- How to evaluate the result

6.8 Financial Plan

6.8.1 Willingness-to-Pay

Households were classified into three groups based on the size of their monthly income. It was assumed that those households with the monthly income of up to Nfa 599 belong to the low income group, those with the monthly income of Nfa 600 to Nfa 999 the middle income group and those with the monthly income of Nfa 1,000 and more the high income group.

According to the socio-economic questionnaire survey conducted by the JICA study team, the average monthly income and the share of each income group works out as shown in the table below. It shows that income is widely apart from group to group. It also shows that the income and the share are negatively correlated.

The average willingness-to-pay for water is Nfa 15.1 in monthly amount and 2.0% as the percentage of income.

Income group wise, the average willingness-to-pay is Nfa 10.3, Nfa 15.7 and Nfa 25.0 in monthly amount in the low, middle and high income groups respectively, while it is 2.8%, 2.0% and 1.6% as the percentage of income in the respective groups.

The table shows that the richer you are, the more you are willing to pay for water. However, it is noticed at the same time that there is not so much difference in the willingness-to-pay in monthly amount as in the size of income between groups. It results in the fact that the richer you are, the less you are willing to pay for water in terms of the percentage of your income.

Item	Low Income	Middle Income	High Income	Total
1. Average Monthly Income, 1997 (Nfa)	365	784	1,519	739
2. Share (%)	49.1	29.1	21.8	100.0
3. Willingness to Pay for Water (Nfa/m)	10.3	15.7	25.0	15.1
4. Willingness to Pay for Water (%)	2.8	2.0	1.6	2.0

The low, middle and high income groups are assumed to be the candidates for the users of communal water points, yard connections and house connections, respectively.

6.8.2 Water Tariff Analysis

According to the results of the socio-economic survey, the high, middle and low income groups in Adiquala are willing to pay monthly at Nfa 25.0, Nfa 15.7 and Nfa 10.3 for water, respectively. However, in terms of percentage of income, their respective willingness-to-pay for water works out at 1.6%, 2.0% and 2.8%.

To achieve the financial objective of sustainable management for WSA Adiquala as well as the social

justice, water price is proposed to be the highest for the house connection users, at a medium level for the yard connection users and the lowest for the communal water point users. The house connection users include non-domestic customers. In the same context, the payment for water in terms of the percentage of income will be higher for the house/yard connection users than for the communal water point users. The latter proposal defies the results of the socio-economic survey. The underlying concept is the cross-subsidizing among income groups. In all cases, the percentage of water payment to income will not exceed 4% as recommended by the World Bank.

After series of mathematical model simulations to attain financial viability and stability for WSA Adiquala and at the same time to fulfill social fairness and justice, water prices in the target years are proposed and shown in Table 6.8.1.

Table 6.8.1 Payment for Water by Service Mode -Adiquala-

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point		Total	
	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)
2000	1,660	20	905	30	407	50	807	100
2005	1,810	23	944	33	472	44	936	100
2010	1,949	27	976	37	547	36	1,084	100
2015	2,113	31	871	69			1,256	100

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	lcd	Price/cm	lcd	Price/cm	lcd	Price/cm
2000	25	7.5	20	5	15	2
2005	29	7.5	22	5	15	2
2010	34	10	24	7	15	2
2015	39	10	27	7		

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	Payment/m	Payment %	Payment/m	Payment %	Payment/m	Payment %
2000	27	1.6	14	1.5	4	0.9
2005	31	1.7	16	1.6	4	0.8
2010	49	2.5	24	2.4	4	0.7
2015	57	2.6	27	3		

The shares and lcd for the three types of water facility users in the target years were previously determined by the study team based on the current water supply and other conditions in Adiquala, which

were clarified as a result of the socio-economic survey. The monthly income by type of users was projected based on the existing economic conditions and socio-economic survey conducted. In doing so, the annual average growth rate of income in real terms was assumed at 3%.

It is proposed that the water price per cubic meter will be Nfa 7.5, Nfa 5 and Nfa 2 for house connection, yard connection and communal water point users respectively up to the target year of 2005. Also, it will be Nfa 10, Nfa7 and Nfa 2 for the respective users up to the target year of 2015 (for communal water point users up to 2010).

Thus, the monthly payment for water will be Nfa 31, Nfa 49 and Nfa 57 for house connection users in 2005, 2010 and 2015 respectively, Nfa 16, Nfa 24 and Nfa 27 for yard connection users in the respective target years, and Nfa 4 for communal water point users up to 2010. In terms of the percentage of income, it will be 1.7%, 2.5% and 2.6% for house connection users, 1.6%, 2.4% and 3% for yard connection users, in the respective target years, and 0.7%-0.8% for communal water point users up to 2010.

6.8.3 Revenue Estimation

The revenue sources of WSA Adiquala are water charge, technical service charge, meter rent and miscellaneous revenues.

Water charge is the central revenue source. It is collected from the house connection, yard connection and communal water point users. House connection users include commercial, industrial and institutional clients. Water charge has been calculated from the number of households/non-domestic customers, family size, lcd and water price by the mode of water supply in each year for the whole period from the completion of the first phase project up to the final target year. In translating the amount of water charge into the revenue, bill collection efficiency was assumed to be 98% based on the current situation where it is virtually 100%.

The second revenue source is the technical service charge. When WSA Adiquala installs an individual connection for a customer, this technical service charge will be collected in addition to the material cost. It is calculated at Nfa 378 on average. The number of individual connections to be installed is estimated at 935, 439 and 561 in 2005, 2010 and 2015, respectively.

The third revenue source is the revenue from meter rent. The rental fee is assumed to be Nfa 1 per month per individual connection.

The last revenue source is miscellaneous revenues such as those from the sale of materials, fines, etc. They were not taken into account because they are of an irregular and unpredictable nature on one hand, and not substantial in amount on the other hand.

The revenue deriving from the above-mentioned sources must be sufficient and stable enough to sustain the management of WSA Adiquala in the years to come.

Taking all the above-mentioned into consideration, the future revenue of the WSA is estimated as follows:

(Unit: Nfa thousand)

Year	2002	2003	2004	2005	2006	2007	2008	2009
Revenue	678	738	806	881	1,086	1,259	1,475	1,744
Year	2010	2011	2012	2013	2014	2015	2016	
Revenue	2,083	2,161	2,324	2,523	2,749	3,004	2,960	

6.8.4 Cost Analysis

(1) Initial cost

Initial cost is comprised of construction cost, engineering fee, administration cost and physical contingency. Each of the above-mentioned cost was divided into local and foreign components.

Construction cost was classified into the cost for pumps and other facilities because of the difference in depreciation period between the two categories. The depreciation period is assumed to be 15 years for the pumps and 50 years for other facilities.

Engineering fee, which belongs to foreign components is assumed to be 10% of construction cost, while administration cost, which is usually composed of local currency is estimated at 2% of construction cost. Finally, 10% was added to the sum total of the above-mentioned cost as physical contingency.

Initial cost is estimated at Nfa 9,942 thousand, Nfa 13,907 thousand and Nfa 8,493 thousand at 1997 prices for the works for the target years of 2005, 2010 and 2015 respectively. (Refer to the tables below.)

- Year 2005

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	13	311	324
Other Facilities	3,767	3,978	7,745
Sub-Total	3,780	4,289	8,069
2. Engineering Fee	-	807	807
3. Administration Cost	161	-	161
4. Physical Contingency	395	510	905
Total	**4,336**	**5,606**	**9,942**

- Year 2010

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	19	602	621
Other Facilities	4,942	5,725	10,667
Sub-Total	4,961	6,327	11,288
2. Engineering Fee	-	1,129	1,129
3. Administration Cost	226	-	226
4. Physical Contingency	519	745	1,264
Total	**5,706**	**8,201**	**13,907**

- Year 2015

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	21	804	825
Other Facilities	2,215	3,854	6,069
Sub-Total	2,236	4,658	6,894
2. Engineering Fee	-	689	689
3. Administration Cost	138	-	138
4. Physical Contingency	237	535	772
Total	**2,611**	**5,882**	**8,493**

(2) Implementation schedule

Implementation for the first, second and third phases of works is scheduled as follows. Each phase of the works covers two years, the first year will be for detail design and the second year for construction.

2000	2001	2002	2003	2004	2005	2006	2007
2008	2009	2010	2011	2012	2013	2014	2015

(3) O & M cost

Operation and maintenance cost to be incurred annually after the completion of each phase of works is estimated as follows.

(Unit: Nfa thousand)

2005	2010	2015
425	870	1,554

6.8.5 Projection of Financial Statement

In preparing projected financial statements based on the estimated revenue and cost as explained in sections 6.8.3 and 6.8.4, it was assumed that:

(1) Initial cost will be totally subsidized by the government, viz., the people of the town will not be obliged to repay the initial cost.

(2) The people of the town will shoulder the replacement cost of all facilities.

(3) No tax will be imposed on the profit from water supply operations.

(4) Project life will be 30 years since the start of the implementation of the first phase of works.

The resultant financial statements including income statement, funds statement and balance sheet are shown in Appendix G, Table-2.

Revenue to Cost Ratio	Cash to Revenue Ratio	Profit to Assets Ratio
121.4%	41.5%	1.2%

As the table shows, WSA Adiquala will be financially successful and have a stable management in the years to come, if all the conditions mentioned in the preceding sections concerned are met.

6.9 Project Evaluation

6.9.1 Economic Evaluation

(1) Benefits of water

Implementation of the Project will provide a reasonable amount of clean and safe water to the wide ranges of the people of the town. It means that women, girls and boys will be set free from the daily repetition of water fetching drudgery. Also, the incidence of water-related diseases such as diarrhea, dysentery, parasitic diseases and skin diseases will be drastically reduced, whereby contributing to the improvement of the health of the people in general.

These economic benefits can be considered to be reflected in the prices of water. Currently, the prices of water in the town is institutionally fixed, ranging from Nfa 1.5 to Nfa 5 per cubic meter depending on service modes. Such water prices only partially represents the economic benefits of water, but not fully due to institutional consideration. The economic benefits of water can be regarded to be fully reflected in the prices of the water bought from water vendors. In Debarwa, where the scarcity of piped water is the most severe among the seven towns, water prices from water vendors range Nfa 16 to Nfa 40 per cubic meter according to the socio-economic survey.

The economic benefits of piped water is assumed at Nfa 20 per cubic meter.

(2) Future lcd and population in the without project case

The lcd or the per capita per day piped water consumption in liters under the existing circumstances in the seven towns is calculated at 10.3 on average based on the results of the socio-economic survey. The value is 74% of 13.9, which is an lcd including water from shallow wells, rivers/springs and rain.

In the "without project" case, it is assumed that the lcd will continue to be 10.3 throughout the project life period.

If the Project is not implemented, it is expected that the population of the town will not grow as fast as envisaged in the "with project" case due to constraints in water supply.

In the "without project" case, it is assumed that the growth rate of population will go down to a half of the rate foreseen in the "with project" case.

(3) Other conditions/assumptions

In performing economic analysis, the following conditions/assumptions were presupposed besides the above ones.

a) Project life:.....30 years from the start of the first phase works

b) Opportunity cost of capital:.....10%, an average value perceived appropriate by the World Bank

c) Cost and implementation schedule:....(see 6.8.4.)

d) Standard conversion factor: .....0.9, to be applied to local components of initial cost

(4) Results of Economic Analysis

Cost benefit streams were prepared based on all the above-mentioned conditions and assumptions, as shown in Appendix G, Table-3.

Using the streams, economic analysis of the Project was carried out, producing the economic criteria as shown in the following table.

Economic Criteria	NPV (Nfa thousand)	B/C	EIRR (%)
Value	578	1.03	10.4

The table shows that the EIRR of the Project is 10.4%, which is slightly over 10% or the assumed opportunity cost of capital (OCC). Thus, the Project can be regarded to be sufficiently feasible.

(5) Sensitivity analysis

Sensitivity analysis was performed to determine how EIRR will change if cost overrun of 20% occurs or if the cost overrun of 20% and the 10% decrease of benefits simultaneously happen. The results are shown below.

EIRR (%)

Case	Base Case	Case 1	Case 2
Conditions	-	Capital Cost: +20% O & M Cost: +20%	Capital Cost: +20% O & M Cost: +20% Benefits: -10%
Value	10.4	7.6	5.4

The table shows that the EIRR stays as much as 7.6% even under the unfavorable situation of Case 1, and still stays substantial in amount even under the severest assumption of Case 2.

6.9.2 Financial Evaluation

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.

Therefore, financial evaluation was done for the projected financial statements only.

The projected financial statements as shown in Appendix G, Table-2 are summarized in the management indice tabulated below.

(Unit: %)

Management Indice	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	121.4	16.0	41.5	1.2

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

6.9.3 Organizational Evaluation

At the national/central level, strengthening of the various Departments of the MoLWE, MoLG and the MoH is proposed. While the task allocation at the central level seems to be clear, those of the region needs much refinement and clarification, especially so far as the relationship with sector at the center is concerned.

While the establishment of the WSA is expected after the promulgation of the Water and Sanitation Law, it is however, proposed to establish the PMU much earlier to facilitate the implementation of the first phase of the project.

In the following are presented the proposed organizational/institutional measures:

(1) There is a need for strong component of institutional capacity building as well as training of middle level and lower level manpower for the main focal ministries at the central level, i.e., MoLWE, MoLG and MoH. WSA staff in Adiquala also need a strong component of re-training. As a

precondition to this, however, stronger and more transparent division of responsibilities between the central focal ministries for water and sanitation and the regional counterparts needs to be established. If RAD/MoLG is to gradually hand-over its executing and supervisory role to the regional level, it is also necessary to build the capacity and the level of skills of regional institutions and regional level manpower.

(2) It is proposed that all training of middle and lower level manpower be centralized and that the national WSA be entrusted with all training responsibilities related to water supply facilities. This will have a number of merits which include better training needs assessments, uniformity in equipment and materials, cost savings, etc.

(3) A close look at the organizational/institutional framework of the three ministries also reveals that the planning function is separate from the main departments responsible for water or sanitation. Though all of them have Planning and Human Resources Department it is not clear how, by whom and where, for example, water demand projection and facility planning will be done. Are these the functions of central level ministries or regions? Or should it be given to the envisaged WSA? The decision need to be taken in order to set the track for a proper management of water and sanitation projects.

(4) In the wake of the establishment of WSA, it needs to be vested with decision making powers in setting water tariffs (which needs to be based on a thorough study of local conditions), as well as personnel management, execution of small-scale rehabilitation and maintenance works, purchasing of equipment and supplies. Approval will be given by the RAD/MoLG and reported to the Board.

(5) With regards to sanitation, training will have to continue to be given by the MoH. It seems, however, that there is duplication and overlap between the functions of the Environmental Health Unit of the MoH and those of the MoLWE concerning issues related with policies, regulations and supervisory role. The same is also true with regards to tasks of the MoLWE and those of the MoLG/RAD in relation to water demand projection and facility planning.

(6) Existing sanitation/health committees will be strengthened in Adiquala, by including members from schools, hospital/health center, the bank, regional WSA staff and the community. The major objective of the committee will be to promote, coordinate and unify activities so that sanitary awareness of the people and the installation of facilities will be effectively promoted.

(7) According to the socio-economic survey conducted by the study team, the sampled households in the study areas are not in favor of communal water points. However, to the extent that the majority of the town residents are from the lower income group, and to the extent that they may not afford private house connections or yard connections, there could be no option rather than to reorganize these committees and empower them with decision making powers in financial, personnel, and technical terms.

(8) Construction of private latrines will be promoted. But communal toilets will be constructed only after due consultation with communities concerned.

(9) The software aspect of the project will be given equal attention as that of the hardware, including assistance to community in water and sanitation management along with continuous sensitization

and awareness creation program.

(10) Given that women are the most concerned with water and sanitation matters, and given that they constitute the majority of the unemployed in the towns, it is proposed that women make up not less than 60 percent of the committee members of communal water points and communal toilets.

Summing up, the following evaluation of the above organizational measures can be made:

(1) Planning and execution of water supply and sanitation projects in the country and indeed in Adiquala will be streamlined and properly effected, and appropriate capacity building measures will be taken to ensure this.

(2) A viable training component will be developed in order to meet the skilled manpower requirements at the country, Debub region and Adiquala town levels.

(3) Project execution will be effected by the PMU which will be established in the MoLG.

(4) WSA will be established in Adiquala and assistance rendered to strengthen it institutionally and to the training of skilled personnel.

(5) Sanitation and environmental health will institutionally occupy its proper position in the town's WSA to fulfill the urgent needs for its sanitary improvement.

(6) The community in Adiquala will assume prime position in the planning, implementation and management of water and sanitation facilities in their locality.

6.9.4 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 shall 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.

6.9.5 Social and WID Evaluation

The value added to women in the town of Adiquala are as follows:

(1) The improvement in piped water supply in Adiquala, will, among other things, result in the significant reduction of time and energy spent in the collection of water, particularly for women, girls and boys. This will allow boys and girls to devote more time for their studies and for women to have more time for other activities, including more leisure time or more opportunity for income generation activities.

(2) This should improve the quality of life for these social groups, making Adiquala town a more pleasant place to live. The health and well-being of residents will improve and eventually these towns will attract more residents thus relieving the pressure on big cities like Asmara..

(3) By the provision of toilets, there will be not only more hygienic environment, but will also allow women and girls the privacy which they have been not allowed to have. Also females will be freed from inconveniences peculiar to them in the absence of proper sanitation facilities.

(4) The project will allow the participation of the community in making decisions regarding the location of public water and sanitation facilities, thus enhancing their sense of empowerment. In addition, the project could provide employment opportunities for women during its implementation and operation stages.

6.9.6 Environmental Impact Assessment

(1) Institutions and policies

The Eritrean Environment Proclamation was drafted in 1996 as a policy instrument for the integrated management of the environment. The Eritrean council for the environment was established under the (draft) proclamation as the organ responsible for integrating national development policies and objectives. At present Department of Environment (previous name was Eritrean Agency for the Environment (EAE)) is the only organization under the Ministry of Land, Water and Environment which deals with the environmental aspects of the country. Since the independence, Eritrea has taken seriously the issue of degraded environment of the country. As a first step, the government of Eritrea has formulated an "Environmental Management Plan for Eritrea" as a blue print for the protection of environmental resources and for the promotion of sustainable development. The Plan represents the framework within which phased actions should be taken to build up the capacity to manage the environment. The plan emphasize on optimizing rather than maximizing resource use.

In Eritrea, environmental assessment is not yet a legal requirement for any development project, except for those projects covered by sectoral regulations (e.g. mining activities, oil and gas exploitation etc.) due to the absence of national environmental legislation. Therefore, some individual organizations have developed their own guidelines or follow other organization's one. For example, Department of Energy and Mines have developed its own sectoral guidelines for Environmental Assessment (EA) which have some legal status. The Ministry of Trade and Industry is currently following UN guidelines for EA. Eritrean Community Development Fund (ECDF) within the Ministry of Local Government has developed two volumes of "Natural Resources Management Handbook" which contains checklists and mitigation

measures for environmental impacts of selected projects.

Since the past years, the Department of Environment has been working on "Eritrean National Environmental Assessment Procedures and Guidelines-1998" with the Environment and Development Group of Oxford, UK. They have already prepared a draft and organized seminars for comment and now they are sending it to the regions for further discussions and comments. According to the guidelines there is a list of projects with categories. The projects listed in category-A are subject to perform a full EIA, projects in category-B will only need environmental evaluation and for category-C no environmental assessment is required.

(2) Initial Environmental Examination (IEE)

As it is mentioned in the earlier chapter that as a whole Eritrea's environment has been degraded in many ways due to many reasons. Especially, forestry of the country has been badly affected, then in relation to this, soil erosion has also become an important environmental issue. Adiquala is also not free from all these problems. Poor standard of sanitation and hygiene need to be addressed. Solid waste disposal system is still to be established. The quality of drinking water is not of that high grade and reports of water-borne diseases are there. The pressure on groundwater is always in increasing trend and causing depletion of water level.

According to the JICA regulations, all development projects are subject to carry out an Initial Environment Examination (IEE) and then, on the basis of the result of IEE, decision for EIA shall be taken. For this purpose, existing environmental conditions in the region and present status of the government policies have been studied and stated above.

The characteristics of the subject project is to develop groundwater for drinking in the seven urban towns, which includes Adiquala. The scale of the project is not a large one. As a part of the project, there is no major construction involved except construction of an intake structure at the downstream of Semomo dam. Average rate of withdrawal is expected to be 4 lit/sec. The construction time will not require more than a week. The conveying means will be pipe lines of 100mm diameter. No major negative impact on the environment is expected due to this project in terms of social, natural environment including pollution. However, attention should be given on the amount of water that will be planned to withdraw from the source and its effect on the surroundings. For this purpose regular monitoring of water level is recommended. On the other hand, supply of safe water will improve the living condition and formulation of sanitary education plan will upgrade the existing health and hygienic conditions of the inhabitants.

However, environmental screening and scooping for an IEE in JICA format have been performed for this sub-regional town. From the result of the IEE it was concluded that no EIA is necessary for this project. The checklists for screening and scooping are presented in Appendix F.

6.10 Project Implementation Plan

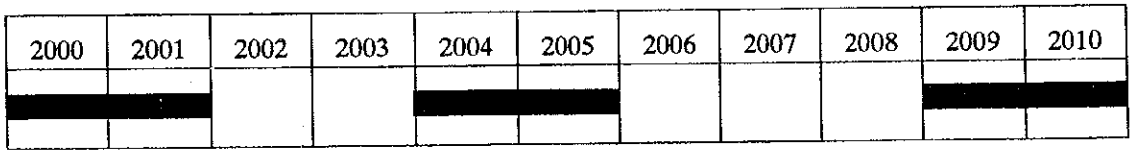
Major works of this project are borehole drilling work, pipe laying work, civil works, mechanical and electrical works, etc. These works have been carried out mostly by manual labor in Eritrea. However, it would be recommended to introduce a certain number of construction machines in order to minimize the construction period.

The implementation schedule is divided into three phases to meet the target year and 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.

Seven towns are also divided into two groups. Group 1 is 3 towns of Debarwa, Mendefera and Dekemhare. Locations of these towns are near the capital of Asmara and the population projection is higher than other towns. Group 2 is remaining 4 towns.

The schedule is proposed in the following, taking into consideration the above two stages and groups.

Figure 6.10.1 Implementation Schedule



CHAPTER 7 PROJECT FEASIBILITY STUDY

Project feasibility was studied for the priority projects targeting the year of 2005.

7.1 Groundwater Development Plan

7.1.1 Hydrogeological Condition

The town is located on the top of small isolated plateau. Steep cliffs dissected by the Mereb main flow and its tributaries surround on three sides of the plateau, and only northern part of the plateau continues to Mendefera corridor through a gentle valley. On the top of the plateau, especially the landscape near around Adiquala town, is very flat having neither hill nor valley. However, there are three small streams: Mai Semomo flowing in the northeastern part, Mai Lafo in the central part and Mai Zeru in the western part of the town.

The plateau-forming Tertiary basalts, with an average thickness of 100 – 130m as observed in the cliffs, are exposed over a wide range in this area. Very thin but alluvial sediments occur along the said three streams. Because of the geological situation, the main aquifer in this area is a fissured aquifer of basaltic volcanics. Besides the main, there are some minor aquifers associated: a fissured aquifer of sedimentary rock and also fissured aquifers of the basement both granite and metamorphics. Plateau forming basalt shows normally fair to moderate aquifer property, yielding 1-2 lit/sec of groundwater. However, portions of hard and/or massive rock quality, which forms residual hills usually, shows impervious property.

7.1.2 Water Resources

(1) Current water resources

In the town, there are two kinds of public water resources: a dug-well group consisted of five dug-wells and a borehole drilled inside of the town. Said dug-wells were dug along the Mai Semomo, at downstream of the Semomo Dam. Four dug-wells among four were installed by mechanical pump to send water to the reservoir in the town. A borehole was installed by a motor and directly connected to the small reservoir tank delivering water through public taps.

(2) Groundwater potential and water quality

Averaged annual rainfall in Adiquala area is around 695.5 mm/a, and the groundwater recharge volume is estimated as 101.7 mm/a. The area on the top of Adiquala plateau is included into the Gefih Ruba basin as a total but subdivided into three sub-basins: Mai Zeru/Iafo, Mai Semomo, and Mek'a Shet sub-basins. The areas of those groundwater sub-basins are 17.0, 20.9, and 33.1 km^2, but the catchment area of the Semomo Dam is only 12.6 km^2. The maximum yearly groundwater recharge volume of the dam catchment is 1.28 MCM/a roughly. While, the major aquifer of the basin is fissured aquifer in basaltic volcano, having no-good continuity and heterogeneous aquifer property. The situation, supposedly, severely restricts the groundwater utilization ratio, less than 10% of the renewal groundwater volume, in general. However, the dam can store the rainwater and prolong the recharging period, which can mitigate the limitation of groundwater usage. Thus, the groundwater development potential of this basin

can be estimated as around 0.21 MCM/a, converted as around 580 m^3/day.

Although the groundwater sample taken from BH-13, which might not be sealed its ground structure, showed negative qualities, the sample taken from BH-6 showed good chemical and bacteriological properties as no problem for drinking water. While, the most of shallow groundwater samples taken from dug-wells showed contamination by faecal coliform bacteria. Then, the surface water in Semomo dam indicated quite high turbidity, muddy color, and contamination by faecal coliform bacteria. The report on the analysis said the water samplings were done under unusual heavy rain condition. However, a periodical severe checking for bacteria contamination must be required when the shallow groundwater is utilized for water resources.

(3) Water resources for the target year

The existing water sources have a total yield of 302.4 m^3/day, which can hardly cover the water demand in 2000 but 2005. To cover the water demand in 2005, any new water resource shall be required to develop. As discussed before, the safety groundwater development volume at the downstream of the Semomo Dam shall be around 580 m^3/day, enough volume to cover the water demands.

The groundwater in this basin deems to flow down through the foundation of the dam as a leakage water. The river deposits of Mai Semomo at this portion are rather thin. Weathered zone of the base rock looks like also thin. These conditions require a new type water intake facility, to collect a leakage water effectively. Thus, the combination with cutoff and shallow but large dug-well (shown in Appendix-C) is proposed as a new water intake facility.

7.1.3 Groundwater Development Plan

Groundwater development plan, for Adiquala town targeting 2005, shall be as follows:

a) Siting for new intake facility (around downstream area of the dam),
- geological reconnaissance, test pits, comprehensive analysis, etc.-

b) Construction of the Intake Facility,
- civil works, pumping test, water quality analysis, etc.-

c) Completion of the Intake Facility, as one of the water sources,
- pump installation, pumping house and a panel board, supply pipe line, etc.-

d) Completion of existing water sources, also as one of the water sources.
- pump installation, pumping house and a panel board, supply pipe line, etc.-

Proposed structure of the new intake facility is presented in Appendix-C.

7.2 Facility Design

7.2.1 Facility Design for Water Supply

(1) Well pump

Submersible pump is recommended as well pump for new intake facility. Capacity and total head of pump are designed to meet the water demand in 2005 and loss head of the transmission pipeline. Specifications of the well pump are shown in the following.

Table 7.2.1 Specifications of Well Pump

Well No.		All intake	Remarks
Discharge	M^3/m	0.372	
Elevation of intake	EL.m	1815.25	
Water level	GL-m	10.0	
Elevation of reservoir	EL.m	1890.5	
Water level	GL+m	3.0	
Actual loss head	m	88.25	
Loss head by pipeline	m	30.68	
Total head	m	118.93	
Number of unit	Set	1	

(2) Transmission pipeline

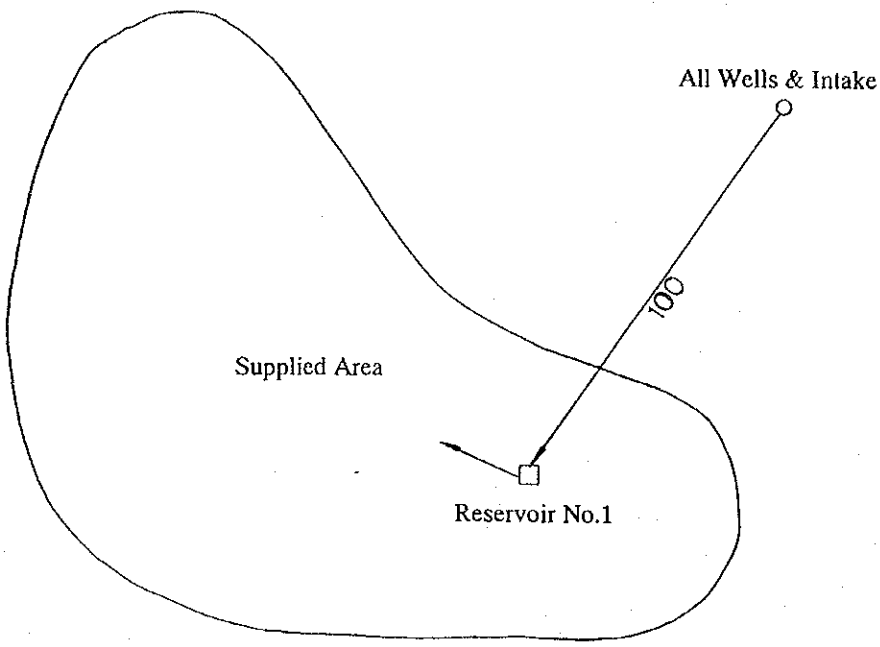
As mentioned in "5.4.3. Facility Plan", transmission pipeline and main distribution pipeline are difficult to be expanded to meet the future demand. Therefore, diameters of these pipelines shall be decided for the water demand in the target year 2010 under this project. On the other hand, other facilities like well, pump, reservoir, etc. shall be designed for the water demand in the target year 2005 because they are easy to be expanded.

Normally, diameters of the pumped pipeline shall be subject to the flow velocity in the pipe. In case of small diameters (less than 300 mm) under the project, the most suitable velocity in the pipe is 0.6 m/s to 1.0 m/s. Therefore, the velocity for the water demand in 2005 shall be more than 0.6 m/s. Ductile cast iron pipe is selected for the transmission pipeline.

The pipeline route from the all intakes to the new reservoir is selected nearly same as the existing line.

Hydraulic feature of the transmission pipeline is shown in the following.

Figure 7.2.1 Plan of Water Sources and Transmission Pipelines (2005)



(3) Booster pump

Booster pump shall be planned beside the new ground reservoir to boost water from the new ground reservoir to the elevated tank. Because the static head of well pump is nearly 120m and dynamic head including water hammer is considered more than 200m. Its pressure causes some unfavorable influence to the transmission pipeline. Type of pump adopted is centrifugal pump. Specifications of the booster pump are shown in the following.

Table 7.2.2 Specifications of Booster Pump

Booster No.		BP 1	Remarks
Discharge	M^3/m	0.372	
Elevation of intake	EL.m	1890.5	
Water level	GL-m		
Elevation of reservoir	EL.m	1903.5	
Water level	GL+m	3.0	
Actual loss head	M	13.0	
Loss head by pipeline	M		
Total head	M	16.0	
Number of unit	Set	1	

(4) Pump pit

A new ground reservoir (reservoir 1) shall be used as a pump pit for the booster pump of BP 1. Therefore, there is no plan for new pump pits.

(5) Reservoir

Two reservoirs are newly planned beside the existing reservoir. Capacity of the new ground reservoir (reservoir 1) is 8-hours max. daily water demand. Capacity of the elevated tank (reservoir 2) is 30-minutes max. daily water demand. Additional capacity of reservoir 2 for the water demand in 2015 will be only $10m^3$. Therefore, the reservoir 2 will be constructed $35m^3$ in capacity. Design capacity of the reservoir is shown in the following.

Table 7.2.3 Capacity of the Reservoir

Reservoir No.		Reservoir 1	Reservoir 2	Remarks
Type & high		Ground	Elevated H=13.0m	
Max. Water Demand	M^3/d	532	532	
Necessary capacity	m^3	177	22	
Design capacity	m^3	180	25	

(6) Distribution pipeline

Main distribution pipeline is also designed for the water demand in the target year 2010 under this project. The minimum diameter of the distribution pipeline adopted is 50 mm. Pipeline network of the main distribution pipeline is designed by use of Hardy-Cross formula, and the diameters of distribution pipes and water level in the reservoirs shall be designed to maintain the terminal pressure more than 7m. Detailed hydraulic calculation is shown in Appendix D.

(7) Service facilities

Number of individual connections is estimated from the percentage of consumers in the target year 2005. Communal water points are planned close to the area of low income houses and the vicinity. Communal water points are arranged to cover up the area by circles of 150m-radius. Service facility plan for each target year is as follows:

Number of individual connections: 935 sets

Number of communal water points: 8 sets

(8) Control house

Control houses are planed for the panel for pump, booster pump, generator for future plan, etc. Type A and B of the control house are for well pump, and type C and D are for booster pump. There is a generator room in the Type B and D. Number of control house is 1set of type A and 1set of type D.

Table 7.2.4 Number of Facilities

Item		Unit	Year
Facility	Description		2005
Intake Facility	New borehole	sets	1
Well Pump Facility	Submersible pump		All In., 0.372m³/min 118.9m
Transmission Pipeline	DCIP 100mm	m	2,851.0
Booster Pump Facility	Centrifugal pump		BP.1, 0.372m³/min 16.0m, 1set
Reservoir	Made of concrete		180m³
	Made of FRP		35m³, h=13m
Distribution Pipeline	PVC 125mm	m	15.0
	ditto 100mm	m	212.0
	ditto 75mm	m	1,326.0
	ditto 50mm	m	12,744.0
	(Sub-total)	m	14,297.0
Control house		sets	2
Communal W.P.		sets	8
Individual Connection		sets	935
Temporary Road	Width 3.0m	m	300

7.2.2 Facility Design for Latrine

The type of toilet designed is one unit with two compartments, for girls and for boys in the opposite direction. Each compartment is having five latrines. The height and area of the latrine is sized just for economic reason. The latrine is water carriage type, but in order to avoid water wastage and breakage of flushing system pour flush latrine with tap provided at lower level on the side of the Turkish WC. The tap water shall also be used for anal cleansing purpose. For those who prefer to use paper basket shall be provided. The latrine also have a 30 m³ capacity septic tank with dry masonry wall for soak-away purpose.

In order to avoid misuse of the toilet by external people after school hour when their is no attendant the toilet is provided with two main doors and iron bar mesh fence. The iron bar mesh fence also help to inspect students while using latrine.

For students in order to develop hand washing practice after using the toilets, hand wash troughs are provided for both girls and boys section.

The type of public toilet recommended is the same as that of school toilets which is pour flush with septic tank and two compartments for ladies and gents with entrance in the opposite direction.

- School latrine – PFL 3 units
- Public latrine – CFL 3 units

7.3 Institutional Strengthening Plan

7.3.1 Central Government

(1) Water Department of MoLWE

To date, the 12 experts assigned to the newly reorganized WD have not been assigned to the two divisions under it. Even though the specifics regarding capacity building and training requirements should be worked out after the placement of personnel is finalized, it is suggested here that the WD be given capacity building and training especially in water resources development; in collection, compiling and analysis of hydrometeorological information; and water resource information related tasks.

(2) Ministry of Local Government (MoLG)

In all the three divisions of RAD, there are 12 staff, six of them under the Infrastructure Services Division, where the PMU is placed. At the same time, it has been identified that there is a gap in fulfilling the task of planning and demand projection, facility design and social organization (software aspect of the project). In order to fill the gap in the function of these three areas, it will be convenient for RAD (at least in the long-run), to assign the task to the three divisions under it. Accordingly, the Economic Division will assume the responsibility of planning and demand projection, the Social Service will take care of the software aspects and the Infrastructure Services for facility design. This, in effect, means adding three more experts one each for each Division. To enhance the skill of these three experts, it is proposed that an arrangement be made for a short term overseas training.

During the implementation phase of the project, a Project Management Unit (PMU) will be established under the Engineering and Project Management Unit of the Infrastructure Division of RAD. It is proposed that the Head of the PMU be an expatriate with extensive technical knowledge and experience in water facility construction and first hand knowledge in the procedures of foreign assistance. He will be assisted by three contractual national experts; two engineers and one expert in community organization and management. One of the two engineers will be responsible for the supervision of the construction activities in Debarwa, Mendefera and Adiquala, while the other one will take care of and Dekemhare, Segeneiti, Adi Keyih and Senafe. Construction works will be given to private contractors.

(3) The Environmental Health Unit of the MoH

There are 5 experts under this Unit, but one graduate in public health sanitation is required for each region of the country. Additionally, at least one sanitarian will be required for each of the 52 sub zones of the country. Presently, there are only 26 and it will be necessary to train another 26. This means that Debub Region will require 12 sanitarians including one for Adiquala. There is a need to support the in-service training for at least one sanitarian for Adiquala in personal hygiene, environmental hygiene (latrines, garbage disposal, safety of drinking water, etc.).

7.3.2 Local Organizations

(1) Water Supply and Sanitation Authority (WSA Adiquala)

The existing WSS Adiquala office, will be transferred to the newly established WSA Adiquala Office. It will be a semi autonomous unit of the national WSA. Adiquala WSA will be fully strengthened with

trained staff and facilities. It will have its own board, whose chairman will report to the town administrator. The board members will be the Adiquala Water and Sanitation Committee members. The appointed manager, who will be accountable to both the Board and the national WSA, will run the daily affairs of the office. He will also act as secretary of the Board. The number of board members as well as the size of the office will depend on the size and complexity of the water supply system. The proposed duties and responsibilities of the core staff in the structure of Adiquala WSA is indicated below.

a) Board chairman:

- calls and chairs all board meetings,
- monitors the performance of water and sanitation committees,
- solves disagreements between residents and committee members,
- represents the board at official meetings and public gathering, and
- prepares reports for the board and the town administrator.

b) Manager

- acts as the secretary of the board,
- prepares quarterly report on water supply and sanitation condition of the town to the national WSA and the board through the chairman,
- manages the office, prepares annual and quarterly plans and target achievement, and budget of the office,
- prepares monthly report to WSA HQ,
- co-signs WSA finance with the finance officer,
- receives and sends incoming and outgoing correspondences,
- approves purchase/requisition of supplies and materials from the national WSA central store,
- supervises the performance of all staff and works closely with the technical officer to ensure reliable water supply and sanitary condition of the town.

c) Finance officer

- ensures that all water bills are collected at the right, and maintains accurate record of all water committees' income,
- prepares monthly financial statements for the manager and the water committees,
- co-signs WSA finance with the manage, and
- prepares annual budget, monthly payroll, etc.

d) Technical officer

- guides the water system operators and evaluates their performance,
- ensures that there is uninterrupted supply of water in the town by speedy maintenance and repair services including that of the communal water points,
- ensures that appropriate records of the performance of the pumping facilities, generators, etc. are

kept,

- ensures that a reasonable stock of all fast moving spare parts, fuel, lubricants etc. are in the WSA store,
- work closely with the manager and all other staff to ensure reliable water supply for the town, and
- prepares training plan for WSA staff.

e) Sanitation Officer

- in collaboration with the town WSC, conduct public relation activities to sensitize and enhance the awareness of the town residents on private, public health and environmental hygiene conditions and practices,
- Organize community to form Public Toilet Management Committee to operate public toilets and keep the town's cleanliness,
- prepare yearly plan on sanitation program, including construction of private latrines, garbage disposal, and education sessions to be conducted,
- undertake regular inspection of the sewerage system and report to the technical officer,
- on the basis of the number of people who want to construct public latrines, prepare loan formality and pass it to the bank for financing,
- undertake monthly inspection of all public sanitary facilities including that of schools, clinics/health centers, hotels, bars, restaurants, etc.
- prepare monthly report to the manager of WSA and to the town clinic/health center/MOH, and
- supervise the staff working under him

(2) Water and Sanitation Committee (WSC)

In Adiquala, a Water and Sanitation Committee (WSC) will be formed, whose members will be school directors, health center/clinic heads, religious leaders, WSA, town elders, the bank, and other notables in the town. It is this committee that will also act as the Board of Adiquala town WSA.

Among the responsibilities of WSC include:

- in collaboration with the WSA sanitation officer, conduct public relation activities with the aim of sensitizing and enhance the awareness of the town residents on private, public health and environmental hygiene conditions and practices,
- undertake continuous campaign on the need to utilize water judicially and protect water facilities and their catchment areas,
- work very closely with the technical sanitation officers and advise them on matters concerning community organization and management related with communal water point and toilet committees, and
- promote the construction of private latrines for those who can afford and help facilitate that beneficiaries secure loan facilities from the Bank or other micro-credit institutions.
- help form Communal Water Point Committees (CWPC) and Community Toilet Committees (CTC)

and try to solve their problems accordingly in collaboration with the town sanitation officer.

(3) Communal Water Points Committee

Communal Water Points Committees (CWPC) will be formed for each public/communal water point in Adiquala. The committee will report to the town's WSA board chairman. It will have a secretary, technical officer and members who will be given specific assignments when the need arises. Members will be volunteers serving the community without pay, except for the water point care-taker/guards who will be paid agreed monthly salary. It is proposed that at least 50 percent of the members of this committee be females including office holders of the committee, especially for the paying job. It is also proposed that the WSA technical staff assume the responsibility for major maintenance and repair activities.

(4) Communal Toilet Committee

Communal Toilet Committees (CTC) will be formed for each zone of Adiquala town. The committee will work in close collaboration with the sanitation officer, but will report to the town's WSA Board Chairman. It will have a secretary, technical officer and members who will be given specific assignments when the need arises. Members will be volunteers serving the community without pay, except for the community toilet guards who will be paid agreed monthly salary. It is proposed that at least 50 percent of the members of this committee be females including office holders of the committee, especially for the paying job. It is also proposed that the WSA technical staff assume the responsibility for major maintenance and repair activities.

7.4 Project Cost

7.4.1 Project Cost for Water Supply

Project cost is estimated in the following table.

Table 7.4.1 Project Cost

(Nakfa)

Description	Local C.	Foreign C.	Total	Remarks
1. Construction cost				
Intake Facility	249,340	51,472	300,812	
Well pump	10,703	222,645	233,349	
Transmission pipeline	591,029	1,655,287	2,246,316	
Booster pump	1,861	87,743	89,604	
Pump pit	0	0	0	
Reservoir	468,387	1,328,991	1,797,378	
Distribution pipeline	1,833,456	866,993	2,700,449	
Individual connection	0	0	0	
Communal water point	144,156	54,931	199,087	
Control house	392,346	20,956	413,302	
Temporary road	89,100	0	89,100	
Sub total	**3,780,377**	**4,289,019**	**8,069,396**	
2. Engineering fee (10% of 1.)	-	806,940	806,940	
3. Administration cost (2% of 1.)	161,388	-	161,388	
4. Physical contingencies (10% of 1.+2.+3.)	394,177	509,596	903,772	
Total	**4,335,942**	**5,605,554**	**9,941,496**	
5. Price contingencies (6% p.a.)	828,234	1,070,751	1,898,985	
Ground total	**5,164,176**	**6,676,305**	**11,840,481**	

7.4.2 Project Cost for Sanitation

Table 7.4.2 Cost Estimation of Latrines

(Nakfa)

Description		Year 2005
School Latrine - PFL	Construction cost	224,177
	Price contingencies	18,472
	Total	**251,885**
Public Latrine - CFL	Construction cost	224,177
	Price contingencies	27,708
	Total	**251,885**
Ground total		**503,770**

7.5 Sustainability of Water Supply Facilities

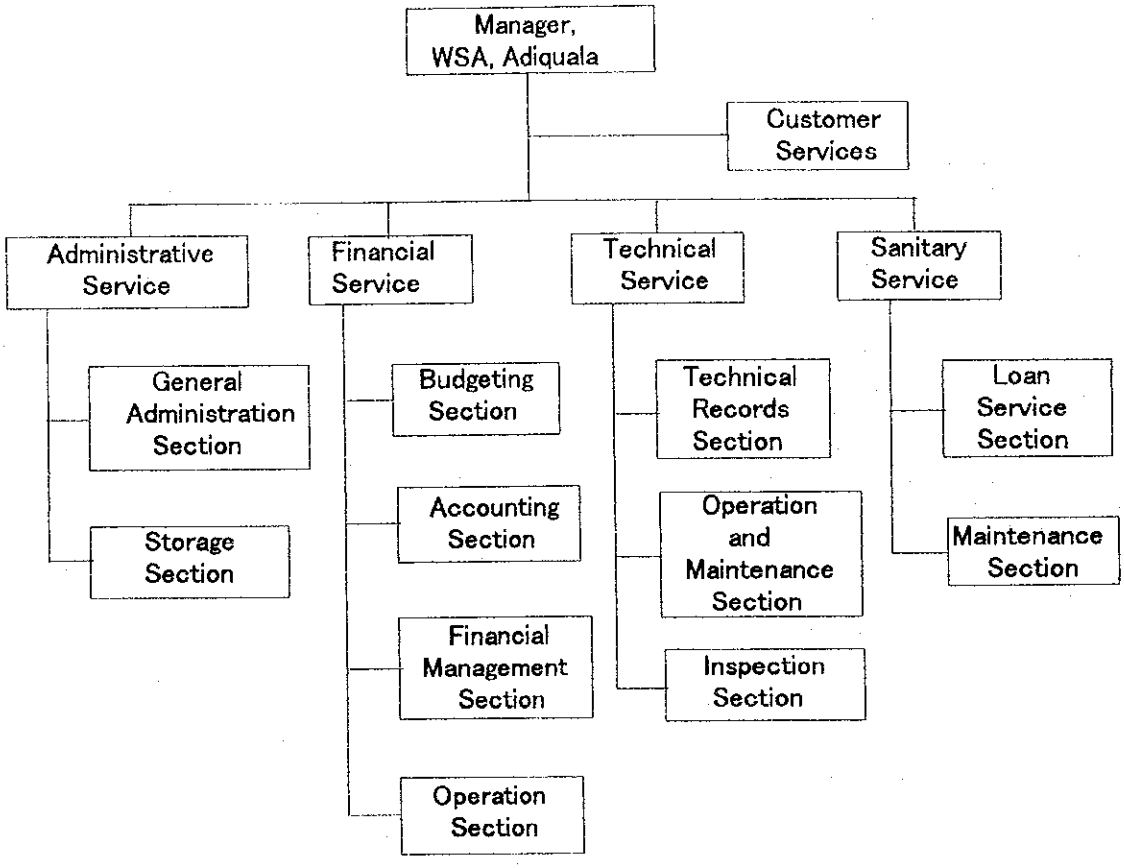
7.5.1 Capacity Building for WSA

The success of implementing this water supply project lies on the competency and capability of the manpower of WSA Adiquala particularly in terms of quantity and quality. With this end and view, the functions and number of personnel to be required in the target year of 2005 shall be planned.

The WSA Adiquala aims at supplying clean and safe water in a sustainable and sufficient manner and

therefore the WSA personnel should be technically and financially competent.

Figure 7.5.1 Proposed Organizational Set-Up of WSA, Adiquala



WSA Adiquala will consist of Manager, Administrative Service, Customer Services, Financial Service, Technical Service and Sanitary Service.

The Manager will be responsible for the successful management of WSA Adiquala and will represent the WSA in dealing with committees, town municipality and national WSA. The Customer Service will serve as window for communicating with the consumers.

Administration Service comprises 4 sections; namely General Administration, Personnel, Storage and Legal sections.

General Administration Section takes charge of secretarial/clerical works. Guards and janitors belong to this section. Personnel Section is responsible for recruitment, assignment and training of personnel and remuneration. The national WSA is proposed to be responsible for training of personnel, while the municipal WSA is proposed to re-train or newly train personnel when need arises using its own fund. Storage section takes charge of storekeeping and procurement of materials/supplies. Lastly, the Legal Section is responsible for complaints, lawsuits and penalties.

Financial Service must be filled by competent and sufficient number of experts. This section encompasses budgeting, accounting, financial management and operation. Budget Section prepares the annual and monthly budget of income and expenditures. Accounting Section prepares financial statements based on daily financial transactions. Financial Management Section analyzes and evaluates financial performances. Operation Section takes charge of meter reading, billing and collection, and cash water selling.

The communal water points are to be managed by the communities themselves. Since the study team did not make a proposal in terms of financial and personnel needs, it was assumed that WSA Adiquala would help the communities in the management of the facilities in some manner.

Technical Service must compose of adequate number of staff and must be competence. Technical Service covers Technical Records, Operation and Maintenance and Inspection sections. Records of equipment and supplies such as acquired date, numbers, plans, dimension, breakdowns and repairs are kept in Technical Records Section. Operation and maintenance of pumping stations, reservoirs, pipelines, communal water points are responsibility of this Operation and Maintenance Section. Inspection of the above-mentioned facilities is regularly carried out by the Inspection Section.

In addition to the organizations related to water supply, the WSA Adiquala proposes to provide intermediary services for expanding the sanitary facilities as well as sanitation services. Thus, Sanitary Service handles Loan Service and Maintenance sections. Loan Service Section provides loan/subsidy to clients for the installation of septic tank toilets, and keep related records. Maintenance Section regularly will take charge of toilets with a vacuum truck, and regularly cleans and maintains drainages.

The total number of personnel are proposed to be 25 in 2005 (Appendix G, Table-1). They were calculated based on the volume of water to be produced in that year.

7.5.2 O&M Cost

(1) Personnel cost

The number of personnel to be required in the target year of 2005 has been projected based on the volume of water to be produced in that year.

Personnel cost is calculated by multiplying the number of personnel by the average remuneration per employee. The average monthly remuneration in the target year of 2005 is calculated, taking into consideration the current average salaries of the Water Supply Service Office (WSSO), which works out to Nfa 616, and the estimated average yearly growth rate of salaries in real terms, which is 3%.

The estimated number of personnel in 2005 is shown below, and the average remuneration per employee is estimated at Nfa 9,364 at 1997 prices in the same year.

(2) Electricity and fuel cost

All mechanical equipment are operated mainly by electricity. Fuel is also required during emergency. Electricity requirements are calculated based on the volume of water to be produced in 2005.

The electricity cost has been calculated by multiplying electricity requirements in kwh by the unit

electricity charge, and by adding 5% of its cost for fuel, in 2005.

The estimated electricity requirements in kwh/day in 2005 are shown below, and the electricity charge per kwh is Nfa 20.16.

(3) Chemical cost

The chemical, hypochlorite or bleaching powder for disinfection to be consumed in 2005 has been projected from the volume of water to be produced in that year.

The chemical cost is calculated by multiplying chemical requirements in kg in 2005 by the unit price of the chemical.

The estimated chemical requirements in 2005 are shown below, and the unit price of the chemical is Nfa 6.5.

(4) Repairing cost

Maintenance and minor repairing works such as replacement of spare parts for pumps and valves, fixing of water leaking locations, checking of water level in the reservoir, etc. are carried out by the staff in the town WSA. Repairing needs are calculated based on the initial cost for mechanical and electrical works as well as on the initial cost for civil works including pipe laying works in 2005.

Repairing cost is estimated at 1% of the initial cost for mechanical and electrical works, and 0.5% of the initial cost for civil works including pipe laying works, in 2005.

(5) Miscellaneous cost

The miscellaneous cost is assumed at 10% of the sum of the preceding four types of costs.

The results of cost calculation are presented below.

(Unit: Nfa)

Item	Year 2005	
1. Personnel Cost	25 persons	234,099
2. Electricity and Fuel Cost	13.20 kwh/day	97,131
3. Chemical Cost	1,387 kg	9,016
4. Repairing Cost	Initial Cost for Pump 322,952 Nfa	46,158
	Initial Cost for Others 7,746,444 Nfa	
5. Miscellaneous Cost		38,640
Total		**425,044**

7.5.3 People's Participation

A key for a successful implementation of water supply/sanitation projects lies in active community involvement. Observed community participation and involvement, as seen from the analysis of the survey, is weak in terms of managing water points, community toilets and overall sanitation activities of the town. People are not encouraged to participate in the management of communal water and sanitation facilities because they take it as part of the Government's/town administration's responsibility.

Another key for a successful implementation of water supply/sanitation projects lies in the active female participation. It appears that female participation is not given adequate attention yet in Adiquala. Therefore, it is necessary to enhance people's participation not only during the execution stage of the project, but most importantly to guarantee their participation in the management and running of the facilities.

To achieve these important project objectives, the following recommendations are forwarded:

(1) To include a strong component of sensitization and awareness creation program (soft ware) in the project by employing a community agent, organizer and/or adviser during the execution and post execution of the project.

(2) The need for the continuous and active involvement of beneficiaries should be secured by establishing strong water and sanitation committees who will be assisted by the community agents or organizers mentioned in 1 above.

(3) Introduce and develop a viable management system for water and sanitation facilities that will be managed by the communities.

(4) Education and training need to be an in-built system of any program that seeks the active involvement of communities in project planning, implementation and management.

7.5.4 Community Based Management

To lay a solid foundation for community based management in Adiquala during the first phase of the project, the following recommendations are forwarded:

(1) Communities must actually own the improved water points, with all that such ownership entails. In addition, such ownership and management should eventually incorporate unimproved water points and water sources into the system.

(2) If community based management is to function in a sustainable manner, both hardware and software components need to be given equal attention. The complexity of the software tasks should not be underestimated nor the amount of time it takes.

(3) Failure should be recognized to be part of the process; and if there is failure somewhere in the line, it should be considered part of the learning curve in the water and sanitation sector.

(4) In community based management, activities should be focused specifically on building self-reliance,

self-confidence, and technical and management skills, and helping to solve problems in such a way that water and sanitation facilities are effectively managed locally.

(5) Frequent participatory appraisal techniques need to supplement committee meetings/contacts with opinion leaders, in the consideration for improvement of software delivery.

(6) Within the context of affordability, service delivery agents need to recognize that communities are consumers and would like to maximize the returns from the money they pay for the service required.

(7) The sustainability of community based management for water supply and sanitation facilities may require software interventions up to five year period with multiple visits and strengthening activities taking place over this period. The final measuring rod for empowerment of the community will therefore lie in the commitment of software fund over time, and not simply at the initial stages of service delivery.

7.5.5 Training Plans

Decentralization or regionalization coupled with capacity building is presently a main issue in the world. This trend comes from the bitter experiences accumulated in the past. It has often been the case that expensive and impressive facilities were constructed by the government under loan agreement with an external agency or government without any consultation with the people who were supposedly the beneficiaries, nor with any solid and comprehensive planning over sustainable operation and management of those facilities. The results were disastrous: the government suffering from a mountain of debt and the facilities left to rust having no operating/maintaining personnel and having scanty number of users. These dismal pictures of failures have been repeated many times.

From the above background, one major factor for a successful operation and management of water supply facilities is to have a sufficient number of competent personnel for the town WAS. Especially, such personnel as financial, technical/engineering and legal experts occupy a crucial position in evaluating the overall manpower strength of a WSA.

Training/education of those experts deems to be an essential and urgent matter. It is thus proposed by the study team that a training center be established under the National WSA to meet the requirements of such experts in the seven towns with the target year set at 2005.

The total training need of experts for WSA's in the seven towns is as follows.

Item	Debar.	Mende.	Adiqu.	Dekem.	Segen.	Adi Ke.	Senaf.
1. Financial/Economic Experts							
Financial Service Head	-	-	1	1	1	-	-
Auditors	-	-	-	-	-	-	-
Budgeting Experts	-	-	-	1	-	-	1
Accountants	1	1	1	1	-	1	1
Financial Analysts	-	1	1	1	-	1	1
Sub-Total	1	2	3	4	1	2	3
2. Technical/Engineering Experts							
Technical Service Head	-	1	1	1	1	1	1
Mechanics	1	1	1	1	-	1	1
Electricians	-	-	-	1	-	-	-
Motor Operators	-	2	1	1	1	2	2
Plumbers	2	-	-	1	1	1	1
Water Meter Technicians	-	-	-	1	-	-	1
Leakage Detectors	-	-	-	-	-	-	-
Water Quality Analysts	-	-	-	-	-	-	-
Designers/Draftsmen	-	-	-	-	-	-	-
Sanitary Technicians/Engineers	-	1	1	1	-	1	1
Sub-Total	3	5	4	7	3	6	7
3. Legal Experts							
Lawyers	-	1	-	1	-	1	-
Contract Experts	-	-	-	-	-	-	-
Sub-Total	-	1	-	1	-	1	-
Total	4	8	7	12	4	9	10

From the above table shows, there is an urgent need to train 54 experts in total, composed of 16 financial experts, 35 technical/engineering experts and 3 legal experts. Out of them, 3 financial experts and 4 technical experts are needed for WSA Adiquala.

Also, on-the-job training of technical experts using the operation manual is essential to elevate their skill as well as to enrich their experience.

7.6 Financial Plan

7.6.1 Willingness-to-Pay

According to the socio-economic survey, the average willingness to pay for water came to Nfa 15.1 in monthly amount and 2.0% as the percentage of income. (Refer to the table below.)

Income group wise, the average willingness-to-pay is Nfa 10.3, Nfa 15.7 and Nfa 25.0 in monthly amount in the low, middle and high income groups respectively, while it is 2.8%, 2.0% and 1.6% as the percentage of income in the respective groups.

The table shows that the richer you are, the more you are willing to pay for water. However, it is noticed that there is not so much difference in the willingness to pay in monthly amount as in the size of income between groups. Based on these results, the richer you are, the less you are willing to pay for water in terms of the percentage of your income.

Item	Low Income	Middle Income	High Income	Total
1. Average Monthly Income, 1997 (Nfa)	365	784	1,519	739
2. Share (%)	49.1	29.1	21.8	100.0
3. Willingness to Pay for Water (Nfa/m)	10.3	15.7	25.0	15.1
4. Willingness to Pay for Water (%)	2.8	2.0	1.6	2.0

7.6.2 Water Tariff Analysis

The general concept of the water tariff is referred in item 6.8.2 above.

After subsequent mathematical model simulations to attain financial viability and stability for WSA Adiquala and at the same time to fulfill social justice, the study team came up with the proposal for water prices in 2005 as detailed in Table 7.6.1.

Table 7.6.1 Payment for Water by Service Mode – Adiquala

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point		Total	
	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)	Income/m	Share (%)
2000	1,660	20	905	30	407	50	807	100
2005	1,810	23	944	33	472	44	936	100

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	lcd	Price/cm	lcd	Price/cm	lcd	Price/cm
2000	25	7.5	20	5	15	2
2005	29	7.5	22	5	15	2

(Unit: Nfa)

Year	House Connection		Yard Connection		Communal Water Point	
	Payment/m	Payment %	Payment/m	Payment %	Payment/m	Payment %
2000	27	1.6	14	1.5	4	0.9
2005	31	1.7	16	1.6	4	0.8

The shares and lcd for the three types of water facility users in 2005 were previously determined based on the current water supply and other conditions in Adiquala, which were clarified as a result of the socio-economic survey. The monthly income by type of users was projected based on the existing economic conditions, made clear by the socio-economic survey. In doing so, the annual average growth rate of

income in real terms was assumed as 3%.

It is proposed that the water price per cubic meter will be Nfa 7.5, Nfa 5 and Nfa 2 for house connection, yard connection and communal water point users respectively in the target of 2005.

Then, the monthly payment for water will be Nfa 31, Nfa 16 and Nfa 4 for house connection, yard connection and communal water point users respectively. In terms of the percentage of income, it will be 1.7%, 1.6% and 0.8% for the respective users.

Then, the affordability of low income group (less than 600 Nfa of monthly income) which is the user of commual water points is examined in detail. The group is further divided into four levels based on the income, and the ratio of monthly water tariff to the income is calculated, as shown in the table below.

The table indicates the share (percentage) of monthly expenditure for water to the monthly income, for every income level, is less than their willingness to pay. Further, the ratio of tariff/income is thoroughly less than 4% which is the recommended limit by World Bank. Thus, the proposed water tariff for communal water points (2.0 Nfa/m^3), which are mostly utilized by the low income group, shall be reasonable.

Table 7.6.2 Payment for Water as Percentage of Income (Low Income group)

Household Income (Nfa/M)	Payment for Water as Percentage of Income (%)	Willing ness to Pay as % of Income
0-199	2.7	5.0
200-299	1.6	3.4
300-399	1.1	2.5
400-599	0.8	2.1

7.6.3 Revenue Estimation

The revenue sources of WSA Adiquala are water charge, technical service charge, meter rent and miscellaneous revenues.

Water charge is the central revenue source. It is collected from the house connection, yard connection and communal water point users. House connection users include commercial, industrial and institutional clients. The revenue from water charge has been estimated based on proposed water tariffs, future lcd, family size, population projection, future water demand and bill collection efficiency.

The second revenue source is the technical service charge. When WSA Adiquala installs an individual connection for a customer, this technical service charge will be collected in addition to the material cost. It is calculated at Nfa 378 on average. The number of individual connections to be installed is estimated at 935 in the target year of 2005.

The third revenue source is the revenue from meter rent. The rental fee is assumed to be Nfa 1 per month per individual connection.

The last revenue source is miscellaneous revenues such as those from the sale of materials, fines, etc. They were not taken into account because they are of an irregular and unpredictable nature on one hand,

and not substantial in amount on the other hand.

The revenue deriving from the above-mentioned sources must be sufficient and stable enough to sustain the management of WSA Adiquala in the years to come.

Taking all the above-mentioned into consideration, the future revenue of the WSA is estimated as follows:

(Unit: Nfa thousand)

Year	2002	2003	2004	2005	2006
Revenue	678	738	806	881	790

7.6.4 Cost Analysis

(1) Initial cost

Initial cost is composed of construction cost, engineering fee, administration cost and physical contingency. Each of the above-mentioned cost was divided into local and foreign components.

Construction cost was classified into the cost for pumps and other facilities because of the difference in depreciation period between the two categories. The depreciation period is assumed to be 15 years for the pumps and 50 years for other facilities.

Engineering fee, which belongs to foreign components is assumed to be 10% of construction cost, while administration cost, which is usually composed of local currency is estimated at 2% of construction cost. Finally, 10% was added to the sum total of the above-mentioned cost as physical contingency.

Initial cost is estimated at Nfa 9,942 thousand at 1997 prices for the works for the target year of 2005. (Refer to the table below.)

- Year 2005

(Unit: Nfa thousand)

Item	Local Components	Foreign Components	Total
1. Construction Cost			
Pumps	13	311	324
Other Facilities	3,767	3,978	7,745
Sub-Total	3,780	4,289	8,069
2. Engineering Fee	-	807	807
3. Administration Cost	161	-	161
4. Physical Contingency	395	510	905
Total	**4,336**	**5,606**	**9,942**

(2) Implementation schedule

Implementation of the works is scheduled as follows. In the two year works, the first year will be for detail design and the second year for construction as shown below.

2000	2001	2002	2003	2004	2005

(3) O&M cost

Operation and maintenance cost to be incurred annually after the completion of the works is estimated at Nfa 425 thousand.

7.6.5 Projection of Financial Statement

In preparing projected financial statements based on the estimated revenue and cost as explained in sections 7.6.3 and 7.6.4, it was assumed that:

(1) Initial cost will be totally subsidized by the government, i.e., the people of the town will not be obliged to repay the initial cost.

(2) The people of the town will shoulder the replacement cost of all facilities.

(3) No tax will be imposed on the profit from water supply operations.

(4) Project life will be 20 years from the start of the implementation of the works.

The resultant financial statements including income statement, funds statement and balance sheet are shown in Appendix G, Table-4.

Revenue to Cost Ratio	Cash to Revenue Ratio	Profit to Assets Ratio
122.6%	43.4%	1.3%

As the above table shows, WSA Adiquala will be financially successful and have a stable management in the years to come, if all the conditions mentioned in the preceding sections concerned are met.

7.7 Project Evaluation

7.7.1 Economic Evaluation

(1) Benefits of water

Implementation of the Project will provide a reasonable amount of clean and safe water to the wide ranges of the people of the town. It means that women, girls and boys will be free from the daily water fetching drudgery works. Also, the incidence of water-related diseases such as diarrhea, dysentery, parasitic diseases and skin diseases will be drastically reduced, whereby contributing to the improvement of the health of the people in general.

These economic benefits can be considered to be reflected in the prices of water. Currently, the prices

of water in the town is institutionally fixed, ranging from Nfa 1.5 to Nfa 5 per cubic meter depending on service modes. Such water prices only partially represents the economic benefits of water, but not fully due to institutional consideration. The economic benefits of water can be regarded to be fully reflected in the prices of the water bought from water vendors. In Debarwa, where the scarcity of piped water is the most severe among the seven towns, water prices from water vendors range Nfa 16 to Nfa 40 per cubic meter according to the socio-economic survey.

The economic benefits of piped water is assumed as Nfa 20 per cubic meter.

(2) Future lcd and population in the without project case

The lcd or the per capita per day piped water consumption in liters under the existing circumstances in the seven towns is calculated at 10.3 on average based on the results of the socio-economic survey. The value is 74% of 13.9, which is an lcd including water from shallow wells, rivers/springs and rain.

In the "without project" case, it is assumed that the lcd will continue to be 10.3 throughout the project life period.

If the Project is not implemented, it is expected that the population of the town will not grow as fast as envisaged in the "with project" case due to constraints in water supply.

In the "without project" case, it is assumed that the growth rate of population will go down to a half of the rate foreseen in the "with project" case.

(3) Other conditions/assumptions

In performing economic analysis, the following conditions/assumptions were presupposed besides the above ones.

a) Project life:..... 20 years from the start of the first phase works

b) Opportunity cost of capital:..... 10%

c) Cost and implementation schedule:..... (see 7.6.4.)

d) Standard conversion factor: ..... 0.9, to be applied to local components of initial cost

(4) Results of economic analysis

Cost benefit streams were prepared based on all the above-mentioned conditions and assumptions, as shown in Appendix G, Table-5.

Using the streams, economic analysis of the Project was carried out, producing the economic criteria as shown in the following table.

Economic Criteria	NPV (Nfa thousand)	B/C	EIRR (%)
Value	2,876	1.32	15.2

The table shows that the Project is economically viable.

(5) Sensitivity analysis

Sensitivity analysis was performed to determine how EIRR will change if cost overrun of 20% happens or if the cost overrun of 20% and the 10% decrease of benefits simultaneously occur. The results are shown below.

EIRR (%)

Case	Base Case	Case 1	Case 2
Conditions	-	Capital Cost: +20% O & M Cost: +20%	Capital Cost: +20% O & M Cost: +20% Benefits: -10%
Value	15.2	11.7	8.2

The table shows that the EIRR stays over the OCC even under the unfavorable situation of Case 1, but goes below OCC under the severest assumption of Case 2.

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 indice tabulated below.

(Unit: %)

Management Indice	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	122.6	18.3	43.4	1.3

The table shows that WSA Adiquala 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 9.0% 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.