his family to guard the water point 24 hours a day. Increasing the number of standposts and tractor cistern-filling stations also increases the burden of control.

In summary, many WUAs will, in fact, be able to cover their basic operating costs, even including the pump operator, but many others will not be able to do so for some time. Each WUA must manage its water inventory/funds better as the first step to effective cost recovery. A good system (such as the coupons described above) should be set up for charging different fees for different kinds of water use/containers. This must be complemented by a water meter at the pump outlet to measure actual output, against which receipts can be compared. With such a system in place, the GOT, through its local services, should expect to continue to cover the balance of accounts for deficit WUAs and be able to verify such need as the case may be. The UAG will have to be involved in assisting/monitoring this process, but it should never be put in the position of "policing" the results.

As a potential solution in the future, associations (or federations) of WUAs might be organized. Such a federation, for instance, might charge all member WUAs a fee equal to 10 percent of their revenues to provide cross-financing from one WUA to another. The federation would then use these funds to cover the expenses of WUAs with deficit problems. This idea of a "common fund" among a group of WUAs is explored in more detail in Appendix J.

In the long run, the UAG will have to give special attention to assisting WUAs to diversify into other means of generating funds. For example, hot-bath houses (*hammam*) could be set up near water points, or a small shop might sell items of importance to the water systems (bleach, soap, cistern parts, water jugs, etc.). It might also be possible to take advantage of the major construction budget for each water point and design a multipurpose structure that would provide a shelter for the engine/generator, a water tank, showers, a meeting room, a small office, and a shop for sale of small items, including water coupons. Such a structure could probably be created at less cost than the plans currently used and would in one action provide not only the needed water storage facilities but also a community center around which a WUA could find its own community identity. See Appendix K for a conceptual drawing of such a center.

WUA Legalization Issues

Many persons interviewed by the evaluation team, both within the WUA leadership and among CTDA personnel, believe legalization will resolve many of the existing problems. Although legalization will certainly be a big step forward, we do not see it, in itself, resolving many of the problems confronted. Waiting for "legalization" at times seems to be an excuse for not effectively dealing with a difficult issue. In fact, it can provide the context in which a struggle for control over the WUA will develop. Whoever controls the water point controls the WUA and the eventual exploitation of the water point. Control of sources of water has always raised charged political/social issues, and each WUA will have to work out its own solution.

Training Activities within WUAs

The only significant training to date has been accomplished with pump operators, who are in fact operating equipment everywhere fairly successfully (see section 3.5.3).

Training in financial management of WUA funds has been postponed by the UAG until legalization of the WUAs, when legal accounts can be set up in the WUA's name at the post office or a regional bank. The UAG could have done much more than it has to create a standardized system of coupons for use by the pump operators at each water point and to train someone within the WUA to monitor the records. Such systems have been successfully set up elsewhere in Tunisia (i.e., Kairouan). The very fact that this has not been accomplished is one of the main reasons for real and suspected abuse in paying fees. Much of this suspicion between community members could have been avoided if some realistic system had been put into place.

Participation of Beneficiaries in Site Selection

For 10 of the sites developed in the current project, at least some of the community members were involved in site selection, although just what that actually involved is not clear. (No attempt was made to involve community members in the previous USAID program.) The selection of the specific location

of the well seems to have been left to the technicians in charge, for hydrogeologic reasons. The CTDA stated that the exact location of other elements (public fountain, reservoir, animal troughs) was determined with the participation of the population concerned. However, this may have been more of a formality than true "community" participation. In an area with a homogeneous population, community participation can take place, by delegation, through recognized leaders. But where there are differing groups, one can foresee disagreement among factions and the engineers subsequently making decisions on their own as to site selection and placement of services. Local people did participate in some of the construction activities, in that some were hired by civil works contractors.

Socioeconomic Impact on Families in Rural Zone

The socioeconomic impact of constructing water points and developing WUAs within rural communities can only be anticipated at this point, but our discussions with many community members are suggestive. Whenever a new water point is put into an area where people have depended on water points that are 8 to 12 km away, several things happen right away. Where people once had to spend 6 to 10 TD for a tractor cistern, they now can either fetch water themselves with an animal-drawn cistern or animal-carried jugs. One would also expect that some people in the community will have higher incomes (e.g., the pump operator, especially if he is permitted an irrigated plot, and the water vendor who sells the water) as a result of new water points.

More water will be available more readily and at less cost, in terms of both time and money, for more people. People at almost all the water sites are taking advantage of closer water by using more water domestically and by creating point-irrigated fruit orchards and vegetable gardens, which will both improve the basic diet of the people and generate new forms of cash-earning activities. There is no question that creation of well-located water points in truly underserved areas will lead to a greening of the countryside. This effect should argue strongly for encouraging smaller potable water wells over those with direct irrigation potential. Point irrigation, combined with domestic water consumption, provides a powerful and equitable means of raising the well-being of thousands of underprivileged people.

It is not clear that the time saved for women/young girls/children who would otherwise carry water will permit creative/productive use of that time, although some women noted that they would spend more time on their housework. There may be, in fact, more demand on children's time for water transport activities because the water points are closer now than before and consumption of water is probably increasing. To encourage creative and productive use of time gained, change agents will be needed to motivate the community (community health workers, for instance).

It is quite clear that a distinction is made in some communities between their "drinking water" from the water point and other water they may have in a private cistern for their animals or household chores. But, as already discussed, the real issue will remain the specific household's ability to pay for water and its need for credit when payments cannot be made. For this reason, the vendors

are providing a very important service to their communities through their advancement of credit at no interest to persons unable to pay right away.

WUAs and Irrigation

Use of water for irrigation is probably one of the most serious inhibiting factors to the institutional development of WUAs. For WUA cohesion, water points should probably be uniquely for domestic consumption of potable water.

The owner of the land on which the well is placed is often asked to be the pump operator. This individual will usually want to use some of the water for irrigation purposes. Such use, unless properly limited, is certain to raise problems, particularly as he becomes successful. Imagine the economic benefits one farmer/pumper can obtain when his 600 apple trees begin to produce. More often than not, it is members of the WUA committee (including the pump operator) or members of their families who "are given" permission by the committee to seek legal/technical authorization to connect up direct irrigation systems. An obvious conflict of interest results, particularly if the community is made up of a number of clan segments.

Everyone wants to benefit from irrigation, but at best only a few can realize the benefits of the water. Water is also being used, by some farmers, for small-scale irrigation of trees. In such cases, anyone can benefit because it is a matter of paying the water vendor who transports the water or hauling water oneself using an animal-drawn cistern. The income generated from the WUA's selling the water to the vendor can be more easily controlled.

An alternative approach would be to create water points specifically for drinking water and not for irrigation. A water point that is large, highly centralized, and multipurpose (water, irrigation) will by its very nature give rise to social and economic pressures and problems. It would be better, for example, to have three small water points than one that tries to bring together several clan groups or families, only one of which is represented by the pump operator and the landowners immediately around the water point. However, the cost of this approach would certainly be more.

Direct irrigation possibilities for a small minority within the community, even if they do pay for their share, immediately cause resentment among many who cannot share in these economic benefits. The UAG should not work with WUAs whose primary objective is the economic exploitation of water for irrigation. Such WUAs should be assisted by the small-scale irrigation (*Petit Perimetre Irrigué*) section of the CTDA (AHA). New boreholes completed under this project should not allow for direct irrigation, not even by the pump operator. In existing WUAs where water use is mixed, the UAG should develop with the concerned committees means of exact measurement of water use, using water meters, and higher rates should be charged for irrigation water.

3.5 Operations and Maintenance

3.5.1 Project Plans and Accomplishments

The assurance of good operations and maintenance is essential if the investments in water points are to be justified and the expected benefits realized. Hence, the Project Paper placed significant emphasis on O&M issues. The project design called for one expatriate and one Tunisian to work with the PDR for two years each to provide training and help establish preventive maintenance. These individuals were to work with the existing PDR crews to establish a comprehensive maintenance plan, train personnel at the local level (pump operators) and regional level (PDR maintenance crews), and conduct regular preventive maintenance. To facilitate these efforts, two vehicles were to be paid for by USAID.

The original budget allocation was for $332,000 for technical assistance and $24,000 for vehicles, a total of $356,000 or 5.5 percent of the total USAID contribution to the project. Project implementation to date has taken a different approach, however. Just before project startup, conditions in the country were such that the installation of an expatriate advisor was difficult. As a result, the project contracted with a local private firm, *Froid & Mechanique Generale Rebobinage-- Electricité* (M. Yahyaoui Boubaker) to work with and train the crews, train pump operators, and establish preventive maintenance. A two-year contract was issued with a total estimated value of $135,000. Contract activities began in July 1988, approximately 18 months after real project startup.

Two vehicles were purchased by the project, but they are being used temporarily by the UAG, and not for maintenance, because it was impossible for the CTDA to procure vehicles out of the GOT budget for the UAG, as planned in the Project Paper. The maintenance contract described above included funds for the long-term rental of two vehicles.

Given the difficulties encountered and the solutions noted above, one could conclude that the CTDA has been quite creative in addressing the O&M component of the project. However, on careful investigation, major problems still exist with the regional-level maintenance system. The private maintenance contractor is completely tied up with repair work and installation of new pumps and motors and essentially has no time for preventive maintenance.

3.5.2 Current Maintenance System

The role of the different actors involved in water point maintenance is described below in brief:

- The pump operator is to run the engine and pump and carry out very simple maintenance tasks, such as oil/filter changes and minor battery repairs. If there is a breakdown, the operator should notify the president of the WUA, who in turn must

notify the delegate, who in turn must notify, by telegram or letter, the responsible maintenance office, be it the PDR or GR.

- The PDR has a large budget for potable water projects. It has two maintenance and repair crews, including 2 crew leaders and 13 other members, of whom only 6 are skilled. The crews have two vehicles and basic hand tools, but no workshop. The two crews are responsible for about 50 water points in the northern part of Kasserine, including the delegations of Kasserine Nord, Thala, El Ayoune, Foussana, Haidra, Jedliene, and Sbiba. The PDR can appeal to the GR for the assistance of the private maintenance contractor in the event of a major breakdown or a major electrical problem; the PDR does not have an electrician but the contractor does.

- The GR is the local engineering office of the Ministry of Agriculture. The GR has a small maintenance team with one skilled crew leader and two trainees, who are responsible for maintenance and repairs for 60 to 80 water points in the southern part of Kasserine (the delegations of Majel Bel Abbes, Feriana, Hassi el Frid, and Kasserine Sud). This team began operations in July 1988, at the same time as the private maintenance contractor hired by the CTDA, and it now works under the technical guidance of the contractor.

- The private maintenance contractor has a team comprised of a crew head and three skilled team members. They provide technical assistance, vehicles, and on-the-job training to the GR crew, and technical assistance occasionally to the PDR crew when needed. The team also carries out installations for the CTDA at new USAID-funded project sites. The contractor has appointed one of his two mechanics to work directly with the GR in Gafsa.

The regional maintenance budget is 100,000 TD (1989), of which the PDR provides 80,000 and the GR an additional 20,000 for parts. This modest budget has to cover the salary of pump operators, maintenance crews, spare parts, and repairs of all water points in the governorate. The budget is not sufficient, and large overruns are incurred each year. The cost of the pump operators alone is about 80,000 TD. No stock of spare parts is maintained, at the GR or PDR, and each part must be ordered when needed, which can take up to a month.

It is easy to see why the maintenance contractor has no time for preventive maintenance. He has a contract with the CTDA, with terms of reference that include a variety of tasks related to preventive maintenance and training (in the spirit of the Project Paper). However, the last item in the contract is for "other tasks related to water point equipment maintenance and repair," which takes up 90 percent of the contractor's time. It is important to note that although the maintenance contract is with the CTDA, the head of the team reports on a daily basis to the GR and receives orders regarding repairs to be done.

The frequency of breakdowns is high, especially in summer. The GR estimated that its crew completes an average of 8 to 10 repairs a month in summer, and about 5 in winter, each lasting 1 to 3 workdays. This workload plus installation work (two to four days per site) means that the crew is very busy. It has no time for any preventive work. The private contractor has recommended that he be allowed to start on these preventive activities, but prevention appears to be viewed as a lower priority than repairs or installations in the minds of the GR, PDR, and CTDA.

In sum, approximately 10 skilled personnel (with four vehicles) are having some difficulties servicing about 120 water points in the Kasserine governorate. In comparison, the GR of Kairouan has eight skilled personnel (with four vehicles) to service 114 water points and is getting good results. The problem in Kasserine is that the available human and material resources are spread across three organizations. The allocation of labor is imbalanced, in that the PDR has more personnel and fewer water points to service. The private contractor's crew and the GR crew are carrying a larger part of the workload. In addition, with three organizations involved, the coordination of activities and the logistics required become quite burdensome. Duplication of effort results from the dispersed responsibilities and personnel. In the past, all maintenance personnel were under the GR, but when a conflict developed between the GR and PDR over allocation of maintenance services at sites funded by PDR versus other sources, the crews were completely transferred to the PDR. Then in July 1988, the new crew under the GR and the private contractor were added. Clearly a major reorganization is needed to centralize maintenance activities in one office. Additional personnel will probably have to be brought in temporarily to initiate preventive activities.

3.5.3 Training of Maintenance Personnel

Early in the project, the UAG initiated training for pump operators. Four one-day sessions were held over the period November 1987 to March 1988.[5] Each session was focused on a few delegations and was held at the main town in one of the delegations. The training program included hygiene/sanitation activities at the water point, technical training on operations and maintenance tasks required (oil changes, etc), hands-on training with several engine pump models, and a review of the role of the pump operator in the WUA (procedures to follow in case of a breakdown). The technical sessions were led by the GR and PDR, the hygiene/sanitation sessions by staff of the Regional Health Education Team, and the others by the UAG itself. This training was provided to 87 pump operators in Kasserine, out of a current total of about 130.

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[5] Note that these sessions were held before the establishment of the contract with the local private maintenance contractor. While it would have been good to have the contractor's input into the training curriculum, the pump operators needed training immediately.

Since the startup of their contract activities in July 1988, the private maintenance contractor and his crew have been able to provide on-the-job training for pump operators and the regional-level crews during their repair work. These training activities are certainly an accomplishment. The UAG realizes that more pump operators must be trained and that all should receive more training, of both a formal and practical nature. The pump operators still have only a very basic knowledge, and with more training they could take on more of the tasks that the regional crews must now do. But the UAG also realizes that it would be better to delay a second series of additional training sessions until the current regional maintenance system is reorganized and consolidated, as described below. That way, they can be trained in accordance with a well-conceived maintenance system that makes use of local, district, and regional personnel.

3.5.4 O&M Costs

Detailed knowledge of O&M costs is essential to evaluating feasibility of projects and to planning cost recovery. These costs fall into two categories. First-level costs--which include operator's salary, diesel fuel (or electricity in some cases), oil, filters, and other parts under 100 TD each--are relatively straightforward to estimate. Second-level costs--which include maintenance crew salaries, transportation, repair parts and labor, and preventive maintenance supplies, parts, and labor--are more difficult to estimate. It is generally accepted that the WUAs will cover the first-level costs and the government the second level.

Several efforts have been made to estimate O&M costs. The economic and financial studies by IDA/CTDA included estimates of O&M costs, the cost-recovery study (Faouzi, 1988) has also examined O&M costs, and the UAG has performed techno-economic studies for each WUA now in the legalization process (*Etudes Techno-Economiques*). The UAG has compiled the O&M cost estimates for all sites currently in the legalization process into a good data-base. All of these estimates examined first-level O&M costs in that their focus was WUA financial viability.

The procedures used for estimating first-level O&M costs are adequate, but could be improved. The estimates of fuel consumption for diesel engines are based on 0.22 liters of fuel per nameplate horsepower. This rule of thumb will be reasonably close in some cases, but probably not very accurate in others. The approach is somewhat optimistic, and theoretically incorrect. Fuel consumption should be computed from the real total dynamic head, the real flow, pump efficiency, and engine efficiency, all of which depend on the real engine loading in relation to the nameplate engine horsepower. Formulas for a more accurate estimate of fuel consumption are suggested in Appendix L.

Cost calculations should be performed using measured values of head and flow. If these data do not exist, water flow estimates can be taken from actual pump specifications, and estimated drawdown can be obtained from the DRE.[6] If such estimates are used, however, it will be important to obtain spot measurements of real flow and real drawdown to determine the accuracy of the estimates. Such a series of measurements should also include measurement of real fuel consumption to check and improve the methodology.

The estimates of operator salaries and oil consumption are adequate. The cost of small repairs and parts is based on a uniform figure of 300 TD per engine per year, which was recently increased from 100 TD, for UAG estimates for the techno-economic studies. Actual field data on these costs are lacking. During field visits to the WUAs, the evaluation team tried to collect data on actual costs. Some data were collected, but the completeness and accuracy are uncertain. Once the WUAs are legalized and the treasurers trained in simple accounting procedures, additional data will be available to improve cost estimates.

Second-level maintenance costs have not been well addressed. The IDA/CTDA study did include the cost of repairs and engine overhauls, but not the cost of crews and transport. A copy of the WASH manual on O&M cost estimation (Jordan and Wyatt, 1989) was left with the CTDA, along with other references on O&M costs, for their use in improving O&M cost-estimation procedures.

3.6 Role of Women

3.6.1 Domestic Users of Water

Young girls and women in rural Central Tunisia manage the domestic water supply destined for both animal and human consumption. Their responsibilities often include fetching water and transporting it by donkey/mule from distant points or on their head/back from closer points.

The project has been successful in increasing access of the target population to potable water. Distances, time spent, and physical energy expended by young girls and women in fetching water have generally been reduced. However, it is not at all clear that the time saved will necessarily result in higher school attendance rates and/or increased economic activity (e.g., small gardens, weaving), as hypothesized in the Project Paper. The young girls we interviewed often said that improved access to water gave them more time to help with domestic chores.

Girls and women are the most frequent users of the domestic water supply, and women are the de facto managers of its use for drinking, washing of clothes, cleaning, cooking, and bathing. Women's informal role as managers of the family's potable water supply is acknowledged in the Project Paper, but there

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[6] After this approach was suggested to the UAG, the UAG director took action immediately to begin collecting these data, which is commendable.

is no evidence that in the early part of the project it was being addressed or reinforced by project interventions. On the other hand, the new project sites (one completed and five under construction at the time of this evaluation), where a laundry area has been provided, clearly reflect increased sensitivity to women's patterns of water use. Most women interviewed at old project sites indicated a preference for washing heavy items, such as sheep wool and blankets, at the water point instead of at home, and they often complained that it was forbidden by the watchman at the water point. Provision of a laundry platform at the new project sites is also welcome because it may promote increased interaction among women: The social construction of women's "leisure" time is often limited to gathering around a water source to do laundry.

3.6.2 Health and Hygiene

In addition to improved access to sources of potable water, women are also beneficiaries of information and advice on health and hygiene at the project sites where the first group of 16 community health workers (*animatrices de base*) have been active.[7] Targeted primarily at women, the health and hygiene education component of the project has been successful in reaching women and sensitizing them to the importance of general hygiene, disinfecting water containers, and maintaining a clean domestic water supply. The package of health information provided also covers primary care for children (vaccination and oral rehydration therapy).

The health education component has also involved women more formally by creating the most visible female role in the project, community health worker. As outreach health workers, women are providing needed health information to other women and their families in project sites. As called for in the health education plan, the first group of young women has been trained and active since March 1988. The training is provided by the Regional Health Education Team, a 10-member team that includes three women from the regional Ministry of Health directorate.

3.6.3 Participation in the WUAs

The separation between the world of men and that of women in rural Central Tunisia is most evident at the WUA level: Membership is limited to men. Although women do not actively participate in association matters, their water-related concerns may be transmitted through their menfolk to the WUA. This is not an effective mechanism for ensuring women's participation as project beneficiaries, especially in those regions where limited sources of income have driven many of the men to other parts of Tunisia or to other countries in search of jobs. The absence of men from these regions, coupled with the effective

[7] Seventeen community health workers have been trained but one was dismissed because of her poor performance.

seclusion of women from the WUAs, seriously undermines the concept of beneficiary representation and participation.[8]

3.6.4 Water Pump Operators

Two of the pump operators in the district of Hassi el Frid are women. Both became pump operators following the death of their husband or father, the original water pump operator. Only one of them has received formal training along with the other operators. The other one felt no need for the training because she had regularly helped her husband and was, in effect, his apprentice. Both women were aware of safety measures; for one woman the WUA strongly recommended that while at work, she wear only European clothing, as opposed to the traditional clothing worn in Central Tunisia, which can more easily get caught in the transmission shaft.

Although both WUA presidents at the water points involved said that there was no opposition to the choice of the women to assume the job of water pump operator, they also made it clear that there were no men in the family to assume the job. The prime reason for selecting the women was economic: They had become heads of households; they needed to provide for their families and to send their sons to school. Such reasons are inscribed in the traditional norms of community assistance and set in the patriarchal social organization of rural Tunisia.

The presence of women as pump operators can be expected under extraordinary circumstances only, as illustrated by the cases cited. Otherwise, there is a clear division between making water available and using it: The former defines the labor responsibilities of men and the latter those of women. Realistically speaking, the goal of expanding women's participation in the project cannot be achieved by promoting the role of pump operator for women.

3.6.5 Participation in UAG

Women's formal involvement in the project has been most conspicuously absent from the UAG. Hopkins and Turner (1983) in their interim evaluation report of the rural water subproject recommended creation of the UAG and specified that it be staffed by one female member in charge of training activities. USAID has frequently suggested this as well, but the CTDA has cited hiring freezes for its inability to respond. In its 1987-1988 report of activities, the UAG underlined its need for two additional staff members, preferably women. Two days before the evaluation team left Kasserine, a recent sociology graduate was hired as an intern (*stagiaire*) for one year. This is a step in the right direction, but the potential role the woman can play will be diluted unless the

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[8] During our debriefing with the Secretary of State of the Ministry of Agriculture, the Secretary proposed the creation of an all-women WUA as an experiment. Recognition at the national level of women's needs as water users is indeed encouraging.

scope of her work is well articulated and she becomes permanent staff. Job descriptions do not exist at the UAG, and the new woman is expected to be responsible for training and "a little bit of everything else, like every other *Unite* staff member." The UAG suffers from the dual problems of diffuse scopes of work and no prioritization of objectives. Unless the UAG clearly sets outreach to women as a priority objective, adding a woman to the team will have little effect on increasing women's effective participation in the project.

3.7 Health and Hygiene Education[9]

To assess the progress made in this component of the project, the evaluation team consulted available reports, visited target communities, and held discussions with key participants in the health and hygiene education program (UAG, Regional Health Education Team, local Ministry of Health officials, community health workers, and district nurses). Our findings confirm previous reports (Hopkins, 1988; Pine, 1988) that the health education program is making good progress toward meeting the objectives set forth in the health education plan (October 1987).

3.7.1 Effect of Project-related Health and Hygiene Education Activities

Changes in Incidence of Water-related Diseases

Dispensary records and project figures available from the regional Ministry of Health directorate show an overall decrease in the number of cases reported for scabies, *taenia*, and diarrhea between 1987 and 1988 in 11 communities in Sbeitla, Sbiba, and Jedliene (see Appendix M) served by community health workers. Kasserine Sud statistics had not yet been reported to the regional directorate. Comparable data for communities without a community health worker were not available for review. In the absence of true epidemiological data to measure change over time, it is not possible to make a definitive statement regarding changes in disease incidence or to attribute changes to project activities. As indicated in the Project Paper, many other intervening factors affect mortality and morbidity and complicate measurement.

Trying to get the beneficiaries' assessment of whether intestinal, skin, and eye infections had decreased with improved access to potable water was not very fruitful: Most people denied the existence of disease, other than a casual cold and coughing. Diarrhea was mentioned infrequently and seems to be related to the time of year. Nurses at the dispensaries confirmed that prevalence was higher in the summer months. On the other hand, dispensary records show a high prevalence of scabies, possibly related to infrequent bathing during cold winter months.

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[9] This section is entitled health and hygiene education, instead of hygiene education as suggested in the Scope of Work. This better reflects the recent addition of immunization, oral rehydration therapy, and first aid for insect bites to the training of the community health workers.

Changes in Health and Hygiene Behavior

It is too early in the life of the project, and specifically in the health education component, to evaluate changes in behavior.[10] Changes in knowledge may be a more appropriate indicator at this point, keeping in mind that increased knowledge is not necessarily associated with behavioral change, as repeatedly revealed by family planning surveys of knowledge, attitudes and practice (KAP).

Many of the women and young girls we interviewed knew about filtering, boiling, or adding a few drops of bleach (*javel*) to keep their water supplies clean. In those communities with health workers, women have also learned about the relationship between contaminated water and disease. Yet, few women could actually produce a bottle of bleach when asked if they had any at home. Women could, however, tell us where they bought the bleach and its price. We noticed that, with the exception of plastic jugs, most containers used for water storage (plastic buckets and ground cisterns) were generally left uncovered.

Bathing is infrequent in winter.[11] Poorer households and persons living farthest from the water point reported least frequent bathing: once a month. Others reported bathing once a week. All said bathing was more frequent in the summer. Water used for this activity is often drastically less than that used for other activities. One or two pails of water were said to be used for bathing by six household members, on average. This compares with about 20 pails a week for laundry, 6 to 7 for housecleaning, and 3 for cooking. Washing of hands to avoid fecal-oral contamination was difficult to determine, especially among poor communities where there are no toilet facilities.

Immunization information is probably the most successful aspect of the services offered by community health workers, in terms of knowledge (its importance for child health), attitudes (acceptance of injections), and practice (following immunization schedule). Although not a water-related health behavior, immunization of children is an important intervention that will help further the overall project goal of improving the health of the target population. The inclusion of immunization in the community health workers' training is also well advised because it was added in response to an expressed need by community members and thus reflects their input. Finally, immunization can contribute to the credibility of the health workers in the community, and, by extension, the program: Some of the health workers reported that women do seek them out, especially for help with the immunization schedule.

Women spoken to also knew about oral rehydration salts (ORS), which they referred to as the "envelope" given at the dispensary, and they adequately

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[10] Although this is a midterm evaluation for the project as a whole, the health education program itself is only a year old.

[11] When we asked women and girls about their various uses of water, they spontaneously answered drinking, washing clothes, cooking, and cleaning in that order. We always had to probe about bathing.

described how to mix the solution. Yet, regular use of ORS and feeding infants and children suffering from diarrhea were not consistently reported by the women.

3.7.2 Responsibility for Health and Hygiene Education

Regional Level

Among project components, health and hygiene education reflects a high level of collaboration among concerned agencies. In particular, good working relations and coordination exist between the UAG and the regional health directorate. Although regional health officials agree that there is no conflict between project health priorities and their own, conflicts of interest do arise because of insufficient staff to implement the directorate's priorities. This occurs, for example, when there is a need to mobilize available staff for governorate-wide immunization campaigns. Such conflicts of interest may decrease with the recently articulated national policy to provide potable water to underserved areas. Although it is not yet clear if and how this policy may affect national health priorities, a policy or commitment at the national level to promote sanitation and hygiene and combat water-related diseases could consolidate the collaboration between the regional health directorate in Kasserine and project activities. In the meantime, there is room for a more efficient collaboration. The achievements to date are noteworthy, however.

The Regional Health Education Team, composed of 10 members from the CTDA/UAG and the regional ministries of health, education, and social affairs, holds regular meetings and is clearly responsible for planning and implementing health education activities at the regional level. To date, the team's activities have mainly focused on outreach to target communities through the community health workers and have included the following: establishing selection criteria for health workers, selecting target communities and community health workers within them, training and supervising the health workers, and coordinating activities with the dispensary and school in communities selected. The team is collecting KAP data on health and hygiene through the community health workers and keeps monthly records of the workers' activities. The data have not yet been analyzed, and thus, results were not available for us to review. Data analysis should progress at a faster pace. A school health program being developed by the team, with technical assistance from a U.S. consultant, will be a major focus of the team's implementation efforts for this year, as will the conceptualization and production of appropriate health education materials for use in the program.

Problems with logistical support (vehicle still not bought), the issue of providing allowances for Ministry of Health staff on the team, delays in the U.S. training planned for the health educator, and the latter's perceived need for video equipment were discussed with Hopkins and Pine during their December 1988 visit to Tunisia and were reiterated during our meetings with regional health ministry staff. Although these problems (especially the purchase of the vehicle) must be resolved, they have not significantly impeded the good work that the team has been able to mount--the members are hard working, motivated,

and dedicated. Moreover, RHET agents generally enjoy good rapport with the communities they serve--WUAs, dispensary nurses, and schoolteachers. Such rapport is particularly evident with the CTDA/UAG and health ministry representatives on the team.

Local Level

Outreach health and hygiene activities in the target communities are the responsibility of the community health worker. Initially identified by the WUAs, young women are screened for the position by RHET agents, and a final selection of one young woman is made with the approval of the WUA. As noted above, these community health workers are an important channel through which women are reached in their homes, where the health worker can observe levels of sanitation and cleanliness of the water supply, involve the women in recognizing a problem, and then suggest a solution.

Sixteen young women have been active for the past year in four delegations; the selection of 20 new health workers from another four delegations is currently under way. The health workers are given a one-year contract and paid 30 TD a month from project funds. At the end of the one-year contract, the WUAs are expected to start paying their salary. Most WUAs are not yet financially able to do so, however. At present, WUAs are likely to resist covering even the pump operator's salary. Until WUAs gain some experience in collecting funds in a systematic manner, it is difficult to know how many could realistically support a health worker's salary as well. Moreover, with the strong expectations of free health services in Tunisia, it will take time before communities willingly assume this cost burden. The WUAs are not yet sufficiently sensitized to the importance of the health aspect of community development. Until they are, it cannot be assumed that they will pick up the health worker's salary even if they have the funds to do so. The WUAs do participate in selecting their health worker, but the men who belong to the WUAs are not the target of her activities. Men in the associations need to be reached more directly by the health education program (e.g., focus groups), so that the community's participation in improving its health conditions can be realized, and the WUA can ultimately serve as a platform for health education as envisaged by Hopkins (1988).

Pump operators have been identified as key WUA members to receive limited health and hygiene education. Their training curriculum includes a one-hour session on water-related diseases and their prevention, disinfection of water tanks, and the role of the pump operator in maintaining water-site sanitation. Some of the operators interviewed were trying to maintain hygienic conditions around the water point; others were less careful.

The nurse at the dispensary, as a participant in the training of the community health worker, and a key resource person for her, is also a partner in the health education component. The health worker's schedule includes regular visits to the dispensary, usually on days when the doctor and/or midwife is in and people are waiting to be seen. Working relationships between the health worker and the nurse are generally good. This is important because their responsibilities are complementary.

As noted above, the school health program should be getting under way this year. It will involve primary school students and instructors as informal partners in health education activities. The program aims to sensitize instructors and students to the importance of health and hygiene so that they, in turn, might act as "health educators" and transmit health messages to other household members.

Ultimately, responsibility for health and hygiene education at the local level will have to rest with the community itself. The community project program is the third component of the comprehensive health education plan developed by the CTDA/Ministry of Health with technical assistance from a U.S. consultant (Plan, 1987; Rull, 1987, 1988). Through this component, limited funds are made available by the Regional Health Education Team for the construction of facilities identified as necessary by the community, which in exchange, contributes its labor. To date, a community in Sbiba delegation (Dhraa) has identified its need for latrines and applied for funding. Construction labor and materials are being contributed by the community.

The responsibility of the Regional Health Education Team at the local level is to motivate community participation in the identification of their health and hygiene needs and to provide needed supervision and support to the health workers. The team has not been able to keep to a regular schedule of supervisory visits, however, due to logistical constraints: The Ministry of Health's administrative procedures have delayed the purchase of the planned vehicle, and no cars are currently available on the Tunisian market.

3.8 Summary of Training and Technical Assistance

Numerous types of training and short-term technical assistance have been provided during the first two years of the project. This section addresses them in the following categories: short-term training in the United States and third-world countries, local training in the project area, and short-term technical assistance.

3.8.1 Short-term Training

The project personnel who have gone for short-term training or study tours to the United States or Egypt express general satisfaction and appreciation for these project-financed activities. These training trips have included the following:

- A two-week trip to New Mexico to observe the application of a method for individual house connections in rural areas with dispersed populations (made by the director and the head of the potable water service of the AHA).

- Two weeks at the University of Pittsburgh's management training workshop (for the CTDA's Director of Planning and Evaluation and the Regional Agricultural Development Commission's head of the DRE).

- Two weeks at the American University in Cairo to observe examples of rural development and women's community participation in improving sanitary conditions (for two UAG agents and two other CTDA field agents).

The Egyptian experience seems to have had the most impact. It resulted in a follow-up trip of Egyptians to Kasserine in December 1988, and another two-week trip to Egypt is planned for spring 1989 for the director and remaining agents of the UAG.

3.8.2 Local Training in the Project Area

The UAG has organized 24 days of training that have involved approximately 600 WUA members. This has included one day of training for 87 pump operators that focused on their role and responsibilities, basic theory and technical training in pump operation, simple maintenance and repairs, and general concepts of basic health, hygiene, and sanitation. Over 100 WUA presidents have received one or two days of orientation/training on their roles and responsibilities and the implications of the various laws and decrees concerning WUAs. The planned training of WUA treasurers has been postponed pending the legalization of the WUAs.

The Regional Health Education Team provided a week's training for the first 17 community health workers for four delegations in February 1988 and one-day follow-up workshops for them in June and September 1988. The team also participated in the one-day training of the pump operators and has provided health education materials and advice to the community health workers during supervisory support visits.

The UAG has identified as a major need having one person solely responsible for the planning, coordination, and evaluation of all local training activities. The Regional Health Education Team has identified its priority as being the project-financed (GOT) vehicle so that members can continue to provide field support to the existing health workers and train and support the new group of approximately 20 health workers who are currently being selected at WUAs in four additional delegations.

3.8.3 Technical Assistance

Overall, general satisfaction is expressed by project personnel regarding the level and quality of the various short-term technical assistance missions during the first two years of the project. The missions that seem to have been most helpful include the biannual visits of the institutional development advisor and the two visits of the initial health education advisor. The technical assistance mission from the Institute for Development Anthropology that developed the water resources mapping study would have been more useful if it had more directly involved the DRE in the preparation of the study and if it had used an approach that would more easily allow for the updating of the study.

Chapter 4

PROJECT MANAGEMENT AND FINANCES

4.1 General Management Considerations

The CTDA is well-run, which has enabled it to execute its tasks in accordance with the terms of reference of the project, existing institutional structures, and its mandate. In particular, under points 7 and 9 of Law No. 78-44 (August 1, 1978), the CTDA is charged with the following:

- implementing socioeconomic infrastructure works through subcontracting with various governmental, para-public, or private organizations (point 7);
- and, more generally, implementing all missions entrusted to it by the government, aiming at the development, improvement, and organization of agricultural activities (point 9).

The CTDA has, among other tasks, responsibility for the "study and implementation, maintenance and up-keep of potable water points." To accomplish this task, an Office for Potable Water (a subdirectorate of the AHA) was established and given responsibility for the following:

- study of various water supply projects;
- execution and follow-up of works connected with potable water supply; and
- coordination with the UAG supporting the establishment of potable water WUAs.

The Office for Potable Water reviews the tender documents for contractual services, provides follow-up services in connection with drilling, and supervises the work of subcontractors, in particular AUI and, when possible, the repairs made by the maintenance contractor. In cooperation with the UAG, the office implements decisions related to the project, in particular site selection, the establishment of WUAs, and the solution of technical problems.

The Budget Office follows fund allotments, in particular the scheduling and payment of new allotments and disbursements, especially those for drilling and civil engineering. Payment is made by the Financial Affairs Unit of the CTDA. On the whole, the procedure followed is based on common audit principles, especially because the Monitoring and Evaluation Unit centralizes all data pertaining to project implementation.

One shortcoming is that regular reports of progress achieved by the project are not prepared. Such a report should be the result of a joint effort of all parties involved and should be endorsed by the UAG, which should have responsibility for centralizing data on the current status of the project with the help of the Monitoring and Evaluation Unit.

Progress reports should be submitted at regular intervals (every month or every three months) and should present condensed information on the progress of the project. A standard form for such reporting is included as Appendix N. A form of this type should be submitted by the CTDA to USAID regularly.

4.2 Private Contractor Relations

Given the work requested by the CTDA and taking into account the existing and potential structures of the CTDA for supervising subcontractors (AUI and maintenance), the Office for Potable Water normally follows the work of subcontractors. As for the engineering firm, AUI, note has been taken of complaints by contractors regarding steps taken in the building of tanks, the methodology used for form work, and visits of site inspectors. Some work has had to be redone, but it is not clear if this is the fault of the contractors, or can be attributed to delays in inspection of construction work. In addition, there have been complaints about the time lag in the payment of invoices, due to the slowness of the administrative procedure adopted by the CTDA (see below).

Regarding maintenance, the work performed has been mainly corrective (repairs). Due to the heavy load of repair work, there has not been time for preventive maintenance. The CTDA supervises the team, which is overworked, and coordinates its activities with the GR. Relationships among the parties involved in preventive and corrective maintenance (GR, PDR, subcontractors, etc.) should be clarified and their work centralized to facilitate proper planning for upkeep and maintenance (see also section 3.5).

One problem noted was a delay in processing invoices submitted by AUI. Administrative procedures within the CTDA have led to delays of several months in payment, much to the discontent of the firm. Several sources indicated that some private firms are reluctant to bid on CTDA contracts because their experience has been that payment takes a long time. In fact, some tender documents for civil works construction have had to be issued two or three times because insufficient bids were received. Although it cannot be said for certain, this may reflect the long payment delays.

External contracting for design and construction supervision has been a help to the CTDA in the implementation of this project, but the question remains as to the best means of performing this type of work in the future. Surely, the CTDA will continue to implement potable water projects after the USAID project is finished. The standard designs developed by AUI will be very useful in that process. However, if the CTDA tried to implement a large number of projects by itself, its staff would be quickly swamped. The CTDA could hire more engineers as civil servants for a donor-funded project, but it would then have excess staff once the funds ran out. Thus, external contracting appears to be the best

approach. It is clear, however, that the CTDA will have to improve its administration of invoices to make the most of this approach.

4.3 Selection of Project Sites

The method followed by the CTDA to select sites is objective and rational, to the extent that it breaks the process into three essential parts: (1) a study of the beneficiary population and a classification of sites based on number of inhabitants; (2) a review by DRE of technical information on the availability of groundwater at the various sites and an evaluation of water requirements; and (3) an economic analysis of the cost/benefit ratio per beneficiary within a 3-km radius. Revisions to the process are needed, however, including an improved model for economic evaluation of potential water points and the consideration of a 6-km radius as the zone of beneficiaries to be served (see discussion in section 3.2.1).

Sites have been selected, generally with the agreement of the various parties concerned with water in the region, particularly the GIH. The record of the GIH meetings do indicate the sites selected, although no mention is made of the socioeconomic criteria used and no ranking of sites appears to be done.

The CTDA is a member of the GIH and its permanent secretariat and through the UAG is in charge of monitoring and evaluating for the GIH. As such, the CTDA contributes to the decision making on water management in rural areas and fosters cooperation among the various parties. This in turn promotes the strengthening of the UAG and ensures its continuity.

At the same time, evaluation of the CTDA experience and of the goals, scope, limitations, and constraints of the UAG should be done by comparison with other similar regions so that the evaluation can be objective, the future clear, and allotment of resources made efficiently and in accordance with a logical plan. Thus, the evaluation of the Kasserine model would be more appropriate if a comparison was made with other projects that use different methods to achieve the same goals. This might prompt revision of the Kasserine model and then its replication in other regions. Indeed, widening the scale of operation of this type project would be consonant with the general trend in Tunisia toward privatization and the participation of the population in development activities.

4.4 Financial Aspects

Based on project records kept by the Budget Unit of the Water Projects Service, the Department of Administrative Affairs and Finance, *Départment des Affaires Administratives et Financières* (DAAF), and the Monitoring and Evaluation Unit, the project's financial situation can be summarized as follows:

Program funds (1987-88) (from planning ministry)	1,100,000 MTD
Funds available	1,300,000
Obligations	1,712,000
Disbursements	1,641,000

Thus, it appears that the CTDA has had to use funds from other line-items pending the release of appropriate funds. This explains the difference between obligations and funds available and between obligations and disbursements.

4.5 Financial Resources for Potable Water Projects

The overall amount planned by the GOT for potable water under all projects implemented in the country is 84 million Tunisian dinars (MTD) for the period 1989-91, distributed as follows:

Budget for 1989	30 MTD
Budget for 1990-91	54 MTD

Total (1989-91)	84 MTD

Funds for potable water are included in several programs, in particular those of the institutions that deal in general with water systems, namely, the GR, the National Society for the Exploitation and Development of Water, *Société Nationale d'Exploitation et de Développement des Eaux* (SONEDE), and the PDRI. In the national program, the allocation for Central Tunisia (i.e., the governorates of Kasserine, Kairouan, and Sidi Bouzid) amounts to 16.5 MTD, distributed as follows:

	1989	1990-91	Total
Kasserine	3.8 MTD	3.2 MTD	7.0 MTD
Kairouan	2.4	2.7	5.1
Sidi Bouzid	3.4	1.0	4.4
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TOTAL	9.6	6.9	16.5

The total cost of the PDRI program project is estimated at 312 MTD for all sectors for the whole country. The share for water components amounts to 17 MTD for 104 sites nationwide. The share for Central Tunisia amounts to 2.3 MTD, distributed over 17 sites in the central governorates, as follows:

Kasserine	9 sites	1.3 MTD
Sidi Bouzid	4 sites	0.4
Kairouan	4 sites	0.6

The overall program is supported equally by the GOT and the Kuwait Fund. Estimates include the base figure plus funds for contingencies.

Chapter 5

REALLOCATION OF PROJECT FUNDS

Given the various findings, conclusions, and recommendations presented in preceding chapters, the allocation of project funds was examined in an effort to determine the most appropriate way to use the remaining project funds. As a first step, current expenditures were compared with the most recent budget (outlined in PIL #18, dated July 1988; see Table 1). USAID and CTDA records were consulted to identify funds already spent or already allocated to activities that have begun. In general, actual costs were used for activities already completed, USAID and CTDA estimates were used for activities under way. That is, estimates were made of the cost of the civil works at five sites where wells have been drilled but civil works have not yet begun. These costs were included because all parties agree the five sites will have civil works construction.[12] Of the $6,500,000 originally budgeted, $3,832,139 has been spent or is planned to be spent on past or current activities. This leaves about $2,667,861 to be allocated to future activities.

Second, estimates of the cost of technical assistance, construction, commodities, evaluation, training, and contingency expenses were prepared. These estimates are in accordance with the scope of work (for the technical assistance), historical costs (for construction, using 0.850 TD/US$ as an exchange rate), and informed estimates (for other items). Results are shown in Table 2. This plan puts considerable emphasis on technical assistance, expenditures we believe will be required. The remaining funds will still cover eight additional wells, four extensions, and one house-connection system. It still appears that 50,000 beneficiaries can be served by the project, but the goal of 26 productive wells is out of reach, given expenses to date. Twenty-two wells would result from this plan.

Expatriate technical assistance is being recommended (as shown in Table 2), but not because of poor performance by the Tunisian organizations. In fact, the hardest part of this project, creating the WUAs at the local level and creating regional institutions to support them, has been ably handled by Tunisians at the CTDA. Expatriate technical assistance in the form of carefully targeted technical and managerial input is needed to make relatively minor improvements to project operations and to ensure that the project develops a model replicable elsewhere in the country.

Finally, Table 3 outlines the major budget line items, as defined in the Project Paper as of July 1988 and under the proposed reallocation. The July 1988 budget reflected a decreased emphasis on technical assistance, but in the proposed budget the emphasis on technical assistance has been increased. The proposed budget appears to reflect an increase for construction, but this is only because there are unallocated funds in the inflation category and some funds in the commodities category have been shifted into construction. In the end, this budget represents the best way to spend the remaining funds.

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[12] The fixed amount reimbursement method was used to account for construction costs.

Table 1

Current Budget and Planned Expenditures

		Budget Amount PIL # 18 July 1988	Planned Expenditure as of Jan. 1989	Balance
A.	TECHNICAL ASSISTANCE			
1.	USAID Personal Services Contract	$55,000	$54,278	$ 722
2.	Water Resources Study	410,000	409,900	100
3.	Architecture and Engineering Contract	145,000	145,000	
4.	Hydrogeological Assistant	22,000	4,130	17,870
5.	Local Organization Assistance	10,000	9,440	560
6.	Maintenance Contract	135,000	135,000	
7.	Nonformal Health Education	72,000	55,678	16,322
8.	Water User Association Development	22,000	19,806	2,194
9.	Computer Training	2,000	2,000	
10.	Training Plan Assistance	8,000	7,998	2
11.	Cost Recovery Study	3,500	3,000	500
12.	Irrigation Associations Study		9,490	(9,490)
	Subtotal	$884,500	$855,720	$28,780
B.	CONSTRUCTION			
1.	Boreholes	$1,619,000	$1,481,992	137,008
2.	Civil Works	1,290,000	860,029	429,971
3.	Extensions	678,000		678,000
4.	House Connection Systems	380,000		380,000
	Subtotal	$3,967,000	$2,342,021	$1,624,979
C.	EVALUATION/AUDIT	$198,000	$115,000	$83,000
D.	COMMODITIES			
1.	E-Logger, Depth gauge, PVC, etc.	$181,000	$121,000	$60,000
2.	Vehicles	58,000	57,958	42
3.	Off-the-shelf Procurement	25,000	19,544	5,456
4.	Miscellaneous	1,000	802	198
	Subtotal	$265,000	$199,304	$65,696
E.	TRAINING/EDUCATION			
1.	Health Education	$150,000	$150,000	
2.	Participant Training	125,000	125,000	
3.	In-country Training	45,000	45,000	
	Subtotal	$320,000	$320,000	
F.	INFLATION	$717,000		$717,000
G.	CONTINGENCY	$148,500	$94	$148,406
	TOTAL	$6,500,000	$3,832,139	$2,667,861

Table 2

Proposed Reallocation of Project Funds

			PERSON MONTHS REQUIRED		
			EXPAT	LOCAL	TOTAL
A.	TECHNICAL ASSISTANCE				
1.	Water System Design Consultancy and Training	$50,000	2.0		2.0
2.	Technical Assistance on O&M Cost Estimation	37,500	1.5		1.5
3.	Maintenance Management Consultancy	115,000	4.0	2.0	6.0
4.	Preventive Maintenance Team	35,800		18.0	18.0
5.	Consultancy on WUA Finance and Management	32,000		4.0	4.0
6.	Technical Assistance on Socioeconomic Data Base Development	52,500	1.5	2.0	3.5
7.	Consultancy for AIFs/Follow-UP on Health Education	115,000	4.0	2.0	6.0
8.	Task Planning for UAG	32,500	1.0	1.0	2.0
	Subtotal	470,300	14.0	29.0	43.0
B.	CONSTRUCTION				
1.	Boreholes @ $100,000 (8)	$800,000			
2.	Civil Works @ $65,000 (8)	520,000			
3.	Extensions @ $120,000 (4)	480,000			
4.	House Connection Systems @ $150,000 (1)	150,000			
	Subtotal	$1,950,000			
C.	EVALUATION/AUDIT	$125,000			
D.	COMMODITIES				
1.	E-Logger, Depth gauge, PVC, etc.				
2.	Vehicles				
3.	Off-the-shelf Procurement	$12,000			
4.	Miscellaneous				
	Subtotal	$12,000			
E.	TRAINING/EDUCATION				
1.	Health Education/Local mechanics	$15,000			
2.	Participant Training (Overseas)				
3.	In-country Training (WUA member info exchange)	10,000			
		$25,000			
F.	INFLATION				
G.	CONTINGENCY	$85,561			
	TOTAL	$2,667,861			

Expat Rate = $25,000/PM
Local Rate = 7,500/PM

Table 3

Comparison of Major Budget Items: Current and Proposed

BUDGET ITEM		PROJECT PAPER 1986		PIL 18 July 1988		PROPOSED BUDGET	
A.	TECHNICAL ASSISTANCE	$1,162,000	17.9%	$884,500	13.6%	$1,326,020	20.4%
B.	CONSTRUCTION	3,967,000	61.0	3,967,000	61.0	4,292,021	66.0
C.	EVALUATION/AUDIT	232,000	3.6	$198,000	3.0	240,000	3.7
D.	COMMODITIES	364,000	5.6	265,000	4.1	211,304	3.3
E.	TRAINING/EDUCATION	189,000	2.9	320,000	4.9	345,000	5.3
F.	INFLATION/CONTINGENCY	586,000	9.0	865,500	13.3	85,655	1.3
	TOTAL	$6,500,000	100.0%	$6,500,000	100.0%	$6,500,000	100.0%

Chapter 6

MAJOR RECOMMENDATIONS

6.1 Water Resources Mapping Study

- In the short term, the DRE should be given a microcomputer and printer with Lotus-123 software to begin more efficient management of its extensive database (currently on paper). At least two of its administrative personnel directly involved with current data management should be trained in the use of the system and helped to design a format into which the current database can be incorporated.

- In the long term, USAID should consider initiating a computerized information systems subproject (using GIS software) for Tunisia, perhaps initially focusing on supporting the GOT's national priority of reaching all rural Tunisians still underserved by potable water points. Placing such a system in a highly visible, centralized location could greatly help to ensure that underserved areas are indeed highlighted and brought to the attention of the responsible political/bureaucratic leaders. Satellite systems (at a cost of about $6,000 per site) would enable regional centers to use the program to manage and update the system from the field. Other government services (education, health, and agriculture, in particular), all of which, in the end, are mutually complementary in terms of the information they need to operate efficiently, might use similar systems.

6.2 Construction Activities

SHORT TERM:

- The CTDA should update the existing computer model for economic evaluation of water points. The revisions and the final product should be approved by USAID, and both parties should agree on minimum values for economic criteria. This work should be coordinated with a study of operating costs, as described in sections 3.5 and 5.5 and in Appendix O.

- The CTDA should give USAID a detailed list of all the proposed water sites suggested to the GIH. The sites must obviously comply with the selection criteria established for the USAID project. The list should include the following information:

    - name of site,
    - delegation and governorate,

- 1989 population (0 to 3 km),
- 1989 population (0 to 6 km, assuming they are not yet supplied),
- estimated total well depth (according to the DRE),
- total estimated cost (drilling, civil engineering, and equipment),
- cost per beneficiary (0 to 3 km),
- cost per beneficiary (0 to 6 km),
- cost/benefit ratio (0 to 3 km),
- cost/benefit ratio (0 to 6 km),
- internal rate of return (0 to 3 km),
- internal rate of return (0 to 6 km), and
- cash flow situation of the WUA in 2, 4, and 10 years.

Sites should be classified by order of priority and the CTDA should propose sites, with justifications, for USAID financing. Certainly, all sites cannot be financed by USAID. Those sites that could be financed by the Rural Development Program or other donors should be noted.

- The CTDA, AUI, and AHA should find ways to reduce the costs of drilling and civil works. For example, it would be easy to reduce the cost of hydraulic equipment for elevated tanks, the diameter of discharge and distribution pipes (World Bank software), and drilling (using PVC tubing and reducing the diameter of pipes at the bottom of the pumps). The CTDA and AUI should reexamine the master plans for civil works.

- The CTDA and AUI should study the optimum size of elevated tanks, taking into account the starting/stopping of motors and having sufficient water storage capacity in case of breakdowns.

- Technical assistance should be provided by an expatriate engineer to help the CTDA and AUI reduce costs for drilling, water storage, and the water distribution network. (See proposed scope of work in Appendix P.) The engineer should train the staff of both organizations in the use of the World Bank software. The work should also include an investigation of the optimum size of tanks, as well as other design and implementation aspects of construction works. Three person-months of consulting would probably be needed. It is important that the consultant be an expatriate who can introduce new ideas and concepts on these questions and bring to bear the experience of other countries in similar projects.

- A water meter should be installed by the CTDA at the discharge point of each pump installed under the project (the 14 wells already in existence and the forthcoming ones). These should be financed by the CTDA if good models are available locally, otherwise by USAID.

LONG TERM:

- The CTDA should try to achieve standardization of pumping equipment. The choice of equipment should take into account the characteristics of the equipment already installed at the water points in Kasserine in order to ensure greater homogeneity of available equipment. Selection criteria should also include an evaluation of the possibilities and the cost of servicing.

- The procurement of pumping equipment should include spare parts needed for preventive maintenance for a period of four years and for frequent repairs in the event of breakdown (alternator, starter, radiator, and the like).

6.3 The Regional Support Unit (UAG)

One can foresee rapid growth in the number of WUAs in the region to which the UAG will feel responsible. This will place increasing demands on the UAG for assistance in training, arbitration, advocacy, and the numerous political and technical services with which the WUAs will have to deal as they become self-running and begin to take organized approaches to dealing with community needs around the water points. The UAG will have to take a very hard look at what it can do best and what it is being asked to do on behalf of both the WUAs and the GIH. Limits will have to be set beyond which action cannot be taken without added personnel and material and logistical support.

SHORT TERM:

- The following actions should be taken to strengthen the UAG:

  - Recruitment of two female agents, one for WUA and the other for training activities. The female agents should work full time in these fields.

  - Provision of three vehicles, one IBM computer, and one printer (wide carriage).

- In order to make maximum use of UAG resources, the UAG's role and tasks should be specified and more clearly defined. A priority should be established for its interventions.

- Four weeks of expatriate and four weeks of local technical assistance should be provided in the near future to establish within the UAG a clear definition of priorities, how they will be achieved, and by whom. The consultants should endeavor to implement the recommendations made by this evaluation in terms of this plan of work.

- Emphasis should be placed on the catalytic and facilitating role to be played by the UAG with the other regional services in order to promote development around the water points. The UAG should be the managing institution for WUAs at the regional level. Its relationship with the GIH should be defined, and its role and authority should be institutionalized so that it can implement its decisions.

- UAG staff should undergo periodic training in Egypt or other countries in Africa, Europe, or the United States. Similarly, once WUA legalization is in place, training should be given to pump operators and to WUA treasurers. In addition, the director of the UAG should receive training in management by objective.

- The UAG should receive additional support in dealing with WUAs at sites where irrigation is performed. This support could be provided by an AHA staff member working with the UAG on irrigation or mixed-use systems, or a new agent could be recruited to work directly on irrigation or mixed-use systems.

LONG TERM:

- In order to ensure the continuity of services provided by the UAG, namely, the establishment, supervision, support, and training of WUAs (during and after the USAID project), it is necessary to clarify the institutional position of the UAG under the CTDA and also in the light of the future restructuring of the regional services of the Ministry of Agriculture.

- The trained staff currently working for the UAG should be kept and integrated in the new regional structure. They should be encouraged to continue their good work; similarly, the UAG should be strengthened through the use of social workers. A way should be found to grant permanent status to the director of the UAG, so that he can devote his time to his work with a sense of security.

6.4 Water User Associations

SHORT TERM:

- A socioeconomic database should be created for the WUAs with the support of the UAG. These data should be limited to indicators that will help in the monitoring and evaluation of water-related assistance in the concerned communities. To accomplish this, the UAG should be given the assistance of an expatriate consultant (socio-economist) for at least six weeks during the next few months of the project and once again at termination of the project. Funds should be provided to

employ community assistants to collect data and to acquire at least one additional computer for data entry and analysis. During the survey period, UAG agents should expect to spend 25 percent of their time on this effort. At the same time, the UAG should standardize its computer operations using IBM/PC or compatible equipment only and the most simple software for data organization (Lotus-123).

- The fee collection/financial management practices of the WUAs must be improved. The UAG and the WUAs must work together, with the help of an outside consultant, to resolve these issues. (See proposed scope of work in Appendix Q.) These efforts should include development of a standardized system for the sale of water using appropriate coupons under the control of the treasurer. The UAG should seek the assistance of political leadership if necessary to make the system work. These efforts should begin immediately, not be postponed until legalization.

LONG TERM:

- The bureaucratic legalization process must become more efficient and truly regionalized as a final authority. The great delays caused by the pending legalization, taken at the highest levels of the bureaucratic/political process, will weaken the GOT's program of decentralizing and giving priority to the WUA process.

- The UAG should be seeking to assist WUA members to obtain the kind of support they need to make their access to water, even after creation of the water point, more equitable. For instance, in some communities almost all the families have animal-drawn cisterns, but in others, few as yet have benefited from a government program currently in place to assist them in obtaining such equipment. Family cisterns in which water is stored or captured also need to be improved. To achieve this, better information about the communities is necessary, as is a better working relationship with other government services. The UAG can help the WUAs to put the right kind of pressure in the right places to encourage such assistance.

6.5 Operations and Maintenance

The current maintenance system should be completely reorganized, in the manner described below, all in the medium term or as outlined below.

- All the existing maintenance crews should be consolidated under a single office. (The private contractor should also report to this new office.) This reorganization should be coordinated with the planned reorganization of the Ministry

of Agriculture, scheduled for later in 1989. The ideal formula would be to have an Office for Water Point Maintenance, with its own budget, run by an engineer, with the assistance of a junior engineer and an administrative assistant (not a secretary). To achieve maximum efficiency at the lowest cost, the office would negotiate contracts with private firms for corrective and preventive maintenance, by means of separate contracts. Regarding the existing government crews, the choice must be made whether to retain them (with additional training), privatize them, or use them on other tasks and replace them with private contractors.

- One of the main tasks of this office would be to <u>establish preventive maintenance plans</u>. With the technical assistance of an experienced expatriate consultant, the office should establish a full preventive maintenance plan, which should define the tasks to be accomplished, their timing, the financial and technical inputs needed to achieve them, and a logical schedule of activities. (See the proposed scope of work in Appendix R.) The responsibilities of the pump operators, the office staff members, and the contractors should also be specified in the plan.

  After the planning phase, the office would negotiate contracts, through a technical and financial bid process, to secure experienced firms, at a reasonable cost. The contractor would follow the pre-determined plans and submit monthly reports on the tasks programmed and completed. The contractor would also report on additional tasks needed at sites visited. The office would monitor the work in progress and maintain maintenance history files on each water point.

A preventive maintenance team would consist of two or three people with a vehicle and tools. The number of teams needed is difficult to determine at this time, but would be established during the development of the maintenance plan. At a minimum, one team should be set up right away. This could be accomplished by adding another team of two or three skilled workers and a vehicle to the contract of the private maintenance contractor.

The proposed technical assistance on maintenance management can begin before the reorganization of the Ministry of Agriculture. The work on identifying and defining tasks and estimating the budget can begin immediately, which would provide information for use in the reorganization of the Ministry of Agriculture and the establishment of the proposed office.

- All pump operators should receive additional training, including training in new tasks assigned to them (e.g., operations log and maintenance calendar/checklist). The pump operators should also receive training on how to diagnose a problem or breakdown, so that the nature of the problem can be conveyed to the repair crew before they set out for the corrective work. The salary of the pump operators should be increased once they have been trained in the new procedures asked of them, to compensate them for their new responsibilities. The wage should probably be raised to about 100 TD per month.

- Corrective maintenance will have to continue, and the volume of work will remain large in the short term. The start-up of preventive maintenance will, over time, reduce the breakdown rate, and the need for corrective maintenance. For the short term, corrective maintenance should be done by the existing crews with the support of the private contractor.

  The proposed consultant on maintenance management will have to develop a long-term plan for corrective maintenance. The consultant should examine the breakdown notification process and evaluate the need for a written corrective maintenance work order system. The future of the existing crews will have to be studied, as noted above for the preventive maintenance crews. (One could estimate now that two preventive maintenance crews and two corrective maintenance crews would be the eventual formula.)

  A mix of regional and delegation-level crews should also be studied. At the delegation level, private repair persons could be trained in each delegation. Small teams (a mechanic and an electrician) could establish contracts or agreements directly with a single WUA or perhaps a group of WUAs, to resolve breakdowns that cannot be fixed by the operator but do not need to be repaired by the regional crews. This system would offer the advantage of quick response and would place less of a burden on the government. However, crews would have to be trained, which will cost money and take time.

- A stock of major spare parts should be maintained by the proposed office for major and "moderate" breakdowns (alternators, starter motors, radiators, parts for overhauls, and the like.) As recommended above, such parts should be purchased by the CTDA (or perhaps by the Rural Development Program) when the equipment is ordered and transferred to this office. A good inventory/ordering system should be developed. Stocking small parts (e.g., filters and batteries) should be the responsibility of the WUAs. The CTDA has considered creating a stock at its office, from which the WUAs could make purchases. Although that would be a help to the WUAs, it would delay the eventual solution of private suppliers making

these parts available. An alternative suggestion would be for the GIH to make credit available to several suppliers to encourage them to stock parts the WUAs will need.

- The data base on O&M costs must be improved. A short-term technical assistance program is needed to improve the estimates of first-level costs and develop estimation procedures for second-level costs. (See the proposed scope of work in Appendix S.) A simple computer procedure could be developed for determining project feasibility and cost. This action should be coordinated with the improvements to the CTDA economic feasibility model used for site selection, as recommended in section 6.2. In addition, these activities should be coordinated with budget development efforts for the 81 WUAs. Easy-to-use tables of O&M cost estimates could be developed for illustrative purposes. A system of comparing actual costs with initial estimates is also needed.

6.6 Role of Women

- To ensure greater involvement of women within the target communities, and working within the given cultural context, efforts should be made to encourage the formation of women's special interest groups, the *Associations d'Interêt Feminin (AIF)*. Comprised of a female representative of each household belonging to a potable water WUA, such groups would complement the work of the WUAs. Specifically, the groups would (1) maintain hygiene and sanitation standards around water points, (2) identify women's perspectives on needed changes in water and health-related conditions in their communities, and (3) communicate those needs to the WUA president or to the UAG agents. (A more detailed description of the proposed role and responsibilities of the women's groups is provided in Appendix T).

- The UAG should be given responsibility for the formation and support of these groups. Specifically, this should be part of the full-time job description for the newly hired female staff member of the UAG, who should work with the community health workers. Thus, the women's groups should be formed around project water points benefiting from the presence of a community health worker. Since there are 16 active health workers and training for a group of 20 will begin in March 1989, about 35 women's groups should be functioning by the end of the project.

- Expatriate technical assistance should be provided to assist in establishing a plan for forming the women's groups. Ideally, this technical assistance would be provided by the same consultant needed for the health education follow-up activities (see below), thus bringing to a total of four

person-months the expatriate technical assistance needed for both activities. Experience working with rural women's organizations, previous work in the Middle East and North Africa, and fluency in Arabic should be required. It is also recommended that two person-months of local technical assistance be provided; it is important to identify a Tunisian woman with experience working with rural Tunisian women in community development/income-generating projects.

- USAID/Tunis should see to it that the new female intern at the UAG be one of the agents sent to the workshop on rural development and women's community participation at the American University of Cairo.

- The formation of the proposed women's groups is directly related to A.I.D.'s Women in Development (WID) priorities, and USAID/Tunis should take the necessary steps to ensure the UAG's compliance with the recommendation to establish the groups and assign the newly recruited female agent full time to this activity. Objectively verifiable indicators of the progress made by the UAG in forming and supporting the women's groups should be developed.

6.7 Health and Hygiene

SHORT TERM:

- USAID/CTDA should extend funding to cover the salary of the first group of community health workers for an additional year at the end of their contract in February 1989. In addition, the WUAs need to be made more sensitive to the importance of these workers in their communities, and they should be prepared to pay their salaries when funding ceases.

- The CTDA should provide the vehicle planned for the Regional Health Education Team in the Project Grant Agreement, as soon as possible.

- The regional Ministry of Health directorate should ensure the overseas training in informal health education methods planned for the regional health educator by providing the round-trip airfare.

- All data collected by the Regional Health Education Team should be entered and analyzed as soon as possible, so it can be used as a tool for sound program planning and better targeting of messages and interventions.

- Health education messages should be reinforced with visual aids (e.g., posters and stickers), especially around the water

points themselves, to promote community involvement in site sanitation.

- At least 10 copies of the Arabic version of *Where There Is No Doctor* should be purchased for the Regional Health Education Team and UAG agents from the funds for health education materials development.

LONG TERM:

- Sound epidemiological data are needed to quantify incidence rates and provide a measure of improved health status. The Regional Health Education Team/Ministry of Health should identify and collaborate with available experts in conducting this activity.

- Men need to be made aware of the importance of health and hygiene. The Regional Health Education Team should consider organizing focus groups to motivate key men in the WUAs.

- An expatriate consultant is needed to continue work on the school health program, assist in developing appropriate health education materials, and ideally, collaborate on WID activities with the UAG.

- The general recommendation for increased exchange of information and experience among WUAs within and across regions also applies to an exchange of health education materials developed in other regions, for example, in Kairouan and Makthar (Save the Children Foundation impact area).

6.8 Policy Issues

In accordance with the political choices made in Tunisia, the following steps are recommended:

- In the short term, the freedom of decision and of management authority for WUAs should be consolidated, particularly in their quest for financial equilibrium, the establishment of water prices, and in the long term, the possible diversification of their sources of income. In the start-up phase, WUAs should have maximum freedom and be supported in their decisions.

- In the long term, WUA activities and the establishment of institutions that could group them together should be coordinated in order to defend their interests and to ensure their autonomy and their continuity (federation or some other formula).

- In the long term, the operation of WUAs should be extended throughout Tunisia and the collective management of water points should be encouraged.

- In the long term, joint institutions should be established to provide certain WUA services, after the start-up phase (e.g., a common fund fed by WUA contributions to play the part of a WUA bank, with duties and attributions to be defined later).

6.9 Project Management and Design

Given the current state of project implementation, as well as of various technical, financial, and institutional aspects, is it recommended that, in the short term,

- a monitoring report be prepared regularly by the CTDA, on the basis of existing documents, and submitted to USAID.

6.10 Training

- USAID and the CTDA should support the second trip to Egypt planned for the remaining staff of the UAG in the spring of 1989 and consider the possibility of another trip in either late 1989 or early 1990. The latter should be contingent upon the identification of a work situation similar to that of the UAG but at a more advanced stage of development in another Arabic- or French-speaking country.

- USAID and the CTDA should give immediate priority to using training funds to increase the knowledge of UAG personnel and selected GIH and WUA members concerning the development of potable water WUAs in other regions of Tunisia.

- An action management workshop is needed to help the UAG redefine and prioritize the roles and responsibilities of each member (including who is to be uniquely responsible for training) and to prepare a 1989-1990 work plan in collaboration with other project components. The objectives of such a workshop would be to help the UAG prioritize its tasks and focus on the most essential. Alternative management approaches that redirect some tasks to other departments should be explored and adopted where feasible. If certain tasks are essential but cannot be handled by the UAG or another agency, the gap in service should be documented. Such a workshop should be facilitated by an "outsider," but someone who has experience working with the UAG. For example, the facilitator could be a consultant who has worked on the project before and thus is familiar with it, but who is sufficiently removed from the project to be objective.

Appendix A

SCOPE OF WORK

APPENDIX A

SCOPE OF WORK

PIO/T 664-0337-3-70117
Attachment No. 1

RURAL POTABLE WATER INSTITUTIONS PROJECT

TERMS OF REFERENCE

I. ACTIVITY TO BE EVALUATED

Project Title: Rural Potable Water Institutions
Project Number: 664-0337
USAID Funding: Grant, $ 6.5 million
LOP Dates: April 30, 1986 to March 31, 1991
PACD: March 31, 1991

II. PURPOSE OF THE EVALUATION

The Project Paper states that two joint evaluations should be undertaken, one each in the spring of 1987 and of 1989 with the first one coming at least one year after the completion of the Resource Mapping Study. This Study was completed in December 1987 and this is the first evaluation of the project to be undertaken. The objective of the evaluation is two-fold: to determine the extent to which the project's goal and specific purpose are being met or can be met within the life of the project; and to provide the Mission and the GOT/CTDA with guidelines to undertake any changes in project design or implementation procedures required.

The project is unique in Tunisia with its emphasis on beneficiary involvement in the management and financing of recurrent costs of potable water points in the central part of the country. Thus, there is great interest on the part of the GOT and of other donors in evaluating the success of project activities. If successful, it is envisaged that the government will adopt the central Tunisian model nationally and seek financing from other donors in order to achieve this.

A major focus of the evaluation will be on policy changes, important assumptions affecting achievement of project purposes, institution building strategies (both water user associations (WUAs) and within the CTDA, and the general socio-political-economic setting. Recommendations pertinent to the role of CTDA as primary manager and executor of project activites, including areas requiring further support or emphasis, will be made. Recommendations should include discussion of the range of assistance options available should the GOT wish to continue this type of project and measures for adapting and expanding this model elswhere in Tunisia.

Project components will be evaluated against EOPS conditions and output indicators; available information on WUAs- including social, economic, political, and legal impacts- will be reviewed. The evaluation will identify special or on-going problems impeding execution of outputs and determine if implementation plans and/or strategies need to be modified.

III. BACKGROUND

The long term goal of the project is to improve the quality of life of the rural poor in the CTRD program area. The project has three purposes: 1) to establish and refine a coordinated and decentralized institutional approach to rural water operations and maintenance, with user participation, and user fees, demonstrating a model to the GOT which may be appropriate for adoption as a nationwide strategy; 2) to maximize water investments by improving site selection for new and improved water systems; and 3) to provide improved access to potable water for underserved rural populations.

The goal and purpose will be achieved through activities in three areas: 1) technology transfer (development of up to 30 new sites, 4 extensions and 2 pilot house hook ups), 2) local institutional development (WUAs able to operate water systems and recover operations and first level maintenance costs), and 3) regional institutional development (establishment of the Unite d'Autogestion in the CTDA, TA in engineering, maintenance, cost recovery, sanitation and health will assist the CTDA and WUAs). By 1990, project activities should achieve the establishment of WUAs at all water points in the program area with 85% of them covering 100 percent of operations and maintenance costs. New installations will be providing potable drinking water to serve an average of approximately 50,000 people. At least one other rural area in Tunisia will be adopting the CTDA model. The evaluation team will closely examine the Logical Framework in the Project Paper to assess progress to date in meeting expected project outputs.

IV. STATEMENT OF WORK

The evaluation will address two levels of achievement. First it will consider the appropriateness of activities undertaken under the project and their contribution to attaining the project's intended outputs and purposes. This aspect will also consider the social, economic, financial, political and legal environment in which project activities have been taking place and achievements in these areas; examine the validity of assumptions made during the project design; document impediments encountered to implementation of project activities and recommend solutions to overcome any impediments. It is assumed that the project will have a differential impact on and involvement of men and women. Thus, all discussion of beneficiaries needs to be gender disaggregated.

Second, the evaluation will assess the contribution of this project to the overall CTDA (and GOT) objective of rationally selecting and developing financially viable rural potable water sites with maximum beneficiary involvement in order to decrease long term GOT recurrent costs. This review will focus on the CTDA's ability to handle the financial inputs and provide the managerial capability to oversee an institutionally novel and challenging program of activities. The ability of the CTDA to manage the technical side (quality of well construction and civil works, maintenance schemes, etc.) of the project will also be examined. The review will recommend modifications to on-going activities as needed and recommend ways to improve/develop the CTDA and the WUA's capabilities to manage efficiently and effectively a scarce resource. An initial mapping out of priority areas of focus after termination of the project will be made including strengthened linkages with other relevant Tunisian institutions, both governmental and non-governmental.

At a minimum, the contractors will address the following questions. Additional topics may emerge during the evaluation which may be pertinent and should be pursued depending on importance overall to achievement of project objectives and according to time constraints.

A. Project activities, implementation status, and implementation issues

1. Implementation progress in each of the project activity areas and status vis-a-vis indicators in the PP log frame. These project activities are discussed in the PP, ProAg, PILs, contract documents and applied studies.

a. Summary of activities undertaken to date.

b. Review of changing political environment with regards to the private sector and cost recovery concerns of the project and the CTDA's future management of project activities.

c. Status of each component, vis-a-vis implementation plan and project targets.

d. Problems, actual and/or anticipated.

e. Assessments: CTDA's participation, ability to perform/constraints including availability of personnel; quality of TA, both host country and direct AID contracts; involvement of USAID; overall management of project components.

f. Recommendations

2. Project activity and implementation issues (based on PP descriptions, consultant reports and discussions with project implementors)

a. Technology Transfer: New Interventions:

AID will finance up to 30 new boreholes, 4 extensions and 2 pilot house hook-ups. Assistance will be provided to the CTDA by a Tunisian A&E firm for construction related activities and by a US firm for the execution of a Water Resources Mapping Study.

(1) Construction Activities Location:

- Does the location of well sites respond to the previously determined criteria according to both technical, social and political need?
- Does the location of civil works construction, ie watering troughs, drainage, etc, respond to both technical considerations and the needs of the beneficiary populations?
- Are sound economic and financial judgements being made in decisions concerning location of sites, types of civil works to construct and types of pumping equipment to install.

Standards and Appropriateness of Technologies:

- Are the standards for construction in conformance with standard AID regulations? Have regular quality control inspections been made by the A&E firm? by AID staff? Have sites been properly certified by an AID engineer prior to reimbursement?
- Have standard type designs been developed and used to the extent appropriate at individual sites?
- Have the least cost designs been chosen for use wherever possible?
- Has the CTDA chosen the most appropriate/least cost technologies to use when equipping sites?

Supervision and Management:

- How effective has the A&E firm's work been? Do they adequately perform their tasks? Are their liaison functions adequately done to ensure that the technical side of the project is done properly?

- How effective has the CTDA been in managing the A&E firm? What institutional development has been ocurring in the CTDA with regards to construction activities? For instance, does the CTDA have the technical capacity to undertake similar activities on its own (both technical and institutional)? Does it need to achieve this capacity? If not, and the trend is towards external contracting, then does the CTDA have the structures and the management capacity to oversee the work being done by the private sector?

Irrigation:

- What impact does the current projected use of extra water for irrigation have on the aquifers? Should this use be controlled? by whom? limited? or discouraged?
- Identify irrigation specific issues that will need to be addressed in the Improved Water Resources Management (IWRM) Project.

(2) Water Resources Mapping Study

Usefulness to Project and to the CTDA:

- To what extent has this study contributed to the optimal selection of well sites to develop?
- To what extent have CTDA staff been trained to use the current maps and to update them based on new information in the area?

To what extent will these maps be used in the planning of water points and other infrastructure eg. (agriculture, schools) developed by the CTDA and other GOT agencies in the region?

Appropriateness for GOT and USAID use in general:

Is it cost effective to develop similar studies in other regions? Can they be produced at less cost and still provide a viable planning tool?

What lessons have been learned from the exercise of developing this study that can be used by the CTDA and USAID in other activities?

b. Institutional Development: Water User Associations

Water User Associations (WUAs) will be established around each new and existing water point in the project area. These WUAs will serve as a model of decentralized management by raising money to cover operations and first level maintenance costs, providing inputs into the site location, design and construction process, undertaking health and sanitation education and maintaing site discipline and order. The project is tasked with devloping WUAs both for sites already in existence and those being built by this project, therefore the questions listed below should distinguish between the old and new project where relevant.

Role of CTDA and GOT:

- To what extent is the project the CTDA and specifically the Unite responsible for the creation of and changed role of WUAs in the management of water resources in Kasserine/Gafsa?
- To what extent has the GOT, outside of CTDA, supported the creation or created constraints hindering their development?
- From the perspective of the beneficiaries, examine the role of the Unite in developing the WUAs and indicate recommendations for improvements if any.

Water User Associations:

- Evaluate how many associations have been created? How many have been given formal legal status?
- Evaluate how well the associations are functioning and able to undertaken their envisaged tasks?
- To what extent have the associations collected funds to operate and maintain their sites? How have they responded to the application of the Cost Recovery Plan (devloped under the project)? Will the associations be covering their costs within the time frame estimated by the project?
- Evaluate training activities for the WUAs? This should include mechanics for pump operators, management and finance for WUA presidents and treasurers, sanitation training to the village "animatrices" and any other training? Has training been adequate? What suggestions do participants have for improving it in the future?
- To what extent did the associations participate in the location of well sites and associated civil works? To what extent did they participate in construction activities? According to beneficiaries would greater involvement be appropriate?
- Analyze the socio-econmic impact of the project on rural families. Examine the impact of the project on family labor and income (may be different for men, women and children). Identify any negative consequences and recommend changes to alleviate them.
- There are indications that water at these sites is not used exclusively for household consumption. In some cases, water is used for hand watering of productive trees and small gardens, in others, actual irrigation is ongoing? What impact does the use of water for irrigation have on the institutional development of WUAs and their management capabilites? Are or should different rates be charged for household versus agricultural use? What is the economic impact on families? What is the impact overall of irrigation use for the project?

Role of Women:

-Evaluate the formal and informal roles and involvement of women in the project? Are there areas which require improvements? Are women receiving adequate training, ie where women are informal pump operator assistants, have they received any necessary training?

Recommendations:

Recommend specific measures for continuing to encourage and expand beneficiary participation in the project, differentiating where appropriate by gender.

c. Institutional Development: Regional Level

The project assumes that by 2000 SONEDE will assume responsibility for all rural water supply. In advance, therefore, the necessary institutional framework needs to be put into place. This includes creating and institutionalizing the Unite d'Autogestion in the CTDA, developing the necessary back-up maintenace support for the systems (Maintenance contract), training in sanitation and health and coordination for this with the Ministry of Public Health, the coordination of Local and Regional Water Committees with WUAs and other GOT agencies and overall coordination of development and management in this sector. More specifically the project is responsible for the creation and development of the Unite and the evaluation should focus on the performance and potential of this unit.

The Unite d'Autogestion:

- Evaluate the performance of the Unite in achieving project objectives.

- Is the Unite adequately staffed? adequately trained? institutionally viable to play the envisioned role in the project?

How well has the Unite achieved the targets for creation and establishment of WUAs? Does the Unite provide sufficient field support to these entities?

- To what extent has the Unite contributed to the establishment of relations between different organizations (DRE, GR, PDR, Gouvernorat, Delegue, Local and Regional Committees, Ministry of Health, etc.)? How adequate are the linkages between these different organizations and with the WUAs?

- Evaluate the overall management of the Unite and recommend improvements.

Evaluate constraints specific to the Unite which hinder full realization of objectives and recommend solutions.

- Evaluate the capacity of the Unite to manage the training for which it is responsible and its capacity to manage TA, both local and direct AID.

Linkages with the rest of the GOT:

- Are the institutional roles and responsabilities clear between CTDA, SONEDE, the Ministry of Health and the Gouvernorat?
- Evaluate the capacity of other GOT organizations, with which the CTDA interacts, to handle their responsibilities? For instance, Ministry of Health with the health and sanitation training, the PDR and its maintenance brigade's ability to respond to second level repairs.
- Recommendations for increasing and improving regional institutional development, including identifying any GOT structural constraints should be provided.

d. Hygiene Education

- Have there been any changes in hygiene behaviour as a result of the project?
- What has been the change in the incidence in water-related diseases?
- Is it clear who has the responsibility for hygiene education?
- What has been the effect of project-related hygiene education activities?
- What recommendations does the team have for improving the hygiene education component?

e. Policy issues

Since the project was designed there have been political and policy changes in the country which may need to be taken into consideration:

- Is there continued support for decentralization?
- Is there continued support for the assumption by beneficiaries of recurrent costs to the extent feasible on publically built infrastructure?
- Have policies enabled turning even more than envisaged over to the private sector? If so, recommendations for change in design should be made?
- An analysis of any changes in the policy environment of relevance to project implementation should be made.

f. Project management and design

The CTDA is responsible for primary management and execution of the project with the assistance of short term host country and direct AID contractors. The adequacy of the CTDA's management needs to be evaluated, USAID's backstopping performance should be reviewed and the quality of the TA provided to the project should be examined.

CTDA Capabilities:

- Evaluate to what extent the CTDA has developed institutional and technical capabilities to run the project.
- Examine the CTDA's anagement capabilities and suggest improvements as necessary.
- Evaluate the degree of internal coordination between the different offices in the CTDA responsible for project implementation and suggest measures for improvement if required.
- Evaluate the capabilities of the CTDA to manage host country contractors.
- Does the CTDA have the capability to function without external TA in the management of future activities of this type?
- Has the CTDA put sufficient emphasis on the cost effectiveness of sites developed? What changes may be needed?
- Evaluate financial, structural and staffing constraints within the CTDA which hinder effective implementation and recommend corrective actions.
- Evaluate the effectiveness of the CTDA's relations with other GOT and nongovernmental institutions. To what extent has the CTDA improved coordination between other groups in the water resources sector?

General Considerations:

- Evaluate the overall progress of the project against PP criteria, ie. physical, financial, procurement of commodities, etc. and recommend any needed improvements.
- Recommend any needed management changes for the project.
- Examine the impact of TA on project outputs and on the institutional development of the CTDA.
- To what extent is the Central Tunisian model transferable to other regions of the country? If so, recommend specific measures.

g. Other Donors

To the extent relevant, evaluate the role of other donors and other activities in this sector, both in Central Tunisia and nationally.

- What collaboration and/or coordination has taken place with other donor organizations?

- Is there anything being done by other donors which will positively or negatively impact on project implementation?

h. Pipeline

Review the financial status of the project according to AID criteria.

- Does a pipeline problem exist? If so, indicate reasons and ways to solve.

B. The Future

The Project's overall contribution to decentralization and cost recovery objectives of the GOT should be reviewed. This should include suggestions for the CTDA in particular for building on lessons learned in the project and suggestions for the GOT in general for future interventions.

C. Team Planning

The contractor will arrange and conduct team planning in Washington, D.C. if all the consultants are Washington based, just prior to the team's departure, or in Tunisia upon immediate arrival if some of the consultants are based in Tunis. The team planner will be responsible for gathering and disseminating all relevant documents, contacting individuals and arranging for participating at the team planning meeting, arranging the meeting site, and preparing a report (for the Mission) on the proceedings. The Mission and IDA should be contacted well in advance to ensure that full documentation is available to team members prior to their arrival in country. The team planning meeting is expected to take 3 days; and preparation time an additional 3 days.

V. METHODS AND PROCEDURES

1. Duration: The evaluation will take approximately six weeks. It will take place o/a January 8 - February 20, 1989. It will consist of a preparatory phase in AID/W; on-site fieldwork in Tunisia; and report completion in the field and in AID/W. These phases are described below and an illustrative schedule provided.

a) Preparatory phase: proposed dates January 8 - 10. During this phase the team will review documents and meet with AID/W and contractor representatives (IDA, Pragma) to discuss the

project, its objectives and the scope of work for the evaluation. During this team the team will review the terms of reference; plan methods to collect data/information, developing any forms and/or questionnaires to be used in the interviews and fieldwork; and delineate team responsibilities.

b) On-site field work: proposed dates January 13 - February 7. Based in Kasserine, the team over a 3 week period will review data, hold discussions with GOT agencies, primarily CDTA, plus all others associated with the project, and contractors to the project, as well as other donors as appropriate and the WUAs. Prior to departure for the field, the team will spend 3 working days in Tunis to discuss the proposed evaluation with Mission staff and gather together any written materials not already consulted in Washington, D.C. Given the breadth of material to be covered, it is expected that the team will observe a six day work week. Mid-way through the evaluation an overnight trip to Tunis should be planned in order to brief senior staff at the Mission on progress in the evaluation. During their stay in Tunisia, the team will draft the evaluation report which will be left with the Mission prior to departure from country.

c) Report Writing and Review: proposed dates February 8-11. The final 4 days will be used to complete the draft report and recommendations, and to review the document with the Mission and the CTDA in Tunis. Following this, the team will complete a final version of the report. The team leader will be alloted an additional week to finalize the report. This can be done on-site in Tunis or immediately upon return to the U.S.

d) Debriefing: A debriefing will be scheduled before the team leaves the country with USAID, Ministry of Agriculture officials and the CTDA; and a debriefing will be scheduled with interested Bureau and S&T staff upon return to AID/W.

2. Methodology: The team will have access to all data gathered as part of project activities as well as program, technical and financial documentation from both USAID and the CTDA. It is expected that both qualitative and quantitative data analyses will provide the information on which the evaluation is based.

VI. EVALUATION TEAM COMPOSITION

USAID plans to obtain the necessary skills for the evaluation through a buy-in to the centrally funded WASH III contract.

A. Team Composition: The team will have a multi-disciplinary mix of consultants who have experience in evaluation, actual long-term implementation experience in rural development projects, preferably in potable water, and with skills in the following areas: hydrogeology and engineering, financial and economic analyses, institutional development and beneficiary participation, social-cultural analyses, and hygiene education. The team composition may change depending on the experience of the team members, provided that the same skills are covered.

The team, ideally, will consist of five specialists: one from AID/W (not funded under this PIO/T), two U.S. or international consultants and two Tunisians with international experience. In order to provide the mix of expertise required, however, the total number on the team may be increased if more Tunisians are used. At least one team member (other than the AID/W person) will have particpated previously on an AID evaluation and will be responsible for briefing the others of specific Agency requirements and expectations. Also, one CTDA representative, at a mid to senior level, will participate in the evaluation on a continuing basis. Team members should be fluent in French (minimum FSI S-3, R-3). The draft left by the team prior to their departure should be in English and arrangements should have been made by the team for a locally translated French version to be available one week after their departure. Translators can be hired locally to do these drafts.

Additional information on the required qualifications and expertise of the planned evaluation team are presented below. The CTDA suggests that it might be most effective to have the institutional analyses of both the GOT and the WUAs undertaken by a Tunisian familiar with the local situation or by a foreigner fluent in Tunisian Arabic and thus able to interact directly with WUA members.

1. Team Leader: The team leader (an expatriate) should have at least ten years' experience implementing rural development projects especially those involving water resources and should have worked on projects emphasizing beneficiary participation. This person should have experience in evaluation and with AID. By preference, this person will have a background in the social sciences and be able to assist with the institutional development analyses (specifically the WUAs and the Unite). Previous work in dry African countries or the Middle East is essential and a preference for Tunisian experience is expressed.

2. Hydrogeologist/Engineer: This specialist (an expatriate) should also have extensive background working in the water sector in dry African or Middle Eastern countries. Tunisian experience is desirable. He/she should be able to review all technical aspects of the project and should be able to make some recommendations for future siting of wells based on information made available by the CTDA.

3. Institutional and/or Management Specialist (Tunisian of international standing): This person needs to have in-depth knowledge of the Tunisian bureaucracy in order to adequately assess the CTDA's structure and management capacities and possess an ability to undertake financial analyses.

4. Anthropologist/Rural Sociologist (Tunisian of international standing): This person must have extensive prior work experience in rural development in the international context and should have worked before in projects promoting beneficiary particpation and if possible with WUAs. The evaluation of project training activities including hygiene education will probably also fall to this person.

5. Agricultural Economist/Financial Analyst (an expatriate) sensitive to social Science issues: This specialist should be able to undertake the requisite economic and financial analyses specified and alluded to in the SOW and should have a sensitivity to the difficulties of economic measurements in the rural context. He/she will need to have worked in dry African or Middle Eastern countries and have a good understanding of rural production systems.

If the hydrogeologist/engineer has the requisite experience in implementing rural development projects and AID evaluation, as well as knowledge of the social sciences and institutional development, it is possible he/she could fill the team leader position. In which case, a hygiene educator/training specialist position (an expatriate) could be filled, keeping the total of expatriate consultants to three.

B. Administrative Arrangements

The USAID/PM Office will serve as the primary liaison for the team, facilitating contacts and providing information as needed; the USAID Program/Evaluation Officer will work with the team to ensure that the evaluation is progressing according to the terms of reference. At the CTDA the Planning Division will be the main liaison.

1. Secretarial Support, Word Processing, Office Space and Translation: The preparation of the draft and final evaluation report is the responsibility of the team leader. Secretarial support is difficult to obtain in Kasserine and if needed in Tunis arrangements should be made in advance to hire someone. The CTDA has limited word processing facilities if team members want to avail themselves, but the team should come equipped with portable computers for maximum efficiency. Limited photocopying facilities exist in Kasserine and are somewhat better in the private sector in Tunis. The CTDA will provide office space in Kasserine. For the limited time the team is in Tunis, a small conference room is the USAID building will be available for the team's use. Professional translators can be hired in Tunis but they are frequently booked up so their time should be arranged in advance.

2. Vehicles: The team will need to rent vehicles, in some cases 4-wheel drive, to ensure their mobility while in Tunisia. The CTDA can be of limited assistance, but only so far as team members plan to join staff on their regularly scheduled monitoring trips.

3. Funding: Except for costs associated with the AID/W representative, USAID will finance the evaluation with project funds designated for this purpose. A total of $ 115,000 is reserved under this PIO/T to finance costs associated with the preparation and management of team planning in AID/W and the services of non-AID members of the team. The estimated cost includes salaries for technical assistance, per diem, international and domestic travel, vehicle rental/ground transportation, secretarial/translation services, photocopying, team planning support, other miscellaneous expenses and contingencies (see Attachment 2 for details).

VII. REPORTING REQUIREMENTS

A. Format of the Report: The evaluation team will prepare a written report that conforms to the Asia/Near East Bureau Guidelines for Evaluation. A set of these guidelines is available in AID/W and should be procure before departure to the field. The report will include sections as stipulated by these guidelines. The major sections are more fully described below.

1. Basic Project Identification Data Sheet: One page.

2. Executive Summary: Three pages, single spaced using the AID Evaluation Summary format and directions found in the afore mentioned guidelines.

3. Body of the Report: The report is to include a description of the country context in which the project was developed and carried out, and provide information (evidence and analysis) on which the conclusions and recommendations are based. The body of the report should not exceed 40 pages in length although the evaluators may include details in appendices.

4. The report should end with a full statement of conclusions and options and problems identified. Conclusions should be short and succinct, with the topic identified by a short sub-heading related to the questions posed in the statement of work. Whenever possible, the recommended option should specify who, or what agency, should take action.

The evaluators will clearly distinguish between their findings, their conclusions (i.e. interpretations of the findings), and their recommended options that follow from the findings and conclusions. This information will be expressed schematically in a matrix in the evaluation report. "Lessons Learned" and "Unintended Consequences" from project activities will be included in this section.

5. Appendices: These are to include at a minimum the following:

a. the evaluation scope of work;

b. the logical framework, together with a brief summary of the current status/statement of the original inputs and outputs.

c. methodology of the evaluation, including copies of instruments and questionnairres used;

d. a bibliography of documents consulted.

Other appendices may include more details on special topics and a list of people/agencies consulted.

B. Submission of Report and Asia/Near East Evaluation Summary:

The team will submit an outline of the final report 7 days before the team's departure, and a preliminary draft will be presented to USAID at least 3 days prior to their departure from Tunisia.

Two copies in English and French will be provided to the Mission two weeks after the team leader's depature if the final report is done in the U.S. or one week after if the report is done in Tunis.

Ten copies of the final report will be due in USAID/Tunis in both English and French within one month following Mission and CTDA transmittal of comments to the contractor.

The team will also be required to complete the Asia/Near East Evaluation Summary (both the abstract and Part II) for submission at the same time as the report.

C. Debriefing:

Prior to departure from Tunisia, the Evaluation team will conduct a debriefing for the USAID Mission Director, or his designee, for Ministries of Agriculture and Plan officials and and for the CTDA. Upon receipt of Mission approval of the report, the team/team leader will debrief AID/W personnel.

APPENDIX B

NEWSPAPER ARTICLE: "WATER: THE NEW STRATEGY"

PROMOSPORT

Place à la Coupe

(Voir p 15)

La Presse de Tunisie

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DEVELOPPEMENT INTEGRAL

BEN ALI REPOND AUX BESOINS POPULAIRES

EAU POTABLE

Un programme général au profit de 500.000 habitants dans les zones rurales

QUARTIERS POPULAIRES

Une enveloppe supplémentaire de 5,6 M.D. pour répondre aux besoins les plus urgents

Eau : la nouvelle stratégie

Le programme de 1989 à 1991 coûtera 74 MD et touchera une population rurale de 2,581 millions d'habitants

La stratégie future s'articulera autour de quatre axes. Elle permettra d'améliorer l'implantation des localités rurales, d'augmenter le nombre des AIC et d'intensifier les interventions de la SONEDE et du génie rural dans le domaine de l'eau potable.

(Voir p. 4)

L'eau potable, problème crucial des zones rurales

Eau : la nouvelle stratégie

LA PRESSE — Le Chef de l'Etat a pris hier au cours d'un CM restreint une série de mesures pour améliorer le taux de desserte de l'eau potable dans les régions rurales. Ces décisions font suite au constat de la situation actuelle.

A la veille du VIIème Plan, la population rurale de la Tunisie comptait, en 1986, 3,2 millions d'habitants dont 1,5 million vivent dans des villages ou agglomérations ruraux. Le reste de la population est dispersé. L'alimentation en eau potable se faisait, pour cette catégorie du peuple tunisien soit à partir de branchements particuliers ou des bornes fontaines publiques, soit par le biais de puits, citernes ou forages, soit alors à partir de puits publics non équipés, des citernes publiques et retenues d'eau et des oueds.

Il faut préciser que la qualité et la quantité de l'eau varient d'un mode d'alimentation à l'autre.

Ce qui a été déjà réalisé

Le VIIème Plan a déjà accordé une importance particulière à ce problème. C'est ainsi qu'un montant de 110 MD a été alloué à ce secteur. 51 % seulement de ces investissements on pu être réalisés permettant la desserte de 564 localités groupant 405 mille habitants ruraux. La cause de ce manque réside dans le manque d'identification des projets et les contraintes des structures et de l'organisation. Le taux de desserte réalisé jusque-là et qui n'a pas dépassé 58 %, restait ainsi limité, et certains habitants dispersés, restent assoiffés.

Il est à remarquer ici, que la région la moins favorisée est le Nord-Ouest (Jendouba, Béja, Siliana et Le Kef), avec un taux de desserte moyen de 41,2

Un programme triennal de 74 MD

• Pour 1989, et afin de remédier à cet état, le programme décidé par le Chef de l'Etat englobe 300 localités ou agglomérations, groupant 185 mille habitants pour un coût de 30 MD. Il sera réalisé par la SONEDE, le génie rural et les programmes de développement rural et de développement rural intégré (PRD et PDRI).

• En plus de la prise en charge de sa part dans ce programme, la SONEDE engagera un programme intéressant 150 localités. Ceci nécessitera des investissements de l'ordre de 9,5 MD dont 4 MD à titre d'accélération du programme complémentaire.

• Pour les deux dernières années du VIIème Plan (1990 et 1991), il est prévu l'alimentation en eau potable de 598 localités rurales groupant 300 mille habitants pour un montant de 54 MD. Ce programme sera réalisé par le génie rural, le PRD et le PRDI et la SONEDE.

C'est ainsi que le taux de desserte atteindra 75,5 %, touchant une population rurale de 2,581 millions d'habitants sur une population rurale totale de 3,119 millions d'habitants.

Une nouvelle stratégie

Il reste cependant que l'Etat ne se limitera pas à colmater les brèches et à agir au coup-par-coup. Une stratégie à long terme a déjà été définie pour développer le secteur de l'eau potable rurale. Cette nouvelle stratégie sera axée autour de quatre axes

1) Prospection des ressources dans les zones défavorisées.

Une opération de recherche de ressources en eau sera lancée en vue de satisfaire les besoins des zones rurales non encore desservies. 53 forages de reconnaissance seront effectués pour un coût global estimé à 4 MD.

2) Elaboration de plan d'aménagement rural.

Ce plan est destiné à améliorer le taux de desserte et à diminuer le coût de l'exécution des projets. Il aura pour but de fixer les orientations nécessaires à l'implantation des localités rurales.

3) Accélération de la mise en œuvre des structures de gestion collective.

Ces structures sont représentées par les associations d'intérêt collectif (AIC). Actuellement, il y en a 200 qui fonctionnent et procèdent à la collecte des cotisations des participants.

Un effort supplémentaire sera fait pour la création des AIC grâce à une campagne d'explication des textes juridiques en vigueur. Des circulaires d'application, au cours d'études au ministère de l'Agriculture, seront envoyées aux parties concernées pour mieux expliciter ces textes.

4) Accélération du programme et du financement supplémentaire.

Cette action vise à intensifier le programme de la SONEDE qui devra à partir de 1991, maintenir un rythme annuel d'engagement de 150 localités et à raison d'un investissement annuel de 6 MD. Cette action vise aussi le génie rural dont les services ont déjà mis au point un programme complémentaire de 53 MD pour desservir 226 mille habitants répartis entre 450 localités rurales. Ce programme sera échelonné sur cinq années.

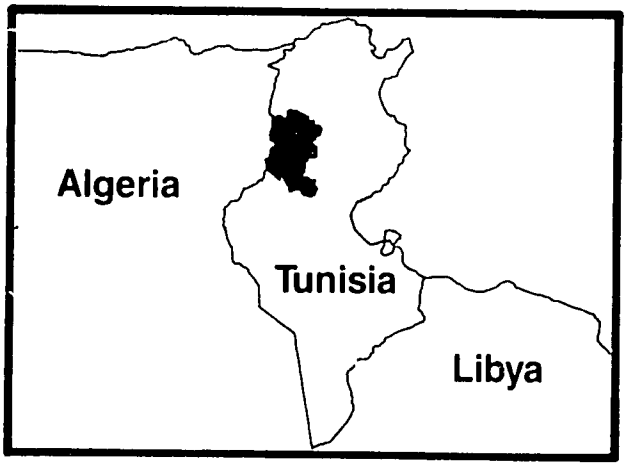
Notons enfin que le programme de desserte des écoles primaires, dispensaires et mosquées s'étalera sur 5 ans et nécessitera 15 MD. 2 MD ont déjà été alloués pour la première tranche de 1989.

K. B.

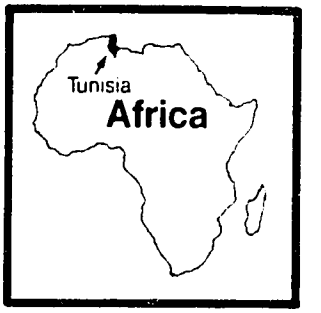
APPENDIX C

PROJECT AREA MAP

Project Area Map



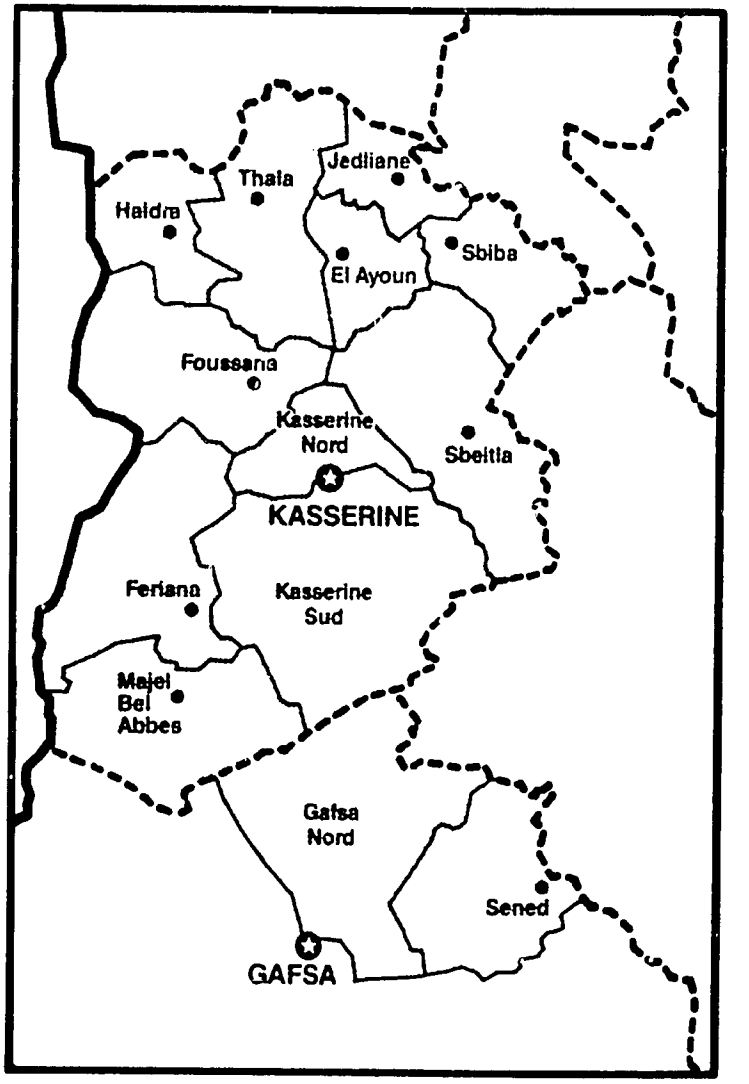
Region Map



Location Map

Legend

- Project Area
- Governorate Boundary
- Delegation Boundary
- Capital of Governorate
- Capital of Delegation



Project Area Map

Source: Office de la topographie et de la cartographie

Year: 1984

APPENDIX D

PROJECT LOGICAL FRAMEWORK

APPENDIX D

PROJECT DESIGN SUMMARY: LOGICAL FRAMEWORK

Project Title: Rural Potable Water Institutions
Life of Project: FY 86 - FY 91
Total U.S. Funding: $ 6.5 million

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal:	**Measures of Goal Achievement:**		
To improve the quality of life of the rural poor in the CTRD program area.	o Improved health of target populations (unquantifiable) o Increased productivity of family members (unquantifiable)	o Regional Directorate of Health statistics on incidence of diarrehea, ameobiasis, scabies, etc. o CTDA monitoring and periodic studies	o Improved access to water will lead to increased use of water; this increased use leads to improved health o Time savings resulting from decreased distance to fetch water will be reallocated to more productive activity
Project Purpose:	**End of Project status:**		
1. Establish and refine a coordinated and decentralized institutional approach to rural water operations and maintenance, with user participation and user fees, demonstrating a model to the GOT which may be appropriate for adoption as a nationwide strategy.	o By 1990, Water User Associations (WUAs) will have been established at all water points in the program area and 85% of them will be covering 100 percent of O+M costs.	o CTDA monitoring reports o WUA Accounts	o High level political support for WUAs will continue. o Citizens will continue to accept need to pay for water themselves and will be able to pay at least O+M costs.
	o Regional & Local Potable Water Committees will be meeting regularly; site specific WUAs will have representatives on at least 4 local-level committees.	o Minutes of Committee Meetings (thru CTDA) o Membership lists of Committees (thru CTDA)	o Regional & local technical services will continue to cooperate in improving rural water supply.

	o Regional and local private sector suppliers and service enterprises will have established linkages with WUAs for fuel, spare parts, and basic repair.	o Sample survey (informal) during project evaluations	o Supply of private sector maintenance services will respond to demand in rural areas.
	o SONEDE will have assumed service responsibility for at least one site administered by a WUA.	o SONEDE records	o SONEDE activities under IBRD 7th Loan will continue more or less as planned.
	o At least one other rural area of Tunisia will be adapting the [redacted] area WUA model. ODC	o Ministry of Agriculture (Genie Rural) reports.	o The GOT will choose to adopt the WUA for another rural area.
2. Maximize water investments by improving site selection for new and improved water systems.	o Kasserine Regional Water Committee will have adopted a stronger policy for guiding site selection of Project and non-Project sites for installation of water points which includes cost effectiveness analysis of alternative approaches and regional/spatial considerations.	o Review of non-AID-funded sites selected annually by committee during Project Evaluations.	o Site selection will continue to be undertaken through Regional and local Committees with WUA participation based on shared criteria and commitment. o CTDA will improve cost center financial data analysis.
	o Hydrogeologic data base in in Kasserine, North Gafsa, and Sened will serve as basis for rational exploitation of water resources.	o DRES documents	o DRES in Gafsa Governorate will cooperate fully with CTDA and DRES/Kasserine
3. Provide improved access to potable water for underserved rural populations.	o At least 30 new installations (26 productive boreholes and 4 extensions) and up to 2 NHM systems o New installations will be providing potable drinking water to serve an average of approximately 50,000 persons	o Project monitoring and evaluation	o Exploitable water resources exist in currently unreached areas. o At least 26 out of 30 plannned boreholes will yield a minimum of 1-5 LPS.

			o Hydrogeologic resources in Kasserine, North Gafsa and Sened are such that cost-effective, productive wells can be drilled.
Outputs:	**Magnitude of Outputs:**		
1. Water User Associations established and functioning in Kasserine Governorate and in Gafsa delegations of North Gafsa and Sened with o Legal status o Financial autonomy o Management autonomy o Defined membership o Trained leadership/ management	1.a. All WUAs in both Governorates will have legal status to collect and disburse funds b. 90% of WUAs will have postal or bank accounts c. 90% of WUAs will have used local private sector for maintenance or repair. d. 50% of WUAs will have invested some funds in site improvement e. 100% of guardian-pumpists and WUA treasurers will have received formal and on-the-job training.	a. Governorate or Ministerial action (decree, law, statute) b. PTT or BNT records; WUA records c. Evaluation survey d. Evaluation survey e. CTDA records and interviews during evaluations	o Regional administration maintains support for experimental efforts
2. Water User Associations supported by decentralized regional support systems coordinated by new "Unité d'Autogestion" (UAG); support includes: o inter-service committees for policy and regulatory actions o Unité for extension and training support o Maintenance Brigade for technical, 2nd degree support o "Education Sanitaire" for health, hygiene and education	2.a. Regional or Local committee representatives will visit each site once each quarter. b. "Unité d'Autogestion" staffed by 4/86; c. Each WUA receives 1 visit/ month by UAG staff by 6/88. d. Regional Maintenance Brigade providing 2nd degree preventative maintenance and repairs on a timely basis e. MOPH Regional Sanitarians and other staff conducting training sessions in each WUA perimeter on a quarterly basis.	a. Evaluation Interviews; committee meeting minutes. b. CTDA reports c. Evaluation; records and interviews d. Evaluations; records and interviews e. Evaluation; records and interviews	o GOT will authorize positions promptly so that staffing UAG can be completed.

3. New water distribution sites established and functioning.	3. a. 30 boreholes, (of which a minimum of 26 are productive), 4 extensions and 2 house hook-up systems completed by 12/31/90 b. RSH and DRES trained in use of equipment, testing equipment. c. Tunisian A&E firm providing timely design, advice and construction monitoring.	3.a. DRES and CTDA reports b. Project records c. Project records d. Project records	o The TH-60 drilling rig purchased during previous proj. will continue to be used in CTDA area o Research equipment provided by AID will be procured and delivered in a timely manner
4. Hydrogeologic data base in Central Tunisia improved	4. a. Water Resources Mapping completed by 6/86 to enable site selection to take place b. Hydrogeologic data improved through test drilling in southern Kasserine, North Gafsa and Sened in 1986, 87, 88 with new research.	4.a. DRES and CTDA reports b. Project records c. Project records d. Project records	o Contracting by AID is undertaken in timely manner with qualified and interested individuals and/or firms.

Inputs:

Implementation Targets:
($'000)

	AID	TUNISIA
1. Personnel and TA	1,162	795
2. Construction	3,967	-
3. Commodities	369	611
4. Training	189	187
5. Other	-	1,120
Evaluation/Audit	232	-
Inflation	581	677
Total	6,500 and	3,390

APPENDIX E

EVALUATION INSTRUMENTS/METHODS

Contents:

1. List of Sites Visited
2. Data collection at Water User Associations
3. Technical Questions for the Pump Operator

Appendix E-1

WUA SITES VISITED - BASELINE DATA COLLECTED FROM CTDA BEFORE VISITS

SITE	CHABIBA	OULED BOUALLEGUE	BOULAABA	OULED AHMED	DHOU-AOUDA	KODIAT MOUSSA	HANCHIR BGAR	OUSNINET 2	ZAOUIET BEN AMAR	ZELFANE	GONNA	KHMOUDA 2	MACHEK CHAMS	EDHRAA
DELEGATION	GAFSA NORD	GAFSA NORD	KASS. NORD	FERIANA	SBEITLA	KASS. SUD	EL AYOUNE	KASS. SUD	SBEITLA	THALA	SBEITLA	FOUSSANA	SBEITLA	SBIBA
CRITERION														
WATER SOURCE	BOREHOLE	BOREHOLE	BOREHOLE	BOREHOLE	BOREHOLE	2BOREHOLES	BOREHOLE	BOREHOLE	SOURCE	BOREHOLE	BOREHOLE	BOREHOLE	BOREHOLE	DUG WELL
WATER USES	POTABLE	POTABLE	POT/IRR	POTABLE	POTABLE	POT/IRR	POTABLE	POTABLE	POTABLE	POT/IRR	POT/IRR	POTABLE	POTABLE	POT/IRR
POPULATION	900	1080	834	786	1146	270	1338	492	420	348	?	1356	840	408
DATE OF WUA CREATION	1988	1988	1987	1987	1987	1987	1986	1987	1986	1987	1986	1987	1986	1986
LEGALIZATION STARTED?	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
REMOTENESS	FAR	VERY FAR	NEAR	FAR	FAR	NEAR	FAR	NEAR	VERY FAR	FAR	NEAR	NEAR	FAR	FAR
OPERATION OF THE WUA	OK	GOOD	NOT YET	NOT YET	NOT YET	GOOD	OBSTACLES	OK	WEAK	OBSTACLES	GOOD	GOOD	OK	OBSTACLES
SOURCE OF FINANCING	USAID	USAID	USAID	USAID	USAID	GOT	USAID	GOT	USAID	GOT	USAID	USAID	USAID	GOT
CIVIL WORKS DESIGN	CTDA	AUI	CTDA	AUI	CTDA		CTDA		CTDA	GR	CTDA	CTDA	CTDA	
ENERGY SOURCE	ELEC	DIESEL	DIESEL	DIESEL	DIESEL	DIES/ELEC	DIESEL	DIESEL	GRAVITY	DIES/GRAV	DIESEL	DIESEL	DIESEL	DIESEL
OPERATING COSTS	?	?	LOW	LOW	HIGH	LOW	HIGH	MODERATE	LOW	HIGH	MODERATE	MODERATE	MODERATE	LOW
ANIMATRICE PRESENT?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
MAINTENANCE AGENCY	GR	GR	PDR	GR	PDR	PDR	PDR	GR	PDR	PDR	PDR	PDR	PDR	PDR
NOTES										EXTENSION FROM HAIDRA	EXTENSION TO ZNEIDA	SITE FOR NMM		

KEY:

POTABLE = POTABLE WATER AND POINT IRRIGATION ONLY
IRR = DIRECT PIPED IRRIGATION
NMM=NEW MEXICO MODEL (HOUSE CONNECTIONS)
AUI = A&E FIRM
GR=GENIE RURAL
PDR=PROGRAMME DE DEVELOPMENT RURALE

E-2 DATA COLLECTION AT WATER USER ASSOCIATIONS

At each WUA visited, the following groups/persons were met by the social impact members of the evaluation team (Ridha Boukraa, Richard Swanson, Sereen Thaddeus, with the assistance of a member of the UAG). People near and far from the site of the water point were interviewed informally, usually in small groups. Major topics of interest around which questions were developed are noted below.

Persons or type of small group meetings sought out:

(1) WUA president, treasurer, pump operator
(2) groups of men
(3) groups of women and children
(4) water haulers (merchants)

The interviews took place:

(1) near the water point
(2) some distance from water point (2+ kilometers away)

The major themes around which our questions were developed are:

1) The Operation of WUA

- supervision
- role of the president, type of president, selection procedures (relatives, political affiliation, etc.), (who they are)
- role of the treasurer in the collection of dues, where money kept,
- role of pump operator, training payment, collection, selection procedures.
- Are women involved in the use of the pump, or have they been trained to use them?

2) Water Users

- difficulties encountered (user fees, maintenance expenditures)
- improvements made possible by access to water
- attitudes towards the association and levels of satisfaction
- Time-table (before and now) (to carry water) (other new activities)
- are there new economic activities ? (irrigated agriculture, increase in number of animals, others)
- how are disputes settled ? (any examples)
- apart from this water point, where is next closest water point? do members of this association ever use it? When and why?
- is there any time of year when open sources of water used ? (rainy period) (from shallow wells or springs, etc.)
- are there any health problems (diseases) that people associate with the water they use at any particular time of the year? any changes they noticed with generally easier access to clean water?
- are there any recommendations members have to make their water point or WUA more effective?

- how did people get water before this water point and how did they pay for it? Is everyone within a radius of 3 km implicated in use of water? Anyone excluded? Anyone receiving water from farther away?

Observe: equipment: faucets, number, state of repair; watering trough for animals, laundry platforms, drainage system.

3) Use of water

a) drinking water
b) personal hygiene
c) washing of clothes
d) dish washing
e) irrigation
f) water for animals
g) house cleaning
j) re-use of water (dishwashing/cleaning/animals? or others?)

Observe: general hygiene conditions in and around homes and water point; containers and cisterns (clean/covered); domestic water supply.

4) Training Sessions

Community health workers, pump operators, treasurers, evaluation of these seminars

5) Effect on the family

- Have the roles of men/women/children changed following the development of the WUA? Or are the changes foreseen?

- How the various actors see the future of WUA?

- How they see the UAG (hygiene, management, economics, culture)?

E-3 TECHNICAL QUESTIONS FOR THE PUMP OPERATOR

A. OPERATION OF THE POTABLE WATER SYSTEM

1. What is the diesel fuel consumption of the engine (in liters per hour)?

2. How long does it take to fill the water tank?

3. How many times a day do you start the engine (pump)?

   in summer_____ in winter_____

4. For how long do you run the engine (in hours)?

   in summer_____ in winter_____

5. Have you ever run out of diesel fuel? If yes, what did you do?

6. Is the water system satisfactory

   in the quality of water? _____
   in the quantity of water? _____

7. How is the water used at this site?

   drinking _____ irrigation_____ filling carts/tanks____ other?_____

8. How many tractor-tanks per week?

   in winter ____ in summer ____

9. If the buyer has no money, what do you do?

10. Do people use water carefully? (no waste)?

B. WORK OF THE PUMP OPERATOR

1. Who pays you? How much?

2. How were you recruited?

3. Are you insured?

4. Do you take safety precautions?

5. How much time do you actually spend at the site (hours/day)?

   in summer_____ in winter_____

6. What tasks do you do? Describe your typical day.

Maintenance	Frequency
Engine check out/start up	_____
Faucet/pipe repairs	_____
Water tank level check	_____
Oil and filter change	_____
Belt change	_____
Pump lubrication	_____
Clean-up around site (well/engine/pump)	_____

Other?

Task	Frequency
_____	_____
_____	_____
_____	_____
_____	_____

C. BREAKDOWNS

1. Have you been able to repair breakdowns?

2. What sort of breakdowns?

3. What other repairs can you do?

4. What repairs are too hard for you?

5. What do you do in the case of a major breakdown?

6. To whom does the WUA turn to in case of major breakdowns?

PDR _____ GR _____ Yahyaoui _____

7. Has the maintenance crew visited this site?

8. How many breakdowns have you had?

in 1988_____ in 1987_____ in 1986_____

the pump?_____ the engine? _____

minor breakdowns?_____ major breakdowns_____

9. How much time does it take for a major repair?

in 1988_____ in 1987_____ in 1986_____

10. What problems, if any, do you have with breakdowns and system maintenance?

D. PURCHASES

1. Where do you buy diesel fuel?

2. How do you transport it to the site?

3. How much do you buy at a time?

4. When do you start the procurement process?

5. What spare parts have you bought?

6. Where do you find spare parts?

Easy to find At a good price?

E. EXPERIENCE AND TRAINING

1. Had you ever worked with engines and pumps before becoming a pump operator? If so, what type of work? For how long?

2. Did you receive training to be a pump operator?

When ?_____ From whom?_____ How many days? _____

3. What new things did you learn?

4. Was the training sufficient for you?

5. Do you need more training?

in what?_____

F. POTABLE WATER SYSTEM DESIGN

1. As a beneficiary, do you participate in the placement of the livestock trough, standpost, cistern filling station, tank, and in the design of these items?

2. Are there any changes in design or location that are needed?

APPENDIX F

PERSONS AND ORGANIZATIONS CONTACTED

APPENDIX F

Persons and Organizations Contacted

TUNIS

USAID

Mr. George CARNER	Mission Director
Ms. Nancy TUMAVICK	Deputy Director/Projects
Dr. Diana PUTMAN	Project Officer
Ms. Nancy HOOFF	Evaluation Officer
Mr. Mohammed Ali HASSAIRI	Program Officer

MINISTRY OF AGRICULTURE

Mr. Ameur HORCHANI	Secretaire d'Etat
Mme. Fatma LARBI	Directrice de la Collaboration Internationale
M. Ahmed FRIH	Directeur des Offices de Mise en Valeur
M. Khmaiss ALOUINI	Directeur General, Genie Rural (GR)
M. Baccar Mahmoud DJEBALI	Direction Generale du GR et de l'Hydraulique Agricole
M. Mohammed ELGHARBI	Directeur General de la Planification
M. Mohammed FRAD	Agroeconomiste de la Direction Generale de la Planification

MINISTRY OF PLAN

M. Mohammed GHANNOUCHI	Minister
M. Bechir NAIJA	Directeur General Adjoint, Commissariat General du Développement Regional

TUNISIAN FUND FOR COMMUNITY DEVELOPMENT (SAVE THE CHILDREN)

Mr. Humphrey DAVIES	Director

KREDITANSTALT FUR WIEDERAUFBRAU (KFW)

Mr. Michael SCHUCHT	Loan Officer

AGENCE DE LA MAITRISE DE L'ENERGIE (AME)

M. Dirk ULLERICH	Conseiller Technique
Dr. Raouf CHERIF	Chef de Service des Techniques d'Electrification
M. Imed CHAOUCH	Ingénieur, Département des Energies Renouvelables

KASSERINE

M. Hedi AYECH	Gouverneur

COMMISSION GENERALE POUR LE DEVELOPPEMENT AGRICOLE

M. Hamdane RAHOUI	Commissaire
M. Ridha ABDALLAH	Chef d'Arrondissement de la Direction des Eaux (DRE)
M. Nacef Mohammed LOTFI	Hydrogeologue (DRE)
M. Mounir MGARECH	Chef d'Arrondissement du GR

OFFICE DE DEVELOPPEMENT DE LA TUNISIE CENTRALE

M. Ahmed Ridha El FEKIH	President Directeur General
M. Mohammed SAKRI	Sous-directeur, Planification et Evaluation
M. Hajji MOSBAH	Directeur, Aménagement Hydro Agricole (AHA)
M. Moncef HUSSEIN	Chef de Service, Eau Potable
M. Hassen HAMADI	Directeur Agricole, Service de Vulgarisation et de Formation

UNITE D'AUTOGESTION

M. Belgacem KHESSAISSIA	Directeur
M. Lazhar LABABIDI	Adjoint Technique
M. Mokhtar LOUITI	Assistant Social
M. Mohsen THEMRI	Assistant Social
M. Tewfik GHARSALLI	Assistant Social
Mlle Chahrazed NASRAOUI	Stagiaire

PROGRAMME DE DEVELOPPEMENT RURAL

M. Mohammed Hedi JERIDI	Directeur Programme Regional de Développement (PRD)

ARCHITECTURE URBANISME INGENEERING

M. Khaled SAHNOUN	Architecte Coordinateur

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M. Yahyaoui BOUBAKER	Chef d'Equipe
M. Houssine RABAOUI	Electro-mecanicien

SONEDE

M. Mohammed BHOURI	Chef de District

DIRECTION REGIONALE DE LA SANTE PUBLIQUE

Dr. Nejib KOUZANA	Directeur Regional
Dr. Belgacem MAHMOUDI	Chef, Soins de Santé de Base Equipe Regionale d'Education Sanitaire
M. Ammar M'RAIHI	Educateur Sanitaire
Mme Fatma GUESSMI	Specialiste, Statistiques Sanitaires
Mme Chrifa SAADAOUI	Specialiste en Nutrition
M. Mohsen FELHI	Infirmier, Fleaux Sociaux

GAFSA

M. Mohammed Bin RAJAB	Gouverneur
M. Mostafa GUEDRAT	Delegue, Gafsa Nord
M. Abdallah Raouf JARBOUI	Delegue, Sned
M. Mohammed Hedi SFAXI	Secretaire General
M. Abdallah RABHI	Directeur Regional ODTC

KAIROUAN

M. Kamel Haj SASSI	Gouverneur
M. Mohammed LABIDI	Secretaire General
M. Habib ESSID	Commissaire General du Developpement Agricole (CRDA)
Mme Yasmina TLILI	Deputee
M. Moncef HAJJI	Technicien Arrondissement du GR
M. Abdelfattah MADDAR	Technicien Arrondissement du GR
M. Hamami Mohammed SALEH	Chef de Service de l'Hygiene du Milieu

APPENDIX G

LIST OF DOCUMENTS CONSULTED

APPENDIX G

LIST OF DOCUMENTS CONSULTED

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APPENDIX H

TECHNICAL AND FINANCIAL DATA ON SITES FUNDED BY USAID

Contents:

1. Technical Aspects
2. Actual Costs
3. Financial Aspects--Fixed amount reimbursements
4. Construction Status
5. List of USAID Project Sites
6. Analysis of Unit Prices from Civil Works Bids
7. Pumping Equipment Purchased by CTDA for USAID Project

USAID SITES - TECHNICAL ASPECTS

SITE	DELEGATION	GOUVERNORAT	POPUL-ATION SERVED	ESTIMATED WATER NEEDS @50L/P/D m3/day	TOTAL WELL DEPTH m	WELL DIAMETER	TOTAL DISSOLVED SOLIDS g/l	WELL STATIC LEVEL m	TEST FLOW l/s	TEST DRAWDOWN m	SPECIFIC DRAWDOWN l/s/m	UTILIZ. FLOW l/s	UTILIZ. DRAWDOWN m
CHABIBA	GAFSA NORD	GAFSA	900	45	244	9 5/8"		5	15.0	50.0	0.30	15.0	50.0
BOUIBET	HASSI EL FRID	KASSERINE	1050	53	213	9 5/8"	2.4	100	32.5	13.6	2.39	10.0	6.0
DHOUAOUDA	SBEITLA	KASSERINE	1750	88	207	9 5/8"	1.0	117	17.8	23.5	0.76	10.0	20.0
BOULAABA	KASSERINE NORD	KASSERINE	834	42	54	8 1/2"	1.8	8	43.0	10.3	4.17	30.0	
ZANNOUCHE	SNED	GAFSA	2700	135	496	9 5/8"		38	5.0	120.0	0.04	5.0	120.0
JADIDA	SNED	GAFSA	1050	53	393	9 5/8"		9	15.0	65.0	0.23	12.0	
O. BOUALLEGUE	GAFSA NORD	GAFSA	989	49	187	9 5/8"		100	3.5	50.0	0.07	3.5	50.0
OULED ZID	GAFSA NORD	GAFSA	1189	59	384	9 5/8"		46	20.0	20.0	1.00	10.0	
BIADHA	SNED	GAFSA	1134	57	478	9 5/8"							
OULED AHMED	FERIANA	KASSERINE	1020	51	150	9 5/8"	0.6	44	20.9	3.4	6.15	15.0	3.0
KODIAT TRICHA	SBEITLA	KASSERINE	2004	100	250	9 5/8"							
KARACHOUN	MAJEL BEL ABBES	KASSERINE	960	50	243	9 5/8"	0.8	143				4.0	
NADHOUR	MAJEL BEL ABBES	KASSERINE	1320	66	300	9 5/8"						10.0	
SERG LAHMAR	SBEITLA	KASSERINE	1218	61	330	9 5/8"						7.0	
SITES	14	14	14	14	14		5	10	9	9	9	12	6
TOTAL			18118		3929								
MEAN			1294	65	281		1.3	61	19.2	39.5	1.7	11.0	41.5
MINIMUM			834	42	54		0.6	5	3.5	3.4	0.0	3.5	3.0
MAXIMUM			2700	135	496		2.4	143	43.0	120.0	6.1	30.0	120.0
STD. DEV.			500	25	120		0.7	48	11.7	34.7	2.0	6.8	39.8
SD / MEAN			39%	38%	43%		51%	78%	61%	88%	121%	62%	96%

USAID SITES - TECHNICAL ASPECT

SITE	DELEGATION	SPECIFIC DRAWDOWN l/s/m	ESTIMATED TDH m	ENGINE	PUMP	CIVIL WORKS DESIGN	TANK SIZE m3	PIPING LENGTH m	WATER USE POINTS	NOTES
CHABIGA	GAFSA NORD	0.30	65	NONE	GUINARD	CTDA				
BOUIBET	HASSI EL FRID	1.67	114	PERKINS 85Hp	GUINARD	CTDA	40	100	POT,BF,ABR	
DHOUAOUDA	SBEITLA	0.50	160	PERKINS 85Hp	GUINARD	CTDA	40	3000	POT,BF,ABR	SECOND PUMP STATION (PS)
BOULAABA	KASSERINE NORD		25	DIESEL 47Hp	BERTOLA	CTDA	40	1100	POT,BF,ABR	
ZANNOUCHE	SNED	0.04	168	NONE	GUINARD	AUI	150	2900	2xPOT,4xBF,2xABR,2xPL,DR	2 TANKS, PUMPS
JADIDA	SNED		71	PERKINS	GUINARD	AUI	25	150	POT,2xBF,ABR,PL,DR	
O. BOUALLEGUE	GAFSA NORD	0.07	160	PERKINS	GUINARD	AUI	25	140	POT,2xBF,ABR,PL,DR	
OULED ZID	GAFSA NORD		66	DIESEL	TURBINE	AUI	50	600	POT,2xBF,ABR,PL,DR	
BIADHA	SNED					AUI				
OULED AHMED	FERIANA	5.00	56	PERKINS 85Hp	GUINARD	AUI	25	2200	POT,2xBF,ABR,PL,DR	
KODIAT TRICHA	SBEITLA					AUI				
KARACHOUN	MAJEL BEL ABBES			110Hp	GUINARD	AUI	25	200		
NADHOUR	MAJEL BEL ABBES			PERKINS	GUINARD	AUI				
SERG LAHMAR	SBEITLA			PERKINS	GUINARD	AUI				
SITES	14	6	9				9	9		
TOTAL										
MEAN		1.3	98.5				47	1154		
MINIMUM		0.0	25.2				25	100		
MAXIMUM		5.0	168.4				150	3000		
STD. DEV.		1.8	50.3				38	1151		
SD / MEAN		139%	51%				80%	100%		

KEY:

POT = FILLING STATION
BF = STANDPOST
ABR = LIVESTOCK TROUGH
PL = LAUNDRY PLATFORM
DR = DRAINAGE SYSTEM

USAID SITES - ACTUAL COSTS (IN TUNISIAN DINARS)

	SITE	DELEGATION	POPUL-ATION SERVED	TOTAL WELL DEPTH	WELL COST	CIVIL WORKS BID	EQPMNT COST	TOTAL COST	WELL COST PER M	WELL COST PER BEN.	CIV. WORKS COST PER BEN.	EQPMNT COST PER BEN.	TOTAL COST PER BEN.
1	CHABIBA	GAFSA NORD	900	244	60206	18312	34917	113435	247	67	20	39	126
2	BOUIBET	HASSI EL FRID	1050	213	42579	19879	34917	97375	200	41	19	33	93
3	DHOUAOUDA	SBEITLA	1750	207	63297	62154	39417	164868	306	36	36	23	94
4	BOULAABA	KASSERINE NORD	834	54	15393	42958	20000	78351	285	18	52	24	94
5	ZANNOUCHE	SNED	2700	496	158646	76611	30976	266233	320	59	28	11	99
6	JADIDA	SNED	1050	393	141405	34369	39950	215724	360	135	33	38	205
7	O. BOUALLEGUE	GAFSA NORD	989	187	77030	29312	31594	137936	412	78	30	32	139
8	OULED ZID	GAFSA NORD	1189	384	150653	43385	20000	214038	392	127	36	17	180
9	BIADHA	SNED	1134	478	168677			168677	353	149			
10	OULED AHMED	FERIANA	1020	150	54743	64065	31594	150402	365	54	63	31	147
11	KODIAT TRICHA	SBEITLA	2004	250	77971			77971	312	39			
12	KARACHOUN	MAJEL BEL ABBES	960	243	68035		34917	102952	280	71		36	107
13	NADHOUR	MAJEL BEL ABBES	1320	300			42123	42123				32	32
14	SERG LAHMAR	SBEITLA	1218	330			42171	42171				35	35
	SITES	14	14	14	12	9	12	14	12	12	9	12	12
	TOTAL		18118	3929	1078636	391045	402576	1872257					
	MEAN		1294	281	89886	43449	33548	133733	319	73	35	29	113
	MINIMUM		834	54	15393	18312	20000	42123	200	18	19	11	32
	MAXIMUM		2700	496	168677	76611	42171	266233	412	149	63	39	205
	STD. DEV		500	120	48886	19277	7131	64834	59	40	13	8	49
	SD / MEAN		39%	43%	54%	44%	21%	48%	18%	56%	38%	28%	44%

USAID SITES - FINANCIAL ASPECTS - FAR AMOUNTS (IN TUNISIAN DINARS)

	SITE	DELEGATION	GOUVERNORAT	POPUL-ATION SERVED	CIVIL WORKS DESIGN	CONSTR. STATUS	TOTAL WELL DEPTH	FAR AMOUNT WELL	FAR AMOUNT CIVIL WORKS	FAR AMOUNT EQPMNT	TOTAL FAR AMOUNT	TOTAL FAR AMOUNT PER BEN.
1	CHABIBA	GAFSA NORD	GAFSA	900	CTDA	MARCHE	244	49349	20143	0	69492	77
2	BOUIBET	HASSI EL FRID	KASSERINE	1050	CTDA	GC 50%	213	39980	24388	0	64368	61
3	DHOUAOUDA	SBEITLA	KASSERINE	1750	CTDA	GC 30%	207	61157	80483	0	141640	81
4	BOULAABA	KASSERINE NORD	KASSERINE	834	CTDA	(MARCHE)	54	15393	47983	0	63376	76
5	ZANNOUCHE	SNED	GAFSA	2700	AUI	GC 10%	496	158646	109331	0	267977	99
6	JADIDA	SNED	GAFSA	1050	AUI	GC 45%	393	141405	36087	0	177492	169
7	O. BOUALLEGUE	GAFSA NORD	GAFSA	989	AUI	MARCHE	187	77030	30778	0	107808	109
8	OULED ZID	GAFSA NORD	GAFSA	1189	AUI	GC 50%	384	150653	45554	0	196207	165
9	BIADHA	SNED	GAFSA	1134	AUI	GC 0%	478	168677		0	168677	149
10	OULED AHMED	FERIANA	KASSERINE	1020	AUI	GC 60%	150	54743	67268	0	122011	120
11	KODIAT TRICHA	SBEITLA	KASSERINE	2004	AUI	GC 0%	250	77971		0	77971	39
12	KARACHOUN	MAJEL BEL ABBES	KASSERINE	960	AUI	GC 0%	243	69034		0	69034	72
13	NADHOUR	MAJEL BEL ABBES	KASSERINE	1320	AUI	GC 0%	300			0		
14	SERG LAHMAR	SBEITLA	KASSERINE	1218	AUI	GC 0%	330			0		
	SITES	14	14	14	14	14	14	12	9	14	12	12
	TOTALE			18118			3929	1064038	462015	0	1526053	
	MOYENNE			1294		38.9%	281	88670	51335	0	127171	101
	MINIMUM			834		0.0%	54	15393	20143	0	63376	39
	MAXIMUM			2700		100.0%	496	168677	109331	0	267977	169
	E.T.			500		38.2%	120	49792	27620	0	62316	40
	E.T./MOYEN			39%		98%	43%	56%	54%		49%	40%

USAID SITES - CONSTRUCTION STATUS

	SITE	WELL CONTRACTOR	CIVIL WORKS DESIGN	DATE OF TENDER DOCUMENTS	DATE OF CONTRACT SIGNATURE	CONTRACTOR	CONSTRUCTION START-UP DATE	PLANNED COMPLETION DATE	PLANNED CONSTRUCTION STATUS	REAL CONSTRUCTION STATUS	DELAY?	CERTIFICATE OF COMPLETION
1	CHABIBA	RSH	CTDA	9/87	12/87	STUBAT	12/87	2/88	100%	OPERATING	NO	YES
2	BOUIBET	RSH	CTDA	3rd 9/88	10/88	MASRIA	10/88	3/89	?	50%	?	
3	DHOUAOUDA	RSH	CTDA	3rd 9/88	12/88	ABDUR ZBATI	12/88	3/89	?	30%	?	
4	BOULAABA	RSH	CTDA	4/88	9/88	BEN HNIAM		1/89	100%	(OPERATING)	NO	YES
5	ZANNOUCHE	LE FORAGE	AUI	6/88	10/88	ABDELKARIM	12/88	4/89	35%	10%	YES	
6	JADIDA	LE FORAGE	AUI	6/88	10/88	DANMANIH	9/88	12/88	100%	45%	YES	
7	O. BOUALLEGUE	LE FORAGE	AUI	4/88		ABDELKARIM	8/88	12/88	100%	OPERATING	NO	YES
8	OULED ZID	LE FORAGE	AUI	6/88	10/88	DANMANIH	9/88	12/88	100%	50%	YES	
9	BIADHA	LE FORAGE	AUI									
10	OULED AHMED	RSH	AUI	6/88	10/88	EL AOUDA	12/88	3/89	55%	60%	NO	
11	KODIAT TRICHA	RSH	AUI									
12	KARACHOUN	RSH	AUI	2/89?			5/89?	8/89?				
13	NADHOUR	RSH	AUI	3/89?			5/89?	8/89?				
14	SERG LAHMAR	RSH	AUI	3/89?			5/89?	8/89?				

LIST OF USAID PROJECT SITES

SITES UNDER DEVELOPMENT

SITE NAME	FAMILIES 0 TO 3 km	FAMILIES 0 TO 6 km	POPULATION 0 TO 3 km	POPULATION 0 TO 6 km	TOTAL WELL DEPTH, m	FAMILIES PER M OF DEPTH 0 TO 3 km	FAMILIES PER M OF DEPTH 0 TO 6 km
1 BOULAABA	139	455	834	2730	54	2.6	8.4
2 BOUIBET	175	295	1050	1770	213	0.8	1.4
3 DHOUAOUDA	292	345	1752	2070	207	1.4	1.7
4 CHABIBA	150	269	900	1614	244	0.6	1.1
5 OULED AHMED	170	361	1020	2166	150	1.1	2.4
6 KARACHOUN	160	381	960	2286	243	0.7	1.6
7 NADHOUR	220	308	1320	1848	300	0.7	1.0
8 SERG LAHMAR	203	306	1218	1836	330	0.6	0.9
9 OULED BOUALLEGUE	165	315	990	1890	187	0.9	1.7
10 OULED ZID	198	384	1188	2304	384	0.5	1.0
11 JADIDA	175	498	1050	2988	393	0.4	1.3
12 ZANNOUCHE	450	511	2700	3066	496	0.9	1.0
13 BIADHA	189	300	1134	1800	478	0.4	0.6
14 KODIAT TRICHA	334	400	2004	2400	250	1.3	1.6
TOTAL	3020	5128	18120	30768	3929		
MEAN	216	366	1294	2198	281	0.9	1.8

CANDIDATE SITES FOR FUTURE DEVELOPMENT

BOREHOLES:

1 EL HAZZA	509	523	3054	3138	250	2.0	2.1
2 EL AFRACHE	250	526	1500	3156	350	0.7	1.5
3 HANCHIR KHEMIA	200	596	1200	3576	200	1.0	3.0
4 HANCHIR EL ASSEL	250	394	1500	2364	300	0.8	1.3
5 BNANA	300	500	1800	3000	300	1.0	1.7
6 MAGCEM	250	542	1500	3252	300	0.8	1.8
7 MANZEL GAMMOUDI	250	354	1500	2124	300	0.8	1.2
TOTAL	2009	3435	12054	20610	2000		
MEAN	287	491	1722	2944	286	1.0	1.8

EXTENSIONS:

	FAMILIES 0 TO 3 km	EXTENSION DISTANCE
1 ALLEG RASSOU	300	5km
2 SRAY	250	5km

HOUSE CONNECTION SYSTEMS:

1 KHMOUDA II

ANALYSIS OF UNIT PRICES FROM CIVIL WORKS BIDS

IN TUNISIAN DINARS

SITE	ZANNOUCHE	EL JADIDA	OULED BOUALLEGUE	OULED ZID	OULED AHMED
BID DATE	7/88	7/88?	4/88	4/88	6/88
CONTRACTOR	ABDELKARIM	DAHMANIH	ABDELKARIM	DAHMANIH	EL AOUDA
UNIT PRICES					
PIPE SUPPLY & INSTALL.					
AC 100mm	6.400	12.500	10.200	13.000	7.000
AC 150mm		20.000		20.000	12.000
TRENCHING, SAND, REFILL	5.900	7.000	5.500	7.200	4.100
REINFORCED CONCRETE					
250 KG	5.000	30.000	31.000	30.000	30.000
350 KG	140.000	160.000	150.000	165.000	170.000
350 KG (ELEVATED)		270.000	220.000	280.000	180.000
ELEVATED TANK PIPING	2654.000 +4500 PUMP	4927.000	4431.000	4974.000	7865.000
BID COSTS					
PIPING	32425	8220	5168	11884	23965
ELEVATED WATER TANKS					
25m3		14717	13022		17760
50m3				20024	
Other	27788				
ENGINE SHELTER	3300	3905	3092	4640	5155
LIVESTOCK TROUGH	2*1554=3038	1333	1365	1333	2776
STANDPOST	4*790=3160	2*779=1558	2*1300=2601	2*779=1558	2*1322=2644
TANK FILLING STATION	2*2070=4140	2510	1972	2398	7001
WASHING SLAB	2*1045=2090	842	908	842	1604
DRAINAGE SYSTEM	5480	1985	1182	2190	3860
DISCOUNT	-4890	-701	0	-885	0
BID TOTAL	76611	34369	29312	44270	64065

PUMPING EQUIPMENT PROCURED BY CTDA FOR USAID PROJECT

SPECIFICATIONS

SERIES	A	B	C	D
NUMBER PROCURED	5	4	4	2
FLOW l/s	15	25	10	7
TOTAL HEAD, m	160	150	170	170
ENGINE/GEN POWER, KVA	80	100	125	150
ENGINE/GEN MOUNT	CART MOUNT	CART MOUNT	SIMPLE FRAME	SIMPLE FRAME

EQUIPMENT PROCURED

PUMP MODEL (GUINARD)	S858T19	S8100T7	S642T16	S627T16
PUMP EFFICIENCY	66.0%	80.0%	67.0%	70.0%
POWER REQUIRED, KVA	36	46	25	17
PUMP MOTOR RATING, KVA	37	55	30	18.5
PUMP UNIT PRICE, TD	7910	7948	6157	4587
PRICE PER m3*M, TD	0.916	0.589	1.006	1.071
ENGINE MODEL	PERKINS	PERKINS	PERKINS	PERKINS
GENERATOR MODEL	STAMFORD	STAMFORD	STAMFORD	STAMFORD
GENERATOR POWER, KVA	80	100	125	150
MOUNTING	CART MOUNT	CART MOUNT	SIMPLE FRAME	SIMPLE FRAME
UNIT PRICE, TD	19521	26418	23812	32202
PRICE PER KVA, TD	244	264	190	215

APPENDIX I

MINIMUM SOCIOECONOMIC DATABASE FOR WUAs, SURVEY DESIGN

APPENDIX I

MINIMUM SOCIOECONOMIC DATABASE FOR WUAs, SURVEY DESIGN

In an effort not to overburden the UAG in implementing such a study, the evaluation team would recommend that an expatriate technical assistance socio-economist be selected to work with a locally hired counterpart to take the leadership in running a 6-8 week baseline survey among the WUAs. When the effort is actually carried out these consultants will need about 25 percent of the field staff's time, as well as the use of daily transportation to the field. We would suggest that the UAG, prior to the arrival of such a team, identify one or two potential literate persons in each WUA who would be capable of filling out such survey instruments, after several days formal training. Because it will be the women of the communities who will be interviewed primarily, first choice should be given to identifying female interviewers. The UAG team should explain to each WUA that this information will assist in their common effort in helping the community and in finding an equitable water user fee system. The UAG should request the WUA committee to identify the persons whom they believe could do the survey for the community and obtain their names and meet them before the arrival of the consultants. One of these individuals would be selected to conduct the survey in the community, being given about 100 millimes/family interviewed. Data entry and analysis should be done by the UAG staff, with assistance from the consultants. This will permit training to take place concurrently with actual implementation.

Minimum Socioeconomic Database for WUAs
(or at least a Sample of WUAs)

		Male	Female
1.	Name of Household Head		
2.	# of Persons Resident in Household		
3.	# of Children < 15		
4.	# of Children > 15		
5.	# of Children in school		
6.	# of animal-drawn cisterns in household		
7	Est. # of animal-drawn cistern trips each month during 3 driest months		
8	Est. # of animal-drawn cistern trips rest of year		
9	# of times water purchased from tractor vendors 3 driest months		
10.	# of times water purchased from tractor vendors rest of year		
11.	# of Household Cisterns below ground		
12.	# of persons in Household who regularly haul water		
13.	Water obtained regularly directly from a public fountain (*borne fontaine*)?		
14.	Time (hours) for round trip to nearest water point from household.		
15.	Est. # of Sheep/goats watered by household		
16.	Sheep/goats watered at home or at watering trough?		
17.	# of fruit trees irrigated by household (animal drawn or tractor hauled)		
18.	Household has a small irrigated vegetable garden?		
19.	Household possesses direct irrigation?		
20.	Household has access to land where fruit tree irrigation could happen.		

* - committee member
** - for active members
*** - members of women's interest group
+ - has a tractor

All information should be obtained over no more than a 1-2 month period, preferably by someone from the community who would be paid a minimum contribution for their assistance (100 millimes/household). Household list already established would be used as basis for survey population.

Information should always be disagreggated by gender whenever possible. This is not seen as an exhaustive list of data which should be obtained. Information obtained however should not take more than 15-20 minutes to collect. Open-ended questions should not be used to permit direct entry onto the computer.

APPENDIX J

PROPOSED COMMON FUND FOR WUA FINANCE

APPENDIX J

PROPOSED COMMON FUND FOR WUA FINANCE

In view of the advanced state of WUA establishment, their legalization, their actual start-up, their normal operation, the development of collective responsibilities, and the community management, it is easily recognized that the development cycle of WUA spreads over several phases, each of which has its own specific character (start-up, launching, maturity...).

Although it is easy to agree that one of the basic t sks of WUA is to establish the price of water, there remains the WUA continuity of operation, its financial health, and its resources management as its main goals. It might be desirable to have one regional price for water and to achieve a measure of standardization and coordination among the various WUAs, which would require the possible creation of a common fund, fed by the various participants in the management of water resources. The WUAs can be classified into three categories:

(1) WUAs which create a surplus,
(2) WUAs in financial balance, and
(3) WUAs with a deficit.

Two formulas are possible for this Common Fund:

1. To decide on a uniform contribution, regardless of the capabilities of the WUA, for example 10 percent of WUA income. GIH should also contribute to the financing. The advantage of this solution is that all WUAs would be dealt with on an equal footing. The drawback is that no account is taken of their financial situation (surplus/deficit).

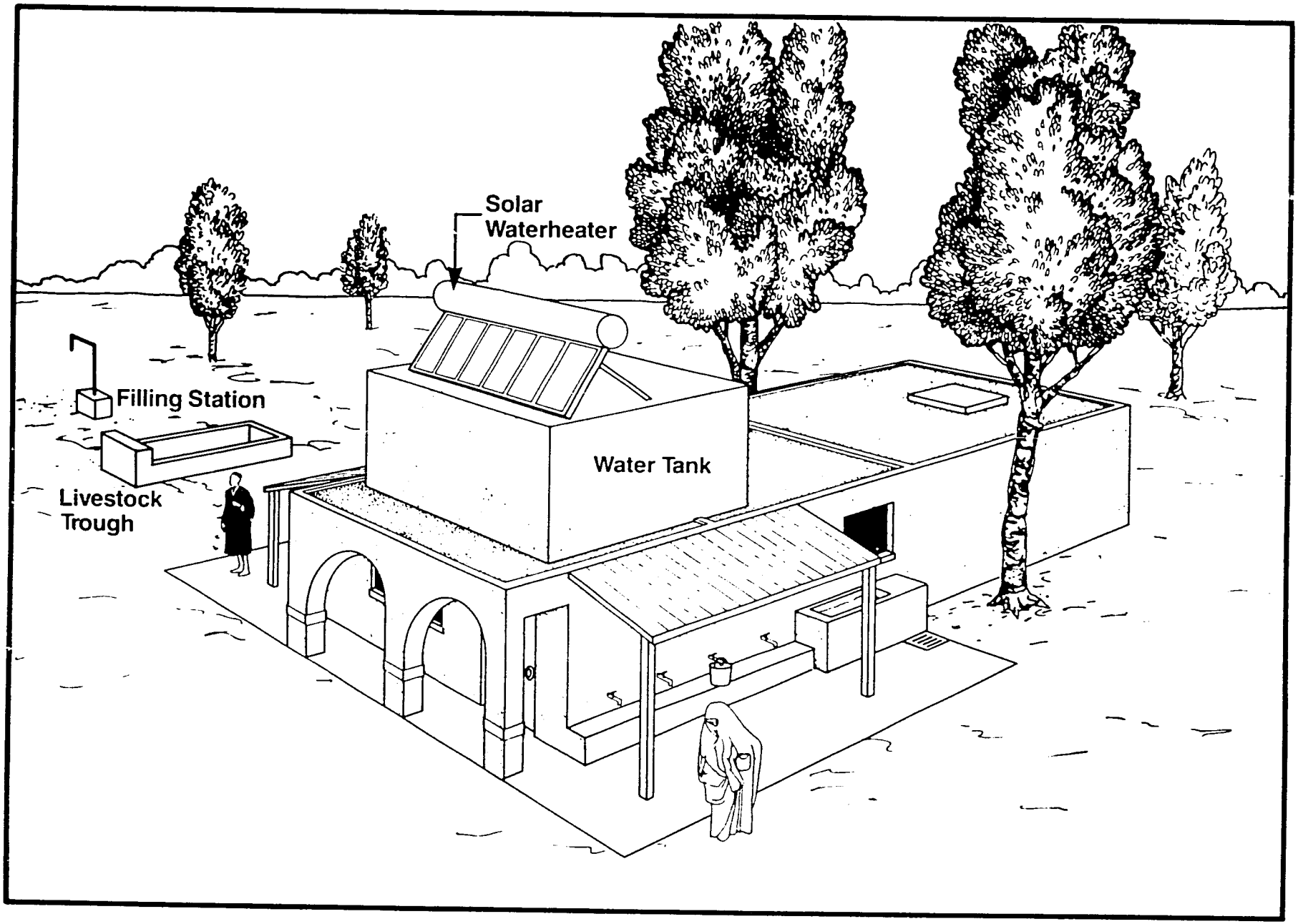
2. To decide on a contribution in proportion to the number of members and the capability of the WUA. The surplus WUA should have more obligation than a deficitary one. The advantage would be that the financial situation of WUA would be taken into account, but the drawback would be, perhaps, that the deficit WUA would have no incentive to remedy their situation, to rationalize their management and to achieve a balance.

In any case, this Common Fund would finance the collective expenses of WUA (seminars, basic documents, legal texts, supplies, circulars, etc...).

Along the same lines, it can be established that water price would be the same at Kasserine in all the rural areas. The advantage of a Fund would be to achieve greater solidarity among WUA and, with time (all depends on the policy of the Fund, which is managed by a board of directors, made up of various participants WUA and GIH) to have the Fund finance some operations, such as: 1) the salary of pump operators, either entirely by the Fund of from some categories of income; 2) the financing of maintenance, etc... The Fund would play the part of an WUA bank. The initiative would always be WUA's. In any case, the system would offer the advantage of supporting WUA activity and their independence.

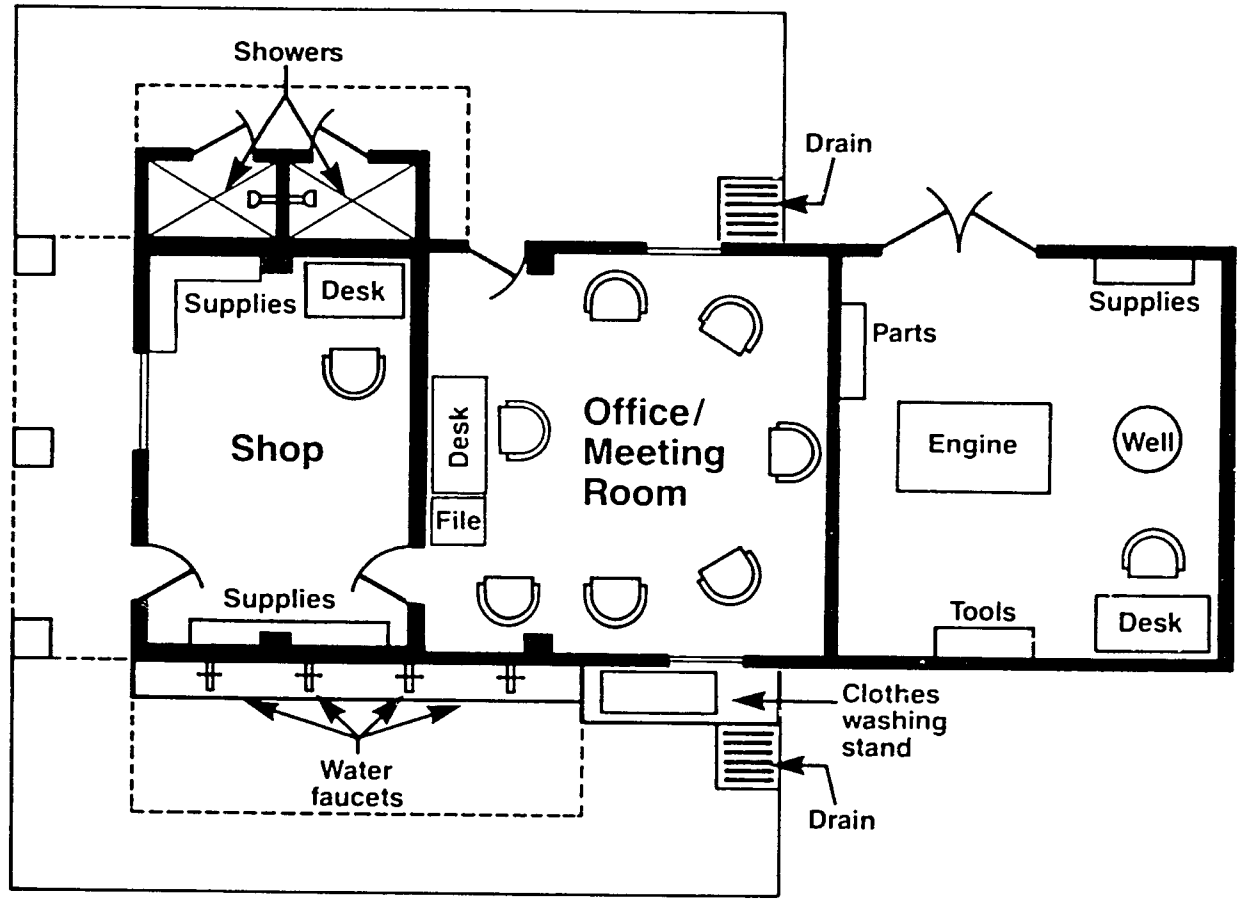
APPENDIX K

ALTERNATE DESIGN FOR WUA WATER POINT STRUCTURE



Elevation

Alternative Design for Water User Association Water Point/Community Center



Floor Plan

Alternative Design for Water User Association
Water Point/Community Center

APPENDIX L

ESTIMATION OF FUEL CONSUMPTION OF DIESEL ENGINE/PUMPS

APPENDIX L

ESTIMATION OF FUEL CONSUMPTION OF DIESEL ENGINE/PUMPS

Definitions:

Q = pump output (l/s)

TDH = Total Dynamic Head (m)
= static water level + drawdown + tank height (from a well head)

n_p = overall pump efficiency

n_m = overall motor efficiency

Formulas:

$$\text{Motor power} = \frac{Q\ TDH\ 9.8}{n_p}\text{, in watts}$$

$$\text{fuel power} = \frac{\text{motor power}}{n_m}\text{, in watts}$$

$$\text{Fuel consumption (l/hr)} = \frac{\text{fuel power}}{(1000\ \text{watts/kw})\ (10.8\ \text{kwh/litre})}\text{, in watts}$$

thus:

$$\text{Fuel consumption} = \frac{Q}{n_p\ n_m}\ \frac{TDH}{1000} \cdot \frac{9.8}{10.8}$$

Example:

if $n_p = 0/60$ $n_m = 0.20$

$$\text{Fuel consumption (l/h)} = \frac{Q \quad TDH \quad 9.8}{0.60 \quad 0.2 \quad 1000 \cdot 10.8}$$

Fuel consumption (l/h) = Q TDH 0.00756

	TDH = 25	50	75	100	150
PUMP OUTPUT					
5 l/s	0.95	1.89	2.84	3.78	5.67
10 l/s	1.89	3.78	5.67	7.65	11.3
15 l/s	2.83	5.67	8.51	11.3	17.0
20 l/s	3.78	7.56	11.3	15.1	22.7
30 l/s	5.67	11.3	17.0	22.7	34.0

For more detailed information, see references in Appendix D by:

Hodgkin, White, and McGowan (1988)
Jordan and Wyatt (1989)
McGowan and Hodgkin (1989)

These references have already been provided to CTDA.

APPENDIX M

REPORTED CASE OF SELECTED WATER-RELATED DISEASE IN THREE DELEGATIONS

APPENDIX M

REPORTED CASE OF SELECTED WATER-RELATED DISEASE IN THREE DELEGATIONS

KASSERINE GOVERNORATE

DELEGATION	DISEASE / LOCALITY	SCABIES 1987	SCABIES 1988	TAENIA 1987	TAENIA 1988	INFANT DIARRHEA 1987	INFANT DIARRHEA 1988
SBEITLA	El Gallel	73	78	19	28	161	134
	Machrek Chams	282	170	156	100	387	259
	Rakhmette	81	53	45	42	312	249
SBIBA	Smairia	26	11	36	14	36	19
	Smata	192	144	107	96	343	239
	Kantra	32	28	26	16	24	14
	Dhraa	26	12	9	13	NR	NR
JEDLIENE	Jedliene	264	236	96	78	193	182
	Ain Hmadna	53	28	29	9	36	24
	Ain Om Jedour	32	14	29	16	NR	NR
	Sidi Ali Bahlad	16	9	42	23	NR	NR

SOURCE: RHET Records
NR: Not Reported

APPENDIX N

PROJECT MONITORING FORM: RURAL POTABLE WATER INSTITUTIONS PROJECT

APPENDIX N: PROJECT MONITORING FORM

RURAL POTABLE WATER INSTITUTIONS PROJECT

DATE: _____

1. FINANCIAL STATEMENT (To be completed by the DAAF)

	Budget	Funds Recieved	Funds Obligated	Funds Disbursed	Balance
Technical Assistance					
Construction					
Evaluation					
Commodities					
Training					
Inflation and Contingency					
Total					

Additional Information / Recommendations

2. CONSTRUCTION (To be completed by the AHA)

Borehole Status

Number of boreholes planned _____
Number of boreholes underway _____
Number of boreholes completed _____

Pumping Equipment

Units ordered _____
Units received _____
Units installed _____
Units under way _____

Civil Works

Number of sites designed _____
Number of sites tendered _____
Number of sites under construction _____
Number of sites completed _____

Additional Information / Recommendations

3. WUA DEVELOPMENT (To be completed by the UAG)

Legalization

Number of WUAs established _____
Number of WUAs legalized _____
Number of WUA legalization files under examination _____
Number of WUA legalization files to be prepared _____

WUA Follow-up

Number of visits planned _____
Number of visits made _____
Number of meetings planned _____
Number of meetings organized _____
Number of meetings postponed _____

Training

Activities Planned

Activities Conducted

Differences

Additional Information / Recommendations

4. HEALTH & HYGIENE (To be completed by Regional Health Education Team)

Activities Planned

Activities Conducted

Differences

Additional Information / Recommendations

5. PROJECT MANAGEMENT (To be completed by the PDG of CTDA)

Supervision of Sub-contractors

Activities Planned

Activities Conducted

Differences

General recommendations on project implementation

APPENDIX O

MODEL OF WATER POINT/WATER TRANSPORT COSTS

APPENDIX O: MODEL OF WATER POINT/WATER TRANSPORT COSTS

The objective of this brief modeling exercise was to investigate the planning target of a 3km radius as a "zone of service" of a water point. That is investments should be made, in the long run, so that no one has to go more than 3km to clean potable water. This target figure has been adopted by the project, and in fact corresponds to a de facto national norm. More precisely, the Ministry of Plan confirmed that 3 km was the common rule of thumb. However, they prefer a target of 1 hour travel time (one way), as a target level of service for rural water programs. Since 3 km/hr is a common walking speed, these two figures correspond, at least on flat terrain.

The choice for a radius of service is a difficult one. A small radius will mean water is close at hand, and thus takes less time, effort and cost to transport to the home. This savings, monetary, and non-monetary, is an important benefit of water point investments[1]. Another way to think of it is to compute the cost of water transport, with water available at different distances. Thus for a small radius the transport cost will be low, and for a large radius the transport cost will be high. Different transport methods should be considered, including walking, using a donkey cart, or buying water from a private vendor. An assumption will have to made as to the "value of time", and since this is difficult, calculations have been made at a variety of values.

However, a small radius requires that a greater number of wells must be dug, tanks constructed, etc. Overall investment and operating costs (in a region) will rise as radius decreases.

So, a very fundamental tradeoff develops between water point capital and running costs on the one hand, and the cost of hauling water, on the other. One is high where the other is low. If we add these two costs together, there will be a radius where costs are minimized, which we can consider an optimal radius. The model developed here attempts, in an approximate fashion, to evaluate this tradeoff, and compute the optimal radius. The analysis computes the total net present value of these two costs, that is investments are taken at face value, but future running and transport costs are discounted to the present.

Due to the limited amount of time available in an project evaluation effort, only a rough analysis could be developed, but the preliminary results appear useful. The approach appears valid, and can be improved with additional data collection efforts if desired. The next few pages show preliminary results, sample calculations, and some of the key formulas used. Before reviewing those details, the basic conclusions of the analysis should be stated:

* Depending on the value of time used, and the mode of transport used, the optimal radius will vary from 2.2 to 6.2 km. As the value of time increases, the optimal radius decreases, and as consumption increases, the optimal radius decreases.

---

[1] Additionally, with water being closer, there will be extra benefits, although more indirect, resulting to greater water use, such as irrigation and improved health and hygiene (theoretically). In this analysis only the first of these benefits, the time savings, will be considered.

* The rule of thumb of 3 km appears adequate. The model results tend to lean a bit more toward 4 km, but this analysis is approximate, and there doesn't appear to be any major reason to recommend any change form the 3 km target. It is interesting to note that the optimal radius corresponds even better to 1 hour travel time. That is, for walkers, whose speed is estimated at 3 km/hr the optimal radius is from 2.2 to 3.8 km. For people using donkey carts, with an estimated speed of 5 km/hr the optimal radius is 4.1 to 6.2 km.

* The transport mechanism known as vendors appears to be quite competitive economically with other mechanisms. That is it appears to be as economically interesting to encourage the private vendors, as to assist people to purchase donkey carts.

* The total cost of transporting water, for all the families served, can be very high. In fact the transport cost greatly exceeds the running costs of the water point (cost of fuel, maintenance, etc.). These costs can even be considered a counterpart contribution to the project, by the beneficiaries. Also, over 20 years the transport costs can reach the same order of magnitude as the investment by the Government.

SUMMARY OF RESULTS:

1. WALKING MODEL

INPUTS:			RESULTS:		
SPEED	CONSUMPTION	VALUE OF TIME	COST PER PERSON @ 3 km RADIUS	OPTIMAL RADIUS	COST PER PERSON @ OPTIMAL RADIUS
3 km/hr	30 l/p/d	0.050 TD/hr	254 TD	3.8 km	240 TD
3 km/hr	30 l/p/d	0.150 TD/hr	487 TD	2.6 km	480 TD
3 km/hr	50 l/p/d	0.050 TD/hr	344 TD	3.2 km	343 TD
3 km/hr	50 l/p/d	0.150 TD/hr	733 TD	2.2 km	680 TD

2. DONKEY CART MODEL

INPUTS:			RESULTS:		
SPEED	CONSUMPTION	VALUE OF TIME	COST PER PERSON @ 3 km RADIUS	OPTIMAL RADIUS	COST PER PERSON @ OPTIMAL RADIUS
5 km/hr	30 l/p/d	0.250 TD/hr	291 TD	6.2 km	229 TD
5 km/hr	30 l/p/d	0.500 TD/hr	319 TD	4.8 km	280 TD
5 km/hr	50 l/p/d	0.250 TD/hr	322 TD	5.2 km	276 TD
5 km/hr	50 l/p/d	0.500 TD/hr	368 TD	4.1 km	347 TD

3. VENDOR MODEL

INPUTS:	RESULTS:		
CONSUMPTION	COST PER PERSON @ 3 km RADIUS	OPTIMAL RADIUS	COST PER PERSON @ OPTIMAL RADIUS
30 l/p/d	249 TD	4.7 km	212 TD
50 l/p/d	336 TD	4.1 km	317 TD

WALKING MODEL

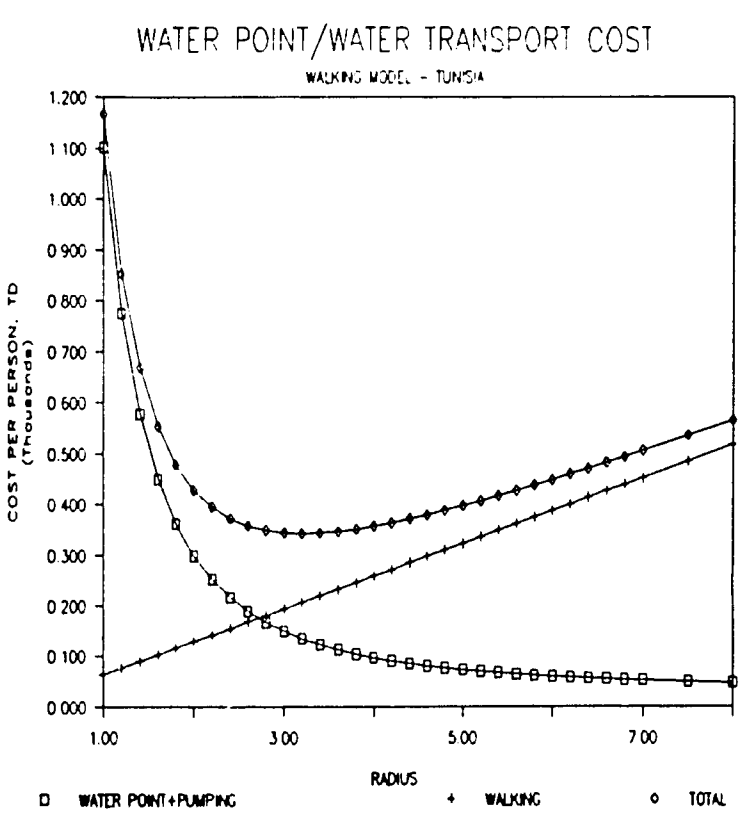
INPUT ASSUMPTIONS	
PEOPLE PER HOUSEHOLD =	6
POPULATION DENSITY, P/km2	35
WATER USE, L/P/DAY =	50
WALKING SPEED, KM/HR =	3
TRIP CAPACITY L/TRIP =	40
VALUE OF TIME, TD/HR =	0.050 TD
PROJECT AREA, km2 =	10000
WATER POINT RADIUS, km =	3
INITIAL COST WATER POINT=	150,000 TD
PUMPING COST, TD/m3 =	0.20 TD
DISCOUNT RATE =	10.0%
PERIOD, YRS =	20

RESULTS	
NUMBER OF WATER POINTS =	278
PEOPLE PER WATER POINT =	1260
HOUSEHOLDS/WATER POINT =	210
INITIAL COST WATER POINT=	150,000 TD
INITIAL WP INVESTMENTS =	41,666,667 TD
ANNUAL RUNNING COST/WP =	4,599 TD
PV PUMPING COST PER WP =	39,154 TD
TOTAL PV PUMPING COST =	10,876,078 TD
TRIPS PER DAY =	7.50
WALKING COST PER WP =	244,712 TD
TOTAL WALKING COST =	67,975,485 TD
WP+PUMPING+WALKING =	120,518,230 TD
COST PER PERSON:	
WATER POINT	119 TD
WATER POINT+PUMPING	150 TD
WALKING	194 TD
WP + PUMPING + WALKING	344 TD

RESULTS OF INFLUENCE OF WATER POINT RADIUS

COST PER PERSON :

RADIUS	WATER POINT	WP + PUMPING	WALKING	WP+PUMPING +WALKING
0.20	26,786 TD	26,817 TD	13 TD	26,830 TD
0.40	6,696 TD	6,728 TD	26 TD	6,753 TD
0.60	2,976 TD	3,007 TD	39 TD	3,046 TD
0.80	1,674 TD	1,705 TD	52 TD	1,757 TD
1.00	1,071 TD	1,103 TD	65 TD	1,167 TD
1.20	744 TD	775 TD	78 TD	853 TD
1.40	547 TD	578 TD	91 TD	668 TD
1.60	419 TD	450 TD	104 TD	553 TD
1.80	331 TD	362 TD	117 TD	478 TD
2.00	268 TD	299 TD	129 TD	428 TD
2.20	221 TD	252 TD	142 TD	395 TD
2.40	186 TD	217 TD	155 TD	372 TD
2.60	158 TD	190 TD	168 TD	358 TD
2.80	137 TD	168 TD	181 TD	349 TD
3.00	119 TD	150 TD	194 TD	344 TD
3.20	105 TD	136 TD	207 TD	343 TD
3.40	93 TD	124 TD	220 TD	344 TD
3.60	83 TD	114 TD	233 TD	347 TD
3.80	74 TD	105 TD	246 TD	351 TD
4.00	67 TD	98 TD	259 TD	357 TD
4.20	61 TD	92 TD	272 TD	364 TD
4.40	55 TD	86 TD	285 TD	371 TD
4.60	51 TD	82 TD	298 TD	380 TD
4.80	47 TD	78 TD	311 TD	388 TD
5.00	43 TD	74 TD	324 TD	398 TD
5.20	40 TD	71 TD	337 TD	407 TD
5.40	37 TD	68 TD	350 TD	417 TD
5.60	34 TD	65 TD	363 TD	428 TD
5.80	32 TD	63 TD	375 TD	438 TD
6.00	30 TD	61 TD	388 TD	449 TD
6.20	28 TD	59 TD	401 TD	460 TD
6.40	26 TD	57 TD	414 TD	472 TD
6.60	25 TD	56 TD	427 TD	483 TD
6.80	23 TD	54 TD	440 TD	494 TD
7.00	22 TD	53 TD	453 TD	506 TD
7.50	19 TD	50 TD	486 TD	536 TD
8.00	17 TD	48 TD	518 TD	566 TD
8.50	15 TD	46 TD	550 TD	596 TD
9.00	13 TD	44 TD	583 TD	627 TD
9.50	12 TD	43 TD	615 TD	658 TD
10.00	11 TD	42 TD	647 TD	689 TD
11.00	9 TD	40 TD	712 TD	752 TD
12.00	7 TD	39 TD	777 TD	815 TD
13.00	6 TD	37 TD	842 TD	879 TD
14.00	5 TD	37 TD	906 TD	943 TD
15.00	5 TD	36 TD	971 TD	1,007 TD



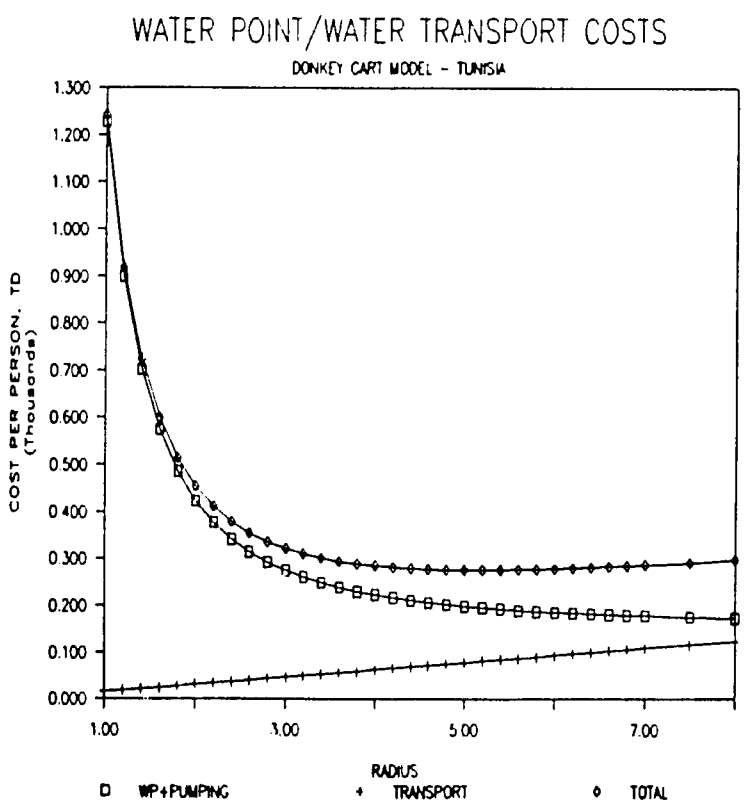
DONKEY CART MODEL

INPUT ASSUMPTIONS		RESULTS	
PEOPLE PER HOUSEHOLD =	6	NUMBER OF WATER POINTS =	278
POPULATION DENSITY, P/km2	35	PEOPLE PER WATER POINT =	1260
WATER USE, L/P/DAY =	50	HOUSEHOLDS/WATER POINT =	210
WALKING SPEED, KM/HR =	5	INITIAL COST WATER POINT=	150,000 TD
TRIP CAPACITY L/TRIP =	500	INVESTMENT IN CARTS+TANKS	43,750,000 TD
VALUE OF TIME, TD/HR =	0.250 TD	INITIAL INVESTMENTS =	85,416,667 TD
PROJECT AREA, km2 =	10000	ANNUAL RUNNING COST/WP =	4,599 TD
WATER POINT RADIUS, km =	3	PV PUMPING COST PER WP =	39,154 TD
INITIAL COST WATER POINT=	150,000 TD	TOTAL PV PUMPING COST =	10,876,078 TD
INITIAL COST OF CART+TANK=	750 TD	TRIPS PER DAY =	0.60
PUMPING COST, TD/m3 =	0.20 TD	TRANSPORT COST PER WP =	58,731 TD
DISCOUNT RATE =	10.0%	TOTAL TRANSPORT COST =	16,314,116 TD
PERIOD, YRS =	20	WP+PUMPING+TRANSPORT =	112,606,861 TD
		COST PER PERSON:	
		WATER POINT	244 TD
		WATER POINT+PUMPING	275 TD
		TRANSPORT	47 TD
		WP + PUMPING + TRANSPORT	322 TD

RESULTS OF INFLUENCE OF WATER POINT RADIUS

COST PER PERSON :

RADIUS	WATER POINT	WP + PUMPING	TRANSPORT	WP+PUMPING +TRANSPORT
0.20	26,911 TD	26,942 TD	3 TD	26,945 TD
0.40	6,821 TD	6,853 TD	6 TD	6,859 TD
0.60	3,101 TD	3,132 TD	9 TD	3,142 TD
0.80	1,799 TD	1,830 TD	12 TD	1,843 TD
1.00	1,196 TD	1,228 TD	16 TD	1,243 TD
1.20	869 TD	900 TD	19 TD	919 TD
1.40	672 TD	703 TD	22 TD	724 TD
1.60	544 TD	575 TD	25 TD	599 TD
1.80	456 TD	487 TD	28 TD	515 TD
2.00	393 TD	424 TD	31 TD	455 TD
2.20	346 TD	377 TD	34 TD	412 TD
2.40	311 TD	342 TD	37 TD	379 TD
2.60	283 TD	315 TD	40 TD	355 TD
2.80	262 TD	293 TD	44 TD	336 TD
3.00	244 TD	275 TD	47 TD	322 TD
3.20	230 TD	261 TD	50 TD	310 TD
3.40	218 TD	249 TD	53 TD	302 TD
3.60	208 TD	239 TD	56 TD	295 TD
3.80	199 TD	230 TD	59 TD	289 TD
4.00	192 TD	223 TD	62 TD	285 TD
4.20	186 TD	217 TD	65 TD	282 TD
4.40	180 TD	211 TD	68 TD	280 TD
4.60	176 TD	207 TD	71 TD	278 TD
4.80	172 TD	203 TD	75 TD	277 TD
5.00	168 TD	199 TD	78 TD	277 TD
5.20	165 TD	196 TD	81 TD	276 TD
5.40	162 TD	193 TD	84 TD	277 TD
5.60	159 TD	190 TD	87 TD	277 TD
5.80	157 TD	188 TD	90 TD	278 TD
6.00	155 TD	186 TD	93 TD	279 TD
6.20	153 TD	184 TD	96 TD	280 TD
6.40	151 TD	182 TD	99 TD	282 TD
6.60	150 TD	181 TD	103 TD	283 TD
6.80	148 TD	179 TD	106 TD	285 TD
7.00	147 TD	178 TD	109 TD	287 TD
7.50	144 TD	175 TD	117 TD	292 TD
8.00	142 TD	173 TD	124 TD	297 TD
8.50	140 TD	171 TD	132 TD	303 TD
9.00	138 TD	169 TD	140 TD	309 TD
9.50	137 TD	168 TD	148 TD	316 TD
10.00	136 TD	167 TD	155 TD	322 TD
11.00	134 TD	165 TD	171 TD	336 TD
12.00	132 TD	164 TD	186 TD	350 TD
13.00	131 TD	162 TD	202 TD	364 TD
14.00	130 TD	162 TD	218 TD	379 TD
15.00	130 TD	161 TD	233 TD	394 TD



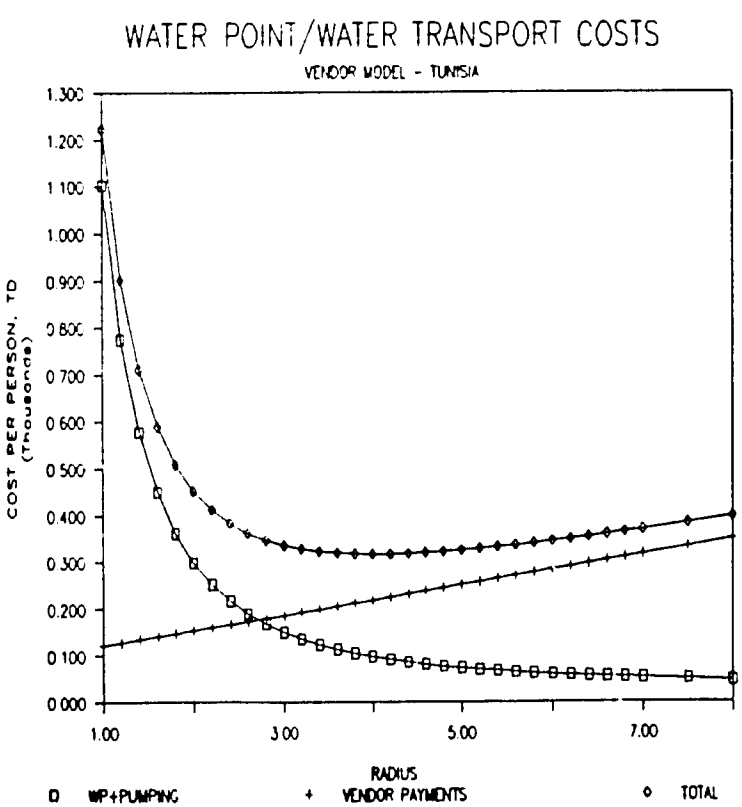
VENDOR MODEL

INPUT ASSUMPTIONS		RESULTS	
PEOPLE PER HOUSEHOLD =	6	NUMBER OF WATER POINTS =	278
POPULATION DENSITY, P/km2	35	PEOPLE PER WATER POINT =	1260
WATER USE, L/P/DAY =	50	HOUSEHOLDS/WATER POINT =	210
TRIP CAPACITY, L/TRIP =	3500	INITIAL COST WATER POINT=	150,000 TD
VENDOR WATER PRICE = 2TD + 0.75TD/km		INITIAL WP INVESTMENTS =	41,666,667 TD
PROJECT AREA, km2 =	10000	ANNUAL RUNNING COST/WP =	4,599 TD
WATER POINT RADIUS, km =	3	PV PUMPING COST PER WP =	39,154 TD
INITIAL COST WATER POINT=	150,000 TD	TOTAL PV PUMPING COST =	10,876,078 TD
PUMPING COST, TD/m3 =	0.20 TD	TRIPS PER MONTH PER FAM.=	2.57
DISCOUNT RATE =	10.0%	VENDOR PAYMENTS PER WP =	234,464 TD
PERIOD, YRS =	20	TOTAL VENDOR PAYMENTS =	65,128,762 TD
		WP+PUMPING+PAYMENTS =	117,671,507 TD
		COST PER PERSON:	
		WATER POINT	119 TD
		WATER POINT+PUMPING	150 TD
		VENDOR PAYMENTS	186 TD
		WP + PUMPING + PAYMENTS	336 TD

RESULTS OF INFLUENCE OF WATER POINT RADIUS

COST PER PERSON :

RADIUS	WATER POINT	WP + PUMPING	VENDOR PAYMENTS	WP+PUMPING +PAYMENTS
0.20	26,786 TD	26,817 TD	94 TD	26,911 TD
0.40	6,696 TD	6,728 TD	101 TD	6,828 TD
0.60	2,976 TD	3,007 TD	107 TD	3,115 TD
0.80	1,674 TD	1,705 TD	114 TD	1,819 TD
1.00	1,071 TD	1,103 TD	120 TD	1,223 TD
1.20	744 TD	775 TD	127 TD	902 TD
1.40	547 TD	578 TD	134 TD	711 TD
1.60	419 TD	450 TD	140 TD	590 TD
1.80	331 TD	362 TD	147 TD	508 TD
2.00	268 TD	299 TD	153 TD	452 TD
2.20	221 TD	252 TD	160 TD	412 TD
2.40	186 TD	217 TD	166 TD	383 TD
2.60	158 TD	190 TD	173 TD	363 TD
2.80	137 TD	168 TD	180 TD	347 TD
3.00	119 TD	150 TD	186 TD	336 TD
3.20	105 TD	136 TD	193 TD	328 TD
3.40	93 TD	124 TD	199 TD	323 TD
3.60	83 TD	114 TD	206 TD	320 TD
3.80	74 TD	105 TD	212 TD	318 TD
4.00	67 TD	98 TD	219 TD	317 TD
4.20	61 TD	92 TD	225 TD	317 TD
4.40	55 TD	86 TD	232 TD	318 TD
4.60	51 TD	82 TD	239 TD	320 TD
4.80	47 TD	78 TD	245 TD	323 TD
5.00	43 TD	74 TD	252 TD	326 TD
5.20	40 TD	71 TD	258 TD	329 TD
5.40	37 TD	68 TD	265 TD	333 TD
5.60	34 TD	65 TD	271 TD	337 TD
5.80	32 TD	63 TD	278 TD	341 TD
6.00	30 TD	61 TD	285 TD	345 TD
6.20	28 TD	59 TD	291 TD	350 TD
6.40	26 TD	57 TD	298 TD	355 TD
6.60	25 TD	56 TD	304 TD	360 TD
6.80	23 TD	54 TD	311 TD	365 TD
7.00	22 TD	53 TD	317 TD	370 TD
7.50	19 TD	50 TD	334 TD	384 TD
8.00	17 TD	48 TD	350 TD	398 TD
8.50	15 TD	46 TD	367 TD	413 TD
9.00	13 TD	44 TD	383 TD	427 TD
9.50	12 TD	43 TD	400 TD	442 TD
10.00	11 TD	42 TD	416 TD	458 TD
11.00	9 TD	40 TD	449 TD	489 TD
12.00	7 TD	39 TD	482 TD	520 TD
13.00	6 TD	37 TD	514 TD	552 TD
14.00	5 TD	37 TD	547 TD	584 TD
15.00	5 TD	36 TD	580 TD	616 TD



BASIC FORMULAS:

WALKING MODEL

Number of water points = Project Area / (4 * radius^2)
People per water point = (4 * radius^2) * Population density
Households per water point = People per water point / Persons per household
Initial WP investments = Initial Cost per water point * Number of water points
Annual running cost/wp = Water use (l/p/d) * 365 * People per water point * Pumping cost (TD/m^3) / 1000
PV pumping cost per wp = Annual running cost/wp * PVA
Total PV pumping cost = PV pumping cost per wp * Number of water points
Trips per day = (Water use (l/p/d) * Persons per household) / Trip capacity
Walking Cost per WP = (Radius/Speed) * Value of time * Trips per day * 365 * Households per wp * PVA
Total walking cost = Walking Cost per WP * Number of water points
WP+Pumping+Walking = Initial WP investments + Total PV pumping cost + Total walking cost

NOTE: PV = Present Value, WP=Water Point

$$PVA = [(1+i)^n - 1] / [i(1+i)^n]$$

i = discount rate
n = project period, yrs

DONKEY MODEL

Formulas are the same except:

Initial investments = (Initial WP investment * Number of WPs) + (Initial Cpost of Cart + Tank * Number of Households)

VENDOR MODEL

Formulas are the same as the Walking Model except:

Trips per Month per Family = Trip capacity / (Water use (l/p/d) * Persons per household)
Vendor Payments per WP = Trips per Month per Family * 12 * [2+(0.75*Radius)]

APPENDIX P

PROPOSED SCOPE OF WORK: CONSULTANCY ON WATER SYSTEM DESIGN

APPENDIX P

PROPOSED SCOPE OF WORK: CONSULTANCY ON WATER SYSTEM DESIGN

OBJECTIVE:

Assist the CTDA and its contractor, AUI, as well as the Association for Hydrogeological Exploration (AHE), *Regie des Sondages Hydrauliques* (RSH), to improve water system designs and reduce costs.

TASKS:

1. Train staff from the CTDA and the AUI in the use of the World Bank's pipe network design software (Microcomputer Programs for Improved Planning and Design of Water Supply and Waste Disposal Systems). These programs can be used for design of the house connection water system and for distribution piping in all water systems to be built under the project. In fact, the design of the Khmouda II site could be used as a training exercise and technical assistance session. This task will require preparation of a limited number of training materials in French.

2. Work with AHE and CTDA staff to determine ways to reduce well costs. Topics to be investigated include the use of thick-walled PVC well casing and reduction of the diameter and/or well casings. This work should result in the adoption of feasible cost-reduction measures for future USAID-funded water points.

3. Work with the CTDA and the AUI to reevaluate reservoir designs. The consultant and these two groups should reexamine the sizing of reservoirs, taking into account water storage during breakdowns, engine cycling time, and reservoir economies of scale. At the same time, effort should be focused on reducing the cost of tank piping, which currently appears to be very expensive. Cost savings in piping should be applied to increasing tank size. This work should result in a new sizing norm and a new standard design for USAID-funded sites.

4. Work with the CTDA on procedures for selecting pumping equipment. It appears that engines are oversized, which lead to high costs and poor fuel efficiency. The consultant should review current selection procedures and recommend improved procedures to the CTDA.

REQUIRED QUALIFICATIONS:

Mechanical, civil or environmental engineering degree.

Experience is required in water system design, including well design, pump equipment selection, reservoir sizing, and pipe network design. Also, experience

is required with the World Bank software, identified above. Experience with the use of operations research in water system design is desirable.

Fluent French or Arabic. Work experience in North Africa/Middle East.

LEVEL OF EFFORT REQUIRED:

The required level of effort will be approximately two person-months. This time will mostly be spent in Kasserine, in two to four trips. The exact timing and duration of the trips can be determined to suit project implementation progress. However, these technical inputs should be made early in the remaining two year project period. A few days of consulting time will be required in the United States for preparation and several days in Tunis will be required for briefing/debriefing USAID/Tunis.

APPENDIX Q

PROPOSED SCOPE OF WORK: CONSULTANCY ON FINANCE AND MANAGEMENT

APPENDIX Q

PROPOSED SCOPE OF WORK: CONSULTANCY ON FINANCE AND MANAGEMENT

This assignment should be conducted by a local consultant with extensive experience in the finance and management of collective enterprises in Tunisia. The consultant should undertake the following tasks:

(1) Analyze the financial situation of the WUAs. This work should take into account the results of the proposed consultancy on O&M cost estimation, described in Appendix R.

(2) Design:

   (a) accounting procedures for recording income and expenditures, as well as summary documents relating the accounting and financial situation of the WUA for periodic reports and

   (b) documents to be used for keeping track of water sales, e.g., coupons or other means.

(3) Establish the methodology for drawing up the budget of a WUA and for following its implementation.

(4) Draw up a model financial report for WUAs.

(5) Suggest an administrative organization for the WUAs, in particular, documentation channels, reports on meetings, and follow-up on implementation decisions.

(6) Train:

   (a) the treasurers of the WUAs in bookkeeping,

   (b) the presidents of the WUAs in organizing meetings,

   (c) the members of the WUA committee in general discussions and debates, and, more generally, in supervising the WUA Boards of Directors.

(7) Prepare booklets on the above-mentioned subjects (accounting, finance, management, and so on).

The design of this WUA management system should be simple, easy to implement, and specific. It should provide for the collection and reporting of comprehensive information.

APPENDIX R

PROPOSED SCOPE OF WORK: CONSULTANCY ON MAINTENANCE MANAGEMENT

APPENDIX R

PROPOSED SCOPE OF WORK: CONSULTANCY ON MAINTENANCE MANAGEMENT

OBJECTIVE:

Assist the proposed Office for Water Point Maintenance in the development of a comprehensive maintenance plan for the governorate of Kasserine.

TASKS:

Work with the proposed Office for Water Point Maintenance to accomplish the following:

1. Develop a plan for preventive maintenance of all public water system equipment in the governorate of Kasserine. This task will begin with the identification of preventive maintenance tasks, including detailed definition, timing, and resource requirements. These efforts would be conducted in collaboration with the consultant working on O&M cost estimation (see Appendix R). Next, a schedule staffing plan and budget must be developed. Finally a training plan must be developed for the training of pump operators and any other personnel (public or private) involved in the preventive maintenance plan.

2. Develop a plan for corrective maintenance. Under this task, the role of the existing repair crews should be examined and decided upon. The role of local-level private mechanics should be investigated and recommendations made for their use/training. The use of private contractors to make major repairs should be studied and compared with continued efforts by government crews, in terms of response time, repair time, cost, and quality of work. Finally, a detailed plan for corrective maintenance work must be developed, including staffing, implementation, and budget. This plan must take into account spare parts issues, as discussed below.

3. Assist the Office for Water Point Maintenance, the CTDA, and the WUAs to develop a plan for the stocking of spare parts. This task should include the development of systems for stocking major parts (probably by the Office), and minor parts (ideally by local suppliers) for use by the WUAs. Consideration should be given to providing incentives for local suppliers to stock small parts, such as filters, for direct purchase by WUAs.

4. Assist the Office for Water Point Maintenance in the implementation of the above plans.

NOTE: The WASH report, Guidelines for Maintenance Management in Water and Sanitation Utilities in Developing Countries (Wyatt, 1988), will be useful in planning and implementing this work.

QUALIFICATIONS REQUIRED:

Mechanical, civil or environmental engineering degree.

Experience in management or maintenance of rural water points using motor-driven pumps.

Fluent French or Arabic. Work experience in North Africa/Middle East.

LEVEL OF EFFORT REQUIRED:

The required level of effort will be approximately six person-months, including four person-months for an expatriate consultant and two person-months for a local consultant. This time will mostly be spent in Kasserine, in a series of trips. The exact timing and duration of the trips can be determined to suit project implementation progress. Initial work on development of the maintenance plans can begin before the reorganization of the Ministry of Agriculture, but the bulk of the work should be carried out in the initial stages of the operation of the Office for Water Point Maintenance. A few days of consulting time will be required in the United States for preparation time, and several days in Tunis will be required for briefing/debriefing USAID/Tunis.

APPENDIX S

PROPOSED SCOPE OF WORK: CONSULTANCY ON O&M COST-ESTIMATION PROCEDURES

APPENDIX S

PROPOSED SCOPE OF WORK: CONSULTANCY ON O&M COST-ESTIMATION PROCEDURES

OBJECTIVES:

1. Assist the CTDA to develop improved procedures for estimating first-level O&M costs. These procedures should be used by the CTDA and the proposed consultant on WUA finance and management (see Appendix T) to prepare improved operating budgets for the WUAs in the legalization process.

2. Assist the proposed Office for Water Point Maintenance in the estimation of second-level O&M costs (see Appendix Q).

TASKS:

1. The consultant should work with the CTDA to develop improved procedures for estimating first-level O&M costs. Appendix L provides some preliminary information on the recommended procedures. Work will involve verification of existing technical data on operating parameters for all WUAs (static level, pump flow, drawdown, etc.). Spot field measurements should be made to verify assumptions on engine and pump efficiencies. Field data on actual costs of small parts and minor repairs should be collected for use in the estimation procedures. A standardized methodology should be adopted for use in WUA budget preparation.

2. The consultant should work with the CTDA to develop a procedure for monitoring the O&M costs of the WUAs. In collaboration with the WUA finance and management consultant, a reporting format should be developed, with which the WUAs can regularly submit data on operating costs to the CTDA. Procedures should be developed whereby the CTDA can compare these records with estimated costs. Thus, improvements in estimating procedures can be made, and suggestions can be made to the WUAs on budget revisions.

3. The consultant should work with the proposed Office for Water Point Maintenance in estimating second-level O&M costs. In collaboration with the consultant on maintenance management, estimates should be prepared of the cost of preventive and corrective maintenance. This work will involve review of existing records and consulting with current staff in the GR and the Rural Development Program, and the private maintenance contractor. This work should provide the information needed to prepare a budget for second-level maintenance for the Kasserine Governorate.

REQUIRED QUALIFICATIONS:

Mechanical, civil or environmental engineering degree.

Experience in maintenance of rural water points using motor-driven pumps.

Experience in analysis of cost data and preparation of maintenance budgets.

Fluent French or Arabic. Work experience in North Africa/Middle East.

LEVEL OF EFFORT REQUIRED:

The required level of effort will be approximately 1.5 person-months. This time will mostly be spent in Kasserine, in two trips. The exact timing and duration of the trips can be determined to suit project implementation progress. However, these technical inputs should be made early in the remaining two-year project period. A few days of consulting time will be required in the United States for preparation time, and several days in Tunis will be required for briefing/debriefing USAID/Tunis.

APPENDIX T

PROPOSED SCOPE OF WORK: CONSULTANCY ON WOMEN'S INTEREST GROUPS WITHIN THE WUAs

APPENDIX T

PROPOSED SCOPE OF WORK: CONSULTANCY ON WOMEN'S INTEREST GROUPS WITHIN THE WUAs

The success of the Rural Potable Water Institutions Project as a model of community participation will remain incomplete so long as women are excluded from the process of identifying needs and solutions to those needs. Apathy prevails and a sense of responsibility is lacking when ideas are imposed on people without their having had an opportunity to express their opinion.

Women in the project area are more than just water users: they are an untapped source of opinion and, potentially, of expertise in the management of scarce resources such as water. To date, women in Kasserine are mainly passive beneficiaries of project activities. They are to a much lesser degree participants in the design and/or execution of project interventions.

The establishment of informal women's interest groups formed within each WUA would help to redress this imbalance. Such interest groups, *Associations d'Interêt Feminin*, have the potential of serving many purposes, most notably the following:

- help women to articulate their opinions on various project activities and the need for site improvements and facilities construction,
- provide a mechanism for communicating women's opinions and concerns to the WUAs,
- involve women in the decision-making process,
- promote women's input in the identification and implementation of community development projects,
- disseminate ideas on productive use of the time and effort saved fetching water, due to generally closer distances to water points, and
- reinforce the messages of the community health workers.

The formation and support of these women's interest groups should be the responsibility of the recently recruited female staff member of the UAG. Key tasks include the following:

(1) work with the community health worker to identify key women in the communities (using a list of WUA member households, their tribal affiliations, and intertribal relations) and to determine whether any informal women's groupings exist, where,

what their organization is, for what occasions, and around which activities women usually assemble;

(2) meet with groups of women and with WUAs to sensitize them to the idea of the women's interest group and to elicit their response;

(3) facilitate the formation of interested women into an effective interest group by acting as their intermediary with the WUAs and the UAG;

(4) involve interested women in developing a schedule of activities and setting objectives that they can realistically accomplish;

(5) coordinate activities with the community health worker, especially with respect to health and hygiene needs and community projects identified by the women; and

(6) build on the philosophy and experience of the UAG in reaching target communities.

Because the new female agent has just begun her job at the UAG, she will need about two months to become familiar with the overall project, the UAG's operations, and the communities themselves. Consequently, the start-up date for planning women's group activities should be May/June of 1989. At that time, one person-month of expatriate and two weeks of local technical assistance should be provided. Both advisors should work together and with the new agent to plan and organize activities. Specifically, technical assistance will be needed for the following:

(1) development of a work plan for forming the women's interest groups;

(2) development of appropriate methods and strategies for identifying and reaching existing informal women's networks; and

(3) identification of training needs for the UAG agent.

Specifications for any follow-up technical assistance should be included in the work plan.

Local technical assistance will be particularly important at this stage to help identify the cultural and political context as it affects women's roles and rights. If the women's interest groups are to have any success, it will be of paramount importance to respect and work within the confines of the cultural setting.