9.2 Implementation Schedule

9.2.1 Project Components and Construction Packaging

The project components are summarized as shown in Table-9.2 below. Considering the type of work and site location of the components, the project is divided into five (5) construction packages, which is the same division of the components shown in Table-9.2.

Table- 9.2 Project Components and Construction Packaging

Project Components Construction Package	Specification
(1) Vaza Barris Multipurpose Dam	
Main Dam	Type: Gravity concrete dam, Height: 48.2m, Crest Length::280.0m
Spillway	Type: Free overflow, Design discharge: Width: 15.00m, Height: 5.2m
Check Dam (or Intake Dam)	Type: Gravity concrete dam, Height: 20.0m, Crest Length: 127.0m Width of Overflow Section: 70.0m
Low Flow Bypass	Type: Concrete Box Culvert, Length: 27.7 km, Size: 1.05m x 1.05m Design discharge: 0.75m³/s
(2) Domestic/Industrial Water Supply Facilities: < Itabaiana City Area >	
Water Conveyance Pipeline	Raw water pump station: 0.546 m³/s, Ductile cast iron pipe: Diameter ϕ 500-700mm, Total length:25.4km
Treatment and distribution facilities	Municipalities: Itabaiana, Areia Branca, Campo do Brito, Macambira, Sao Domingos
(3) Domestic/Industrial Water Supply Facilities: < Lagarto City Area >	
Water Conveyance Pipeline	Raw water pump station: 0.52 m³/s, Ductile cast iron pipe: Diameter ϕ 500-700mm, Total length:24.0km
Treatment and distribution facilities	Municipalities: Lagarto, Poço Verde, Simao Dias, Riachao do Dantes
(4) Forestation for Environmental Protection	
Forestation	Total 300 ha (main dam site: 150 ha, check dam site: 50 ha reservoir: 100 ha)
(5) Irrigation Water Supply Facilities	
Water Conveyance Pipeline	Raw water pump station: 2.912 m³/s, Water Conveyance to agricultural land
Irrigation Facilities	Irrigation area: 4,553 ha, Beneficial municipalities: Lagarto, Itaporanga de Ajuda, Salgado

9.2.2 Procurement Method

(1) Consulting Services

The procurement of consulting services is to be made between January 2001 and December 2001. The recommended method for the selection of a competent consultant is the Short List method in accordance with the Guidelines for the Employment of Consultants by borrowers of a foreign soft loan. However, the direct appointment of a specific consulting company should be considered, as the JICA Study Team has already studied the project in some detail. Similarly, the contract with the consultant should be made in one package for both the design stage and construction stage, in order to assist in the coordination and smooth execution of the project.

(2) Construction Work

The procurement of contractors is to commence from July 2002 and to be completed by December 2003. In accordance with the Guidelines for Procurement under foreign soft loans, International Competitive Bidding (ICB) is proposed. The project involves the construction of a concrete dam, a check dam, a low flow bypass, water supply facilities, forestation works and irrigation facilities. ICB will be the best method for achieving the economic and efficient implementation of the project. In the interests of the broadest possible competition, contract packages have been made a reasonable size to attract bids on an international basis. Tenders will be limited to contractors who have pre-qualified and been accepted onto the short list.

9.2.3 Implementation Schedule

The project is composed of the following work items:

0) Project Preparation
1) Loan procedure for Foreign Soft Loan
3) Procurement for consulting services and construction work
3) Consulting services including project management, detailed design and construction supervision.
4) Construction work
5) Land acquisition and compensation

The overall implementation schedule is shown in Table-9.3. Following procurement of the consulting services, the total required period for the main works is five (5) years which comprises four (4) main stages: i) 24 months for the detailed design, ii) 12 months for land acquisition and compensation, iii) 18 months for procurement of contractors (overlapping with the design stage), iv) 36 months (3 years) for construction.

9.3 Financial Disbursement Schedule

Finance for the project is requested from the foreign soft loan with the exception of the costs for land acquisition and compensation, government administration and government tax which will be borne by the federal or state budget. Although loan amount to be borrowed is limited to 60 % of the total project cost, 50 % of that is assumed to be loaned taking into account of the State financial conditions.

The financial disbursement schedule of the project in phase-1 is summarized in Table-9.4.

Table- 9.3 Implementation Schedule: Project of Water resources Development and Supply in Vaza Barris River- Sergipe

Project Stages	(1) 1999	(2) 2000	(3) 2001	(4) 2002	(5) 2003	(6) 2004	(7) 2005	(8) 2006	(10) 2012	(11) 2013	(12) 2014	(12) 2015	(12) 2016
	Preparation Stage			Implementation Stage (Phase-1)					Implementation Stage (Phase-2)				
0 Project Preparation													
(1) F/S of the Project													
(2) Basic Design of Water Supply Facilities													
(3) F/S on Irrigation Project													
(4) Formulation of RIMA													
(5) Approval of Project Implementation													
(6) Formulation of L/P													
1 Loan Arrangement													
(1) Project Identification	*												
(2) Pledge (Exchange of Note)		*											
(3) Loan Agreement			*										
2 Procurement													
(1) Consulting Services													
(2) Construction Work													
3 consulting Services													
(1) Assistance for Project Management													
(2) Detailed Design													
(3) Construction Supervision													
4 Construction Works													
(1) Dam, Check Dam and Low Flow Bypass													
(2) Urban Water Supply Facilities to Itabaiana													
(3) Urban Water Supply Facilities to Lagarto													
(4) Forestation for Environmental Protection													
(5) Irrigation Water Supply Facilities													
5 Land Acquisition and Compensation													
(1) Land Acquisition and Compensation													

Table-9.4 Finance and Disbursement Schedule of Phase-1 Project

(Unit: R$1000)

Item		Total	2002	2003	2004	2005	2006
Consulting Services							
Construction Works							
Land Acquisition & Compensation							
1. Construction Costs	Total	224,232	0	0	39,213	112,512	72,508
	Base Cost	176,253	0	0	32,229	88,920	55,103
	Price Esc.	47,980	0	0	6,982	23,594	17,405
(1) Dam Construction	Total	83,597	0	0	38,337	45,260	0
	Base Cost	67,280	0	0	31,510	35,770	0
	Price Esc.	16,317	0	0	6,827	9,490	0
(2) Itabaiana Water Supply	Total	44,667	0	0	0	21,444	23,223
	Base Cost	34,597	0	0	0	16,948	17,649
	Price Esc.	10,070	0	0	0	4,496	5,574
(3) Lagarto Water Supply	Total	47,419	0	0	0	22,439	24,980
	Base Cost	36,716	0	0	0	17,733	18,983
	Price Esc.	10,703	0	0	0	4,706	5,997
(4) Reforestation	Total	875	0	0	875	0	0
	Base Cost	719	0	0	719	0	0
	Price Esc.	156	0	0	156	0	0
(5) Irrigation Water Supply	Total	47,675	0	0	0	23,370	24,305
	Base Cost	36,941	0	0	0	18,470	18,471
	Price Esc.	10,734	0	0	0	4,900	5,834
2. Land Acquisition & Compensation	Total	2,929	951	1,978	0	0	0
	Base Cost	2,536	845	1,691	0	0	0
	Price Esc.	393	106	287	0	0	0
3. Consulting Services	Total	21,906	3,644	3,789	3,940	5,163	5,370
	Base Cost	17,877	3,239	3,239	3,239	4,080	4,081
	Price Esc.	4,029	405	550	701	1,083	1,289
4.Administration	Total	2,516	465	483	502	523	543
	Base Cost	2,065	413	413	413	413	413
	Price Esc.	451	52	70	89	110	130
5. Contingency	Total	12,452	235	292	2,163	5,876	3,886
	Base Cost	9,833	208	251	1,777	4,644	2,953
	Price Esc.	2,619	27	41	385	1,233	933
Total Project Costs	Total	264,038	5,294	6,542	45,818	124,075	82,308
	Base Cost	208,564	4,705	5,593	37,658	98,057	62,548
	Price Esc.	55,474	589	949	8,160	26,018	19,759
Foreign Soft Loan		132,019	2,647	3,271	22,909	62,037	41,154
Total Project Costs (US$1000)		137,520	2,757	3,407	23,864	64,622	42,868
Foreign Soft Loan (US$1000)		68,760	1,379	1,704	11,932	32,311	21,434

Note: - Exchange rate: US$ 1 = R$ 1.92 as of September 1999
- 4 % of annual price escalation is set since the year of 2000
- 50 % of the project cost is assumed to be raised with Foreign Soft Loan, taking into account of the state financial condition.

CHAPTER 10 PROJECT EVALUATION

10.1 Technical Evaluation

The Project of Water Resources Development and Water Supply Project in Vaza Barris River- Sergipe (PROVABASE) was planned according to the following technical information, standards, judgments and proper implementation procedures, and is assessed to be technically feasible as a result.

1) The information necessary for planning was collected from the data and information that the Federal Government and the State Government own and applied to the Plan after precise examination and careful selection. Moreover, additional information concerning the topographical, geological and environmental conditions was given through the topographic survey at the dam site and reservoir, geological survey, water quality survey and ecological survey at the dam site conducted by the Study Team. The standards established by the Federal Government were applied for the planning and design, as standards required in the Plan. For example, the Hydropower Generation Design Standards of CEMIG were used as the dam design standards in the Plan. However, the international standards such as in Japan and USA were also used when necessary.

2) The following facilities were added in the proposed system to ensure the quality level for domestic water and irrigation due to the high-chlorine concentrated river water at the proposed dam site:

   a) Additional storage volume system for dilution

   b) Low-flow bypass for discharging particularly the low flow volume of high-chlorine concentrated river water to downstream of the dam before inflowing to the dam reservoir.

   The technical viewpoint of the system are as follows: 1) volume necessary for dilution, 2) chlorine concentration of river water, 3) design discharge for low flow bypass, 4) type of the low flow bypass, and 5) possibility of chlorine-density layer formation. As to 2), the formula related between flow volume and chlorine concentration was given from the study of the existing data and the survey data by the Study Team. 1) and 3) were decided after completing reservoir simulation based on the above formula and flow volume data during these 10 years. As to 4), the culvert type was selected from the technical, economic and environmental viewpoints after compared with other two types of open channel and pipeline. As to 5), intake pump facilities to abstract surface reservoir water were planned, avoiding the abstraction of high-chloride concentrated water in the bottom of the reservoir, because it is not yet confirmed that the chlorine-density layer could be formulated.

3) The information and opinions concerning the basic policy of the plan as well as alternative plans and designs were exchanged aggressively between the Study Team and organization related to the water sector of the State Government through 6 workshops in the feasibility study stage.

Although PROVABASE was assessed to be technically feasible, this technical assessment should be reviewed and re-confirmed in the study of a detail design stage according to the additional information and data such as river water quality, geological condition of the dam and detail topographical maps.

10.2 Social Evaluation

10.2.1 Social Benefits

(1) Increase of Employment and Activation of Regional Economy

Construction works of the dam, the pipelines for domestic/industrial water supply and irrigation water supply would offer a new labor opportunity to the people unemployed and underemployed. In general, unskilled worker living in or around the project site would be employed. The wages payable to unskilled workers in the project costs will be an amount of R$ 18 million during the construction period. The annual amount will be R$ 3.6 million, which is equivalent to 0.7% of 1998 GRDP of the project area. The effect would be greater if taking the skilled workers' wages and similar wages for the irrigation project into account.

In addition, basic materials for concrete such as cement and aggregate for dam construction could be procured at the project area, an amount of which is estimated at R$ 30 million during the two years of construction. Annual amount of R$ 15 million is equivalent to 3% of 1998 GRDP of the project area.

Generally, the workers' consumption behavior will stimulate the business activities of the related manufacturers and retail stores in the region. Thus, this increased income of both workers and manufacturers of the construction materials will induce a multiple economic effect to the region, which activates the regional economy as a whole.

(2) Improvement of Safe Water Coverage and Public Health

Upon completion of the project in 2020, all incremental urban population and 85 % of rural population in the project area will be provided with clean and sufficient potable water by the project. Moreover, the project is designed with 10-year return period that will make it possible to supply water safely even in a drought year.

According to the water use survey by the Study Team, almost rural inhabitants without residential water supply systems desired a private tap system in dwellings. A hygienic reason was the most remarkable. The expansion of potable water supply by the project could decrease water-borne diseases and mortality rate in the region.

(3) Mitigation of Economic Disparity and Alleviation of Centralization in the State Capital

The present industrial water supply rate through public water supply system is assumed at less than 1% of the industrial water demand in the project area. It could be lifted to 50% by the target year of 2020.

The proposed site of the irrigation project is located in Lagarto Municipality with total irrigation area of 4,519ha. Irrigated agriculture land could produce many benefits. According to pre-feasibility study of the irrigation water conducted by SEPLANTEC, the benefits of the with-project will increase almost by six times of the without-project within 5 years since the start of irrigation.

Thus the project will alleviate the impact of water scarcity in the project area of the state that will attract the manufacturers to build its plant in the region and also give farmers an

incentive to cultivate harder. That will stimulate intensively regional economic activities and bring the inhabitants more sufficient living conditions. As a result, it could lead the mitigation of economic disparity among regions and the alleviation of economic and demographic centralization to metropolitan area of Aracaju.

10.2.2 Social Environment Impacts

The project could induce several social problems among societies and residents in the project area during the construction and operation period. The negative social impacts derived from the problems must be mitigated through appropriate implementation of the project. The careful planning of these measures will be necessary and effective to mitigate the social negative impacts, but should be disclosed and explained publicly, and should be discussed with the society and the residents. All of these entire implementations could minimize effectively the social environmental impacts.

The mitigation measures for these negative social impacts are discussed specifically in Chapter 6. And Environment Impact Assessment (EIA) is conducted in Section 10.5.

10.3 Economic Evaluation

10.3.1 Condition of Evaluation

In the economic evaluation, economic cost and benefit was estimated based on the conditions as shown in Table-10.1

The financial construction costs of the multi-purpose dam are R$ 78.4 million. According to "Separable Cost Remaining Benefit Method", the dam construction costs are allocated as follows: 1) R$ 37.6 million or 47.9 % for Domestic and Industrial Water Supply Project and 2) Irrigation Water Supply Project at R$ 40.8 million or 52.1 %.

Table-10.1 Condition of Economic Evaluation

Items	Assumptions
1.Prices	September of 1999 for cost and benefit
2.Exchange Rate of Real	R$ 1.92 = US$ 1.00
3.Opportunity Cost of Capital	10 %
4.Conversion Factor	1) Sector-specific: Material 0.88, Machinery & Equipment 0.80, Skilled Labor 0.81, Unskilled Labor 0.46 2) Standard Conversion Factor 0.96 3) Conversion factor for irrigation project: 0.85
5.Time Horizon for Evaluation	50 years
6.Economic Life	
1) Dam	80 years
2) Structures	40 years (to be replaced after life termination)
3) Equipment	15 years (ditto)
4) Cast-iron pipeline	50 years
7.Benefits	
1) Residential Water	
- Rural Area	3% of the monthly household income of R$280: R$ 2.1 / capita / month
- Urban Area	3% of the monthly household income of R$680: R$ 5.0 / capita / month
2) Commercial Water	Actual water charge base (R$/capita): Urban 0.23, Rural 0.05
3) Public Water	Actual water charge base (R$/capita): Urban 0.62, Rural 0.20
4) Industrial Water	Actual water charge base: R$ 2.6 / m^3
5) Irrigation Water	Incremental Net Cash Flow under with/without Project

Note: SEPLANTEC conducted the pre-feasibility study on the irrigation project through the contract with a local consultant. The assumptions in the table concerning with agriculture were applied in the pre-feasibility study.

10.3.2 Results of Economic Evaluation

(1) Analysis on PROVABASE Project

The result of economic evaluation is shown in Table-10.2. The EIRR (Economic Internal Rate of Return) of the project of PROVABASE (the entire project) results in 14.9%, which exceeds opportunity cost of 10%. Thus, the project PROVABASE is assessed to be economically feasible.

According to the implementation schedule, the project was divided into two phases as below:

1) Phase-1: Dam, Domestic/Industrial Water Supply Project (Phase-1) and Irrigation Water Supply Project from year 2002 to 2006
2) Phase-2: Domestic/Industrial Water Supply Project (Phase-2) from year 2013 to 2016

The EIRR of each phase was also conducted, which respectively resulted in 16.0% and 10.7% that exceeds opportunity cost of 10%. In the analysis, the construction cost of the dam allocated to the Domestic and Industrial Water Supply Project as discussed above was evenly divided to the Phase-1 and Phase-2.

The EIRR of Domestic and Industrial Water Supply Project, and Irrigation Water Supply Project respectively resulted in 11.3% and 20.8%, which also exceeds opportunity cost of 10%.

Table-10.2 Result of Economic Evaluation of the Project

Project	EIRR (%)	NPV at 10% (R$ million)	B/C
PROVABASE	14.9	75.4	1.59
PROVABASE Phase 1	16.0	72.6	1.74
PROVABASE Phase 2	10.7	2.8	1.09
Domestic & Industrial Water Supply	10.8	8.1	1.10
- Phase-1	10.9	5.3	1.11
- Phase-2	10.7	2.8	1.09
Irrigation Water Supply	20.4	67.3	2.37

(2) Analysis on Each Project of PROVABASE

< Domestic and Industrial Water Supply Project >

The EIRR of 10.8% of the Project shows economic feasibility. However, it was a slight lower than 12.1% in the Master plan, mainly due to the increase of the construction cost of the low flow bypass and the pipeline system, as a result of precise cost estimation study in Feasibility Study. The results of economic analysis of each phase are given in Table-10.2, which shows economic viability respectively.

< Irrigation Water Supply Project >

Economic analysis was conducted on the basis of data and information in the pre-feasibility study by SEPLANTEC. The EIRR of 20.4% shows sufficiently economic viability. It was higher than 15.0% in the Master Plan. The reason was derived particularly from the great difference of incremental benefits under the with/without project between in pre-feasibility study and in Master Plan, in spite of the increase of the project economic cost by 70% in the pre-feasibly study.

(3) Sensitivity Analysis

The sensitivity analysis is to examine the sensitivity of EIRR with respect to the major variables that may affect economic benefits and costs applied in the economic evaluation of the project. In this analysis, the sensitivity of the EIRR is ascertained by the price values considered as the major variables as shown below. Considering the inflation rate of 11.3% in 1996, 7.2% in 1997, 1.7% in 1998 and 8.5% in 1999/June, the price change is set at 10% as a foreseeable maximum level in the nation.

Case-1: Construction costs increase by 10%.
Case-2: Market prices of agriculture products decrease by 10%.

Table-10.3 shows the results of sensitivity analysis performed under the above variations. Almost all the projects still show economic feasibility in both cases, although EIRR of the Phase-2 project of PROVABASE in Case-1 results in 9.7%, slightly lower than opportunity cost of 10%.

Table-10.3 Sensitivity Analysis of the Projects

Project/Case	EIRR (%)		NPV at 10% (R$ million)	
	Case-1	Case-2	Case-1	Case-2
PROVABASE	13.8	*13.6*	63.5	*55.1*
(Base Case)	14.9	14.9	75.4	75.4
PROVABASE Phase 1	15.0	*14.4*	64.8	*52.3*
(Base Case)	16.0	16.0	72.6	72.6
PROVABASE Phase 2	9.7	10.7	-1.3	2.8
(Base Case)	10.7	10.7	2.8	2.8
Dom. & Ind. Water	10.0	10.8	0.3	8.1
(Base Case)	10.8	10.8	8.1	8.1
Phase 1	10.3	10.9	1.6	5.3
(Base Case)	10.9	10.9	5.3	5.3
Phase 2	9.7	10.7	-1.3	2.8
(Base Case)	10.7	10.7	2.8	2.8
Irrigation Water	19.1	*17.6*	63.2	*47.0*
(Base Case)	20.4	20.4	67.3	67.3

Note:
- Case-1: Construction costs increase by 10%.
- Case-2: Market prices of agriculture products decrease by 10%.

10.4 Financial Evaluation

10.4.1 Financial Conditions of the State Government

(1) Basis for Financial Evaluation

The following financial schemes were confirmed through discussion with the State Government and were applied to financial analysis of this Study.

1) The construction of the dam, the domestic/industrial water supply systems and the irrigation water supply system will be conducted by UGP-PROVABASE. Accordingly, the State Government shall be entirely responsible for raising funds for the projects.
2) The State Government is planned to apply a foreign soft loan. Accordingly, source of funds for project costs will be composed as follows:
   - Soft Loan; 50% of the project cost in Phase-1

– Transfer from the Federal Government; 50% of the project cost in Phase-1

The Soft Loan in Phase-1 is set at 50% of the project cost, considering the debt limited by Legislation and other project progress.

3) After constructed by UGP-PROVABASE, the dam and the domestic/industrial water supply system will be transferred to DESO by the State Government as an increase of capital of the company. Also, the irrigation water supply system will be transferred to COHIDRO as an increase of capital of the company after constructed by UGP-PROVABASE.

(2) Project Costs and Disbursement of the Funds

Total investment amount of the project is R$ 370.5 million, of which R$ 174.6 million will be disbursed by the Federal Government as a transfer of the General Budget and R$ 195.9 million from the Soft Loan. The amount of the Soft Loan in Phase-1 and Phase-2 will be respectively R$132.0million and R$63.9million.

(3) Interest Payment and Repayment Scheme of the Loan

In this analysis, the guideline of a foreign soft loan was applied for the term and conditions of the Soft Loan are as follows:

– Loan Period: 25 years (7 years of grace period and 18 years of repayment)
– Interest Rate: 2.5 % per annum payable semi-annually

Phase-1 Loan commences in 2002 and terminates in 2026. Phase-2 Loan commences in 2013 and terminates in 2037. The interests payable will be an amount of R$65.2million in the aggregate.

(4) Debt Capacity of the State Government

(a) Indebtedness Limitation

The State Government owed loans equivalent to one year's net current revenue of the budget in 1998. However, the Debt Service Coverage Ratio was kept in lower level. It means that the state government financial condition is healthy in terms of the ratio. However, the state's indebtedness capacity is limited by Federal legislation.

The Federal Law No.9496 of September 11, 1997 prohibits the states owing outstanding debt amount superior to the real net revenue (Receita Liquida Real) from further credit operations. The internal and external outstanding debt amount of the State Government is R$ 920 million as of July 1999, which exceeds the real net revenue of R $ 760 million, calculated based on the amount announced by the Central Bank. Accordingly, further credit operations are not allowed for the State Government at the moment. Nevertheless, the external loans subject to projects are considered as exceptional cases.

To qualify for any credit operation, the State must meet the following two conditions established by Federal Senate Resolution No.78 of 1998:

a) The overall value of credit transactions may not exceed debt charges and amortization payment already due and payable in the year or, alternatively, 18 % of real net revenue, this being the revenue received in the twelve months prior to the Central Bank's analysis.

b) In addition, the maximum annual expenditure for amortization, interest and other charges for all credit operations already contracted and to be contracted may not exceed 13% of real net revenue.

Thus, the State's total indebtedness capacity was estimated by applying these criteria on an annual basis with the following results:

- Current capacity to assume an additional credit operation of up to R$ 140 million and annual debt-service capacity of up to R$ 100 million.

A. Real Net Revenue: R$ 770 million *
B. Overall Debt Capacity (A x 0.18): R$ 140 million
C. Debt Service Capacity (A x 0.13): R$ 100 million

Note *: Real net revenue of the State of July 1999 announced by Central Bank was multiplied by 12 months.

(b) Indebtedness Situation with the Soft Loan

The Soft Loan of R$ 132.0 million in Phase-1 and R$ 63.9 million in the phase-2 are respectively within the limited amount of R$ 140 million.

According to the current debt service (total amount of repayment and interests) schedule prepared by the Secretary of Finance of the State, the debt service will decrease year by years and sharply from 2015. In spite of debt service increases with the Soft Loan, the total debt services will not exceed the annual limit of R$ 100 million stipulated by the legislation. In addition, the State Government could maintain a healthy level of the debt service coverage ratio. The ratio is estimated at a peak of 10.4% in 2002. It means that the State Government could afford the overall debt services.

Table-10.4 Debt Service Ratio of the State Government

Unit: R$ million

Year	1999	2002	2005	2010	2015	2020	2030	2037
Current Debt Services	77.0	91.5	84.8	70.5	30.4	26.2	0.0	0.0
Debt Services Increases with Soft Loan	-	0.0	1.5	10.5	10.3	13.8	4.3	3.6
Total Debt Services	77.0	91.5	86.3	81.0	40.7	40.0	4.3	3.6
Debt Service Coverage Ratio (%)	8.7	10.4	9.8	9.2	4.6	4.5	0.5	0.4

Source of current debt services data: the Secretariat of Finance of Sergipe State
Note: Net Current Revenue of the State Budget Balance of 1998 (R$881.6million) was applied as base revenue.

(5) Project Cash Flow of the State Government

Project cash flow of the State Government during 36 years from 2002 till 2037 of the loan termination year are shown in Table-10.5.

Table-10.5 Project Cash Flow of the State Government

Unit: R$ million

Item/Year	2002 to 2019	2020 to 2037	Total
Cash Flow from Investing Activities	-265.4	0.0	-265.4
Cash Flow from Financial Activities	-189.3	291.6	480.9
Transfer from Federal Gov.	127.0	0.0	127.0
Soft Loan	138.4	0.0	138.4
Repayment of Loan	-63.7	-74.7	-138.4
Interest Payment	-33.4	-11.9	-45.3
Dividends Received	21.0	378.2	399.2
Cash increase/decrease	-76.1	291.6	215.5

Note: Soft Loan - R$ 104.3 million in phase-1 and R$ 34.1million in phase-2.

The aggregate net cash flow during the period of 2002/2019 will be a negative amount of R$ 76.1 million, which should be made up by the State Government.

However, the yearly net cash flow will turn positive in 2020 due to estimated dividends which will be paid by the Domestic and Industrial Water Supply Company (DESO) from 2017. The accumulated cash surplus during the period of 2020/2037 will be an amount of R$ 291.6 million

Accordingly, the Project generates accumulated cash surplus of R$ 215.5 million till 2037 when the Loan terminates. Total project cost of R$ 265.4 million could be entirely recovered by the year of 2040.

10.4.2 Financial Evaluation of the Public Companies concerned

In this analysis, financial evaluation is conducted independently on three companies to distinct each financial conditions: 1) Domestic and Industrial Water Supply Company, 2) Irrigation Water Supply Company and 3) Multi-purpose Dam Company.

(1) Domestic and Industrial Water Supply Company

(a) Basis for Financial Evaluation

Water charges per m^3 of domestic water are set up on the basis of the actual water and projected unit consumption rates. And the charges of industrial water are set up at the actual consumption basis. Incremental consumption volume in project area is set up on the basis of implementation schedule of the project.

Table-10.6 Water Charges and Incremental Consumption Volume

Item		Water Charge (R/m^3$)	Incremental Consumption ($1000m^3$/day)			
			2007	2010	2015	2020
Domestic	Urban	1.15	1.1	4.4	12.9	23.0
	Rural	1.05	0.2	0.6	2.2	3.8
Industrial		2.70	0.3	1.4	12.7	30.7
Total		—	1.6	6.4	27.8	57.5

(b) Financial Analysis

The Company will start its operation in 2007. However, net income will continue negative till 2011. So the short-term bank loan should be raised during the period to run the company. Loan amount is estimated at R$ 1.0 million in 2007, R$ 1.2 million in 2008, R$ 0.6 million 2009 and R$ 0.6 million in 2010. In this analysis, short-term interest rates are set up at 20 % per annum.

The net income will turn positive from 2012. And retained earnings (accumulated net income) will turn to surplus from 2014. As a result, the Company could continue to pay dividends to the shareholders from 2017, judging from the Profit/Loss Statement and the Cash Flow Table.

The paid-in capital of the Company is R$ 140.0 million. Dividend rate (dividend per share/face value of share) is estimated at 5 % till 2019 and at 20 % afterwards. Thus the accumulated dividends paid till 2037 are estimated at R$ 399.2 million. The State Government is a big shareholder of the Company and will receive almost all the dividends paid.

Table-10.7 Profit and Loss Statement in Summary

Unit: R$ million

Item/Year	2007	2008	2009	2010	2011	2012/16	2017/37
Operating Revenue	0.9	1.7	2.5	3.5	6.4	78.1	840.7
Operating Expenses	5.3	5.3	5.3	5.9	7.0	42.1	274.1
Non-operating Expenses	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Income before Tax	-4.5	-3.7	-2.9	-2.5	-0.6	36.0	566.6
Net Income	-4.5	-3.7	-2.9	-2.5	-0.6	31.0	425.0
Dividends	0.0	0.0	0.0	0.0	0.0	0.0	399.2

Table-10.8 Cash Flow Table in Summary

Unit: R$ million

Item/Year	2007	2008	2009	2010	2011	2012/16	2017/37
CF from Operating Activities	-0.8	0.0	0.8	1.2	3.0	51.6	534.9
CF from Investing Activities	-79.4	0.0	0.0	0.0	0.0	-26.7	-49.8
CF from Financing Activities	80.3	0.0	-0.6	0.6	0.0	26.7	-371.6
Cash increase/decrease	0.1	0.0	0.2	0.6	3.0	51.6	113.5
Cash at end	0.1	0.1	0.3	0.9	3.9	55.5	169.0

According to the above financial data, replacement costs of the water supply system and recurrent costs of the Company incurred during the period could be recovered entirely with water charges. And the cash surplus in 2037 is estimated at R$ 169 million, which should be retained as a reserve for forthcoming replacement of the pipelines and re-construction of the system.

(2) Irrigation Water Supply Company

The tariff for irrigation water is set by COHIDRO that is currently R$ 0.025/m^3. However, the current tariff is too low to recover either the operating expenses or O&M/training expenses of the Company.

Table-10.9 Annual Operating Expenses

Unit: R$ 000

Operating Expenses	O&M/Training	Water Right Charge	Depreciation
3,517	1,623	280	1,615

The tariff should be set at a level to recover the entire operating expenses of the Company, including depreciation that will be retained as a cash reserve for forthcoming replacement costs of equipment. All recurrent and replacement costs should be recovered by beneficiaries.

The projected irrigation water supply volume is set at 1.507 m^3/sec on average. As a result, the tariff should be R$ 0.074/m^3, which is almost triple of the actual tariff. Thus, the Company could continue its operation without financial assistance from the State Government, though the Company could not generate enough profits to pay dividends.

The project site consists of 6 models. The financial evaluation of the each model in case of proposed tariff of R$0.074/m^3 is conducted and the FIRR of each model is shown in Table-10.10.

Table-10.10 FIRR of each Model

Model	A	B1	B2	C	D	E
Lot Area (ha)	3	5	5	10	20	50
FIRR (%)	20.8	29.6	21.5	57.2	37.2	33.1

All models resulted in high level of FIRR over 20% that shows financially feasible. Judging from it, the proposed tariff could be acceptable. However, when considering the long-term financial cost that is estimated at more than 15% in Brazil, the FIRR of 20.8% of the model A and 21.5% of the model B will be the bottom line.

(3) Multi-purpose Dam Company

Users should cover the project costs. However, the Irrigation Water Supply Company could not afford as discussed above. The costs will be covered indirectly with dividends paid to the State Government by the Domestic and Industrial Water Supply Company. Accordingly, the forthcoming re-construction expenditures could be covered with the cash reserve of the State Government as mentioned above.

The annual operating expenditure of the Company is estimated at R$ 1,637 thousands (R$ 95 thousands of O&M expenses and R$ 1,542 thousands of depreciation). Users should cover the O&M expenses of R$ 95 thousand. Thus, the Company could continue its operation without financial assistance from the State Government during the project life.

10.5 Environmental Impact Assessment

10.5.1 Environmental Impacts

(1) Social Environment

(a) Resettlement

The Vaza Barris Dam reservoir will have a surface area of approximately 9.5 km^2 at normal water level. Because there are no villages in the inundated area, resettlement inhabitants are expected to be a small number. According to topographical maps (1:5,000 in 1985), there are 31 sheds and 13 houses within the inundated area of Vaza Barris Dam and Check Dam. Some of these houses must be barns for grazing activity. Actual number of resettlement, including three families identified by the field surveys, will be less than ten families. Some of them have no land and are employed by the farm owners, who have responsibility for their relocation. However, some of the families may obtain the relocation site in their own lands around the reservoir. Since the pipelines were planned along existing roads and extensive agricultural land, resettlement will not be needed.

(b) Economic Activity

The two dam sites and the reservoir areas are located in hilly area where agriculture is the only economic activity, but is not in a great scale. The land acquisition area is extensive pastureland or grassland including small cultivated-pasturelands and riverside forests. Therefore, the agricultural resources loss of the farmers seems not to be large. The inundated pastureland is about 600 hectares. Due to the reservoir barrier effect, pastureland will be divided. Moreover, bathing points for the livestock will be lost in this

area because the corridor from end of the reservoir to the check dam, about 9 km long will be dried up during dry season.

Pipeline construction needs acquisition of land use right along its alignment. This agricultural lands and products will be lost, but the area is not so large in the overall.

An increase of construction workers to the project area will put additional pressure on the social services and the medical facilities. On the other hand, dam construction works will bring additional income to the local residents in terms of the employment of workers, the local economy will be revitalized subsequently.

(c) Infrastructure Facilities and Cultural Property

State road (SE-110) crosses Vaza Barris River at about 20 km upstream of Vaza Barris Dam site. Although the reservoir reaches the bridge at normal water level, the bridge girder is far over the water level. There are several farm roads in the reservoir area. The impact of inundation to the roads is considered to be minor, because these roads are hard for automobiles to cross the river even in dry season and the users have been limited. There are no other infrastructure facilities or cultural properties in the inundated area.

In and around the dam sites, there are only farm roads that are possible to pass only by tractors and jeeps. As new construction road is planned, the impact of construction vehicles on the traffic around project area is considered to be minor.

(d) Public Health Condition

The reservoir might lead to an increase in the potential of water borne disease and provide breeding areas for mosquitoes that tend to breed in stagnant water and field edges. Therefore, the risk of water or mosquito borne disease such as schistosomiasis or dengue fever may increase. As the breeding areas in the reservoir are unavoidable, the local governments have to conduct a campaign and eradication program against dengue fever. However, there are no villages around the reservoir. Therefore these diseases will hardly break out.

(e) Waste

The volume of construction waste from the dam construction will be large. The waste includes excavated soils, rocks, cements and some bulky waste such as concrete piles. Excavation works for the pipelines will also generate surplus soils. These impacts can be mitigated by reuse plan and proper disposal plan, such as: 1) filling valleys with high permeability in the reservoir, 2) refilling the quarry site, and 3) providing waste as construction materials to local companies and people.

(2) Natural Environment

(a) Hazard and Soil Erosion

The two dam sites, the reservoir area and the pipeline alignments are located in hilly areas. There are no serious or large soil erosion sites such as gully erosion in the area. Storage of water into the reservoir may reduce the slope stability of the bank. However, according to the result of geological and topographical survey, large-scale landslide could not occur.

During the construction period, due to cut slope, land clearing and soil stripping, the topsoil may be eroded more easily, but these soil erosions can be mitigated by proper design and construction plan.

(b) Groundwater

In Sao Domingos town located near the reservoir, groundwater is the main source of water supply. Some local people living around Vaza Barris River use well water. Storage of water into the reservoir may increase the recharge level. However, according to the result of hydrogeological survey, the impact on the present groundwater use will not occur.

(c) Water Quality

The outlet of wastewater from Sao Domingos town is located 3 km away from the reservoir. Because the wastewater is a small quantity and purified by the stabilization pond and natural purification, the effect on reservoir water quality may be negligible. There are no other significant pollution sources in the upper catchment area.

Because the concentration of phosphorus in Vaza Barris River is low, it will be hard for eutrophication of the reservoir to occur. However, for the first few years, the nutrient level in the reservoir will be influenced by the decay of the vegetation left at the time of first filling. Some pockets of anoxic water will occur in the shallow hollows of the reservoir where vegetation was dense at the time of inundation. Although it is impossible to completely remove the vegetation, land-clearing works in the inundated area will improve water quality of the reservoir. Even if some vegetation remains, the effect on the water quality is considered to be minor. The reasons for this are as follows:

- The reservoir will have a high proportion of water volume to the vegetative biomass.
- A high rate of flushing will be expected during floods.
- The sinking of the water level prior to the rainy season will flush out the nutrients released into the water by the decay of vegetation.

Consequently, the water quality of the reservoir will be essentially the same as that of the river under present condition except for the sediment load, and will be suitable for domestic/industrial and irrigation use. The study of reservoir water quality will show in the next section in detail.

(d) Hydrological Situation and Estuary

Hydrological situation of the downstream will alter after the dam is closed,. The down flow and sediment load will be reduced. These effects are inevitable with the project implementation. The hydrological alternation by the project is shown in Figure-10.1. The total reservoir volume is equivalent to 34 % of the average annual flow at the dam site. The average annual flow at the dam site will decrease from 8.7 m^3/s to 6.0 m^3/s. This decrease volume is equivalent to 25 % of average annual flow at the end of the river (river mouth).

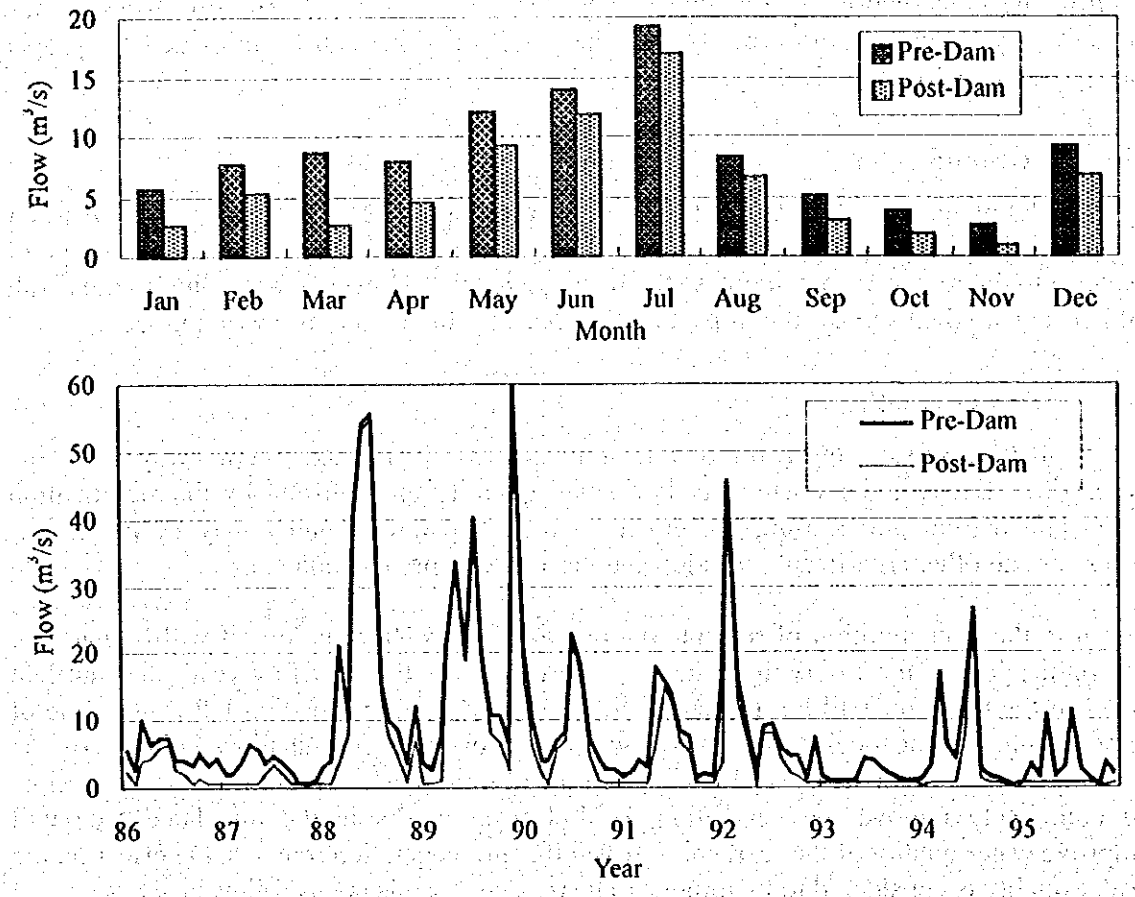

Figure-10.1 Effect of Average Monthly Discharge at the Dam Site (1986-1995)

Bed load sediment from the upstream will remain in the reservoir and most of wash load will also remain in the reservoir because of the long reservoir course and large reservoir volume.

There is a mangrove forest zone with high value as wild life habitat in the estuary. The alteration of river flow, sediment load and water quality may damage the ecosystem and the fisheries in the estuary. The actual effects on the mangrove zone by the project are described as follows:

1) Increase in concentration of salinity in the estuary water, due to decrease in the river flow.
2) Decrease in sediment load and nutrients.
3) Alterations of flood pattern.

According to the water quality analyses, the salinity in the mangrove forest zone is similar to that of seawater. In the estuary, the river flow contributes a very little to the total water volume of the estuary. Although there are no available data on the tidal condition, the average decrease volume of the river flow during one tide cycle will be equivalent to one-hundredth (1/100) order of the seawater inflow volume. Therefore, the impacts of the decrease in the river flow on the mangrove forests and its ecosystem is considered to be minor.

Decrease in sediment load may bring about long-term topographical transition in coastal area depending on the oceanographic condition. In general, this long-term transition is hard to estimate. About 70 % of the mangrove forests in the estuary are formed on the coastal sand. The mangrove zone is an inlet area rather than a river area. Because the river sediments are concentrated mainly in the upper area of the estuary, the large-scale topographical transition will not occur. Moreover, suspended solids including nutrients will not decrease substantially. Therefore, the impacts of decrease in sediment load and nutrients on mangrove forests will be limited within the upper area of the estuary and is considered not to be large scale.

In general, floods play important roles in the ecosystem of mangrove zones and the main roles are:

1) Transportation of sediments and nutrients from upstream area.
2) Supply of nutrients to surrounding area, due to hydrodynamic diffusion of detritus (organic sediment).
3) Supply of oxygen to anoxic bottom due to hydrodynamic diffusion.

Because the large part of floodwater in rainy season will flow through the spillway, the alternations of flood pattern will not be so large. However, depending on abnormal low precipitation, middle class floods will be stored in the reservoir except for the environmental discharge. Although this impact on the mangrove forests and its ecosystem can not be predict at this stage, after the precipitation returns to normal levels, the disturbed ecosystem will restore itself to original condition.

Consequently, serious negative impacts on the mangrove forests and its ecosystem might not occur. However, more detailed survey on the estuary and long-term monitoring program should be conducted.

(e) Flora and Fauna

Construction works such as land clearing, excavation, blast and hauling operations will drastically change the physical environment and damage the wildlife. Although the suitable construction plans can minimize the effects to some extent, this impact cannot be avoided completely. Some wildlife in/around the dam site and the pipeline alignments will be lost.

Based on the limited available information from topographical maps, satellite image and site inspection, there are no extensive areas of undisturbed forest and wildlife habitat in the inundated area. Only scattered riverside forests remain along Vaza Barris River and the tributaries. These riverside forests have relatively high wildlife habitat value. Because rare or endangered species have not been identified in the project area, serious impacts on biodiversity would not occur. However, the riverside forests of about 90 hectares will be inundated. Although this biological loss is inevitable with the project implementation, the biological resources lost by the project can be restored by reforestation program.

After the dam is closed, migration of the fish will be obstructed. However, migratory fishes that swim up the river from the sea for spawning have not been identified in the project area. Adverse effect on the local fishes cannot be avoided, but the impact will be, to some extent, counteracted by the reservoir, as a newly created aquatic habitat. The fish will shift from species of rapid river type to species of pool or lake type.

As for newly created biological conditions around the reservoir, some qualitative change will occur in the vegetation along the edge of the reservoir over the next 20 or 30 years, due to the rise of groundwater level and humidity. Water level of the reservoir will change by about 15 m. The draw down zone of reservoir water level will not be covered with vegetation. Submerged aquatic plant also cannot grow under such condition. These water bodies will not get a chance to the complex food chains and species diversity. In areas where clearing is not performed, the bare skeletons of trees remain for many years, but eventually insects and bacteria will destroy them.

(f) Landscape

There are no scenic spots around the dam sites, the reservoir and the pipeline alignments. However, construction works such as clearing and excavation will drastically change the physical environment and damage the landscape. This impact that the artificial big objects, the two dams and reservoirs will be newly built, can be mitigated by reforestation program of the dam sites and the buffer zone of the reservoir. The reforestation activities will create the harmonious scenery.

(3) Environmental pollution

Dam construction operation may increase the SS level of the river. This impact can be minimized by providing a turbid water clearing plant during the construction works.

Improper disposal of the waste and accidental spilling of harmful materials such as petroleum, oil and cement cause water and soil contamination but these impacts can be minimized by implementation of proper disposal plan and maintenance of the construction equipment. Heavy equipment operation will generate dust, noise and vibration, which are harmful to the local residents and construction workers. Because the pipelines will pass several towns, temporary and localized disturbance to the residents will occur. These impacts can be mitigated by proper construction methods. With regard to the dam constructions, these impacts on the residents are negligible because the work sites are remote from the residential areas.

10.5.2 Analysis of Future Water Quality Behavior in Vaza Barris Dam Reservoir

(1) Possible Impacts of Agrotoxics

Some irrigation projects have been developed at the region of Canudos in the upstream of Vaza Barris River in Bahia State, using water from Cocorobo Dam. Recent commercialized agrotoxics types present the tendency to use more and more property with lower toxicity and susceptibility for decomposition by solar energy.

There is not disposal any useful data at the present moment about the real applied types and quantity of agrotoxics at that region. However, in the viewpoint of long watercourse of Vaza Barris River as well as the bypass system that should be adopted to avoid the great part of water originated from the upper semi-arid region to discharge out of the reservoir, it is reasonable to consider that the agrotoxics effects on the future reservoir would be practically null.

It must be stood out that as one of the provision to prevention and control, it is recommendable to propose the discussion with the local authority, even though the region does not belong to Sergipe State, basing on the federal water pollution control laws.

(2) Eutrophication

The accumulation of the water in the reservoir may cause the exaggerated algae proliferation, depending on the water quality. The result of the analysis of the main parameters regarding to nutrients (N and P) obtained at three stations on Vaza Barris River are shown in Table-10.11. The results inserted in this table indicate that the nutrient contribution originated from the upper basin at Ponte SE-302 is very restricted, comparing to that obtained at Fazenda Belem. This fact suggests an existence of significant sources of nutrient loads in the basin situated between Ponte SE-302 and Fazenda Belem.

The simulation of eutrophication evolution level in the future reservoir was held through Vollenweider model that is known it is representatively of eutrophication phenomenon related as follow.

$$P_X = \frac{P_{IN}}{Z / T_W (1 + 2 \cdot T_W)}$$

Where, P_X: Total Phosphorous average concentration in reservoir (mg/l)
P_{IN}: Average concentration of total phosphorous in affluent (mg/l)
Z: Average depth (m)
T_W: Detention time (year)

$$CHL - a = 0.28 \cdot P_X^{0.90}$$

Where, *CHL-a:* *Chlorophyll-a concentration (mg/m³)*
P_X: Average Total Phosphorous concentration (mg/m³)

According to simulation performed based on the data obtained at Fazenda Belem station and equations above referred, the trophic level predicted for Vaza Barris Dam reservoir would correspond to the range of oligotrophic stage as can be seen in Table-10.12 where shows comparison of trophic level criterion. This simulated trophic category would not constitute any problems to multiple use of future Vaza Barris Dam reservoir.

It must be pointed out, however, that the domestic sewage of municipalities as well as the diffuse pollution found in Vaza Barris drainage basin could constitute an important source of eutrophication, requiring the implantation of the adequate treatment plants for mitigation of these pollution loads.

The decree-law CONAMA 20 that establishes the classification of water system on the Brazilian territory prohibits discharge of any type of sewage into the water basin where exists drinking water facilities.

Table-10.11 Results of Nutrients Analyses in Vaza Barris River

Parameters \ Sampling Date		April 7th	April 13th	April 20th
Ponte SE-302 Station				
Org. N	mg/l	0.5	0.3	0.2
NH_4-N	mg/l	0.019	0.009	0.055
NO_3-N	mg/l	ND	ND	ND
NO_2-N	mg/l	0.001	trace	trace
Total P	mg/l	0.052	0.06	0.05
PO_4-P	mg/l	0.002	0.005	ND
Flow	m^3/s	0.06	0.07	0.06
Total P flux	kg/d	0.27	0.363	0.259
Total N flux	kg/d	2.592	1.814	1.21
Sao Domingos Station				
Org. N	mg/l	0.4	0.2	0.5
NH_4-N	mg/l	0.03	0.008	0.048
NO_3-N	mg/l	ND	ND	0.03
NO_2-N	mg/l	trace	0.003	trace
Total P	mg/l	0.076	0.02	0.15
PO_4-P	mg/l	0.002	ND	ND
Fazenda Belem Station				
Org. N	mg/l	0.5	0.4	0.3
NH_4-N	mg/l	0.018	0.011	0.046
NO_3-N	mg/l	ND	ND	0.02
NO_2-N	mg/l	0.004	0.001	trace
Total P	mg/l	0.043	0.1	0.039
PO_4-P	mg/l	0.014	0.005	ND
Flow	m^3/s	1.5	1.3	1.2
Total P flux	kg/d	5.57	11.23	40.44
Total N flux	kg/d	64.8	44.93	33.18

Table-10.12 Proposed Criterion of Trophic Category (Vollenweider,1983)

Trophic Category	Average TP (mg/l)	Average Chlorophyll-a (mg/m^3)
Ultra-oligotrophic	< 4.0	1.0- 2.5
Oligotrophic	< 10.0	2.5- 8.5
Mesotrophic	10.0- 35.0	8.5- 25.0
Eutrophic	35.0- 100.0	25.0- 75.0
Hipertrophic	> 100.0	> 75.0
Vaza Barris reservoir	6.0	1.6

(3) Water Color of the Reservoir

The water originated from the upstream of the basin presents normally good transparence without any objectionable color. Significant watercolor appears only after the rainfall that brings the soil erosion materials constituted mainly micro particles, colloidal form of soil and some part of the humic substances with brown color. The great part of these materials loose rapidly into the water body owning to precipitation process when water remains quiet in the reservoir even if some of dissolved substances stay for a long period. Although depending on the verification of the water characteristics, the color products in the future reservoir could not attain any harmful level for water use.

10.5.3 Conclusion of Environmental Impact Assessment

Environmental impacts can be considered as falling in two categories. There are as follows:

< Unavoidable Adverse Impacts >

Unavoidable adverse impacts are impacts such as the land loss to reservoir inundation, alteration of downstream situation and change of physical environment in the dam site and the pipeline alignment site. These impacts are inevitable with project implementation and do not have avoidable actions without compromising the project.

< Manageable Effects >

Manageable effects are classified into direct/indirect and adverse/beneficial effects. Some sort of action plans can lessen these effects and enhance the secondary benefits. Vaza Barris Dam project has potentially adverse impacts on many environmental items. These environmental impacts will occur at operation stage as well as construction stage. However, the manageable adverse effects can be avoided by suitable mitigation plans. Considering no other useful water resources, Vaza Barris Dam project is judged to be environmentally feasible.

However, environmental investigation is not enough only in this Study and the following surveys should be conducted in the detail environmental impact assessment stage, to supplement this study results.

1) Fauna and Flora Survey at the Dam Site and the Reservoir Area
2) Land Use Survey in the Reservoir Area
3) Hydrological Situation (tide, current, seawater intrusion) Survey in the Estuary
4) Ecological Survey in the Estuary
5) Bed Load Sediment and Wash Load Survey at the Dam Site and the River Mouth
6) Water Quality Analysis of Vaza Barris River, Tributaries and Cajaiba Dam Reservoir.
7) Economic Activity Survey in and around Reservoir Area
8) Environmental Monitoring in the Estuary of Vaza Barris River

CHAPTER 11 RECOMMENDATIONS

(1) Implementation of the Project of Water Resources Development and Supply in Vaza Barris River- Sergipe (PROVABASE)

The project of water resources development and supply for domestic and industrial water in Itabaiana and Lagarto areas and for irrigation water in the right side of Vaza Barris River was proposed. The project consists of:

- Vaza Barris Multi-purpose Dam
- Domestic and Industrial Water Supply Facilities for Itabaiana Water Supply Area
- Domestic and Industrial Water Supply Facilities for Lagarto Water Supply Area
- Irrigation Water Supply Facilities

The Low flow bypass system was introduced in the dam reservoir operation, while river water that could not be utilized before becomes clean and comes to be used as potable and irrigation water.

The population of these areas is 259,000 inhabitants in 1996 and is estimated to be 540,000 in 2020, which represents almost two thirds of population in Aracaju Capital Area at the same year (875,000 inhabitants). The lack of adequate water supply is a serious obstacle to the development of the so mentioned regions and creates a migratory pressure towards the State capital, worsening even more problems in Aracaju. Therefore, it's mandatory to try to stabilize the water supply for high-concentrated population, and is indispensable to boost its social-economical development and to improve the quality of life. The beneficial municipalities strongly requested the project and issued "Lagarto Declaration" to the Federal Government. Moreover, Sergipe Government has already proposed the consultation letter (Carta Consurta) to the Federal Government in order to progressively promote this project.

Although the expansion projects was proposed as PROAGUA in the same area, necessity of PROVABASE is still very high, because: 1) PROAGUA project cannot meet the future water demand in this area, 2) PROAGUA Project in Lagarto area will use the water of Piaui Dam, of which water is in high chlorine characteristics and is reserved by irrigation use.

(2) Financing of the Project Cost

The investment of the phase-1 project amounts to R$ 264 million with a price escalation of 4 % per annum. The average share of water resources development investment to the tax revenue in the State budget was 3.1% during 5 years from 1994 to 1998. The funds of the State budget for the investment with the same increase rate of 5 % per annum as projected GRDP growth rate of the State were estimated at R$ 390 million during ten (10) years. However, annual amount would be only R$ 39 million, which is far from the project cost.

Nevertheless, the indebtedness capacity of the State Government is limited by the federal legislation and is estimated as follows: 1) R$ 140 million of overall debt capacity and 2)

R$ 100 million of debt service capacity. When considering current debt services of the State Government, the soft loan is required as a principal source of funds for the implementation of the project. Accordingly, the overall sources of funds are raised as follows:

- Soft Loan: 50% of the project cost in Phase-1
- Transfer from the Federal Government: 50% of the project cost in Phase-1

As for the phase-1 project, 50 % (R$ 132 million or US$ 69 million) of the project cost is recommended to be loaned by the foreign soft loan, considering the debt limited by federal legislation and the other project progress. Accordingly, the State Government should raise R$ 132 million by itself.

(3) Necessity of Additional Study

Prior to the loan procedure and implementation of the project, the following additional studies are necessary and should be implemented by the State:

- Basic Design of Water Supply Facility in Itabaiana and Lagarto Areas
- Feasibility Study on Vaza Barris Irrigation Project
- Formulation and Approval of EIA Report (RIMA)
- Formulation of Implementation Program Integrated with this Study Results

(4) Necessity of Water Quality Monitoring

In the viewpoint of water quality in Vaza Barris River, Chlorine (Cl) concentration is high and critical for potable water, as well as Electric Conductivity (EC), Sodium (Na), Magnesium (Mg), Calcium (Ca), Carbonic Acid (HCO_3) and pH Value (pH) are important for irrigation planning. Water quality observation has been conducted during the Study.

However, it is noted that water quality data in Vaza Barris River is not yet enough to understand the water quality behavior. It is needed to continue observation of water quality such as the said parameters at least, not only at the existing observation stations but also at the proposed dam site and the check dam site.

(5) Arrangement between Sergipe and Bahia

Vaza Barris River is the federal river located in Bahia State upstream and Sergipe State downstream. Vaza Barris Dam is located in almost most downstream of the main stream of Vaza Barris River. Water resources development and management in the upstream, such as a dam construction, irrigation development and forestation, directly affects to the downstream river and to this project in Sergipe State. Therefore, the arrangement on basin development and management should be mutually discussed between Sergipe State and Bahia State. Responsible organization should be SRH/SE and SRH/BA.

APPENDICES

APPENDICES

Appendix - A List of JICA Advisory Committee Members

1.	Chairperson	: Jyosuke KASHIWAI
2.	Member	: Hiroki KATO

Appendix - B List of JICA Study Team Members

1.	Team Leader / Water Supply	: Masatomo Watanabe
2.	Water Resources Development	: Kenji Nagata
3.	Agriculture and Irrigation	: Kazuhiko Otani
4.	Hydrology and Hydraulics	: David Merrett
5.	Facility Design / Cost Estimate	: Toshio Yano
6.	Topographic Survey	: Manabu Kawaguchi
7.	Operation and Maintenance	: Naoki Hara
8.	Groundwater / Topography and Geology	: Hiroshi Nakamura
9.	Water Quality Analysis	: Hideo Kawai
10.	Environment	: Kanji Watanabe
11.	Law and Institution	: Tatsuro Tashino
12.	Socio-economy and Finance	: Noboru Osakabe
13.	Interpreter / Regional Planning	: Atsuhiko Uehara
14.	Coordinator (Master Plan Study)	: Tetsuhiro Imagawa
15.	Dam Geology (Feasibility Study)	: Kei Ichikawa
16.	Dam Design(Feasibility Study)	: Toru Fujita
17.	Coordinator (Feasibility Study)	: Akihiro Shimomura

Appendix - C List of Steering Committee Members

(Master Plan Study)

Name	Institution	Post and Profession
Marcos Antonio de Melo, President	State Secretariat of Planning, Science and Technology – SEPLANTEC	Secretary/ Economist
Ailton Francisco da Rocha, Coordinator	Water Resources Superintendency – SRH	Superintendent/ Agricultural Engineer
Hélio Sobral Leite	Company for the Development of Water Resources and Irrigation in Sergipe – COHIDRO	Director- President/ Agricultural Engineer
Luiz Simões de Faria	Company for Livestock and Agriculture Development of Sergipe – EMDAGRO	Director-President/ Agricultural Engineer
Luís Carlos Resende	State Environmental Administration – ADEMA	Executive- Secretary/ Chemical Engineer
Arivaldo Ferreira de Andrade Filho	Sanitation Company of Sergipe– DESO	Director- President/ Civil Engineer
Manoel Hora Batista	Project for Support to the Low Income Families of the Semi-arid Region in Sergipe – PRÓ-SERTÃO	General Coordinator/ Agricultural Engineer
João Augusto de Barros Nascimento	Company for Industrial and Mineral Resources Development in Sergipe – CODISE	Director- President/ Manager
Adalberto Pereira de Figueiredo	Civil Defense	Special Coordinator of Civil Defense/ Economist
Francisco Alves	State Management Unit for PROÁGUA– UEGP	Coordinator/ Agricultural Engineer

(Feasibility Study)

Name	Institution	Post and Profession
Marcos Antonio de Melo Presidente	Secretaria de Estado do Planejamento e da Ciência e Tecnologia – SEPLANTEC	Secretário/ Economista
Ailton Francisco da Rocha, Coordenador	Superintendência de Recursos Hídricos – SRH	Superintendente/ Eng. Agrônomo
José Luís dos Santos Andrade	Companhia de Desenvolvimento de Recursos Hídricos e Irrigação de Sergipe – COHIDRO	Diretor- Presidente/ Economista
José Wolney Soares de Brito	Empresa de Desenvolvimento Agropecuário de Sergipe – EMDAGRO	Diretor-Presidente/ Veterinário
Luís Carlos Resende	Administração Estadual do Meio Ambiente – ADEMA	Secretário-Executivo/ Eng. Químico
Gilmar de Melo Mendes	Companhia de Saneamento de Sergipe – DESO	Diretor- Presidente/ Eng. Civil
Manoel Hora Batista	Projeto de Apoio às famílias de Baixa Renda da Região Semi-Árida de Sergipe – PRÓ-SERTÃO	Coordenador Geral/ Eng. Agrônomo
José Haroldo Sampaio Barros	Companhia de Desenvolvimento Industrial e de Recursos Minerais de Sergipe – CODISE	Diretor- Presidente/ Administrador
Carlos Tavares	Defesa Civil	Coordenador Especial de Defesa Civil / Economista
Francisco Alves	Unidade Estadual de Gestão do PROÁGUA – UEGP	Coordenador/ Eng. Agrônomo

Appendix - D List of Technical Committee Members

(Master Plan Study) List of Technical Committee Members

Name	Institution	Post / Profession
Ailton Francisco da Rocha, President	Water Resources Superintendency, SRH	Superintendent / Agricultural Engineer
José Walter de Aragão Menezes	Sanitation Company of Sergipe, DESO	Chief of Water Resources Div. / Geologist
Lucilene Tiyomi Takahashi	State Environmental Administration, ADEMA	Coordinator of Special Project / Geographer
Décio Garcez Vieira Filho	Company for Industrial and Mineral Resources Development in Sergipe, CODISE,	Director of Mineral Resources / Geologist
Elder Prudente Barbosa	Company for the Development of Water Resources and Irrigation in Sergipe, COHIDRO	Agricultural Engineer / Technical Assistant
Jodemir Antônio Pires Freitas	Company for Livestock and Agriculture Development of Sergipe, EMDAGRO	Agricultural Engineer /Assessor of the Presidency
Uitan Maynard de Oliveira	Project for Support to the Low Income Families of the Semi-arid Region in Sergipe, PRÓ-SERTÃO	Water Supply Assistant / Civil Engineer
Fátima Maria Diaz da Hora	Superintendency, IBAMA/SE	Forest Engineer
Nicanor Moura Neto	Civil Defense	Director of Engineering Service / Civil Engineer
Arisvaldo Vieira de Melo Júnior	State Management Unit for PROÁGUA–UEGP	Agricultural Engineer / Consultant
Bergson Rodrigues Santiago	Company for Development of the São Francisco Valley, CODEVASF	Chief of the 4th DPL/Economist
Ederlon Ribeiro de Oliveira	Brazilian Enterprise of Agriculture and Livestock Research/ Center of Research of the Coastal tablelands, EMBRAPA/CPATC	Auxiliary Chief CPATC / Veterinarian
Clóvis Roberto Pereira Franco	Federal University of Sergipe, UFS	Chief of the Biology Department – UFS/ Teacher
Antônio César Tavares Santana	National Department of Drought Alleviation, DNOCS	Director / Eng. Civil
Cláudia de Araújo Xavier	Institute of Technology and Research of Sergipe, ITPS	Assessor of the Presidency / Chemical Engineer
Roberto Sales Cardoso	State Company of Household and Public Works, CEHOP	Assessor of the Presidency / Chemical Engineer
Eduardo Gonçalves	National Institute of Meteorology, INMET	Chief of the 4th DISME / Captain
Antônio de Pádua Louree Pereira	National Agency of Electrical Energy, ANEEL	Superintendent / Electrical Engineer

(Feasibility Study) List of Technical Committee Members

Name	Institution	Post / Profession
Ailton Francisco da Rocha, Presidente	Superintendência de Recursos Hídricos, SRH	Superintendente/ Eng. Agrônomo
José Walter de Aragão Menezes	Companhia de Saneamento de Sergipe, DESO	Chefe da Divisão de Recursos Hídricos / Geólogo
Lucilene Tiyomi Takahashi	Administração Estadual do Meio Ambiente, ADEMA	Coordenadora Projeto Especial/ Geógrafa
Décio Garcez Vieira Filho	Companhia de Desenvolvimento Industrial e de Recursos Minerais de Sergipe, CODISE	Diretor de Recursos Minerais/ Géólogo
Elder Prudente Barbosa	Companhia de Desenvolvimento de Recursos Hídricos e Irrigação de Sergipe, COHIDRO	Eng. Agrônomo/ Assist. Técnico
Jodemir Antônio Pires Freitas	Empresa de Desenvolvimento Agropecuário de Sergipe, EMDAGRO	Eng. Agrônomo/ Assessoria de Pesquisa
Uitan Maynard de Oliveira	Projeto de Apoio às famílias de Baixa Renda da Região Semi-Árida de Sergipe, PRÓ-SERTÃO	Assist. de Abastecimento de Água / Eng. Civil
Fátima Maria Diaz da Hora	Superintendência do IBAMA-SE	Eng. Florestal
Nicanor Moura Neto	Defesa Civil	Diretor de Serviço de Engenharia / Eng. Civil
Arisvaldo Vieira de Melo Júnior	Unidade Estadual de Gestão do PROÁGUA – UEGP	Eng. Agrônomo/ Consultor
Bergson Rodrigues Santiago	Companhia de Desenvolvimento do Vale do São Francisco, CODEVASF	Chefe do 4° DPL/ Economista
Ederlon Ribeiro de Oliveira	Empresa Brasileira de Pesquisa Agropecuária / Centro de Pesquisa dos Tabuleiros Costeiros, EMBRAPA/CPATC	Chefe Adjunto CPATC / Veterinário
Clóvis Roberto Pereira Franco	Universidade Federal de Sergipe, UFS	Chefe do Departamento de Biologia-UFS/ Professor
Antônio César Tavares Santana	Departamento Nacional de Obras Contra a Seca, DNOCS	Diretor/ Eng. Civil
Cláudia de Araújo Xavier	Instituto de Tecnologia e Pesquisa de Sergipe, ITPS	Assessora Presidência Eng. Química
Roberto Sales Cardoso	Companhia Estadual de Habitação e Obras Públicas, CEHOP	Assessora da Presidência/ Eng. Químico
Eduardo Gonçalves	Instituto Nacional de Meteorologia, INMET	Chefe do 4° DISME / Capitão
Antônio de Pádua Louree Pereira	Agência Nacional de Energia Elétrica, ANEEL	Superintendente / Eng.° Elétrico

Appendix - E List of Advisors for the Steering and Technical Committees

(Master Plan Study)

Name	Institution	Post / Profession
JOSÉ LUIZ LIMA DE OLIVEIRA	Representative of Bahia State	Superintendent of Water Resources
JOSÉ CARLOS GUIDOLIN	Representative of MMARHAL / SRH	Consultant
JOSÉ THEODOMIRO DE ARAÚJO	Representative of CEEIVASF	President / Agricultural Engineer
ALEXANDER MAX FIGUEIREDO DE SÁ	Representative of CHESF	Chief of the Water Resources Management Division
JÚLIO FLORÊNCIO FILHO	Representative of Alagoas State	Coordinator of UEGP/ Agricultural Engineer
FRANCISCO BEZERRA SIQUEIRA	Representative of CODEVASF	Supervisor of Sub-Basins / Agricultural Engineer
CARLOS FERNANDO PINTO TEIXEIRA	Representative of SUDENE	Coordinator of Natural Resources Planning / Geologist

(Feasibility Study)

Name	Institution	Post / Profession
MILTON CEDRAZ	Representante do Estado da Bahia	Superintendente de Recursos Hídricos
JOSÉ CARLOS GUIDOLIN	Representante da MMARHAL / SRH	Consultor
JOSÉ THEODOMIRO DE ARAÚJO	Representante da CEEIVASF	Presidente Engº Agrônomo
ALEXANDER MAX FIGUEREDO DE SÁ	Representante da CHESF	Chefe da Divisão da Gestão de Recursos Hídricos
MURILO L. MARINHO	Representante do Estado de Alagoas	Engº Agrônomo
FRANCISCO BEZERRA SIQUEIRA	Representante da CODEVASF	Supervisor de Sub-Bacias Engº Agrônomo
CARLOS FERNANDO PINTO TEIXEIRA	Representante da SUDENE	Coordenador de Planejamento de Recursos Hídtricos

Appendix - F List of Counterpart Personnel

(1) Master Plan Study

<List of Work Group – A>

Work Target: Water Resources Potential
Group Leader (JICA) : David J. Merret
Group Leader (Sergipe Side) : João Carlos Santos da Rocha

Institution	Name - Post / Profession
JICA Study Team	David J. Merrett: Hydrology and Hydraulics Hiroshi Nakamura: Groundwater, Topography & Geology Hideo Kawai: Water Quality Analysis Kenji Nagata: Tetsuhiro Imagawa
SRH	João Carlos Santos da Rocha: Director / Geologist Overland Amaral Costa: Director de Coordination Office/ Geographer Roberto Barros: Assessor / Civil Engineer
DESO	José Walter Aragão Menezes: Chief of the Division /Geologist Cláudio Julio Machado: Operational Assistant / Geographer
ADEMA	Jorge Antônio Lima: Chief of the Division / Chemical Engineer José Alves Nunes: Chief of the Division / Civil Engineer
CODISE	Inajá Francisco de Souza: Meteorologist Gustavo Zambrana Campo Verde: Geologist
COHIDRO	Jorge Assis Fernandes dos Santos: Chief of COPRO / Geologist Maria Auxiliadora Santos Lima: Geologist Luís Marcolino Gonçalves Neto: Assistant of COPRO / Civil Engineer
EMDAGRO	Tânia Maria Delmontes Freitas Dias: Coordinator /Economist Manoel Fernando de A. Dantas: Agricultural Engineer
CODEVASF	Fátima Cristina Salgueiro: Civil Engineer Francisco Carlos Góes da Costa: Agricultural Technician
UFS	José Patrocínio Hora Alves: Prof. / UFS – Chemical Engineer
ITPS	Cláudia de Araújo Xavier: Assessor of the Presidency /Chemical Engineer
INMET	Eduardo Gonçalves: Chief of 4° DISME /Captain
ANEEL	P Antônio de Pádua Louree ereira : Superintendent / Electrical Engineer
CPRM	Romulo Alves Leal: Geologist

<List of Work Group – B>

Work Target: Plan and Design for Water Resources Development
Group Leader (JICA) : Kenji Nagata
Group Leader (Sergipe Side) : Artemízio Cardoso de Rezende

Institution	Name – Post / Profession
JICA Study Team	Kenji Nagata Masatomo Watanabe Toshio Yano Kazuhiko Otani Hiroshi Nakamura Manabu Kawaguchi
SRH	Artemizio Cardoso de Rezende: Assessor / Geologist Luiz Carlos Neto: Director of the Coordination Office / Agricultural Engineer Andrei Lopes Costa: Director of the Coordination Office / Economist
SEPLANTEC	Thieres Gonçalves Sobrinho: Chief de Services /Economist
DESO	Nancy Santana Barreto: Chefe de Dep. Assessor of Planning / Civil Eng. Wilson Lima Júnior: Chief of Department / Civil Engineer
CODISE	Carlos Aurélio Barreto: Director of CEPS / Geologist Cibele de Oliveira Correia: Coordinator of Lab / Geographer
COHIDRO	Elder Prudente Barbosa: Technical Assistant / Agricultural Engineer Clélio da Silva Araújo: Coordinator of CODEA / Agricultural Engineer Jailton Teles Barreto: Chief of ASPLAN / Economist Idalton Antônio Martins: Coordinator of COREF/ Cartography Eng.
EMDAGRO	Jodemir Antônio Pires Freitas: Assessor of Presidency / Agricultural Engineer
PRÓ-SERTÃO	Uitan Maynart de Oliveira: Technical Coordinator / Civil Engineer
DEFESA CIVIL	Nicanor Moura Neto: Civil Engineer
UFS	Francisco Sandro R. de Holanda: Teacher/UFS – Agricultural Engineer
UEGP	Arisvaldo Vieira de Melo Júnior: Consultant / Agricultural Engineer
CODEVASF	José Bizerra de Aguiar: Chief of the 4th DPLT / Economist Eduardo Alves Bastos: Chief of the 4th DPLA / Economist
DNOCS	Antônio César Tavares Santana: Director / Agricultural Engineer
ADEMA	Marly Menezes Santos: Biologist Lucilene Tiyomi Takahashi: Gepgrapher
CEHOP	Roberto Sales Cardoso: Civil Engineer
PRONESE	Osvaldo Kasume: Chief of Nucleus / Civil Engineer Carmem Lúcia: Agricultural Engineer
FNS	Alvaro José Bastos Figueiredo: Chief of Services / Civil Enginner Rui Eduardo de Oliveira: Director of the SAAE / Civil Engineer

<List of Work Group – C>

Work Target: Water Demand, Project Evaluation, Institution, Operation & Maintenance
Group Leader (JICA) : Atuhiko Uehara
Group Leader (Sergipe Side) : Jessé Cláudio de Lima Costa

Institution	Name – Post / Profession
JICA Study Team	Atsuhiko Uehara Kazuhiko Otani Tatsuo Tashino Naoki Hara Kanji Watanabe Noboru Osakabe
SRH	Jessé Cláudio de Lima Costa: Director of Department / Teacher Luís Carlos Neto: Director de Coordenation Office / Agricultural Eng. Overland Amaral Costa: Director of Coordenation Office / Geographer
SEPLANTEC	Samuel Oliveira Ribeiro: Director of Dept. / Economist Iêda Maria de Carvalho Oliveira: Consultant / Economist José Carlos Pereira: Economist Raimundo Rabelo Lucas: Chief of Services / Economist
DESO	Nilton Matos: Industrial Chemical Engineer
ADEMA	Gleidineides Teles dos Santos: Biologist Lucilene Tiyomi Takahashi: Geographer
CODISE	Inajá Francisco de Souza: Geographer
COHIDRO	José Albuquerque Cunha: Coordinator / Geologist Adnaldo Santana Santos: Coordinator of CENIR / Civil Engineer
EMDAGRO	Antônio Paulo Feitosa: Agricultural Engineer
UEGP	Moacyr Wanderley: Consultor / Geologist
CODEVASF	Pedro de Araújo Lessa: Chief of the 4th DEG / Agricultural Engineer Orlando Tavares de Oliveira: Chief of Services / Agricultural Engineer
EMBRAPA	Luis Carlos Nogueira: Surveyor / Agricultural Engineer
UFS	Lilian Cunha Góes: Teacher / Civil Engineer
SEFAZ	Maria da Glória: Superintendent / Tributary Inspector
SEICT	Pedro Ferreira dos Anjos: Chief of Asplan / Economist
SEMA	Maria Luiza Santos: Coordinator / Biologist
IBAMA	Fátima Maria Diaz da Hora: Forest Engineer

(2) Feasibility Study

<List of Work Group – A>

Work Target: Plan and Design
Group Leader (JICA) : Toshio Yano
Group Leader (Sergipe Side) : Antônio Carlos de Aragão Resende (SRH)

Institution	Name	Post / Profession
JICA	**Tashio YANO** Kenji NAGATA Atsuhiko UEHARA Masatomo WATANABE Toru FUJITA	
SRH	Ailton Francisco da Rocha **Antônio Carlos de Aragão Resende** João Carlos Santos da Rocha Jessé Cláudio de Lima Costa José Holanda Neto	Superintendente/Eng. agrônomo Assessor/Eng. Civil Diretor/Geólogo Diretor / Historiador Assessor/ Eng. Agrônomo
SEPLANTEC	Fernando Lopes Cruz Tânia Resende	Superintendente/Eng. Agrônomo Diretora/Supes
DESO	Nilton Dantas **Marcelo Monteiro** Wilson Lima Júnior Roberto Leite	 Diretor Técnico /Eng. Civil Eng. Civil Diretor de Operações/Eng. Civil
ADEMA	Gleidineides Teles dos Santos **Lucilene Tiyomi Takahasshi**	Bióloga Geógrafa
CODISE	Inajá Francisco de Souza **Luís Gonzaga Luna Reis**	Meteorologista Eng. Agrônomo
COHIDRO	**Élder Prudente barbosa** Adnaldo Santana Santos Antônio Paulo Feitosa Luís Marcolino Gonçalves Neto	Eng. Agônomo Eng. Civil Eng. agrônomo Eng. Civil
EMDAGRO	**Jodemir Antônio Pires Freitas** João Serafim Pinto Jeferson Carvalho Elisabeth Denise Campos	Eng. Agrônomo Eng.° Agrônomo Eng. Agrônomo Eng. Agrônoma
CODEVASF	Fátima Cristina Salgueiro **Pedro de Araújo Lessa** Eduardo Alves Bastos Orlando Tavares de Oliveira	Eng° Civil Eng. Agrônomo Economista Eng. Agrônomo
UFS	**Francisco Sandro R. de Holanda** Antenor de Aguiar Neto Lilian Cunha Góis	Prof. / UFS - Eng.° Agrônomo Prof/UFS -- Eng. Agrônomo Prof./UFS – Eng. Civil
CEHOP	**Roberto Sales Cardoso**	Eng. Civil
PRONESE	**Osvaldo Kasume** Carmem Lúcia	Eng. Civil Eng. Agrônoma
ANEEL	**Antônio de Pádua Louree Pereira**	Superintendente / Eng.° Elétrico
EMBRAPA/ CPATC	Luis Carlos Nogueira Aurelir Nobre Barreto **Ederlon Ribeiro de Oliveira**	Eng. Agrônomo Eng. Agrônomo Chefe Adjunto/ Veterinário
DNOCS	**Antônio César Tavares**	Eng. Civil
FNS	**Alvaro José Bastos Figueiredo** Rui Eduardo de Oliveira	Eng. Civil Eng. Civil
SAGRI	Eduardo Cabral de V. Barreto **João Amaral** Geraldo Sobrinho	Eng. Agrônomo Eng. Agrônomo Eng. Agrônomo
PRÓ-SERTÃO	**Uitan Maynard de Oliveira**	Eng. Civil

<List of Work Group – B>

Work Target: Survey and Analysis
Group Leader (JICA) : Kenji NAGATA
Group Leader (Sergipe Side) : João Carlos Santos da Rocha (SRH)

Institution	Name	Post / Profession
JICA	Kenji Nagata Hiroshi Nakamura Manabu Kawaguchi Ichikawa	
SRH	Artemizio Cardoso de Rezende João Carlos Santos da Rocha Overland Amaral Costa Roberto Barros Filho	Assessor / Geólogo Diretor de Departamento/ Geólogo Diretor de Coordenadoria/ Geógrafo Assessor/ Eng. Civil
ITPS	Cláudia de Araújo Xavier	Assessora da Presidência
DESO	José Walter Aragão Menezes Cláudio Julio Machado Mendonça Filho Roberto Leite Frederico Souza Nilton Matos	Chefe de Divisão/ Geólogo Geógrafo Diretor/ Eng. Civil Químico Industrial
CODISE	Carlos Aurélio Barreto Gustavo Zambrana Campo Verde Cibele de Oliveira Correia Luís Gonzaga Luna Reis	Diretor do CEPS / Geólogo Geólogo Coord. de Laboratório / Geógrafa Eng. Agrônomo
CPRM	Romulo Alves Leal	Geólogo
EMBRAPA/CP ATC	Luís Carlos Nogueira Aurelir Nobre Barreto	Eng. Agrônomo Eng. Agrônomo
COHIDRO	Jorge Assis Fernandes dos Santos Maria Auxiliadora Santos Lima Luís Marcolino Gonçalves Neto Idalton Antônio Martins José Albuquerque Cunha	Chefe da COPRO / Geólogo Geóloga Eng. Civil Coord. COREF/ Eng.° Cartógrafo Coordenador / Geólogo
EMDAGRO	João Serafim Pinto	Eng. Agrônomo
PRÓ-SERTÃO	Uitan Maynart de Oliveira	Coord Técnico / Eng.° Civil
DEFESA CIVIL	Nicanor Moura Neto	Engº Civil
UFS	Lilian Cunha Góis José Patrocínio Hora Alves João Sampaio D'Ávila	Prof./UFS - Engº Civil Prof / UFS – Eng. Químico Prof / UFS – Eng. Químico
UEGP	Arisvaldo Vieira de Melo Júnior Moacyr Wanderley	Consultor / Eng.° Agrônomo Consultor / Geólogo
CODEVASF	Pedro de Araújo Lessa Orlando Tavares de Oliveira Fátima Cristina Salgueiro	Chefe da DEG / Eng. Agrônomo Chefe de Serviço/ Eng. Agrônomo Eng. Civil
DNOCS	Antônio César Tavares Santana	Diretor / Eng.° Agrônomo
ADEMA	Marly Menezes Santos Lucilene Tiyomi Takahashi Jorge Antônio Lima José alves Nunes	Bióloga Geógrafa Eng. Químico Eng. Civil
CEHOP	Roberto Sales Cardoso	Engº Civil
IBAMA	Marluce Rocha M. de Sousa	
PRONESE	Osvaldo Kasume Carmem Lúcia	Chefe do Núcleo / Eng.° Civil Engª Agrônoma
FNS	Alvaro José Bastos Figueiredo Rui Eduardo de Oliveira	Chefe de Serviço / Eng.° Civil Diretor da SAAE / Engº Civil

<List of Work Group – C>

Work Target: Project Evaluation and O & M
Group Leader (JICA) : Naoki HARA
Group Leader (Sergipe Side) : José Holanda Neto (SRH)

Institution	Name	Post / Profession
JICA	**Naoki Hara** Tatsuo Tashino Kanji Watanabe **Noboru Osakabe**	
SEPLANTEC	Samuel Oliveira Ribeiro Iêda Maria de Carvalho Oliveira José Carlos Pereira Raimundo Rabelo Lucas **Fernando Lopes Cruz** João Alberto de Oliveira Rocha Jussara Maynard Araújo	Diretor de Deptº / Economista Consultora / Economista Economista Chefe de Serviço / Economista Superintendente/ Eng. Agrônomo Chefe de Departamento/ Economista Superintendente
SRH	Jessé Cláudio de Lima Costa **José Holanda Neto** Ailton Francisco da Rocha Andrei Lopes da Costa Denise Teles Barreto	Diretor de Departamento / Professor Assessor/ Eng. Agrônomo Superintendente/Eng. Agrônomo Diretor de Coordenadoria/ Economista Diretora de Coordenadoria
DESO	**Nilton Matos** Beneti Nascimento	Químico Industrial Jornalista
ADEMA	Gleidineides Teles dos Santos Lucilene Tiyomi Takahashi **Antônio Carlos de Andrade** Maria Luiza Santos	Bióloga Geógrafa Bióloga
CODISE	Fernando Leite	
COHIDRO	Clélio da Silova Araújo **Jailton Teles Barreto** Vicente de Paula Primo	Eng. Agrônom Economista Eng. Agrônomo
EMDAGRO	**Jodemir Antônio Pires Freitas** Elisabeth Denise Campos	Eng Agrônomo Eng. Agrônomo
UEGP	**Moacyr Wanderley** Rui de Souza Mendonça	Consultor / Geólogo Consultor
CODEVASF	José Bizerra de Aguiar Eduardo Alves Bastos **Bergson Rodrigues Santiago** Antônio Augusto Correia Lima Filho	Economista Economista Economista Eng. Civil
EMBRAPA	Edmar Ramos de Siqueira Antônio Carlos Barreto **Ederlon Ribeiro de Oliveira**	Eng. agrônomo Eng. Agrônomo Veterinário
UFS	**Vânia Fonseca** ClóvisRoberto Pereira Franco	Prof/UFS – Depto. de Geografia Prof. UFS/ Depto. de Biologia
SEFAZ	**Maria da Glória**	Superintendente / Auditora Tributária
SEICT	Pedro Ferreira dos Anjos	Chefe da Asplan / Economista
INCRA	Emanuel Oliveira Pereira **Vicencia Maria Schettino** Maria Al;cione Dias	Eng. Agrônomo Bióloga Assistente Social
PETROBRÁS	Ismael Quirino Trindade Neto	Gerente da Assessoria de Meio Ambiente
IBAMA	**Fátima Maria Diaz da Hora** Marluce Rocha M. de Sousa	Engª Florestal