

7.7.2 Financial Evaluation

As a result of the evaluation of the Project, the financial internal rate of return (FIRR) cannot be calculated due to the peculiar state of cost benefit streams, characterized by the absence of initial cost in the cost stream.

This financial evaluation was done only for the projected financial statements.

The projected financial statements as shown in Appendix G, Table-4 are summarized in the management indices tabulated below.

(Unit: %)

Management Indices	Revenue to Cost Ratio	Profit Rate	Working Capital to Revenue Ratio	Profit to Total Assets Ratio
Formula	Revenue / Cost x 100	Profit / Revenue x 100	Working Capital / Revenue x 100	Profit / Total Assets x 100
Value	123.8	18.7	44.4	1.3

The table shows that WSA Debarwa will have a substantial extent of profit enough to cushion unpredictable financial turbulences, a thick reserve of working capital to prepare for replacement of facilities and a nominal profit to the assets invested in the years to come.

A trial simulation on FIRR, under the conditions that the initial cost is to be borne by the beneficiaries and the water tariff is to be twice of the proposed one, was conducted as a reference. The result indicated only 8.8% of FIRR under the conditions, which is less than the discount rate of 10%. It means the water tariff must be more than twice of the proposed one to achieve the discount rate of 10%, and it deems to be too heavy burden for the beneficiaries to bear.

7.7.3 Organizational Evaluation

- (1) The skeletal administrative/organizational structures of the PMU and WSA will enable the smooth execution of the first phase of the project and indeed its management latter on. The functions as well as structures will, of course, get more diversified throughout the rest of the Development Program Period as water demand increases and there is more water production.
- (2) The ultimate organizational structure that will be realized in the year 2005 for Debarwa WSA is elucidated in section 7.5.1, and the management of communal water points and toilets will be comprehensive in that it tries to involve all the possible actors or beneficiaries in the town.
- (3) In case of Debarwa WSA, there will be the Town's Water and Sanitation Committee that will also act as the board of WSA. It will have wide powers and responsibilities especially in seeing the efficient management of communal water points and toilets. It can change the members and composition of CWPC and CTC. It will also approve and supervise all planned activities and achievements of the manager of WSA.
- (4) The manager of Debarwa WSA has wide responsibilities and challenges to meet. He will be greatly assisted by the Board and of course the national WSA in all his efforts in managing the office and

run the water and sanitation facilities to the satisfaction of the residents. He will have more and better qualified staff.

- (5) The existence of a separate unit in Debarwa WSA charged with sanitation issues will greatly improve the town's sanitation. It is expected that there will be easy access to credit facilities to construct latrines for those who should afford.

7.7.4 Technological Evaluation

The proposed water supply system is composed of relatively simple facilities, those of which are not quite different from the existing ones. Main materials for the project, such as PVC pipe for casing and screen, submersible pump for well pump, ductile cast iron pipe for transmission pipeline and PVC pipe for distribution pipeline, are recently very common in Eritrea. There are a few agents of these materials in Asmara. Although a new material made of fiberglass reinforced plastic is to be introduced for elevated tank, the light material could facilitate the construction work very smoothly. The material is also expected to have a long life span comparing with other conventional materials, thus the long run cost could be reduced for the reservoir.

The construction works are carried out by manual labor at present. Soil features are sometimes fresh rock, and topographical configurations are various and steep. Moreover, the lengths of transmission and distribution pipelines are so long. Therefore, use of construction machinery is to be considered to minimize the construction period. Also, the construction works by machinery will be useful and popular in future in Eritrea.

Under the project, several numbers of boreholes are newly required. Their locations are distant from the town and/or distant each other, or sometimes away from others. Therefore, mobilization of these well pumps and boosting pumps is required for periodical or daily operation. In this regard, transportation shall be strengthened by means of vehicle or motorbike.

7.7.5 Social and WID Evaluation

- (1) Both newly constructed and existing communal water points will be managed by the community, 50 percent of whom will be women.
- (2) In order to strengthen good community management in both communal water points and health/sanitation areas, community organizers will be made available by the PMU. Well managed community water and sanitation facilities are expected to minimize current community' frustration with opening hours, breakdowns and repairs, water tariff, etc. The community is expected to be financially self-sufficient and will be vested with decision making powers in financial, personnel and when appropriate in technical terms as well as personnel.
- (3) The value-added related to WID are as follows:
 - The project should result in the shift in the quality of life of all social groups from a lower level to a higher level. It will make Debarwa a more pleasant place to live and will attract house builders, especially from Asmara who wish to commute to Debarwa, thus relieving the demand for land and houses in Asmara.

- By improving the piped water supply in Debarwa, the intended benefits will include the significant reduction of time and energy spent in the collection of water, for men, women, boys and girls. This will allow, almost every one in Debarwa to have more time for other activities including more leisure time, income generating activities and improved sanitary behaviors. More specifically, it will allow the girl learners and boys to have more time for studying.
- The construction of latrines and public toilets, will enable women and girls to have more privacy than they have had in the past for urination, defecation and menstruation. Additionally, improved latrine facilities will benefit all residents of the town, as the bad smell will be substantially reduced.
- The project will allow the community to have a say in the determination of the location and design of the facilities in Debarwa, thereby increasing their sense of empowerment in matters that directly concern them. In addition, it is expected that the project will generate employment opportunities some of which are likely to be for a long term.

7.8 Project Implementation Plan

Major works of this project are borehole drilling work, pipe laying work, civil works, mechanical and electrical works, etc. Construction works for the distribution facilities (reservoir and distribution pipeline) and service facilities (individual connections and communal water points) can be carried out anytime after obtaining work permission. However, a few borehole drilling and consequent construction of transmission facilities shall be implemented after surveyed and fixed the exact location of the well.

Although the existing water supply facilities are obsolete and insufficient, they are kept working during construction. Therefore, the existing water supply facilities shall not be damaged during the time.

Implementation schedule is divided into two stages, namely, a) preparation of finance including the foreign currency portion and of detail design together with tender documents, and b) implementation of the project.

Figure 7.8.1 Implementation Schedule

Work Item	Year 1999	Year 2000
Stage I Preparation		
(1) Preparatory Work and Detail Design	████████████████████	
Stage II Construction		
(1) Pump and Control house		████████
(2) Transmission Pipeline		████████
(3) Reservoir		████████████████
(4) Distribution Pipeline		██
(5) Communal Water Point		████████████████
(6) Temporary Road		████████

CHAPTER 8 CONCLUSION AND RECOMMENDATION

8.1 Conclusion

The project of Groundwater Development and Water Supply for Seven Towns in Southern Region is concluded as follows:

8.1.1 Field Survey

- (1) Through the reconnaissance of the town and work shops held in the town, the current poor water supply and sanitary conditions, people's eagerness for water supply development, and inhabitants' well understanding on the importance of sanitary condition were recognized.
- (2) A series of hydrogeological investigation grasped the hydrogeological property of the area and selected out a test well drilling point. DEB-1, thus drilled, indicated quite high yield of around 15 lit/sec. An automatic water level recorder has been installed, and the groundwater monitoring is still under way.
- (3) A hydro-meteorological survey collected existing data and set a rain-gauge at each target town, two staff gauges along the Mereb, and a staff gauge at two surface dams. Observations through those gauges are still continued.
- (4) A series of socio-economic survey revealed the actual life-level and willingness of the inhabitants, such as occupation, house income, current water supply means and volume of water consumed willingness to pay, and so forth.

8.1.2 Formulation of Development Plans

- (1) The project for water resources development, water supply and sanitation improvement was formulated as phased plans with horizons of 2005, 2010, and 2015. Water resources development was focused on groundwater, and a domestic water supply was given priority.
- (2) Future population of Debarwa is projected to be 9490, 13020, and 17230 at each target year respectively. While, a domestic water consumption rate is estimated at 18.8, 19.9, and 22.6 l/c/d for the same respective years. Based on those figures, as well as the consideration on the other water uses, extension of service area, etc., the water demand is calculated to be 411, 754, and 1318 m³/day for each target year.
- (3) Groundwater development potential around Debarwa is quite high because the ground-water basin including the town has a large area and the major aquifer in the basin has fair to excellent property. DEB-1 can solely cover the water demand by 2010 target year, and existing BH-12 shall be involved by the year 2015.
- (4) Planned water supply facilities comprise of new reservoir tanks, covering 1,860 m of transmission pipeline with max. diameter of 100 mm and 59,058 m of distribution pipeline with max. diameter of 125 mm, 2 control houses, etc.

- (5) Planned sanitary facilities are public latrines and school latrines. Besides, sanitation improvement plans such as waste water and storm water drainage, refused disposal, etc., as well as the educational program on sanitation, were studied and recommended.
- (6) Institutional strengthening plans on MoLWE, MoLG, MoH, WSA, local WSAs and some other local agencies were studied and several recommendations were presented.
- (7) Project costs on water supply and sanitation facilities were estimated as follows:

Target year	Water supply	Sanitation	Total
2005	8,153,400	419,800	8,573,200 Nfa
2010	6,239,900	224,700	6,464,600 Nfa
2015	16,872,800	300,700	17,173,500 Nfa

- (8) O&M cost for the facilities were estimated to be 300900, 557800, and 924100 Nfa for the target years of 2005, 2010, and 2015 respectively.
- (9) Through the financial analysis, water tariffs of 7.5 – 6.5 Nfa for house connection, 4 Nfa for yard connection, and 2 Nfa for communal water points were proposed.
- (10) Economic evaluation figured out 7,111 thousand Nfa of NPV, 1.46 of B/C, and 15.2% of EIRR, and sensitive analysis indicated an economical toughness of the Project.
- (11) While, financial evaluation suggested a reasonable extent of profit to make a provision for unpredictable financial turbulence, a thick reserve of working capital to prepare for replacement of facilities and nominal profit to the assets invest in the years to come.
- (12) The project was, thus, tolerable for economic and financial evaluation, and withstanding for organizational, technological, social and WID, and environmental evaluations.
- (13) Project implementation plan is formulated as follows: from 1999 for the first, from 2003 for the second, and from 2008 for the third phase implementation. Each phase shall have around one year of preparatory work period and following one year of actual implementation period.

8.1.3 Feasibility Study

- (1) Project feasibility was studied for the priority projects targeting the year of 2005.
- (2) The first phase implementation for the priority projects is feasible on the condition that the initial cost will be subsidized by the government, and to be promoted by the Ministry of Local Government with appropriate foreign assistance.
- (3) Projected water demand in 2005 is 411 m³/day, and the volume is easily covered only by DEB-1.
- (4) Designed facilities to be constructed under the Project are a well pump, transmission pipeline, distribution pipeline, reservoir, communal water points, temporary access roads, control houses, school latrines, and public latrines.

- (5) Project cost for water supply is estimated at 8,153,400 Nfa, while for sanitation 419,800 Nfa. The O&M cost for the first phase is estimated to be 300,900 Nfa.
- (6) For smooth implementation and effective O&M of the facilities, a capacity building of local WSA as well as the establishment of local sanitary committees, is required.
- (7) Water tariff to be applied under the Project is estimated at 7.5, 4.0, and 2.0 Nfa/m³ for house connection, yard connection, and communal water points users, respectively. Revenue estimation based on the tariff suggested sufficient sound management of WSA.
- (8) Cost benefit streams analyzed were 1,804 thousand Nfa of NPV, 1.24 of B/C, and 13.6% of EIRR, showing soundness of the Project. Sensitive analysis figured out also an economical toughness of the Project.
- (9) Financial evaluation figured out 123.8% of revenue to cost ratio, 18.7% of profit rate, 44.4% of working capital to revenue ratio, and 1.3% of profit to total assets ratio. The figures show the WSA will have a reasonable profit, a thick reserve of working capital, and a nominal profit to assets invested in the year to come.
- (10) The Project is tolerable for organizational, technological, social and WID aspects evaluations.
- (11) Implementation schedule is to be divided into two stages: a preparatory stage and construction stage.
- (12) The Project is, thus, feasible.

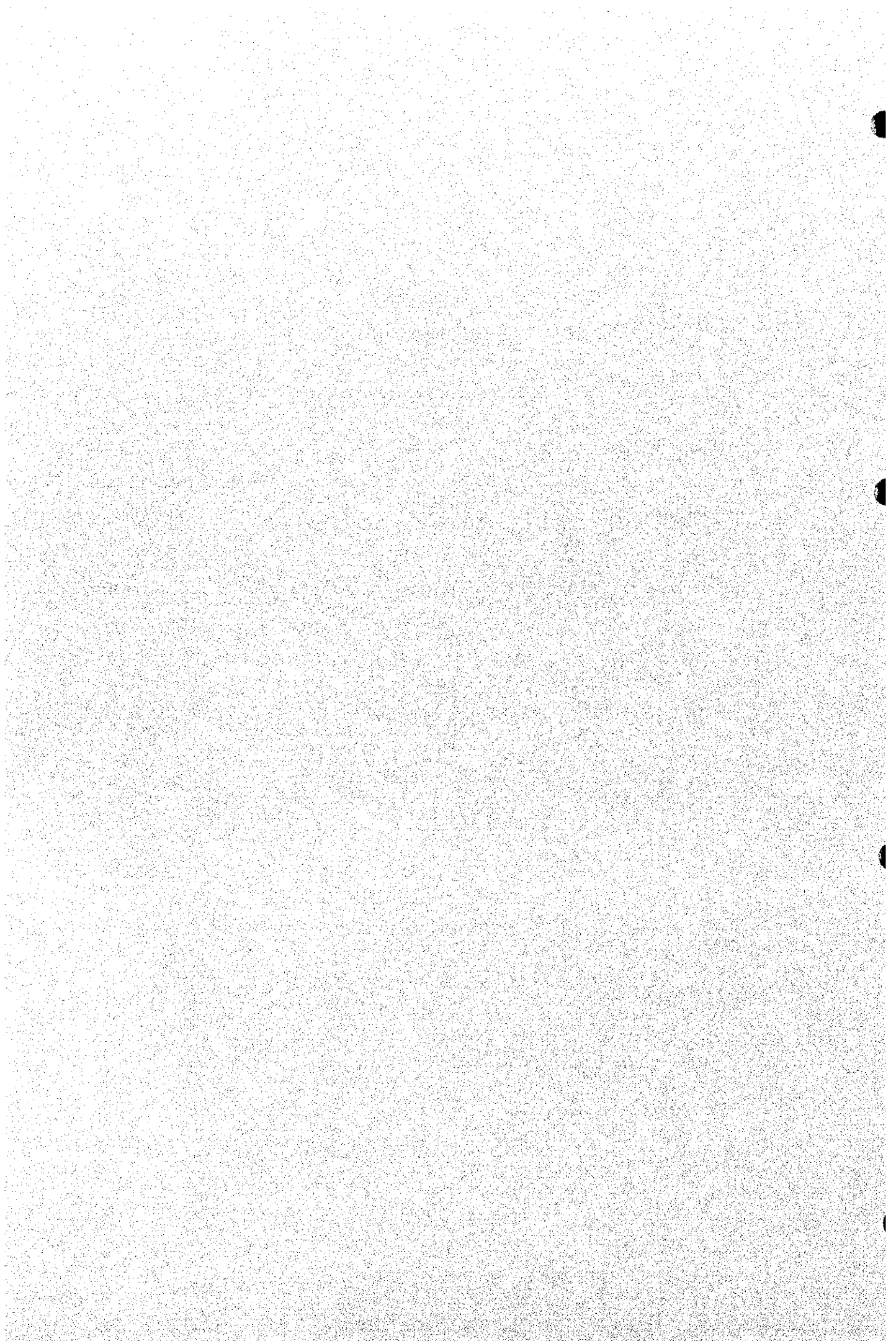
8.2 Recommendation

- (1) The Government of Eritrea is recommended to consider financing of the Project of Groundwater Development and Water Supply for Seven Towns in Southern Region to implement the first phase of the phased plans targeting 2005.
- (2) Institutional strengthening of RAD of MoLG, WD of MoLWE, EHU of MoH are quite important, not only for the Project but also for all other national development programs.
- (3) Smooth and complete establishments of WSA both of national and local levels, as well as the associated local committees based on autonomous management, are highly recommended.
- (4) PMU of the Project, under RAD of MoLG, shall be established as soon as possible.
- (5) Establishment of a training center under the national level WSA, for financial, technical, and legal personnel of local WSA, is recommended.
- (6) The concept of community based management and people's participation shall be taken into the consideration throughout the project implementation and O&M after construction.
- (7) Besides the provision of public/school latrines under the Project, provision of on-site drainage system for sewerage, and refuse truck/containers for refuse disposal, are recommended.

- (8) Educational program is also of vital importance for sanitation improvement, against the construction of sanitary facilities. Thus, carrying out this educational program formulated under the Project is recommended.
- (9) Monitoring of groundwater, observation of rainfall, and measuring of river runoff are essential for the Project and for future water resources development programs. To continue those measurement is highly recommended.

APPENDICES

A. Scope of Work	i
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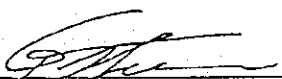


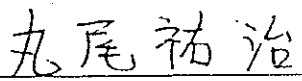
A. Scope of Work

SCOPE OF WORK
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT AND WATER SUPPLY
FOR
THE SEVEN TOWNS IN SOUTHERN REGION
OF
ERITREA

AGREED UPON BETWEEN
THE MINISTRY OF LAND, WATER AND ENVIRONMENT
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

Asmara, April 22, 1997


TESFAI GHERMAZIEN, Ph.D.
Minister for Land, Water and Environment


Dr. Yuji MARUO
Leader of the Preparatory Study Team,
Japan International Cooperation
Agency (JICA)



I . INTRODUCTION

In response to the official request of the Government of State of Eritrea (hereinafter referred to as "the Government of Eritrea"), the Government of Japan decided to conduct a Study on Groundwater Development and Water Supply for the Seven Towns in Southern Region of Eritrea (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Eritrea.

The present document sets forth the Scope of Work for the Study.

II . OBJECTIVES OF THE STUDY

The objectives of the Study are:

- (1) to evaluate potential of water resources, focusing on groundwater
- (2) to formulate a development plan for water supply and sanitation
- (3) to conduct feasibility study for water supply project
- (4) to pursue technology transfer to counterpart personnel in the course of the Study.

III . STUDY AREA

The Study will cover following 7 towns in Southern Region.

- Adiquala, Segeneiti, Adi Keyih, Senafe, Mendefera, Dekemhare, Debarwa

IV . SCOPE OF THE STUDY

Stage I: Data Collection and Evaluation of Present Condition

1. Collection, review and analysis of related data and information
 - a. social and economic conditions
 - b. natural conditions (topographical maps, hydrogeological maps, meteorological data, hydrological data, geological data, aerial photo, etc.)
 - c. other projects relevant to the Study
 - d. existing well data and existing water supply services
 - e. sanitary conditions
 - f. present conditions and policies related to "Women in Development (WID)"
 - g. laws, regulations and policies on water resource development, water supply and sanitation
 - h. other relevant data and information
2. Topographic surveying
3. Diagnostic survey of existing water supply facilities
4. Water quality analysis for existing water supply facilities

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5. Survey on actual conditions of seven towns
 - a. condition of water use and sanitation
 - b. social and economic aspects
 - c. people's awareness on health and hygiene and their willingness to pay for better water supply services
 - d. cultures and habits on water supply and sanitation
 - e. women's social situation
6. Initial Environmental Evaluation (IEE)

Stage II: Water Resources Potential Survey

1. Field reconnaissance
 - a. topographical and geological investigation
 - b. rivers and springs
 - c. hydrogeological investigation
2. Preparation of inventory of existing wells
3. Geophysical exploration
4. Test well construction, well logging, pumping test and water quality analysis
5. Leveling survey for observation wells
6. Observation of groundwater level
7. Observation of river flow and water quality analysis
8. Water balance analysis and preparation of hydrogeological map
9. Evaluation of water resources potential

Stage III: Development Plan for Water Supply and Sanitation

1. Water demand projection and confirmation of planning framework
2. Formulation of water sources development plan
3. Formulation of water supply facility plan
4. Formulation of operation and maintenance plan and institutional development plan
5. Sanitation development plan
6. Cost Estimation
7. Evaluation
 - a. socio-economic evaluation
 - b. institutional and technical evaluation

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- c. environmental impact
- 8. Formulation of implementation program
- 9. Selection of projects for feasibility study

Stage IV: Feasibility Study on Development Projects

- 1. Supplementary investigation
- 2. Water demand projection and confirmation of planning framework
- 3. Formulation of groundwater development plan
- 4. Formulation of water supply facility plan
- 5. Preliminary design of facilities
- 6. Cost Estimation
- 7. Formulation of operation and maintenance plan and institutional development plan
- 8. Evaluation
 - a. financial plan and evaluation
 - b. institutional and technical evaluation
 - c. socio-economic evaluation
 - d. environmental impact assessment (EIA)
- 9. Formulation of implementation program

V. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the tentative schedule as attached in the appendix. The schedule is tentative and subject to modification if such necessity should arise during the course of the Study and mutually agreed to by both parties.

VI. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Eritrea.

1. Inception Report:

Ten(10) copies at the commencement of the first work period in Eritrea. This report will contain the schedule and methodology of the Study as well as outline of the field survey.

2. Progress Report :

Ten (10) copies about three(3) months after the commencement of the first work period in

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Eritrea.

3. Interim Report:

Ten (10) copies at the end of the first work period in Eritrea. This report will summarize the findings of the first field survey.

4. Draft Final Report:

Ten (10) copies at the third work period in Eritrea. The Government of Eritrea shall submit its comments within one (1) month after the receipt of the Draft Final Report.

5. Final Report:

Ten (10) copies within two (2) months after the receipt of the comments on the Draft Final Report.

VII. UNDERTAKINGS OF THE GOVERNMENT OF ERITREA

1. To facilitate the smooth conduct of the Study, the Government of Eritrea will take the following necessary measures:

- (1) To secure the safety of the Japanese study team (hereinafter referred to as "the Team")
- (2) To permit the members of the Team to enter, leave and sojourn in Eritrea for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees
- (3) To exempt the members of the Team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into Eritrea for the conduct of the Study
- (4) To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study
- (5) To provide necessary facilities to the Team for remittance as well as utilization of the funds introduced into Eritrea from Japan in connection with the implementation of the Study
- (6) To secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study
- (7) To secure permission for the Team to take all data and documents (including photographs and maps) related to the Study out of Eritrea to Japan
- (8) To provide medical services as needed, expenses for which will be chargeable to the members of the Team.

2. The Government of Eritrea shall bear claims, if any arise, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of

their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the member of the Team.

3. The Ministry of Land, Water and Environment shall act as a counterpart agency to the Japanese Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations for the smooth implementation of the Study. The Ministry of Land, Water and Environment shall, at its own expense, provide the Team with the followings, in cooperation with other organizations concerned:

- (1) available data and information related to the Study
- (2) counterpart personnel
- (3) suitable office space with necessary equipment in Asmara
- (4) credentials or identification cards
- (5) appropriate number of vehicles with drivers.

VIII. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures:

1. to dispatch, at its own expense, study teams to Eritrea
2. to pursue technology transfer to the Government of Eritrea counterpart personnel in the course of the Study.

IX. CONSULTATION

JICA and the Ministry of Land, Water and Environment shall consult with each other in respect of any matter that may arise from or in connection with the Study.

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TENTATIVE STUDY SCHEDULE

MONTH DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
WORK IN ERITREA																	
WORK IN JAPAN																	
STAGE OF THE STUDY			STAGE I	STAGE II							STAGE III, IV						
REPORT PRESENTATION	▲ IC/R			▲ P/R				▲ IT/R							▲ DF/R		▲ F/R

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B. Member of the Study Team

KUME Takao	Team Leader / Water Supply
KAWASAKI Ryoichi	Hydrogeology (A) / Groundwater Development
HIGUCHI Masao	Hydrogeology (B)
Mahbub A.K.M. REZA	Hydrology / Environment
TAKAHASHI Naoyoshi	Geophysics
HASE Masahiro	Drilling Supervisor
ISHIBASHI Naomichi	Financial Planning / O&M
Haregu GEBRESILASSIE	Sanitary / Hygiene Improvement Planning
KIMATA Noriyasu	Facility Planning / O&M
TANAKA Etsuji	Design / Cost Estimation
Tesfa Mariam TEKIE	Socio-economy / People's Participation
SHIBATA Eichi	Coordinator

C. Name of Counterpart Personnel

Mr. Ghebremichael Temnewo	Acting General Manager
Mr. Michael Negash	Chief Hydrologist
Mr. Tewolde Solomon	Chief Hydrogeologist
Mr. Fikremariam Kahsai	Head, Water Quality Test Laboratory



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JICA