6.5 Basic Policies for Operation and Management of Public Faucets

6.5.1 Present Conditions of KIOSK Operation and Management

In the current water supply system in the City of Bangui, operation and management of public faucets (kiosks) are commissioned to private entrepreneurs by leasing their concession (right to operate kiosks). Any person or group of persons can run the kiosks if the submitted application form is approved by SNE. It only costs 31,000 CFA as a deposit to run kiosks. Presently, kiosk concession holders buy water at a price of 2.07 CFA per 10 litter from SODECA and sell it at 5 CFA per 10 litter.

Usually, the concession holders employ workers to run their kiosks. These employees are paid about 20,000 CFA per month. The concession holders sometimes save these wages by employing their relatives or close neighbors.

There are some problems on the present operation and management system of kiosks. At the time of December 1998, 18% of the kiosks were temporary closed. The Study Team conducted interview surveys in June 1999 on these kiosks.

According to the results of the interview surveys, most of the closed kiosks have some kind of management problems during their operation. The management problems include the following 2 major causes:

- One is that sometimes concession holders received daily income from their employees, but they misuse it without payment for SODECA. Consequently, SODECA stopped supplying water to the kiosks.
- Another mismanagement comes from dishonesty of the employed kiosk operators. They misuse daily income of kiosks and the owners can not pay to SODECA.

Meanwhile, some of the kiosks are strictly stopped due to the concession holders' misunderstanding on the ownership of kiosks such as:

- Some concession holders think that the kiosks are their personal property although their legal ownership belongs to SNE.
- Some concession holders who have run kiosks would not like to give up their concession even though he/she cannot afford to pay. As a result, kiosks lose

possibility to start again with other owners.

Because most of the kiosks are run by individual concession holders who are often strangers to the community or district, it is sometimes difficult to prevent them from cheating the consumers as well as SODECA once they run away. Proper qualification of individual concession holders as well as some kind of supervising system is needed to avoid intentional mismanagement of kiosks by individual concession holders. While, the current registration system of individual concession holders will be mainly succeeded with some improvement on qualification and supervision mechanisms, the Study Team also introduces below the community-based management of kiosks, as an option of kiosks operation and management. The possibility of community-based management of kiosks can be examined by conducting some pilot studies.

In Section 6.5.2 and 6.5.3, possible advantages of community-based kiosk management and basic framework of its introduction are explained as a future option of kiosk management.

6.5.2 Advantages of Community-Based Operation and Management of Kiosks

Community Based Management is generally considered as an important aspect of sustainable water management.
Followings are particular advantages for Community Based Management of the kiosks in this project:

- SNE and DGH have relevant experience in this field.
- In the study of kiosk, management problems are shown clearly. Community Based Management is one of the possible solutions to this problem.
- Involving communities will create a positive attitude of the population towards the project. It would prevent single sided mistakes by the project.
- Generally, the willingness to pay will increase once Community Based Management is introduced.
- Transparency of financial management is also a very important aspect. If Community Based Management is properly done, financial management will be transparent to the community. It makes the population feel more secure and responsible to buy water because they will see the benefit goes to them.
- If Community Based Management is introduced, the benefits will return to the community.

The last aspect is very important for the project. Around Bangui presently, most financial benefits of selling water are going to the concession holders. However, Community Based Management of the kiosk make it possible to return the benefit to the community directly. How the benefit can be utilized for the community includes:

- Since water-borne diseases are serious problems in CAR, the community can support the distribution of Javel and some medicines by utilizing the benefit
- Potable water supply and sanitation is very closely related. The project should also promote a sanitation program, and communities can collaborate with this program, e.g. latrine building and initiating training activities.
- Since many people think that the distance to the kiosk is a problem for buying water, the community can organize a water transportation service for the population living far from the kiosk or people who have difficulties to get water from the kiosk by themselves (Old people, single parents etc). The service can be done in some ways, for example, by employing distributors with wheel carriers who carry water to these households.
- If a community wants, the benefits of water sales would be used for other purposes, e.g. schooling, social infrastructure, etc.

6.5.3 Basic Framework of Introducing Community-Based Operation and Management of Kiosks

1) Establishment of a Community Based Management concept

Community Based Management can be defined in many different ways. In this study, Community Based Management means that the communities are actively responsible for planning, implementing and managing the kiosks in a sustainable way. Achieving fully effective Community Based Management is not easy. Extension works and community organization building are the most important aspects.

It is important to make all the tasks clear for each party. Responsibilities have to be clearly defined. Following table is called Project Actor Matrix, suggesting a division of responsibilities between the community and the project implementation body

Table 6.5.1 Project Actors Matrix

Project Activities	Community	Project Implementation Body
Needs analysis		Needs analysis
Motivation of safe water use	Joining training	Training to people
Organizing a water management committee	Selection of the committee members	Explanation of Kiosk System and contract
Selection of the site		Selection of the site according to the formulation
Technical possibility		Crosscheck the site in view of technical feasibility
Planning of water point	Community join the planning phase	Project organizing planning meeting
Motivation of the sustainable water resource use	General guidance about the sustainable use of the water retail	Giving guidance to community
Establishment of operation and maintenance	Choosing the person in charge of operation and maintenance	Giving guidance to the person in charge of operation and maintenance
Agreement	Community agree up on the installation of kiosks	
Construction	Supervising construction work	Realizing construction work
Handing-over, signing the contract	Signing the contract	Signing the contract
Monitoring	Keeping the record for monitoring	Checking the record

Detailed activities are as follows

- Finding out community needs

  There are several techniques like the use of secondary data, questionnaire, interview, etc. to find out community needs. Also RRA/PRA techniques are very useful to reflect community needs. Community needs heavily reflect to the sustainability of the project and the willingness to pay.

- Motivation of safe water

  Since people's awareness takes main role to stimulate safe water use and community based water management, extension activities are very important. These activities include training, workshop, discussion, etc. RRA/PRA technique will also stimulate people's awareness.

- Selection

  The project and the community must closely discuss the possibility of the

project planning in practical way, also for avoiding disturbance from traditions and customs.

- Planning

  Participatory planning techniques are useful to match the need of the population directly to the planning procedure. The community including women must be actively involved. Involvement of the community should be as early as the design period. The community has to be consulted in determining the location of the kiosk.

- Installation

  This is the realizing phase of the project, installation of the kiosk. The community must closely supervise the installation works. It would be possible that the community can get a kind of contract for construction works. They can also earn from wage works.

- Follow-up

  For sustainable water resource management, some practical training like operation and maintenance tasks, bookkeeping, etc are necessary.

- Monitoring the Community Based Management system

  After the establishment and handing over, continuos monitoring are needed. The community must collect the information regularly in a systematic way, and the extension worker from the project can check the record and discuss with the community about the problems they face.

2) Establishment of the Animation Team

To realize the strategy of Community Participation/Community Based Management, the project must establish a well trained animation team.
They must be trained in the following aspect.

- Participatory research technique

  To meet local needs better, the animation staff must know these techniques such as RRA/ PRA during extension period. These kinds of approaches will

provide trust to the project as well as positive participation of population.

- Communication skills

  Animation staff needs to have good communication skills. The most important thing is that he/she must understand and practice the meaning of participation.

- Knowledge on topics for training of population and Water Management Committee
- Local population and Water Management Committee members must receive some training in order to make project successful.

Followings are the topics that the animation team should cover;

For training of population

- Basic knowledge of sanitation and hygiene to encourage people to use potable water and proper storage of water
- Participatory planning technique, including conflict management technique.
- General idea of sustainable water resource management
- Basic technical knowledge

For training of committee

- Leadership training
- Management Knowledge
- Bookkeeping
- Hygienic Management of Kiosks

Training of population can be done in each community in order to involve the population as much as possible. In contrast, training of committee member needs to be done only for particular committee members who are in charge of these topics.

It is recommended that the animation team should be developed under the leadership of DGH. The Section of Supervising Promotion and Public Relation Activities (see Table 6.3.4) of DSOMC.

6.6 Analysis of Water Tariff Structure

6.6.1Present Water Tariff

1) Water Tariff Reformation

Since the SODECA was entrusted to operate and maintain the existing water supply system by the SNE in 1992, the water tariff has been reformed three times as mentioned in Table 6.6.1. The present water tariff was got into effect in April 1995.

Table 6.6.1 History Water Tariff of SODECA (FCFA/m³)

Categories	May 1992	May 1994	April 1995
Private Subscribers			
1st Section (< 5 m³/month)	237.07	265.89	180.00
2nd Section (6~20 m³/month)	144.27	161.82	200.00
3rd Section (> 20 m³/month)	285.00	319.64	436.00
Administrative Subscribers			
1st Section (< 5 m³/month)	237.07	265.42	180.00
2nd Section (6~20 m³/month)	144.27	161.45	200.00
3rd Section (> 20 m³/month)	285.00	319.64	338.00
Public Faucet (Kiosks)	120.69	129.2	206.6

2) Analysis of Actual Cost / Benefit Account of the SODECA in 1998

In accordance with SODECA's balance sheet of 1998, revenue was summaried as follows.

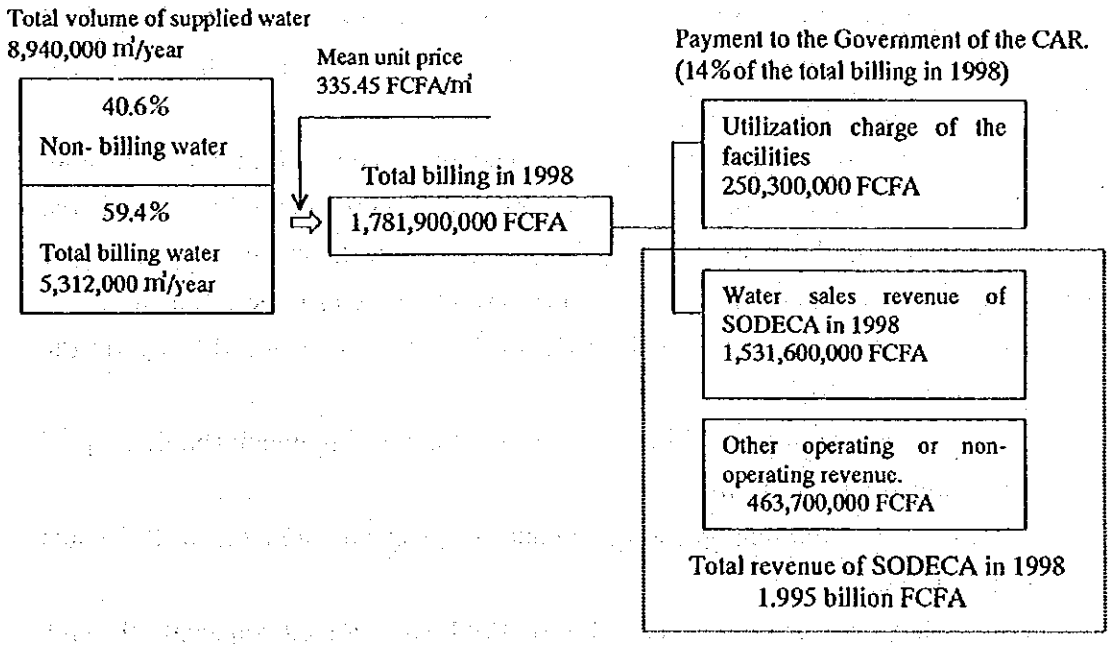


Fig. 6.6.1 Revenue of SODECA in 1998

The total volume of supplied water to the Capital Bangui and the other 7 provincial cities in 1998 amounted to 89 million m^3/year. And about 5.31 million m^3/year, which corresponds to 59.4% of the total supplied water, was billed to the subscribers as a whole. The total billing in 1998 was counted at 1.78 billion FCFA. The SOCECA paid 250 million FCFA, which equivalent to 14% of the total billing, to the Government of CAR as the utilization charge of the water supply system. 1.53 billion FCFA, which was the remainder after deduction of the utilization charge from the total billing minus, was kept as water sales revenue. Adding other operating and non-operating revenues to the above water sales revenue, the total revenue of the SODECA was amounted to 1.995 billion FCFA in 1998.

On the other hand, the expenditure in 1998 totally amounted at about 2.078 billion FCFA including 1.884 billion FCFA of operating expenditure for salaries, materials used, electricity charge or the other operating expenditure and 194 million of non-operating expenditure. Accordingly about 83 million FCFA was the deficit in 1998. The water sales revenue of the SODECA is based on the billing amount which includes non-collectable water charge and delayed payment from subscribers. That means the actual sales revenue should reduce taking those non-collectable amount, which would amount at a few hundred million FCFA annually, into consideration. Therefore it can be said that the SODECA is in deficit financing.

2) Appraisal of Present Water Tariff

The above analysis shows that a mean unit sales price was 335.45 FCFA/m^3 which was gained after dividing the total billing divided by the total billing water volume. A unit production cost was calculated at 391 FCFA/m^3 which was gained after divided the total expenditure by the same water volume. It means that 56 FCFA was lost per every m^3 of supplied water.

Based on the above analysis, the Study team conducted a trial estimation of future revenue and expenditure in accordance with water demand projection of the Bangui area, which was estimated in the Master Plan study. In this case, the existing water supply area was only covered. The following hypotheses were applied for the estimation.

- The mean unit sales price: 335.45 FCFA/m^3 which was deduced based on the present water tariff.
- Utilization charge of the facilities: 14% of the total billing which should be paid to the Government of CAR.
- Other operating and non-operating revenues per 1 m^3: as same rate as the actual ones in 1998.
- Total Salary: the same as actual value of 1998 was adopted constantly through calculation years.

- Materials, chemicals, electricity and other operating expenditures per 1 m^3: as same rate as the actual ones in 1998.
- Total depreciation per annum: 174 million FCFA, which is the actual value of 1998, was adopted through calculation years.
- Non-operating expenditure per 1 m^3: as same rate as the actual ones in 1998.

The result is shown in Fig. 6.6.2 (a). The above calculation shows that the deficit financing of the SODECA would improve as the annual supplied water volume would increase. Because an increase rate of the revenue per 1 m^3 is bigger than the one of the expenditure. Therefore it is anticipated that the revenue might exceed over the expenditure in 2007 then the annual supplied water volume should over about 8.5 million m^3.

6.6.2 Analysis of Water Tariff of Groundwater Development Project

In accordance with the same manner of the above estimation, a water tariff for the groundwater development project was analyzed. The followings were hypothesized to the estimation.

- Groundwater development project would commence in 2004
- Mean unit sales price: 232.2 FCFA/m^3 which was calculated by considering that the present water tariff and the estimated supplied water volume as follows.
  * prices: 207 FCFA/m^3 at kiosk and 253 FCFA/m^3, which was deduced from actual data in 1996 and 1997, at private connection.
  * Total supplied water volume: 446,000 m^3 in 2005, 45.2 % of it would be supplied through kiosks and the remaining 54.8 % would be through private connections.
- Utilization charge of the facilities: 20% of the total billing which should be paid to the Government of CAR.
- Other operating revenues: as same percentages to the sales revenue as the actual ones in 1998.
- Costs for Salary, Chemicals, Electricity: estimated costs (See Section 7.1.3)
- Costs of fuel and oil per 1 m^3: 10 FCFA which is one third of the actual ones in 1998, considering less operational works than the existing system.
- Rental fee and other commissions: not accounted.
- Other operating expenditure: as same costs per 1 m^3 as the actual ones in 1998.
- Reserved fund for replacement of the facilities per annum: 30 million FCFA which would be deposited for replacement of the facilities in due time in the future.
- Non-operating expenditure: not accounted

The result is shown in Fig. 6.6.2 (b). The above estimation shows that the groundwater development system could be operated profitably form the beginning year if present water tariff would be applied. The total revenue amounted at 83.8 million FCFA/year against the 70.8 million FCFA/year of the total expenditure in 2004. Therefore 14.0 million FCFA would be gained in the first operational year. In 2009, when full capacity of the groundwater would be supplied, profit would increase to 53.3 million FCFA/year. Since the unit production cost was calculated at 200 FCFA/m^3 in 2005, the sales price can be reduced about 12% from the present one which was estimated at 232.2 FCFA/m^3. And as the year goes up, profitability of the new system can be expected to increase up to the proposed maximum production amount of the groundwater, about 803,000 m^3/year.

In accordance with the water demand projection, however, the water demand in the target area would exceed the proposed production water volume from the new system by around 2007. Then, the shortage of supplied water should be filled up from the SODECA's distribution network. Taking this probability into consideration, the new system shall be recommended to operate as an integrated system with the present one.

6.6.3 Financial Impact of Groundwater Development Project to the Existing System

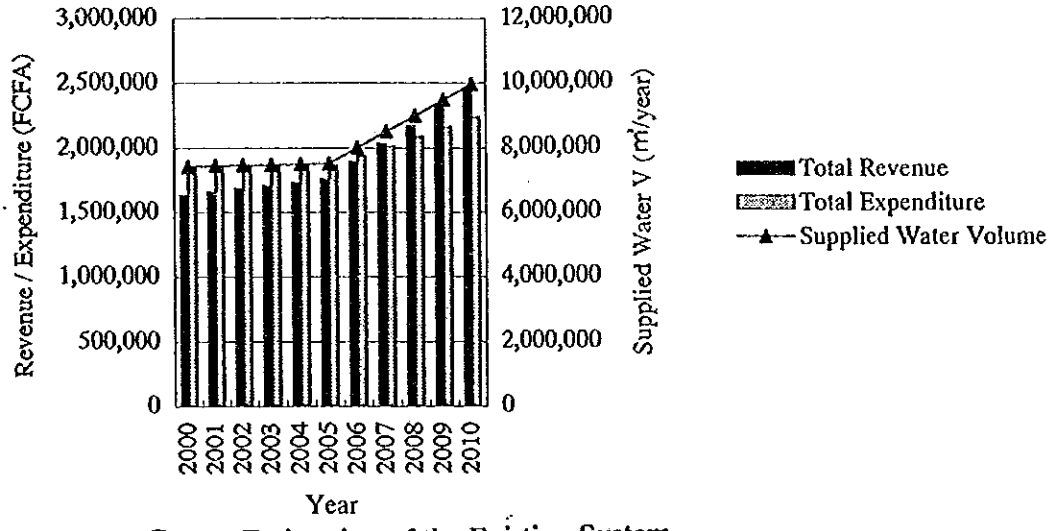
As analyzed above, the groundwater development project shall be profitable. In case that the system be integrated to the existing one, however, it is concerned that the impact of this profit would not largely affect to the present financial situation. Because the production water volume from the new system would share only less than 10 % of the total supply water volume of the existing system. A financial improved by integrating the two system is shown in Figure 6.6.2 (c).

In order to evaluate a magnitude of the impact of integration of the new system to the existing one, the following two case studies were conducted.

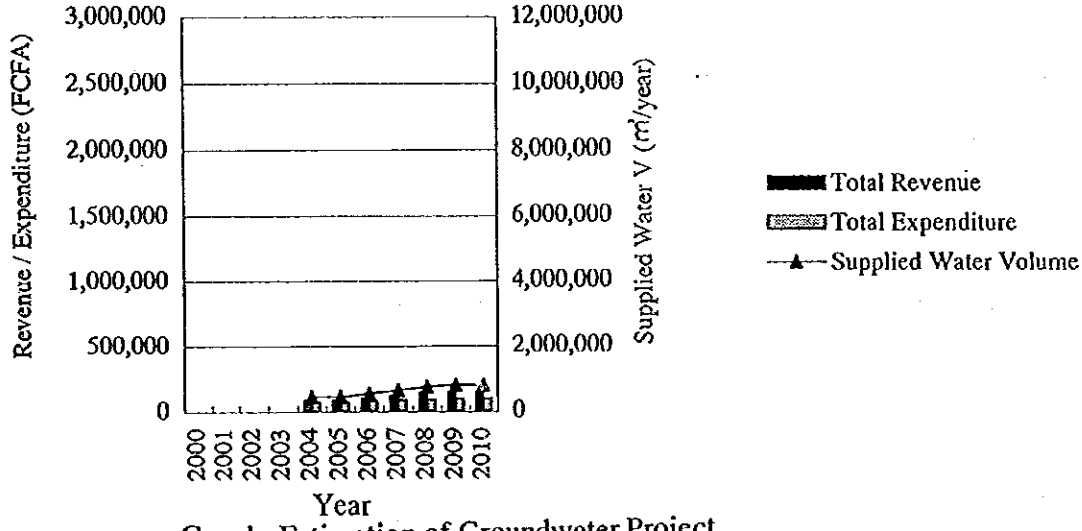
Case 1 : to apply the present water tariff

Case 2 : to reduce 10% from the present wholesale price for kiosk in the present water service area and the newly proposed water service areas taking HBN factor's point of view. .

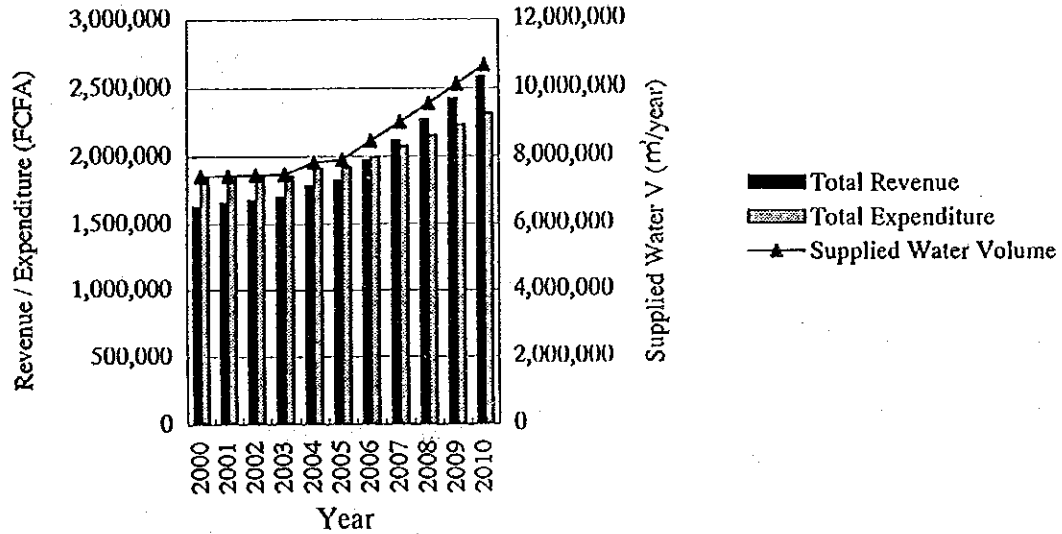
The theory of analysis was applied as the same way that was mentioned in Chap. 6.6.1 and 6.6.2. The result is shown in Figure 6.6.3.



Case a. Estimation of the Existing System

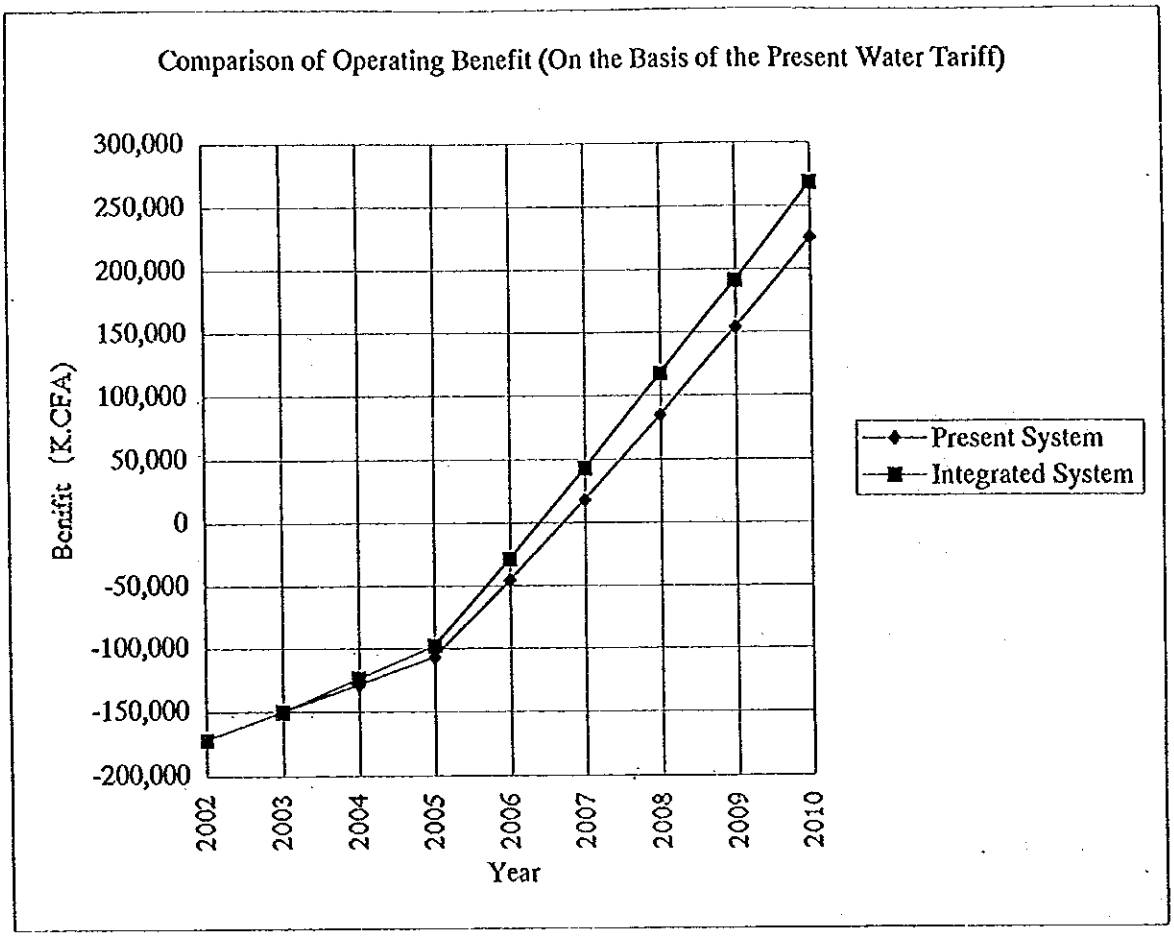


Case b. Estimation of Groundwater Project



Case c. Estimation of Integrated System (Groundwater & Existing Systems)

Figure 6.6.2 Analysis on Revenue / Expenditure and Supplied Water Volume



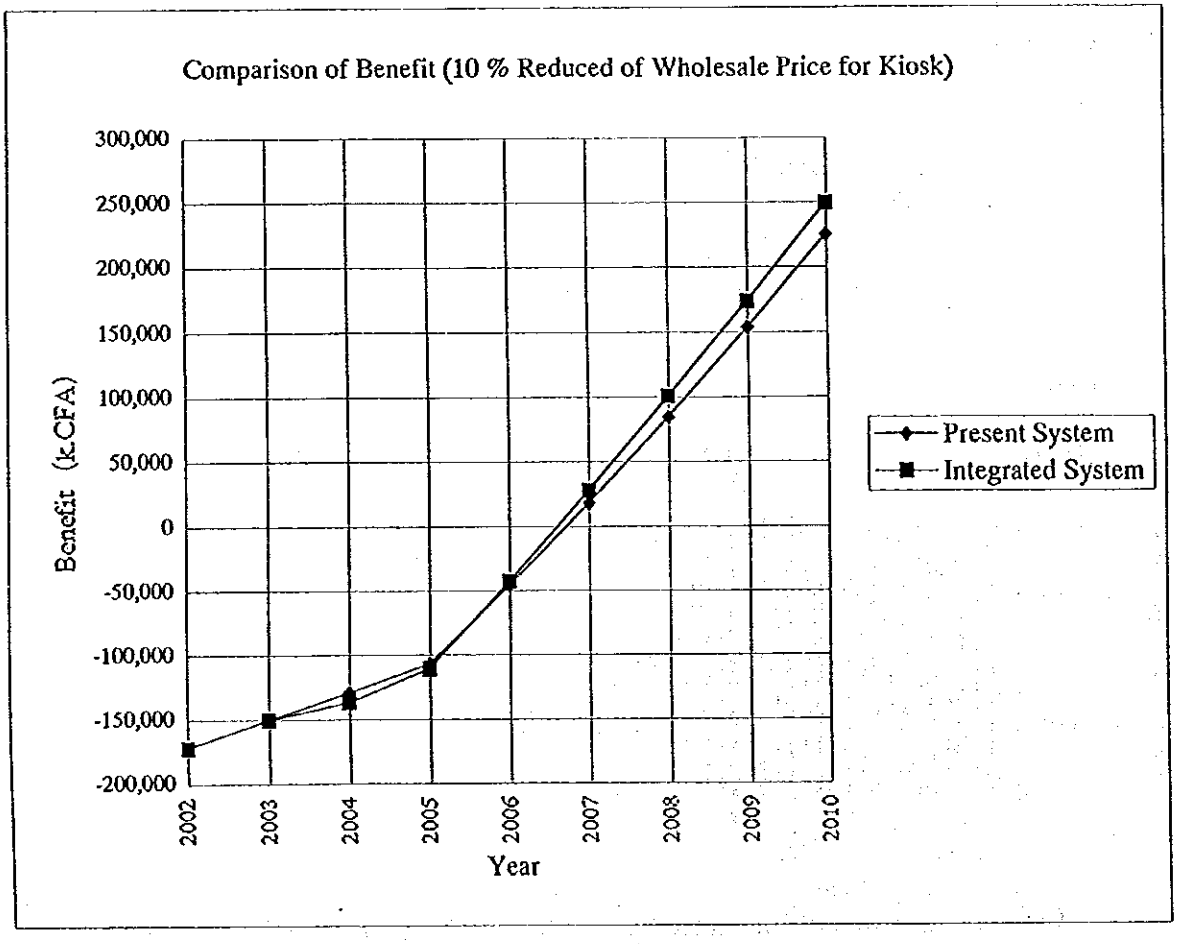


Figure 6.6.3 Water Tariff and Operating Benefit

As shown in Figure 6.6.3, in Case 1, in which the present water tariff was applied, the financial condition was slightly improved after the groundwater development project would be inaugurated in 2004. The magnitude of improvement of financing was estimated at 3% at the beginning and it would reach to 24% in 5 years. On the contrary, in Case 2, in which the wholesale price of kiosk was reduced 10% in the entire water coverage area, it was confirmed that the profit gained in the case 1 would be almost canceled in the initial years. It means the impact of groundwater development project to the financial situation would be too small to consider reduction of the present water tariff within first several years. Therefore the present water tariff structure was resulted to be appropriate. Although the profit to be gained by the new project is small, it could assist to improve the present financial situation. Therefore integration of the new project into the present system can be beneficial to the private firm which would be entrusted to operate the present water supply system in the capital Bangui.

6.6.4 Trial Idea for Operation and Management of Kiosk

There are many traditional shallow wells in this area. A lot of people depend the water on these shallow wells despite of its bad quality. After commencement of the water service these people are expected to become users through public faucet. It is obvious that public water service is sustained by the revenue of water selling to the people and if the revenue is insufficient, the service to the people would easily level down. Therefore it is most important that how people's intention of buying water would increase. For this purpose, education or campaign for the people to understand the beneficial of using the public water service should be very important. Moreover if it is done to return profit to users, sustainability of the project would be more guaranteed.

As concluded in the former chapter, it should be difficult to reduce the present wholesale price for kiosk. Now retail price at kiosk is 5 FCFA/lit. which corresponds 2.5 times higher than the wholesale price. If a community based operation of kiosk is functioned, the profit could be returned to the community. It is supposed that there should be many difficulties to run the community based operation. The Government of the CAR therefore should bear various tasks such as to integrate people's opinions, to organize water committee in the community, to give many training programs of keeping books, maintaining kiosk, to manage the financial balance, etc. to members of the committee.

Chapter 7. PROJECT COST & PROJECT IMPLEMENTATION PLAN

7.1 Project Cost

7.1.1 Basic Conditions for Cost Estimate

(1) Composition of Project Cost

Project cost is divided into construction cost and recurrent cost. Construction cost is the cost necessary for implementing of project at initial stage, and recurrent cost is the cost necessary for the operation & maintenance of the facilities after completion of the construction.

Construction cost is composed of direct cost, indirect cost, general overhead, engineering fee, physical contingency, and price escalation. Direct cost is the cost necessary for the construction works (e.g. pipeline works, concrete works, etc.), and indirect cost is the cost necessary for indirect works (e.g. temporary construction facilities cost, construction equipment rental cost, field office cost, etc.)

The recurrent cost is composed of annual operation & maintenance cost, personnel cost, cost of chemicals, cost for replacement of mechanical equipment, cost for transportation.

(2) Currency Exchange Rate

The exchange rate of foreign currencies were surveyed at the Banquè Internationale Pour Le Centrafrique (BICA) on June 2, 1999. In addition, the exchange rate on June 2, 1999 was cross-reviewed with the currency data obtained by the universal currency converter (www.oanda.com/converter/classic) through INTERNET. Based on these data, the exchange rates for the cost estimate are adjusted as follows:

FRF1	=	100.00FCFA
US$1	=	627.23FCFA
J.Yen1	=	5.18FCFA

(3) Unit Price

In order to prepare the cost estimate for F/S project, a CAR's criteria on construction cost estimate was surveyed by the Study Team. It is found that concrete criteria have been yet to be standardized at present, and cost estimate for project was carried out by means of reviewing the unit prices prepared by other authorities.

The unit cost, referred by the Team, includes material cost, transportation cost, tax, etc., namely "all-in-cost". Further, the recent tender price/unit price for the relevant projects in CAR and suppliers' quotations for the materials were examined by the Team. Based on these unit prices and quotations, the unit prices for the cost estimate for F/S Project are prepared with "all-in cost" basis as summarized in the Supporting Report.

(4) Portions of Foreign and Local Currencies

The project cost will be further divided into two portions: foreign currency and local currency portions. According to the construction market survey carried out by the Study Team, the imported materials and equipment such as submersible motor pump, transmission pump, pipes including the fittings, reinforcement bar, etc. are available through the big distributors in Bangui. As a result, foreign currency portion is needed to be provided for the preparation and procurement of imported material and equipment, with the CIF prices basis at Bangui.

In addition, the construction materials such as cement, reinforcement bar, sand, crushed stone, bolder, brick, block, wood, etc. are also available in local market. These and other raw materials are counted into local currency portion.

(5) Indirect Cost

Indirect cost is composed of the temporary work cost and the field office cost. 20% of the direct cost is taken into account for the temporary work cost, and 10% for the field office cost.

(6) Engineering Fee

At the implementation stage of the project, a foreign engineering consultant is assumed to be hired. Engineering fee is taken into account at 10% of the sum of direct cost and indirect cost.

(7) Price Escalation and Physical Contingency

According to the study at the initial stage, the living cost ratio became approximately double during the period from 1990 to 1999, and the material cost became approximately triple as well. As a result of review of current project and discussions with the officials of DGH, the price escalation is taken into account at an annual escalation rate of 5% for foreign currency portion and 2% for local currency portion.

Physical contingency at 10% of the sum of direct cost, indirect cost, and engineering fee is included in the construction cost.

(8) Land Acquisition/Compensation

From the discussions with the officials of DGH, it is found that there is no concrete criteria on the land acquisition/compensation. Thus, the cost necessary for land acquisition/compensation is based on the past experience of DGH as follows: 2,500FCFA per m^2 for acquisition of land without house and 17,000FCFA per m^2 for acquisition of land with house. The compensation for the temporary construction works is taken into account at 550CFA per m^2. In addition, the compensation for felling fruit tree is taken into account at 35,000CFA per tree.

(9) Electric Cost

Tariff for electric cost was collected by the Team from The Energy of Central Africa (ENERCA), and the electric cost, one of the recurrent cost, will be estimated on the basis of this tariff.

(10) Others

The cost of chemicals and the personnel cost, ones of recurrent cost as well as electric cost, are collected from SODECA. These costs will be estimated on the basis of data obtained.

7.1.2 Construction Cost

Construction cost is estimated on the basis of past experience of the Team and divided into foreign ad local currencies' portions. The construction cost is summarized in Table 7.1.1 and the breakdowns of the items are prepared in the Supporting Report.

Table 7.1.1 Construction Cost

Description	Foreign Currency (FRF)	Local Currency (FCFA)
1.Direct Cost	22,935,000	1,518,439,000
(1) Drilling Works	2,924,000	0
(2) Civil Works	20,011,000	1,488,566,000
(3) Electrical Works	0	29,873,000
2. Indirect Cost	6,881,000	455,532,000
(1) Temporary work cost 20% x (1)	4,587,000	303,688,000
(2) Field office cost 10%x (1)	2,294,000	151,844,000
3.Land Acquisition/Compensation	0	2,488,000
4. Engineering Fee 10% x (1+2)	2,982,000	197,398,000
5. Physical Contingency 10% x (1+2+3+4)	3,280,000	217,386,000
6. Price Escalation 5% for foreign and 2% local x (1+2+3+4+5)	1,804,000	47,825,000
Total	37,882,000	2,439,068,000

7.1.3 Recurrent Cost

(1) Annual Operation & Maintenance Costs (O&M Costs)

1). Electricity Cost

Electricity cost for the water supply facilities will be supplied by the existing electric

power line, managed by ENERCA. Mechanical equipment to operated by electric power is composed of four submersible pumps, and two transmission pumps.

Four submersible pump will be operated by the power from the low tension line for 18 hours a day, and two transmission pumps will be operated by the power from the medium tension line for 18 hours a day.

Electricity cost works out by multiplying electricity requirements in kwh by electricity charge per kwh. Annual electricity cost is summarized as shown in Table 7.1.2.

Table 7.1.2 Annual Electricity Cost

Category	Power Requirement (kW)	Nos.	Total Power Consumption (kWh)	Unit Cost (FCFA/kwh)	Annual Electricity Cost (FCFA)
Submersible Pump*	4.02	4	14.472	94	8,937,618
Transmission Pump	31.66	2	56.988	36	13,478,802
Total					22,416,420

*Power requirement is average

2) Personnel Cost

Basically, O&M works will be carried out by SODECA's technical personnel. The annual personnel cost worked out on the basis of the personnel classification prepared by SODECA, and is summarized as shown in Table 7.1.3.

Table 7.1.3 Annual Personnel Cost

Expertise	Required Classfication	Nos.	Salary (FCFA)	Annual Personnel Cost (FCFA)
Hydrogeologist	3rd grade of 3rd category M3	1	171,000	2,052,000
Water Supply Engineer	3rd grade of 3rd category M3	1	171,000	2,052,000
Electromechanic	2nd grade of 3rd category E3	1	45,000	540,000
Plumber	1st grade of 3rd category E3	2	42,000	1,008,000
Driver	ditto	2	42,000	1,008,000
Operator	2nd grade of 2nd category E2	6	37,000	2,664,000
Watchman	2nd grade of 1st category E1	4	32,800	1,574,400
Total				10,898,400

3) Cost of Chemicals

The chemicals such as bleaching powder are required for the disinfection of the water, and the cost of chemicals worked out by multiplying chemical requirements in kg by the price of the chemical per kg. The annual cost of chemicals is summarized as follows.

Table 7.1.4 Annual Cost of Chemicals

Required Ratio (ppm)	Ave. Water Demand (m^3/day)	Effectiveness Ratio (%)	Daily Necessary Volume (kg)	Unit Price (FRF/kg)	Annual Cost (FRF)
2	2,200	65	6.78	23.30	57,626

4) Other costs

Other costs will include uniforms for the personnel, per-diem for O&M works, telephone, maintenance of operator house, consumables such as office supplies, etc.

7. 2 Project Implementation Plan

7.2.1 Executing and Responsible Agencies

Restructuring of the governmental organization and authorities is being made in CAR. For instance, SNE is dissolved, and the property of water supply facilities of Bangui city is transferred to DGH. In relation to the Project (F/S project), DGH will be the responsible organization for the planning, tendering, and the supervision of the Project works.

Prior to the implementation of the F/S Project, a task force, which is composed of the project manager, civil engineer, hydrogeologist, and financial accountant, will be organized in DGH, for executing the project. In order to assist above task force in preparing detail design, tender documents, and supervision of the construction, a engineering consultant will be hired on a contract basis during the period from design stage to construction stage. The Contractor will be selected through international/local tender, and the works will be conducted under the supervision of DGH.

7.2.2 Organization for O&M (Central Level)

DGH will be tentatively responsible for nation-wide waterworks, and actual operation of water supply of Bangui city, including small scale of maintenance works (e.g. replacement of tertiary distribution pipes), will be carried out by SODECA as before.

At the commissioning stage of the project, SODECA's personnel necessary for the training of operation are required to participate in the commissioning together with DGH's personnel. This training will be programmed by a engineering consultant hired and performed a contractor.

After the completion of overall construction work including commissioning, the property of the facilities constructed in this project will be handed over to DGH, and the actual operation of the facilities will be managed by SODECA.

7.2.3 Project Implementation Plan

(1) Basic Considerations

1) Weather Conditions

During rainy season from May to October, it rains heavily and occasionally. Existing drainage system is very poor in project area, especially in Bimbo District. Due to such heavy rains, drainage system usually does not function, and the land becomes too sluggish for construction. For this reason, the construction works should be desirably avoided during the rainy season.

2) Construction Period

In order to meet water demand at the target year of F/S project, the construction works including the commissioning should be preferably completed by the end of year 2003.

3) Financial Arrangement

According to project evaluation conducted by the Team, EIRR and FIRR have worked at very low. In case that the project is implemented with a loan basis, it is expected that the construction works period will be beyond the target year because of time-consuming for financial arrangement. From those viewpoints, it is recommended that the project is implemented with the finance on a grant aid.

4) Contract for Construction

Generally, the contract is divided into civil works and electromechanical works. The construction works of this F/S project is composed of intake facilities (Deepwells), transmission facilities, and distribution facilities. Each component of these facilities is neither complicated, nor big scale. For this reason, the construction contract for

this project is preferable to be based on the single contract.

5) Detailed Design

Prior to the commencement of the construction works of the Project, all works of the detailed design shall be completed. The works of the detailed design will be composed of topographical survey, detail facility design, design drawings, bill of quantities, cost estimate, and tender documents.

6) Land Acquisition/Compensation

In order to make the land available free from encumbrance, it is necessary to take immediate action for the land acquisition and/or compensation. In addition, it is necessary to take action for resettlement, if necessary.

7) Electrical Works

According to the national regulation, the electrical works shall be done by ENERCA. Thus, the electrical works from medium/low tension line to control device of the facilities will be undertaken by ENERCA.

8) Telephone Cable

In urbanized area, especially, at the wellfield site, the attention shall be paid not to damage telephone cable line during the construction period.

7.2.4 Implementation Schedule

Taking into account above basic considerations, the implementation schedule of the Project is formulated as shown in Figure.7.1.1.

The duration necessary for the financial arrangements including finding of finance sources is assumed to be a year. At the stage of the detailed design, a engineering consultant will be hired for the execution of the detailed design and the preparation of the tender documents. The required duration of the consultant's services from the agreement to preparation of the tender documents is a year. The consultant services will be commenced only after finalizing financial arrangement.

Preparatory works such as land acquisition/compensation will be tackled by DGH when the detailed design is commenced. A year would be required for those works including allowance for the negotiation with the inhabitant.

Three years would be required from tendering to commissioning. The construction works will be divided into drilling works, civil works (pipeline, structure, etc.), mechanical works, and electrical works. Of these works, manufacturing and delivery of the mechanical equipment and pipe materials such as ductile iron pipes, submersible motor pumps, transmission pumps would be critical activity.

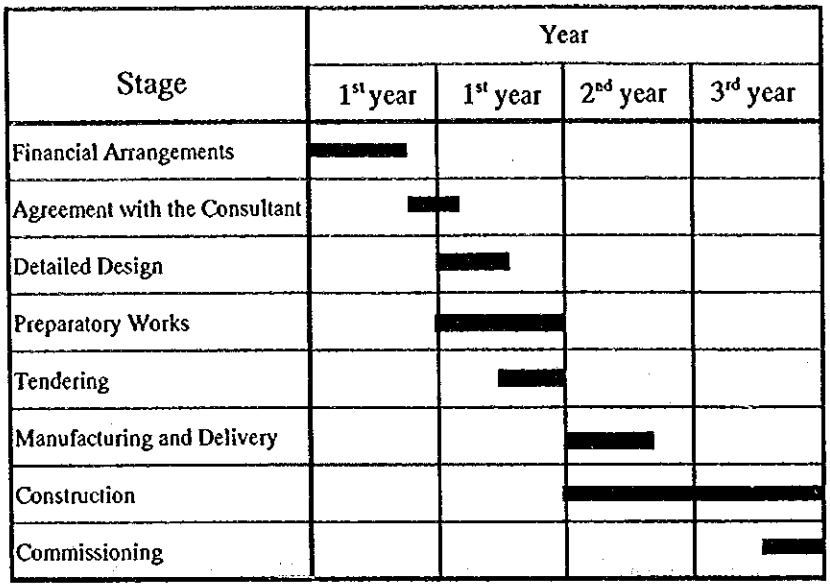


Figure 7.1.1 Implementation Schedule of the Project

7.2.5 Investment Schedule

Based on the implementation schedule of the project, the project costs by year are estimated from the first year as the commencement of works, and the yearly investment cost is as shown in Table 7.1.5.

Table 7.1.5 Investment Schedule by Year

Description	Total Cost		1st year		2nd Year		3rd Year	
	Foreign (FRF)	Local (FCFA)	Foreign (FRF)	Local (FCFA)	Foreign (FRF)	Local (FCFA)	Foreign (FRF)	Local (FCFA)
1.Direct Cost	22,935,000	1,518,439,000		0	10,755,000	612,398,000	12,180,000	906,041,000
(1) Drilling Works	2,924,000	0		0	2,924,000	0	0	0
(2) Civil Works	20,011,000	1,488,566,000		0	7,831,000	582,525,000	12,180,000	906,041,000
(3) Electrical Works	0	29,873,000		0	0	29,873,000	0	0
2. Indirect Cost	6,881,000	455,532,000		0	3,227,000	183,720,000	3,654,000	271,812,000
(1) Temporary work cost	4,587,000	303,688,000		0	2,151,000	122,480,000	2,436,000	181,208,000
(2) Field office cost	2,294,000	151,844,000		0	1,076,000	61,240,000	1,218,000	90,604,000
3.Land Acquisition/Compensation	0	2,488,000		2,488,000	0	0	0	0
4. Engineering Fee	2,982,000	197,398,000	1,044,000	78,960,000	969,000	59,219,000	969,000	59,219,000
5. Physical Contingency	3,280,000	217,386,000	105,000	8,145,000	1,495,000	85,534,000	1,680,000	123,707,000
6. Price Escalation	1,804,000	71,738,000	58,000	2,688,000	822,000	28,227,000	924,000	40,823,000
Total	37,882,000	2,462,981,000	1,207,000	92,281,000	17,268,000	969,098,000	19,407,000	1,401,602,000

Chapter 8. EMVIRONMENT IMPACT ASSESMENT (EIA)

8.1 Objective and Scope of EIA

An Environmental Impact Assessment (EIA) aims to examine further the various impacts on the items which were pointed out in the initial environmental examination (IEE) that the negative impacts might be caused by the implementation of the groundwater development in Bangui City.

The pointed out items in IEE are as follows:

a. Natural Aspects
- land erosion
- Groundwater
- River
- Land subsidence

b. Social Aspect
- Economic activities

For the details of IEE procedures and results, refer to Master Plan Report.

The further examinations were added on the items mentioned above based on the new findings obtained after IEE and more concrete development plan formulated after IEE.

8.2 Environmental Impact Assessment

8.2.1 Natural Aspects

(1) Land Erosion

It is anticipated that the land erosion will not take place by the groundwater development because any excavation and embankment work will not be done for the groundwater development.

(2) Groundwater

It is anticipated that the regional serious groundwater level draw-down which will cause the drying up of the existing wells will not arise because the groundwater development amount was determined so as to prevent such negative impacts as described in chapter 3.

However, the monitoring on the groundwater level should be continued after the

groundwater development because the prediction will not always right. In case that the groundwater level draw-down will get larger than that of anticipated, the measures such as reducing the discharge amount shall be taken.

(3) River

Although the discharge amount of the sewage will increase in accordance with the increase of the water supply amount, the contaminant amount itself discharged to the river will not change because the contaminant discharging rate per Capita will not get larger even if the water consumption rate per Capita will increase. In such a case, the concentration of the contaminant in the sewage will dilute with increase of water supply amount.

It is anticipated that the contamination of the river will be caused by the increase of the population and industrial development rather than the increase of the water supply amount.

(4) Land subsidence

It is anticipated that the land subsidence will not arise because the laterite layers are hard enough and the regional draw-down of the groundwater level to be caused by the groundwater development is kept as small as less than 1.4m.

8.2.2 Social Aspect

(1) Economic activities

It is anticipated that the damage of economic activities in the manioc fields on the proposed route of access road will not arise because the disturbance is minor. Lands for the route and the water reservoir belong to the Government and the proposed well sites belong to private owners. Lands necessary for the well sites should be acquired by the Government. Therefore a large scaled of compensation for land acquisition will not be required. The cultivators agreed with project to use the land.

Chapter 9 PROJECT APPRAISAL

9.1 Introduction

In this chapter, feasibility of the project is appreciated from financial, economic, social, and environmental viewpoints. The project-life period is assumed as 33 years starting from 2001 up to 2033 (30 years after facilities operation). Benefits (both financial and economic) of the project and operational & maintenance (O&M) costs are annually appropriated on the basis of income and expenditure calculation by the cost planning staff of JICA Study Team.

The outline of the project to be appraised here is given in Table 9.1.1 below.

Table 9.1.1 Outline of the Project to be Appraised

Items	Assumptions and Data Used
Water Supply Area	- The west and north peripherals of the present water supply area (see Table 4.1.1 and Figure 4.1.1)
Planned Water Supply Population	- 45,000 persons by the year 2007
Water Supply Capacity	- 803,000 m^3/year
Water Supply Charge	- 232,2 FCFA/m^3 (a weighted average of the charges for private connection and kiosks)
Project Period	- 33 years (2001-2033)
Construction Period	- 3 years (2001-2003)
Construction Cost (Initial Cost)	- Foreign Cost (in FRF): 37,882,000 - Local Cost (in FCFA): 2,439,068,000
Discount Rate Applied	- 12%
Currency Exchange Rate Applied	- FRF 1 = 100.00 FCFA - US$ 1 = 627.23 FCFA - Japanese Yen ¥ 1.- = 5.18 FCFA

Financial feasibility is appreciated by examining the Financial Internal Rate of Return (FIRR) of the project during the project period of 33 years.

Economic feasibility of the project is analyzed in the manner of Economic Internal Rate of Return (EIRR) based on the calculation of project cost and benefit.

Social appraisal of the project is done in accordance with the checklist, which was made by the social analyst of JICA Study Team through referring to several key materials on social impact assessment.

Environmental appraisal of the project is made by reviewing the results of Environment Impact Assessment (see Chapter 8).

Lastly, a synthetic project appraisal is made by integrating all the results above.

9.2 Financial Appraisal

(1) Methodology

The financial aspect of the project is appreciated in the manner of Financial Internal Rate of Return (FIRR) for the project period of 33 years.

FIRR is estimated on the basis of annual revenue and cost calculation of the project under the conditions given below respectively.

(a) Project Revenue

Operational revenue of the project consists of drinking water sales and miscellaneous operational incomes including fees for connection works, kiosk concession charges, etc.

The income from drinking water sales is annually calculated by the following formula.

Drinking Water Sales (FCFA/year)

= Annual Effective Water Supply Amount *1 (m^3/year) X Unit Water Charge (232.2 FCFA/m^3)

*1 Annual effective water supply amount is the result of multiplying the annual water produced by the ratio of chargeable water. The ratio is assumed every year on the basis of the SODECA's past records of bill collection performance.

Meanwhile, miscellaneous operational incomes are annually appropriated in accordance with the results of the analysis of SODECA's financial reports and performance indicators.

(b) Project Cost

The construction cost is allocated to each year in accordance with the actual implementation schedule of construction works during the construction period from 2001 to 2003 as given in Table 9.2.1 on next page.

Table 9.2.1 Allocation of Construction Cost (2001-2003)

Unit: 000FCFA

Description	1st year (2001)	2nd year (2002)	3rd year (2003)	Total Cost
1.Direct cost	0	1,687,898	2,124,041	3,811,939
Drilling	0	292,400	0	292,400
Civil	0	1,365,625	2,124,041	3,489,666
Electrical	0	29,873	0	29,873
2.Indirect cost	0	506,420	637,212	1,143,632
Temporary work cost	0	337,580	424,808	762,388
Field office cost	0	168,840	212,404	381,244
3.Land acquisition	2,488	0	0	2,488
4.Engineering fee	183,360	156,119	156,119	495,598
5.Physical contingency	18,645	235,034	291,707	545,386
6.Price escalation	8,488	110,427	133,223	252,138
Total	212,981	2,695,898	3,342,302	6,251,181

Replacement cost are reckoned just after the end of durable years of the installed facilities (constructed assets of submersible and transmission pumps and electric facilities: 16 years) and residual value of the facilities are booked as negative costs at the period following the last year of the project (see Table 9.2.2).

Table 9.2.2 Replacement Cost and Residual Value of Investment at the End of the Project Life

Unit: 000FCFA

Facilities to be Replaced	Investment Amount	Durable Years	Year of Replacement	Residual Years at the end of P/L	Residual Values at the end of P/L
Pumps and Electric Facilities	8,9257	16	2019	2	11,157
Pipes and Wells	3,425,074	40	(N/A)	10	856,268
Others	297,686	60	(N/A)	30	148,843
Total	3,812,017			Total	1,016268

O&M costs, comprising personnel, power, chemicals, and other miscellaneous maintenance expenses are respectively estimated by the operation planning staff of the JICA study team on the basis of actual figure of SODECA (refer to 7.1.3 recurrent cost).

(2) Appraisal

Based upon all the assumption and provision mentioned above, FIRR of the project is calculated in Table 9.2.3 on next page.

Table 9.2.3 Calaculation of Financial Internal Rate of Return (FIRR) of the Project

Year	Groundwater Supply Project					
	Revenue	Construction Cost	O/M Cost	Replacement Cost	Total financial Cost	Cash Balance
2001	0	212,981	0	0	212,981	-212,981
2002	0	2,695,898	0	0	2,695,898	-2,695,898
2003	0	3,342,302	0	0	3,342,302	-3,342,302
2004	100,173	0	40,756	0	40,756	59,417
2005	100,521	0	40,756	0	40,756	59,765
2006	121,718	0	47,041	0	47,041	74,677
2007	142,937	0	53,326	0	53,326	89,611
2008	164,179	0	59,611	0	59,611	104,568
2009	176,857	0	64,654	0	64,654	112,203
2010	176,417	0	64,654	0	64,654	111,763
2011	176,417	0	64,654	0	64,654	111,763
2012	176,417	0	64,654	0	64,654	111,763
2013	176,417	0	64,654	0	64,654	111,763
2014	176,417	0	64,654	0	64,654	111,763
2015	176,417	0	64,654	0	64,654	111,763
2016	176,417	0	64,654	0	64,654	111,763
2017	176,417	0	64,654	0	64,654	111,763
2018	176,417	0	64,654	0	64,654	111,763
2019	176,417	0	64,654	89,257	153,911	22,506
2020	176,417	0	64,654	0	64,654	111,763
2021	176,417	0	64,654	0	64,654	111,763
2022	176,417	0	64,654	0	64,654	111,763
2023	176,417	0	64,654	0	64,654	111,763
2024	176,417	0	64,654	0	64,654	111,763
2025	176,417	0	64,654	0	64,654	111,763
2026	176,417	0	64,654	0	64,654	111,763
2027	176,417	0	64,654	0	64,654	111,763
2028	176,417	0	64,654	0	64,654	111,763
2029	176,417	0	64,654	0	64,654	111,763
2030	176,417	0	64,654	0	64,654	111,763
2031	176,417	0	64,654	0	64,654	111,763
2032	176,417	0	64,654	0	64,654	111,763
2033	176,417	0	64,654	0	64,654	111,763
2034		-1,016,268	N/A	N/A	-1,016,268	1,016,268
Total	5,040,393	5,021,932	1,857,840	89,257	6,969,029	-2,141,617

Cost	5,032,968
Revenue	872,330
NPV	-4,160,639
FIRR	-1.95%

Table 9.2.4 Profit and Loss Statement (P/L) and cashflow of the Project

Year	unit	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Annual Water Supply	m3/year	446,030	446,030	545,018	644,006	742,994	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000
Chargeable Ratio	%	79.1%	79.4%	78.6%	78.2%	77.8%	77.6%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%
Annual Chargeable Water Supply	m3/年	352,761	353,986	428,631	503,355	578,158	622,805	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256
Gross Water Sales	000FCFA	81,911	82,195	99,528	116,879	134,248	144,615	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256
Other Operational Income	000FCFA	18,262	18,326	22,190	26,058	29,931	32,242	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161
Gross Income	000FCFA	100,173	100,521	121,718	142,937	164,179	176,857	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417
O/M Cost	000FCFA	40,756	40,756	47,041	53,326	59,611	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654
Depreciation	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Net Profit	000FCFA	-36,632	-36,284	-21,372	-6,438	8,519	16,154	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714
Project Cashflow																					
The Balance Brought Forward	000FCFA	0	59,417	118,966	193,255	282,567	386,675	498,509	609,888	721,266	832,645	944,023	1,055,402	1,166,781	1,278,159	1,389,538	1,500,916	1,524,922	1,636,301	1,747,679	1,859,058
Net Profit	000FCFA	-36,632	-36,500	-21,759	-6,738	8,060	15,784	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330	15,330
Fund Reserved for Replacement	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Total Financial Sources	000FCFA	59,417	118,966	193,255	282,567	386,675	498,509	609,888	721,266	832,645	944,023	1,055,402	1,166,781	1,278,159	1,389,538	1,500,916	1,612,295	1,636,301	1,747,679	1,859,058	1,970 436
Replacement Cost	000FCFA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87,373	0	0	0	0
The Balance Carried Forward	000FCFA	59,417	118,966	193,255	282,567	386,675	498,509	609,888	721,266	832,645	944,023	1,055,402	1,166,781	1,278,159	1,389,538	1,500,916	1,524,922	1,636,301	1,747,679	1,859,058	1,970,436

Year	unit	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Annual Water Supply	m3/year	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000
Chargeable Ratio	%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%
Annual Chargeable Water Supply	m3/年	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256
Gross Water Sales	000FCFA	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256	144,256
Other Operational Income	000FCFA	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161
Gross Income	000FCFA	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417
O/M Cost	000FCFA	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654
Depreciation	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Net Profit	000FCFA	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714
Project Cashflow																					
The Balance Brought Forward	000FCFA	1,970,436	2,082,199	2,193,962	2,305,725	2,417,488	2,529,251	2,641,014	2,752,777	2,864,540	2,976,303	3,088,066	3,112,456	3,224,219	3,335,982	3,447,745	3,559,508	3,671,271	3,783,034	3,894,797	4,006,560
Net Profit	000FCFA	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714
Fund Reserved for Replacement	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Total Financial Sources	000FCFA	2,082,199	2,193,962	2,305,725	2,417,488	2,529,251	2,641,014	2,752,777	2,864,540	2,976,303	3,088,066	3,199,829	3,224,219	3,335,982	3,447,745	3,559,508	3,671,271	3,783,034	3,894,797	4,006,560	4,118,323
Replacement Cost	000FCFA	0	0	0	0	0	0	0	0	0	0	87,373	0	0	0	0	0	0	0	0	3,425,075
The Balance Carried Forward	000FCFA	2,082,199	2,193,962	2,305,725	2,417,488	2,529,251	2,641,014	2,752,777	2,864,540	2,976,303	3,088,066	3,112,456	3,224,219	3,335,982	3,447,745	3,559,508	3,671,271	3,783,034	3,894,797	4,006,560	693,249

Year	unit	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063
Annual Water Supply	m3/year	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000	803,000
Chargeable Ratio	%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%	77.4%
Annual Chargeable Water Supply	m3/年	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256	621,256
Gross Water Sales	000FCFA	144,256	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317	144,317
Other Operational Income	000FCFA	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161	32,161
Gross Income	000FCFA	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417	176,417
O/M Cost	000FCFA	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654	64,654
Depreciation	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Net Profit	000FCFA	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714
Project Cashflow																					
The Balance Brought Forward	000FCFA	693,249	805,012	916,775	1,028,538	1,140,301	1,252,064	1,276,454	1,388,217	1,499,980	1,611,743	1,723,506	1,835,269	1,947,032	2,058,795	2,170,558	2,282,321	2,394,084	2,505,847	2,617,610	2,729,373
Net Profit	000FCFA	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714	15,714
Fund Reserved for Replacement	000FCFA	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049	96,049
Total Financial Sources	000FCFA	805,012	916,775	1,028,538	1,140,301	1,252,064	1,363,827	1,388,217	1,499,980	1,611,743	1,723,506	1,835,269	1,947,032	2,058,795	2,170,558	2,282,321	2,394,084	2,505,847	2,617,610	2,729,373	2,841.136
Replacement Cost	000FCFA	0	0	0	0	0	87,373	0	0	0	0	0	0	0	0	0	0	0	0	0	297,687
The Balance Carried Forward	000FCFA	805,012	916,775	1,028,538	1,140,301	1,252,064	1,276,454	1,388,217	1,499,980	1,611,743	1,723,506	1,835,269	1,947,032	2,058,795	2,170,558	2,282,321	2,394,084	2,505,847	2,617,610	2,729,373	2,543,449

The result certainly tells that this project is not adequate for loans, either by private finance or by so-called "soft loans" of official development assistance, but for grant.

Meanwhile, Table 9.2.4 shows annual cash flow of the project during the operation period of 60 years from 2004 to 2063 in case the initial investment is provided on grant basis. All the constructed facilities are to be replaced once or more after 60 years from starting operation. The table shows that the project is self-sustained to cover the replacement cost of granted facilities without any external financing.

The above results implies that the project is feasible enough to be implemented if initial investment cost is covered on grant basis.

9.3 Economic Appraisal

(1) Methodology

The economic aspect of the project is appreciated in the manner of Economic Internal Rate of Return (EIRR) for the project period of 33 years from 2001 to 2033.

EIRR is estimated on the basis of annual economic cost and benefit calculation of the project under the conditions given below respectively.

(a) Economic Cost

Economic cost of the project is converted from the financial cost under the conditions and assumptions below.

To calculate economic cost of the project, all the cost factors are divided into two categories: domestic procurement (local cost) and procurement from abroad (foreign cost). While foreign cost is exempted from extraction of transfer payments (e.g. taxes, subsidies, etc.), local cost has to be adjusted by eliminating those factors. The transfer payments are estimated as 18% of market prices of commodities or services purchased domestically.

Meanwhile, Standard Conversion Factor (SCF), to be applied to adjust market prices of local cost to shadow prices, is computed as 95.25% (see Table "Estimation of Standard Conversion Factor" on next page). The formula of SCF is defined as follows:

SCF = (I+E)/(I+Ic+E-Et+Ss)
(I: Import, E: Export, Ic: Import Tariff, Et: Export Tax, Ss: Net Subsidies).

Table 9.3.1 : Estimation of Standard Conversion Factor (SCF)

(Unit: billion FCFA)

Year	Import Amount	Export Amount	Import Tariff	Export Taxes	Net Subsidies	SCF (%)
1998	102.4	188.8	17.9	4.2	0.0	95.51
1997	75.9	101.1	11.4	2.0	0.0	94.96
1996	64.2	74.5	9.9	2.6	0.0	95.00
G/T	242.5	364.4	39.2	8.8	0.0	95.25

* Figures of year 1998 and 1997 are estimates.
Source: Republique Centrafricaine, *Budget de l'Etat, Annee 1996 - 1998,*
IMF, *International Financial Statistics, January 1999* and
IMF, *Direction of Trade Statistics Quarterly, December 1998*

SCF and the ratio of transfer payment used here follows the figure in the Master Plan because it is found not necessary to revise them under the current availability of relevant data.

The following explanation is of how to calculate each economic cost account (see Table 9.3.4: "Economic Internal Rate of Return").

(Replacement Cost)

The Facilities subject to replacement during the project period include some of water intake and transmission facilities and power transmission facilities. Their aggregated proportion of foreign cost and local cost is estimated by the project cost planning staff of the JICA study team as given in Table 9.3.2 below.

Table 9.3.2: Allocation of Foreign and Local Cost for Replacement of the Facilities

Item	Foreign Cost (FRF)	Local Currency (FCFA)
Submersible Pumps (Intake facilities)	238,800	1,596,000
Transmission Pumps	331,200	288,000
Disinfection Device	5,000	0
Electric Facilities	0	29,873,000
Total	575,000	31,757,000

(Personnel Expenditure)

This account is genuinely local. The condition of unskilled labor is disregarded, because since unemployment rate in CAR is unknown but easily expected to be very high, to put stress heavily upon workers' job opportunity is possibly promote exploitation of local labor force.

(Construction Cost)

Construction is also divided into foreign cost and local cost by the project cost planning staff of JICA study team (See Table 7.5 Investment Schedule).

(Chemicals / Power Expenses)

Chemicals used for purification of water are totally imported while electricity is domestically produced.

(Miscellaneous Maintenance Cost)

Based on the analysis of items included in the miscellaneous cost of the project, it is assumed by the cost planning staff of the JICA study team that 60% of the miscellaneous maintenance cost is foreign while the remaining 40% is local respectively.

(b) Project Benefit

In the case of water-resource development, cost reduction in spending time (to carry heavy water containers for a long distance), in medical expenditure (of water-borne/related diseases), and/or gain in opportunity benefit for kids/women to be able to go to school/to be engaged in other income-generating activities are frequently taken as beneficial factors for the appraisal.

In this economic appraisal, following the methodology applied in the Master Plan, benefit of the project is calculated based upon prospective water sales amount of public faucets (kiosks) at current billing rate of sales, which is considered to include all the prospective benefits for consumers of newly developed water-distribution service from the results of social surveys and analysis conducted by JICA Study Team.

Therefore, Annual economic benefit of the project is estimated by the following formula.

Annual Economic Benefit
= [Water Supply by new facilities (m^3/year) X 1,000 (liters) X Unit Sales Price at Kiosk (0.5 FCFA/liter)] ÷ 1,000 = Economic Benefit (Unit -000- FCFA)

Table 9.3.3: Billing Rate of Sales at Public Faucets (Kiosks) in Bangui Metropolitan Areas

(Unit: FCFA)

Sales Volume	Sales AMT
0 — 10 liters	5
11 — 20 liters	10
21 — 30 liters	15
31 — 40 liters	20
41 — 50 liters	25
51 —100 liters	50
101 —200 liters	100

Source: SODECA

(The unit price of kiosk water is deduced: FCFA 5 ÷ 100 = 0.5 FCFA/liter.)

(2) Appraisal

Results of calculation of EIRR are shown in Table 9.3.4 on next page. The EIRR of the project is 3.71 % with the Cost-Benefit Ratio of 0.41. These figures indicates negative signs if the proposed project is implemented only for economic development. Implementation of the project need be properly justified from the viewpoints of Basic Human Needs.

Table 9.3.4 Calculation of Economic Internal Rate of Return (EIRR) of the Project

Year	Water Supply by New Facilities (m3)	Benefit	Replacement Cost		Personnel Expenditure (Local Cost)	Construction Cost		Chemicals Expenso (Foreign Cost)	Power Expenso (Local Cost)	Misc. Maintenance Cost (Foreign)	Misc. Maintenance Cost (Local)	Total Cost	Cash Balance
			(Foreign)	(Local)		(Foreign)	(Local)						
2001	0	0	0	0	0	120,700	72,076					192,776	-192,776
2002	0	0	0	0	0	1,726,800	756,913					2,483,713	-2,483,713
2003	0	0	0	0	0	1,940,700	1,094,721					3,035,421	-3,035,421
2004	446,030	223,015	0	0	8,511	0	0	3,201	9,724	8,524	4,439	34,399	188,616
2005	446,030	223,015	0	0	8,511	0	0	3,201	9,724	8,524	4,439	34,399	188,616
2006	446,030	223,015	0	0	8,511	0	0	3,842	11,670	10,416	5,424	39,863	183,152
2007	545,018	272,509	0	0	8,511	0	0	4,482	13,616	12,308	6,409	45,325	227,184
2008	644,006	322,003	0	0	8,511	0	0	5,123	15,562	14,200	7,394	50,789	271,214
2009	742,994	371,497	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	316,378
2010	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2011	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2012	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2013	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2014	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2015	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2016	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2017	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2018	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2019	803,000	401,500	57,500	24,803	8,511	0	0	5,763	17,508	15,346	7,991	137,422	264,078
2020	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2021	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2022	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2023	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2024	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2025	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2026	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2027	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2028	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2029	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2030	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2031	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2032	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2033	803,000	401,500	0	0	8,511	0	0	5,763	17,508	15,346	7,991	55,119	346,381
2034			0	0	0	-566,209	-351,521	0	0	0	0	-917,729	917,729
Total	22,542,108	11,271,054	57,500	24,803	255,330	3,221,992	1,572,189	163,924	497,996	437,627	227,872	6,459,233	4,811,821

NPV	-2,584,357
ERR	3.71%
COST	4,579,956
BENEFIT	1,895,599
B/C Ratio	0.41

9.4 Social Appraisal

Social appraisal of the project is made in accordance with the checklist of positive/negative social impacts assessment, which is made by the social analyst of JICA Study Team. Table 9.4.1 below shows the result of social appraisal of the project for each impact assessment factor.

Table 9.4.1 Comprehensive Appraisal of Social Impacts of the Project

Area	Positive	Negative	Remark
Employment Opportunity	The project will create additional job opportunities during construction as well as operation period such as: -civil / construction workers. -kiosk operators. -facilities maintenance and operation workers.	No significant impact.	The works of present water vendors need be taken into account.
Work Load for Water Collectors	Generally, work load for water collectors will be relieved by building the kiosks within a distance of every m as planned.	No significant negative impact. Work load may be increased if the consumers start using water separately between shallow-wells and kiosks.	Possible increase in work load of women, children, and old peoples need be taken into account.
Hygiene and Sanitation	The project will reduce the risk of water-borne diseases due to limited access to safe drinking water. Infant mortality rate as well as other infant health indicators may be improved.	No significant negative impact.	Hygiene and sanitation education need be encouraged to use safe water in the community as well in school.
Productive Activities	Generally, time for water collection will be saved for other more productive activities (education for children, housekeeping, income generating works, etc.)	In some cases, work load may be increased.	The use of water vendors may need be considered to save work load and time for water collection.
Equality	The project will improve the present inequality in water supply services.	Difference in distance to kiosks (which is not big), may be a problem.	Equality in access to kiosks need be taken into account in locating them.
Impacts on existing wells	Water from shallow-well may be properly used. High dependence on shallow-wells may be released.	The project is designed not to give negative impacts on existing wells such as decline in groundwater level, etc.	Monitoring of existing wells may be needed.
Increase in living cost	Generally, increase in living cost may be offset by increasing in opportunity of other productive activities.	It may be difficult for low income families to pay water bill.	Response measures need be taken for low income families and peoples such as, providing labor instead of monetary payment, etc.

From the results shown in Table 9.4.1, a number of positive social impacts are anticipated while very few negative impacts are identified in the project. All of the anticipated negative impacts of the project can be avoided by taking necessary social considerations. It can be concluded that the project is socially feasible and acceptable to the peoples.

9.5 Environmental Appraisal

Based on the result of Environmental Impact Assessment of the project (see Chapter 8), environmental impact of the project is outlined as given in Table 9.5.1 below.

Table 9.5.1 Comprehensive Appraisal of Environmental Impacts of the Project

Area	Appraisal Results
Land Erosion	Land erosion will not take place by the project because no excavation and embankment work is to be done.
Groundwater	No serious groundwater level draw-down will arise because the project is designed to prevent such negative impacts (see Chapter 3). Groundwater monitoring will also be regularly conducted to avoid such risk.
River	
Land Subsidence	Land subsidence will not occur because the laterite layer is hard enough and groundwater level draw-down will be minimized.
Social Aspects	No significant negative impact is anticipated by land acquisition for the project because most of the land acquired belongs to the Government. The disturbance of the project to the existing economic activities of the peoples is also minor.

From the table above, it can be concluded that the project is environmentally feasible and acceptable.

9.6 Synthetic Project Appraisal

Based on the results of financial and economic appraisal of the project hitherto with its social and environmental analyses to be discussed hereunder, comprehensive appraisal of the project is made as follows:

(1) FIRR of the project is negative (-1.95%). The result indicates that the project is not to be financed by loans but grants.

(2) EIRR of the project is 3.71%. It implies that the project could not be implemented for economic development. It also tells that it is still difficult to justify the project for responding the Basic Human Needs.

(3) In terms of social benefit, the project will produce some important BHN impacts such as:
- Releasing the women and children from hard work load for drinking water collection,
- Releasing the people from the present serious risk of water-borne diseases,
- Improving the present hygiene and sanitation conditions,
- Saving the time and cost to be wasted due to limited access to safe drinking water.
- Increasing the opportunity and potential of the people to be engaged in more productive activities.
- Improving present inequality in safe water supply in the region.

(4) In terms of the environment, no serious negative impact is identified in the Environmental Impact Assessment by the JICA Study Team.

From the result of comprehensive appraisal of the project above, the project still have some important social benefit not to be ignored in terms of Basic Human Needs although it is very difficult to justify in financial and economic terms.

Chapter 10. CONCLUSION AND RECOMMENDATION

10.1 Conclusions

The Master Plan study focused on a groundwater development project as recommendation for the Feasibility Study to save the people from the unsanitary and inconvenient life condition. The Ground water development project has advantages of less construction cost and operation and maintenance cost as well. In the west or north peripherals of the present water service area, which areas are targeted in this project, people are exposed to a high risk of sweep of water born diseases due to non or poor level of water service in pressure and quantity. Therefore a project of groundwater development project was established as follows.

(1) Water Resource

In accordance with Hydrogeological survey and construction of 20 exploration wells, 2 sites were selected at Bakongo and Mbossor in Bangui City as the optimum well field. The exploitable groundwater volume was decided at 800,000 m^3/year from the view point that water level of the existing shallow wells around the proposed deep well would not get down more than 1.5 m from the present level even in the dry season. Groundwater produced from the proposed deep wells can be distributed to the consumers through only a chlorination system depending on the result of water quality analysis.

(2) Population Projection

The current estimated population in the target area of 54,100 is projected to reach 79,200 by 2005, 105,100 by 2010 and 140,900 by 2015. The population estimated to be supplied by 2005, the target year of Feasibility Study is 37,300. In year 2007, when the proposed system would be operated fully, the service population is estimated at about 45,000.

(3) Water Demand Projection

In accordance with the water demand of the project area, maximum daily supply volume was estimated at 1,650 m^3/day by 2005, 3,220 m^3/day by 2010 and 6,180 m^3/day by 1015. The proposed production volume of the wells, 2,200 m^3/day, corresponds to the maximum daily supply volume in 2007.

(4) Proposed Facilities

The proposed facilities were designed correspondently with the proposed production volume 2,200 m^3/day. The specification of the proposed facilities are given in Table 10.1.1 below.

Table 10.1.1 Proposed Facilities

Facility	component	Specification	No.
Well Facility	Deep Well	Dia. 12"1/4, Depth 50m to 150m, FRP Casing Dia. 6", INOX type screen Dia. 6"	6
	Submersible Pump	Q=0.51 m^3/min., 2.4 kw to 5.43 kw	6
	Raw water main	Dia. 100 mm to 200mm, DCIP	3,120 m
	Aqueduct	Dia. 150 mm, L=29m	1
Transmission Facility	Receiving tank	RC structure, V=122 m^3	1
	Transmission main	Dia. 200 mm, DCIP	4,780m
	Transmission pump	1.07 m^3/day, 31.66 kw	3
	Disinfection device	Hypochlorite dosing system	1
Distribution Facilitiy	Pipeline	Dia, 50 mm to 300 mm, DCIP / PVC	71,840
	Distribution Reservoir	RC structure, V=1700 m^3	1
	Public fountain		40

(4) Project Cost

- Cost estimates are based on a currency exchange rate on June 2, 1999. The rates are 1F-Franc. = 100.0 FCFA, 1US $ = 627.23 FCFA, 1J-Yen=5.18 FCFA

- The cost of design and construction stage was estimated at 37,882,000F-Franc as a foreign currency portion and 2,439,068,000 FCFA as a local currency portion.

- Main recurrent costs, which shall be annually invested for electricity, salary, Chemicals, and others for operation and maintenance of the new system, are calculated. These have been assumed to come out of the Project's operational budget, and therefore funded from Project's revenue.

- The cost per capita over the total investment for the scope of the feasibility study comes to F-Franc 1,380 (equivalent to US$ 220) considering a estimated water service population in 2007 when the full capacity of the new system would meet the estimated demand.

(5) Financial and Economic Appraisal

In accordance with the result of financial and economic appraisal, FIRR and EIRR were estimated at –1.95 and 3.71 respectively. The result certainly tells that this project is not adequate for loans, either by private finance or by so-called "soft loans" of official development assistance, but for grant. Since the annual recurrent operation and maintenance cost can be recovered by operating revenue, if the initial investment is paid for by some development assistance with high ratio of grant element and operations of water supply are properly managed, the project would be considered to be viable.

(6) Environmental Impact Assessment

There are no significant negative impact by implementation of the proposed project. However, groundwater level and quality of water should be monitored regularly after commencement of the project in order to let the project be sustainable. It is recommended that the Government of CAR should take proper measures to acquire the land for construction of the proposed facilities.

(7) Conclusion

The project was evaluated not so positive to implement on loan basis. It is anticipated, however, that the project could be managed with profitable balance at the operation and maintenance stage. The operation of the new facilities can be covered by the present capacity of the local engineers. The Government of CAR can entrust operation and maintenance work of the new system to the private firm under its supervision, that is the same manner as the Government does now. From the BHN point of view, it was justified that implementation of this project can highly contribute to improve the present circumstance in the target area.

10.2 Recommendations

In order to guarantee more sustainability of the project's implementation, the following issues are recommended to the Government of CAR.

(1) Establishment of Monitoring System on Groundwater Level and Water Quality

The water source of the project is groundwater to be developed in the urbanized area. The proposed production volume of the groundwater was decided in order that the shallow groundwater would not dry up due to operation of the proposed wells even in the dry season. Quality of the groundwater to be developed by the project was anticipated to clear the WHO's guideline even in future. However, considering difficulty to foresee precisely changes of water level and quality, that might occur due to influence of continual pumping and various activities in the recharging area of groundwater, it is recommended to establish a monitoring system on groundwater level and water quality in the DGH body. Data accumulated by this system will enable the DGH to make a necessary study and take proper measures about revise of pumping rate of groundwater, installation of removing device of Fe or Mn or others in due time.

(2) Formulation of counter measure for groundwater preservation

At present there are several large factories and offices which might cause groundwater pollution, in the groundwater recharging area. The result of field survey conducted by the study team showed that these would not contaminate the groundwater. There is neither regulation nor law that shall prohibit to erect chemical related factories or dye works in Bangui City and Bimbo District. Therefore, in order to protect of groundwater quality, it is recommended that the Government of the CAR should establish underground water preservation law over the recharge area and regulate to discharge of pollutants or to erect a chemical industry without proper treatment facilities. Although the NO_3 concentration in the groundwater still presently remains in low level and it may take long time to exceed the WHO standard in future, it is recommended that furnishing septic tanks in the private houses shall be also conducted. On the other hand a project for arrangement of sewage system should be commenced in near future in Bangui City.

(3) Reinforcement of the DGH

The DGH, the implementing organization of the project of the CAR side, has been involved in development of water supply service in rural area for more than 10 years under the Ministry of Mines and Energy. Under the organizational reform policy of the Government, the DGH was appointed to implement and promote water supply activities in the whole country last year. Therefore the DGH is preparing a proposal for new organizational structure. In accordance with its experience of various project's implementation, the DGH can manage study and construction for the proposed project. At the operation and maintenance stage of the project, however, the DGH has not enough experienced staff and know-how on entrustment of operation and maintenance of the proposed facilities to the private firm, supervision and evaluation of the performance of the private firm, billing and financial management, public relation activities, etc. Therefore, the DGH has to reinforce its capacity by employment of proper capable persons and training of their staff by participation to certain training programs presented by NGO or international aid organizations. It is highly recommended that the Government of the CAR should support the DGH's activities by all means in points of finance and personnel.

(4) Formulation and implementation of measures for increasing the water service ratio

The CAR Government has been making effort to increase the water service ratio in Bangui City by introducing financial and technical assistance from mainly French Government for years. Recently a review of the study on 4th project for rehabilitation and reinforcement of the existing distribution pipe network was completed by the assistance of the AFD. The study aims at augmentation water service population and strengthening of management of the sector. The Government of CAR has requested the Government of France to implement this project through the AFD. Increase of water service ratio would bring the project better effects such as increase of the workability of the system and efficient use of water resource and consequently profitable management. Therefore the Government of the CAR is recommended to promote formulating and implementing proper measures for increase of the water service ratio by its own responsibility.

(5) Pilot management of public faucet by community oriented water committee

This project aims to serve safe potable water stable to the people who are categorized into low income class and live under the worse sanitary situation. It is

expected that most of them would become public faucet (kiosk) users after completion of the facilities. If profit on selling water at kiosk can be returned to the users, the project would be more accepted by the people. Therefore it was proposed to introduce a system of community based kiosk operation in the project as a pilot system. There may be various obstacles to introduce the new system, however, the DGH is recommended to play a significant role to organize, educate and train the community in order for the system to take loot in the target area.

(6) Thorough education for inhabitants about the utilization of water supply

The purpose of the public water supply is to provide safe water in stable to the peoples in order to support their healthy and cultural life. And the water supply service is sustained by collecting of water charges properly from the water users. People in the project area are mostly migrant from the rural area who aim to obtain better jobs in the urban area. They are still continued same life as they did in their home regions. Therefore they generally do not know a proper manner for use of the public faucet (kiosk) and its advantages. And also, in many cases, they are lack of adequate understanding on paying water. Therefore, in order to diffuse the proper water supply service, edification movement on the utilization of water supply should be conducted to such inhabitants.