GROUNDWATER EVALUATION

SOMALIA COMPREHENSIVE GROUNDWATER PROJECT

PROJECT NO. 649-0104

PROJECT EVALUATION STATEMENT

MOGADISHU, SOMALIA

by

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I. INTRODUCTION

From February 17 to March 10, 1983, an interim evaluation of the Compresive Groundwater Project was completed by three consultants, Stanley M. Remington, team leader, hydrologist; E. E. Nesbitt, well-driller with Geosource International; and Ms. Susan Gunn, anthropologist. The evaluation is presented herewith with a separate appended evaluation of drilling methods and equipment by Mr. Nesbitt, and an appended evaluation of the socioeconomic conditions of the Project by Ms. Gunn.

The first half of the three-year Project was carried out by Louis Berger International, Inc., of East Orange, New Jersey, and Roscoe Moss Drilling Co. of Los Angeles, California, in a joint operation. The agreement between the Water Development authority of the Ministry of Mineral and Water Resources was signed in March, 1981, for a period of three years at a cost of U.S. $4,504,000.

An Inception Report was prepared in August, 1981, outlining courses of action to be taken during the life of the Project. An Exploratory Report for the Bay Region was submitted in January, 1983, including an Annex containing detailed data collected for the first 18 months of the Project. Also, Economic and Environmental reports were submitted in May, 1982.

Specifically, the evaluation team was asked to:

1. Determine progress toward attainment of the Project objectives,

2. Identify and evaluate problem areas or constraints which have or may inhibit such attainments,

3. Assess how such information has been and may be used to help overcome such problems or constraints,

4. Evaluate the development impact of the Project,

5. Evaluate the rapport between the W. D. A. and the contractors,

6. Evaluate USAID's monitoring role of the Project and their understanding of the adequacy of the Project Design,

7. Evaluate the extent of the contractor's emphasis on the socioeconomic aspect of the Project.

Discussions were held with most of the members of the contracting teams including Phil Roark, project manager; Robert Turney, chief hydrogeologist; Dr. Paula Roark, sociologist; R. Eckart and Mr. Soderman, hydrogeologists; also Mr. Yousuf, deputy director general, W. D. A.; M. Sulleiman, chief

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Surface runoff from the burs brings in additional fresh water recharge to the granitic aquifers. Also, it is suspected that some fresh groundwater exists adjacent to dry river beds where recharge occurs from surface runoff. The aquifers of the granitic basement complex generally have a very low permeability. The upper part is composed of a chemically weathered layer called decomposed granite (DG). Underlying the DG is a thin zone of fractured rock where the highest permeability usually exists. This zone is normally no thicker than one or two meters. The fractures rapidly decrease at depth except in faulted areas. Because of this fact, large diameter, hand-dug wells are usually more suited for these conditions. The hand-dug wells provide for storage of the water, the amount being proportional to the size of the well and the depth below the water table.

III. OBJECTIVES FOR 3-YEAR CONTRACT

1. Supply 30 liters per capita per day plus provision for livestock in priority areas.

2. Create institutional capability for the Government to plan and execute a program for installing rural water supply systems on the basis of at least eight wells per year per rig.

3. Provide technical and material assistance to install at least 48 wells for domestic and livestock use in support of integrated rural development projects for the Bay Region and Central Rangelands. In addition, at least 24 wells will be drilled for exploratory purposes during the first year of the project and most of these wells will be developed for future use as production wells.

4. Collect and analyze data to supplement the data base for planning and programming water resources development for the entire country.

5. Train the staffs of the W.D.A. and MMWR to plan and implement activities on an ongoing basis beyond the project period.

IV. PROJECT DESCRIPTION AND SCOPE OF WORK

1. Develop the water resource base -- mainly in the priority areas of Bay, Hiran, Galgadug and Mudug Regions, and also stengthen the Government's capability to install, operate and maintain rural water supply systems Specifically:

   a. Conduct general nationwide groundwater resource surveys, standardize and collect data.

b. Undertake a detailed survey of project priority areas so as to develop an exploratory drilling program.

c. Execute the exploratory drilling of 24 wells and provide overlay of maps and reports.

2. Provide Institutional Support to WDA and MMWR.

a. Improve hydro data collection and analysis systems.

b. Assist in ordering the supply of equipment and parts.

c. Help establish an equipment/parts inventory control system.

d. Assist WDA in maintaining records on costs and recommend a method of determining appropriate water charges.

e. Undertake sociological analyses and establish social criteria of sites for wells.

f. Provide an analysis of water utilization and develop economic guidelines for allocating costs and adjusting water charges/fees.

g. Undertake environmental data collection and analysis so as to measure the impact of new water supply system -- especially surface water and livestock watering points.

h. Provide on-the-job training to counterparts.

i. Conduct seminars on hydrogeology and groundwater during rainy seasons.

V. ACCOMPLISHMENTS

1. Twenty-five boreholes were drilled using Project equipment and three additional boreholes were drilled by WDA crew in the Bay Region.

2. All previous literature was searched out and collected.

3. Standardization of data forms was worked out with WDA which covered all phases of water resource development which provided a format for all future activities in groundwater assessment. This was also supported by the GTZ (German Technical Assistance Organization for Development).

4. Drilling was performed in high priority areas where a potential existed and where water demand was high.

5. Tuulo village surveys were conducted in 12 tuulos and a range of socioeconomic data was collected and processed for community for community participation were established.

6. Institutional support was provided to the WDA and MMWR, primarily in the form of training and project management.

7. A few pump tests were run because of lack of proper equipment.

8. Water quality analyses were conducted from drilled wells, hand-dug wells, wars and springs. Thirteen separate parameters were conducted for quality, and areas of poor quality were mapped.

9. Socioeconomic study was completed and results and conclusions are presented in the interim report.

I. IDENTIFY AND EVALUATE PROBLEM AREAS OR CONSTRAINTS WHICH HAVE OR MAY INHIBIT SUCH ATTAINMENTS

Discussion - Drilling

1. Fuel has been a major constraint. It was reported that the drilling rigs have been operating about 50% of the time. This is because of the fuel shortage, lack of supporting equipment and spare parts. However, the wells targetted for the first year have been drilled.

2. The equipment which was ordered prior to the implementation of the Project by USAID was not the best type for drilling in limestone formations. The rigs which were ordered are very sophisticated for this country and the problem of getting spare parts may preclude their use upon completion of the 3-year contract if mechanics are not properly trained and additional parts do not become available. LBI is training WDA mechanics to help overcome this problem. Few pumping tests have been conducted because the pumps on order for the Project have not yet arrived. The WDA had loaned some pumps to the Project but have taken them back.

3. Many areas of the Bay Region contain groundwater of very high salinities which may preclude these waters for human and/or livestock consumption.

4. The casing ordered by USAID prior to contract for exploratory drilling was polyvinyl chloride (PVC). Steel casing would have been better.

5. Some wells have not been designed properly. Gravel used in gravel packing is not the correct size for the aquifer conditions. The packing was necessary because the PVC casing required stabilization and gravel packing was the only way to do it.

Equipment and Material

On reviewing the procurement order PIO/C, it was found that several items have been double ordered. The review as not a complete study and it is suspected more items than the samples listed below have been double-ordered.

Double-Ordered Parts

Item No.	Quantity	Page No.
9 & 31	12 & 6	18 & 19
10 & 32	12 & 6	18 & 19
14 & 34	50 & 6	18 & 19
63 & 116	2 & 2	10 & 12
108 & 126	2 & 2	12 & 13

Vehicle Order

The quantity of vehicles ordered should improve the operation and I do not find it excessive. I do, however, note the below:

1. A complete set of wheels has been ordered for each truck. This was unnecessary and they will never be used. No wheels on the trucks so far assigned to the Project have as yet failed.

2. All off-road trucks should have been ordered with single semi-flotation type tires and wheels. A vehicle fitted with these tires and wheels will navigate wet and soft sand terrain far more efficiently than a vehicle fitted with regular dual road tires.

Casing Order

A pump capable of producing in excess of 2000 gallons per hour can be fitted into a well of less than 6" in diameter, and, as most of the wells planned do not require that amount of output, I find the order for 8" and larger diameter casing unnecessary.

USAID ordered 450D meters of 8" PVC which was done prior to the contract; 400 m. of 6 5/8" and 5 9/16" blank steel casing and 1300 m. of 6 5/8" and 5 9/16" of steel telescoping screen has since been ordered.

In some areas of the limestone plateau, such as the Baidoa region, fresher groundwater overlies more saline groundwater. If the groundwater is pumped for a long period and at a relatively high rate, the lower and more saline groundwater migrates upward. The result is a continuous deterioration of the groundwater quality. This is presently occurring in the new well fields supplying the city of Baidoa.

To overcome this problem 'skimming' wells are constructed. These wells are larger in diameter, shallower, and pumped at a much lower rate so as to reduce the drawdown in the well. The problem with them is that more are required and their spacing farther apart. However, if the well field containing the skimming wells is properly managed, theproblem of increased salinity can often be avoided. This must be done with a cable-tool rig, or hand-dug wells can be constructed where the depth to water is not too much.

IX. EVALUATE RAPPORT BETWEEN THE WDA AND THE CONTRACTORS

A fairly good rapport exists between the WDA and the contractors. The Deputy Director of the WDA said he was very happy with the Contractor's performances, especially with the drilling personnel. He did point out one problem area, the relationship with the hydrogeologists. In our discussion with the Deputy Director it became apparent that the problem consisted of the unwillingness of the WDA hydrogeologists to go to the field, and this was primarily because of the low field allowances given them.

Consequently, the two hydrogeologists with LBI became concerned because it was their responsibility to field train their counterparts. This has resulted in some friction between the two groups.

The Deputy Director was initially unhappy with LBI. Of the seven names listed on their original proposal, only three were supplied when the contract was signed. He has said that he is now satisfied with the performances of the substituted personnel.

X. EVALUATE USAID'S MONITORING ROLE OF THE PROJECT AND THEIR UNDERSTANDING OF THE ADEQUACY OF THE PROJECT DESIGN

Recent changes in the USAID Project Manager have created a shortcoming in USAID's monitoring of the Project. Also, a personnel shortage has exarcebated the problem. The present project manager has several other major responsibilities. The LBI team leader said that little or no monitoring of their activities has occurred in the past.

The post of the General Development Officer has been vacant in the Mission and is being filled by the project manager. A SPAR for this position was

recently approved and, hopefully, when this position is filled, more time will become available for proper USAID monitoring.

COMMENTS ON DRAFT WORK PLAN FOR 1983

My comments are opinions based on experience in similar hydrogeological conditions in areas near Somalia. They may not agree with all of the original Project Paper or LBI's Inception Report or the Work Plan for 1983.

1. It is my opinion that any further drilling in the basement complex area will only confirm the presence of low permeabilities and groundwater with a high salinity except in the immediate vicinities of the burs and near dry river beds where groundwaters with lower salinities will be found. This can be proven with the planned resistivity surveys. I would restrict any exploratory drilling in the areas known to contain fresh groundwater and only put in shallow, slim boreholes which would not penetrate the hard, granite basement rocks.

2. It is necessary to provide considerable field training to the WDA hydrogeologists. This has been lacking during much of the first year.

3. How many of the 23 wells in the Bay Region will be production and how many exploratory, or will they all be exploratory and those that can be turned into production wells will be included as part of the 23? Primarily production and some exploratory, subject to the approval of the Bay Region.

4. The job of conducting pump tests is usually done by the hydrogeologists. About the only meaningful parameter you get from short-term pumping tests in limestone aquifers without observation wells is the specific capacity of the well.

5. Are the 12 to 16 production wells part of the 23 wells listed above? (Para. 2.3, (2)).

6. The geological map shows a formation containing gypsum and anhydrite in much of the Central Rangeland. Wouldn't this fact preclude good quality groundwater over much of the area?

7. I would recommend reducing the 12-inch diameters to 10 inches or 8 inches if the down-the-hole bit is used. There are 400 m. of 6 5/8" and 5 9/16" plus 1300 m. of the same size well screens.

8. The number of wells scheduled seems abnormally low for 2 IR-TH 60 and one-cable tool rigs, if the reported constraint of diesel fuel availability is overcome as outlined above (3.7 (b)) and the commodities arrive soon and the problem of vehicle maintenance can be solved.

RECOMMENDATIONS

Drilling

1. Since the contract only has 1 1/2 years remaining it would be impractical to order new drilling equipment unless it is decided to extend the contract to its 6-year life. If so, one or two Mayhew type 1500, and one 1000 rigs should be ordered.

2. Exploratory drilling on the basement complex should be reduced and either hand-dug wells or cisterns be constructed upon the completion of resistivity surveys to delineate areas where fresh and saline waters occur.

3. The TH-60 rigs should be used as much as possible in the areas which require its down-hole hammer capabilities. It is designed for this type of drilling.

4. A cable tool drill rig should be used as much as possible in drilling larger diameter wells and setting 3" casing.

Other Recommendations

1. Continue the Project for the present three-year contract period.

2. The Project civil engineer should be familiar with hand-dug well and cistern construction techniques.

3. Reevaluate the Economic Feasibility section of the original Project Paper, especially the life of the equipment. I noted that a life of 13 years was given to the vehicles. Two years is more realistic.

4. The Project should consider designing 'skimming' wells whereever a layer of fresh groundwater overlaysmore saline groundwater. This will avoid the increases in salinity such as is happening with the Baidoa city water supplies.

5. Reevaluate the Project in one year to better measure the impact and costs. It can be decided at that time if two or three additional rigs should be ordered which are more suitable for existing hydrogeological conditions in the country. Also, at that time the evaluation can better judge the infrastructure of the WDA to determine if they can maintain the Project.

6. Stress more on field training of the hydrogeologists. Select only those WDA hydrogeologists for academic training who show a desire for field work and are proficient in English.

7. Consider a re-emphasis of the original Project design to include more surface water elements, especially in the basement complex areas.

8. A vehicle maintenance shop should be set up to maintain Project vehicles. The present Agricultural Extension shop will be closed to the Project in the immediate future.